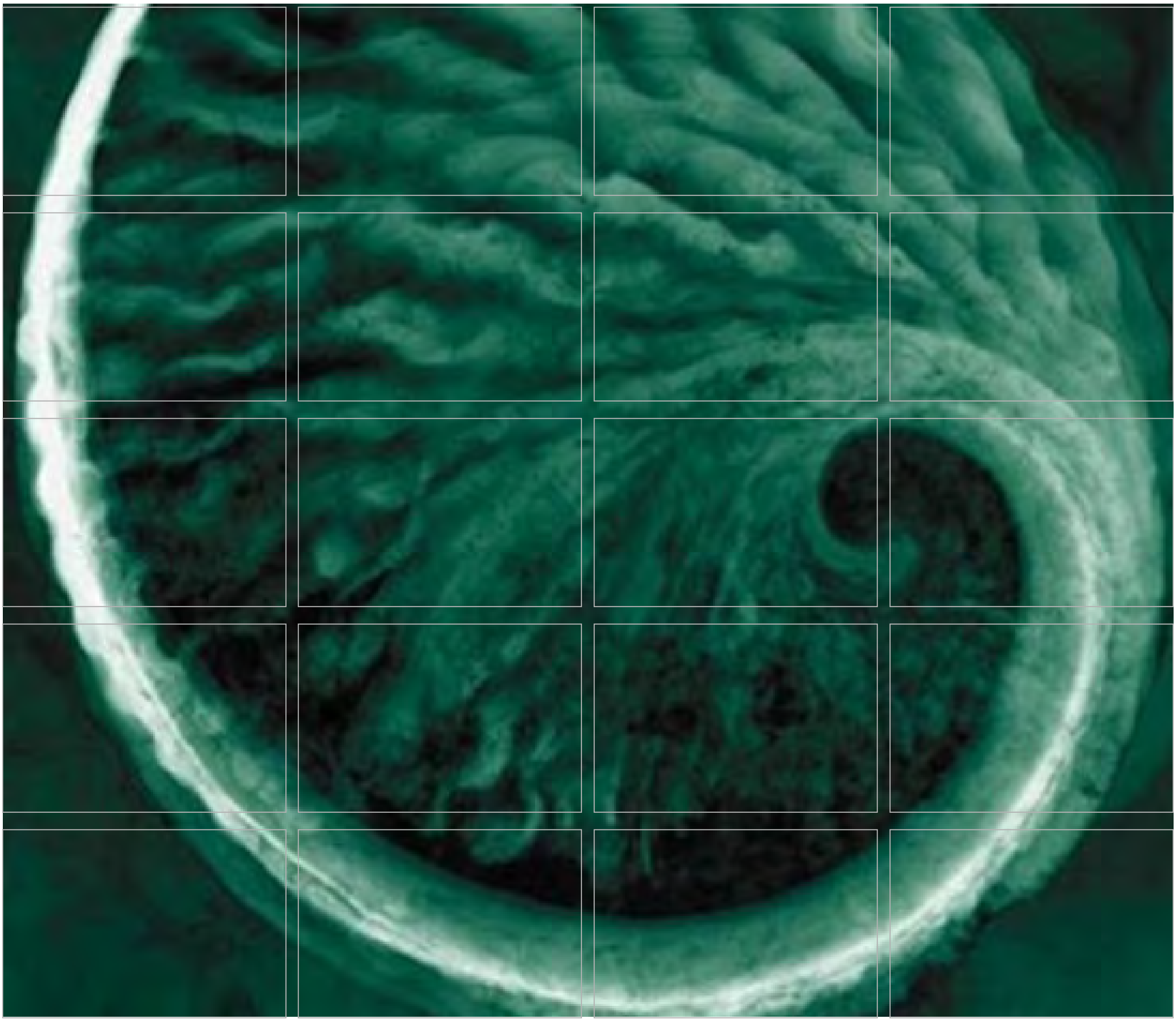
Planning Act 2008
Infrastructure Planning (Changes to, and Revocation of, Development Consent Orders) Regulations 2011
Document reference: TR030006/D4/7

Able Marine Energy Park

Material Change 2

Original sHRA

(referenced in response to question 5.0.8)



Able UK Ltd

Able Marine Energy Park:
Habitats Regulations Assessment Information

December 2011

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Able Marine Energy Park: *Habitats Regulations Assessment Information*

December 2011

Reference 0120872

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For and on behalf of Environmental Resources Management	
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CONTENTS

1 INTRODUCTION

1.1 BACKGROUND

1.1.1 Able Humber Ports Ltd proposes to develop a marine energy park on the south bank of the Humber Estuary east of North Killingholme (see *Figure 1.1*). If consented, the development will be known as the Able Marine Energy Park (AMEP). AMEP will incorporate a new quay together with onshore facilities for the manufacture of offshore wind turbines. Further details about the project are contained in *Chapter 4 AMEP Project Description and List of Other Projects*.

Figure 1.1 AMEP Site Location

1.1.2 Part of AMEP lies within the Humber Estuary, which is designated under European law as an important site for nature conservation and forms part of the Natura 2000 network of sites. This network consists of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) established under the Habitats Directive (92/43/EEC [1]) and the Birds Directive (79/409/EEC) [2] respectively. It is also a listed Ramsar site under the Ramsar Convention [3]. In the UK it is Government policy

(1) European Commission Directive 92/43/EEC on *The Conservation of Natural Habitats and of Wild Fauna and Flora* (The Habitats Directive). EC.
(2) European Commission Directive 79/409/EEC on *The Conservation of Wild Birds* (The Birds Directive). EC.
(3) The 1971 Ramsar Convention on Wetlands of International Importance, Especially as Waterfowl Habitat.

to give listed Ramsar sites the same protection as SPAs and SACs (1). For the purposes of this report SPAs, SACs and Ramsar sites are all referred to as 'European' sites. As AMEP lies partly within the European sites, it has the potential to affect them.

1.1.3 It is a requirement under European law, as implemented in the UK, for competent authorities to determine whether a project will have a likely significant effect on European sites, either individually or in-combination with other projects. If a significant effect is likely or there are uncertainties, then an Appropriate Assessment (AA) of the implications of the project (against the European site's conservation objectives) must be undertaken.

1.2 *PURPOSE OF THIS REPORT*

1.2.1 The purpose of this report is to assist the Competent Authority (in this case the Infrastructure Planning Commission (IPC)) in fulfilling its obligations under the Habitats Regulations 2010 (2) by providing information to assist the IPC in undertaking its assessment (hereafter referred to as a Habitats Regulations Assessment (HRA)). Guidance on the Habitats Regulations Assessment (IPC, 2011 (3)) includes the following advice:

"…it is the responsibility of the developer to carry out the necessary preparatory work and assemble evidence in support of the DCO (4) *application to enable the competent authority to carry out its duties. The IPC strongly advises developers to shadow the HRA process at the pre-application stage so that the developer is able to compile all the information necessary for the competent authority to make a determination during the examination."*

1.2.2 Further details about the HRA process is provided in *Chapter 2* of this report.

(1) Office of the Deputy Prime Minister (2005) *Planning Policy Statement 9: Biodiversity and Geological Conservation.* ODPM.
(2) *The Conservation of Habitats and Species Regulations 2010.* SI 2010 – 490 (as amended). The Stationary Office Ltd.
(3) Infrastructure Planning Commission (2011) *Habitats Regulations Assessment - Advice Note 10: Habitats Regulations Assessment Relevant to Nationally Significant Infrastructure Projects.* IPC.
(4) Development Consent Order

1.3 REPORT STRUCTURE

1.3.1 The remainder of this report is set out as listed below.

- *Chapter 2* Habitats Regulations Assessment (HRA) Process.
- *Chapter 3* HRA Methods and Technical Engagement.
- *Chapter 4* AMEP Project Description and List of Other Developments.
- *Chapter 5* European Sites and Likely Significant Effects.
- *Chapter 6* Shadow Appropriate Assessment
- *Chapter 7* Alternative Solutions.
- *Chapter 8* Imperative Reasons of Overriding Public Interest (IROPI).
- *Chapter 9* Compensation Measures.
- *Chapter 10* Summary.

1.3.2 These chapters are supported by the *Annexes* listed below.

- *Annex A* Supporting Information – Consultations.
- *Annex B* European Designated Site Location and Citations
- Annex C Supporting Ornithological Information.
- *Annex D* Screening Assessment – Humber Estuary Habitats and Non Bird Species.
- *Annex E* Screening Assessment – Humber Estuary Birds.
- *Annex F* Supporting Information for Assessment of Effects of Piling.
- Annex G Supporting Information on Impact of Loss of Farmland on Sunk Island

2 THE HABITATS REGULATIONS ASSESSMENT (HRA) PROCESS

2.1 INTRODUCTION

2.1.1 The approach to the HRA has followed that set out in Planning Circular 06/2005 on Biodiversity and Geological Conservation – Statutory Obligations and their Impact within the Planning System produced by the Office of the Deputy Prime Minister (ODPM). It has also taken account of a range of other material guidance including Advice Note 10 (Habitats Regulation Assessment for Nationally Significant Infrastructure Projects) produced by the Infrastructure Planning Commission (IPC) (2011)[(1)] and guidance produced by the European Commission (EC) (2011[(2)(3)]; 2007[(4)]; 2002[(5)]; 2007 [6)]).

2.2 OVERVIEW OF HRA PROCESS

2.2.1 The HRA process comprises four main stages as shown in *Figure 2.1*, below (which is directly copied from Figure 1 of Circular 06/2005 produced by the Office of the Deputy Prime Minister (ODPM)). These are:

- **Stage 1 Screening** to identify the likely impacts of a project on a European Site and consider whether the impacts are likely to be significant;

- **Stage 2 Appropriate Assessment** to determine whether the integrity of the European site will be adversely affected by the project;

- **Stage 3 Assessment of Alternative Solutions** to establish if there are any that will result in a lesser effect on the European site; and

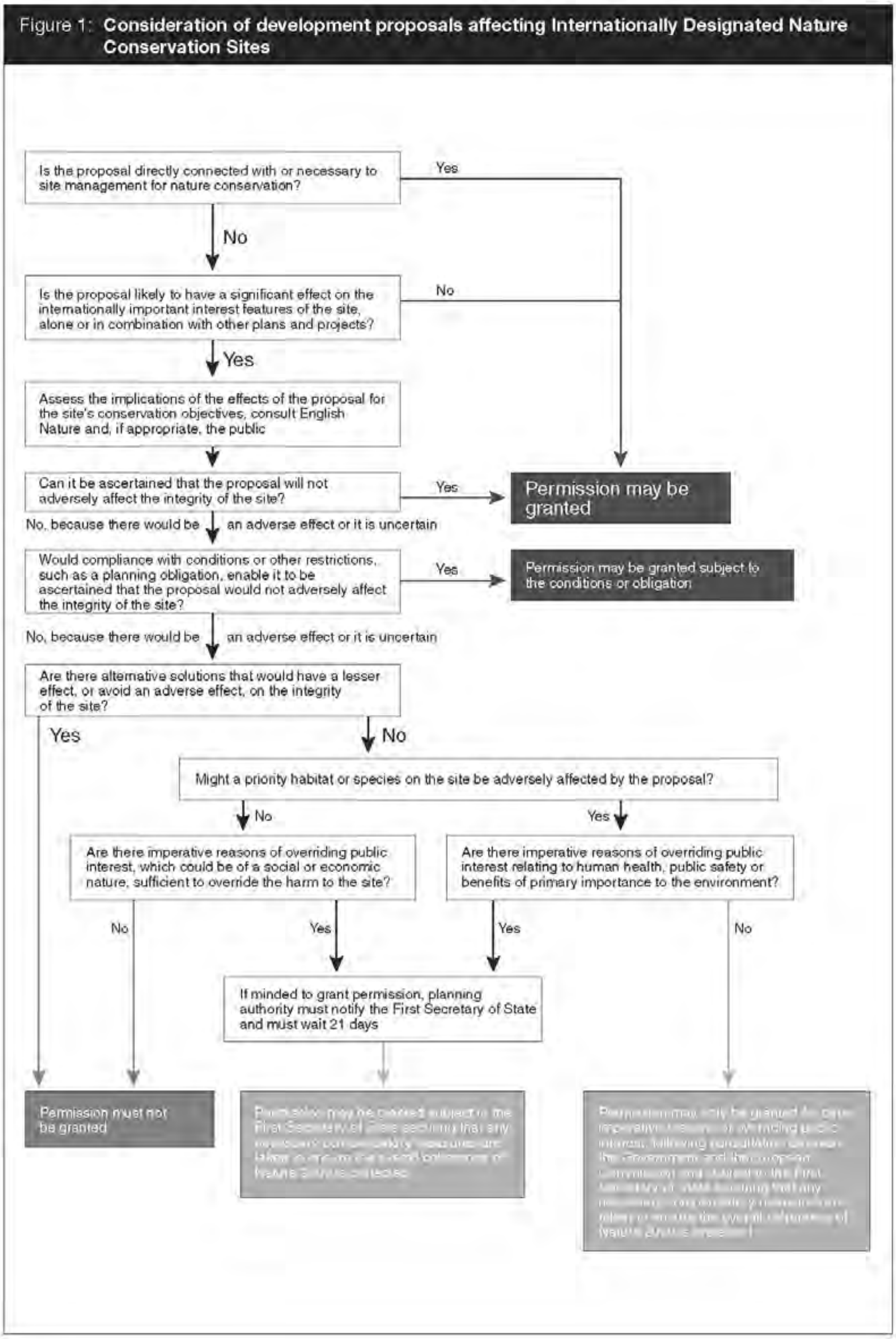
- **Stage 4 Imperative Reasons of Overriding Public Interest (IROPI) and Compensatory Measures** to establish whether it is necessary for the project to proceed despite the effects on the European site, and

(1) Infrastructure Planning Commission (2011) *Habitats Regulations Assessment - Advice Note Ten: Habitat Regulations Assessment Relevant to Nationally Significant Infrastructure Projects*. IPC.
(2) European Commission (2011) Guidelines on the Implementation of the Birds and Habitats Directives in Estuaries and Coastal Zones with Particular Attention to Port Development and Dredging. Advice Note 10 EC
(3) European Commission (2011) Guidelines on the Implementation of the Birds and Habitats Directives in Estuaries and Coastal Zones with Particular Attention to Port Development and Dredging. Advice Note 10 EC
(4) European Commission (2007) Guidance Document on Article 6(4) of the Habitats Directive 92/43/EEC. EC
(5) European Commission (2002) Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites. Methodological Guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC. EC
(6) European Commission (2000) Managing Natura 2000 Sites - The Provisions of Article 6 of the 'Habitats' Directive 92/43/CEE. EC

to confirm that necessary compensatory measures are in place to maintain the coherence of the Natura 2000 network.

2.2.2 Each of the above stages is discussed in more detail in the following sections.

Figure 2.1 HRA Process



2.3 *Stage 1 - Screening*

2.3.1 The screening stage examines the likely effects of a project either alone or in-combination with other projects and plans on a Natura 2000 site, and addresses the question *"can it be concluded that no likely significant effect will occur?"* To determine if the AMEP proposals are likely to have any significant effects on the designated sites the following issues have been considered:

- could the proposals affect the qualifying interest and are they sensitive / vulnerable to the effect;
- the probability of the effect happening;
- the likely consequences for the site's Conservation Objectives if the effect occurred; and
- the magnitude, duration and reversibility of the effect.

2.3.2 The screening stage has therefore sought to conclude one of the following three outcomes[1]:

1. no likely significant effect;
2. a likely significant effect; or
3. it cannot be concluded that there will be no likely significant effect.

2.3.3 Where the assessment concludes outcomes two or three, then the need for an Appropriate Assessment (AA) is triggered.

2.3.4 *"Likely significant effect"* in this context is any effect that may reasonably be predicted as a consequence of the project that may significantly affect the conservation or management objectives of the features for which a site was designated[2]. The effect must be an effect on a European site and a judgement as to significance must take into account factors relevant to the question of significance as described above. These will include such matters as temporal considerations (*ie* length of time of effect), physical considerations (ie extent of effect on the European site and the elements of the site including its conservation objectives). It is possible, therefore, for an effect to cause damage to the European site, but because such damage is fleeting, limited in extent or damaging to something outwith any conservation objectives the effect on the European site is insignificant. The judgement should also take

(1) European Commission (2002) Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites. EC
(2) Habitats Regulations Guidance Note 3. The Determination of Likely Significant Effect under The Conservation (Natural Habitats &c) Regulations 1994. English Nature, 1999.

into account the likely effects of mitigation. In terms of certainty, EC guidance by the EC (2000) states that:

"The safeguards set out in Articles 6(3) and 6(4) of the directive are triggered not by a certainty but by a likelihood of significant effects. Thus, in line with the precautionary principle, it is unacceptable to fail to undertake an assessment on the basis that significant effects are not certain".

2.3.5 The findings of the screening assessment indicated that a likely significant effect on the designated European sites would result (see *Chapter 5*). These findings were discussed in detail at regular meetings with Natural England (NE) along with the scope of the AA. NE also provided comments and guidance on the evolving assessment and HRA report (see *Chapter 3 HRA Methodologies and Technical Engagement* and *Section 5.4*).

2.4 STAGE 2 - APPROPRIATE ASSESSMENT (AA)

2.4.1 An AA is an assessment carried out under *Article 6(3)* of the Habitats Directive or under *Regulation 61* of the *2010 Habitats Regulations*. The aim is to assess whether the proposals will have any adverse effects on the integrity of the European site. Site integrity is defined as:

"the coherence of its structure and function across its whole area that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified"[1].

2.4.2 The decision on whether the integrity of the site could be adversely affected by the proposals should be taken in view of the site's Conservation Objectives (see *Section 5.2* and *Annexes D* and *E)*.

2.4.3 The AA (see *Chapter 6*) has drawn on the following information:

- details on the proposed AMEP project and other existing or proposed developments (see *Chapter 4*);
- description of the Protected Sites in the Humber Estuary, the qualifying interest features for each site, and possible effects on the qualifying interest features of the European sites (see *Chapter 5*);
- the findings of surveys undertaken specifically for the AMEP project (see *Section 5.3 Ornithological Interests on AMEP and Immediate*

(1) European Communities (2000) Managing Natura 2000 sites - The provisions of Article 6 of the 'Habitats' Directive 92/43/CEE. EC

Surrounds in *Chapter 5 (European Sites and likely Significant Effects), Annex* C *Supporting Ornithological Information*, and *Section 11.5 Baseline in the ES*) ;

- other publically available information, which is referenced where used; and

- information and views from consultations particularly with NE (see *Section 3.3* in *Chapter 3 HRA Methods and Technical Engagement, Annex A Supporting Information - Consultees* and *Volume 1, Annex 2.2* of the *ES*).

2.4.4 The aim of the Appropriate Assessment is to answer the question "*can it be demonstrated that the proposals will not adversely affect the integrity of the site?*" In accordance with the Waddenzee judgment (ECJ Case 127/02), the European Court of Justice ruled that a plan or project may be authorised only if a competent authority has made certain that the plan or project will not adversely affect the integrity of the site. "*That is the case where no **reasonable scientific** doubt remains as to the absence of such effects*", (emphasis added). In terms of what is reasonable, guidance from Scottish Natural Heritage (SNH) states "*to identify the potential risks, so far as they may be reasonably foreseeable in the light of such information as can be reasonably obtained.*"(1). A UK High Court judgement relating to the Little Cheyne Wind Farm proposals in Kent also highlighted the need for reasonable scientific doubt to be backed up by scientific information or analysis, and that reliance on various studies to raise a *"cloud of doubt"* was not acceptable(2).

2.4.5 The assessment also takes into account any avoidance, or mitigation measures, which will be implemented to avoid or reduce the level of impact from the AMEP. The Competent Authority may also consider the use of conditions or restrictions to help avoid adverse effects on site integrity.

2.4.6 If the AA concludes that the proposals will not adversely affect the integrity of the European site, then permission may be granted. However if, the AA concludes that there will be an adverse effect on the integrity of the European site, or that there is uncertainty and a precautionary approach is taken (see *Paragraph 2.4.7* below), then consent can only be granted if there are no alternative solutions (see *Section 2.5 Stage 3 – Assessment of Alternative Solutions*), and there are imperative reasons of overriding public interest (IROPI) and

(1) Scottish Natural Heritage (SNH) (2001) Natura Casework Guidance: Consideration of Proposals Affecting SPAs and SACs. SNH Guidance Note Series. SNH
(2) Merricks v Secretary of State for Trade and Industry (CO/478/ 2006)

compensatory measures have been secured (see *Section 2.6 Imperative reasons of Overriding Public Interest and Compensation Measures*).

2.4.7 The Precautionary Principle has been described in PAN 58 (1) as:

".. the principle that authorities should act prudently to avoid the possibility of irreversible environmental damage in situations where the scientific evidence is inconclusive but the potential damage could be significant".

2.5 STAGE 3 - ASSESSMENT OF ALTERNATIVE SOLUTIONS

2.5.1 All feasible alternatives have to be analysed to ensure that there are none which *"better respect the integrity of the site in question"* and its contribution to the overall coherence of the Natura 2000 network (EC, 2007). Alternatives could include the location of the site, its scale and design, and the way in which it is constructed and operated. The do nothing option also has to be considered.

2.5.2 The comparisons of alternatives should not allow other assessment criteria (*eg* economics) to overrule ecological criteria (EC, 2007), although clearly an option which is not commercially viable is not an alternative option. The same guidance also refers to the opinion for the case C-239/04, where the opinion of the Advocate General was that:

"the choice does not inevitably have to be determined by which alternative least adversely affects the site concerned. Instead, the choice requires a balance to be struck between the adverse effect on the integrity of the SPA and the relevant reasons of overriding public interest".

2.6 STAGE 4 - IMPERATIVE REASONS OF OVERRIDING PUBLIC INTEREST (IROPI) AND COMPENSATION MEASURES

2.6.1 Where a development has an adverse effect on the integrity of a European site and there are no alternative solutions consent can only be granted in one of the following ways as described in *Regulation 62* of the *Habitats Regulations 2010*:

- if the site hosts a priority habitat or species which is affected, proposals can only be consented if they relate to:
  - human health, public safety or beneficial consequences of primary importance to the environment, or

(1) Scottish Executive Development Department (1999) Planning Advice Note 58 - Environmental Impact Assessment.

- any other reasons which are considered by the Competent Authority to be IROPI taking account of the opinion of the EC; and

- if the site does not host a priority habitat or species, then IROPI must be demonstrated, and the reasons can include those of a social or economic nature.

2.6.2 If the importance of the proposed development is deemed to outweigh the effects which will result to the European site, and there are no alternatives, compensatory measures must be secured before consent is granted. Compensatory measures are independent of the project and intended to offset the adverse effects of a project. The compensation measures must ensure that the overall coherence of the Natura 2000 network is maintained. Article 6 (3) describes Natura 2000 as:

"a coherent European ecological network of special areas of conservation that shall enable the natural habitat types and species' habitats concerned to be maintained, or where appropriate, restored at a favourable conservation status in their natural range" (EC, 2007).

2.6.3 To be acceptable compensatory measures should:

- take account of the comparable proportions of habitats and species which are adversely effected;

- be within the same bio-geographical range within which the European site is located;

- provide functions which are comparable to those which justified the selection of the of the original site; and

- have clearly defined implementation and management objectives so the measures can achieve the aim of maintaining the overall coherence of the network.

3 *HRA METHODOLOGY AND TECHNICAL ENGAGEMENT*

3.1 INTRODUCTION

3.1.1 This chapter provides further details about the assessment approaches used during the HRA, and explains the reasons why the European sites on the Humber Estuary are the only European sites affected by the AMEP scheme.

3.1.2 It also summarises the consultations on technical issues that have been held with consultees, notably with Natural England (NE), the Royal Society for the Protection of Birds (RSPB) and Humber Industry Nature Conservation Association (HINCA). A list of meetings held with consultees is provided in *Annex A (Supporting Information – Consultations)*, with further details in the Consultation Report submitted with the application (BDB, 2011).

3.2 ASSESSMENT METHODOLOGIES

Screening

3.2.1 The approach to the screening assessment has been described in *Section 2.3 (Stage 1 – Screening)* of this report. This section explains how the European sites which are affected have been determined and specific technical issues used in the assessment.

3.2.2 The assessment has considered which European sites could be affected by the AMEP proposals based on:

- a review of the activities associated with the construction, operation, maintenance and decommissioning of the AMEP scheme and determination of the effects and the areas over which they would be effective;
- a review of other existing and proposed developments in the area;
- a review of the European sites present in the area surrounding AMEP and their qualifying interests; and
- the sensitivities / vulnerabilities of those European sites to the effects resulting from AMEP and other developments.

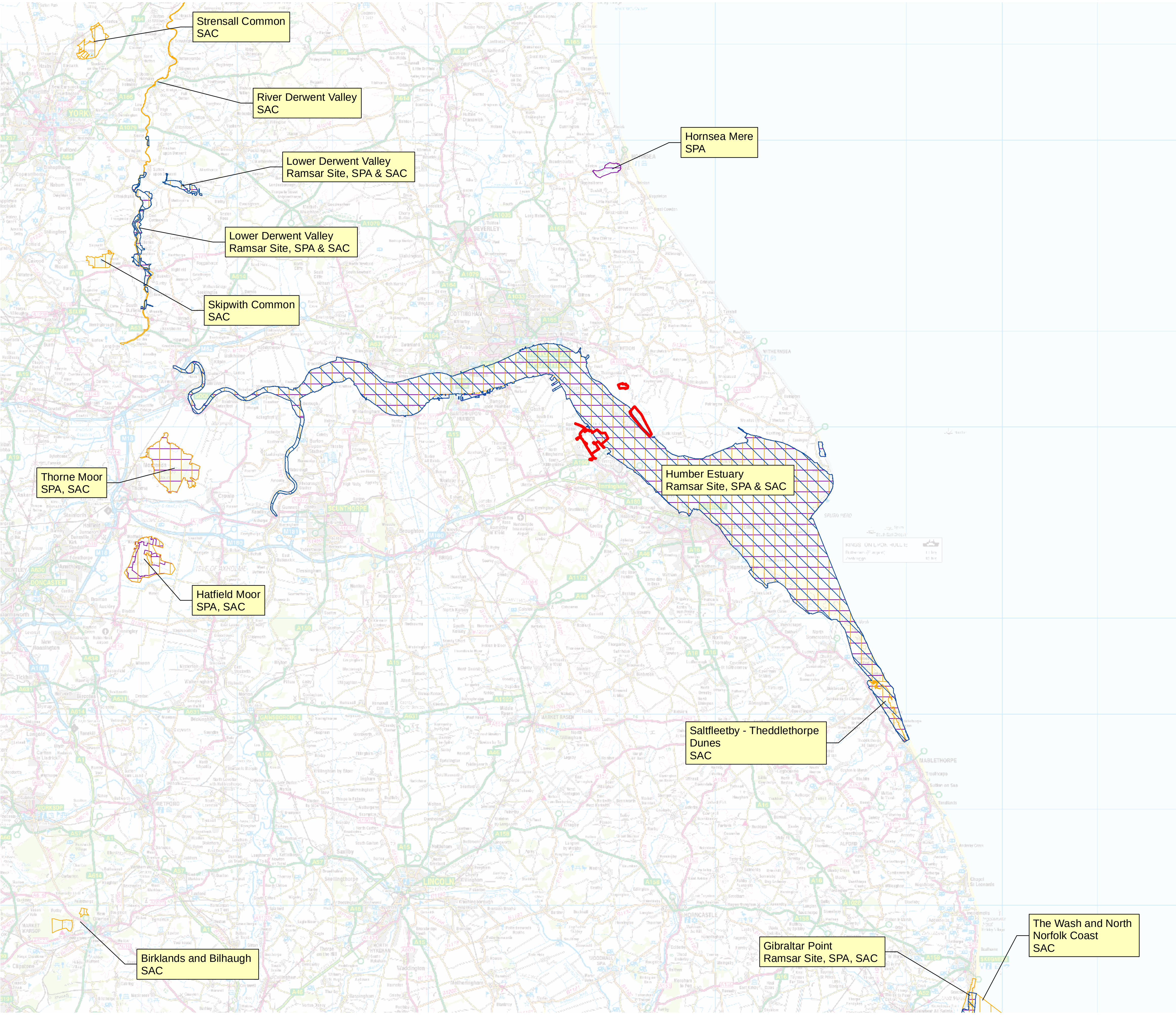
3.2.3 The activities associated with AMEP and the effects that are likely to result from them are described in *Section 5.4 (HRA Screening for Likely Significant Effect)* in *Chapter 5 European Sites and Likely Significant Effect* and *Chapter 6 Shadow Appropriate Assessment*. The majority of the effects are localised (*eg* direct and indirect habitat loss, disturbance from airborne noise, and visual disturbance from people / lighting), although some effects occur over much wider areas (*eg* sediment dispersion and disposal, underwater noise).

3.2.4 It is clear that the Humber Estuary European sites (SAC, SPA and Ramsar site) will be affected, as part of the AMEP scheme lies within the boundaries of the European sites and there will be a direct and indirect loss of estuarine habitat, and effects on the fauna species they support which are predominantly birds, with lamprey and marine mammals offshore.

3.2.5 *Figure 3.1* shows the Humber Estuary European site along with the nearest other European sites. *Figure 3.1* shows that the other terrestrial European sites are located at long distances away from the AMEP site and none will be affected by direct or indirect habitat losses, or any noise or visual disturbance sources due to AMEP, as it will have much more localised effects. Effects from sediment dispersal and disposal will affect the Humber Estuary, but the nearest other coastal or marine European sites are at Flamborough Head and Bempton Cliffs (UK0013036) over 80 km to the north, and Inner Dowsing, Race Bank and North Ridge mSAC (UK 0030370), approximately 100 km to the south, both of which are too distant from the AMEP scheme to be affected.

3.2.6 Hence it is clear from the above that the only European site which will be affected by the proposals is the Humber Estuary which is designated as a Special Area of Conservation (SAC), Special Protection Area (SPA) and is a listed Ramsar site

3.2.7 *Section 2.3 (Stage 1 – Screening)* of this report stated that the assessment has been taken in view of the conservation objectives of the European site. Many of the conservation objectives include a requirement to maintain the extent of habitats, and for there to be no reduction in extent from the established baseline, except where this is due to natural processes. The screening stage has therefore considered the areas of qualifying interest habitat affected permanently or temporarily, and if temporary, whether that loss will be reversible. In the case of AMEP, it is clear that significant areas of some of the qualifying habitats of the Humber Estuary SAC will be permanently lost (see *Section 5.4 (HRA Screening for Likely Significant Effect)* in *Chapter 5 European Sites and Likely Significant Effect*.



Key

- Application Boundaries
- RAMSAR
- SAC
- SPA

PROJECTION: British National Grid

Rev	Date	Comments	Drw	Chk	App
A	01/12/2011	Preliminary Issue	MTC	WB	SP

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ERM

Project: ABLE Marine Energy Park

Client: ABLE UK Ltd

Title: Figure 3.1
Location and Extent of European Designated Sites in Relation to the Development Site Boundary

PRELIMINARY

Scale:	Drawn	Checked	Approved
1:400,000@A3	MTC	WB	SP
Date	01/12/2011	01/12/2011	01/12/2011

Drawing No.: ABLE_HabitatRegulationAssessmentLarge.mxd

Revision:. A

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3.2.8 Where the qualifying interest of the SAC is a fauna species, then the targets are largely focused on maintaining stable or increasing populations, and avoiding significant disturbance and barriers to movement. Comparatively little is known about lamprey species, which are a qualifying interest of the SAC. The need to consider these species in more detail as part of the AA was largely required due to the uncertainties about the ecology of the species and hence the likely effects on them from AMEP.

3.2.9 The likely risks to birds have taken account of both the effects on the birds and the habitats which support them. A reduction of ≥1% in the population of a qualifying species, or assemblage has been used as a threshold to indicate a likely significant effect. This is in accordance with the approach set out in NE (2009) (1). Such reductions were assessed based on direct and indirect habitat loss and the likely effects from disturbance (*eg* due to noise and from visual sources such as people).

3.2.10 In some cases bird species occur on the AMEP site in percentages which are ≥1%, but still only comprise one or two birds. In such circumstances no likely significant has been concluded where it is evident that these birds could be accommodated elsewhere within the European sites. Similarly where it is evident that the bird species recorded are not reliant on the habitats lost (even where the numbers ≥1%) and hence can also be accommodated elsewhere, then no likely significant effects have also been concluded.

3.2.11 The screening assessment has taken into account mitigation where it was evident that it could be incorporated and would be successful.

3.2.12 No significant impact were concluded for qualifying interest habitats and species where it was clear that AMEP will have no impacts at all on them.

3.2.13 The screening assessment adopted a similar approach to the consideration of other developments which are likely to affect the European designations, and identified those which needed to be considered as part of an in-combination assessment (see *Section 6.7*). The assessment was based on information which was readily available. For some developments such as that at Green Port Hull, no specific information about the proposals was available, and the assessment had to rely on data from the approved Quay 2005 development, which is

(1) Natural England (December 2009) *Conservation Objectives and Definitions of Favourable Condition for Designated Features of Interest - Humber Estuary SSSI.* Draft Version 2. NE.

understood to be of the same scale and covered by the existing Harbour revision Order.

3.2.14 The approach to the screening assessment, and the findings of that assessment on specific qualifying habitats and species see *Section 5.4* in *Chapter 5 European Sites and Likely Significant Effect*), were discussed with NE during the regular meetings (see *Section 3.3 Engagement with Consultees*).

Shadow Appropriate Assessment

3.2.15 Where the effects on qualifying interest habitats and species were identified, or could not be ruled out, further assessment was undertaken. The criteria against which the assessment was made were broadly similar to those used in the screening assessment described above, as they reflected the Conservation Objectives and associated targets. This assessment comprised a more detailed investigation of the effects, and consideration of any mitigation options and their likely success.

3.2.16 For example, the screening assessment identified noise from piling activities for the new quay as a source of disturbance to birds on the remaining areas of mudflats on the foreshore around the new quay, and at North Killingholme Haven Pits (NKHP). At that stage it could not be concluded that no likely significant effect would occur, as there was a risk of disturbance. As part of the AA, noise levels were predicted based on detailed discussions with a suitably qualified and experienced contractor about source noise levels, and the expected maximum noise levels. The mitigation effects on the noise levels provided by the use of noise shrouds were also taken into account. The areas of mudflat remaining around the proposed new quay which were likely to be used by birds were determined and the number of birds of each species predicted. These numbers took account of the likely effects of visual disturbance on the birds from construction activities. The noise levels were then compared with those considered to affect birds and the numbers of birds likely to be affected assessed.

3.3 ENGAGEMENT WITH CONSULTEES

3.3.1 The project team has undertaken an extensive consultation process including regular meetings and conference calls with NE, RSPB and HINCA. A list of meetings including organisations that attended is provided in *Annex A*.

3.3.2 The discussions have facilitated the development of a scheme design for AMEP which will both mitigate and where necessary compensate for the resulting impacts.

In particular consultations with Natural England have included regular discussions on:

- the likely significant effects resulting from AMEP and issues which needed further consideration in the shadow AA;
- and the findings of that assessment taking including the mitigation measures which will be provided and their effectiveness; and
- the location and scale of the compensation sites which are to be provided on the north bank of the Humber Estuary to maintain the coherence of the Natura 2000 network (see *Sections 9.2 -9.4* in *Chapter 9 Compensation Measures*).

4 *DESCRIPTION OF THE DEVELOPMENT*

4.1 THE WIDE CONTENT

The Over-arching Project

4.1.1 The proposed development of AMEP is directly related to the emerging global project to decarbonise world energy production. The need to decarbonise world energy production, and its overriding benefit to the global environment, is detailed in the ES *Chapter 5 Need for the Development*.

The Broad Aim of the Development

4.1.2 AMEP will provide a new and substantial manufacturing base for the offshore marine energy sector. Currently, this market is anticipated to be dominated by offshore wind energy with this sector expected to contribute significantly to a new secure, low carbon and balanced energy mix for the UK.

4.1.3 As well as having quays to receive and export raw materials and products, the development will also provide facilities that are necessary to assemble the offshore generators, including offshore wind turbines (OWT's), in preparation for loading onto installation vessels for direct transport from their place of manufacture to the offshore development site.

4.2 THE DEVELOPMENT

Introduction

4.2.1 The development is located on the south bank of the Humber Estuary as shown in *Figure 1.1 in Chapter 1 Introduction*. To obtain a comprehensive understanding of the proposals, this chapter of the ES should be read in association with the drawings included in the application.

4.2.2 This site lies between the Humber Sea Terminal (HST) and ABP Immingham Port. The boundary of the site lies partially within the Humber Estuary, which is protected under both national and European law, including the EC Habitats Directive (92/43/EEC). The estuary is part of the Natura 2000 network of nature conservation areas within the European Union that has been established to ensure the survival of

Europe's most valuable species and habitats. The network currently comprises 25 000 sites and covers over 800 000 km^2 (or 20 per cent) of the EU's total land area and 100 000 km^2 of marine environment.

4.2.3 As the proposals for AMEP will, if consented, cause the loss of a significant area of estuary and intertidal mudflat which are specific features of the Natura 2000 network, it is necessary, subject to the specific requirements of the Habitats Regulations 2010, to provide compensatory habitat to ensure the continued coherence of the network in the future. Accordingly, a related habitat creation site on the north bank ("the Compensation Site") has been designed to provide new mudflat and estuarine habitat that offers equivalent functional value to the flora and fauna for which the area has been designated. The EIA for the Compensation Site is reported in *Volume 2* of the ES.

4.2.4 This chapter describes the activities that are proposed to be undertaken during the construction of AMEP and during the subsequent operation and use of the completed facility.

4.3 LOCATION OF THE PROJECT

4.3.1 As indicated in *Chapter 1*, AMEP is situated in an area known as Killingholme Marshes on the southern bank of the River Humber, approximately 2 km from the village of North Killingholme to the west, and 3.3 km from Immingham to the south.

4.3.2 The site comprises the following development areas:

Existing terrestrial land approximately 220 ha to industry and 48 ha to ecological mitigation
Existing intertidal area - 31.5 ha
Existing subtidal area - 13.5 ha

4.3.3 The proposed terrestrial areas include 122.4 ha of land that has the benefit of extant planning consents for port related storage and 11.5 ha of land that has temporary consent as a lay-down area during the construction of a biomass fuelled power station; details of these consents are included in the ES in *Chapter 3 Planning Policy and Context*. Development has commenced in the area for which planning permission has been granted for port related storage; construction of the power station has not commenced. The balance of the terrestrial areas comprises Grade 3 agricultural land that is allocated for industrial development in North Lincolnshire Council's Local Plan. This land allocation is continued within the Council's Core Strategy that was adopted in June 2011.

4.3.4 The western boundary of the development is defined by Rosper Road, which provides access to the A160, part of the trunk road network. Beyond Rosper Road lies the Total Oil Refinery and Conoco Philips Humber Refinery and combined Heat and Power Plant. The eastern boundary of the existing territorial area is marked by the existing flood defence wall, beyond which lies the Humber Estuary.

4.3.5 The intertidal and subtidal areas are located within the Humber Estuary and extend from the existing tidal defences towards the deep water channel that serves the HST.

4.4 DESCRIPTION OF THE WORKS

Introduction

4.4.1 A plan showing the core development areas is reproduced in the ES in *Figure 4.1* in *Chapter 4*.

4.4.2 An indicative site plan, based on the development serving the offshore wind sector, is reproduced in the ES in *Figure 4.2*. The principal elements of the proposal are described below. As discussed in the ES in *Chapter 2 The Environmental Assessment Process*, the development proposal necessarily incorporates a degree of flexibility with respect to the actual sizing and siting of buildings.

4.4.3 A project specification is included in *Annex 4.1 (Volume 1* of the *ES)*, which provides details of the flexibility that is being sought.

The Quay

4.4.4 Proposals for the quay are detailed on the following drawings included in the application.

- AMEP_P1D_D_001 – Quay General Arrangement
- AMEP_P1D_D_002 – Indicative Piling Layout
- AMEP_P1D_D_003 – Quay Sections 1 of 2
- AMEP_P1D_D_004 – Quay Sections 2 of 2
- AMEP_P1D_D_005 – Front Wall Elevation
- AMEP_P1D_D_006 – Northern Return Wall Elevation
- AMEP_P1D_D_007 – Southern Return Wall Elevation
- AMEP_P1D_D_009 – Concrete Deck General Arrangement

4.4.5 Briefly, the frontage will be 1 279 m in length and will be located close to the western edge of the existing dredged channel that provides access into HST. This existing channel has consent for capital dredging to 7.2 m below Chart Datum (CD).

4.4.6 The quay is proposed to be a solid berth structure for 1 200 m of its length with a front wall that comprises a combination of large diameter tubular steel piles alternating with steel sheet piles. This arrangement is commonly referred to as a combi-pile wall. The tubular piles will be tied back with flap anchors that fix the piles in position near their top. These anchors rely on the passive resistance of the quay backfill material. This front wall will return at the southern end of the quay and form part of a specialist berth for emerging offshore wind turbine installation vessels. At the northern end, the quay returns at an angle that is square to the existing flood defence.

4.4.7 A piled relieving slab will be constructed behind the front wall and will enable a range of plant including large dock cranes, up to 1 600 t capacity, to operate anywhere on the quay.

4.4.8 The berthing pocket in front of the quay will be over-dredged to the top of the natural bedrock and then backfilled to -11 mCD with stone aggregate to enable repeated loading by 'jack-up' barges.

4.4.9 The existing intertidal area between the existing flood defence and the new quay will be filled with sea or estuary dredged material. The upper sections of fill, approximately 1 m, will comprise imported stone that will provide a drained heavy duty pavement for operational plant which will include tracked cranes and self propelled mobile transporters. The finished level on the perimeter of the quay will be approximately 6.1 mAOD. This will ensure that waves within the estuary do not significantly overtop the structure in extreme weather events over the lifetime of the development.

4.4.10 The structural pavement will enable the storage of heavy components. According to *A Guide to an Offshore Wind Farm*, (Crown Estate, 2010) the storage space taken up by a single set of turbine components is one hectare. Given that sufficient components need to be placed close to the quay to facilitate efficient loading onto the installation vessels, each quay is provided with around 5 ha of lay down area which will provide for storage of around five complete OWTs.

4.4.11 The quay will be drained by a network of land drains that discharge into the Humber Estuary. Drainage water will pass through oil interceptors where a high risk of oil spillage exists.

4.4.12 To enable the quay to operate twenty-four hours a day, sufficient lighting will be provided to enable personnel to access, egress and carry out their work safely and to identify any hazards or obstacles in the workplace. Accordingly, external lighting over the quay frontage will comprise 50 m towers that will be fitted with directional luminaires to limit spill outside the working areas. Over the operational areas of the quay (notionally taken to be that area within 50 m of the quay edge), the lighting will provide average luminance of 50 lux, with a minimum of 20 lux. Elsewhere, on the storage areas behind the quay, lighting will be designed to provide an average luminance of 20 lux with a minimum of 5 lux.

4.4.13 Navigational lighting will be provided on the quay to enable safe berthing and manoeuvring of vessels.

4.4.14 Cooling water infrastructure that serves two nearby power stations, operated by E.ON and Centrica, is routed through the intertidal area north of the quay. A new outfall will be constructed in the quay to allow for the diversion of the E.ON outfall given the residual uncertainty with respect to potential accretion in this area as a consequence of the development. This is further discussed in the ES in *Chapter 8 Hydrodynamics and Sedimentary Regime*.

Dredging

4.4.15 The proposed works will include capital dredging operations.

4.4.16 Compressible silt is present over part of the footprint of the proposed new quay and some may need to be removed by a trailing suction hopper dredger (TSHD) before placing any fill material. A TSHD trails a suction pipe (or pipes) when working, and loads the dredge spoil into one or more hoppers in the vessel. When the hoppers are full, the TSHD sails to a disposal area and either dumps the material through doors in the hull or pumps the material out of the hoppers. It is estimated that approximately 250 000 m^3 of silt may be removed from the footprint of the quay in this way. The operation is illustrated in *Figure 4.3* below, and is routinely undertaken on the Humber.

4.4.17 To enable vessel access to the operational quay and allow berthing alongside its length over a commercially viable tidal range, capital dredging will be required from three distinct areas as described below.

Figure 4.3 Illustration of a Trailing Suction Hopper Dredger

Source: [redacted]

4.4.18 **Berthing Pocket:** Based on current knowledge of the emerging designs for new generation wind turbine installation vessels, an operational draught of 10 m has been adopted. Accordingly, the quay will have a dredged berthing pocket that will be maintained at -11 mCD with an initial over-dredge to bedrock; this will allow accommodation of 10 m draft vessels with a minimum under keel clearance of one metre. The berthing pocket will be 60 m wide. The side slopes of the berth will have a gradient appropriate to the in-situ properties of the bed material.

4.4.19 In the area of the berthing pocket, bed levels currently range from around -2 mCD to -4 mCD. The chalk strata is currently interpreted to be at approximately -8 mCD and -10 mCD at the northern and southern ends of the quay respectively (refer to the planning application drawings). A maximum capital dredge of approximately 9 m is therefore required to create the berthing pocket.

4.4.20 **Approach Channel:** Based on a maintained depth of -9 mCD, capital dredging within the approach channel will be around 5.5 m at the northern end of the quay but reduce to about 2.5 m at the southern end. The majority of the approach is already dredged to allow access to Killingholme Oil Terminal and HST. An initial over-dredge of 0.3m will be undertaken.

4.4.21 **Turning Area:** To enable vessels to arrive and depart at most states of the tide, a turning area will be provided; this will have a maintained depth of -9 mCD. In the turning area, bed levels currently average -9 mCD and a maximum capital dredge of 1.5 m is required.

4.4.22 *Table 4.1* details the approximate quantities of capital dredging works that will be required depending on the final dredge depth.

Table 4.1 Approximate Capital Dredge Quantities

Area	**Dredge**
Reclamation Area	294 500 m^3
Berthing Pocket	827 000 m^3
Approach Channel	682 000 m^3
Turning Area	132 000 m^3
TOTAL	1 935 500 m^3

4.4.24 Once the development is complete, maintenance dredging will be required from time to time and an assessment of maintenance dredge requirements at the new development is included in *Chapter 8 Hydrodynamics and Sedimentary Regime*. The impact of the development on maintenance dredging of adjacent port sites has also been assessed and is also reported in *Chapter 8 Hydrodynamics and Sedimentary Regime.*

Heavy Component Manufacturing Site

General

4.4.25 Offshore wind turbines comprise a number of very large and/or heavy components that need direct access to a quayside as they are too large to be transported by road on a frequent basis. The principal components are[1]:

- Nacelles 150-300 t
- Rotors 90-150 t
- Towers 200-400 t
- Blades 5-25 t (60 m long x 5 m max width)
- Steel Foundations 600-800 t

4.4.26 AMEP will provide a heavy component manufacturing base for the manufacture of the above items. *Figure 4.4* shows these components diagrammatically.

[1] Extracted from, '*A Guide to an Offshore Wind Farm*', published by the Crown Estate. Discussions with leading manufacturers however indicate that new generation Nacelle's may increase to 500 t in weight; towers may be up to 450 t and blades up to 30 t.

4.4.27 The particular mix of manufacturing facilities that will locate to the site cannot be fixed prior to the application. The heavy component manufacturing site is based on the following indicative development proposal for the offshore wind sector:

- 3No. nacelle factories producing a total of 600 units per year
- 2No. tower factories producing a total of 400 units per year
- 2No. blade factories producing a total of 1 200 units per year
- 1No. foundation factory producing a total of 50 units per year

4.4.28 Based on this indicative mix, the gross weight of goods manufactured on the site would lie within the range 200 000 – 400 000 t.

4.4.29 As the manufactured goods are bulky and, other than blades, cannot be stacked, the factory units require substantial external areas for storage of their finished product. These laydown areas are designed to be sufficient to ensure that manufacturing is never interrupted by the absence of available storage space.

Figure 4.4 Principle Components of an Offshore Wind Turbine

Source: *' A Guide to an Offshore wind Farm'*, Crown Estate

Buildings

4.4.30 The schedule below details the maximum size for each building type currently proposed on the heavy component manufacturing site.

Table 4.2 Schedule of Buildings

Reference (see Fig 4.2)	Type	Max Plan Dimensions (exc. Offices)	Max height to eaves	Total Aggregate Area
N1	Nacelle Factory	150 m x 50 m	24 m	
N2	Nacelle Factory	150 m x 50 m	24 m	
N3	Nacelle Factory	150 m x 50 m	24 m	
T1	Tower Factory	200 m x 100 m	24 m	
T2	Tower Factory	200 m x 100 m	24 m	
B1	Blade Factory	300 m x 40 m 100 m x 50 m 100 m x 50 m	24 m	
B2	Blade Factory	300 m x 40 m 100 m x 50 m 100 m x 50 m	24 m	150 000 m^2
F1	Foundation Factory	300 m x 65 m	45 m	
F1	Foundation factory paintshop	50 m x 50 m	45 m	
	Electric Substation	10 m x 6 m	5 m	
SPMT	SPMT Service Building	72 m x 40 m	6 m	

4.4.98 These factory units will be of steel framed construction with powder coated metal cladding. Buildings will generally be single span portal frame type with a minimum roof pitch of 6°. Rooflights will generally be incorporated into the roof cladding to maximise natural light internally. Each building will have sectional overhead doors (or their equivalent) to tenant requirements and sufficient fire escape doors to permit safe evacuation of the building. Subject to tenant requirement, a concrete or masonry dado wall will be provided around the perimeter of the building to mitigate the consequences of any low level impact from manoeuvring plant.

4.4.99 Lighting levels immediately outside the buildings will be provided by external downlights fixed to the buildings to provide an average luminance of 35 lux.

4.4.100 Office space is incorporated into, or annexed to, each building, up to three storeys in height.

4.4.101 Each building will have a bituminous car parking area with safe pedestrian access from the car park into the buildings. The car parks will be illuminated with 30 m high columns to achieve an average luminance of 20 lux and a minimum level of 5 lux.

4.4.102 A concrete service yard will be provided around the perimeter of the building to permit access by heavy goods vehicles up to 44 t. These areas will be a maximum of 50 m wide.

4.4.103 External illuminated unit identification signs may be provided on one side of each building

External Storage Areas

4.4.104 External storage areas within each plot will be provided with a stone pavement suitable for tracking by heavy duty plant. To suppress dust the surface will be finished with a skim of tarmac chippings or similar.

4.4.105 As with the quay, the external storage areas around the manufacturing plants will need to operate twenty-four hours a day. Accordingly, external lighting for these areas will comprise 50 m towers that will be fitted with directional luminaires to limit spill outside the working areas. The external lighting will provide an average luminance of 20 lux with a minimum of 5 lux.

Surface Water Drainage

4.4.106 The site lies within the Killingholme Marshes drainage catchment, which is within the North East Lindsey Drainage Board (NELDB) district. The North Killingholme, South Killingholme and Killingholme Marsh's catchment are currently subject to tide locking on each tide cycle, and during intense rainfall events the flood plains inter-connect to form a complex hydraulic regime. An existing outfall lies within the footprint of the proposed quay. It is proposed to relocate this outfall to the north of the new quay and to construct a new pumping station that will enable surface water run-off from the site to discharge into the Humber Estuary at high tide. At low water the surface water will discharge under gravity. Further details of the proposals are included in the ES in *Chapter 13 Drainage and Flood Risk* and in the Flood Risk Assessment.

4.4.107 The site will be provided with an improved ditch system that will carry surface water to the pumping station. The new ditches will be approximately 15 m wide (subject to detailed design) and comprise a main channel and a flood berm that will store water in extreme events and minimise, as far as reasonably practicable, the pumping requirement.

4.4.108 On-plot drainage will comprise high capacity slot drains within the concrete service yards and infiltration drainage within the storage areas. The latter form will comprise stone filled trenches with porous pipes that discharge into the open ditches running through the site.

Foul Water Drainage

4.4.109 Foul water drainage from buildings will fall by gravity into pumping stations distributed throughout the site. These will pump the foul effluent through rising mains into the adopted foul water drainage system operated and maintained by Anglian Water.

Ground Levelling

4.4.110 Existing ground levels within the manufacturing site will be graded to provide adequate falls into the new surface water drainage system. There will be a net requirement to import around 2 million m^3 of material to achieve final design levels. Along the eastern edge of the manufacturing area ground levels will be raised by around 3.5 m to tie into the quay.

Fencing

4.4.111 Each plot will be fenced to provide a secure environment for the storage of raw materials and finished products. Fencing will be approximately 2.5 m high steel palisade or similar.

Highway Access

4.4.112 The site is currently provided with two accesses on Rosper Road. One access is currently a private road but will be improved and the junction reconfigured to a standard that is suitable for its increased level of use. Access for existing users will be maintained.

4.4.113 One additional access is proposed onto Rosper Road to facilitate access and egress. This new junction is located between Station Road and the existing access into Able Humber Port Facility. Rosper Road will need to be widened at this location to provide a right turn ghost island for traffic approaching the site from the south.

Lighting

4.4.114 As noted above lighting will comprise a combination of the following:

- 50 m lighting columns to provide general external lighting;
- 30 m lighting columns within car parks; and
- floodlighting fixed to buildings to supplement lighting around the building cartilage.

Rail Crossings

4.4.115 The existing rail line that runs through the site is the remnant of the Killingholme Branch Line and has been largely disused since 2005. The existing Network Rail infrastructure terminates just beyond the Humber Sea Terminal, the track beyond having been taken up in the 1960s. The remaining section of line has three level crossings for vehicular traffic (Marsh Lane, Station Road and Haven Road), three level crossings within the Humber Sea Terminal and a number of at-grade farm accommodation crossings. Network Rail undertook a Pre-Feasibility study for re-opening this section of the Killingholme Brach line in 2009 but found that there was no compelling business case to justify the necessary level of investment by them.

4.4.116 It is proposed to transfer ownership of the Network Rail land and its associated infrastructure to the applicant. In this case the existing line will become a privately operated siding with Humber Sea Terminal retaining any existing rights. A barrier will be erected to demarcate the siding from the Network Rail line and control access. New level crossings will be constructed to enable access for manufactured goods to the quay.

Soft Landscaping

4.4.117 A soft landscaping scheme is proposed to mitigate for the impacts of the development on the existing ecology and to soften and screen the development insofar as it is possible to do so, given its scale. Landscaping proposals include:

- shrub and tree planting at the entrance to each plot and around car parking areas;

- shrub and tree planting along Rosper Road to supplement existing features; and
- a green corridor running along the side of the main north south ditch running through the site.

4.4.118 Species of generally local provenance will be used that are known to suit the particular microclimate adjacent to the estuary. More details are provided in the ES in *Chapter 20 Landscape and Visual Impact*.

Supply Chain Park

General

4.4.119 The proposed Supply Chain Park (SCP) is wholly located on areas of the site that currently have the benefit of planning consent for port related storage. The main SCP is on land that is currently used for storing imported cars. This part of the site covers around 35 ha.

4.4.120 This area will be developed as a base for supply chain industries serving the offshore energy sector. These industries also need to expand and, ideally, they are located close to their clients' business.

4.4.121 The following supply chain industries are considered most likely to develop new facilities on the site:

- generator manufacturers;
- baseframe manufacturers;
- sub-station control panel manufacturers;
- canopy and spinner manufacturers; and
- project offices

4.4.122 Like the heavy component manufacturing site, the particular mix of facilities that will locate to the site is not known with certainty at this stage. Accordingly, the application will seek to obtain a flexible consent that can respond to market demand. The SCP is based on a total floor area of 25 000 m^2.

Buildings

4.4.123 In most respects buildings on the SCP will be similar to those described above on the heavy component manufacturing site.

4.4.124 In summary, these buildings will be in the range 6-15 m high to eaves; car park lighting will be provided by 30 m columns and the concrete service yard will be a maximum of 25 m wide.

External Storage Areas

4.4.125 The majority of the SCP area currently has a tarmac finish that was designed for use by light vehicles only. It is anticipated that this will be unsuitable for most tenants. Accordingly, the tarmac will be removed as required and the bearing capacity of the pavement layer will be improved to tenant requirements by the addition of imported stone fill and geogrid where necessary.

4.4.126 As with the quay and the heavy component manufacturing site, the external storage areas around the SCP will need to operate twenty four hours a day. The existing external lighting for these areas comprises 30 m towers that are fitted with directional luminaires to limit spill outside the working areas. The lighting is consented for an average luminance of 25 lux with a minimum of 5 lux and will be retained.

Drainage

4.4.127 Within the main SCP site, the existing drainage system was installed in 2006 and comprises high capacity slot drains that discharge into the open ditches running around its perimeter. These drains will be retained where possible.

Foul Water Drainage

4.4.128 The existing site has two package treatment plants that discharge into the NELDB drain running through the site; these units will be retained. However, all new buildings will be provided with a connection to the adopted foul water drainage system operated and maintained by Anglian Water.

Ground Levelling

4.4.129 Existing ground levels within the SCP will be raised by up to 600 mm to provide a thicker stone pavement. There is expected to be a net requirement to import around 150 000 m^3 of fill material to achieve final design levels.

Fencing

4.4.130 The perimeter of the main SCP area has a 2.5 m high electric fence. This will be retained.

4.4.131 Each plot will be fenced to provide a secure environment for the storage of raw materials and finished products. Fencing will be 2.5 m high steel palisade or similar.

Highway Access

4.4.132 The site is currently provided with two accesses on Haven Road. One access is presently unsuitable for heavy goods vehicles but will be improved under an extant permission to provide a new junction that is suitable for its increased level of use.

Lighting

4.4.133 As noted above lighting will comprise a combination of the following:

- 30 m lighting columns to provide general external lighting; and
- floodlighting fixed to buildings to supplement lighting around the building curtilage.

Soft Landscaping

4.4.134 Existing soft landscaping around the perimeter of the SCP will be retained.

Overflow Storage Area

4.4.135 The Killingholme Pits SSSI lies adjacent to the northern boundary of the application site. The proposed overflow storage area has the benefit of extant planning consent for port related storage. A condition attached to the consent limits stacking of containers within 200 m of the SSSI boundary. This area will therefore be used as an overflow storage area for items less that 6 m high.

Electric Services

4.4.136 The AMEP development requires electrical power in the order of 30 MVA for peak operation of the facility.

4.4.137 The power supply necessary for the site will be provided at 33 KV. Within the site there will be three substations from which this medium voltage supply will be stepped down to 11 KV.

4.4.138 The supply must be continuous and reliable; therefore the site will be served by two synchronised 33 KV lines.

Water Services

4.4.139 AMEP is expected to require a potable water supply in the order of 500 m^3/day with a peak requirement of 25 litres /second.

4.4.140 Anglian Water will reinforce their existing infrastructure to provide the peak demand.

Traffic Junction Improvements

4.4.141 A traffic impact assessment has been undertaken and a number of junction improvements are proposed on the approaches to the development site. These are detailed in the ES in *Chapter 15 Traffic and Transport*.

4.5 ECOLOGICAL MITIGATION AREA

4.5.1 To the south of the industrial development lies plot of approximately 48 ha that will be landscaped and managed in the future for the benefit of ecological interests that would otherwise be adversely affected by the development. The majority of the plot will be managed as wet grassland to provide feeding and roosting habitat for over-wintering birds.

4.5.2 A 0.7 ha plot of land to the south of Chase Hill Wood will also be managed for the benefit of fauna. This will include the creation of new ponds for the translocation of great crested newts from the main development site.

4.6 DIVERSION OF PUBLIC RIGHTS OF WAY

4.6.1 A public right of way exists along the top of the existing flood defence wall within the AMEP site. This right of way will be diverted around the perimeter of the site. The route is shown on the application drawings.

4.7 CONSTRUCTION METHODOLOGY – MEP SITE

Working Hours

4.7.1 Construction is proposed to be undertaken at the times detailed in *Table 4.3*:

Table 4.3 Schedule of Working Hours

Location	Day	Working Hours
Marine Works	Monday to Friday Saturday Sundays and Bank Holidays	Piling Works: 06:00 – 22:00 All other Works: At all times
MEP Site, existing terrestrial areas	Monday to Friday Saturday Sundays and Bank Holidays	07:00 to 19:00 07:00 to 17:00 Occasional working as required

Task Lighting

4.7.20 During construction, local mobile task lighting will be used to illuminate areas under construction during the hours of darkness. This lighting will generally be less than 10 m high and will be directed away from sensitive receptors.

Marine Development on the AMEP Site

4.7.21 The proposed construction sequence is illustrated on the following drawings included in the application:

AMEP_P1D_D_101 – Indicative Sequence Plan View 1/3;
AMEP_P1D_D_102 – Indicative Sequence Plan View 2/3;
AMEP_P1D_D_103 – Indicative Sequence Plan View 3/3;
AMEP_P1D_D_104 – Indicative Sequence Cross Section 1/2;
AMEP_P1D_D_105 – Indicative Sequence Cross Section 2/2;
AMEP_P1D_D_106 – Proposed Site Facilities and Access 1/2;
AMEP_P1D_D_107 – Proposed Site Facilities and Access 2/2.

4.7.22 Marine works, other than piling works, are proposed to be undertaken twenty fours a day. Vessel lighting will be required including localised task lighting after dark. Lighting will be kept to a minimum with light spill controlled by the use of appropriate lighting units.

4.7.23 Large diameter tubular piles that will form part of the quay wall, will be installed from barges operating within the estuary; it is anticipated that two jack up barges will operate simultaneously. These piles will be vibrated through any soft superficial deposits that are present and will then be driven to their design depth using hydraulically operated piling hammers.

4.7.24 The sheet piles will also be driven by a vibrating ram until refusal. If the pile refuses before reaching its design level, further driving will be completed using a hydraulic hammer.

4.7.25 The tubular piles are fixed close to their top by flap anchors. This system avoids the use of anchor piles and thereby avoids further noise generating activity that would arise from their installation. To install the flap anchors a trench will be excavated by backhoe dredger, landward of the combi-pile wall.

4.7.26 Parts of the footprint of the new quay will overlie soft alluvial deposits that would settle significantly under loading if left in place. Accordingly, a proportion of this existing bed sediment will be dredged.

4.7.27 Once the above operations are complete for a section of quay, land reclamation is expected to commence. The area immediately behind the combi-piles is proposed to be backfilled with marine dredged granular material which would be placed by pumping from a dredger berthed sea side of the quay wall using a technique known as "rainbowing".

4.7.28 For the main reclamation area, three cells are proposed to be created using imported granular material. A system of pipelines would then be installed that would transport either imported marine dredged material or material from the dredge, from the supply vessel or dredger respectively, into the cells.

4.7.29 Each cell will be surcharged with fill material in order to accelerate settlement of both the placed material and the original ground. Vertical sand drains may also be installed to aid this process.

4.7.30 The number of staff required for construction of the quay is expected to vary during the construction phase. However, based on a preliminary programme it is considered likely that employment levels would peak at around 230 staff for this section of the works.

4.7.31 A minimum 2 year construction programme is anticipated for the marine works although this is dependent on other constraints established during the consultation process, in particular any restrictions imposed on working during the winter period.

Site Infrastructure

Cut and Fill Earthworks

4.7.32 Existing levels on the site vary from less than 3 mAOD immediately behind the existing flood defence along the eastern edge of the current terrestrial area, to just over 6 mAOD adjacent to Rosper Road along the western edge of the site.

4.7.33 As the majority of the site lies within Environment Agency Flood Zone 3, only a relatively small volume of cut/fill operations will be undertaken. The majority of the earthworks are anticipated to be undertaken using imported fill material. Imported fill would comprise a mixture of general fill that complies with the Highways Agency's Specification for Highway Works and capping material or Type 1 sub-base for the pavement layer. The importation would be minimised where possible by using multiple layers of structural geogrids within the pavement layers.

4.7.34 Ground levels are anticipated to be raised by around 3.5 m along the landward edge of the existing flood defence.

4.7.35 The pavement layer thickness will depend on the bearing capacity of the subsoil which is normally gauged by reference to the measure of its California Bearing Ratio (CBR).

4.7.36 It is expected that approximately 2 million m^3 of fill will need to be imported onto the site over a period of around two years. Stone could either be imported into the Port of Immingham and transported to the site on the local road network or could be imported by road from a quarry within the United Kingdom. Once the new quay is partially complete it will also be used for importing fill.

Utility Services

4.7.37 Cooling water pipes for the E.ON and Centrica power stations pass underground through the site. This essential infrastructure will be retained in-situ and will be protected at the start of the works by erecting barriers either side of their centre line to create a protected 6m wide corridor. Heavy duty crossing points will be constructed at discrete locations to enable heavy plant to pass over the pipelines.

4.7.38 At the southern end of the site a number of oil pipelines run underground through the site, within the area to be developed for ecological mitigation.

4.7.39 Following on from the cut/fill operations, drainage and service trenches are proposed to be excavated by a hydraulic excavator to their required depth. Services would be laid in the base of the trenches and imported backfill placed over the pipes or cable. Warning tape will be placed as appropriate to mitigate against accidental damage in the future.

Buildings

4.7.40 Building foundations are expected to be either reinforced concrete pads or pilecaps. Piles are proposed to be either driven steel or precast or alternatively continuous flight auger, which is a low noise, low vibration technique. Excavation for foundations is expected to be undertaken using backhoe excavators. Reinforcement would be delivered by flatbed lorry and concrete is likely to be delivered from an off site batching plant although a temporary on-site batching plant may be installed, subject to its economic viability.

4.7.41 Buildings are proposed generally to have heavy duty reinforced concrete ground bearing slabs that will be cast onto an imported subgrade. Piled slabs may also be used subject to tenant loading requirements for particular buildings and existing ground conditions. Concrete delivery vehicles would discharge into long reach concrete pumps that would transport the concrete close to its final position. Floor slabs are expected to be cast in large sections with saw cut contraction joints made whilst the concrete is still green. Floor finish will be achieved using a laser screed machine to achieve a high quality flat finish.

4.7.42 The steel building frame will be fabricated off site and delivered on lorries. The frame would then be erected by crane and clad using mobile platforms. Once the frame is erected the internal fit out would be undertaken with all deliveries being made by road.

4.7.43 The external concrete service yard is expected to be constructed in a similar manner to the internal floor slabs.

4.7.44 Up to three buildings may be under construction simultaneously.

Dredging

Material to be Dredged

4.7.45 Between 15 June and 15 July 2010 a ground investigation of the foreshore between HST and ABP Immingham was undertaken by Soil

Engineering Ltd. on behalf of Yorkshire Forward. The work comprised the following:

- 30 No. vibrocores;
- Bathymetric Survey;
- Magnetometer Survey; and
- Unexploded Ordnance Desk Study.

4.7.46 The results of the investigation are reported in the factual ground investigation report by Soil Engineering and reproduced in the ES in *Annex 7.3*. An interpretative report was prepared by Buro Happold and is reproduced in the ES in *Annex 7.4*.

4.7.47 The vibrocore investigation shows that the general subsoil sequence in the area of the investigation comprises the following:

- very soft to soft alluvial clays/clayey silts – occasional thin peat layers;
- silty and gravelly sands; and/or
- soft to firm becoming stiff glacial till with beds of glacial sands and gravels.

4.7.48 The respective volumes of the different materials to be dredged have been estimated from the borehole information and are detailed in the ES in *Chapter 7 Geology, Hydrogeology and Ground Conditions*.

Dredging Methodology

4.7.49 Dredging works will be undertaken using a combination of the following plant:

- TSHD;
- backhoe dredger; and
- bucket ladder dredger.

4.7.50 A detailed dredge methodology is included in the ES in *Annex 7.6*.

4.8 MITIGATION OF CONSTRUCTION IMPACTS

4.8.1 The impact of the construction works on ecology, the local and strategic road network, noise, air quality, water quality, light and navigation will be discussed elsewhere in this report.

4.8.2 Mitigation of any potential effects would be delivered through a Code of Construction Practice (CoCP) to be approved by the local authority. The draft CoCP is included in the ES in *Annex 4.2*.

4.9 Operational Details

General

4.9.1 The development will be one of a number of facilities both in the UK and in continental Europe that either manufactures or assembles marine energy components. Manufactured goods will be distributed between these sites in accordance with market demand at any particular point in time.

4.9.2 A schedule of the AMEP development including projected employee numbers and shift patterns is included in the ES in *Annex 4.3*.

The Quay

4.9.3 The application includes for the creation of a new harbour authority to manage the operation of the facility. On completion, the quay will be used for the export of goods and for the import of materials and components that are procured from overseas or from other coastal locations within the UK.

4.9.4 A number of berths will be designated along the quay and allocated for use by different tenants. Each berth will be around 200 m long. Whilst the berths will be primarily designated for installation craft this does not exclude their use by other vessels delivering raw materials and other products either related to marine energy or otherwise.

4.9.5 Energy generation components will be moved onto the quay using self propelled mobile transporter (SPMT) units that can be linked together in various permutations to manoeuvre large and heavy items. To take into account the potential for future optimisation of the installation procedure, it is assumed that OWT's that are assembled on the site may be fully erected on the quayside prior to load out.

4.9.6 Loading of the installation vessels will be undertaken using a combination of heavy duty mobile dock cranes and the vessels own cranes. Loading of each vessel will be undertaken on a 24/7 basis with a typical total turnaround time for each vessel of between 24 and 48 hours. However loading is a weather critical operation with crane lifts being subject to limiting wind speeds for safety reasons.

4.9.7 Vessels alongside will also replenish their consumables and may undertake some routine maintenance.

The Manufacturing Park

General

4.9.8 Given the current focus on offshore wind, the indicative masterplan is based upon a development that serves that sector. Nevertheless, alternative technologies may emerge that will also be served by the facility. There are a number of technologies for wind turbine manufacture, this section outlines the common types and typical features.

Tower Manufacturing Process

4.9.9 **Dimensions and Design:** Towers for offshore wind turbines have, to date, been of the conical steel design with a base diameter of approximately 5 m to 6 m diameter and a top diameter of approximately 3 m. Tower heights range from 60 m to 80 m. Wall thickness is in the range 10 mm to 70 mm thick. Towers are typically manufactured in two or three sections up to 30 m long and will be pre-assembled onshore before being loaded onto an installation vessel to be taken to site. A typical section will have a mass of up to 100 t; the complete tower will weigh between 200-400 t and house electrical and control equipment.

4.9.10 **Materials:** Flat steel plate is the prime raw material which is delivered in various thicknesses to the factory. Plate may be supplied in rough cut form or edge prepared and shaped ready for welding and rolling. Steel plate width is a function of the tower design and may be constrained by the width of rollers used in tower fabrication or to comply with transport restrictions. Plates can be up to 14 m long. UK sources of the relevant specification steel are the Tata plate mills in nearby Scunthorpe (200 000 t annual capacity) as well as Motherwell and the Spartan plate mill in County Durham. UK sourced steel would be delivered by rail or road . Vessels supplying steel sourced in Europe are generally up to 7 500 dwt (deadweight tonnage) and typically up to 120 m overall length. Vessels supplying steel sourced from overseas are generally up to 25 000 dwt and typically up to 180 m overall length.

4.9.11 **Components:** Flange rings are supplied to the factory readymade and allow the tower sections to bolt together or to be fixed to its foundation. Flange rings are typically forged or rolled and then machined and have a diameter of up to 6 m and mass of 10 t. Flange sources exist in the UK and overseas and could be located on the SCP.

4.9.12 Internal components such as doors, platforms, ladders, dampers and lifts are supplied by sub contractors and delivered by road transport.

4.9.13 **Coatings:** Zinc coating and urethane paints are used on the completed tower. Materials are delivered by road transport and supplied in drums up to 50 kg.

4.9.14 **Quantities:** The amount of raw materials required varies according to the tower design, but a 1 GW capacity production facility manufacturing 200 towers per year may typically use the following materials.

Table 4.4 Typical Raw Material Quantities for a 1 GW Tower Facility

Material	Tonnage p.a.	Approx. number of truck deliveries p.a.*	Truck deliveries/week
Steel Plate	40 000	1 600**	32
Welding materials	500	50	1
Cast components	2 000	200	4
Paint products	54	27	<1
Fittings	50	25	<1

* Load size per truck varies according to material type
**Can be reduced by direct delivery by ship

4.9.15 **Manufacturing Processes:** There are seven distinct stages to the manufacturing process for towers, these are illustrated diagrammatically below in *Figure 4.7* and briefly explained in the following paragraphs.

Figure 4.7 Tower Manufacturing Process

4.9.16 Plates can be flame cut to size and weld surfaces prepared either by the supplier or within the tower manufacturing facility. Computer numerical controlled (CNC) cutting will typically be used to ensure precision of joint lines. Plates are welded together in flat form to feed the rolling process to manufacture 3-4 m long sections of the tower. These individual sections are called "cans".

4.9.17 Multiple cans are welded together to build up tower sections. Submerged arc welding is normally employed to weld the cans together. For circumferential welds the can/tower is rotated. For longitudinal welds the weld arm can be moved. Non destructive testing is completed on all weld joints

4.9.18 Flanges are welded in position the ends of each tower section.

4.9.19 After welding, the door apertures are cut out and door frames are fitted along with flanges and internal fittings for mounting of platforms, ladders and transformers.

4.9.20 Tower sections are cleaned using power washers and detergent to remove ultrasonic gel residue. The sections are then shot blasted inside before being having a zinc rich primer coat applied. The sections are then spray painted and fitted out with internals such as ladders and platforms.

4.9.21 A single rolling machine is capable of making cans for up to 200 complete towers per annum on a 24/7 basis.

4.9.22 The production processes for a one GW facility produces scrap materials. The quantities vary depending on the manufacturing process but typically may include:

Table 4.5 Quantities of Scrap Material Produced from a 1 GW Tower Plant

Item	**Quantity (t)**
Landfill	72
Recycling	720
	of which
Steel	470
Paper/cardboard	20
Plastic	15
Wood	30
Shotblast grit	50
Chemicals	35
Other recycling	100

4.9.23 **Handling:** Most sections will be moved with SPMT machines.

4.9.24 **Hazardous Materials:** In addition to normal industrial disciplines particular precautions will apply in the following areas:

- handling and storage of flammable materials – paints, solvents; and
- dust emissions.

4.9.25 **Employee Health:** Employee health monitoring will include specific checks on lung function and hand-arm vibration (HAV).

4.9.26 The main sources of noise will be extraction fans, power tools and air handling systems. These are consistent with conventional industrial applications. Individual noise sources are unlikely to exceed 80 $dBLA_{eq}$ within 5 m.

Blade Manufacturing Process

4.9.27 **Dimensions:** Blades weigh from 15-25 t with current designs for offshore use in the range 48-73 m long; in future, blade length and mass is likely to increase. The root end (the fixing point of the blade to the wind turbine hub) is in the range 2-4 m in diameter; the chord (the widest point of the blade) is in the range of 4 m to 7 m.

4.9.28 The internal structure is typically a hollow box cross section created either by an internal spar or by a series of shear webs assembled in the moulding process.

4.9.29 **Material Types:** All blades currently used in offshore wind turbines are manufactured from a glass or carbon fibre composite in conjunction with a polymer resin system. Glass or carbon is supplied in woven mats which are laid in moulds. This can be dry or pre-impregnated with resin for the moulding process. Whilst glass fibre is lower cost, carbon fibre has higher stiffness properties.

4.9.30 Mats are supplied in rolls and handled by fork lift. Pre impregnated mats are stored at low temperature at either 5 ºC or -18 ºC to extend their shelf life. The cost of refrigeration encourages manufacturers to reduce storage and only hold a minimal inventory. Total refrigerated area for those manufacturers would be unlikely to exceed 500 m^2.

4.9.31 Two types of polymer resin are typically used in offshore blades, thermoset polyester and epoxy. Epoxy resin uses a two-part mix to initiate curing and has superior structural performance but is more expensive. Polyester resin cures in conjunction with a catalyst and has lower strength but is also lower cost.

4.9.32 Bulk resin is supplied in 20 t liquid containers. On site storage will either be in the supplied container or in purpose built storage vessels within the factory. Bulk resin will be piped to the mixing station alongside each blade mould.

4.9.33 Depending on the blade design, components are often joined using structural adhesives. These are commonly epoxy based. Blades may be either painted using two-pack polyurethane paint or have a polyester gelcoat incorporated in the moulding process. Metal inserts are embedded at the root of the blade in order to provide a bolting interface to the rest of the structure. These may be cast iron or steel.

4.9.34 Due to the physical scale, shelf life and cash flow implications of blade materials, all blade manufacturers operate with low levels of inventory and will use "just in time" supply systems to support production flow. Glass and resin supplies will be often be delivered daily. High flammability materials are kept to small quantities to both minimise risk and also stay below COMAH levels. The total external storage area for raw materials will not exceed 2000 m^2.

4.9.35 **Quantities:** The amounts of raw materials required varies according to the blade design, but a 1 GW capacity production facility manufacturing 600 blade per year may typically use the following materials:

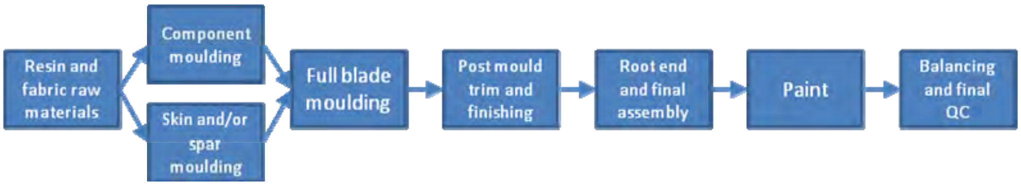
Table 4.6 Typical Raw Material Quantities for a 1 GW Blade Factory

Material	Tonnage p.a.	Approx. number of truck deliveries p.a.*	Truck deliveries/week
Glass / Carbon Fibre	10 000	1 000	10
Resins and adhesives	4 000	300	3 to 5
Iron and steel	250	20	1
Paint products	200	20	1
Cables	20	2	< 0.5
Acetone and thinner*	18	50	1

* Load size per truck varies according to material type
** Flammable materials handled in low volume containers

4.9.36 **Manufacturing Processes:** Whilst there are variations in technology and manufacturing systems, a generic manufacturing process is illustrated below in *Figure 4.8* and described in the paragraphs following.

Figure 4.8 *Generic Blade Manufacturing Process*



4.9.37 Separate components such as root end fittings, shear webs and spars are manufactured prior to the main blade moulding process, either by sub-suppliers or in-house but separate from the blade moulds. The main blade mould is in two halves that close to create the blade shape. Moulds are typically mounted in a steel lattice framework and the closing mechanism is hydraulically operated.

4.9.38 Pre-made components are assembled into the main mould along with glass and/or carbon fibre woven fabrics. This "lay-up" is then covered with a polythene bag and the air pumped out. Resin is introduced into the vacuum and is infused through the fabrics and cured. Typical infusion processes are in the temperature range 60 °C to 90 °C and moulds are often temperature regulated (using heating and cooling systems) to maintain strict control of curing.

4.9.39 Once the cured blade is lifted out of the mould it is necessary to finish off any rough edges arising at the joints in the mould. Robot automation may be used for edge trimming. Any surface blemishes are repaired at this stage.

4.9.40 If paint is to be applied then once the surface is prepared the blade will be placed in a paint booth for spray painting. Paint spraying may be automated or applied manually. Post-curing of the paint will take several hours at 40 °C or more.

4.9.41 The production processes will produce scrap from fabric off-cuts, infusion materials, flashing and cured but unused resin. Intelligent handling and segregation of waste will allow recycling in some cases. Almost all waste is inert and safe for landfill or high temperature incineration whilst unused and uncured chemicals are removed from site by specialist licensed operators.

4.9.42 The production processes for a one gigawatt facility may typically generate the following scrap:

Table 4.7 Quantity of Scrap Material Produced from a 1 GW Blade Plant

Item	**Quantity (t)**
Incineration	700
Landfill	100
Recycling	600
	of which
Wood	40
Paper/cardboard	190
Plastic	60
Prepreg	200
Shotblast grit	20
Other	90

4.9.43 **Process Equipment:** Fluids used in manufacturing will typically be delivered in containers or drums and moved around site using forklift plant. Bulk infusion resins may be supplied by road tanker with static holding tanks. Mixing equipment is located alongside the moulds and feed mixed resins and adhesives directly to the manufacturing lines. Automated mixing and sampling is used to ensure consistency and quality standards.

4.9.44 Various solvents may be used in moderate quantities through the manufacturing process. Any high volatility solvents are held in small quantities and strictly controlled for both health and fire hazard risks. Solvent use is typically well below COMAH limits.

4.9.45 Robots are increasingly being used in fabric preparation and lay-up, edge trimming, and paint application.

4.9.46 Overhead gantry cranes are used to handle blades, moulds, large equipment and components. Typical cranes have multiple bridges with ratings up to 40 t per bridge.

4.9.47 Blades are moved between processes and rotated as required in purpose-build fixtures. Telescopic handlers are typically used in tandem to carry blades to storage or loading onto transport.

4.9.48 **Health, Safety and Environment:** In addition to normal industrial disciplines particular precautions apply in the following areas:

- handling and storage of resins – bunded storage and drainage protection;
- handling and storage of flammable materials – solvents;
- dust emissions;

- vapour emissions from styrene based resins and/or polyurethane paints;
- skin contact with uncured epoxy resins; and
- exothermic risk from epoxy curing.

4.9.49 Employee health monitoring would normally include specific checks on lung function, skin irritation and HAV.

4.9.50 Typical operations are twenty-four hours within the building. With the main sources of noise being extraction fans, power tools and air handling systems. These are consistent with conventional industrial applications.

4.9.51 Certain areas and operations will be designated as requiring ear protection where local noise levels may exceed 80 $dBLA_{eq}$. In particular these may include grinding, polishing and flash trimming within the finishing process. Plant rooms and air extraction equipment are typically equipped with noise insulation to maintain external noise levels below 80 $dBLA_{eq}$ within 10 m of the building.

Nacelle Assembly Process

4.9.52 **Dimensions:** The nacelle is the structure at the top of the wind turbine tower that accommodates the drive train and auxiliary systems and supports the rotor hub assembly onto which the blades are mounted. The nacelle is assembled from its component parts which are manufactured by various specialist suppliers and delivered to the factory by road or sea.

4.9.53 Nacelles for offshore use currently have a maximum (rated) power output in the range of 3 MW to 6 MW. However, designs are being developed for turbines up to 10 MW capacity. They are typically up to 9 m high, 8 m wide and 16 m long, including the hub and any transport frames. There is a large variation in nacelle mass from 70 t for the lightest 3 MW turbines up to 500 t for the heaviest 6 MW turbines. Hub assemblies are in the range 15 to 80 t.

4.9.54 Internal structural components are either cast iron or forged or fabricated steel. Nacelle covers are typically composite fibreglass and polyester, although some are steel or aluminium.

4.9.55 **Material Types and Handling:** The components assembled in the nacelle and hub assembly include large castings and fabrications, large electro-mechanical sub-assemblies such as generators, control units and gearboxes, wiring looms, hydraulic systems and personnel protection equipment. Whilst castings and large fabrications may be stored externally, most other components are stored inside prior to assembly.

4.9.56 Total external storage areas for inbound components for a 1 GW facility including castings, composite covers and fabrications do not exceed 2 000 m^2.

4.9.57 Some nacelle designs incorporate castings as the base structure which supports the drive train. Castings are of spheroidal graphite Iron and may weigh up to 40 t. There are currently no established UK sources for such castings. Units sourced from overseas or some UK locations would typically be delivered by ship but delivery by road from other UK location is also possible.

4.9.58 Hub castings can weigh up to 60 t and be up to 4 m in diameter. Larger models require special vehicles for road transport and are preferably delivered by sea. Close proximity of the foundry, machine and paint shops to the assembly facility significantly reduces logistics cost.

4.9.59 Castings are typically handled within the assembly facility using overhead gantry cranes. They are delivered pre-machined and painted ready for assembly.

4.9.60 Key sub-assemblies may include:

- generator;
- mechanical brake system;
- slewing rings and bearings;
- pitch and yaw systems;
- gearbox;
- shafts and couplings;
- control system, wiring looms and sensors;
- switch gear;
- transformer and converter;
- auxiliary heating, cooling and health systems;
- walkways, guards and railings;
- maintenance aids; and
- Nacelle and hub covers.

4.9.61 Components for these sub assemblies can be delivered from sources in the UK and overseas. Heavy or large items such as generators and covers may be supplied directly from adjacent factories established to support the turbine manufacturer.

4.9.62 Many smaller components such as fixings, cables, brackets and electrical components can be supplied by UK stockists and would be delivered by conventional road transport.

4.9.63 The weight of the complete nacelle produces the greatest handling challenge. Self-propelled modular transporters are typically used to move them around site. Large capacity cranes or purpose designed rail mounted trolleys and forklifts may also used.

4.9.64 **Quantities:** The quantity of components required varies according to the nacelle and hub design but a production facility with the capacity of 1 GW per year and assembling 200 nacelles would typically use the following material:

Table 4.8 Components for 1GW Factory assembling 200 Nacelles per year

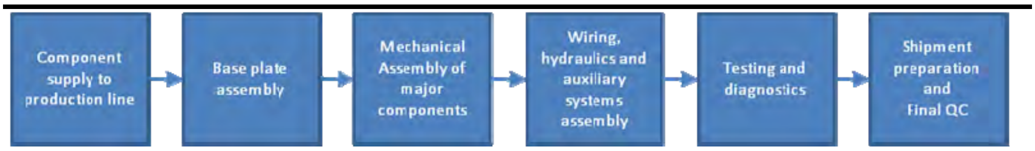
Material	Tonnage p.a.	Approx. number of truck deliveries p.a.*	Maximum HGV deliveries/week
Castings	30 000 **	1 500	30
Fabricated assemblies	25 000 **	1 200	24
Major sub-assemblies	2 0000 **	1 300	25
Small components	3 000	2 000	40
Cables	1 500	300	15
Oils and lubricants	400	40	<1
Other	10 500	1 100	22

* Load size per truck varies according to material type
** Direct supply by ship would reduce road movements

4.9.65 The total of 156 truck movements per week would be reduced by direct transfer of product from adjacent manufacturers or by direct delivery by sea.

4.9.66 **Assembly Processes:** A typical assembly process is illustrated diagrammatically below in *Figure 4.9* and explained in the following paragraphs.

Figure 4.9 Typical Nacelle and Hub Assembly Process



4.9.67 Larger wind turbine manufacturers are starting to develop a moving production line system with parts delivered directly to line-side locations. Davit or gantry cranes are used to position and then assemble heavy components. Hubs will be assembled in parallel using a similar process and assembled to the nacelle at point of dispatch

4.9.68 Major sub-assemblies (such as main bearing to the main shaft) are completed separately from the main production line. These, and major components such as the gearbox, generator frame and generator, are bolted into position prior to electrical and hydraulic connections and the hub assembly being fitted.

4.9.69 Power take-off and control system wiring is completed and hydraulic systems are filled.

4.9.70 No-load rotation and control system functional tests and diagnostic systems are run to ensure the turbine systems are all working correctly. Finally, hub and nacelle covers are fitted and complete assemblies are mounted onto transport frames.

4.9.71 **Waste and Scrap:** As an assembly process, there is little scrap produced. The majority of waste materials will be associated with packaging and transport frames associated with large and heavy items and will be recycled.

4.9.72 Steel transport frames are often collected and returned for re-use subject to the costs of return transport and the item value. The production processes for a 1 GW facility may typically generate the following waste.

Table 4.9 Quantity of Scrap Material Produced from a 1GW Nacelle Plant

Item	Quantity (t)
Incineration	40
Recycling	210
	of which
Wood	15
Paper/cardboard	15
Plastic	10
Steel	120
Other	50

4.9.73 **Process Equipment:** The most expensive equipment is associated with the moving production line. This incorporates cranes and handling systems to assist in assembling the large components.

4.9.74 Although test strategies vary, most facilities incorporate some level of purpose designed systems test equipment to verify correct operation of the assembled nacelle and hub.

4.9.75 **Health, Safety and Environment:** In addition to normal industrial disciplines particular precautions apply in the handling and storage of hydraulic fluids and lubricants.

4.9.76 Employee health monitoring includes specific checks on HAV.

4.9.77 Typical operations are twenty-four hours within the building. External movements are concentrated on daylight hours. Main sources of noise are plant room, power tools and air handling systems. These are consistent with conventional industrial applications. Individual noise sources are unlikely to exceed 80 dB within 5 m.

The Supply Chain Park

General

4.9.78 The Supply Chain Park will provide a base for a range of industries but the precise mix of tenants cannot be known at this stage. This section details a range of potential manufacturing processes that might locate to the site and these examples define the envelope of the environmental impacts.

Substation Control Panel Assembly Process

4.9.79 An offshore wind farm is connected via High Voltage Array Cables to an offshore substation. In a Round 3 wind farm, which is distant from shore, further array cables will carry the power from several substations to a converter station. Here the High Voltage Alternating Current (HVAC) power will be converted to High Voltage Direct Current (HVDC).

4.9.80 The substations and converter stations need a very large number of complex control panels to provide protection and control for electrical systems and the substations. The degree of interface and complexity provide advantages to assembling a proportion of the panels close to the industry cluster so that issues are resolved timeously.

4.9.81 **Dimensions:** Control panels need not be physically large; many control boards comprise of a suite of many standard rack panels cabled together. Individual panels are circa 1m wide by 1m deep by 2.5 m high. A suite of twenty panels would not be uncommon and there are many advantages to assembling and shipping a fully equipped suite to its final assembly location. The panels are relatively light compared to other materials, typically up to a maximum of 400 kg per panel.

4.9.82 **Material Types and Handling:** The panels comprise a steel cabinet, to which racks or mounting plates can be fixed. The door of the cabinet might include a PVC panel. The racks and mounting plates will be fitted with components. These will include a wide range of sophisticated protection relays, control relays, PLC's and auxiliary power units. There will also be a considerable low power cabling and connections. It is not expected that the panels will include any hazardous materials.

4.9.83 The steel cabinets represent the largest volume and could be sourced from suppliers such as Rittal or Eldon within Yorkshire, or from more distant suppliers. Materials must be stored internally, and deliveries of components will be by conventional road transport.

4.9.84 **Quantities:** It is anticipated that over 300 substations and 30 converter substations will be required in Round 3, each requiring in excess of 100 control or protection panels. These panels will come from many sources. The limiting factor in the assembly of panels may be the availability of the skilled wiremen needed. It is anticipated that a typical assembly plant will produce 1 000 panels per annum. Such a factory would typically use the following material:

Table 4.10 Components for a Factory assembling 1 000 Control and Protection Panels per year

Material	Tonnage p.a.	Approx. number of truck deliveries p.a.*	Maximum HGV deliveries/week
Cabinets	20	50	1
Protection Relays	50	10	<0.2
Contactors, PLC's	20	10	<0.2
Small components	20	10	<0.2
Cables	20	10	<0.2

* Load size per truck varies according to material type

4.9.85 The total of two truck movements per week would be in addition to a number of van and courier deliveries.

4.9.86 **Assembly Processes:** Individual panels are required in relatively low volume so represent a highly labour intensive operation. Some robotic preparation of wiring and ferrules has been introduced to the industry but this is still the exception for individual project panels.

4.9.87 Preparation of the Cabinet, racks and mounting plates include the drilling and punching of holes and mounting slots, usually by means of a CNC punching machine. Following punching, plates require a painting operation.

4.9.88 The racks and mounting plates will be equipped by the necessary hardware such as the PLC modules, protection relays, auxiliary relays and switches, control switches and fuses. The racks and mounting plates will then be prewired with those connecting wires that connect units within the plate.

4.9.89 The racks and plates are mounted in the cabinet, and the very large number of connection wires between the different modules and the connection terminals are individually cut to length and crimped. Whilst plug and socket technology is widely used, there are many other connections where individual terminals are used.

4.9.90 When the complete cabinet is wired, the wiring is checked for connection and continuity and functional testing of the panel is undertaken. The control or protection suite is then ready for shipment either as a complete unit, or after disconnection as individual panels.

4.9.91 **Waste and Scrap:** As an assembly process, there is little scrap produced. The majority of waste materials will be associated with packaging. The cabinet packaging should be suitable for repeated use.

4.9.92 The production processes for a 1 000 panel facility may typically generate the following waste:

Table 4.11 Quantity of Scrap Material Produced from a 1 000 pa Panel Plant

Item	**Quantity (t)**
Recycling	2
	of which
Wood	<0.2
Paper/cardboard	1
Plastic	<0.3
Steel	<0.3
Other	<0.2

4.9.93 **Process Equipment:** Equipment for the assembly process is relatively simple. Some panels will include High Voltage inputs and specialist test equipment may be necessary. This will include appropriate shielding and safeguards such that it poses no risk externally, and is used by trained operators.

4.9.94 **Health, Safety and Environment:** In addition to normal industrial disciplines particular precautions apply to the testing of high voltage electricity.

4.9.95 Employee health monitoring includes specific checks on HAV.

4.9.96 Typical operations are twenty-four hours within the building. External movements are concentrated on daylight hours. Main sources of noise are plant room, power tools and air handling systems. These are consistent with conventional industrial applications. Individual noise sources are unlikely to exceed 80 $dBLA_{eq}$ within 5 m.

Base frame (or Yaw Frame) Manufacturing Process

4.9.97 **Dimensions and Design:** A nacelle is connected to the yaw bearing and drive ring, through its base frame (sometimes called a Yaw Frame). The ability of the nacelle to rotate (yaw) to face the wind greatly increases efficiency. Different designs use entirely fabricated structures, whilst others use a central casting for primary load transfer, with a support frame for the electrical and service structures. The final dimension of a base frame for a typical new generation offshore wind turbine will be 8m wide and 10m long (the width is needed to allow access past the 7m diameter generator). The size of the frame makes its manufacture near to the nacelle assembly facility a significant commercial advantage. A typical base frame will have a mass of up to 15 t. The base frame will not only provide a transfer path for the thrust loads to the tower, but resists the torque created by the generator. It also provides the location frames for the generator stator, converter cubicles, condition monitoring and control cubicle and a range of nacelle facilities.

4.9.98 **Materials:** Flat plate and I beam sections are the prime raw material that is delivered in various sizes to the factory. Plate may be supplied in rough-cut form or edge prepared and shaped ready for welding and rolling. UK sources of the relevant specification steel are the Tata plate mills in Scunthorpe (200 000 t annual capacity) as well as Motherwell and the Spartan plate mill in County Durham. UK sourced steel would be delivered by rail or road. Vessels supplying steel sourced in Europe are generally up to 7 500 dwt and typically up to 120 m overall length. Vessels supplying steel sourced from overseas are generally up to 25 000 dwt and up to 180 m overall length.

4.9.99 **Components:** If the main load transfer is by casting, the casting will be delivered from a foundry, most likely by vessel, but castings could be delivered by lorry as an over width load. Flange rings (into which the Yaw bearings are located) are supplied to the factory readymade. Flange rings are typically forged or rolled and then machined and have a diameter of up to 4 m and mass of 3 t. Flange sources exist in the UK and overseas.

4.9.100 **Coatings:** Urethane paints are used on the completed base frame. Materials are delivered by road transport and supplied in drums up to 50 kg.

4.9.101 **Quantities:** The amount of raw materials required varies according to the base frame design, but a production facility to support 1 GW or nacelle manufacture may typically use the following materials:

Table 4.12 Typical Raw Material Quantities for a 1 GW base frame Facility

Material	Tonnage p.a.	Approx. number of truck deliveries p.a.*	HGV deliveries/ week
Steel Plate	3 000	140**	3
Welding materials	40	10	<2
Cast components***	200	90	2
Paint products	3	10	<2
Fittings	5	10	<2

* Load size per truck varies according to material type
**Can be reduced by direct delivery by ship
*** If casting design used (in which case steel plate is reduced)

4.9.102 **Manufacturing Processes:** The stages of the manufacturing process are briefly explained in the following paragraphs.

4.9.103 I sections can be cut to length and profiled, and plates can be flame cut to size and weld surfaces prepared either by the supplier or within the base frame manufacturing facility. Computer numerical controlled (CNC) cutting will typically be used to ensure precision of joint lines. If a fully fabricated design is being manufactured the facility will have a simple plate rolling capability.

4.9.104 A combination of I section and plates are fabricated, incorporating the load bearing casting if appropriate. Submerged arc welding is normally employed to weld the structure. Load bearing elements of the design will have a very high degree of control. Jigs and holding fixtures are extensively used to hold components in place during fabrication.

4.9.105 For a fully fabricated design the angle and alignment of the generator stator flange and the yaw bearing flange is critical, and major fixtures will be used.

4.9.106 After the load transfer section of the main base frame is welded, the support frames on which a range of electrical cubicles and hydraulic services are mounted are then welded in position.

4.9.107 The base frame may be cleaned using power washers and detergent to remove ultrasonic gel residue. The frame is then shot blasted inside before being having a zinc rich primer coat applied. The frame is then spray painted.

4.9.108 The production processes for a 1 GW facility produces scrap materials. The quantities vary depending on the manufacturing process but typically may include:

Table 4.13 Quantities of Scrap Material Produced from a 1 GW Base Frame Plant

Item	Quantity (t)
Recycling	76
	of which
Steel	40
Paper/cardboard	1
Plastic	0.5
Wood	1
Shotblast grit	30
Chemicals	2
Other recycling	2

4.9.109 **Handling:** Complete base frames will be moved with special trolley frames due to their width and length.

4.9.110 **Hazardous Materials:** In addition to normal industrial disciplines particular precautions will apply in the following areas:

- handling and storage of flammable materials – paints, solvents;
- dust emissions.

4.9.111 **Employee Health:** Employee health monitoring will include specific checks on lung function, and HAV.

4.9.112 Main sources of noise will be extraction fans, power tools and air handling systems. These are consistent with conventional industrial applications. Individual noise sources are unlikely to exceed 80 $dBLA_{eq}$ within 5 m.

Canopy and Spinner Manufacturing Process

4.9.113 **Dimensions:** Canopies are the composite structure that provides the roof and walls of the Nacelle. They weigh from 2 – 4 t with new designs for direct drive turbines for offshore use in the range 8 m diameter and 11 m long; in future, the diameter is likely to increase. Spinners provide weather protection to the blade pitch drives, as well as aerodynamic benefits. Typically 5m in diameter they weigh less than 1 t.

4.9.114 Canopies can either be specified as a single piece, complete structure (in which case transport must be by ship), or designed in multiple pieces for road transport. In either case they are relatively thin walled structures with access hatches, and connection points for instruments, ventilation etc. Spinners are usually specified as single piece structures, again with ports for the blades and an access hatch.

4.9.115 **Material Types:** Canopies will usually be made from fibreglass. Glass is supplied in woven mats that are laid in moulds. This can be dry or pre-impregnated with resin for the moulding process. Spinners are usually made from a GRP Resin Infusion Moulding process.

4.9.116 Mats of fibre and the resins used are similar to those described in the blade manufacturing process above. The total external storage area for raw materials will not exceed 500 m^2.

4.9.117 Depending on the canopy and spinner design, components may be joined using structural adhesives. These are commonly epoxy based. Canopies and spinners may be either painted using two-pack polyurethane paint or have a polyester gelcoat incorporated in the moulding process. Metal inserts are embedded into the structure in order to provide safety rails and interfaces to the rest of the structure. These are usually steel.

4.9.118 **Quantities:** The amounts of raw materials required varies according to the canopy and spinner design, but a 1 GW capacity production facility manufacturing 180 canopies/Spinners per year may typically use the following materials:

Table 4.14 Typical Raw Material Quantities for a 1 GW Canopy / Spinner Factory

Material	**Tonnage p.a.**	**Approx. number of truck deliveries p.a.***	**HGV deliveries/week**
Glass Fibre	500 t	40	<1
Resins and adhesives	250 t	20	<0.5
Iron and steel	20 t	2	<0.1
Paint products	10 t	2	<0.1
Cables	5 t	2	< 0.1
Acetone and thinner*	1 t	2	<0.1

* Load size per truck varies according to material type
** Flammable materials handled in low volume containers

4.9.119 **Manufacturing Processes:** The generic manufacturing process is described in the paragraphs following.

4.9.120 Separate components such as fittings for safety rails, anemometers, warning lights, are manufactured prior to the canopy moulding process by sub-suppliers. Where a canopy is designed as a single piece GRP moulding, the mould is in several pieces, which during the laying up process are progressively fitted to create the canopy shape. Spinner moulds are typically rather simpler and may be a two piece arrangement.

4.9.121 Pre-made components are assembled into the main mould along with glass fibre woven fabrics. This "lay-up" is then covered with a polythene bag and the air pumped out. Resin is introduced into the vacuum and is infused through the fabrics and cured. Typical infusion processes are in the temperature range 60 °C to 90 °C and moulds are often temperature regulated (using heating and cooling systems) to maintain strict control of curing.

4.9.122 Once the cured canopy or spinner is lifted out of the mould it is necessary to finish off any rough edges arising at the joints in the mould. Robot automation may be used for edge trimming. Any surface blemishes are repaired at this stage.

4.9.123 If paint is to be applied then once the surface is prepared the blade will be placed in a paint booth for spray painting. Paint spraying may be automated or applied manually. Post-curing of the paint will take several hours at 40 °C or more.

4.9.124 The production processes will produce scrap from fabric off-cuts, infusion materials, flashing and cured but unused resin. Intelligent handling and segregation of waste will allow recycling in some cases. Almost all waste is inert and safe for landfill or high temperature incineration whilst unused and uncured chemicals are removed from site by specialist licensed operators.

4.9.125 The production processes for a 1 GW facility may typically generate the following scrap:

Table 4.15 Quantity of Scrap Material Produced from a 1 GW Canopy and Spinner Plant

Item	Quantity (t)
Incineration	10
Landfill	30
Recycling	20
	of which
Wood	4
Paper/cardboard	5
Plastic	5
Prepreg	3
Other	3

4.9.126 **Process Equipment:** Delivery of materials, the storage and handling of materials and the treatment of flashings are similar to that described above in relation to the blade manufacturing process

4.9.127 **Health, Safety and Environment:** In addition to normal industrial disciplines particular precautions apply in the following areas:

- handling and storage of resins – bunded storage and drainage protection;
- handling and storage of flammable materials – solvents;
- dust emissions;
- vapour emissions from styrene based resins and/or polyurethane paints;
- skin contact with uncured epoxy resins; and
- exothermic risk from epoxy curing.

4.9.128 Employee health monitoring would normally include specific checks on lung function, skin irritation and HAV.

4.9.129 Typical operations are twenty-four hours within the building. With the main sources of noise being extraction fans, power tools and air handling systems. These are consistent with conventional industrial applications.

4.9.130 Certain areas and operations will be designated as requiring ear protection where local noise levels may exceed 80 $dBLA_{eq}$. In particular these may include grinding, polishing and flash trimming within the finishing process. Plant rooms and air extraction equipment are typically equipped with noise insulation to maintain external noise levels below 80 $dBLA_{eq}$ within 10 m of the building.

4.10 THE MAIN DESIGN ALTERNATIVES CONSIDERED

4.10.1 In accordance with The Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 Schedule 4 Part 1 Section 18, an ES must record;

"(a)n outline of the main alternatives studied by the applicant and an indication of the main reasons for the applicant's choice, taking into account the environmental effects."

4.10.2 *Annex 4.4* of the ES provides an account of the main alternatives to the final proposal that have been studied. *Chapter 6* of the ES (*Choice of Sites*) considers alternative sites to that proposed and also compares the impact of providing the same aggregate capacity as AMEP but on a number of smaller sites.

4.11 DECOMMISSIONING

The Quay

4.11.1 The quay, once constructed will form a significant part of the nation's port infrastructure. In the event that demand for port space by the offshore energy sector reduces in the future, the quay will find other uses related to the import and export of goods. The new quay will also replace an existing flood defence wall and will protect the immediate hinterland and adjacent properties from flooding. The quay will be maintained to ensure that it continues to provide appropriate flood protection, including for the effects of climate change, as currently predicted, over the next one hundred years. Accordingly, there will be an overriding requirement to maintain the quay rather than decommission it.

Industrial Buildings and Related Infrastructure

4.11.2 Whilst the industrial buildings will be constructed with a nominal 60-year design life, it is possible that in the future they will be dismantled and replaced with other bespoke buildings. A large proportion of the buildings will be recyclable at the end of their commercial life. In particular, the steel frame can either to be taken down and re-erected on another site or sold as scrap to a steel foundry; the concrete can be crushed for use as a sub-base or capping material or as general hardcore.

4.11.3 The infrastructure comprising imported fill material and services will be maintained to enable continued use of the facility as a working port in the future.

4.11.4 The Health and Safety File, produced in accordance with the Construction (Design and Management) Regulations 2007 will record all materials incorporated into the works to enable safe demolition in the future if it is ever required.

4.12 OTHER DEVELOPMENTS

4.12.1 This section includes a list of other developments that have been identified in the wider area surrounding the AMEP development and which could have an impact on the Humber Estuary European designated sites. Further details are provided in the ES in *Volume 1 Annex 2.3*. The effects of the following projects in-combination with AMEP are considered further in this report in *Section 6.7 In-combination Effects*.

- *Able UK Ltd Area F (PA/2008/1463)*
- *Able UK Ports Facility: Northern Area (PA/2009/0600)*
- *ABP Maintenance Dredge*
- *Immingham Oil Terminal Approach Channel Deepening*
- *Grimsby Ro Ro*
- *Hull Riverside Bulk Terminal – ABP (HRO) / Green Port Hull (ABP)*
- *URSA Glass Wool Factory (PA/2008/0988)*
- *Bioethenol Plant (PA/2006/1880)*
- *Drax Heron Energy Plant (PA/2009/1269) (Now Consented)*
- *Helius - Bio Power/ Fuel (DC/303/07/IMM)*
- Abengoa Bioenergy - Bioethanol Plant (DC/1147/10/IMM)
- *Vireol PLC – Bioethanol Plant (DC/202/08/WOL)*
- *Magna Holdings (DC/730/07/IMM)*
- *IGCC Power Station (output up to 430MW)*
- *Neptune RE Ltd – Tidal stream generator (24778)*
- *Vivergo Fuels – Bioethanol facility (07/07450/STPLFE)*
- *E.ON (Humber Wind Ltd) – Humber Gateway Offshore Wind Farm.*

5 *EUROPEAN SITES AND LIKELY SIGNIFICANT EFFECT*

5.1 *INTRODUCTION*

5.1.1 This chapter sets out the screening assessment which has been undertaken of AMEP. The interests are then assessed against the conservation objectives to determine whether the AMEP proposals will have a likely significant effect on them. Details of the methodology used, and the approach to determining the 'likely significant effect', are provided in *Chapter 2* of this report.

5.1.2 The assessment has drawn upon the following information:

- a summary of the qualifying interest of the Humber Estuary SPA, SAC and Ramsar site including the conservation objectives, current condition status, and any known sensitivities or vulnerabilities of the sites; and
- a summary of the baseline ornithological interest on and around the AMEP site.

5.2 *THE HUMBER ESTUARY EUROPEAN SITES*

Overview

5.2.1 The Humber Estuary is one of the largest estuaries in the UK comprising extensive wetland and coastal habitats. Its input of freshwater into the North Sea is the largest in Britain draining a catchment of some 24 240 km^2, and it has the second-highest tidal range in Britain (7.2 m). At low tide approximately one-third of the estuary is exposed as mud or sand-flats. There are extensive areas of reedbed with areas of mature and developing saltmarsh in the inner estuary, with grazing marsh in the middle and outer estuary. Behind the saltmarsh, there are low sand dunes with marshy slacks and brackish pools. The estuary supports important numbers of waterbirds (especially geese, ducks and waders) during the migration periods and in winter, and important breeding populations of terns and raptors over the summer months.

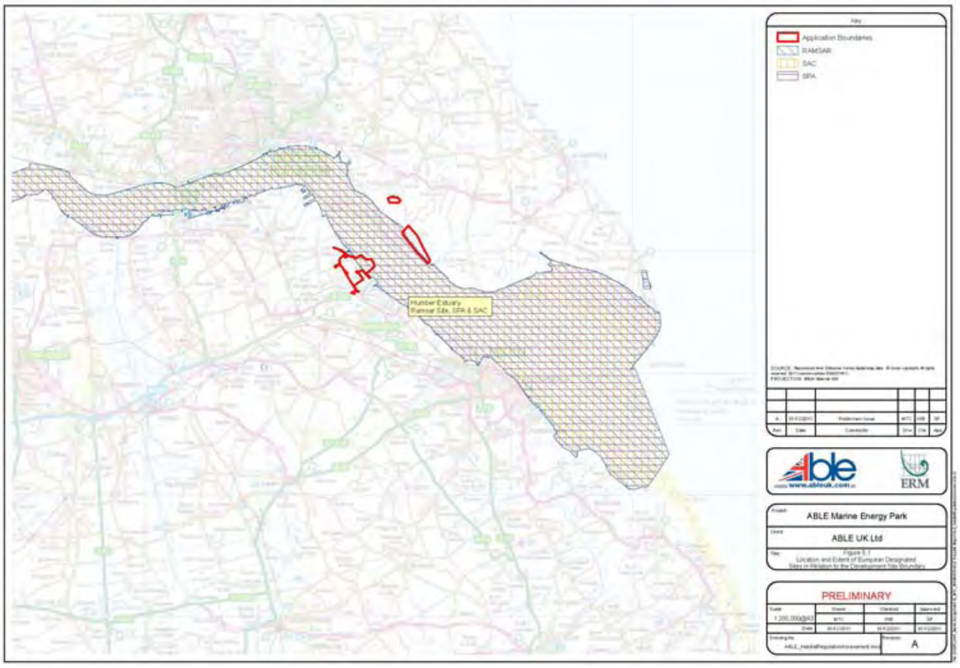
5.2.2 The Humber Estuary is covered by the following European designations:

- Special Area of Conservation (SAC);
- Special Protection Area (SPA); and

- Ramsar site.

The following sections provide summaries of the interests that each of the designations cover and *Figure 5.1* shows their location and extent. The citations for each of these designations and maps showing the extent of each designation, which have been provided by NE are contained within *Annex B (European Designated Sites Locations and Citations)*. These are the only European designations which will be affected by the AMEP scheme (see *Section 3.2 Assessment Methodologies*).

Figure 5.1 Location and Extent of European Designated Sites in Relation to the AMEP Site Boundary



Qualifying Interest Habitats and Species and Conservation Objectives

Humber Estuary SAC

5.2.3 The Humber Estuary SAC covers an area of 36 657.15 ha and as designated under the Habitats Directive, qualifies as a SAC for the following *Annex I* habitats and *Annex II* species as listed in the EU Habitats Directive:

Annex I habitats that are a primary reason for the designation of the site:

- estuaries (including sub-tidal habitat); and
- mudflats and sandflats not covered by seawater at low tide.

Annex I habitats that are present as qualifying features but are not a primary reason for the designation:

- sandbanks which are slightly covered by seawater all the time;
- coastal lagoons (a priority habitat [1]);
- *Salicornia* and other annuals colonising mud and sand;
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*);
- embryonic shifting dunes;
- shifting dunes along the shoreline with *Ammophilia arenaria* ('white dunes');
- fixed dunes with herbaceous vegetation ('grey dunes' a priority habitat); and
- dunes with *Hippophae rhamnoides*.

Annex II species that are present as qualifying features but are not a primary reason for the designation:

- grey seal (*Halichoerus grypus*);
- river lamprey (*Lampetra fluviatilis);* and
- sea lamprey (*Petromyzon marinus).*

Humber Estuary SPA

5.2.4 The Humber Estuary is one of the most important estuaries in the UK for its populations of waders and wildfowl, particularly for its wintering populations. It is important in a European context, supporting internationally important bird populations over an area of 37 630.24 ha. The most recently published WeBS counts 2009/2010 place the Humber Estuary as the sixth most important site in the UK in terms of total numbers of waterbirds (Holt *et al*, 2011 [2]).

5.2.5 The Humber Estuary qualifies as an SPA and Ramsar Site by way of the following interests listed below. As part of this screening exercise, tables have been drawn up (as given in *Annex D Screening Assessment Humber Estuary Birds*) for all species listed within the SPA and Ramsar citations. Those species listed in categories below have been screened for likely significant effects and have then been either included or excluded from the Shadow Appropriate Assessment as appropriate.

(1) Where a priority habitat is present the only considerations which can be raised under Article 6 of the Directive are those relating to human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other Imperative Reasons of Overriding Public Interest (IROPI).
(2)Holt C A, Austin G E, Calbrade N A, Mellan H J, Mitchell C, Stroud D A, Wotton S R & Musgrove A J (2011) *Waterbirds in the UK 2009/10: The Wetland Bird Survey.* BTO/RSPB/JNCC in association with WWT. Thetford.

- aggregations of non-breeding birds – wintering and passage waterfowl including nationally important numbers of 22 wintering species;

- ≥ 1% of the GB populations of *Annex I* wintering and passage species;

- ≥ 1% of the GB populations of *Annex I* breeding species; and

- ≥ 1% of the bio-geographical populations of regularly occurring migratory species.

5.2.6 The conservation objectives for the European sites are, subject to natural change, to maintain the habitats and species described above in favourable condition (or restore it to favourable condition if features are judged to be unfavourable) (1). Further details, including what *"favourable condition"* means for each of the qualifying interest features, are contained in *Annexes D* and E of this report.

5.2.7 The Humber Estuary is largely (approximately 91%) in an unfavourable but recovering condition (2). This condition status includes the stretches of the coastline where the AMEP will be located. North Killingholme Haven Pits (NKHP) is also in unfavourable condition but with no change.

5.2.8 The Humber Estuary is subject to a number of influences including sea level rise and climate change and the effects of human development. Key issues for the estuary include the following effects which arise from a range of sources across the estuary:

- coastal squeeze;
- impacts on the sediment budget and changes in the geomorphological structure and function of the estuary (due to sea level rise, flood defence works, dredging and the construction, operation and maintenance of ports, pipelines and other infrastructure);
- changes in water quality and flows;
- pressure from additional built development; and
- damage and disturbance arising from access, recreation and other activities (3).

(1) Natural England (December 2009) *Conservation Objectives and Definitions of Favourable Condition for Designated Features of Interest - Humber Estuary SSSI.* Draft Version 2. NE.
(2) Based on information from Natural England website last updated 17 March 2011.
(3) Taken from the Natura 2000 Standard Data Form.

Ramsar Site

5.2.9 The Humber Estuary is a representative example of a near-natural estuary with the following component habitats over an area of 37 987.8 ha:

- dune systems and humid dune slacks;
- estuarine waters;
- intertidal mud and sand flats;
- saltmarshes; and
- coastal brackish/saline lagoons.

5.2.10 It is a large macro-tidal coastal plain estuary with high suspended sediment loads, which feed a dynamic and rapidly changing system of accreting and eroding intertidal and subtidal mudflats, sandflats, saltmarsh and reedbeds. Examples of both strandline, foredune, mobile, semi-fixed dunes, fixed dunes and dune grassland occur on both banks of the estuary and along the coast.

5.2.11 The estuary supports a full range of saline conditions, and shores which are sandy in the outer part of the estuary, and muddier in the more sheltered inner estuary and up into the tidal rivers.

5.2.12 The lower saltmarsh of the Humber is dominated by *Spartina anglica* (common cordgrass) and *Salicornia* (annual glasswort) communities. Low to mid marsh communities are mostly represented by *Aster tripolium (*sea aster), *Puccinellia maritima* (common saltmarsh grass) and *Atriplex portulacoides* (sea purslane) communities. The upper portion of the saltmarsh community is atypical, dominated by *Elytrigia atherica* (*Elymus pycnanthus*) (sea couch) saltmarsh community. In the upper reaches of the estuary, the tidal marsh community is dominated by *Phragmites australis (*common reed) fen and *Bolboschoenus maritimus (*sea club rush) swamp with *Elytrigia repens (Elymus repens)* (couch grass) saltmarsh community. Within the Humber Estuary Ramsar site there are also good examples of four of the five physiographic types of saline lagoon.

5.2.13 The Humber Estuary Ramsar site supports a breeding colony of grey seals (*Halichoerus grypus*) at Donna Nook, the second largest grey seal colony in England and the most southerly regularly used breeding site on the east coast. The dune slacks at Saltfleetby-Theddlethorpe on the southern extremity of the Ramsar site are the most north-easterly breeding site in Great Britain of the natterjack toad (*Bufo calamita*).

5.2.14 The Humber Estuary is an important migration route for both river lamprey (*Lampetra fluviatilis)* and sea lamprey (*Petromyzon marinus*) between coastal waters and their spawning areas.

5.2.15 In addition to the above the Ramsar site is important for its bird species and populations as listed below.

- Species occurring on passage at levels of international importance as follows:
  - Eurasian golden plover (*Pluvialis apricaria - altifrons* subspecies);
  - red knot (*Calidris canutus - islandica* subspecies);
  - dunlin (*Calidris alpine - alpina* subspecies);
  - black-tailed godwit (*Limosa limosa - islandica* subspecies); and
  - common redshank (*Tringa tetanus - brittanica* subspecies).
- Species wintering at levels of international importance as follows:
  - common shelduck (*Tadorna tadorna);*
  - Eurasian golden plover (*Pluvialis apricaria - altifrons* subspecies);
  - red knot (*Calidris canutus - islandica* subspecies);
  - dunlin (*Calidris alpine - alpina* subspecies);
  - black-tailed godwit (*Limosa limosa - islandica* subspecies);
  - bar-tailed godwit (*Limosa lapponica - lapponica* subspecies); and
  - common redshank (*Tringa tetanus - brittanica* subspecies).
- The assemblage of all waterbirds which is of international importance (153,934 waterfowl, non-breeding season - 5 year peak mean 1996/97-2000/2001) and includes the species listed above and those listed below which occur in nationally important numbers:
  - dark-bellied brent goose (*Branta bernicla - bernicla* subspecies) wintering;
  - eurasian wigeon (*Anas penelope)* wintering;
  - common teal (*Anas crecca - crecca* subspecies) wintering;
  - common pochard (*Aythya farina)* wintering;
  - greater scaup (*Aythya marila - marila* subspecies) wintering;
  - common goldeneye (*Bucephala clangula - clangula* subspecies) wintering;
  - great bittern (*Botaurus stellaris - stellaris* subspecies) wintering;
  - hen harrier (*Circus cyaneus)* wintering;
  - Eurasian oystercatcher (*Haematopus ostralegus - ostralegus* subspecies) wintering;
  - pied avocet (*Recurvirostra avosetta)* wintering;
  - great ringed plover (*Charadrius hiaticula - hiaticula* subspecies) wintering;
  - grey plover (*Pluvialis squatarola -squatarola* subspecies) wintering;
  - northern lapwing (*Vanellus vanellus)* wintering;
  - sanderling (*Calidris alba)* wintering;
  - curlew (*Numenius arquata - arquata* subspecies) wintering;
  - ruddy turnstone (*Arenaria interpres - interpres* subspecies) wintering;

- great ringed plover (*Charadrius hiaticula - psammodroma* subspecies) on passage;
- grey plover (*Pluvialis squatarola - squatarola* subspecies on passage;
- sanderling (*Calidris alba*) on passage;
- ruff (*Philomachus pugnax)* on passage;
- whimbrel (*Numenius phaeopus - slandicus* subspecies) on passage; and
- common greenshank (*Tringa nebularia)*.

- Breeding species which occur in nationally important numbers and are listed as noteworthy on the citation for the Ramsar Site comprise:
  - great bittern (*Botaurus stellaris);*
  - Eurasian marsh harrier (*Circus aeruginosus);*
  - pied avocet (*Recurvirostra avosetta);* and
  - little tern (*Sterna albifrons - albifrons* subspecies).

5.3 *ORNITHOLOGICAL INTEREST ON AMEP AND IMMEDIATE SURROUNDS*

Introduction

5.3.1 The ornithological interest of the AMEP site and its surrounds has been determined through a review of the following information:

- published core count data from the Wetland Bird Survey (WeBS) (1) scheme;

- the latest available low tide WeBS count data undertaken over the winter of 2003/04;

- monthly Through-the-Tide-Count (TTTC) surveys (2) undertaken by the Institute of Estuarine and Coastal Studies (IECS) for Able UK Ltd between April 2010 and April 2011 at Killingholme Marshes and Killingholme Haven Pits; and

- surveys undertaken on inland fields by Graham Catley (Nyctea Ltd) for Humber Industry Nature Conservation Association (HINCA) during January – May 2007, July 2007 to March 2008, and September 2010 to April 2011.

5.3.2 The main areas relative to AMEP used by birds from the European sites are the intertidal mudflats of the foreshore of Killingholme Marshes, the saline lagoons of NKHP and the inland agricultural fields. The following sections provide a summary of the interest in each of these

(1) [redacted]
(2) Except for July, August, October, January, February and March, when two counts per month were made.

areas. Further supporting information is contained in *Annex C (Supporting Ornithological Information)* and also in the baseline description of each site contained in *Section 11.5 Baseline* of *Chapter 11* (*Terrestrial Ecology and Birds*) of the AMEP ES. The references in this document to Killingholme Marshes refer to the intertidal mudflats along the foreshore, as this is the description which is used for the WeBS count sectors which cover the intertidal mudflats in this location.

5.3.3 Ideally a comparison of the numbers recorded from the TTTCs undertaken in 2010/11 as part of the baseline studies for AMEP would be made with population estimates based on estuary wide low tide count data. However, the most recent estuary wide low tide data available date back to 2003/04 and it was agreed with NE at consultation meetings that these data were too old for such a comparison, although they may still provide some more general contextual information. The TTTC data have therefore been used as the main data source on which to base the descriptions of the use of the foreshore at Killingholme Marshes by birds at low tide.

5.3.4 It was agreed with NE that in order to calculate the percentages of the bird populations of the Humber Estuary using the Killingholme Marshes foreshore and NKHP, both the TTTC data and the WeBS core count data (based on counts around high tide using five year peak means) would be used (see *Table 5.1*). Some of the percentages calculated based on the TTTC data will automatically be higher than those based on the WeBS core count data for species which occur in greater numbers on the intertidal mudflats at low tide. At high tide the Killingholme Marshes foreshore has little roosting and feeding habitat available, as it is largely covered by seawater.

Killingholme Marshes Foreshore

5.3.5 The intertidal mudflats at Killingholme Marshes support a range of bird species over the passage and winter months including a number of species which occur in numbers ≥1% of the Humber Estuary population (see *Table 5.1*).

5.3.6 Collectively the TTTC and WeBS core count data recorded 38 wetland bird species which meet specific SPA/Ramsar qualifying interest criteria in their own right. They also form part of the overall qualifying assemblage that includes all wetland bird species recorded. Of these 38 species, 26 were recorded in significant numbers (ie ≥ 1% of the Humber population) with 10 species recorded as ≥ the 1% threshold based on the WeBS counts, and 19 species based on the TTTC. Three species (black-tailed godwit, curlew and redshank) were recorded ≥ 1%

by both the WeBS and TTTC. The overall bird assemblage also exceeded the 1% threshold based on the TTTC data.

Table 5.1 Killingholme Marshes Foreshore - Wetland Bird Data Summary

Species	Humber population	Peak count	Proportion Of Humber Population (%)	Month	Data Source
Assemblage	140 197	3 766	2.7	Oct	TTTC
		314	0.2	Dec	WeBS
Avocet	493	4	0.8	Aug	TTTC
		-	-	-	WeBS
Bar-tailed godwit	(5 926)	123	2.1	Mar	TTTC
		-	-	-	WeBS
Black-headed gull	(7 865)	252	3.2	Aug	TTTC
		-	-	-	WeBS
Black-tailed godwit	3 887	2 566	66	Oct	TTTC
		50	1.3	Oct	WeBS
Common gull	2 005	73	3.6	Jan	TTTC
		-	-	-	WeBS
Common sandpiper	(46)	3	6.5	Aug	TTTC
		-	-	-	WeBS
Coot	1 166	2	0.2	Dec	TTTC
		31	2.7	Dec	WeBS
Cormorant	219	2	0.9	Nov	TTTC
		-	-	-	WeBS
Curlew	4 440	158	3.6	Mar	TTTC
		61	1.4	Dec	WeBS
Dunlin	21 518	1 029	4.8	Nov	TTTC
		87	0.4	Dec	WeBS
Gadwall	179	-	-	-	TTTC
		4	2.2	Feb	WeBS
Golden plover	46 926	1	<0.1	Jul	TTTC
		-	-	-	WeBS
Great black-backed gull	(226)	40	17.7	Sep	TTTC
		-	-	-	WeBS
Grey heron	74	-	-	-	TTTC
		1	1.6	Jan	WeBS
Grey plover	2 916	6	0.2	Oct,Nov,Dec	TTTC
		-	-	-	WeBS
Herring gull	(117)	7	5.9	Jul	TTTC
		-	-	-	WeBS
Knot	41 772	4	<0.1	Aug	TTTC
		1	<0.1	Nov	WeBS
Lapwing	18 756	325	1.7	Jan	TTTC
		15	0.1	Mar	WeBS
Lesser black-backed gull	93	6	6.5	Jul	TTTC
		-	-	-	WeBS
Little grebe	92	-	-	-	TTTC
		2	1.7	Aug,Feb	WeBS
Mallard	2 096	14	0.7	Jul	TTTC

Species	Humber population	Peak count	Proportion Of Humber Population (%)	Month	Data Source
		13	0.6	Mar	WeBS
Mediterranean gull	(2)	2	100	Aug	TTTC
		-	-	-	WeBS
Moorhen	146	-	-	-	TTTC
		4	2.5	Mar	WeBS
Mute swan	288	2	0.7	Dec,Jan	TTTC
		3	1.1	Jan, Apr	WeBS
Oystercatcher	3 528	12	0.3	Mar	TTTC
		<1	<0.1	May	WeBS
Pochard	317	-	-	-	TTTC
		<1	<0.1	Feb	WeBS
Redshank	5 445	540	9.9	Aug	TTTC
		83	1.5	Dec	WeBS
Ringed plover	(2 168)	210	9.7	Aug	TTTC
		-	-	Mar	WeBS
Ruff	64	1	1.6	Aug, Sep	TTTC
		-	-	-	WeBS
Shelduck	5 314	109	2.0	Feb	TTTC
		9	0.2	May	WeBS
Shoveler	145	-	-	-	TTTC
		11	7.6	Mar	WeBS
Smew	2	-	-	-	TTTC
		1	50	Jan,Feb,Mar	WeBS
Teal	2 865	12	0.4	Sep	TTTC
		13	0.5	Dec	WeBS
Tufted duck	417	-	-	-	TTTC
		4	0.9	Mar	WeBS
Turnstone	(570)	-	-	-	TTTC
		1	0.2	Sep	WeBS
Whimbrel	88	2	2.2	Aug	TTTC
		-	-	-	WeBS
Wigeon	3 520	24	0.6	Jan	TTTC
		-	-	-	WeBS
Yellow-legged gull	6	1	25	Jul	TTTC
		-	-	-	WeBS

Humber Population – Population taken from mean of peak data from 5 Year WeBS core count data between 2004/05 – 08/09 for Sector 38950 the Humber Estuary. () indicates mean calculated from an incomplete 5 year data set.

Peak count – The highest species count recorded within Killingholme Marshes either from WeBS data or IECS surveys (datasets expanded below).

WeBS – Mean of Peak Count derived from WeBS 5 Year Core Count Data from 2004/05 - 08/09 for Sector 38406 Killingholme Marshes (TA178187).

TTTC – Waterbird Surveys undertaken at Killingholme Marshes by Institute of Estuarine Coastal Studies (IECS) between April 2010 and April 2011

Month – For IECS data the month(s) refers to when the peak count per species was recorded from the Peak Count column. For WeBS data the month still refers to when the peak count was recorded although the corresponding Peak Count figure for WeBS is a mean of peak rather than a peak of peaks.

Records highlighted in blue represent counts ≥1% of the Humber Population

species written in red are those which meet individual qualifying interests of the Humber Estuary SPA, as opposed to being part of the assemblage.

5.3.7 The TTTC were undertaken in a number of different sectors across the intertidal mudflats (see *Figure 5.2*). The survey findings show that assemblage is greatest over the autumn passage and winter months, with particularly high numbers in the autumn passage period in Count Sectors C and D (see *Figure 5.3*). It is clear from the data that the majority of the birds used the intertidal habitats within Count Sectors C-E (see *Figure 5.4*), which are also the sectors containing the largest areas of available mudflat through the tidal cycle.

Figure 5.2 ***Wetland Bird Survey Areas and Breeding Bird Transects for Killingholme Marshes* and Foreshore**

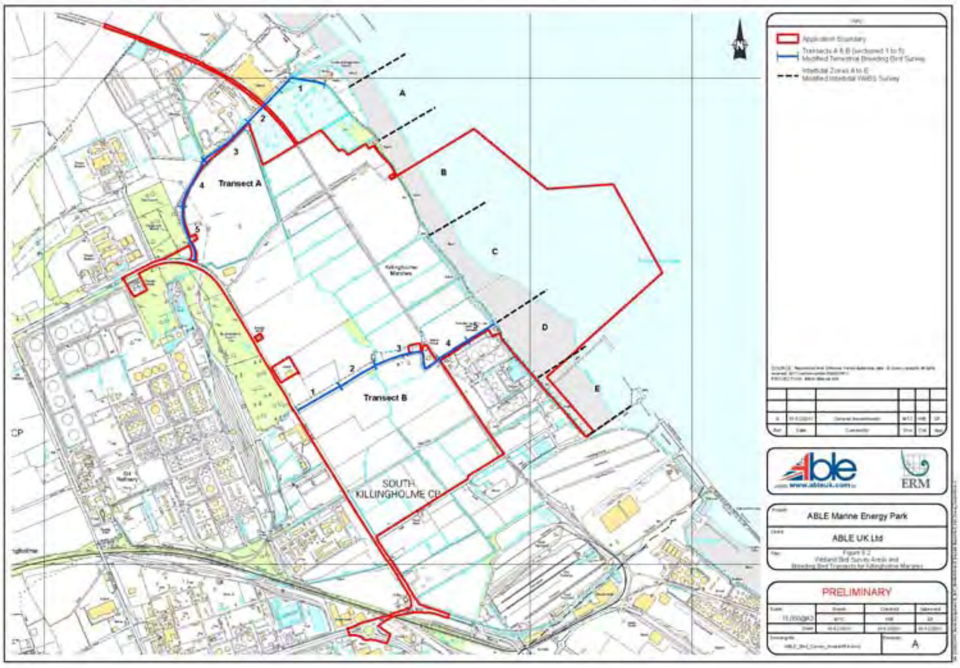
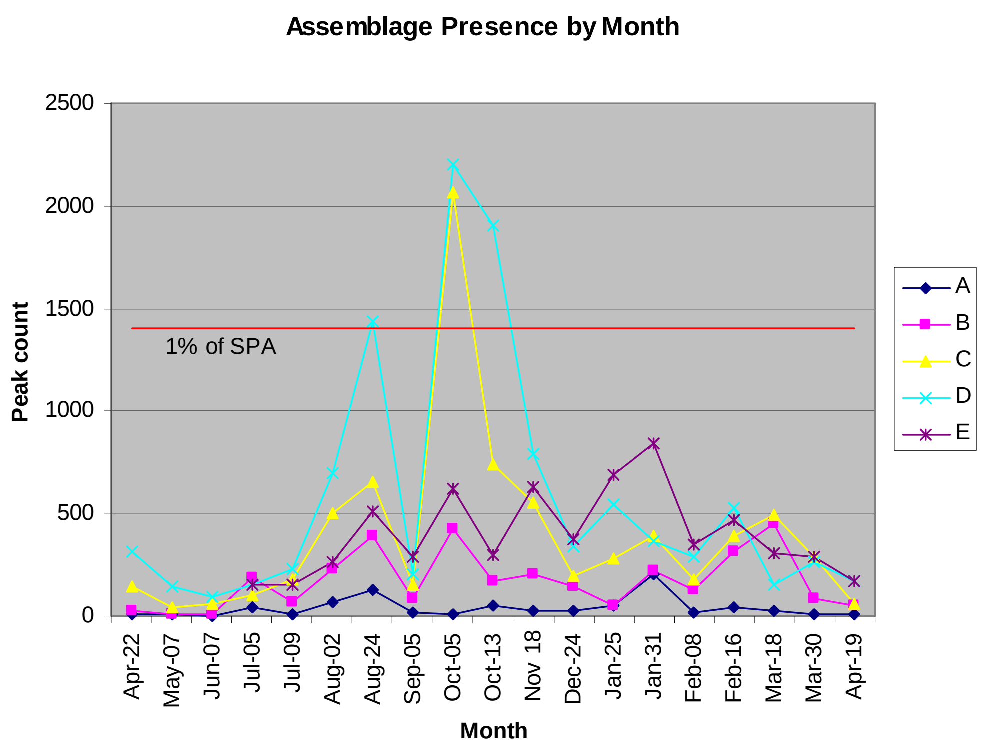
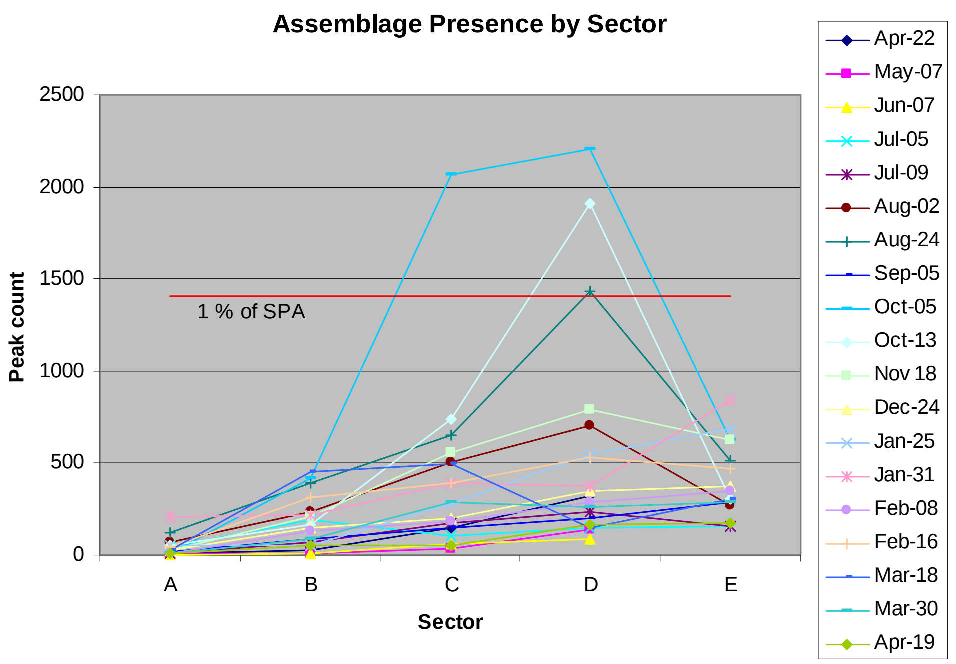


Figure 5.3 Bird Assemblage By Month



Source: Data from TTTC April 2010 –April 2011.

Figure 5.4 Bird Assemblage in Each Count Sector



Source: Data from TTTC April 2010 –April 2011.

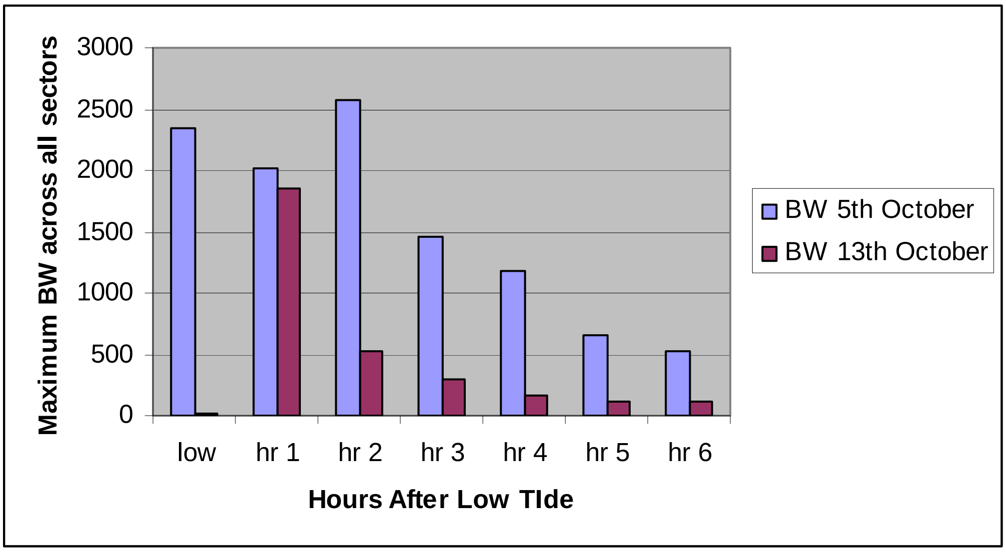
5.3.8 The data in *Table 5.1* also show that the Killingholme Marshes foreshore supports important numbers of individual wetland bird species. The numbers of black-tailed godwit in particular recorded by the TTTC surveys (66% of the Humber Estuary population) show that the foreshore where AMEP will be located is currently a very important site for this species in the Humber Estuary. The proximity of the NKHP as a roost site is also likely to be an important factor, as this species prefers to roost in close proximity to its food resource. However the data show that the peak period of usage by black-tailed godwits of NKHP in August (see *Table 5.2*) did not coincide with peak usage of the intertidal mudflats on the Killingholme Marshes foreshore which occurred in October, suggesting that birds using NKHP also comprised birds that were foraging elsewhere in the Humber Estuary in August, and that some of the birds foraging on the foreshore at Killingholme Marshes in October were then roosting someone other than NKHP.

5.3.9 There were minimal counts of black-tailed godwits at both NKHP and on the Killingholme Marshes foreshore in September across the six hour tidal cycle. This occurred despite September being the usual month when the peak numbers of this species are present on the Humber Estuary as a whole. So whilst NKHP seemed to be the favoured roosting site during the autumn passage period, the data suggest that the birds are not solely reliant on it as a roosting site, or on the Killingholme Marshes foreshore as a feeding area throughout the whole Autumn passage period.

5.3.10 There is also evidence of movement of birds across the mudflats. Surveys during the late winter indicate that those black-tailed godwits which remain on the Humber Estuary tend to utilise the mudflats in Count Sector E more than other Count Sectors (see *Table C2.9* in *Annex C Supporting Ornithological Information*). This may indicate that the feeding resource has become depleted in their preferred Count Sectors of C and D (where godwits predominately feed in autumn), and that these wintering birds have moved to utilise an area with remaining food resource (*ie* Count Sector E).

5.3.11 Across all the count sectors of the Killingholme Marshes foreshore, the surveys recorded black-tailed godwit activity peaking closer to low tide (see *Figure 5.5*). However in Count Sector E, which comprises the main area of intertidal mudflat which will remain once the new quay is constructed, the preferred usage was in the mid-high tide range (ie the reverse of the pattern across all the whole of the Killingholme Marshes foreshore) (see *Figure 1.13* in *Annex F*). As black-tailed godwits tend to moult during Autumn (Mander & Cutts, 2005 (1)), the birds are likely to spend a minimal amount of time feeding and the majority of their time at NKHP, either roosting or loafing.

Figure 5.5 ***October Surveys Showing Black-tailed Godwit Activity through the Tidal Cycle for All Sectors***

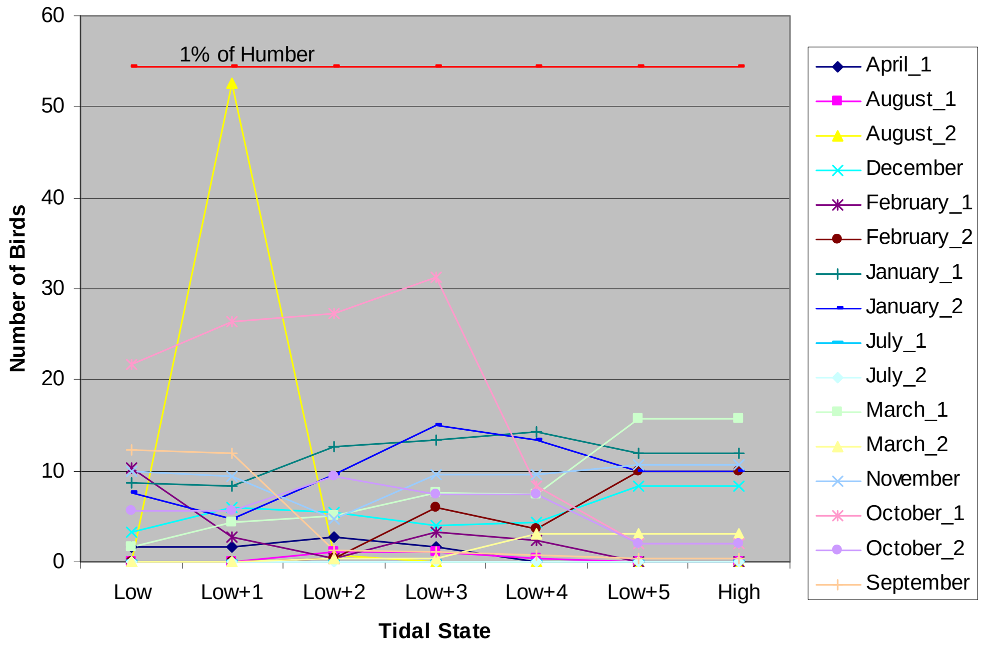


Source: Data from TTTC surveys undertaken by IECS April 2010 – April 2011. (BW is the British Trust for Ornithology (BTO) species code for black-tailed godwit.)

5.3.12 Other species recorded in important numbers on the intertidal mudflats at Killingholme Marshes included bar-tailed godwit, dunlin, redshank, curlew, lapwing, ringed plover and ruff, although only a single ruff was recorded (see *Table 5.1*). Redshank in particular, was present in numbers ≥1% of the Humber Estuary population throughout the autumn passage and winter period, with the highest counts in August (see *Figure C2.15* in *Annex C Supporting Ornithological Information*). This species showed a preference for Count Sectors C and D (see *Figure C2.14* in *Annex C Supporting Ornithological Information*), and in Count Sector E (*ie* the main area of remaining intertidal mudflats once the new quay is constructed) it was present throughout the tidal cycle (see *Figure 5.6*). During the main passage period in August, the numbers in Count Sector E peaked at one hour after low tide.

(1)Mander L & Cutts N D(2005). Humber Estuary Wetland Bird Survey. Twelve Months of Low Tide Counts. September 2003 to August 2004. *English Nature Research Reports* No **656**. English Nature, Peterborough.

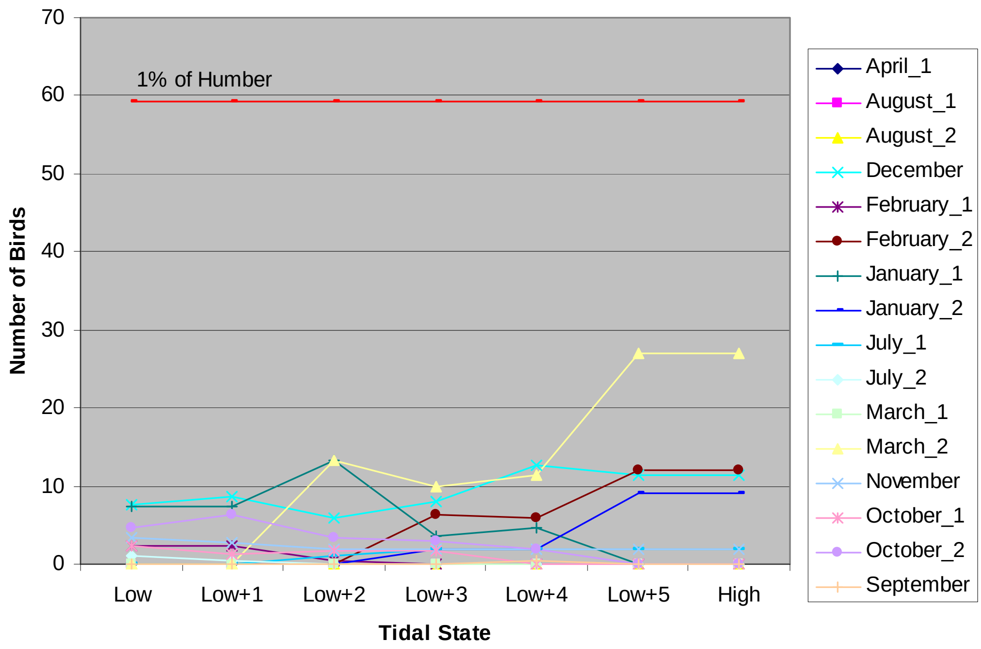
Figure 5.6 ***Redshank Numbers in Count Sector E - Through the Tidal Cycle***



Source: Data from TTTC surveys undertaken by IECS April 2010 – April 2011.

5.3.13 Bar-tailed godwit exhibited a more varied presence, with a peak in March and much lower numbers over the autumn passage period (see *Figure C2.11* in *Annex C Supporting Ornithological Information*). The godwits favoured Count Sectors D and E (see *Figure C2.10* in *Annex C Supporting Ornithological Information*) and were present in Count Sector E throughout the tidal cycle, but with occasionally high numbers around high tide and the hour preceding it (see *Figure 5.7*).

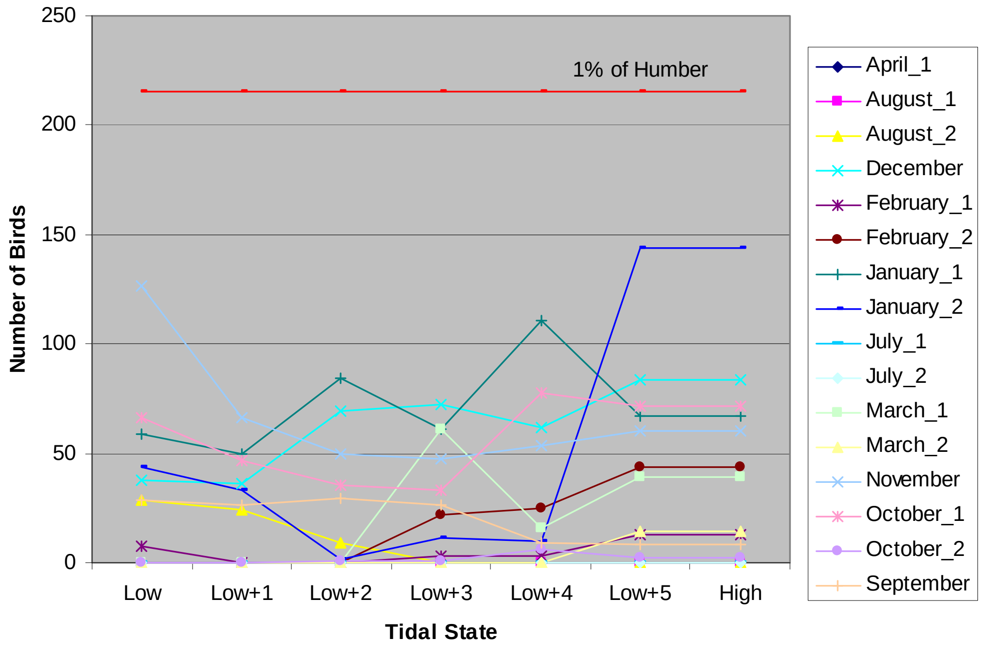
Figure 5.7 ***Bar-tailed Godwit Numbers in Count Sector E - Through the Tidal Cycle***



Source: Data from TTTC surveys undertaken by IECS April 2010 – April 2011.

5.3.14 Dunlin numbers peaked over the winter months (see *Figure C2.7* in *Annex C Supporting Ornithological Information*), with numbers regularly exceeding 1% of the Humber Estuary population in Count Sectors C, D and E (see *Figure C2.6* in *Annex C Supporting Ornithological Information*) and were present in Count Sector E throughout the tidal cycle (see *Figure 5.8*).

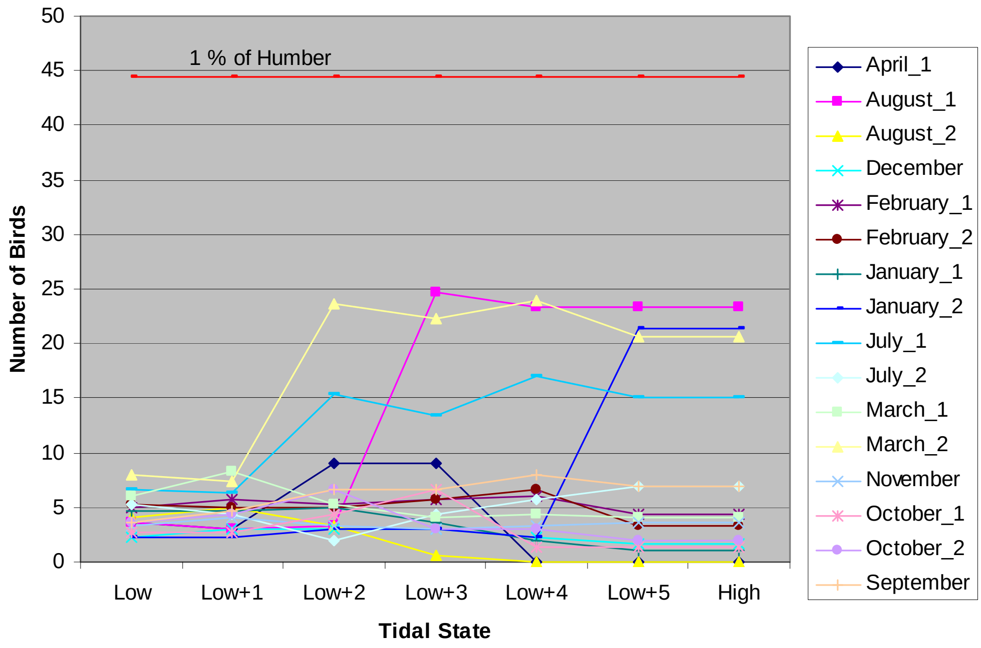
Figure 5.8 Dunlin Numbers in Count Sector E - Through the Tidal Cycle



Source: Data from TTTC surveys undertaken by IECS April 2010 – April 2011.

5.3.15 Curlew numbers were found to be variable across the survey period (see *Figure C2.13* in *Annex C Supporting Ornithological Information*), with numbers regularly exceeding 1% of the Humber Estuary population in Count Sectors D and E (see *Figure C2.12* in *Annex C Supporting Ornithological Information*). Birds were present in Count Sector E throughout the tidal cycle and where any higher numbers occurred it was typically over the period from two hours after low tide to high tide (see *Figure 5.9*).

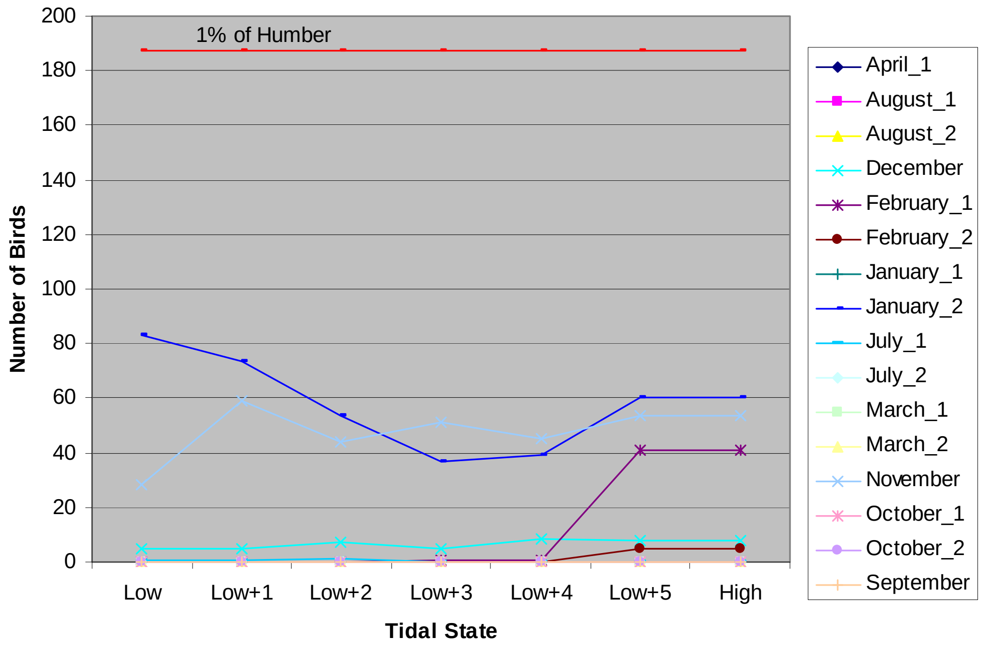
Figure 5.9 Curlew Numbers in Count Sector E - Through the Tidal Cycle



Source: Data from TTTC surveys undertaken by IECS April 2010 – April 2011.

5.3.16 Lapwing numbers on the intertidal mudflats at Killingholme Marshes were found to be generally low outwith the period November to February (see *Figure C2.5* in *Annex C Supporting Ornithological Information*). Where numbers did occur they were typically in Count Sector E (see *Figure C2.4* in *Annex C Supporting Ornithological Information*), and present in Count Sector E throughout the tidal cycle (see *Figure 5.10*).

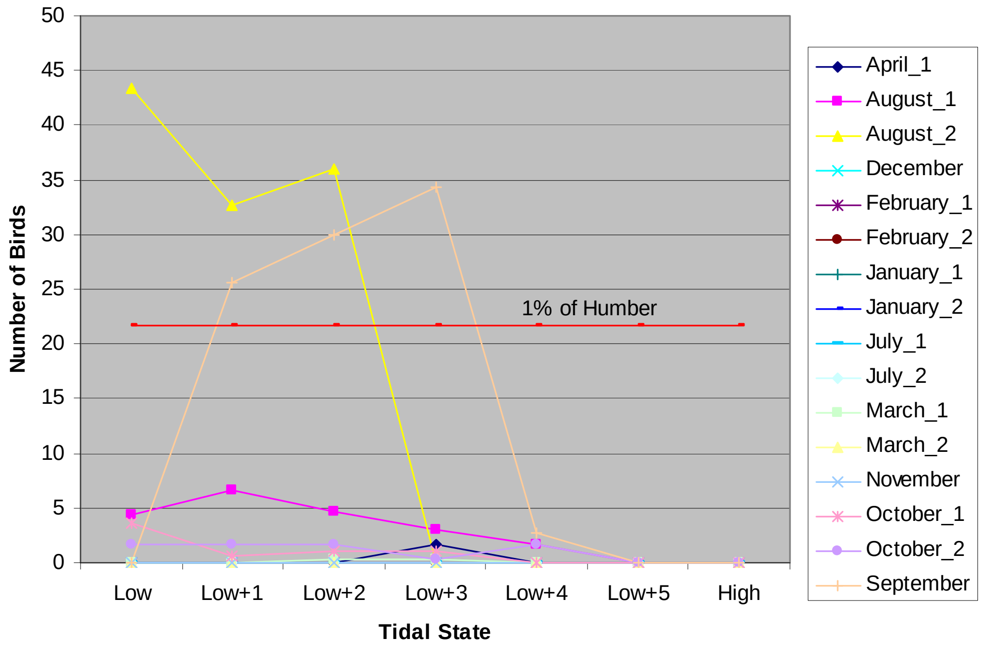
Figure 5.10 Lapwing Numbers in Count Sector E - Through the Tidal Cycle



Source: Data from TTTC surveys undertaken by IECS April 2010 – April 2011.

5.3.17 Ringed plover was only present in any numbers during the autumn passage period in August and September (see *Figure C2.17* in *Annex C Supporting Ornithological Information*). Where numbers did occur they were typically in Count Sectors D and E in which numbers ≥1% of the Humber Estuary population were recorded on the same surveys visits (see *Figure C2.16* in *Annex C Supporting Ornithological Information*). The birds were present in Count Sector E through the period from low tide to two to three hours after low tide, with few if any birds present, from mid to high tide (see *Figure 5.11*).

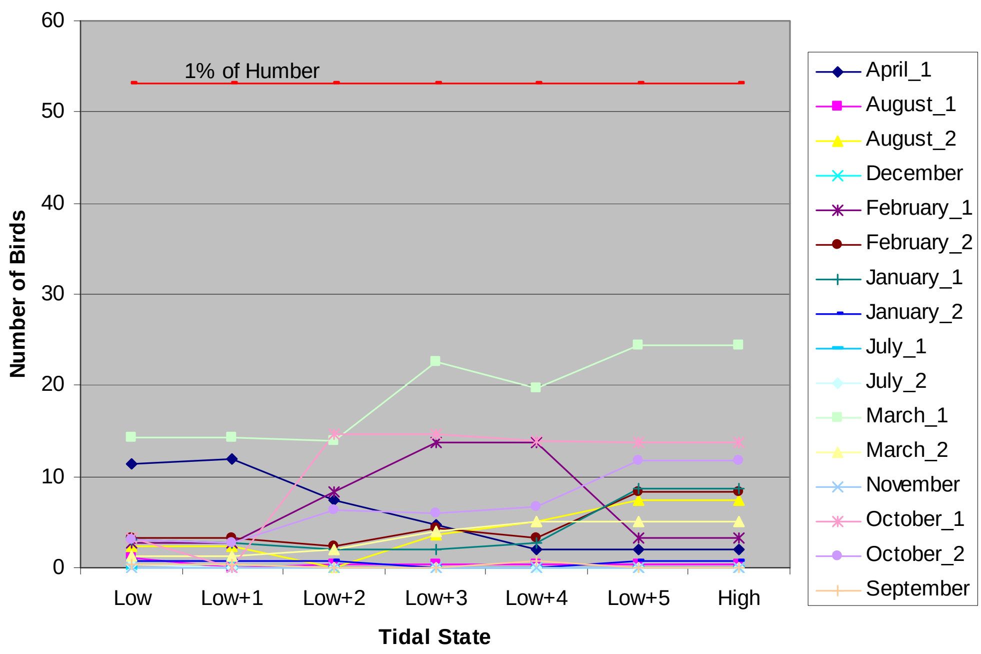
Figure 5.11 Ringed Plover Numbers in Count Sector E - Through the Tidal Cycle



Source: Data from TTTC surveys undertaken by IECS April 2010 – April 2011.

5.3.18 Amongst the wildfowl only shelduck (of the qualifying interest species meeting qualifying criteria individually) was recorded by the TTTC in numbers ≥1%. It was recorded regularly throughout the year, with the greatest numbers in the autumn passage period and late winter (see *Figure C2.3* in *Annex C Supporting Ornithological Information*). This is a species which favours mudflats and was recorded predominantly in Count Sectors C – E, which held the largest areas of intertidal mudflat (see *Figure C2.2* in *Annex C Supporting Ornithological Information*). Within Count Sector E there was little variation in presence across the tidal cycle (see *Figure 5.12*).

Figure 5.12 Sheldkuck Numbers in Count Sector E - Through the Tidal Cycle



Source: Data from TTTC surveys undertaken by IECS April 2010 – April 2011.

5.3.19 Some species such as shoveler, were recorded in large numbers during the WeBS counts, but not recorded by the TTTC. Others such as coot were recorded largely using Count Sector A, an area which the data show supported comparatively few birds. The low usage of Count Sector A was considered largely due to the narrower area of mudflat habitat available, the steep profile, the more stoney nature of the mudflat in this sector, and the regular records of predators (avian and mammalian) that were recorded during the surveys (*pers comm* IECS, 2011).

5.3.20 Large numbers of gulls were recorded on the Killingholme Marshes foreshore, but all of these species will use a wide range of coastal areas to loaf. The foreshore also supported a peak count of two Mediterranean gulls, a species which is increasing in numbers and becoming more widespread in winter (Holt et al, 2011[(1)]) and also breeding in the UK in ever increasing numbers (JNCC, 2011 [(2)]).

5.3.21 The TTTC have also shown there is high usage of the site at certain points during the tidal cycle and that this differs between species. Some species such as dunlin and redshank will remain at relatively

(1)Holt C A, Austin G E, Calbrade N A, Mellan H J, Mitchell C, Stroud D A, Wotton S R & Musgrove A J (2011) *Waterbirds in the UK 2009/10: The Wetland Bird Survey.* BTO/RSPB/JNCC in association with WWT. Thetford.
(2) Joint Nature Conservation Committee (2011) *Seabird Population Trends and Causes of Change: 2011 Report* http://www.jncc.gov.uk/page-3201

constant numbers until two hours before high tide when they leave the foreshore presumably to roost. Shelducks remain almost constant in number through the tidal cycle, and will feed along the moving tide mark across the habitat available in the count sectors. The fact that the TTTC contributed the greater proportion of those species recorded in significant numbers compared to the WeBS core count data, indicates the importance of low and mid tide usage of the mudflats at Killingholme Marshes.

North Killingholme Haven Pits (NKHP)

5.3.22 NKHP lies immediately inland from the Killingholme Marshes foreshore and has largely stable water levels throughout the tide cycle. It forms an important high tide refuge for many species, including those that forage on the intertidal areas of the Humber during other tidal states. Fewer species overall were recorded at NKHP compared with Killingholme Marshes foreshore, with a total of 32 individually qualifying species plus the wider assemblage (see *Table 5.2*). Species composition differed slightly also, with fewer wader and gull species then at Killingholme Marshes foreshore. Despite this NKHP still supports important numbers (ie ≥ 1% of Humber Estuary population) of a large number of species which are qualifying interests of the European site.

5.3.23 Sixteen species and the assemblage were recorded in numbers ≥ 1% of the Humber population (10 based on both WeBS and TTTC, five based solely on the TTC and one based solely on the WeBS counts, and the assemblage based on both). That 10 species were recorded as ≥ 1% of the Humber Estuary population by both survey methods showed a much greater overlap between the data than the survey records at Killingholme Marshes foreshore. This reflects the use of the NKHP as a high tide roost, with the variance between the two methods probably reflecting the fact the surveys were carried out on different days.

5.3.24 The only species occurring at NKHP in numbers ≥ 1% of the Humber population which the data showed had a definite link between the numbers of birds foraging on the Killingholme Marshes foreshore was black-tailed godwit, and possibly redshank, although it was no particularly clear from the data. Effects on roosting numbers of these species may therefore also be influenced by effects on their foraging habitat at Killingholme Marshes foreshore, and not just effects on the birds when they at NKHP.

Table 5.2 North Killingholme Haven Pits Wetland Bird Data Summary

Species	Humber population	Peak count	Proportion Of Humber Population (%)	Month	Data Source
Assemblage	140 197	4112	2.9	Aug	TTTC
		3787	2.7	Sep	WeBS
Avocet	493	16	3.2	Mar	TTTC
		27	5.5	Mar	WeBS
Bar-tailed godwit	(5 926)	1	<0.1	Aug, Sep, Oct	TTTC
		-	-	-	WeBS
Black-headed gull	(7 865)	41	0.5	Aug	TTTC
		-	-	-	WeBS
Black-tailed godwit	3 887	3 800	97.8	Aug	TTTC
		3 338	85.9	Sep	WeBS
Canada goose	580	-	-	-	TTTC
		1	0.2	Apr	WeBS
Common sandpiper	(46)	1	2.2	Jul,Aug	TTTC
		-	-	-	WeBS
Coot	1 166	2	0.2	May,Feb,Mar	TTTC
		3	0.3	Mar	WeBS
Cormorant	(219)	1	0.5	Aug	TTTC
		1	0.5	Sep	WeBS
Curlew	4 440	7	0.2	Oct, Mar	TTTC
		12	0.3	Feb	WeBS
Dunlin	21 518	270	1.3	Oct	TTTC
		380	1.8	Nov	WeBS
Golden plover	46 926	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	41 772	12	<0.1	Aug	TTTC
		-	-	-	WeBS
Lapwing	18 756	5	<0.1	Oct	TTTC
		276	1.5	Nov	WeBS
Little egret	38	1	2.6	Jun, Jul	TTTC
		-	-	-	WeBS
Little grebe	92	-	-	-	TTTC
		1	0.9	Sep	WeBS
Little ringed plover	6	2	34	Apr	TTTC
		-	-	-	WeBS
Mallard	2 096	34	1.6	Oct	TTTC
		71	3.4	Sep	WeBS
Moorhen	146	4	2.7	Jul	TTTC
		2	1.6	Sep	WeBS
Mute swan	288	1	0.3	Jul,Oct,Jan	TTTC
		1	0.3	Feb	WeBS
Oystercatcher	3 528	4	0.1	Mar	TTTC
		2	<0.1	Aug	WeBS
Redshank	5 445	249	4.6	Aug	TTTC
		215	3.9	Aug	WeBS
Ringed plover	(2 168)	-	-	-	TTTC
		1	0.1	Aug	WeBS
Ruff	64	-	-	-	TTTC
		1	0.9	Sep	WeBS
Shelduck	5 314	9	0.2	May	TTTC

Species	Humber population	Peak count	Proportion Of Humber Population (%)	Month	Data Source
		7	0.1	Mar	WeBS
Shoveler	145	61	42.1	Oct	TTTC
		29	20	Dec	WeBS
Smew	2	1	50	Jan	TTTC
		-	-	-	WeBS
Snipe	118	6	5.1	Oct	TTTC
		4	3.4	Oct	WeBS
Teal	2 865	46	1.6	Oct	TTTC
		30	1.0	Nov	WeBS
Tufted duck	417	1	0.2	Jul	TTTC
		1	0.2	Sep	WeBS
Water rail	7	2	28	Jun	TTTC
		-	-	-	WeBS

Table Legend

Humber Population – Population taken from Mean of Peak data from 5 Year WeBS Core Count Data between 2004/05 – 08/09 for Sector 38950 the Humber Estuary. () indicates mean calculated from an incomplete 5 year data set.

Peak count – The highest species count recorded within North Killingholme Haven Pits either from WeBS data or IECS surveys (datasets expanded below).

WeBS – Mean of Peak Count derived from WeBS 5 Year Core Count Data from 2004/05 - 08/09 for Sector 38201 North Killingholme Haven Pits (TA166196).

IECS – Waterbird Surveys undertaken at Killingholme Marshes by Institute of Estuarine Coastal Studies (IECS) between April 2010 and April 2011

Month – For IECS data the month(s) refers to when the peak count per species was recorded from the Peak Count column. For WeBS data the month still refers to when the peak count was recorded although the corresponding Peak Count figure for WeBS is a mean of peak rather than a peak of peaks.

Records highlighted in blue represent counts ≥1% of the Humber Population

Species written in red are those which meet individual qualifying criteria of the Humber Estuary SPA, as opposed to being part of the assemblage.

Killingholme Fields

5.3.25 In addition to the use of NKHP, wetland bird species using the intertidal mudflats at Killingholme Marshes have been recorded using fields inland around high tide.

5.3.26 The main roosting / feeding areas between East Halton Skitter and Immingham Docks, based on 35 years of observations Catley (2006 (1)) are shown in *Figure 5.13*. The fields labelled as J and K, both permanent pastures, lie within the AMEP site boundary and will be lost as a result of the development. The northernmost of the fields labelled as L lies within the proposed mitigation area for AMEP (Area A) (see *Section 6.3* in *Chapter 6 Shadow Appropriate Assessment, Section 1.7 Mitigation* in *Chapter 11 Terrestrial Ecology and Birds in the ES*, and the *Landscape and Ecology Masterplan, Annex 4.5* of the ES). Rosper Road Pools (a former Lincolnshire Wildlife Trust (LWT) Nature Reserve) which lies outwith the AMEP scheme boundary to the south will not be affected

(1) Catley G P (2006) *Wader and Wildfowl Roosts on the South Side of the Humber Estuary between East Halton Skitter and Immingham Docks*. Nyctea Ltd

significantly. The comparative field numbers used in the surveys undertaken by Catley are shown on both *Figures 5.15* and *5.17*.

Figure 5.13 Key Roosting / Feeding Sites on South Humber Bank

Source: Catley 2007/08 Winter Bird Survey of East Halton and Killingholme Marshes and Inland Fields.

5.3.27 Only six wetland bird species were recorded using the fields on the proposed AMEP site (black-tailed godwit, lapwing, redshank, whimbrel, shelduck and curlew). The majority of the records were of curlew (see *Figures 5.14* and *5.15*). *Table 5.3* lists the occurrences of wetland bird species other than curlew.

Figure 5.14 Curlew Usage of Killingholme Fields (Based on Surveys by Catley in 2007/2008)

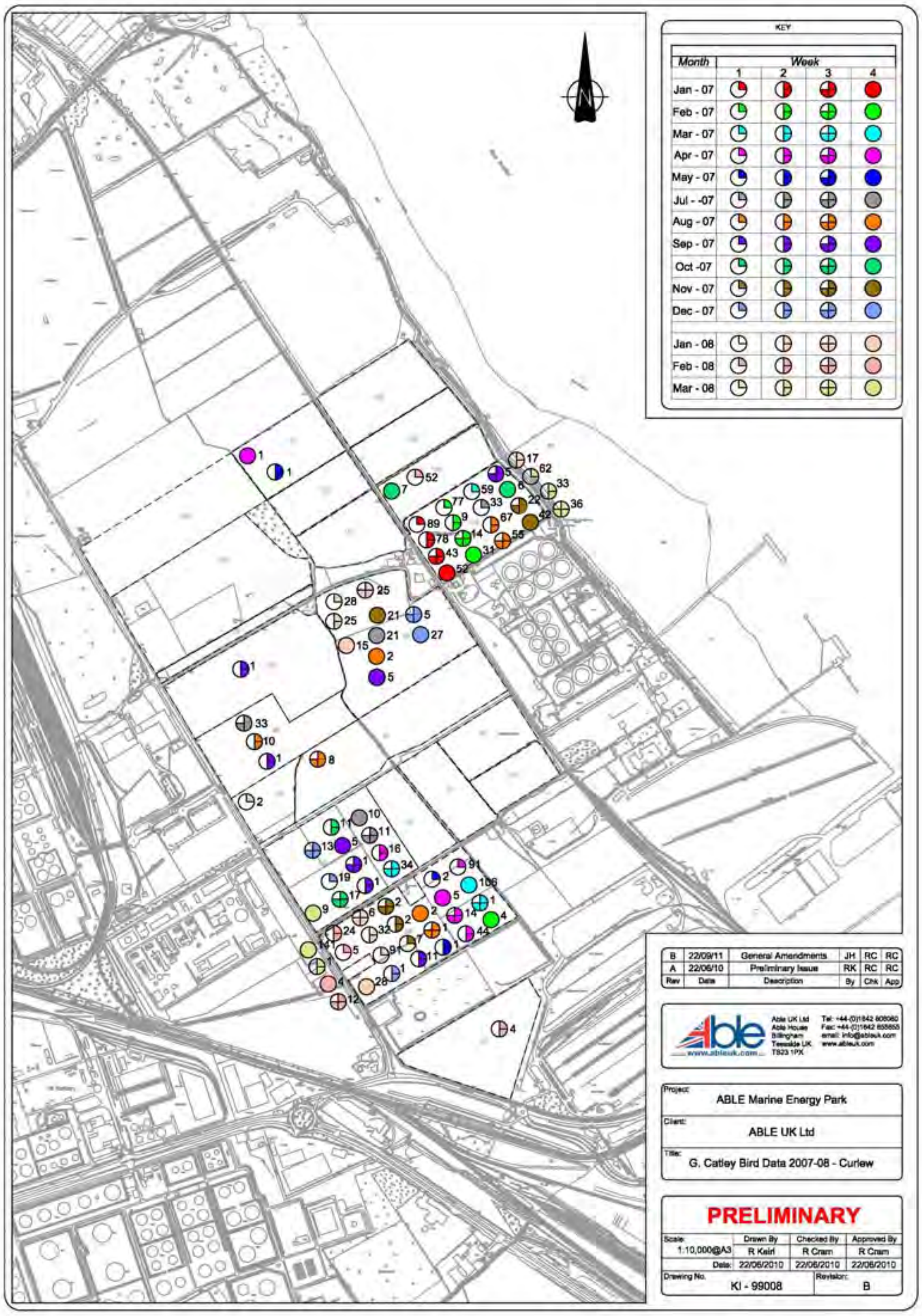


Figure 5.15 Curlew Usage of Killingholme Fields (Based on Surveys by Catley in 2010/2011)

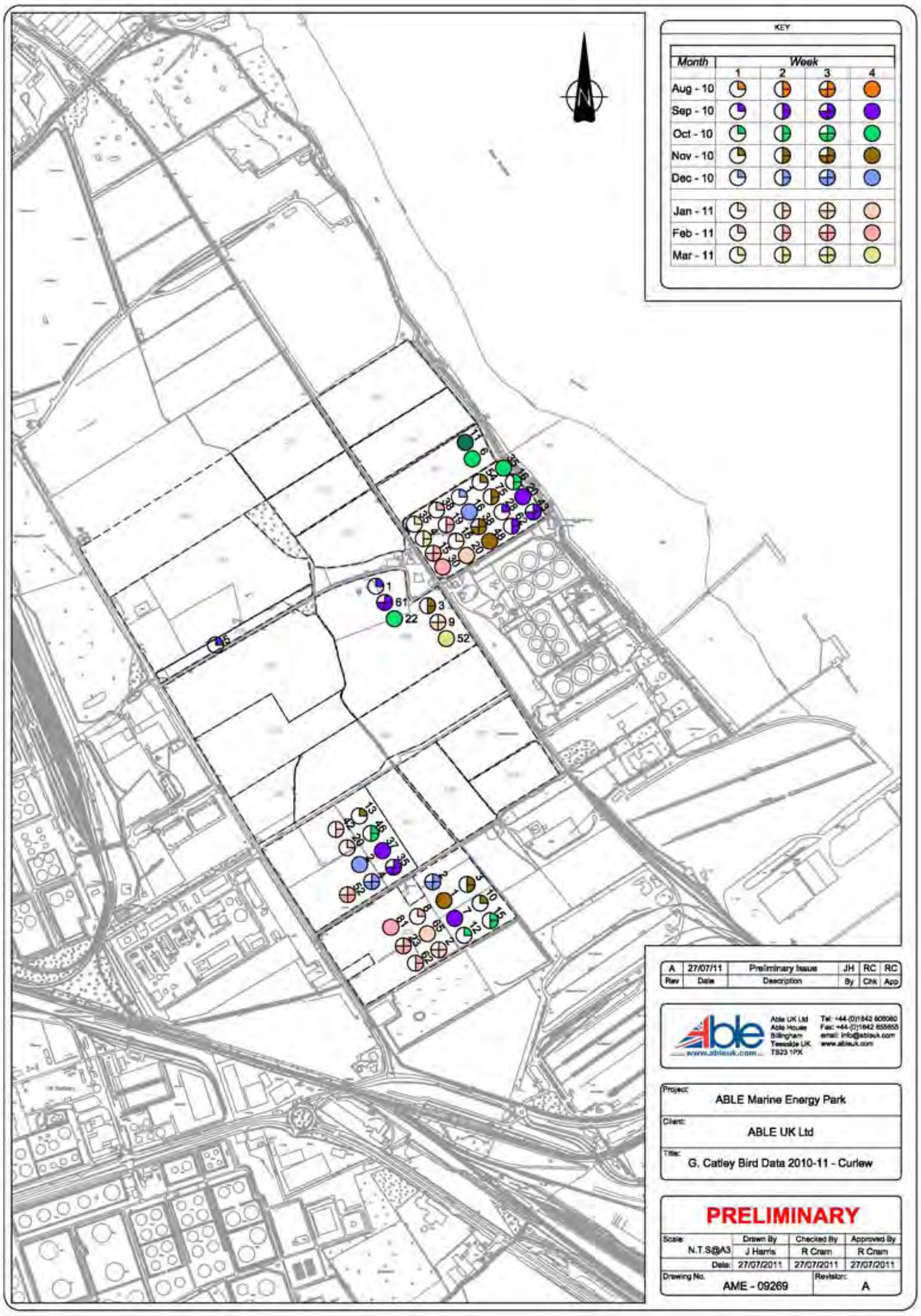


Figure 5.16 Other Wetland Species Usage of Killingholme Fields within AMEP Scheme (Based on surveys by Catley in 2007/2008)

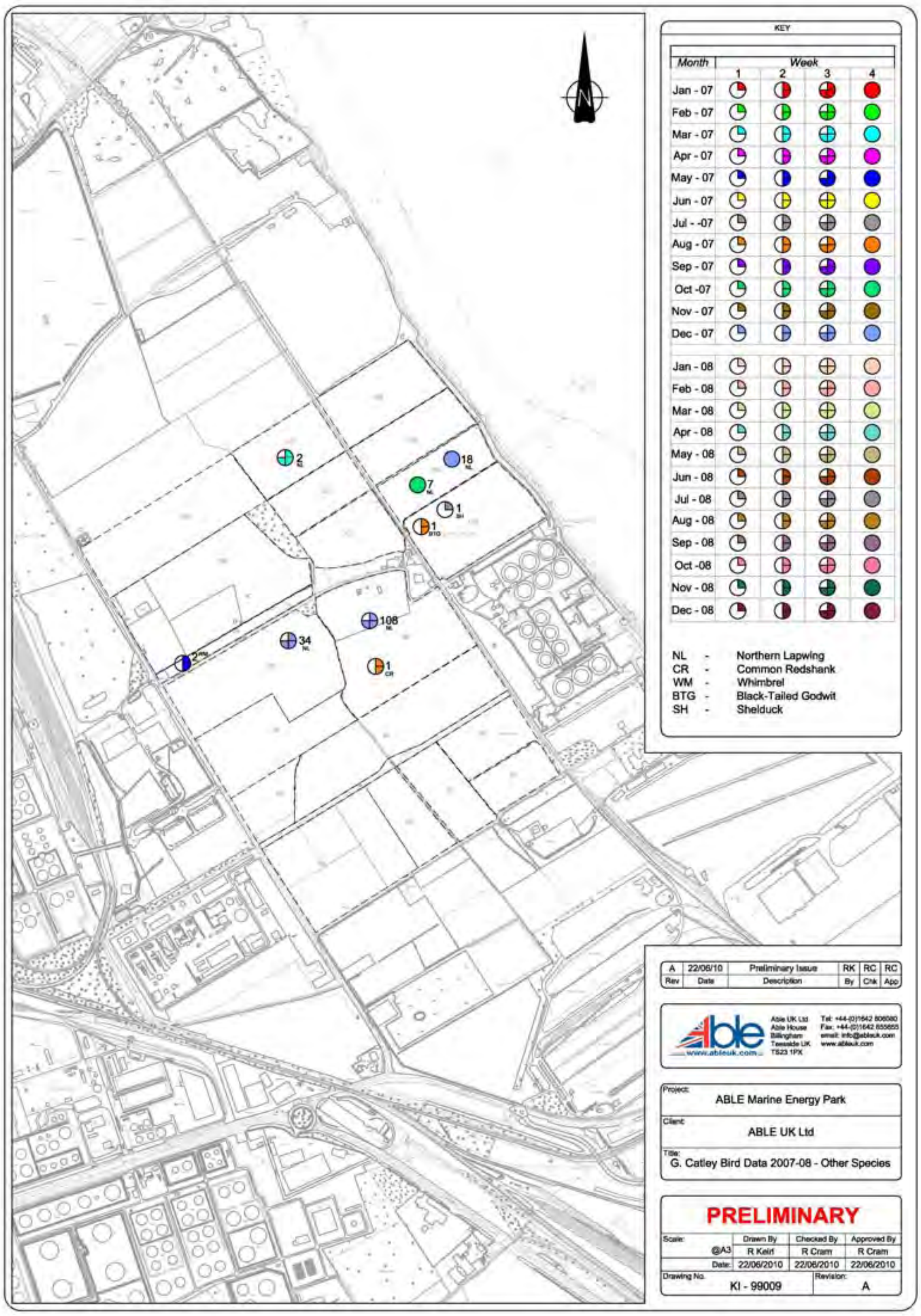


Figure 5.17 Other Wetland Species Usage of Killingholme Fields within AMEP Scheme (Based on surveys by Catley in 2010/2011)

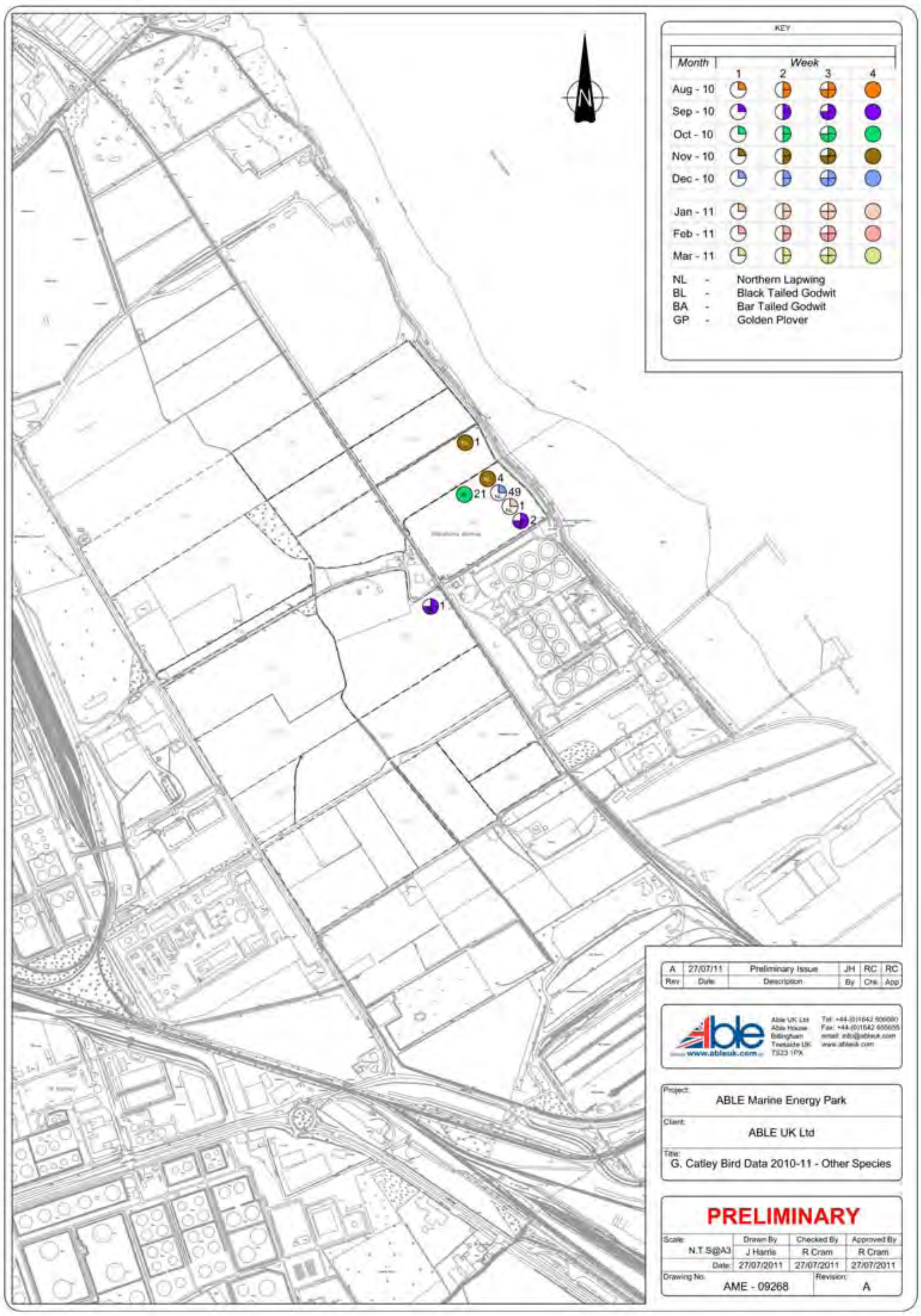


Table 5.3 *Use of Inland Fields by Other Wetland Bird Species (Records in Fields to be lost to AMEP shown in Italics. Data Source: Humber Environmental Data Centre)*

Species	*Numbers*	*Weekly Survey Period*	*Field Number**	*% of Humber Estuary Population*
Lapwing	*108*	*16-22 Dec 2007*	*235*	*0.6*
	34	*16-22 Dec 2007*	*234*	*0.2*
	31	5 – 11 February 2007	225	*0.2*
	18	*30 Dec 2007 – 5 Jan 2008*	*241*	*0.1*
	7	*21-27 Oct 2007*	*241*	*0.04*
	2	5- 11 March 2007	225	*0.01*
	2	9 – 15 April 2007	225	*0.01*
	2	23 – 29 April 2007	225	*0.01*
	5	30 April – 6 May 2007	225	*0.03*
	2	*14 – 20 May 2007*	*244*	*0.01*
	1	*22 – 25 November 2010*	*241*	*0.01*
Mallard	5	19 – 25 February 2008	225	*0.2*
	7	26 February – 4 March 2007	225	*0.3*
	2	26 March – 1 April *2007*	225	*0.1*
	6	23 – 29 March 2008	225	*0.3*
Common snipe	5	5 – 11 February 207	225	*4.2*
	1	26 March – 1 April 2007	225	*0.9*
Black-tailed godwit	*1*	*12- 18 August 2007*	*240*	*0.03*
	2	25-27 October 2010	225	*0.05*
Gadwall	4	23 – 29 March 2008	225	*2.2*
Pink-footed goose	1	22 – 24 February 2011	225	*0.02*
Shelduck	*1*	*1 – 7 July 2007*	*240*	*0.02*
Whimbrel	*2*	*14 – 20 May 2007*	*236*	*2.3*
Redshank	*1*	*12 – 18 August 2007*	*235*	*0.02*

% of Humber Estuary Population – Humber population taken from Mean of Peak data from 5 Year WeBS Core Count Data between 2004/05 – 08/09 for Sector 38950 the Humber Estuary.

* Field numbers relate to field identifiers used in Catley 2007/08 and 2010/11, see *Figure 5.6 and 5.7* for field location.

Records highlighted in blue represent counts ≥1% of the Humber Estuary Population

5.3.28 The data show that some of these species occur in numbers ≥1% of the Humber Estuary population. However, such occurrences are sporadic and comprise very low numbers of birds. In addition only one of the records ≥1% (that of whimbrel), was in a field which will be lost for the AMEP scheme. Historically lapwings were recorded at the Killingholme Fields in numbers ≥1%, but recent years have seen much fewer birds at Killingholme with a maximum count of 142 (*ie* 0.75% of the Humber Estuary population) on one occasion in December 2007 (Catley, 2008[1]).

5.3.29 In contrast the numbers of curlew recorded during the surveys were regularly ≥1% of the Humber Estuary population (ie ≥44 birds). *Table 5.4* contains the records from the latest 2010/2011 winter survey, which

(1) Catley G P (2008) *East Halton- Killingholme Winter Birds Survey 2007/2008*. Nyctea Ltd.

shows a peak of 158 birds in week 3 (13th – 19th September 2010) (*ie* 3.6%) of which 123 (*ie* 2.8%) was within Fields 98/235 and 103/240 within the AMEP site.

5.3.30 Curlew numbers from the 2007/2008 surveys show a similar pattern, with only a very few additional fields used (see *Figure 5.14*). However, all but one of the records comprised 10 birds or less (*ie* ≤0.23% of the Humber population) and the other was of 33 birds (*ie* 0.75% of the Humber population). So the survey findings overall found the main fields used by curlew correspond with those highlighted in *Figure 5.13*. These are Fields 240 and to a lesser extent Field 235 which will be lost for the AMEP scheme, Field 89/226 which will form part of the mitigation (Area A) for AMEP, and Field 88/225 which will remain unaffected by the AMEP scheme.

Table 5.4 ***Curlew Numbers at Killingholme Fields (September 2010 - April 2011)***

Field	**Week Number**																													
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*	*29*	*30*	*31*
225	0	0	0	7	0	12	15	0	0	10	10	0	1	0	0	2	0	0	0	0	2	65	8	62	23	81	54	9	16	66	28
226	0	0	35	0	37	0	46	0	0	13	0	0	0	0	0	0	4	2	20	0	0	42	0	0	52	0	0	90	0	0	28
235	1	0	61	0	0	0	0	0	22	0	3	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	52	0
240	0	28	62	43	20	0	16	0	35	54	75	38	48	1	0	0	0	16	15	0	0	20	38	19	15	30	35	4	0	0	0
241	0	0	0	0	0	0	0	0	6	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
247	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

5.3.31 These main fields are all permanent pasture fields. With the exception of one record of curlew roosting in Field 240 during the winter of 2010/11, the remainder of the records were all of foraging birds, with roosting birds largely on the upper intertidal areas (Area I on *Figure 5.13*) with only low numbers at NKHP (*pers comm* Catley, 2011). The survey findings recorded more extensive use of the grassland fields towards Rosper Road by curlew as the winter progress (Catley, 2011 [(1)]).

5.3.32 The curlew population at South Humber Bank consists of two main flocks with little interchange, one at East Halton (north of the AMEP site) and the other at Killingholme Fields (Catley, 2007 [(2)]). The curlew foraging on the fields that will be affected by the AMEP scheme belong to the southern flock. Only low numbers of curlew roost in NKHP which may include some birds from the northern flock.

(1) Catley G P (2011) *Humber INCA North and North-east Lincolnshire Autumn and Winter Birds Surveys September 2010 - April 2011.* Nyctea Ltd.
(2)Catley G P (2007) *Winter Bird Survey of East Halton and Killingholme Marshes and Inland Fields Encompassed by North Lincolnshire Council Boundary: January to March 2007.* Nyctea Ltd

5.3.33 Numbers of curlew on the Killingholme Fields did not always correspond with those on the Killingholme Marshes foreshore, with counts on the foreshore well in excess of those at the Killingholme Fields. It is likely that the foreshore numbers reflect the combined numbers of birds from the southern flock of curlew which used the Killingholme Fields and most probably those from the East Halton Northern Flock. Hence curlews displaced from the foreshore could include birds from the northern flock.

5.4 HRA SCREENING FOR LIKELY SIGNIFICANT EFFECT

Is the AMEP Necessary for the Management of the Humber Estuary EMS or Ramsar Site?

5.4.1 It is clear that the AMEP is not directly connected with or necessary for the management of the Humber Estuary European Sites.

Can it be concluded that AMEP will not have a Likely Significant Effect on the Internationally Important Interest Features of the Humber Estuary European Sites either Alone or In-combination?

Components of the AMEP Scheme or Activities Likely to Cause Effects

5.4.2 The works which are required to construct and operate AMEP have already been described in *Chapter 4* (AMEP *Project Description and List of Other Developments*) of this report. It is clear from that description that there are a number of components of AMEP that will affect the Humber Estuary European site and its qualifying interests and could have a likely significant effect. This section of the report identifies those components of the development and the main features of AMEP which could affect the European sites.

5.4.3 A key component of AMEP and the one which has the greatest effect on the intertidal habitats of the European sites is its quay. This will be located on the existing intertidal mudflats at Killingholme Marshes foreshore and will result in the permanent loss of estuary habitats from within the European site boundary. Such losses will occur as direct effects of the quay footprint and also due to indirect changes to habitats resulting from changes in sediment distributions caused by the presence of the new quay.

5.4.4 The creation of the quay will initially require the construction of an outer wall, using tubular and sheet piles. The piling (using a vibrating ram, and a hydraulic hammer as necessary) will be installed from barges which will create noise which could affect birds (including SPA qualifying interest species on the foreshore, in NKHP and the inland Killingholme Fields), lampreys and grey seals.

5.4.5 Prior to any fill material being placed in the void that it created there may also be a need for some dredging of the compressible silt, which settles significantly under loading, and is present over the footprint of the quay. This is likely to be done using suction dredgers with the hoppers on the vessel being emptied at a designated disposal site in the Humber Estuary. The silt will be lost from the estuarine habitats and specifically the intertidal mudflat, a qualifying interest habitat of the Humber Estuary European sites.

5.4.6 The void behind the quay front wall will be filled with sea or estuary dredged material which will be brought to the site via a series of pipelines from the dredge site, or from the dredge vessel. It is expected that some 5 million m^3 of fill will be required over the two year construction period. These activities could result in additional sediment being released into the waters surrounding the quay and the disposal site, which could affect lamprey species.

5.4.7 To enable vessel access to the operational quay and allow berthing alongside it over a commercially viable tidal range, capital dredging will be required. This will result in removal of sediments and hence loss of estuarine habitat which may affect lamprey. There will also be movement of vessels and associated noise, all of which could disturb birds, lamprey and grey seals. The volumes of material that will be dredged are listed in *Table 4.1* in *Chapter 4 (AMEP Project Description and List of Other Developments)*, and the modelling of indirect effects has taken account of the dredging which will have taken place to create the new quay and allow boat access. The dredging will be in the following three areas:

- the berthing pocket to allow vessels to berth at the quay with a suitable clearance beneath the vessel (maximum depth of 7.5 m);
- the approach channel to the quay (2.5 – 5.5 m depth (1)); and
- turning area which is necessary to allow vessels to arrive and leave at most states of the tide (1.5 m depth maximum).

5.4.8 The construction of the quay also has the potential to impact on local water quality and hence on habitats and fauna species during construction works, and as a result of land drainage from AMEP to the estuary.

(1) Range as parts of the approach channel are already dredged to allow access to the Killingholme Oil Terminal and the Humber Sea Terminal.

5.4.9 In addition to the piling referred to above, there will be visual disturbance source to bird species due to the presence of people (construction workforce) and the movements of construction vehicles and vessels in line of sight of birds on the remaining areas of mudflats. The site will be illuminated during the construction works, which may affect birds on the adjacent mudflats, although directional lighting will be used to avoid illumination of the mudflats wherever possible.

5.4.10 Construction of the quay will take a minimum of 24 months and work will be undertaken at all times of the day and throughout the year including bank holidays. Marine piling activity will be restricted to between 6 am and 10 pm daily and will be completed over a 6 month period. Hence the work has the potential to affect bird species throughout one or more of the winter, passage and breeding periods.

5.4.11 AMEP will be operational 24 hours of the day and hence there will be ongoing activities on the quay including movement of people, ships, tracked cranes, mobile transporters, and lighting, all of which could result in disturbance of birds on estuarine habitats adjacent to the site. Lighting will, however, be directed to avoid spillage outside the quay as much as possible. Some navigational lighting will be required to facilitate vessel access and manoeuvrability and maintenance dredging will be required to maintain the areas described above.

5.4.12 The quay lies due south of water coolant intake and outfall pipes for the nearby E.ON and Centrica power stations. Increases in the water temperature could impact on the benthic invertebrates which use the intertidal mudflats and hence on the birds, and fish species which feed on them.

Habitats

5.4.13 There will be a direct and permanent loss of 45 ha of estuarine habitat due to the AMEP scheme on the southern side of the Humber Estuary. The estuarine habitats lost comprise intertidal mudflats (31.5 ha) and sub-tidal sediments (13.5 ha), see *Tables 5.5* and *5.6*.

5.4.14 In addition to the direct losses, there are also indirect losses and gains resulting from the presence of the new quay. The modelling predicts that accretion will result in the creation of 12.3 ha of saltmarsh, comprising 10.3 ha in areas which are currently intertidal mudflats and approximately 2 ha in areas which are currently sub-tidal. In addition 7.88 ha of new intertidal mudflat will result in areas that are currently sub-tidal. In addition to these losses there will also be a temporary functional loss of 6 ha of intertidal mudflat during the construction of the quay. This will result from the effects of disturbance on birds from the construction works. The birds are likely to avoid this area and are hence displaced from a potential foraging and roosting area. Overall there will be a loss of approximately 34 ha of mudflat from the SAC / 40 ha mudflat from the SPA and 13.5 ha of estuary habitat from the Humber Estuary SAC. The overall gain of saltmarsh is a likely significant effect and a positive effect, as it is a qualifying interest feature of the European site. These figures do not take into account the effects on designated habitats of the proposed compensation site (see *Chapter 9 Compensation Measures*). In undertaking the assessment NE has advised that loss of sub-tidal habitat can be offset by any other estuarine feature.

Table 5.5 ***Direct and Indirect Effects (ha) on Estuary Habitat of the Humber Estuary SAC due to AMEP***

	Saltmarsh	Intertidal Mudflat	Sub-tidal (estuary)
Direct Loss	0	-31.5	-13.5
Indirect Loss / Gain	+12.3	-10.35 +7.88	-9.83
Total Area	+12.3	-33.97	-13.5*

Source: For full details on direct and indirect losses see *Chapter 2 Project Description and Chapter 8 Compensation Measures*
*The 13.5 ha of sub-tidal losses are losses to the 'estuary' feature. These can be offset with any other estuary feature; therefore the saltmarsh gains of 10.3 ha can be subtracted from the indirect sub-tidal losses. Due to the uncertainty of the indirect changes, they are not offset against any direct losses.

Table 5.6 ***Direct and Indirect Effects (ha) on Estuary Habitat of the Humber Estuary SPA due to AMEP***

	Saltmarsh	Intertidal Mudflat	Sub-tidal (estuary)
Direct Loss	0	-31.5	-13.5
Indirect Loss / Gain	+12.3	-10.35 +7.88	-9.83
Temporary functional loss	N/A	-6	N/A
Total Area	+12.3	-39.97	-13.5*

*Refer to Table 5.5.

5.4.15 These habitats support a range of important bird species and populations. The implications of disturbance / displacement of AMEP on these species, and resulting habitat 'losses' for foraging / roosting are discussed in the following sections.

5.4.16 The dredged material taken from the site will be disposed of at licensed disposal site in the Humber Estuary. The use of this site and the capacity of material that it can accept have already been subject to relevant assessments, including on the European nature conservation designations of the Humber Estuary.

Bird Species

5.4.17 The main areas where effects are likely to occur on birds from the European sites are the intertidal mudflats on Killingholme Marshes foreshore, NKHP, and the Killingholme Fields which lie inland from the mudflats and which are used largely by foraging curlew. All of these areas support important numbers of bird species which meet specific individual designation criteria for the European sites, as well as the overall assemblage.

5.4.18 A likely significant effect has been concluded on the species listed in *Table 5.7* as they occur on the foreshore in numbers ≥1% of the Humber Estuary population and numbers will be displaced by AMEP.

Table 5.7 Bird Species on Killingholme Marshes Foreshore - Likely Significant Effect from AMEP

Species	Percentage of Population (to nearest 1%)
Shelduck	2
Avocet (breeding)	3
Ringed plover	10
Lapwing	2
Dunlin	5
Black-tailed godwit	66
Bar-tailed godwit	2
Curlew	2
Redshank	10

Several of these species also occur in numbers ≥1% of the Humber Estuary population in NKHP (black-tailed godwit (86 – 98% (1)), dunlin (1 – 2%), lapwing (2%) and redshank (4-5%)) along with other species listed in *Table 5.8*. There will be no direct or indirect habitat loss at NKHP and no significant effects due to other sources which can often create disturbance (eg general construction activity, lighting) as described in *Annex E*. However the implications on birds (including at NKHP) from noise arising from piling activities for the new quay located on the Killingholme Marshes foreshore needed to be assessed, and are evaluated in *Section 6.4* of *Chapter 6 Shadow Appropriate*

(1) The percentage ranges reflect the use of different numbers recorded by the WeBS counts a and TTTC, and are rounded up to the nearest 1%.

Assessment. Hence it was not possible to conclude no likely significant effect on these species at this stage.

Table 5.8 ***Bird Species Present in Numbers ≥1% in NKHP and May be Affected by Piling Noise***

Species	*Percentage of Population Present (to nearest 1%)*	*Reason for No Likely Significant Effect Conclusion*
Teal	2	No direct or indirect loss of habitat from AMEP, and no significant disturbance from visual or general noise sources during construction or operation as described in *Annex E*. Lights levels (in terms of lux levels) that will be experienced at NKHP with AMEP will also not exceed current levels (see *Section 11.6* in *Chapter 11 Terrestrial Ecology* and *Chapter 19 Landscape and Visual Impact* of the ES). Hence the effects on birds will be no greater than those which exist.
Mallard	3	
Shoveler	42	
Smew	50	
Grey heron	4	
Little egret	3	
Water rail	28	
Moorhen	3	
Avocet	6	
Little ringed plover	34	
Snipe	6	
Common sandpiper	2	

5.4.19 One of the qualifying criteria for both the SPA and Ramsar designations is the waterfowl assemblage. The AMEP scheme will displace up to 2.7% of the overall wetland assemblage. A likely significant effect is therefore concluded and the effects on the assemblage have been assessed further (see *Section 6.3 European Site Bird Interest Features* in *Chapter 6 Shadow Appropriate Assessment*).

5.4.20 *Table 5.9* describes species that occur at Killingholme Marshes foreshore in numbers ≥1% of the European site population, but for which there are other reasons why no likely significant effect has been concluded (*eg* not reliant on intertidal mudflats, or only one or two birds recorded and there is a reasonable expectation that these birds can be accommodated elsewhere in the Humber Estuary). *Table 5.10* lists all species that are part of the European site population assemblage but were not recorded either on the Killingholme Marshes foreshore or on NKHP in numbers <1% of the Humber Estuary population, and hence it has been concluded that their populations will not be significantly affected by the AMEP scheme.

Table 5.9 ***Bird Species Present in Numbers ≥1% at Killingholme Marshes Foreshore but for which No Likely Significant Effect has been Concluded***

Species	*Percentage of Population Affected at Killingholme Marshes Foreshore (to nearest 1%)*	*Reasons for Concluding No Likely Significant Effect at Killingholme Marshes Foreshore*	*Significant numbers (≥1%) also recorded at NKHP (✓/ ✗)*
Mute swan	1	Low numbers and species not reliant on area lost.	✗
Shoveler	9	Numbers recorded largely passage birds (not reliant on intertidal mudflats) therefore unlikely that area lost is critical to the maintenance of the Humber population.	✓
Gadwall	2	Not reliant on area lost as predominantly a freshwater species.	✗
Smew	50	Only one bird and Humber estuary not an important wintering area for this species.	✓
Little grebe	2	Not reliant on area lost as species prefers ponds or lakes.	✗
Grey heron	2	Only one bird, area lost will not have a negative impact on the persistence of this species.	✓
Moorhen	3	Not reliant on area lost as a feeding resource, population size will not be compromised.	✓
Coot	3	Not reliant on area lost as a feeding resource, population size will not be compromised.	✗
Ruff	2	Only one bird recorded and population size will not be affected by area lost.	✗
Whimbrel	3	Not reliant on area lost, displacement of passage birds not predicted to affect population size.	✗

Species	*Percentage of Population Affected at Killingholme Marshes Foreshore (to nearest 1%)*	*Reasons for Concluding No Likely Significant Effect at Killingholme Marshes Foreshore*	*Significant numbers (≥1%) also recorded at NKHP (✓/ ✗)*
Common gull	4	Not reliant on area lost and disturbance unlikely to have a significant effect on Humber population.	✗
Black-headed gull	3	Not reliant on area lost as a feeding resource. Displacement of loafing birds from mudflats during post breeding period not predicted to have any significant effect on Humber population.	✗
Great-black backed gull	18	Not reliant on area lost as a feeding resource. Displacement of loafing birds from mudflats during post breeding period not predicted to have any significant effect on Humber population.	✗
Mediterranean gull	100	Rare species in the Humber estuary. Unlikely to be reliant on area lost.	✗
Herring gull	6	Not reliant on area lost. Effects on Humber population not predicted.	✗
Lesser black-backed gull	7	Not reliant on area lost. Effects on Humber population not predicted.	✗
Common sandpiper	7	Not reliant on area lost effects on Humber population not predicted.	✓
Marsh harrier	10	Not reliant on area lost and no predicted disturbance of breeding birds at KP.	✗
Yellow-legged gull	25	Rare passage/winter visitor. No impacts on population predicted.	✗

Table 5.10 ***Other Assemblage Bird Species of European Sites for which No Likely Significant Effectfrom AMEP has been Concluded as Occur in Numbers <1% Humber Estuary Population (based on WeBS and / or TTTC Data – ✓= species present / x = species absent)***

Species	*Recorded at Killingholme Marshes Foreshore*	*Recorded at NKHP*
Dark-bellied brent goose	✘	✘
Canada goose	✓	✓
Tufted duck	✓	✓
Wigeon	✓	✘
Pochard	✓	✘
Scaup	✘	✘
Goldeneye	✘	✘
Pintail	✘	✘
Garganey	✘	✘
Ruddy duck	✘	✘
Great crested grebe	✘	✘
Cormorant	✓	✓
Bittern	✘	✘
Golden plover	✓	✓
Grey plover	✓	✓
Oystercatcher	✓	✓
Knot	✓	✓
Turnstone	✓	✘
Sanderling	✘	✘
Greenshank	✘	✘
Little tern	✘	✘
Hen harrier	✘	✘
Jack snipe	✘	✓
Kingfisher	✘	✓
Arctic tern	✘	✘
Bar-headed goose	✘	✘
Barnacle goose	✘	✘
Bewick's swan	✘	✘
Black-throated diver	✘	✘
Common scoter	✘	✘
Common tern	✘	✘
Curlew sandpiper	✘	✘
Egyptian goose	✘	✘
Eider	✘	✘
European white-fronted goose	✘	✘
Goosander	✘	✘
Green sandpiper	✘	✘
Greylag goose	✓	✓
Kittiwake	✘	✘
Light bellied brent goose	✘	✘
Little stint	✘	✘
Long-tailed duck	✘	✘
Pink-footed goose	✘	✘
Red-breasted goose	✘	✘
Red-throated diver	✘	✘
Roseate tern	✘	✘
Ruddy shelduck	✘	✘
Shag	✘	✘
Spoonbill	✘	✘
Spotted redshank	✘	✘
Whooper swan	✘	✘
Wood sandpiper	✘	✘

Species	*Recorded at Killingholme Marshes Foreshore*	*Recorded at NKHP*
Woodcock	✘	✘

5.4.21 There will be a permanent loss of inland terrestrial habitat used by qualifying interest bird species from the European sites at high tide, predominantly curlew. Two of the main onshore areas used by curlew at Killingholme Fields lie within the AMEP site and will be lost, these are fields J (also referred to in the surveys as Field 240) and K (also referred to as Field 235) (see *Figure 5.13)*. It is not possible at this stage to conclude no likely significant effect. The AMEP project does include areas of land (47.8 ha) which will provide mitigation for the loss of this inland habitat for bird species in accordance with the strategic approach to mitigation at South Humber Bank [1]. This is discussed further in see *Section 6.3* in *Chapter 6 Shadow Appropriate Assessment, Section 1.7 Mitigation* in *Chapter 11 Terrestrial Ecology and Birds in the ES,* and the *Landscape and Ecology Masterplan*, *Annex 4.5* of the ES).

5.4.22 There are a number of other developments in parts of the Humber Estuary around AMEP, however, the risk of in-combination effects of AMEP with these other is considered unlikely. Development affecting qualifying interest species of the Humber Estuary SPA / Ramsar site is well controlled and each development is only likely to be approved either if it can demonstrate no likely significant effect / no adverse effect on the integrity of the European sites (taking account of the mitigation that will be provided) or that suitable compensation will be in place to maintain the coherence of the Natura 2000 network in light of the adverse effects. However, further consideration of likely in-combination effects is given in *Section 6.7 In-combination Effects* of *Chapter 6 Shadow Appropriate Assessment*.

Other Fauna Species

5.4.23 The designations of the European sites include four other fauna species:

- grey seals;
- river lamprey;
- brook lamprey; and
- natterjack toad.

(1) The South Humber Gateway Conservation Mitigation Strategy is being developed by a group comprising Natural England, North Lincolnshire Council, North East Lincolnshire Council, the Royal Society for the Protection of Birds, Yorkshire Forward, Lincolnshire Wildlife Trust and Humberside Industry Nature Conservation Association. It will provide a strategic approach to mitigation for impacts of development on birds which use the estuary thereby allowing the requirements of the Habitats Regulations to be met, and reduce the risk of one development creating problems for another.

5.4.24 The following paragraphs summarise the issues relating to each of these species. Further information including about the existing occurrence and distribution the grey seal and lamprey species in the Humber Estuary and effects of AMEP on them are provided in *Chapter 10 Aquatic Ecology*. The predicted effects of the change in the thermal plume in the vicinity of the outfall from the power station are insignificant. The thermal plume rapidly cools away from the outfall to less than 1°C above ambient which is an order of magnitude less than the natural seasonal variation and hence no likely significant effects on marine habitats and fauna from this change are predicted, and it is not considered further.

5.4.25 Grey seals breed at Donna Nook, which is approximately 30 km from the AMEP at the mouth of the Humber Estuary, and are considered occasional visitors of the middle estuary. Whilst there will be no effects on the breeding areas of the seals given the distance of Donna Nook from AMEP, the seals are considered to be sensitive to noise and vibration and hence could be affected by construction activities associated with the construction of the new quay.

5.4.26 Grey seals at Donna Nook will not be affected by behavioural or auditory damage. They communicate acoustically in air and water and have significantly different hearing capabilities in the two media (Southall et al, 2007(1)). Given the distance from the piling location to the seal colony at Donna Nook (approximately 30 km) together with intervening undulating coastline noise levels are unlikely to affect hauled out seals. Monitoring of seal disturbance at the haul-outs at Seals Sand in the Tees in 2008 has not shown an impact of nearby piling and dredging activities carried out at Graythorp Dock (INCA, 2008 (2)). Therefore, seals whilst in air are not considered to be affected and are not considered further.

5.4.27 The seals are not likely to change behaviour, and are unlikely to be discouraged from using the estuary entrance based on the underwater noise levels that have been predicted. They would only suffer potential auditory damage if they regularly approach within approximately 6.8 - 10.6 km of the piling (at a scenario of 20 000 to 40 000 pile strikes per day respectively). So while some seals may venture into the estuary, most will prefer to hunt for food at sea or the outer estuary and so not regularly approach the AMEP site within 6.8 - 10.6 km. No likely significant effects are therefore predicted to grey seals.

(1) Southall, B.L, et al. (2007). Marine mammal noise exposure criteria: Initial scientific recommendations. Aquatic Mammals 33(4): 411-521.
(2) INCA (2008). Tees Seals Research Programme Monitoring Report No.20 (1989 – 2008). Compiled by Robert Woods.

5.4.28 Lampreys are migratory fish species which use the Humber Estuary as a migratory pathway between their marine environment and the spawning grounds in the rivers. Adult and juvenile sea lampreys are present year round and they spawn between June and August. The river lamprey is present from August to November (spawning run) and their juveniles spend four to six years buried in estuarine substrate. Smelt concentrate in winter at estuaries and enter the estuary between February and April for their spawning run.

5.4.29 The effects of construction activities involved in the creation of new structures in the marine environment for AMEP are predicted to be only temporary and localised (see *Paragraph 10.1.31* in *Chapter 10 Aquatic Ecology*). Lampreys are poor swimmers and hence tend to move in shallow waters along the edge of the main watercourses. However the new quay structure is not predicted to result in a permanent barrier to the movement of lampreys upstream as they will be able to move alongside the new structure and through other shallow margins of the estuary (see *Paragraph 10.1.30* in *Chapter 10 Aquatic Ecology*).

5.4.30 There is, however, little information available about the sensitivity of lamprey to the effects of underwater noise, including from piling activities which will be required to create the new quay. It is possible that underwater noise could create a barrier to lamprey movement. The AMEP also implies a small loss of subtidal habitat that is possibly used by lamprey. Hence it was not possible to conclude no likely significant effect on lamprey and further assessment and further assessment work has been undertaken (see *Section 6.5 Effects of Piling Noise on Lamprey* in *Chapter 6 Shadow Appropriate Assessment*)

5.4.31 Natterjack toads are only recorded from the Saltfleetby – Theddlethorp Dunes SSSI which lies in the outer estuary over 30 km south of AMEP. The construction, operation and maintenance activities associated with the AMEP scheme will not affect either the dunes that support the toads, or the toads themselves. Hence no likely significant effect has been concluded.

5.5 SCOPE OF THE SHADOW AA

5.5.1 The screening assessment has shown that an AA is needed to assess the effects of the AMEP scheme on the integrity of the European sites. The following paragraphs summarise the issues that will need to be considered further in the Shadow AA to determine whether the integrities of the European sites are affected.

5.5.2 AMEP is considered to have a likely significant and negative effect on two *Annex I* habitats: estuaries and mudflats and sandflats not covered by seawater at low tide. These effects arise from the permanent loss of habitat due to the construction of the quay and indirect effects which result in changes in the habitat types surrounding the quay, predominantly arising from the presence of the quay. The effects on these habitats from AMEP have been assessed in more detail to determine whether there is an adverse effect (see *Section 6.5 Habitat Features* in *Chapter 6 Shadow Appropriate Assessment*).

5.5.3 Whilst AMEP on the southern banks of the Humber Estuary does not result in the loss of any saltmarsh, one of the indirect effects is predicted to be the generation of new areas of saltmarsh around the quay. This comprises a likely significant and positive effect on the European sites.

5.5.4 AMEP is predicted to have a likely significant and negative effect on the following bird species that use the intertidal mudflats at Killingholme Marshes foreshore:

- shelduck;
- lapwing;
- dunlin;
- black-tailed godwit;
- bar-tailed godwit;
- ringed plover;
- redshank; and
- curlew.

5.5.5 AMEP is also predicted to have a likely significant and negative effect on the bird assemblages of the European sites.

5.5.6 It is possible that the following bird species at NKHP could be affected as a result of noise from piling activities to create the new quay:

- avocet;
- black-tailed godwit;
- common sandpiper;
- dunlin;
- lapwing;
- little ringed plover;
- mallard;
- moorhen;
- redshank;
- smew;

- snipe;
- teal; and
- water rail.

5.5.7 The shadow AA has therefore assessed the effects of the habitat losses on these bird species in more detail, any functional losses that may occur through the loss of habitat due to disturbance effects during construction, and whether any adverse effects result to roosting populations (eg at NKHP) from effects on feeding populations (*eg* at Killingholme Marshes foreshore). The effects of piling noise on birds using the intertidal mudflats on Killingholme Marshes foreshore, NKHP and at Killingholme Fields have also been assessed.

5.5.8 The effects of AMEP on qualifying interest bird species, notably curlew, using inland fields at South Killingholme have been assessed as part of the shadow AA to inform the mitigation requirements.

5.5.9 Noise generated by piling during the construction of the new quay may also affect lamprey species, causing a barrier to their migratory movements and the shadow AA has assessed this further along with the effects on habitat loss from the footprint of the new quay.

5.5.10 The shadow AA has considered any in-combination effects of AMEP with other developments and whether adverse effects result.

5.5.11 No likely significant effects are predicted for any of the other habitat features of the European sites, or for grey seals and natterjack toad, as described above and in *Annex D - Screening Assessment – Humber Estuary Habitats and Non Bird Species*.

6 *SHADOW APPROPRIATE ASSESSMENT (AA)*

6.1 *INTRODUCTION*

6.1.1 The findings of the Screening Assessment reported in *Chapter 5* (*European Sites and Likely Significant Effects*) showed that an Appropriate Assessment (AA) was required for the Humber Estuary European sites (*ie* the Humber Estuary SAC, SPA and Ramsar site).

6.1.2 This chapter assesses the impacts of AMEP on these qualifying interest features (habitats in *Section 6.2* and fauna species in *Section 6.3*) based on the scope set out in *Section 5.5* in *Chapter 5* (*European Sites and Likely Significant Effects*), and presents the findings of a shadow AA. In accordance with the guidance on HRA (IPC, 2011[1]) it is intended to inform the Competent Authority, who will undertake the AA. Its aim is to identify whether no adverse effect on the integrity of the European sites can be concluded as described in *Chapter 2* (see *Section 2.5*) or whether adverse effects on the integrity of the European sites will result. Further consideration to in-combination effects of other developments with AMEP has been given in *Section 6.7* (*In-combination Effects*).

6.2 *HABITAT FEATURES*

6.2.1 The following sections assess the effects on the integrity of the Humber Estuary SAC taking account of the effects of AMEP on the following qualifying interest habitats in the SAC:

- mudflats and sandflats not covered by seawater at low tide;
- estuary (including sub-tidal); and
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*).

The proposed new quay will result in the overall loss of 31.5 ha of intertidal mudflat (0.33% of this habitat type within the European site) and 13.5 ha of estuarine (sub-tidal) habitat (0.08% of the 16,800 sub-tidal resource [2])). It will not be possible to mitigate for these losses within the designated area.

(1) Infrastructure Planning Commission (2011) *Habitat Regulations Assessment. Advice Note Ten: Habitat Regulations Assessment Relevant to Nationally Significant Infrastructure Projects*. IPC.
(2) Information on sub-tidal area provided by Natural England.

6.2.2 Whilst this loss comprises only a small percentage in the context of the European site, any reduction in the extent, or changes in the distribution or spatial pattern of estuarine habitats, which do not result from natural change, are regarded as leaving the European site in an unfavourable status(1). NE has advised that such an outcome will have a negative and adverse effect on the conservation status of the European site. Compensation measures for the loss of these areas, which include the creation of new intertidal and estuarine habitat) have been agreed with NE and the details are provided in *Section 9.2* (*Compensation Requirements*) in *Chapter 9 Compensation Measures*.

6.2.3 The AMEP scheme will result in the creation of approximately 12 ha of saltmarsh on intertidal areas around the new quay, in areas that are currently either intertidal habitat (approximately 10 ha), or sub-tidal (approximately 2 ha). There are concerns within the UK regarding estuarine habitats primarily due to the likely effects of sea level rise and coastal squeeze. It is estimated that the UK will lose approximately 100 ha per annum of saltmarsh(2). The saltmarsh communities on the Humber Estuary are known to be at risk, predominantly from coastal squeeze (which may lead to the loss of upper and mid saltmarsh), and to a lesser extent smothering due to the dumping of dredged spoil from land drainage outfalls(3). Hence the creation of saltmarsh which is an important estuarine habitat type on the Humber Estuary is a significant and positive effect for the European site.

6.3 EUROPEAN SITE BIRD INTEREST FEATURES

Introduction

6.3.1 The AMEP proposals will affect the qualifying interest bird species from the European sites. The effects on birds using estuarine habitats will result from direct and indirect habitat loss and disturbance during construction and operation of AMEP. Specific consideration has been given to the effects on wetland birds of the piling works during the construction of the new quay. Some bird species from the European sites forage on the inland agricultural fields (predominantly grassland) at high tide when the intertidal mudflats are not exposed, and others roost in the saline lagoons of NKHP. The following sections assess the effects of AMEP on the bird species which were included within the scope of the Shadow AA, based on the screening assessment (see *Section*

(1) Natural England (December 2009) *Humber Estuary SSSI - Conservation Objectives and Definitions of Favourable Condition for Designated Features of Interest*. NE, Peterborough.

(2) [redacted]

(3)Natural England (December 2009) *Humber Estuary SSSI - Conservation Objectives and Definitions of Favourable Condition for Designated Features of Interest*. NE, Peterborough.

5.5 Scope of Shadow AA in *Chapter 5 European Sites and Likely Significant Effects*).

6.3.2 In undertaking the Shadow AA, the effects of AMEP on these bird species have been assessed against the conservation objectives for the European sites (see *Table 6.1*).

Table 6.1 Conservation Objective (1)

Conservation Objective	*Detail*
Habitat Extent	No decrease in extent of listed habitats from established baselines, subject to natural change.
Population Size	Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation- whichever is highest.
Disturbance and Displacement	No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors.
Variety of Species	Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.

6.3.3 The relative importance of the sectors to bird species is discussed within the individual species assessments. However the TTTC found that Count Sector A in general supported fewer birds. This is thought to be due to several different factors as follows (*pers comm* IECS, 2011):

- these sectors are narrow and have a steep profile;
- the sediment composition which is a mixture of pebbles, sand and mud, compared with only sand and mud in the remaining sectors;
- the area is fringed by trees and shrubs along the eastern edge of North Killingholme Haven Pits providing greater cover for predators;
- a range of avian and mammalian predators have been observed in this area including marsh harrier, buzzard, sparrowhawk, corvids, fox and stoat; and
- disturbance from sources in adjacent industrial areas.

(1)Natural England (December 2009) *Humber Estuary SSSI - Conservation Objectives and Definitions of Favourable Condition for Designated Features of Interest.* NE, Peterborough.

Shelduck

6.3.4 The effects of AMEP on shelducks, focuses on the effects on birds using the intertidal mudflats at Killingholme Marshes, as NKHP is only used by small numbers of shelducks (see *Table 5.2* in *Chapter 5 European Sites and Likely Significant Effect* and *Table C1.12* in *Annex C Supporting Ornithological Information*).

6.3.5 The use of the intertidal mudflats at Killingholme Marshes by shelduck varies depending on the data source. The WeBS data suggest that the peak count of shelducks occurs over the spring/summer. The mean peak based on WeBS core count data is nine birds in May (0.2% of the Humber Estuary population of 5 314 birds), with a peak of 30 birds in June recorded by the WeBS low tide counts. In contrast the TTTC data over 2010/2011 show more extensive use of the mudflats throughout the year. The greatest numbers were recorded in the autumn and over the winter, with numbers regularly exceeding 1% of the Humber Estuary population (August /October 2010 and February / March 2011). A peak of 109 birds was recorded in February 2011 representing 2.1% of the Humber Estuary population (see *Table 6.2*).

Table 6.2 Killingholme Marshes Foreshore Counts - Shelduck

Shelduck	***TTTC***	***LW 03/04***	***WeBS (2004/05 – 2008/09)***
April	20	4	11
May	19	9	13
June	20	30	
July(1)	16		
July(2)	9		
August	68		1
August(2)	91		
September	19		1
October	64		
October (2)	66		
November	41		11
December	3		
January	31		10
January (2)	39		
February	50	2	2
February (2)	109		
March	106	1	5
March (2)	36		
April	48		
MAX	*109*	*30*	*13*
Month	*Feb*	*June*	*May*

6.3.6 Shelducks are specialist feeders, with non-breeding birds on estuaries concentrating on invertebrates, particularly *Hydrobia ulvae*, within muddy substrates. They were predominantly recorded in survey Count Sectors C, D and E which contain the largest extent of mudflats (see *Annex C Supporting Ornithological Information*). All of Count Sector C and the majority of Count Sector D will be lost to accommodate the footprint of the new quay.

6.3.7 A review of what little existing literature has been published on the effects of construction on wetland birds (most is on the effects of recreational distrubance) suggests that distances over which effects could occur varies with species (see below). However, even the lower distances indicate that disturbance effects from construction will extend into part of Count Sector E affecting the wetland bird species using that Count Sector.

6.3.8 Disturbance distances have been reviewed based on information provided in reports by Goss-Custard (2007 [(1)]), Cutts *et al* (2008 [(2)]) and other sources including ERM's own experience on monitoring the disturbance effects on birds from construction piling across the foreshore near South Humber Bank (which affected birds within approximately 200 m), and compared with the distances between the AMEP construction site and Count Sector E. Whilst the literature often gives varying distances at which birds are disturbed, they all generally agree that disturbance from recreational activities usually has the greatest effect (*eg* approximately 160 m for dunlin and approximately 340 m for curlew when disturbed by walkers on tidal flats (Goss-Custard (2007) and Smit & Visser (1993) [(3)]). Disturbance distances from construction tend to be less (*eg* between approximately 120 m for dunlin/ringed plover and 275 m for curlew assuming unhabituated birds (Cutts *et al* (2008)), possibly due to habituation. It is possible that overwintering birds may show some degree of habituation to the works over that period, although this is less likely for passage birds such as ringed plover. This has not been allowed for here and may result in some further reductions in the numbers of birds affected.

6.3.9 It is possible that shelduck may in fact be less affected than described above, particularly overwintering birds which are considered to be moderate to low as they are known to exhibit a degree of habituation

[(1)]Goss-Custard J D (2007) *National Cycle Network - Exe Estuary Proposals - Assessment of the Anticipated Effects on the Exe Estuary Special Protection Area.* Report to Devon County Council.

[(2)]Cutts N, Phelps A & Burdon D (2008) *Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance.* Report for HINCA. IECS

[(3)]Smit,CJ & Visser,GJM (1993) Effects of disturbance on shorebirds: A summary of existing knowledge from the Dutch Wadden Sea and Delta area *Wader Study Group Bull* **68**: 6-19.

(Cutts *et al*, 2008[1]), although unhabituated shelducks are known to exhibit greater alert distances to people of approximately 200 m. For the purposes of this assessment a precautionary approach has been taken and applied to all species considered in this chapter (*ie* using the greatest disturbance distance, which in the above review was for curlew), hence the extent of disturbance effects within Count Sector E has been predicted for all species based on this disturbance distance. It is likely that some species could be affected within an area approaching two thirds of Count Sector E.

6.3.10 AMEP will therefore result in a loss of the extent of habitat for shelduck displacing numbers that are regularly in excess of 1% of the Humber Estuary population.

6.3.11 The Humber Estuary population is regarded as relatively stable over the past 15 years with perhaps a slight increase (Austin *et al*, 2008[2]). The population has seen redistribution from the middle and outer parts of the south shore, to the inner and north shore, however the reasons for this are uncertain. This slightly expanding population of shelduck has coincided with some birds using areas of intertidal mudflats along the northern and inner parts of the estuary previously unused by this species. This suggests that the Humber Estuary may have some additional capacity for this species although the extent of that capacity also remains uncertain.

6.3.12 The breeding population of shelduck has been expanding inland, where it is assumed that they are feeding on molluscs which are readily available in eutrophic inland waters[3]. However, they are less likely to be able to compensate for loss of intertidal feeding in the non-breeding season by foraging in other habitats including inland fields.

6.3.13 So it remains uncertain whether any displaced birds can be accommodated elsewhere in the Humber Estuary, and hence for the purposes of this assessment it has been assumed that there would be a reduction in the Humber Estuary population.

6.3.14 The reduction in the extent of habitat contravenes the conservation objectives which require no decrease in the extent of listed habitats and that the ability of the estuary to support its bird populations must be maintained. The loss of between 1 and 2% of the Humber Estuary

(1) Cutts N, Phelps A & Burdon D (2008) *Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance. Report to Humber INCA*. Institute of Estuarine and Coastal Studies (IECS).
(2) Austin G E, Calbrade N A, Rehfisch M R & Wright L J (2008) Humber Estuary SPA Waterbird Populations: Trend Analyses by Count Sector. *BTO Research Report* No.**497.** British Trust for Ornithology.
(3) Linton E & Fox A D (1991). Inland Breeding of Shelduck *Tadorna tadorna* in Britain *Bird Study* **38**, pp123-127

population also contravenes the conservation objective that requires the population to be maintained within acceptable limits. As it is not possible to mitigate for these effects within the European sites adverse effect on the Humber Estuary SPA/Ramsar sites are predicted.

Ringed Plover

6.3.15 AMEP will result in the loss of intertidal mudflats on the Killingholme Marshes foreshore which support important numbers of foraging ringed plover. The WeBS core counts around high tide recorded very few ringed plover, probably reflecting their preference for the mudflats at lower tidal stages. The TTTC recorded up to 210 birds (approximately 10% of the Humber Estuary population) (see *Table 6.3*).

Table 6.3 Killingholme Marshes Foreshore Counts – Ringed Plover

Lapwing	*TTTC*	*LW 03/04*	*WeBS (2004/05 – 2008/09)*
April	10		
May	11		
June	12		
July(1)	1	1	
July(2)	5		
August	20		
August(2)	210		
September	152	5	
October	15		
October (2)	5		
November	0		
December	0		
January	0		
January (2)	0		
February	0		
February (2)	2		
March	1		2
March (2)	3		
April	5		
MAX	*210*	*5*	*2*
Month	*Aug*	*Sept*	*Mar*

6.3.16 Available data show ringed plover are present in important numbers on the intertidal mudflats on Killingholme Marshes foreshore only during the autumn passage period. This is typical of ringed plover as virtually all the peak numbers at all the principal sites for this species in the UK relate to the passage periods (Holt *et al*, 2011[(1)]). This species

(1)Holt C A, Austin G E, Calbrade N A, Mellan H J, Mitchell C, Stroud D A, Wotton S R & Musgrove A J (2011) *Waterbirds in the UK 2009/10: The Wetland Bird Survey.* BTO/RSPB/JNCC in association with WWT. Thetford.

particularly favours Count Sectors D and E (see *Annex C Supporting Ornithological Information*). The majority of Count Sector D will be lost for the new quay and a significant proportion of Count Sector E affected by disturbance as described above. Further analysis into the effects of piling noise from construction suggests that numbers in excess of 1% of the Humber Estuary population may still be present on the area of mudflats in Count Sector E which are predicted to remain undisturbed (see *Figure C1.26* in *Annex F*). Even allowing for this it is clear that important numbers of ringed plover (*ie* 8-9 of the Humber Estuary population) will be lost as a result of AMEP.

6.3.17 The populations of ringed plover have been in a steady decline in Britain for over twenty years (Holt *et al*, 2011[(1)]). This decline coincides with an increase in the Netherlands, suggesting a shift in its core wintering range, and a steady decline in UK breeding population.

6.3.18 The loss of a significant proportion of the Humber Estuary population from a population which is in steady decline will result in an adverse impact on the European sites which cannot be mitigated.

Lapwing

6.3.19 The Humber Estuary is of national importance for lapwing with a five year mean peak population for the Humber Estuary of 18 756. Lapwings are part of the assemblage qualifying feature of the European site.

6.3.20 The records from the various surveys show that the open intertidal habitats at Killingholme Marshes foreshore are used by lapwings for roosting (during the winter months) with the greatest numbers from the low tide counts (2003/04) and the TTTC of 2010/11 (see *Table 6.3*). Numbers from the WeBS core counts around high tide are much lower reflecting that this species feeds primarily inland on terrestrial habitats at high tide.

6.3.21 Previous surveys have recorded the largest numbers of lapwing roosting on the mudflats at low tide to the north of North Killingholme Haven Pits near the Humber Sea Terminals site (Just Ecology Ltd, 2007[(2)]), although numbers on the Humber Estuary have declined since then (Calbrade *et al*, 2010[(3)]). The TTTC counts in 2010/2011 recorded lapwings on the Killingholme Marshes foreshore over the winter

(1)Holt C A, Austin G E, Calbrade N A, Mellan H J, Mitchell C, Stroud D A, Wotton S R & Musgrove A J (2011) *Waterbirds in the UK 2009/10: The Wetland Bird Survey.* BTO/RSPB/JNCC in association with WWT. Thetford.
(2) Just Ecology Ltd (2007) *Able Humber Ports Facility, Killingholme - Coastal Birds Survey - Main Report.* Just Ecology.
(3) Calbrade N, Holt C, Austin G, Mellan H, Hearn R, Stroud D, Wotton S & Musgrove A (2010) *Waterbirds in the UK 2008/09 The Wetland Bird Survey.* BTO/RSPB/JNCC/WWT.

months with a peak of 291 birds (1.6% of the Humber Estuary population). The birds were predominantly in Count Sector E, which is the furthest count sector from AMEP, and to a lesser extent Count Sector D. Although recorded across the tidal cycle, the greatest numbers were recorded roosting/loafing on the mudflats over and around low tide. The peak of 875 birds from the 2003/04 low tide counts represents approximately 4.7% of the Humber Estuary population.

Table 6.4 Killingholme Marshes Counts - Lapwing

Lapwing	*TTTC*	*LW 03/04*	*WeBS (2004/05 – 2008/09)*
April	0		3
May	0		2
June	0		
July(1)	3		
July(2)	0		
August	0		
August(2)	0		
September	0		
October	11		30
October (2)	1		
November	187		1
December	40	875	19
January	0	93	19
January (2)	291		
February	123	10	7
February (2)	45		
March	0	10	39
March (2)	0		
April	0		
MAX	*291*	*875*	*39*
Month	*Jan*	*Dec*	*Mar*

6.3.22 A trend analysis found no clear pattern other than one of fluctuation in terms of the general Humber population, but did note a shift from count sectors in the middle and outer parts of the southern shore of the estuary towards the northern shore (particularly Paull Holme Strays/ Cherry Cobb Sands) and inner estuary (Austin *et al* 2008[1]).

6.3.23 As the greatest numbers of lapwing on the intertidal mudflats at Killingholme Marshes foreshore recorded by the TTTC were found to be roosting around low tide and favoured Count Sector E, it is possible that many of these birds will remain on the area of mudflats within

Count Sector E that are predicted to remain undisturbed. However, given the higher numbers recorded by some of the WeBS counts, compared with the TTTC (for which there is no information available about distribution across the mudflats on the foreshore), the loss of important numbers of lapwings due to AMEP cannot be ruled out.

6.3.24 It is not possible to mitigate for this loss within the European site and hence a precautionary approach is to conclude that an adverse effect will result to the European sites based on effects on this species. Whilst mitigation is not possible the managed re-alignment project at Paull Holme Strays on the northern banks of the Humber Estuary has been particularly successful at providing intertidal roost sites for this species (Mander *et al*, 2007[(2)]).

Dunlin

6.3.25 AMEP will result in the loss of intertidal habitat used by dunlins. Dunlins occur on the intertidal mudflats at Killingholme Marshes foreshore throughout the passage and winter periods. The TTTC recorded a peak of 1 029 birds in November 2010 which comprises 4.8% of the Humber Estuary population of 21 518 dunlins, based on peak means of WeBS core count data between 2004/5 and 2008/9 [(3)]. Numbers of dunlin ≥1% of the Humber Estuary population were regularly recorded by the TTTC (see *Table 6.4*).

Table 6.5 Killingholme Marshes Counts - Dunlin

Dunlin	*TTTC*	*LW 03/04*	*WeBS (2004/05 – 2008/09)*
April	0		
May	0		
June	1		
July(1)	0	6	
July(2)	0		
August	6		3
August(2)	140		
September	156	110	
October	742	124	29
October (2)	452		
November	1029	3	76
December	645	149	276
January	571	223	48
January (2)	524		

(1)Austin G E, Calbrade N A, Rehfisch M R & Wright L J (2008) Humber Estuary SPA Waterbird Populations: Trend Analyses by Count Sector. *BTO Research Report* No.**497.** British Trust for Ornithology.
(2) Mander L, Cutts N D, Allen J & Mazik K (2007). Assessing the Development of Newly Created Habitat for Wintering Estuarine Birds. *Estuarine, Coastal and Shelf Science* **75**: 163-174.
(3) The five year peak mean for dunlin on the Humber Estuary has decreased slightly to 19,493 based on the very recently published WeBS data in 2011, and using this revised figure would increase the percentage of dunlin affected to 5.3%.

February	102	128	16
February (2)	404		63
March	431		5
March (2)	89		
April	*0*		
MAX	*1029*	*223*	*276*
Month	*Nov*	*Jan*	*Dec*

6.3.26 The surveys recorded dunlins predominantly in Count Sectors C, D and E, although birds were also recorded in Count Sectors A and B (see *Annex C Supporting Ornithological Information*). All of Count Sector C and the majority of Count Sectors B and D will be lost for the footprint of the new quay, and as described earlier birds in two thirds of Count Sector E and the remainder of B are likely to be affected by disturbance.

6.3.27 Even allowing for some birds to be retained in Count Sectors A (and part of E), it is clear that numbers well in excess of 1% of the Humber Estuary population will be lost. AMEP will therefore contravene the conservation objective to maintain the extent of habitat supporting this species.

6.3.28 Trend analysis also indicates a long term decline in dunlin numbers both in the UK and on the Humber Estuary (Austin *et al* 2008[(1)]). This is thought to be due to an increase in the numbers wintering in the Waddensee[(2)], possibly demonstrating a rapid response to the effects of climatic change. The loss of >1% of the birds from the population on the Humber Estuary which is already in decline, is predicted to have an adverse effect on that population. Such an effect would not be in accordance with the conservation objective to maintain the population within acceptable limits.

6.3.29 Overall AMEP is predicted to have an adverse effect on dunlin on the European sites due to a reduction in the extent of habitat, and through affecting the maintenance of the population. None of these effects can be mitigated for within the European site.

Black-tailed Godwit

6.3.30 AMEP will result in the loss of intertidal mudflat at Killingholme Marshes foreshore which is used by important numbers of foraging

(1)Austin G E, Calbrade N A, Rehfisch M R & Wright L J (2008) Humber Estuary SPA Waterbird Populations: Trend Analyses by Count Sector. *BTO Research Report* No.**497.** British Trust for Ornithology.

(2) Maclean I M D, Austin G E , Rehfisch M M , Blew J , Crowe O, Delany S, Devos K , Deceuninck B , Gunther K , Laursen K , van Roomen M & Wahl J (2008). Climate Change Causes Rapid Changes in the Distribution and Site Abundance of Birds in Winter. *Global Change Biology* **14**: 2489-2500

black-tailed godwits. The five year mean of peak counts from the WeBS counts show a mean peak of 50 birds (1.3% of the Humber Estuary population [(1)]), whilst the TTTC recorded up to 2 566 foraging birds (66% of the Humber estuary population) (see *Table 6.5*).

Table 6.6 ***Killingholme Marshes (KM) and North Killingholme Haven Pits (NKHP) Counts – Black-tailed Godwit***

	KM			*NKHP*		
Black-tailed Godwit	***TTTC***	***LW 03/04***	***WeBS (2004/05 – 2008/09)***	***TTTC***	***LW03/04***	***WeBS (2004/05 – 2008/09)***
April	250		8	500	4	86
May	64			64		42
June	1					
July(1)	88	506		270	215	
July(2)	100			250		
August	818	486	3	2200	705	3140
August(2)	983			3800		4150
September	57	961	1	86	927	
October	2566		145	800	651	3735
October (2)	1859			3500		
November	0		4			2710
December	0		15			11
January	66		21			1
January (2)	16					
February	96			1		390
February (2)	184					
March	205		11	18		222
March (2)	193			1		
April	121			136		
MAX	*2566*	*961*	*145*	*3800*	*927*	*4150*
Month	*Oct*	*Sept*	*Oct*	*Aug*	*Sept*	*Aug*

6.3.31 Black-tailed godwits use Killingholme Marshes foreshore on a seasonal basis, with birds arriving and undertaking their post breeding moult through the autumn, before then moving onto Pyewipe further south along the southern Humber coast and also to the Wash over the winter. There is evidence of spring passage at Killingholme Marshes foreshore although the numbers are much lower, but still over 5% of the Humber Estuary population. The birds favour Count Sectors C and D in autumn when peak numbers of foraging birds are present. However

(1) The most recent WeBS data shows an increase in the five year mean population of black-tailed godwit on the Humber Estuary to 4,180 (09/10) from 3,887 (080/09 data). Hence the 2,566 birds recorded represents 61.4% of the Humber Estuary population.

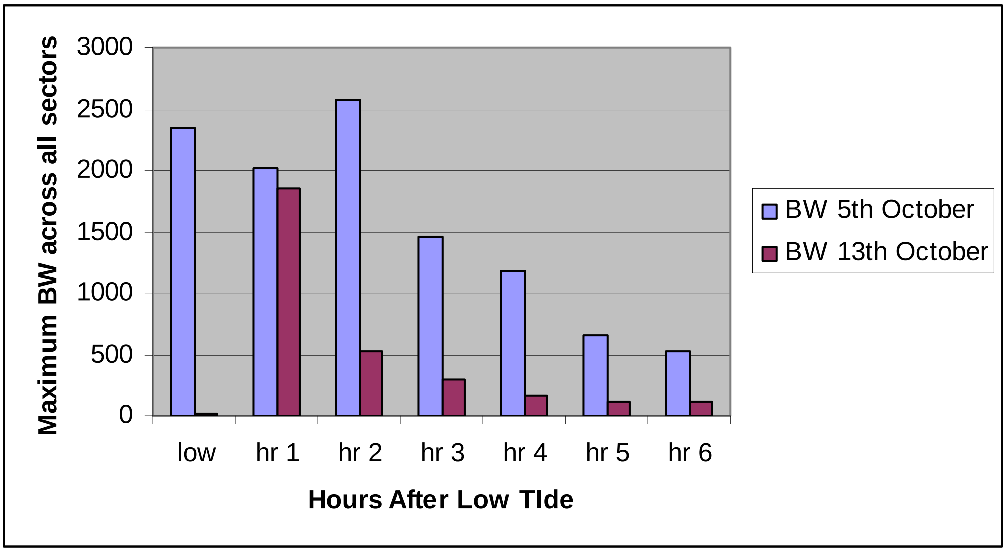
from late winter, the birds which remain on the Humber tend to favour Count Sector E (see *Annex C Supporting Ornithological Information*).

6.3.32 The change in sector use, and in area over the winter, suggest that the feeding resource has become depleted in the sectors favoured by the birds when they arrive at Killingholme Marshes, and wintering birds have moved to utilise an area with remaining food resource. Such a pattern is consistent with resource depletion models(1). Black-tailed godwit are highly efficient predators and it is likely that the removal of biomass by them beyond a certain point in certain areas makes the Killingholme Marshes foreshore suboptimal, and birds redistribute to other areas of mudflats both within the Humber Estuary and even to other estuaries. Feeding patterns are also known to change in winter in response to prey depletion, with a greater proportion of annelid's and other invertebrates consumed on mudflats and a shift towards supplementary feeding in flooded agricultural fields in areas where these fields occur inland(2).

6.3.33 In autumn black-tailed godwits tend to moult (Mander & Cutts, 2005(3)), so during a single tidal cycle the birds will only spend a minimal amount of time feeding on the mudflats on foreshore, and the majority of their time at NKHP either roosting or loafing. TTTC found peak foraging activity at Killingholme Marshes foreshore to be closer to low tide presumably to optimise feeding opportunities (see *Figure 6.1*).

(1) Gill J G, Sutherland W J & Norris K (2001). Depletion Models can Predict Shorebird Distribution at Different Special Scales. *Proc R Soc Lond B* **268**: 369-376.
(2) Ward S D & Bullock D J (1988). The Winter Feeding Ecology of the Black-tailed Godwit - a Preliminary Study. *Wader Study Group Bull* **53**:11-15.
(3)Mander L & Cutts N D(2005). Humber Estuary Wetland Bird Survey. Twelve Months of Low Tide Counts. September 2003 to August 2004. *English Nature Research Reports* No **656**. English Nature, Peterborough.

Figure 6.1 October Surveys showing Black-tailed Godwit Activity through the Tidal Cycle for all Sectors



Source: Data provided by IECS Spring Passage & Winter Bird Data. (BW is the British Trust for Ornithology, BTO for Black-tailed Godwit.)

6.3.34 Even larger numbers roost at NKHP, which is the preferred roost site for black-tailed godwit on the Humber Estuary. WeBS counts recorded a mean peak of 3 338 birds (approximately 86%) roosting at NKHP out of the Humber population estimated at 3 887 (from WeBS core count data). TTTC recorded 3,800 (approaching 98%). There is evidence of seasonal use also at NKHP, albeit to a lesser extent than Killingholme Marshes foreshore, and again with lower numbers in spring.

6.3.35 Whilst no significant effects are predicted on the birds roosting at North Killingholme Haven Pits, there is evidence that proximity between roost sites and feeding sites is important for black-tailed godwits. It may be that the managed realignment at Paull Holme Strays, and the roost it provides, lies behind the rapid increase in the number of birds foraging on Cherry Cobb Sands reported in the population trends analysis (Austin *et al* 2008[1]). Hence it is possible that effects from AMEP on feeding black-tailed godwits may in turn affect their preferred roost sites in the Humber Estuary.

6.3.36 It is evident from the surveys that a proportion of the birds using the Pits and the nearby mudflats at Killingholme Marshes foreshore are the same birds. However, the correlation between the numbers of black-tailed godwits at NKHP and Killingholme Marshes foreshore is poor. The TTTC and WeBS core count data for NKHP both indicate that peak

(1)Austin G E, Calbrade N A, Rehfisch M R & Wright L J (2008) Humber Estuary SPA Waterbird Populations: Trend Analyses by Count Sector. *BTO Research Report* No.**497.** British Trust for Ornithology.

roosting numbers occur in August, whilst at Killingholme Marshes foreshore the peak month is in October. The TTTC in particular often show large discrepancies between the numbers using NKHP and Killingholme Marshes foreshore, and usually recorded the highest count at the roost site at NKHP. This indicates that the birds roosting at NKHP are drawn from a wider area then simply the Killingholme Marshes foreshore site. This also mirrors the findings of flightline surveys which show movements across the Humber Estuary to and from NKHP (Catley, 2009).

6.3.37 It is clear from the above that the Killingholme Marshes foreshore is one of the most important areas for black-tailed godwits on the Humber Estuary, and the majority of this feeding area will be lost due to the AMEP proposals. There will, as a result, be significant displacement of birds with no certainty that the displaced birds can be accommodated elsewhere, and hence could be lost from the Humber Estuary population. The loss of mudflat and the black-tailed godwits it supports cannot be mitigated for within the European site.

6.3.38 The WeBS core counts show that the population of black-tailed godwits on the Humber Estuary has increased rapidly since the early to mid 1990s (Austin *et al*, 2008), although there was been a slight decline between 2006 and 2008. Despite the general upward population trend, the number of birds which are likely to be lost from NKHP is such that the Humber Estuary population would be significantly reduced.

6.3.39 It is clear from the above that in the absence of any suitable mitigation within the European sites the conservation objectives for black-tailed godwit on the European sites would be compromised. As a result the favourable conservation status of this species may not be maintained and an adverse effect on the integrity of the European sites will result.

Bar-tailed Godwit

6.3.40 Bar-tailed godwits were recorded at Killingholme Marshes foreshore by the TTTC in 2010/2011, with large numbers (123 ie 2.1%) in March 2011, indicating that Killingholme is an important area for this species during the late winter/spring passage. Other counts in July (passage) and December and January (winter) also approached the 1% level (see *Table 6.6*). Neither the low tide WeBS counts nor the WeBS core counts recorded godwits using Killingholme Marshes foreshore (see *Table 6.6*).

Table 6.7 Killingholme Marshes Counts - Bar-tailed Godwit

Bar-tailed Godwit	*TTTC*	*LW 03/04*	*WeBS (2004/05 – 2008/09)*
April	0	0	0
May	0	0	0
June	16	0	0
July(1)	26	0	0
July(2)	55	0	0
August	1	0	0
August(2)	0	0	0
September	1	0	0
October	23	0	0
October (2)	26	0	0
November	12	0	0
December	48	0	0
January	42	0	0
January (2)	27	0	0
February	7	0	0
February (2)	37	0	0
March	2	0	0
March (2)	123	0	0
April	0		
MAX	*123*	*0*	*0*
Month	*Mar*	*N/A*	*N/A*

6.3.41 At Killingholme Marshes foreshore the godwits were recorded predominantly in Count Sectors C, D and E, with little or no use of Count Sectors A and B (see *Annex C* Supporting Ornithological Information). When the birds were present in large numbers (eg 123 in March 2011) they were also recorded during the mid to high tide periods with the majority of the birds foraging. AMEP will result in the loss of foraging habitat within Count Sectors C and D which are two of the main sectors used by bar-tailed godwits at Killingholme Marshes foreshore, and effective loss of foraging area in approaching two thirds of Count Sector E due to the predicted effects of disturbance as described earlier.

6.3.42 The population trend has been one of peaks and troughs over the last 15 and this is reflected in the incomplete counts of this species on the Humber Estuary over the years (Holt et al, 2011[1]), where numbers have declined along the south shores of the estuary (main area used is the stretch of coastline between Cleethorpes-North Promenade to Anthony's Bank), and yet increased in the north with the main

(1)Holt C A, Austin G E, Calbrade N A, Mellan H J, Mitchell C, Stroud D A, Wotton S R & Musgrove A J (2011) *Waterbirds in the UK 2009/10: The Wetland Bird Survey.* BTO/RSPB/JNCC in association with WWT. Thetford.

population distributed between Paull and Spurn Head (Austin *et al*, 2008[1]). This contrasts with a steady increase in numbers in the Netherlands that suggests a shift in the core winter range eastwards in western Europe (Holt *et al*, 2011).

6.3.43 Despite the lack of records from the WeBS data it is clear that bar-tailed godwits do use the Killingholme Marshes foreshore, and in numbers which are important in the context of the European site. The majority of their favoured areas on the intertidal mudflats will also be lost or affected by disturbance, and this loss cannot be mitigated for within the European sites.

6.3.44 It is clear from the above that AMEP will affect bar-tailed godwit populations resulting in an adverse effect on the integrity of the European sites which cannot be mitigated within the designated areas.

Curlew

6.3.45 The Humber Estuary is the fifth most important UK wintering site for curlew, with a mean peak population of 4 440 [2], and curlew forms part of the qualifying bird assemblage of the European sites.

6.3.46 The loss of intertidal mudflat at Killingholme Marshes foreshore will remove an area that supports curlew throughout the year (with peaks during both autumn and spring passage and during winter), and regularly supports over 1% of the Humber Estuary population (see *Table 6.7*). The WeBS core counts recorded a mean peak of 61 birds (1.4%) and the TTTC recorded a peak of 158 curlews (3.6%).

6.3.47 The TTTC at Killingholme Marshes foreshore recorded birds present throughout the tidal cycle including birds feeding and roosting/loafing. The main Count Sector used by foraging curlew was Count Sector D, with lower numbers in Count Sectors C and E, and little use of B and A. Some birds also roost at Killingholme Marshes foreshore (peak of 92 birds which is approximately 2% of the Humber Estuary population).

(1)Austin G E, Calbrade N A, Rehfisch M R & Wright L J (2008) Humber Estuary SPA Waterbird Populations: Trend Analyses by Count Sector. *BTO Research Report* No.**497.** British Trust for Ornithology.
(2) The latest published WeBS data reports a five year peak mean of 4,239 which is similar to that quoted here which is based on the data published in 2010.

Table 6.8 Killingholme Marshes (KM) and Killingholme Fields (KF) Counts - Curlew

	KM			KF
Curlew	*TTTC*	*LW 03/04*	*WeBS (2004/05 – 2008/09)*	*TTTC*
April	26		51	
May	40	1	28	
June	15	34		
July(1)	126	13		
July(2)	109			1
August	141	6	43	
August(2)	126			8
September	92	10	15	54
October	60	6	45	7
October (2)	83			36
November	143	5	20	
December	31	1	92	31
January	58	77	36	
January (2)	122			72
February	74	30	6	12
February (2)	118			
March	121	24	14	
March (2)	158			
April	*72*			
MAX	*158*	*77*	*92*	*72*
Month	*Mar*	*Jan*	*Dec*	*Jan*

6.3.48 Supplementary feeding also occurs on inland fields at high tide with numbers ≥1% of the Humber Estuary population recorded (see *Section 5.3 Ornithological Interests on AMEP and Immediate Surrounds* in *Chapter 5*).

6.3.49 The curlew population at South Humber bank consists of two main flocks, one at East Halton (north of the AMEP site) and the other at Killingholme (Catley, 2007[(1)]). AMEP will result in the loss of two of the main permanent grassland fields used by the southern curlew flock at Killingholme Fields (see *Figures 5.14* and *5.15* in *Section 5.3)*.

6.3.50 To mitigate for the loss of these fields it has been agreed with NE that an area of land will be included within the AMEP development site (known as Area A) that will be managed to provide a safe and secure foraging area for wetland bird species and especially curlew. Mitigation Area A will be implemented in the southern part of the

(1)(1) Catley G P (2007) *Winter Bird Survey of East Halton and Killingholme Marshes and Inland Fields Encompassed by North Lincolnshire Council Boundary*. Nyctea Ltd.

AMEP scheme (see *Landscape and Ecology Masterplan*, *Annex 4.5* of the ES), and will comprise a 16.7 ha core area with a 150 m surrounding buffer (including an operational buffer of 50m on the northern side adjacent to the working area within the AMEP site). Full details on the transformation of the existing arable habitats to grassland (taking account of available guidance[(1)]), the design and location of wader scrapes of variable depths, and the short and long term management and maintenance of the habitats to benefit wetland bird species and a monitoring programme will be agreed with NE. This habitat will be created prior to any significant area of existing terrestrial habitat of roosting and foraging value being lost.

6.3.51 Curlew populations on the Humber have been increasing over the 15 year period 1991/92 to 2006/07, however, large declines were found over the same period at Killingholme Marshes (Austin *et al* 2008[(2)]). Curlew populations in the UK have been steadily declining since 2000 reportedly due to declines in the UK breeding population and a shift in the wintering distribution with increasing numbers in the Netherlands (Holt et al, 2011[(1)]).

6.3.52 Whilst the use of inland fields by curlew will be maintained through the mitigation that will be implemented, AMEP will result in the loss of the main areas used by curlew on the intertidal mudflats at Killingholme Marshes foreshore. The loss of over 3% of the Humber Estuary population from a species whose UK population appears to be declining, and which has already lost large numbers of birds from the Humber Estuary population at Killingholme will result in an adverse effect on the assemblage of the European sites for which mitigation cannot be provided within the designated areas.

Redshank

6.3.53 Redshank is a qualifying interest species of the European sites in its own right as well as part of the overall wetland bird assemblage. It uses both NKHP (as a roosting site) and Killingholme Marshes foreshore (predominantly as a feeding site). The mean peak numbers recorded at Killingholme Marshes from the WeBS data are well in excess of 1% of the Humber Estuary population of 5 445, and peaks from the TTTC (540 birds, see *Table 6.8*) suggest the numbers present on the Killingholme Marshes foreshore can reach approximately 10% of the Humber Estuary population.

(1) White, G. (2006) RSPB *Information and Advice note, Arable reversion to wet grassland*.
(2)Austin G E, Calbrade N A, Rehfisch M R & Wright L J (2008) Humber Estuary SPA Waterbird Populations: Trend Analyses by Count Sector. *BTO Research Report* No.**497.** British Trust for Ornithology.

6.3.54 Large numbers of redshank use the Killingholme Marshes foreshore over the passage and winter period. Redshank is usually an upper shore feeder, although at Killingholme Marshes foreshore they were recorded foraging predominantly on the exposed mudflats at low and mid tides. They were recorded throughout the count sectors, but favoured Count Sectors C and D, both of which will be lost to AMEP.

6.3.55 WeBS core data for Killingholme Marshes foreshore indicate peak numbers occur in winter, however, the TTTC counts indicate a peak during the autumn passage period, and particularly in August, with a maximum count of 540 (9.9%). TTTC recorded numbers of ≥ 1% of the Humber Estuary population persisting throughout the winter and into March (see *Table 6.8*).

Table 6.9 Killingholme Marshes Counts - Redshank

Redshank	*TTTC*	*LW 03/04*	*WeBS (2004/05 – 2008/09)*
April	55		38
May	0		
June	0	1	
July(1)	0	12	
July(2)	5		
August	183	30	13
August(2)	540		
September	119	100	66
October	226	28	52
October (2)	177		
November	206	13	82
December	67	69	127
January	154	51	76
January (2)	163		
February	157	59	76
February (2)	135		
March	94	24	86
March (2)	84		
April			
MAX	*540*	*100*	*127*
Month	*Aug*	*Sept*	*Dec*

6.3.56 On the Humber Estuary most feeding sites of redshank are in close proximity to high water roosting areas (Mander & Cutts 2005[(2)]). The

(1)Holt C A, Austin G E, Calbrade N A, Mellan H J, Mitchell C, Stroud D A, Wotton S R & Musgrove A J (2011) *Waterbirds in the UK 2009/10: The Wetland Bird Survey*. BTO/RSPB/JNCC in association with WWT. Thetford.
(2)Mander L & Cutts N D(2005). Humber Estuary Wetland Bird Survey. Twelve Months of Low Tide Counts. September 2003 to August 2004. *English Nature Research Reports* No **656**. English Nature, Peterborough.

roost at NKHP holds between 200 and 250 birds (see *Table 5.2* in *Chapter 5 European Sites and Likely Significant Effect*), and the similarity in the roost counts is expected given the WeBS counts are focused around high tide. It is possible that on high tides some of the Killingholme Marshes foreshore population may then move to roost at the pits, however, there are no data to confirm any linkage between the birds using the two areas.

6.3.57 The redshank population trend on the Humber Estuary shows a relatively stable population (Austin *et al* 2008(1)). However, like many bird species on the Humber there has been redistribution from the outer and mid south shore to the inner estuary. In comparison the redshank numbers on the outer northern shore have remained more static, with the highest numbers of redshank found along the shores between Paull and Spurn Head.

6.3.58 AMEP is likely to result in the loss of approaching 9% of the Humber Estuary population from the Killingholme Marshes foreshore. The conservation objective which requires the extent of habitat to be maintained will not be met and there will be disturbance to, and displacement of, redshank. It is not possible to mitigate for these effects within the European site and hence an adverse effect on the European site will result from the los of birds from the foreshore.

6.3.59 Noise levels from piling have been shown not to result in disturbance to birds in NKHP (see *Section 6.4 Piling Noise Effects on Birds*), and hence redshank roosting there will not be adversely affected as a result. However, if the use of NKHP by redshank is linked to their use of the Killingholme Marshes foreshore, and numbers at NKHP decline, then an adverse effect on NKHP will result.

SPA Assemblage

6.3.60 AMEP will result in the displacement of approximately 3 550 birds (approximately 2.5% of the Humber Estuary bird assemblage - the assemblage is determined as 140 197 individual birds based on a five year mean peak between 2004/5-2008/09) from the Killingholme Marshes, due to habitat loss and disturbance especially during construction. This figure was derived from the TTTC, and is substantially higher than the WeBS 5 year mean peak (314 birds equalling 0.2% of the Humber Population), although it should be noted that these latter counts are undertaken around high tide.

(1)Austin G E, Calbrade N A, Rehfisch M R & Wright L J (2008) Humber Estuary SPA Waterbird Populations: Trend Analyses by Count Sector. *BTO Research Report* No.**497.** British Trust for Ornithology.

6.3.61 The only additional losses to the above would be any from NKHP. There will be no habitat losses in NKHP, and no significant disturbance effects from constriction noise or other sources. Hence the only effects on NKHP are where bird species that forage on the foreshore and then use NKHP as a roost site (*eg* black-tailed godwit, and possibly redshank). Such losses have in any event been taken into account in the assessment of losses of birds from Killingholme Marshes foreshore described above.

6.3.62 It is clear from the species assessments above that with AMEP, the European sites will no longer retain the same extent of habitat to support the assemblage for which it was designated, and there will be displacement and disturbance to the assemblage species. This conflicts with conservation objective to maintain the assemblage population within acceptable limits and would result in an adverse effect on the European sites.

6.4 PILING NOISE EFFECTS ON BIRDS

6.4.1 The screening assessment highlighted the need to consider the effects of piling noise on birds on the intertidal mudflats of Killingholme Marshes foreshore, NKHP and the inland Killingholme Fields. This section presents a summary of the baseline noise survey findings, the predicted levels from piling at each of the above sites, and assesses the effects on wetland birds.

Noise Baseline

6.4.2 Baseline noise data at Killingholme were collected in December 2010 and data for the following locations are presented in *Tables 6.9 – 6.12:*

- on Station Road close to Killingholme Marshes foreshore (Location S1);
- on Station Road close on Killingholme fields (Location S2);
- on Killingholme fields (Location S3); and
- in North Killingholme Haven Pits (NKHP) (ECO_1).

6.4.3 Noise levels monitored at these locations are considered to be representative of the noise levels in the general area. Hence the survey data recorded at ECO_1 on the northern side of NKHP are representative of the existing noise levels across NKHP. Location S1 is located to the west of the flood defences, as it was not practical to undertake measurements actually on the mudflats. As the marine environment has a significant effect on the acoustic environment, it is possible that existing levels may actually be slightly higher on the foreshore, however, it is still considered that the existing noise levels recorded at S1 are representative of the foreshore area.

6.4.4 As this section focuses on the impacts of piling activity, which will occur between 6 am and 10pm, only daytime baseline data is reported. For further information on the baseline noise environment see *Chapter 16* including *Figure 16.1* and *Figure 16.2* for receptor locations and *Section 16.5* for further information on baseline data collection methods.

Table 6.9 Baseline Noise Sampling from Killingholme Marshes Foreshore (S1)

Date	Average Day Time LA90, dB (A)	Average Day Time LAeq dB (A)	Average Day Time LA10 dB (A)	Range LAmax dB (A)
09-12-10	45	52	50	54 – 83
10-12-10	46	51	51	54 – 87
11-12-10	40	47	47	45 – 78
12-12-10	35	45	45	44 – 75
13-12-10	43	51	50	53 – 82
14-12-10	29	39	36	33 – 70
Overall Level	**40**	**49**	**47**	

Table 6.10 Baseline Noise Sampling from Station Road close to Killingholme Fields (S2)

Date	Average Day Time LA90 (dB (A))	Average Day Time LAeq (dB (A))	Average Day Time LA10 (dB (A))	Range LAmax dB (A)
09-12-10	46	56	55	54 - 79
10-12-10	48	56	55	54 - 76
11-12-10	40	51	48	45 - 74
12-12-10	38	52	45	44 - 73
13-12-10	39	56	50	53 - 76
14-12-10	38	58	52	33 - 77
Overall Level	**42**	**55**	**51**	

Table 6.6 Baseline Noise Measurements for Killingholme Fields (S3)

Date	Average Day Time LA90 (dB (A))	Average Day Time LAeq (dB (A))	Average Day Time LA10 (dB (A))	Range LAmax dB (A)
06-01-11	47	55	55	54 - 72
07-01-11	55	59	62	61 - 74
08-01-11	54	59	60	60 - 69
09-01-11	47	53	55	55 - 65
10-01-11	52	59	62	58 - 71
11-01-11	56	59	61	60 - 73
Overall Level	**52**	**58**	**59**	

Table 6.12 Baseline Noise Measurements for North Killingholme Haven Pits (ECO_1)

Date	Average Day Time LA90 (dB (A))	Average Day Time LAeq (dB (A))	Average Day Time LA10 (dB (A))	Range LAmax dB (A)
09-12-10	45	53	54	53 – 75
10-12-10	43	52	53	50 – 68
11-12-10	45	51	52	49 – 64
12-12-10	42	51	54	45 – 64
13-12-10	42	53	55	48 – 67
14-12-10	42	55	56	45 – 70
Overall Level	**43**	**53**	**54**	

6.4.5 From recordings at all sites there appears to be a wide variation in noise levels throughout a 24 hour period. The main noise sources included the Humber Sea Terminal (HST) and the Immingham Dock which operates 24 hours a day and noise emissions from ship loading or offloading will depend on the state of the tide and is not necessarily in relation to daylight hours. The following section describes the baseline noise environment in important bird areas on and near the AMEP site.

6.4.6 Statistical analyses of the noise monitoring data reveals the following regarding the existing acoustic environment with respect to existing maximum (LAMax) noise levels (see also *Table 6.13*):

- The highest LAMax noise levels recorded during the daytime period were 87 dB(A) at S1 and 75 dB(A) at ECO_1;
- LAMax noise levels exceed 55 dB(A) 91% of the time at ECO_1 and 71% of the time at S1 (see *Table 6.13*); and

- The range of LAMax noise levels within one standard deviation of the statistical mean ranges up to 72 dB(A) at ECO_1 and up to 68 dB(A) at S1.

6.4.7 This shows that the existing acoustic environment at S1 is less noisy than at NKHP but LAMax levels are still above 55 dB (A) for almost three quarters of the time (see *Table 6.13*).

Table 6.13 Analysis of LAMax Noise Levels at NKHP and Killingholme Marshes Foreshore (December 2010)

Parameter	*ECO_1*	*S1*
Occurrence of LAMax noise levels > 55 dB(A)	91%	71%
Occurrence of LAMax noise levels ≥ 75 dB(A)	5%	2%
Statistical Mean LAMax	65 dB(A)	60 dB(A)
Standard Deviation (SD)	7	8
Mode (noise level which occurs the most frequently) dB(A)	68 (7%)	64 (7%)
LAMax Range within 1 SD, dB(A)	58 – 72	52 - 68
Occurrence of LAMax noise levels within 1 SD	73%	69%
Occurrence of LAMax between 55 dB(A) and 75 dB(A)	86%	79%
Occurrence of LAMax between 58 dB(A) and 72 dB(A)	73%	-
Occurrence of LAMax between 52 dB(A) and 68 dB(A)	-	69%

6.4.8 The findings of the noise survey indicated that the key noise sources contributing to the existing noise climate were related to typical activities at the docks. Whilst the survey was undertaken over a period of six days in December 2010, the activities recorded are considered typical of those which will occur at the docks throughout the year.

6.4.9 The bird surveys commissioned by Able have recorded important numbers of bird species associated with the SPA/Ramsar designations particularly along the foreshore (S1) and in NKHP (ECO_1). The noise surveys were not undertaken at the same time as the bird surveys, so it is not possible to draw conclusions on the exact effect of specific noise levels on the birds at the time, or determine whether the existing noise climate is having any effects currently on birds. However, these levels are considered to be indicative of the general noise climate in these areas, and important numbers of birds are still being maintained in these areas. Similarly the various reports by Catley and the Lincolnshire Wildlife Trust over the last 5-10 years show that birds continue to use both the Killingholme Fields and the Rosper Road Ponds under current conditions despite existing noise from Rosper

Road and dock related activities which represent two of the largest local noise sources.

Predicted Noise Levels from Piling Activity

6.4.10 The predicted LAMax noise levels at the receptors during piling activities, based on a max source sound power level of 134 dB(A) are given in *Table 6.14* (see *Annex F* for noise contour maps).

Table 6.14 Predicted Noise Levels Incorporating Partial and Full Mitigation

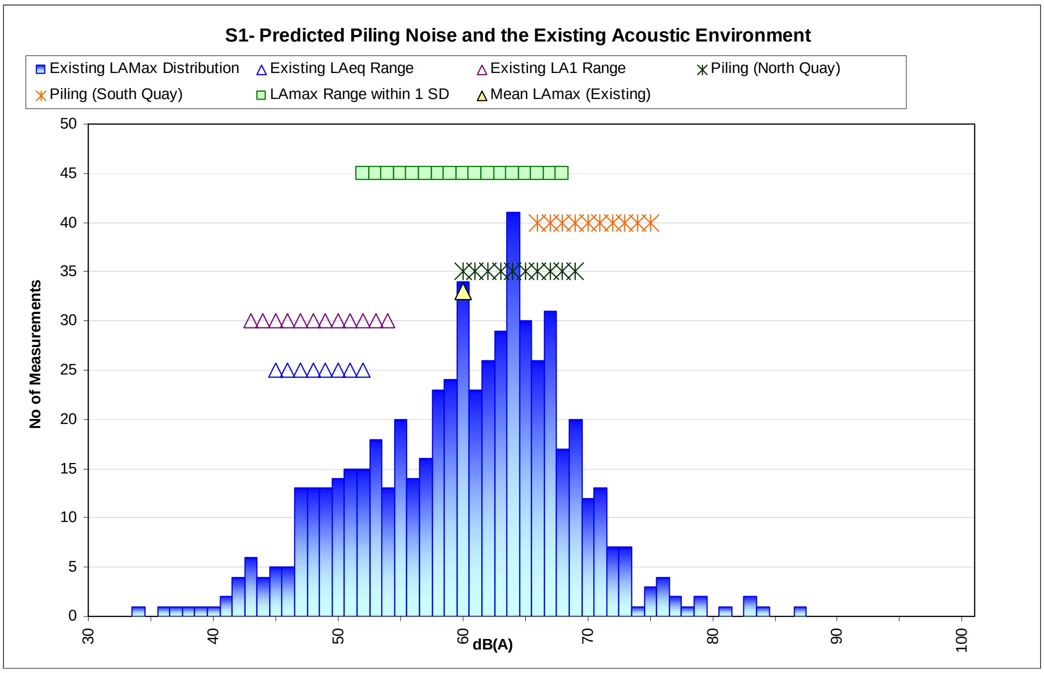
Site	Average LAMax dB(A)	Predicted LAMax Noise Levels with No, Partial and Fully Mitigated Piling (dB(A))		
		None	Partial	Full
S1	60	72	68	66
S2	68	64	61	59
S3	69	57	53	51
ECO-1	65	63	60	58

None- piles free standing, no shroud or completely lifted / Partial- Incomplete enclosure of piles by noise shroud / Full- Complete enclosure of piles down to water level.

6.4.11 It is clear from the data in *Table 6.14* that predicted unmitigated noise levels from piling at Killingholme Fields (S2 and S3) and NHKP (ECO_1) are less than the existing average LAMax levels. There will therefore be no discernable noise effects from these levels at these sites.

6.4.12 Assuming baseline noise levels are relatively consistent along the foreshore, it is likely that the difference between the existing mean maximum noise level and predicted unmitigated piling noise levels would be representative of the increase in noise at other locations on the foreshore. Unmitigated piling noise levels which are higher than the baseline mean LAMax noise levels are predicted along the foreshore at S1. This is illustrated further in *Figure 6.2.* This shows that the predicted LAMax noise levels at Killingholme Marshes Foreshore (S1), with piling occurring at the southern end of the quay, are largely towards the upper end and above the range around the recorded average (see also *Table 6.15*).

Figure 6.2 Predicted Piling LAMax Noise Levels and Existing LAMax Noise Levels S1



Graph displays the range of LAMax noise levels; this is dependant on distance from the noise source and to the level of mitigation being applied.

Table 6.15 Predicted LAMax Noise Level Range relating to Location and Extent of Mitigation

Location	LAMax range from Piling, South Quay, dB(A)[1]	LAMax range from Piling North Quay, dB(A)[1]
S1	66-72	57-63
S2	58-64	56-61
S3	51-57	47-52
ECO_1	48-53	58-63

Note 1: Piling LAMax noise level dependant on location (proximity to receptor) and level of mitigation

6.4.13 A piling specialist has advised that the use of full mitigation will not be possible until the piling gate has been removed. This means that the majority of the piling work will only be possible with partial mitigation, and work could not commence with full mitigation in place.

6.4.14 The predicted L_{AMax} noise level at the foreshore (S1) with partial mitigation is 68 dB (A), which is above the existing mean L_{AMax} noise levels along the foreshore, being 60 dB (A). It is however, less than the highest recorded L_{AMax} noise level recorded during the noise survey in December 2010. The predicted noise level with partial mitigation is within the same category of predicted disturbance as the baseline mean L_{AMax} level as described in Cutts *et al* (2008b) (see *Annex F Supporting Information for Assessment of Effects of Piling*). There will, therefore, be no discernable change to the existing situation, and hence the effects on birds are not expected to be any greater than they are at present.

6.4.15 This is further supported by recent monitoring of piling activities during works to replace a mooring dolphin at the South Killingholme Oil Jetty in close proximity to the AMEP site, where no significant effects on birds have been recorded (*pers comm.* Darren Clarke, HINCA, 2011). It also matches with Able's own experience on the River Tees during the construction of the TERRC facility which also found that construction including piling activities did not cause a major disturbance to waterfowl in the area, in areas approximately 400 m from the work (Scott Wilson, 2009). Only one major disturbance incident was recorded throughout the six week monitoring period. The majority of disturbance events were related to activities unrelated to Able's activities.

6.4.16 NE has confirmed that they will not be seeking any seasonal restrictions on piling activity.

Effects of Vibration

6.4.17 The most significant source of vibration during the construction works will be from the installation of the tubular steel piling and sheet piling for the quayside wall. BS 5228 provides guidance for the prediction of an estimate of vibration from piling operations which is based on the energy per blow or cycle (determined by the type of piler and ram weight), the distance of the receptor from piling and generalised soil conditions.

6.4.18 Reference vibration levels from Table D8 Item C32 of BS 5228 for similar piling operations, indicated a measured Peak Particle Velocity (PPV) of 7.4 mm/s and 3.3 mm/s at plan distances of 27m and 55m respectively. The calculation formulae provided in Annex E of BS 5228 were adjusted to these measured values to calculate expected vibration emissions.

Table 6.10 Estimated Vibrations from Tubular Piling and Sheet Piling Operations

Threshold Value, PPV mm/s	Sheet Piling Plan Distance, m	Tubular Steel Piling Plan Distance, m		
		500 KJ	300 KJ	200 KJ
50	2	6	5	4
25	3	11	9	8
20	4	13	20	9
10	6	22	18	15
5	10	37	30	26

Threshold Value, PPV mm/s	Sheet Piling Plan Distance, m	Tubular Steel Piling Plan Distance, m		
		500 KJ	300 KJ	200 KJ
1	32	126	104	89
0.5	52	213	175	150
0.3	75	300	258	220

6.4.19 Ground vibration from pile driving is likely to be perceptible at the nearest sensitive receptors S1 and S2 when piling activities approach within a distance of 150 m to 300 m based on 500 KJ hammer energy, although a much smaller hammer is likely to be used.

6.4.20 Location S1 is potentially within 50 m of the nearest piling location and could experience vibration levels in the order of 5 to 10 mm/s. Such levels would be noticeable to human occupants and would normally result in adverse comments or complaints. In the absence of any information about effects on birds it has been assumed that birds would also perceive these vibrations and may be affected.

6.4.21 The predictions suggest that it is likely to be perceptible at the nearest sensitive receptors when piling activities approach within a distance of 125 m to 250 m based on 500 KJ hammer energy. As stated above, it is likely that the main areas of intertidal mudflats which will be used by the birds during construction will be over 300 m from the works at their closest point. Hence ground vibration is not predicted to affect the birds.

6.5 EFFECTS OF PILING NOISE ON LAMPREY

6.5.1 Lamprey populations are possibly affected by underwater noise and from loss of subtidal habitat underneath the AMEP footprint. Considering the life cycle of sea and river lamprey and their occurrence in the Humber Estuary, and the duration of piling activities, it is likely that the period of impact will overlap with the period of higher vulnerability of lamprey, that is during their summer downstream migration, peaking in June-July, and/or during the late summer-autumn upstream spawning migration (as adult individuals), peaking in August-September.

6.5.2 There is a lack of information available on hearing in lamprey and no reported audiograms exist for these species. Given that they both lack any specialist hearing structures and that their ear is relatively simple (they have no swim bladder or anatomical structure tuned to amplify sound signals), they are considered to be hearing generalists. Therefore behavioural or physiological effects on lamprey are usually considered likely to occur only when the organism is very close to a powerful noise source.

6.5.3 Work has been undertaken on cephalopods however, which also have statolith organs for the detection of linear accelerations including gravity (Packard *et al.* 1990 [1]). This investigation confirmed that cephalopods could detect the kinetic component of low frequency sounds and it is believed that the statoliths are the sensory organs involved (Packard *et al.* 1990). Based on these results and on the similarity of hearing organs, there is potential that lamprey may also be able to hear infrasound.

6.5.4 Lenhardt & Sismour (1995 [2]) carried out experiments on sea lamprey and detected a startle response to frequencies between 20 and 100Hz. However, the response is likely to be associated more to vibration than waterborne noise, as the click sound was delivered by a submerged vibrator through the tank wall where lamprey were attached. Startle responses while swimming were rare suggesting that direct contact with the vibrating surface was needed to trigger the reaction.

6.5.5 The river lamprey was included in a study on the effect of a playback system (with emission frequencies between 20 and 600Hz) in reducing estuarine fish intake rates at a power plant cooling water inlet (Maes *et* al 1999 [3], 2004 [4]). No significant reductions in river lamprey catches were observed.

6.5.6 The absence of a significant response of lamprey resulting from the above mentioned studies might suggest a low hearing ability of these species at a frequency bandwidth of 20 to 600Hz. However, the low level of sound pressure emitted during the experiment carried out by Lenhardt & Sismour (1995) and the low number of lamprey in catches assessed by Maes *et al* (1999, 2004) (0 to 5 individuals per catch), mean these studies cannot be considered as conclusive in demonstrating low hearing ability of lamprey species. According to the available information, the possible hearing range of lamprey is likely to overlap

(1)Packard A, Karlsen H E & Sand O (1990). Low frequency hearing in cephalopods. *Journal of Comparative Physiology A.*, **166**, 501 - 505.
(2)Lenhardt M L & Sismour E (1995). Hearing in the Sea Lamprey (*Petromyzon marinus*) and the Long Nose Gar (*Lepisosteus spatula*). The Association for Research in Otolaryngology, Abstract: 259.
(3)Maes J, Peeters B, Ollevier F, Parmentier A, Thoelen E, Franchois H, Turnpenny AWH, Lambert DR & Nedwell JR (1999). *Evaluation of the Fish Guidance System at the Cooling Water Inlet of the Nuclear Power Plant Doel 3/4. Studierapport in opdracht van Electabel NV, Kerncentrale Doel*. Katholieke Universiteit Leuven, Department Biology, Laboratory of Aquatic Ecology.
(4)Maes J, Turnpenny AWH, Lambert DR, Nedwell JR, Parmentier A & Ollevier F (2004). Field Evaluation of a Sound System to Reduce Estuarine Fish Intake Rates at a Power Plant Cooling Water Inlet. *Journal of Fish Biology*, **64**, 938-946.

with the sound emissions from dredging and piling activities. However no clear evidence on the actual hearing sensitivity of the species is available, particularly at their migrating active phase. The species might also be affected by vibration arising from construction activities, although no information on the sensitivity to vibration of the species while swimming or resting is available.

6.5.7 It is not known if piling noise acts as a 'non-physical barrier' that elicits a behavioural response that prevents fish from swimming upriver, there is no scientific evidence to support the proposition. In the absence of any definitive information about the effects consideration, has been given to the effects on other migratory fish species (*eg* salmon) to determine whether there was a likely need for any seasonal restrictions to piling. Salmon smolt for instance show avoidance to certain noise sources (Knudsen *et al*, 1994 [(1)]). This has been the basis for the development of acoustic deterrents near power plant intakes. Hearing sensitive fish have been shown to learn to avoid acoustic deterrents (Taylor et al, 2005 [(2)]). There are also indications that species can habituate to piling noise as has been suggested for cod in response to the noise emitted by piling operations for offshore wind farms (Mueller-Blenkle et al 2010 [(3)]).

6.5.8 If piling of the front wall would coincide with the main spawning reason, some river and sea lamprey may be prevented from swimming upriver while other individuals continue their upstream journey unaffected. If a number of migratory fish would be prevented from reaching spawning grounds upriver the overall Humber population numbers for that particular year class and their offspring is possible. As it is not known if and what proportion of adults will be prevented from reaching spawning grounds upriver, it is not possible to quantify this change.

6.5.9 An assessment was carried out by Subacoustech (see *Annex 10.3* of the *ES)* which uses a depth integrated noise propagation model to assess the impacts of piling noise on Atlantic salmon. The results of this study confirm the small range at which fatal injury or tissue damage of an Atlantic salmon from peak noise levels would occur. The study calculated the distance at which behavioural avoidance reactions of Atlantic salmon can be expected based on the dB_{ht} concept that

(1)Knudsen F R, P S Enger & O Sand (1994) 'Avoidance Responses to Low Frequency Sound in Downstream Migrating Atlantic Salmon Smolt, Salmo Salar' in Journal of Fish Biology, Vol. 45, pages 227-233.
(2)Taylor R M, M A Pegg & J H Chick (2005) 'Response of Bighead Carp to a Bioacoustic Behavioural Fish Guidance System' in *Fisheries Management and Ecology*, Vol.**12**, pages 283–286.
(3)Mueller-Blenkle C, McGregor P K, Gill A B, Andersson M H, Metcalfe J, Bendall V, Sigray P, Wood D T & Thomsen F (2010) Effects of Pile-driving Noise on the Behaviour of Marine Fish, COWRIE Ref: Fish 06-08, Technical Report 31st March 2010.

assumes a species-specific level at which a certain proportion of the population demonstrates an active avoidance reaction. In line with these findings, a significant proportion of Atlantic salmon is expected to move across the estuary unperturbed. The distance at which 50% of the salmon would demonstrate a strong avoidance response with a piling operation of 1.8 m lies at 2.1 km, less than the width of the estuary at AMEP. These results suggest a limited effect on migratory salmon and other hearing generalist species with a similar hearing sensitivity.

6.5.10 On the basis of the findings of the Subacoustech study it has been concluded that there will be a corridor within the estuary through which migratory fish including lamprey species can pass even when piling is being undertaken at AMEP.

6.5.11 The loss of subtidal habitat is another possible impact. The abundance of lamprey impinged at the South Humber Power Station, at the edge of the main channel (the intake head being situated about 1.3km from the shore at low tide), would suggest this area as a possible preferential route for migration, as it would provide a quick access to deeper waters (channel), to take advantage of favourable tidal currents, and to adjacent shallow subtidal areas (where the water current is lower) when tidal currents are opposite to the migration stream. Although there is no evidence of such a behaviour in the estuary (all the studies on swimming behaviour have been carried out in stream habitats), localised movements are commonly observed during fish migrations into estuaries to benefit from a net active transport following tidal currents (McCleave & Horrall, 1970 (1) ; Hill, 1995 (2)). Therefore, unlike other fish species (e.g. flounder), estuarine intertidal and shallow subtidal areas do not appear to be essential habitats for lamprey, as their parasitic feeding habit is associated with large pelagic marine hosts and their spawning and nursery (ammocoete) habitats occur in the freshwater catchments. However, the use of shallow subtidal estuarine areas close to the AMEP site by resting individuals during daytime cannot be completely excluded, as no data either confirming or refuting this behaviour in the estuarine environment are available. The total subtidal project footprint at the AMEP site is estimated at 13.5 ha, which is <0.1 percent of the overall subtidal estuarine habitat of 16 800 ha in the estuary. Because any individuals resting in this area at the time of construction will be displaced and move to other parts of the

(1)McCleave J D & Horrall RM (1970). Ultrasonic Tracking of Homing Cutthroat Trout (*Salmo clarki*) in Yellowstone Lake. *Journal of the Fisheries Research Board of Canada*, **27**, 715-730.
(2)Hill A E (1995). The Kinematical Principles Governing Horizontal Transport Induced by Vertical Migration in Tidal Flows. *Journal of the Marine Biological Association of the United Kingdom*, **75**, 3-13.

estuary, it is unlikely that such a reduction in resting habitat will significantly affect the population size of lamprey in the catchment.

6.6 SUMMARY OF SHADOW APPROPRIATE ASSESSMENT

6.6.1 There will be significant loss of intertidal mudflats (approximately 38 ha) and sub-tidal (estuarine) habitat (approximately 13.5 ha) resulting in an adverse effect that cannot be mitigated for within the European sites. Compensation for the loss of these areas has been agreed with NE and the details are provided in *Section 9.2 Compensation Requirements* in *Chapter 9 Compensation Measures*.

6.6.2 The AMEP scheme will create approximately 12 ha of saltmarsh in areas which are currently sub-tidal or intertidal mudflats, as a result of indirect effects on intertidal habitats from the new quay. Saltmarsh is a qualifying interest feature of the Humber Estuary SAC and communities are at risk on the Humber Estuary. This change is a significant and positive effect of AMEP.

6.6.3 The loss of the intertidal mudflat habitat will remove foraging and roosting habitat for significant numbers of bird species which are qualifying interest species for the Humber Estuary European sites as follows. The European site qualifying bird species adversely affected by AMEP comprise:

- shelduck, lapwing, ringed plover, dunlin, black-tailed godwit and bar-tailed godwit using the intertidal mudflats on Killingholme marshes foreshore;
- black-tailed godwit and possibly redshank roosting at NHKP (birds from Killingholme Marshes foreshore);
- curlew foraging on grassland on Killingholme Fields;
- the wetland bird assemblage.

6.6.4 In addition to the effects from habitat losses / changes on the Killingholme Marshes foreshore arising from the construction of the new quay, there will be a functional loss of habitat for birds within an area of approximately two thirds of the intertidal mudflats in Count Sector E south of the proposed new quay. This will result from the effects of disturbance caused by construction activities, which will effectively deter birds from using this area.

6.6.5 There will be a loss of inland grassland fields at South Killingholme used at high tide by qualifying interest bird species from the Humber Estuary European sites, predominantly curlew, which is part of the wetland bird assemblage of the European sites. To mitigate for this loss, the AMEP scheme includes the creation of wet grassland in a mitigation area (called Area A) in the southern part AMEP site, which comprises 16.7 ha or core wet grassland habitat surrounded by a 150 m buffer. This approach is in accordance with the Strategic Mitigation Strategy for the South Humber Gateway and has been agreed with NE.

6.6.6 Noise resulting from piling activities during construction of the new quay was found not to result in adverse effects on birds on the intertidal mudflats at Killingholme Marshes foreshore, NKHP or at Killingholme Fields. The maximum predicted noise levels from piling activities at NKHP and Killingholme Fields will be within the range of maximum noise levels recorded by baseline monitoring, hence there wil be no change to existing levels. Predicted maximum noise levels on the intertidal mudflats at Killingholme Marshes foreshore will be maintained within the baseline range of maximum levels through the use of a noise shroud around the rig. This can be implemented from the outset of piling where necessary. Subject to this NE has agreed that no adverse effects on qualifying interest bird species will result and that no seasonal restrictions are required on piling activities.

6.6.7 Noise from piling is not predicted to result in a barrier preventing the migratory movements of lamprey along the Humber. Underwater noise modelling by Subacoustech has shown that a corridor will remain within the estuary through which lamprey can pass even whilst piling is being undertaken. The use of shallow subtidal estuarine areas close to the AMEP quay site by resting lamprey during daytime cannot be completely excluded, however, any individuals resting in this area at the time of construction will be displaced and move to other parts of the estuary, and it is unlikely that such a reduction in resting habitat will adversely affect the population size of lamprey in the catchment.

6.6.8 The AA has concluded that the AMEP Scheme will result in an adverse effect on the integrities of the European nature conservation designations on the Humber Estuary. It is, however, demonstrated that there are no alternative solutions (see *Chapter 7 Alternative Solutions*) and that the development is in the public interest (see *Chapter 8 IROPI*). As a result suitable compensation measures have been developed and agreed with NE to maintain the coherence of the Natura 2000 network (see *Chapter 9 Compensation Measures*).

6.7 IN-COMBINATION EFFECTS

6.7.1 This section considers the effects on the European sites from the development of the AMEP scheme in-combination with other proposed developments in the area (see *Section 4.11* in *Chapter 4 AMEP Project Description and Other Proposed Developments*).

6.7.2 The findings of the assessment show that AMEP will have an adverse effect on the European sites of the Humber Estuary. As a result compensation measures or mitigation measures will be implemented to maintain the integrities of these European sites, and hence the Natura 2000 network of which they are part (see *Chapter 9 Compensation Measures*). These measures will offset the impacts of AMEP on all habitats and species where adverse effects have been identified in this chapter.

6.7.3 The wetland bird species which are affected by AMEP occur in three locations, Killingholme Marshes foreshore, NKHP and Killingholme Fields. At Killingholme Marshes foreshore, the compensation measures have been agreed with NE that will provide new habitat to replace that which is lost from direct effects, indirect effects and where there will be a functional loss for birds. As a result there will be replacement habitat for all bird species that the surveys identified using the areas to be lost, including those species present in numbers <1% of their Humber Estuary population. Hence in-combination effects are not predicted. Similarly at Killingholme Fields a mitigation area has been agreed with NE which will provide a safe and secure area for the wetland bird species which are affected by AMEP. As a result in-combination effects are not predicted.

6.7.4 The only wetland bird species which are likely to be subject to in-combination effects are those at NKHP. The AMEP development borders NKHP on the southern and western sides, and the Humber Estuary adjoins NKHP to the east. The northern side of the NKHP is already dominated by existing industrial / commercial development. The proposed developments such as the IGCC Power Station, the Ursa Glass Wool Factory and the bio-ethanol plant will not have any direct effects on NKHP and none are located close enough to NKHP to result in any significant disturbance effects, and in-combination effects are not predicted. Other development in the northern area is being undertaken by Able and is the subject of a mitigation package which has been agreed with NE.

6.7.5 It is possible that the Neptune RE Tidal Stream Generator may have a likely significant effect on lamprey, however, it is envisaged that if this were the case then further assessment will be required and mitigation or compensation measures agreed with NE. Hence in-combination effects are not foreseen. It is also our understanding that Associated British Ports (ABP) have agreed measures with NE to avoid adverse effects to migratory lamprey associated with the Green Port development in Hull, however, no details are available at this time. Assuming such measures have been agreed, then adverse effects on lamprey in-combination with AMEP are not predicted.

6.7.6 Based on the above assessment no adverse effects which will affect the integrity of the Humber Estuary European sites from AMEP in-combination with other proposed developments are predicted.

7 *ALTERNATIVE SOLUTIONS*

7.1 INTRODUCTION

Legislation

7.1.1 In accordance with the Conservation of Habitats and Species Regulations 2010, where an appropriate assessment concludes that the project will give rise to significant adverse effects on a European Site and that these cannot be fully mitigated, then the project may only be consented where: there is a need; there are no feasible '*alternative solutions*', '*the plan or project must be carried out for imperative reasons of overriding public interest*' and acceptable compensatory land is secured. This part of the report demonstrates the absence of any feasible alternative solutions to meet the needs that define the project objectives.

Guidance

7.1.2 According to Managing Natura 2000 Sites: The Provisions of Article 6 of the 'Habitats Directive 92/43/EEC', (EC, 2000), '*The **first step** of the competent authorities is to examine the possibility of resorting to alternative solutions which better respect the integrity of the site in question.*' It further states that alternative solutions can '*involve alternative locations (routes in case of linear developments), different scales or designs of development, or alternative processes. The 'zero-option' should be considered too.*'

7.1.3 The EC has issued guidance on Article 6(4) of the Habitats Directive: 'Clarification of the Concepts of: Alternative Solutions, Imperative Reasons of Overriding Public Interest, Compensatory Measures, Overall Coherence, Opinion of the Commission', January 2007. The advice states that:

> *'The decision to go ahead with a plan or project must meet the requirements of Article 6(4). In particular, it must be documented that:*
>
> *1. The alternative put forward for approval, is the least damaging for habitats, for species and for the integrity of the Natura 2000 site, regardless of economic considerations, and that no other feasible alternative exists, that would not affect the integrity of the site.'*

7.1.4 Although the above guidance suggests that alternatives should be examined '*regardless of economic considerations*', those solutions that are not commercially viable and would therefore never be constructed, are effectively equivalent to a 'zero option'.

7.1.5 In her Opinion for the case C-239/04, the Advocate General (paragraphs 43 and 44) considered that

> *'43. The absence of alternatives cannot be ascertained when only a few alternatives have been examined, but only after* all *the alternatives have been ruled out. The requirements applicable to the exclusion of alternatives increase the more suitable those alternatives are for achieving the aims of the project without giving rise – beyond reasonable doubt – to manifest and disproportionate adverse effects.*
>
> *44. Among the alternatives short-listed in that way, the choice does not inevitably have to be determined by which alternative least adversely affects the site concerned. Instead, the choice requires a balance to be struck between the adverse effect on the integrity of the SPA and the relevant reasons of overriding public interest.'*

7.1.6 Whilst the wording of Article 6 seems to require that there is a complete absence of alternatives, The Court of Justice, has explained this requirement by stating that alternatives which '*cannot be ruled out immediately*' would have to be examined (Court of Justice, Case C-239/04, paragraph 38). This, in effect, means that an alternative solution that can be ruled out immediately does not need not to be explored by the authorities. In practice therefore, the Court has been pragmatic and recognised that not all alternatives to a plan or project need be examined in detail.

7.1.7 Taking into account the above, the purpose of this report is to present to the decision maker the categories of alternative solution considered for the Marine Energy Park and thereby demonstrate that there is no alternative solution that satisfies the project objectives.

7.2 THE OBJECTIVES OF THE PROJECT

Introduction

7.2.1 The Project will address three key objectives of European Energy Policy, viz.

- decarbonise the means of electricity production;
- provide secure energy supplies for the UK; and
- improve EU competitiveness by creating jobs and growth in a sector in which European business is a global leader.

In particular the project will:

- provide facilities for the manufacture of large scale offshore energy components;

- contribute to 'rebalancing' the UK economy by enabling the development of a significant manufacturing cluster - such a cluster will have a beneficial impact on the competitiveness of the European offshore wind industry; and

- regenerate the Humber Estuary sub-region, an economically deprived area of the UK.

7.2.2 The need for new manufacturing facilities and for construction ports in the UK to enable growth of the offshore wind energy sector arises from a number of international, national and regional imperatives, viz.

7.2.3 **World production of energy needs to be decarbonised** in order to avoid the potential adverse impacts of climate change. Climate change is the first global environmental challenge that mankind has knowingly faced; it is regarded as one of the most serious threats facing the world's environment, economy and society (Defra, 2006). Accordingly, International Treaties, European and national legislation compel the UK Government to make an urgent transition to a low carbon economy.

7.2.4 **The UK must ensure security of its energy supplies** whilst managing its own transition from fossil fuels to renewable forms of energy over the next few decades. In this context, a secure energy supply is characterised by: a diverse energy mix of different sources and fuels; limited reliance on imported supplies; reliable and well managed infrastructure and stable prices. Wind energy is part of such a diverse mix of energy generation. The transition is to be market-led.

7.2.5 **Europe must develop large capacity offshore wind turbines** to make the delivery of sufficient offshore wind turbine capacity feasible and to reduce the environmental impacts associated with manufacturing, deployment and maintenance. Such turbines will need to be manufactured at portside locations.

7.2.6 **The UK needs to increase its manufacturing base** and, where practicable to do so, target investment in areas of relative deprivation to reduce social imbalance between regions. The transition from a fossil fuel economy to a low carbon one, offers substantial new employment opportunities in the manufacturing sector and the potential for significant socio-economic benefit to the UK.

7.2.7 **The Humber sub-region is an area of relative deprivation and is in need of substantial investment.** Both North Lincolnshire and North East Lincolnshire are currently suffering high levels of unemployment. Even prior to the recent recession, employment growth in the area had been flat compared with the national and regional pattern as illustrated in *Figure 7.1* below. The site also lies within the Humber Assisted Area, as illustrated in *Figure 7.2*; the area is thus recognised by the EC as one that requires investment to raise employment levels and its manufacturing base (EC, 2007).

Figure 7.1 Index of Employment Change 1998 - 2008

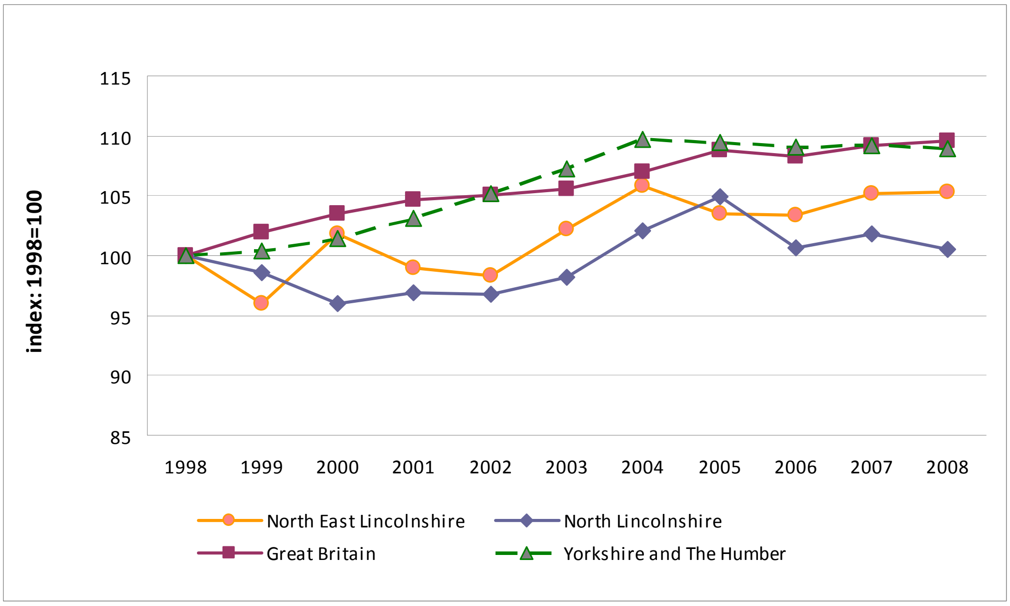
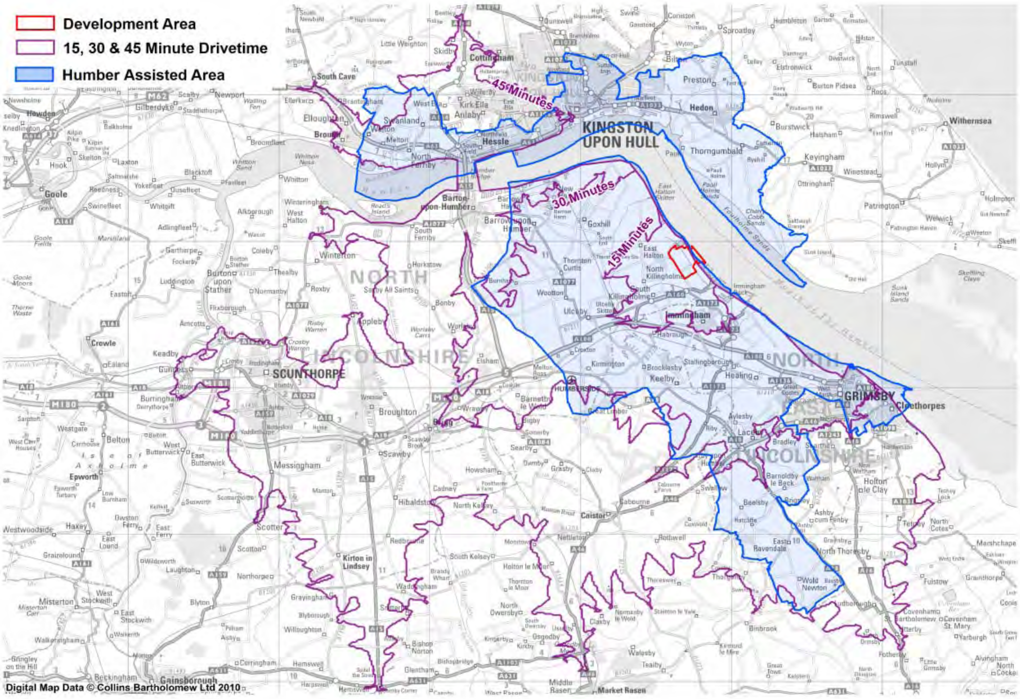


Figure 7.2 Assisted Areas Proximal to the AMEP Site



The Need to Decarbonise Energy Production

7.2.8 The earth's climate has been changing constantly over millions of years. Indeed, it is only ten thousand years since the majority of the UK land mass was covered by a series of thick ice sheets. In the current era we can understand the climate and the factors that influence it.

7.2.9 The climate is mainly influenced by the amount of energy coming from the sun, but also by factors such as the amount of greenhouse gases and aerosol propellant in the atmosphere. Recent human activity is changing the composition of the atmosphere and its properties. Since pre-industrial times (around 1750), carbon dioxide concentrations have increased by just over a third from 280 parts per million (ppm) to 380 ppm today, predominantly as a result of burning fossil fuels, deforestation and changes in land use. The concentration of other greenhouse gases such as methane and nitrous oxide are also rising.

7.2.10 There is compelling scientific evidence that the rising levels of greenhouse gases will have a warming effect on the earth's climate through increasing the amount of infrared radiation (heat energy) trapped in the atmosphere, "the greenhouse effect". In total the

[1] emitted by human activities is now equivalent to around 430 ppm of carbon dioxide and is rising at around 2.3 ppm per year. Current levels of greenhouse gases are higher now than at any time in at least the past 650 000 years (Stern, 2006). In 2009, the UK energy sector was responsible for 195 million tonnes of carbon dioxide equivalent emissions (DECC, 2011).

7.2.11 The impact of climate change is to potentially threaten the basic elements of life for people around the world – access to water, food, health and use of land and the environment generally. One of the ways in which this would occur would be through rises in sea levels, inundating coastal areas around the world. Accordingly, the UK Government is a signatory to International commitments on climate change and European and national legislation has been developed that provides a statutory framework for the reduction of greenhouse gas emissions over the next few decades.

7.2.12 The Kyoto Protocol was developed to limit the growth of greenhouse gas emissions. Under the protocol, industrialised countries and those in transition to a market/industrialised economy agreed to limit or reduce their emissions of greenhouses gases. It came into force on 16 February 2005 and commits signatories, including the United Kingdom, to reduce or limit their greenhouse gas emissions to a specified target value relative to their 1990 emissions in the period 2008-2012.

7.2.13 The UK government has achieved its target reduction for emissions. Since the Kyoto Protocol, however, it has become evident that more significant action is required to limit climate change. Accordingly, legislation has been introduced in the European Parliament, and by the UK Government, to impose legal obligations that compel a transformation to a lower carbon economy.

7.2.14 In July 2009, the Government issued, 'The UK Low Carbon Transition Plan', (DECC, 2009) setting out a strategy to tackle climate change, maintain secure energy supplies and to maximise economic opportunities in the emerging renewable energy sector.

The Need for Security of the UK Energy Supply

7.2.15 Whilst the development of renewable energy has been mainly driven by concerns over climate change, a new issue is emerging – the role of

[1] Carbon dioxide (C02), Methane (CH4), Nitrous oxide (N20), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF6), as defined in the Kyoto Protocol

renewables in contributing to security of energy supplies. This is being driven by global shortages of oil supplies and increased oil demand from the developing economies (particularly China), depletion of national offshore gas reserves (particularly in the UK) and political actions by the world's largest gas supplier – Russia.

7.2.16 In accordance with Section 172 of the Energy Act 2004, The Secretary of State is required, in every calendar year, to,

> *'publish a report dealing, as regards both the short term and the long term, with the availability of electricity and gas for meeting the reasonable demands of consumers in Great Britain'.*

7.2.17 The most recent of such reports, '*Statutory Security of Supply Report*', (DECC, 2010), records that at the end of 2009, the UK as a whole had a total of 85.3 GW of electricity generating capacity of various kinds. This compared to a peak demand of 60 GW. In addition, Great Britain had the capacity to import and export the equivalent of 2.5 GW from and to France and Ireland. However, the annual report also notes that:

> *'A substantial proportion of the UK's electricity generating capacity is expected to close over the next few years. Electricity generation capacity has a finite lifetime, and faces increasingly strict environmental regulation. Both these factors will lead to closures of some existing plant over the next decade. The Large Combustion Plants Directive (LCPD) will lead to closure of around 12 GW of coal and oil-fired fleet by 2016 at the latest4. The Industrial Emissions Directive (IED) could also lead to further closures by 2023. In addition, and according to current timetables, up to 7.4 GW of existing nuclear generating capacity is reaching the end of its operational life and will have closed by 2020'*

7.2.18 The Overarching Energy National Policy Statement, EN-1, states that the need for low carbon electricity generating infrastructure is now 'urgent' [1], and that 59GW of new electricity generating capacity should be planned for by 2025 [2].

The Need for Large Capacity Offshore Turbines

7.2.19 The European Strategic Energy Technology Plan (SET-Plan) is the EU's response to the challenge of accelerating the development of low carbon technologies leading to their widespread market take-up, (EC, 2007). It sets out a vision of a Europe with world leadership in a diverse

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[1] paragraph 3.3.1

[2] paragraph 3.3.23

portfolio of clean, efficient and low-carbon energy technologies as a motor for prosperity and a key contributor to growth and jobs. It proposes joint strategic planning and more effective implementation of programmes. One of the key objectives of the Plan is to:

> *'(d)ouble the power generation capacity of the largest wind turbines, with off-shore wind as the lead application'*

The Need to Rebalance the UK Economy

7.2.20 The concept of a "rebalanced" economy has become central to the debate on how the UK can emerge from recession and generate sustainable growth. One major imbalance is considered to be the level of manufacturing in the UK compared to other industrialised countries. In the UK, manufacturing has declined rapidly in recent decades, falling from 29 per cent of the UK output in 1979 to 13 per cent of output in 2007 (NESTA, 2010). Another imbalance is that between the economic outputs of different parts of the UK.

7.2.21 The wind energy industry has its origins in Denmark although Germany has also provided a solid onshore wind market throughout the past 15 years. This has led to the current dominance of German and Danish companies in the offshore wind energy supply chain, with the result that 80 percent to 90 percent of the historic capital value in UK offshore wind farm projects has been based on imported goods and services and the economic benefits to the UK have been very limited (Garrad Hassan, 2010).

7.2.22 The total cost for installing the Crown Estate's 32.2 GW, Round 3 project is variously estimated to be around £80-100 billion. Accordingly, the UK Government's offshore wind energy programme will give rise to the largest construction project ever undertaken. However, to succeed, it requires urgent and significant investment in new manufacturing facilities and port infrastructure. This investment must be market led, and for the UK to benefit significantly from private sector investment in new manufacturing facilities, it must provide suitable development sites.

7.2.23 Independent reports evidence the significant opportunity for the UK to build a manufacturing base for offshore renewables. For example, Renewable UK has estimated that 22 factories will be required for turbines, foundations and cable manufacturing alone (Douglas Westwood, 2010). In an earlier report they estimated that the sector could generate up to 45 000 jobs by 2020 (Bain and Company, 2008). Elsewhere the Carbon Trust has estimated that, *'offshore wind will provide the UK with up to 70,000 jobs and £8bn in annual revenues **if delivered with a proactive UK Government manufacturing strategy',*** (emphasis added)

7.2.24 This level of socio-economic benefit will not be realised unless the UK provides port sites suitable for manufacturing OWTs. Without such development sites, employment benefits from the offshore sector will be limited to assembly, installation and operation and maintenance.

7.2.25 The past two decades have seen a widening of regional differences in economic growth and job creation in the UK. London and the South East have experienced robust growth, benefiting from the concentration of business and financial services in those areas, whilst the north of England, Northern Ireland and Wales have all lagged behind. This creates economic and social issues that consecutive governments have attempted to rectify. In the short term, regional disparities are likely to become accentuated as heavy public spending cuts hit all regions of the UK in the next few years.

The Need to Regenerate The Humber Sub-Region

7.2.26 For the period 2007-2013, the EC has recognised the parts of North Lincolnshire and of North East Lincolnshire are sufficiently deprived to be eligible for state aid. Qualifying areas were identified based on the following criteria:

- employment rate;
- adult skills at Level 2 or above;
- incapacity benefit claimants; and
- manufacturing share of employment.

7.2.27 Accordingly, there is a manifest need to address deprivation in the Humber sub-region by promoting investment in that area.

7.2.28 The development of AMEP will have a significant positive impact on these criteria at the local level but will also benefit the Humber sub-region as a whole.

7.2.29 The employment impact at the site will be 4 100 FTE jobs. The net additional local impact is 3 740 FTE jobs taking into account deadweight, leakage, displacement, and indirect and induced multiplier effects. The UK-wide cumulative net additional impact is 10 600 FTE jobs. These jobs will generate significant net additional GVA in the local economy – estimated at £210 million, and in the national economy – estimated at £602.5 million. As indicated above, these estimates are considered conservative and the GVA impact will potentially be higher due to higher GVA per job in the offshore wind energy sector.

7.2.30 The MEP labour market impact is potentially significant, especially in the immediate vicinity of the development. It is expected that the workforce will have to come from a wider area, both North and North East Lincolnshire and from within the wider region of Yorkshire and the Humber.

7.2.31 Based on the impact assessment of AMEP, it is evident that economic impacts can be expected to be highly positive.

- Diversification of the manufacturing sector into new offshore wind technologies providing higher job security compared to traditional industries in decline.

- New jobs (4 100 direct jobs excluding installation related jobs) created directly at the site absorbing some of the potentially available pool of workers (unemployed and potentially economically active).

- These new jobs will attract highly skilled workers from other areas as well, thereby creating a critical mass of offshore wind professionals in the local area.

- AMEP will enable the development of an offshore wind manufacturing cluster in the Humber region as it will be cheaper and more efficient to co-locate businesses in the supply chain. A manufacturing cluster will help to develop offshore wind (and other marine renewables) technologies further.

- New offshore wind jobs will require highly qualified workers and AMEP represents opportunity to raise the skill level of local labour to ensure increased local participation.

- The supply chain for AMEP offshore wind manufacturers will be developing in the Yorkshire and the Humber region and beyond with signs of this process appearing recently with foundation manufacturers setting up facilities in Scunthorpe and Teesside.

- AMEP will also support 200 FTE jobs at a number of suppliers of goods, services, and works locally (i.e. within NL and NEL) and further 920 FTE jobs through spending of its and suppliers' employees in the local economy.

- Wider impacts will include attraction of inward investment, growth of R&D in offshore wind in Yorkshire and the Humber, upskilling of the workforce, and others.

7.2.32 The impact of the AMEP workforce on housing and social infrastructure is potentially significant. However, both North and North East Lincolnshire authorities have already noted the development of South Humber Bank and its impact on housing when setting their housing targets. The impact mitigation process has therefore already started. New housing development will result in expansion of schools and health care facilities based on the adopted planning practices.

7.3 PROJECT DESCRIPTION

Summary

The Over-arching Development

7.3.1 The development of a Marine Energy Park is directly related to the global environmental project to decarbonise world energy production. The need to decarbonise world energy production, and its overriding benefit to the global environment, is beyond any reasonable scientific doubt.

AMEP

7.3.2 The project is described in *Chapter 4* of the Environment Statement, Volume 1.

Works having an Adverse Effect on Integrity

Works outside the Natura 2000 Site

7.3.3 Works outside the Natura 2000 site comprise the manufacturing areas and the impacts of that development of Natura 2000 features are mitigated within the development site.

Works within the Natura 2000 Site

7.3.4 Works within the Natura 2000 site comprise a new solid quay structure and the environmental impact of those works cannot be mitigated. It is therefore necessary to consider whether any alternative solutions to those works exist that would avoid an adverse effect on integrity of the Natura 2000 network.

The Assessment of Alternatives

7.3.5 The assessment of alternative solutions is undertaken in four stages

Stage 1 - Zero Option

7.3.6 An assessment of the feasibility of constructing the development without the quay, or not constructing the development at all.

Stage 2 – Is There an Alternative Site that would result in less damage to the Natura 2000 Network?

Stage 2A

7.3.7 Subject to the development being needed and needing a quay, an assessment of whether the development could be constructed on an alternative site that is not part of the Natura 2000 network.

Stage 2B

7.3.8 Subject to there being no alternative site outside the Natura 2000 network, an assessment of whether the development could be constructed on another Natura 2000 site and have less overall environmental impact.

Stage 2C

7.3.9 Subject to there being no alternative site for the whole development anywhere, an assessment of whether the development could feasibly be constructed as a series of smaller developments and have less overall environmental impact.

Stage 3 – Is There an Alternative Design that would be less damaging to the Natura 2000 Network?

Stage 3A

7.3.10 Subject to there being no feasible alternative site or sites for the development, an assessment of whether the environmental impact could be reduced by adopting a different scale of development.

Stage 3B

7.3.11 Subject to there being no feasible alternative site or sites for the development, an assessment of whether the environmental impact could be reduced by adopting a different design for the quay.

Stage 4 – Can the Facility be Operated in any way that would reduce the negative impact on the Natura 2000 Site?

7.3.12 Subject to there being no feasible alternative design or scale of development, an assessment of alternative means of operating the facility to reduce its environmental impact.

7.4 STAGE 1: THE ZERO-OPTION

Definition

7.4.1 The zero option can comprise either:

- constructing manufacturing facilities for offshore wind turbines without a quay, or

- not building offshore wind manufacturing facilities at all.

Offshore Turbine Manufacturing Facilities without a Quay

7.4.2 If the development excluded the quay then all of the products manufactured on the site would need to be transportable by road or rail to a nearby port. This would mean that products could be no larger that those manufactured for onshore installation.

7.4.3 The EC consider that offshore wind turbines must increase in size so that they became more commercially viable. The European Strategic Energy Technology Plan (SET-Plan), 'Towards a Low Carbon Future', (EC, 2007) laid down seven technology challenges to meet the 2020 targets. One of these challenges is to, *'(d)ouble the power generation capacity of the largest wind turbines, with off-shore wind as the lead application'*. To meet this challenge, offshore turbines are being developed that are not transportable by road or rail. Consequently, all new manufacturing facilities for offshore wind turbines must have direct access to a quay and existing onshore facilities cannot be used that rely on road or rail transport.

7.4.4 In summary, manufacturing facilities for next generation offshore wind turbines need a quay and the development cannot proceed without it.

No Offshore Wind Turbine Manufacturing Facilities

7.4.5 In 2009 the EC set out the European Wind Initiative (EC, 2009). The initiative states that (emphasis added),

> *'Wind energy has to accelerate the reduction of costs, **increasingly move offshore** and resolve the associated grid integration issues if it is to fulfil its huge potential. To support its **rapid expansion**, we need: to develop a better picture of wind resources in Europe, through coordinated measurement campaigns; to build 5-10 testing facilities for new turbine components; up to 10 demonstration projects of next generation turbines; at least 5 prototypes of new offshore substructures tested in different environments; demonstrate new manufacturing processes; and test the viability of new logistics strategies and erection techniques in remote and often hostile weather environments. All of this must be underpinned by a comprehensive research programme to improve the conversion efficiency of wind turbines. The total public and private investment needed in Europe over the next 10 years is estimated as €6 bn. **The return would be fully competitive wind power generation capable of contributing up to 20% of EU electricity by 2020 and as much as 33% by 2030**',* (emphasis added)

7.4.6 To fulfil the European Wind Initiative, many new offshore wind turbine manufacturing facilities are required.

7.4.7 In summary, manufacturing facilities for next generation offshore wind turbines need to be built.

Summary

7.4.8 The development of large turbines specifically for the offshore wind sector is firmly rooted in European policy.

7.4.9 Next generation offshore wind turbine manufacturing facilities must have direct access to a quay as they are too heavy to transport by road or rail. A quay is therefore an essential requirement for new offshore turbine manufacturing facilities.

7.4.10 The zero option is therefore discounted.

7.5 STAGE 2: ALTERNATIVE SITES

Possible Alternative Sites

The Geographical Limits - The Continent

7.5.1 'The UK Low Carbon Transition Plan' (DECC, 2009) recognises the potential for new business opportunities in UK manufacturing stating that (emphasis added):

> *'Many more of us will find ourselves working in a growing low carbon industry. Already 880,000 people in the UK work in the low carbon and environmental sector, a rapidly growing worldwide market worth £3 trillion per year and £106 billion per year in the UK. By 2020, this could rise to more than a million people if we seize the opportunity to establish the UK as a global centre of low carbon industries and green* ***manufacturing****. Around 200,000 of these new jobs by 2015 are expected to be in renewable energy, which could grow by a further 300,000 additional renewables jobs by 2020 as set out in the UK Renewable Energy Strategy,* ***a total of half a million additional UK jobs in the renewable energy industry to 2020****. In doing this, the UK will need to focus on low carbon sectors where we are likely to have a competitive advantage such* ***as offshore wind****, marine energy, civil nuclear power, carbon capture and storage, renewable chemicals, low carbon construction and ultra-low carbon vehicles, and specialist financial and business service,'* (pg 112, author's emphasis).

7.5.2 Alternative sites outside of the UK are not therefore considered as such sites would not meet the long term economic and social needs of the UK or stated Government policy. Furthermore they would not deliver the project objectives outlined above of contributing to the security of UK energy supplies, and the growth and rebalancing of the UK economy through regeneration and the development of manufacturing industry.

7.5.3 Continental ports will, in any event, be required to provide land and services for respective Member States' own offshore wind developments.

The Geographical Limits - The UK

7.5.4 To be commercially viable as a manufacturing cluster with an on-site construction port, the alternative sites are realistically limited to the south and east coast of Britain where the Round 3 zones are concentrated and where there is ready access to other Member States' economic zones.

Site Specification

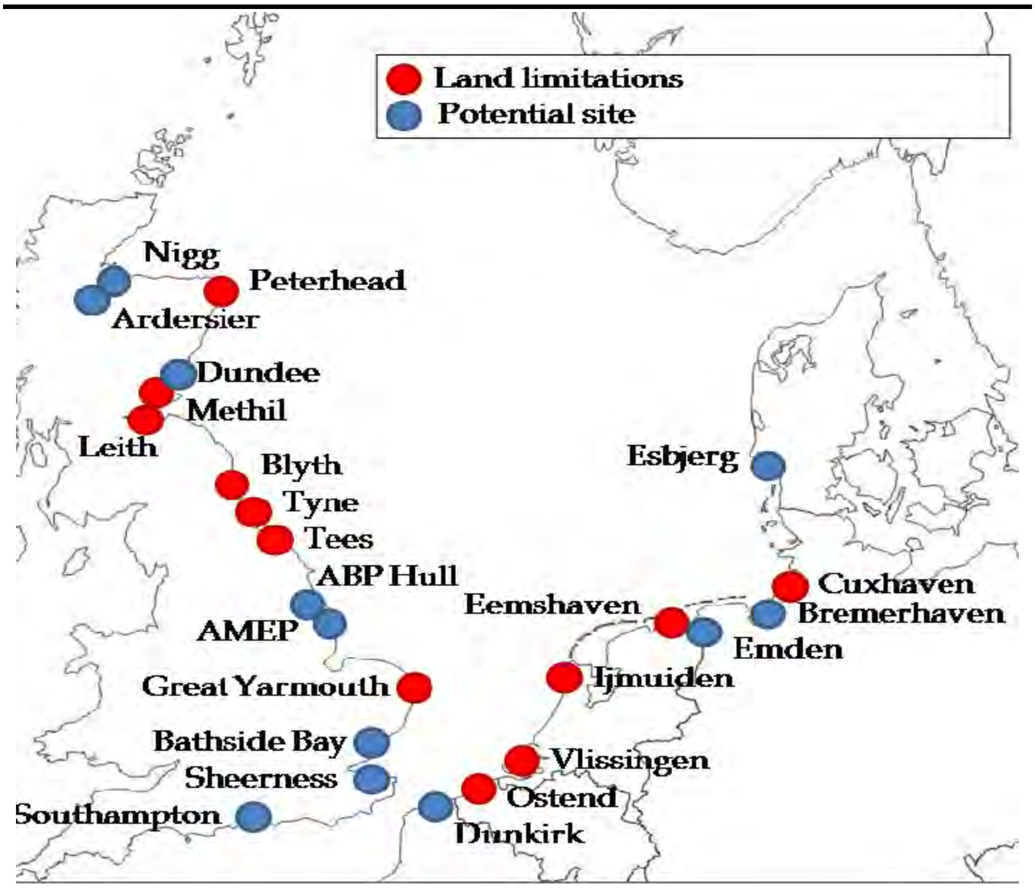
7.5.5 The specific site requirements are set out in *Chapter 6* of the ES and are summarised below:

- Proximity to the major Round 3 development zones.
- A substantial single parcel of flat land with access to deep water.
- Good road and rail access.
- Appropriate land use allocation.

Port Sites on the South and East Coast of Britain

7.5.6 A number of port sites are identified in the publication, *UK Offshore Wind Ports Prospectus* (DECC, 2009). The report contains details of 26 potential ports, 15 of them on the southern and eastern shoreline of the UK, which could be developed to serve the offshore wind industry in some capacity. These ports are Nigg, Peterhead, Dundee, Methil, Leith, Blyth, Tyneside, Able Middlesbrough, Hartlepool, Able Seaton, ABP Hull, Able Humber, Great Yarmouth, Isle of Grain, Sheerness and Southampton. Their locations are illustrated in *Figure 7.3.*

Figure 7.3 ***Potential Alternative Port Locations***



Source:BVG Associates

7.5.7 Of the ports identified, eight have clear size limitations in terms of their development as a manufacturing and construction port cluster; these are summarised in *Table 7.1* below and have been screened out of any further assessment. The remaining alternatives– Nigg, Ardersier, Dundee, ABP Hull, Bathside Bay, Sheerness and Southampton - are considered in greater detail below. Information has been sourced from company documents and websites as well as publications by public and industry bodies. Distances to wind farm sites are to the centre of the zone.

7.5.8 A Strategic Environmental Assessment of the Scottish sites has been undertaken on behalf of Scottish Enterprise and Highlands and Islands Enterprise (HE-HIS, 2010). A comprehensive review of ports in East Anglia is included in, 'Offshore Industries Integrated Regional Operation, Maintenance, Training & Service Capability', (ITPower, 2009).

Table 7.1 Port Locations with Insufficient Land

Port	Restriction	Details
Peterhead	Land/Quay	The port is developing an 8 ha site for renewables with a further 22 ha offsite. A new 200 m quay has been developed to support operations.
Methil	Land/Quay	The port's Energy Park is 54 ha of which 14 ha are currently available. The site has two quays with a total length of 340 m. It has been used for the fabrication of offshore foundations for the Alpha Ventus project and can reasonably be expected to develop this business further.
Leith	Land	The port owner has designated 40 ha for renewable activity. The port has 1 800 m of quay but this is lock restricted and includes areas already committed.
Blyth	Land/Quay	100 ha of land are available with more than 500 m of quay but this is divided into six parcels with areas already utilised by existing customers.
Tyne	Land	The Renewable Energy Park is located on the north bank of river and has 60 ha of available land with 800 m of quayside. This is split into a number of discontinuous sites. The Port of Tyne operates a site downriver (estimated 60ha) and has indicated its interest in offshore wind but has made no public offering.
Tees	Land	The Seaton and Middlesbrough sites on the north and south banks of the river could offer a total of 72 ha and 550 m and 350 m respectively. Outside the river mouth, Hartlepool offers 23 ha with 910 m of quayside. The sites could be developed for discrete manufacturing facilities but not a construction port/manufacturing cluster.
Great Yarmouth	Land	The port has 12 ha of development land with up to 1,000 m of quay as well as the opportunity to develop further land beyond the new outer harbour. Its proximity to the Norfolk Bank zone would suggest that it has long term potential as one of the construction ports for that site.

Nigg

7.5.9 A development masterplan for the Port of Nigg was developed in 2009 by The Highlands and Islands Enterprise and the Highlands Council. The masterplan identified two options for the site, one of which was for a green energy park that accommodated manufacturing.

7.5.10 The Nigg site is illustrated in *Figure 7.4.*

Figure 7.4 Nigg Site Layout

Source: HE-HEIS, 2010

7.5.11 The 70 ha fabrication yard has the benefit of an existing 306 m long dry dock. A heavy duty quay partly runs along one side and is capable of supporting a distributed load of 90 T/m^2. The quay wall outside of the dock is 430 m long but has a working draft of only 4.5 m below Chart Datum, which renders that unsuitable for the larger installation vessels.

7.5.12 The proximal land to the east lies on steeply rising ground and only a small area near the coast is actually flat and suitable for offshore component manufacturing. The coastal boundary also lies within the Cromarty Firth SPA/SSSI/Ramsar site.

7.5.13 Its geographic remoteness from the majority of the Round 3 zones is a significant barrier to the commercial development of a manufacturing cluster. Topographic constraints also mean that Nigg cannot be considered a feasible site for a MEP. It is nevertheless in a very favourable position to serve as a construction port for the Moray Firth zone and could clearly support a significant foundation fabrication yard. Its dry dock also provides a real opportunity for the manufacture of gravity based foundation structures.

Ardersier

7.5.14 The Ardersier yard is located in north east Scotland on the south shore of the Moray Firth and lies within the Moray Firth SAC, Inner Moray Firth SPA and Ramsar sites and Whiteness Head SSSI. The site is approximately 550 km from Dogger Bank, 650 km from Hornsea and 800 km from Norfolk Bank. An aerial view of Ardersier is shown at *Figure 7.5*.

7.5.15 Ardersier was originally reclaimed for the construction of oil and gas platforms in the early 1970s but such activity ceased in the early 1990s. The available site is 109 ha of prepared hard core with an additional 28 ha of development land. The sheet piled harbour wall is around 1 000 m and is sheltered by a natural sand spit but its condition and the load bearing capacity of its quay is unknown. Dredging would be required to achieve suitable water depths.

7.5.16 The site is owned by a private company, Whiteness Property Company, which has outline planning permission for nearly 2 000 houses already and ambitions for up to 4 000 units. Investment has been made to remediate the land in preparation for housing. The site is approximately 22 km from Inverness.

7.5.17 Whilst the Scottish Government has included the port in their 'National Renewable Infrastructure Plan' (N-RIP) (Scottish Enterprise, undated), there is little public information that suggests the owner is taking steps to move away from its original housing plans. The fact that the port is a significant distance from all the main UK North Sea wind farms would also be a disincentive for any major turbine manufacturer.

Figure 7.5 Aerial View of Ardersier

7.5.18 The HE-HIS Strategic Environmental Assessment concluded that there was potential for development to have significant adverse environmental effects on the designated sites. In summary the assessment stated that:

> *'It is likely that Habitats Regulations Appraisal will be required at the project level, covering at least the following issues:*
>
> - *effects of construction noise and vessel movement on bottlenose dolphins*
> - *effects of construction on birds using habitat within the SPA*
> - *effects of dredging on coastal erosion/deposition patterns and the potential for this to affect the SPA and SAC interests.'*

7.5.19 The site's geographical remoteness is its key weakness.

Dundee

7.5.20 The port has 24 ha available in the port. The city also has two other sites (57 ha and 97 ha) within 3 miles of the port but with no direct quay access. The port has 1 800 m of quay but this is not continuous, is already utilised by existing customers and is partially lock bound. Development of the port for the offshore wind sector would require reclamation and consequential habitat loss within the Firth of Tay and Eden Estuary SAC.

7.5.21 The landholding is clearly too dispersed to provide a base for an integrated manufacturing and construction port facility.

ABP Hull

7.5.22 The port of Hull is owned by ABP and is 10 km upriver from the application site. An aerial view of Hull is shown in *Figure 7.6*.

Figure 7.6 Aerial View of Hull

7.5.23 It is currently a general purpose port handling dry bulks, general cargo, containers and roll-on/roll-off services as well as passenger traffic. Consent was granted in 2006 for the development of a 12 ha riverside berth with 600 m of quayside adjacent to Alexandra Dock on the western end of the port. The consent provided for the development of a container terminal and is likely to require a new authorisation to cover a different use.

7.5.24 Development of the site was subject to an appropriate assessment (Department for Transport, 2005) which agreed with English Nature (as so named at the time) that the development would have an adverse effect on the integrity of the Humber Estuary designated site because it would, 'result *in the loss of about four hectares of inter-tidal mudflats used by waders and other water birds, while demolition of West Wharf Pier would result in a loss of roosting habitat'*. In the event consent was granted on the basis that no alternatives existed and that the development was required for imperative reasons of overriding public interest (IROPI). The decision letter noted that:

> *'(t)he Secretary of State accepts the Applicant's case that the port forms part of the national infrastructure and is a valuable component in the national and regional logistics chain. The port plays a vital role in the national feeder container market and in the continental short sea shipping market. The potential of Hull and of the Humber Region to provide a major link between Ireland, the UK and continental Europe is*

recognised in Regional Planning Guidance note 12. The Secretary of State observes moreover that Hull and the Humber ports form one of the key areas in the three northern Regional Development Agencies' Northern Way initiative for the regeneration of the North of England.'

7.5.25 Despite the IROPI case being accepted, the consent has never been implemented and ABP has since marketed the facility to the offshore wind industry and has also proposed infilling half of Alexandra dock to offer more development land. Further quayside would also be available within the King George Dock, although this would be beam restricted by locks. In January 2011, Siemens identified Hull as their preferred location for the construction of a new offshore wind turbine factory that further evidences the potential of the Humber as a manufacturing and port hub for the offshore wind sector.

7.5.26 A 200 ha satellite site is available close to Hull Docks but is separated from it. If it were to be developed as a manufacturing site additional quays would need to be developed. The land has a narrow frontage onto the estuary.

7.5.27 The development of Hull for a turbine factory is already progressing. Accordingly, this is not an alternative site and does not preclude the need an MEP.

<u>Bathside Bay</u>

7.5.28 Bathside Bay lies within the Stour and Orwell Estuaries SPA and Ramsar site. It also lies within the Stour Estuary SSSI.

7.5.29 Bathside Bay is located on the south bank of the river Stour in Essex next to the existing port of Harwich. The existing port of Harwich is 125 km from the East Anglia zone, 250 km from the Hornsea zone and 400 km from the Dogger Bank zone. An aerial view is shown in *Figure 7.7.*

Figure 7.7 Aerial View of Bathside Bay

7.5.30 Bathside Bay was given planning permission in 2006 for a container terminal able to accommodate the world's largest vessels. An artist's impression of the completed terminal is shown in *Figure 7.8*. The consent is limited to ten years but the recession has affected the growth of the container market that has meant that demand has not yet justified its construction. Hutchison Ports (UK) Ltd (HPUK) is currently working to extend the consent up to 2021. If constructed, the project would see up to 113 ha of port land reclaimed and 1 400 m of quayside built. There would be no beam restrictions and a 15 m water depth limit.

Figure 7.8 Artist's impression of completed container terminal at Bathside Bay

7.5.31 The consented development will result in the direct loss of 69 ha of intertidal feeding habitat within the SPA. As a consequence the development has been assessed to have an adverse effect on the integrity of the designated site and a 138 ha managed realignment site has been secured to compensate for the damage to the coherence of the Natura 2000 network. The development was consented on the basis that there were imperative reasons of overriding public interest for a container terminal to be developed at the site and that no alternatives existed.

7.5.32 It is likely that use of the terminal for anything other than containers would require either a change of use of the extant permission or a new development consent. The land area available is sufficient for the requirement of a construction port with associated manufacturing.

7.5.33 While HPUK has marketed the development to the offshore wind industry, it appears firmly committed to its container port plans in the long term. This is shown by the fact that the company has described its ambitions for offshore wind in the port as a temporary measure in the interim before demand for containers picks up sufficiently. Turbine manufacturers are expected to require tenancies in ports lasting 15 years or more and that is inconsistent with the development of a permanent manufacturing hub.

7.5.34 In conclusion of the above, a 110 ha could feasibly be located on this site but such development would:

- permanently displace consented container terminal development that is required for imperative reasons of public interest;
- destroy more Natura 2000 land than the Able Humber site whilst providing less land for manufacturing.

Sheerness

7.5.35 The Port of Sheerness is located on the bank of the Medway near its confluence with the Thames. An aerial view is shown in *Figure 7.9*. The port is 180 km from the East Anglia zone, 300 km from the Hornsea zone and 450 km from the Dogger Bank zone. Sheerness is not located within in a European designated site although the Thames Estuary and Marshes SPA and the Medway Estuary and Marshes SPA are both in close proximity.

Figure 7.9 Aerial View of Sheerness

1. Ridham Dock
2. Neats Court
3. Queensborugh
4. Sheerness
5. Isle of Grain
6. Kingsnorth (off picture)

7.5.36 The Port handles over 450 000 T per year of high value forest products including pulp, packaging paper, printing paper, sheet material and lumber. In addition it handles 700 000 T of fresh produce per annum having invested £70 million since 1990 in dedicated facilities. A significant area of land is also used for car storage with around 400 000 units currently being handled each year. Other cargo is also brought in at the Port including steel products, aggregates and cement.

7.5.37 The South East England Development Agency (SEEDA) has published an information brochure, '*Offshore Wind: Opportunities in South East England*', which provides details of potential facilities at Sheerness. SEEDA state that the port could currently release 50 ha of land for offshore wind with the potential for > 85 ha in the future although it has not defined which areas of the port this covers. The only feasible location for this land is the existing car storage area. It has also said that a further 80 ha could be made available in the future through an undefined reclamation scheme.

7.5.38 In terms of quayside, 330 m of jetty is currently available which is accessed by a pier. This jetty and pier arrangement is not suitable for use by the offshore wind industry and the quay could only be made suitable by land reclamation works. A further 630 m of quay is said to be potentially available but, again, this could only feasibly be achieved by further significant land reclamation works.

7.5.39 In addition to the existing port estate, the Regional Development Agency identified a number of additional sites that are all within 10 km of the port by road or barge. These include Ridham Docks (6 ha, 200 m quay, 6.2 m draft), Queensborough (12 ha) and Neats Court (36 ha).

7.5.40 On the north bank of the Medway, there is a 46 ha site at Kingsnorth and up to 150 ha on the National Grid's Isle of Grain site. Both sites are currently undeveloped and would require the construction of port facilities.

7.5.41 While the port is able to offer parcels of land almost immediately, that land parcel is currently too small. The additional sites in the surrounding area could help meet the total land requirement but the benefits of clustering would potentially be diminished by the need to load units onto barges to be moved between sites.

7.5.42 The location of the site also means that while it is well located to serve the East Anglia zone and the southern North Sea, it is not favourably located for the Hornsea or Dogger Bank zones.

7.5.43 In conclusion of the above, an 80 ha site or thereabouts could feasibly be located at Sheerness but such development would:

- permanently displace a significant quantum of existing international trade activity;
- need development of the existing quays including land reclamation and potentially dredging; a likely significant effect on nearby SPA's cannot be excluded;
- provide a less optimal geographic location than Able Humber and thereby give rise to a greater overall carbon footprint from vessels travelling to the three main offshore development zones.

Southampton

7.5.44 The port of Southampton is shown in *Figure 7.10*. It is owned and operated by ABP and is located on the UK's south coast. It is a mixed use port, handling a range of traffic including cars, containers and cruise liners. The main port is heavily utilised with limited spare land available but it does have a 323 ha site called Dibden Bay available on the western bank of the river Test. Dibden Bay lies within the Solent

Maritime SAC, and the Solent and Southampton Water SPA and Ramsar sites. All of these habitats fall within the Hythe to Calshot SSSI.

7.5.45 That site was the subject of a £600 million proposal submitted by ABP in 2000 for a deep water container terminal with a 1 850 m quay and 202 ha of port facilities. However the application faced strong local opposition and was rejected on environmental grounds in 2004 following a public inquiry. According to the Inspectors Report (The Planning Inspectorate, 2003),

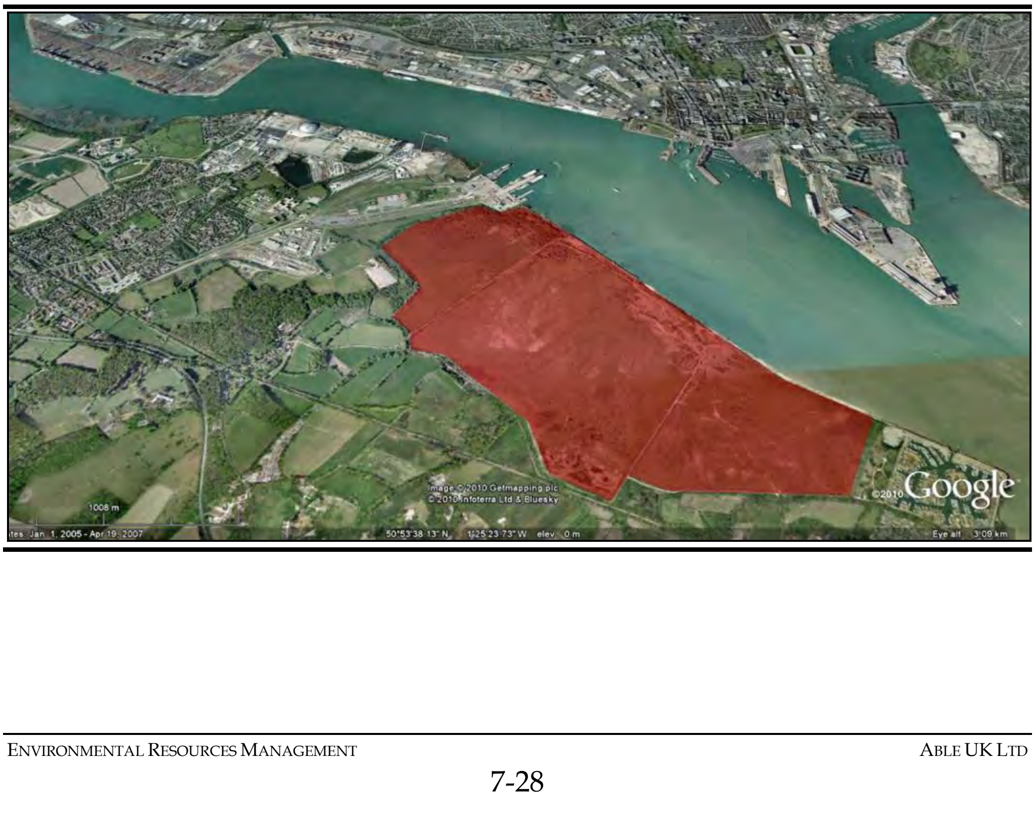
> *'(t)he construction of the proposed quay, and the dredging of the deep-water berthing pocket and approach channel, would entail the destruction of some 76ha of inter-tidal mudflat on the Dibden foreshore, together with 52ha of shallow sub-tidal habitat. This harm is unavoidable if the project proceeds. It cannot be mitigated,'* (paragraph 7.94).

7.5.46 The site is currently undeveloped with no quay and any proposal would require planning permission to proceed.

7.5.47 Southampton is 450 km from the East Anglia zone, 600 km from the Hornsea zone and 700 km from the Dogger Bank zone.

7.5.48 While the Dibden Bay site would meet the requirements for a Marine Energy Park, its location on the south coast means it is too far from the main North Sea sites to be viable as major turbine manufacturing and construction cluster. Development would also result in significant environmental impact to a designated site.

Figure 7.10 Aerial View of Southampton



7.5.49 In conclusion of the above, a large MEP could feasibly be located on this site but such development would:

- exclude its potential development as a container terminal in the future;
- destroy significantly more Natura 2000 land than the Able Humber site whilst providing only a small additional area of land for manufacturing;
- provide a far less optimal geographic location than Able Humber and thereby give rise to a much greater overall carbon footprint from vessels travelling to the three main offshore development zones.

Summary of Alternative Sites

7.5.50 A brief summary of salient features relating to alternative sites is detailed in *Table 7.2*. There is no alternative site that is of an equivalent scale to AMEP except for Southampton and development of that site would result in the destruction of significantly more of the Natura 2000 network than would AMEP. Whilst a combination of other smaller cluster sites could provide an equivalent distributed facility, the two sites in Scotland, Nigg and Ardersier, are remote from the main Round 3 development zones and this would result in a significantly greater operational carbon footprint for the facility than AMEP.

7.5.51 An assessment of the relative carbon footprint associated with a cluster site compared to a UK distributed site, and a continental distributed site is reproduced in *Annex 6.2.*

Table 7.2 Summary of Alternative Sites

	Nigg	Ardersier	Southampton	Sheerness	Bathside Bay	ABP Hull	Able Humber
Area Available (ha)	70 (234 ha proximal land is on sloping ground)	109 (28 ha additional land available)	323	50 (+ potential for an additional 85 ha)	113	82	330
Potential Quay Length (m), and Draught	420 m @ 9.4m (existing)	1 000 m @ 4.5 m (new quay req'd)	1 850 m @ 16 m (new quay req'd)	800 @ 9m (new quay req'd)	1 400 m @ 15 m (new quay req'd)	600 m @ 11m (new quay req'd)	1200 m @ 11m (new quay req'd)
SPA/SAC Site	Cromarty Firth SPA/Ramsar	Moray Firth SAC, Inner Moray Firth SPA/Ramsar	Solent Maritime SAC, Southampton Water SPA/Ramsar	Proximal to Thames Estuary and Marshes SPA, Medway Estuary and Marshes SPA	Stour and Orwell Estuary SPA/Ramsar	Humber Estuary SPA/SAC/Ramsar	Humber Estuary SPA/SAC/Ramsar
Area of European Site likely to be adversely affected	Unquantified indirect effects	Unquantified indirect effects	Up to 128 ha	Unquantified indirect effects	69 ha	4 ha	55 ha
Proximity to Wind Farm zones (NM):							
Dogger	283	283	377	244	202	117	111
Hornsea	328	328	310	168	131	46	40
Norfolk	421	421	218	90	53	108	102
Existing Planning Consents	No, existing use is for offshore fabrication	Yes, site has been remediated for housing	No, application for container terminal refused in 2004	No, operational port activity would be displaced	Yes, for container terminal that would be displaced.	Yes, for container terminal that would be displaced.	Yes, on terrestrial areas for 116 ha of port related storage

Conclusions

Stage 2A

7.5.55 From the above assessment, there are no sites outside of the Natura 2000 network capable of supporting a marine energy park that would achieve AMEP's objectives.

Stage 2B

7.5.56 From the above assessment, only Southampton has a land parcel of sufficient scale to support AMEP. However, development of Southampton would have a greater impact on the Natura 2000 network than development of the application site, provide no socio-economic benefit to the Humber Assisted Area, and its operation would generate a greater carbon footprint than AMEP.

Stage 2C

7.5.57 From the above assessment, only the Port of Hull, the Port of Sheerness and Bathside Bay are likely to be viable. Of these three, the development of Bathside Bay would have a greater impact on the Natura 2000 network than development of the application site. The remaining two are existing ports and their development would displace existing or, in the case of ABP Hull, proposed international trade capacity.

7.5.58 The Port of Hull has been identified by Siemens for turbine manufacturing, and as such is not an alternative to AMEP; it is needed as well. The provision of a facility at Hull would not remove the urgent need for windfarm manufacturing that drives the requirement for a facility of the scale of AMEP.

7.5.59 The Port of Sheerness has been identified by Vestas for turbine manufacturing, and as such is not an alternative to AMEP; it is needed as well. Manufacturing at the Port of Sheerness would however displace existing international trade activity that will erode the buffer capacity of the UK's existing port infrastructure.

Overall Conclusion

7.5.60 There is no alternative site to Able Humber that would have a less damaging effect on the Natura 2000 network. Other, smaller potential development sites will be needed as well and are therefore not alternatives.

7.6 *STAGE 3A: ALTERNATIVE SCALE OF DEVELOPMENT*

Reducing the Scale of Development

7.6.1 AMEP comprises the development of 223 ha of land for manufacturing of components that need direct access to a quay. It has been demonstrated in *Chapter 5* of the ES that there is a significant need for land to be developed for this use both in the UK and in Europe. AMEP is not of a sufficient scale in itself to meet the overall need – other developments are required as well. Reducing the scale of the development would merely transfer the need for that quantum of development omitted to be located elsewhere. However, the number of potential alternative sites is limited; other sites are needed as well and others are also located within, or adjacent to, the Natura 2000 network themselves. Accordingly, the alternative of reducing the scale of the development is discounted as it inconsistent with the imperative need to urgently provide significant facilities for the manufacture of marine energy products.

7.7 *STAGE 3B: ALTERNATIVE DESIGNS*

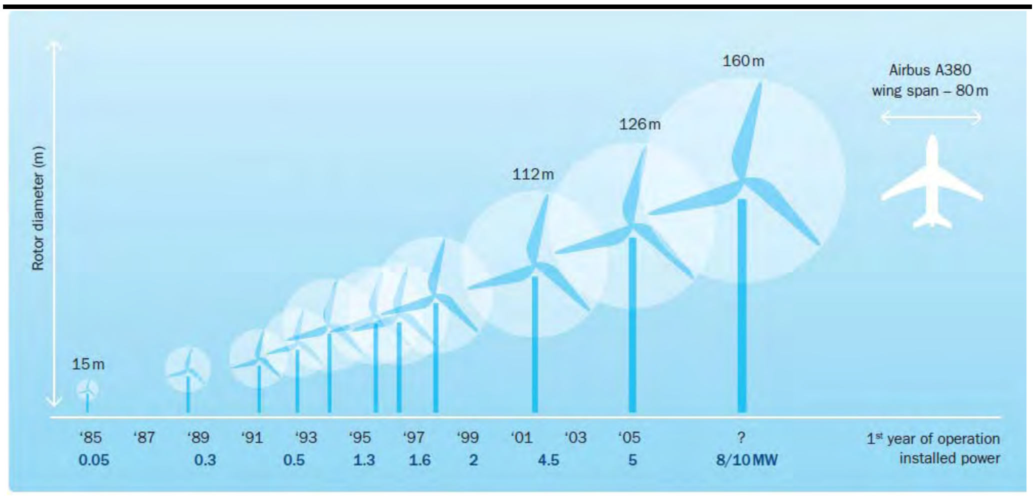
Introduction

7.7.1 Offshore energy component parts are of a significant size and weight. *Table 7.3* shows how the size and weight of turbine components is expected to increase as generating capacity of individual units grows. Development to date is illustrated in *Figure 7.11.*

Table 7.3 Growing Scale of Current and Future Turbines

	3-4 MW		5-6 MW		8-10 MW	
	Mass (tonnes)	Dimensions (metres)	Mass (tonnes)	Dimensions (metres)	Mass (tonnes)	Dimensions (metres)
Nacelle and hub	180	13x4x4	400	15x8x8	500-700	16x9x9
Blade (3 per turbine)	20	50x5x3	25	65x7x3.5	30	75x8x4
Tower	250	80x5x5	300	85x6x6	500	100x7x7

Figure 7.11 Size Evolution of Wind Turbines over Time



Source:(EWETP, 2008)

7.7.2 The movement of such oversized and heavy components require heavy duty craneage – in excess of 1 000 T rated capacity – and self propelled mobile transporters. Such plant imparts heavy concentrated loads on the ground or any supporting structure over which it travels. The components themselves require commensurately large laydown areas and areas for pre-assembly into the fewest possible parts for shipping and installation offshore. Because of the size and weight of the sub-components of the OWT, pre-assembly takes place at the quayside where goods are stored in preparation for loading. The land immediately behind the quay is therefore a large storage and assembly – an area of 5 ha is normally required by the offshore sector behind each installation quay. A typical construction port is illustrated in *Figure 7.12.*

7.7.3 Alternative designs for a pier and jetty arrangement of quays and for a suspended quay are considered in *Annex 4.4* of the ES. They were discounted as being not fit for the purposes of the offshore energy sector.

Conclusion

7.7.4 There is no feasible alternative design that will be fit for use by the offshore energy sector.

Figure 7.12 Port of Nyborg – Land Use at a Construction Port

Source: Associated Danish Ports

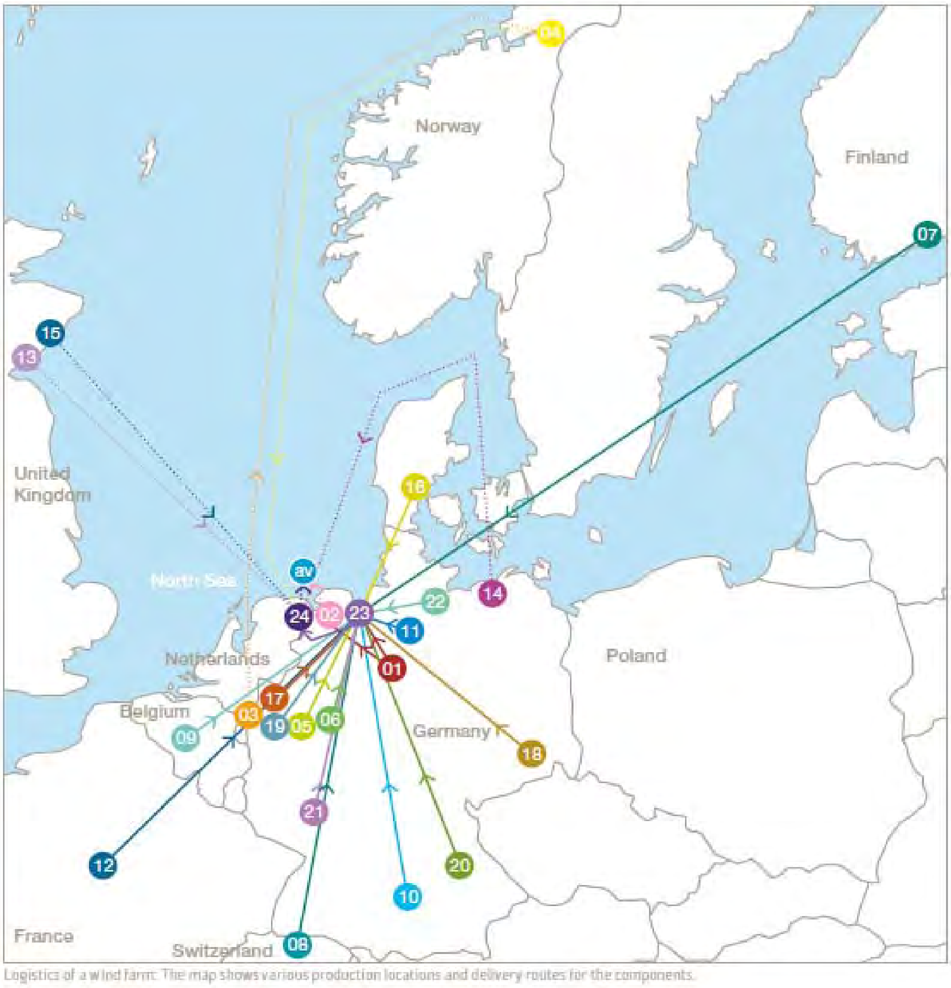
7.8 *STAGE 4: ALTERNATIVE OPERATION OF THE FACILITY*

Introduction

7.8.1 To date, offshore wind farm developments have substantially comprised onshore technology with special offshore foundations. The existing onshore manufacturing sector is widely distributed and has led to significant logistical challenges in transporting sub-components to the construction ports for preassembly before shipping to the wind farm site itself.

7.8.2 *Figure 7.13* below illustrates an example of components being sourced from across Europe for the German Alpha Ventus wind farm.

Figure 7.13 Distributed Supply Chain for the Alpha Ventus Wind Farm



Source: www.alpha-ventus.de

7.8.3 The European Wind Energy Technology Platform, which is supported by the EC, identified two key major challenges in the assembly and installation of large-scale offshore wind farms (EWETP, 2008). One of these was the transfer of components from suppliers across Europe to wind farm sites. This was acknowledged to be a complex and repetitive logistical process, which required efficient transport links, large drop-off areas and good harbours. To be capable of meeting the needs of an expanding offshore market EWETP noted that:

> *'**The installation industry will need to develop safe, efficient, reliable processes** that are easy to replicate. In turn these will reduce costs, minimise risks, guarantee standards and deliver investor confidence. In order to achieve these goals, the industry will require a variety of vessels and installation equipment to cope with the range of turbines, sub-structures and environmental conditions that will be encountered**. … mobilisation and assembly will require good harbours with suitable drop-off areas**; these are a scarce resource in*

many of the areas designated for offshore development. Substantial investment will be required to develop suitable facilities', (emphasis added)

Environmental Benefits of Combined Manufacturing Facilities and Construction Ports

7.8.4 At a combined site, manufactured products can be transferred to a goods handling zone with quays that are specifically designed for use by installation vessels. This avoids transhipment of finished components to other ports and provides an environmental benefit by cutting CO_2 emissions from shipping that would otherwise arise from "double handling" the manufactured products. The environmental benefit, in terms of reduced CO_2 emissions, of the operation of a significant combined facility is set out in *Annex 6.2* of the ES.

Economic Benefits of Combined Manufacturing Facilities and Construction Ports

7.8.5 If the current approach to manufacturing and assembly continues, then the potential economic benefits of scale will be diminished. The delivery of offshore windfarms is far less likely to undergo a step change in scale and as a result the UK is far less likely to meet the targets set out in its Renewable Energy Strategy. The challenge of sourcing and then coordinating the delivery of many different components to a remote construction quay is an unnecessary cost.

Health and Safety Considerations

General

7.8.6 In considering alternative methods of operation, it is necessary to consider the impact on the health and safety of persons who will be working on the site and on offshore windfarm installation generally. The guiding principle is that risks to the workforce should be '*as low as reasonably practicable'*, or ALARP. For a risk to be ALARP it must be possible to demonstrate that the cost involved in reducing the risk further would be grossly disproportionate to the benefit gained. It is often a judgment of the balance of risk and societal benefit.

Council Directive 89/391/EEC

7.8.7 This Directive introduced measures to encourage improvements in the safety and health of people at work. Article 6 of the Directive places general obligations on employers as follows:

'1. Within the context of his responsibilities, the employer shall take the measures necessary for the safety and health protection of workers, including prevention of occupational risks and provision of information and training, as well as provision of the necessary organization and means.

The employer shall be alert to the need to adjust these measures to take account of changing circumstances and aim to improve existing situations.

2. The employer shall implement the measures referred to in the first subparagraph of paragraph 1 on the basis of the following general principles of prevention:

(a) ***avoiding risks****;*

(b) evaluating the risks which cannot be avoided:

(c) combating the risks at source;

(d) adapting the work to the individual, especially as regards the design of work places, the choice of work equipment and the choice of working and production methods, with a view, in particular, to alleviating monotonous work and work at a predetermined work-rate and to reducing their effect on health.

(e)adapting to technical progress;

(f) ***replacing the dangerous by the non-dangerous or the less dangerous****;*

(g) ***developing a coherent overall prevention policy which covers technology, organization of work****, working conditions, social relationships and the influence of factors related to the working environment;*

(h) giving collective protective measures priority over individual protective measures;

(i)giving appropriate instructions to the workers.'

7.8.8 The Directive is transposed into UK law by the Management of Health and Safety at Work Regulations 1999. Accordingly, in considering alternative means of operation, even at this stage, it is necessary to consider whether risks are being introduced that can be avoided.

Alternative 1: No Pre-Assembly on site

7.8.9 The development could potentially operate as a manufacturing facility with an import/export quay only. All products manufactured at the site would be exported to a separate construction port. There, they would be stored in preparation for the installation campaign. There are however significant adverse safety considerations with this approach.

Logistical Challenge

7.8.10 In *Alternative 1* a number of shipping movements are required in order to transfer the goods produced by the manufacturers to a separate construction port. The construction port needs to be equipped with duplicate cranage and the same heavy transporters as the manufacturing site. Once the installation commences the products will need to be taken back to the quay for assembly and loading back onto a vessel. Developers are therefore duplicating plant and resources.

The Safety Case

7.8.11 In *Alternative 1* a number of heavy lifting operations are undertaken that can be avoided compared to pre-assembly being undertaken at the manufacturing port. Whilst good planning and adherence to good practice, can mitigate the risk of an accident occurring during a crane lift, human error, inevitably, remains. Unfortunately where an incident does occur during a heavy lift, the consequences can be severe. Accidents are only one health implication of crane-lifts however; in this particular alternative any overall assessment would also need to consider the health impacts caused by producing, using and maintaining all of the duplicated plant. Furthermore, fuel production and use leads to emissions, which in turn has health impacts.

7.8.12 The occupational hazards associated with offshore wind farms have been considered in a major risk study reported by the Health and Safety Executive. This concluded that the principal safety hazards arise from:

> *'Construction and major repair: operation of jack-up construction barges and associated* ***lifting operations*** *during tower and nacelle erection. These* ***health and safety issues may be more challenging in the future, as the new generation of wind turbines become significantly larger and taller****.*
>
> *Operation (maintenance and minor repair operations): primary issues are access and egress (frequent personnel transfers between boats/construction vessels/towers), working at height, and emergency response. It is anticipated that each offshore wind turbine could require up to six maintenance or repair visits per year'*, (HSE, 2006, emphasis added).

7.8.13 A further report on health and safety challenges related to offshore renewable energy detailed 17 incidents that have occurred since 2006 during works to construct, transport, install and maintain offshore wind turbines. Of these, eight incidents, around half of all incidents occurred as a result of crane lifts. Two of the incidents resulted in a fatality, (Sintef, 2011).

7.8.14 It is clear from the above that in accordance with ALARP principles, lifting operations should be kept to an absolute minimum. Using a separate construction port should be avoided where it is reasonably practicable to do so and accordingly, the development should incorporate construction quays for any wind farms within reasonable sailing time.

7.8.15 *Alternative 1* is discounted as it introduces demonstrable and unnecessary risks for those people working on the construction and installation of marine energy projects; it prolongs the construction programme, increases costs and increases the environmental impact of the operations being undertaken.

Alternative 2: Maximum Pre-Assembly on Site

7.8.16 This is the alternative proposed and provides an optimal environmental and economic solution and reduces risks to as low as reasonably practical by substantially reducing trans-shipment of goods to a construction port.

7.9 SUMMARY AND CONCLUSION

The Project

7.9.1 The proposed development incorporates a quay that adversely affects protected features within the Humber Estuary SAC. It is also likely to have an adverse effect on features of the Humber Estuary SPA and Ramsar site.

The Project Objectives

7.9.2 The project will contribute towards the achievement of three key objectives of European Energy Policy, viz.

- decarbonise the means of electricity production;
- provide secure energy supplies for the UK;
- improve EU competitiveness by creating jobs and growth in a sector in which European business is a global leader.

In particular the project will:

- provide facilities for the manufacture of large scale offshore energy components;

- contribute to 'rebalancing' the UK economy by enabling the development of a significant manufacturing cluster - such a cluster will have a beneficial impact on the competitiveness of the European offshore wind industry; and

- regenerate the Humber Estuary sub-region, an economically deprived area of the UK.

The Habitats Regulations

7.9.3 In accordance with the Conservation of Habitats and Species Regulations 2010, where an appropriate assessment concludes that the project will give rise to significant adverse effects on a European Site and that these cannot be fully mitigated, then the project may only be consented where: there is a need; there are no feasible '*alternative solutions*', '*the plan or project must be carried out for imperative reasons of overriding public interest*' and acceptable compensatory land is secured. This part of the Habitat Regulations report has considered whether there is any alternative solution to the need that would have a lesser effect on the Natura 2000 network.

The Alternative Solutions

General

7.9.4 Any alternative solution must meet the project objectives noted above.

Zero Option

7.9.5 The growth of the marine renewable energy sector and specifically the offshore wind sector is rooted in European policy.

7.9.6 Next generation offshore wind turbine manufacturing facilities must have direct access to a quay as they are too heavy to transport by road or rail. A quay is therefore an essential requirement for new offshore turbine manufacturing facilities. It is likely that over ten quays, 200 m long, will be required just to deliver the UK's renewable energy targets for offshore wind.

7.9.7 The zero option, which is that there are no new quays for use by the offshore renewable energy sector, can be discounted.

Alternative Sites

7.9.8 A number of port sites are identified in the publication, *UK Offshore Wind Ports Prospectus* (DECC, 2009). The report contains details of 26 potential ports, 16 of them on the southern and eastern shoreline of the UK, which could be developed to serve the offshore wind industry in some capacity.

7.9.9 Of the 16 potential locations, eight have clear size limitations in terms of their development as a manufacturing and construction port cluster. The remaining alternatives to AMEP are Nigg, Ardersier, Dundee, ABP Hull, Bathside Bay and Sheerness.

7.9.10 There is no alternative site that is of an equivalent scale to AMEP except for Southampton and development of that site would result in the destruction of significantly more of the Natura 2000 network than would the development of AMEP. Whilst a combination of other smaller cluster sites could provide an equivalent distributed facility this would result in a significantly greater operational carbon footprint for the facility than AMEP. An assessment of the relative carbon footprint associated with a cluster site compared to a UK distributed site, and a continental distributed site is reproduced in *Annex 6.2* of the ES.

Alternative Scale of Development

7.9.11 AMEP is not of a sufficient scale in itself to meet the overall need – other developments are required as well. Reducing the scale of the development would merely transfer the need for that quantum of development omitted to be located elsewhere. However, the number of potential alternative sites is limited; other sites are needed as well and others are also located within, or adjacent to, the Natura 2000 network themselves.

Alternative Designs for the Development

7.9.12 The offshore renewable energy sector requires facilities that allow manoeuvring of very large and very heavy components. These components need direct access from their place of manufacture to an export quay. Pre-assembly of several large components close to the quay is also required, necessitating laydown areas and areas for heavy lift cranage. The result is that the quay needs to be fully reclaimed to provide a design that is fit for purpose. There is no feasible alternative design.

Alternative Means of Operation

7.9.13 Providing a bespoke facility that enables manufactured products to be shipped directly to their place of installation minimises the carbon footprint of the operational facility, provide economic benefits, and minimise risks from heavy lifting operations.

8 *IMPERATIVE REASONS OF OVERRIDING PUBLIC INTEREST (IROPI)*

8.1 INTRODUCTION

Legislation

8.1.1 In accordance with the Conservation of Habitats and Species Regulations 2010, where an appropriate assessment concludes, or is uncertain, that a plan or project will give rise to significant adverse effects on a European Site and those effects cannot be fully mitigated, then that plan or project may only be consented where: there is a need; there are no feasible '*alternative solutions*' and '*the plan or project must be carried out for imperative reasons of overriding public interest*'. In the case of these tests being met, acceptable compensatory land must be secured to ensure the coherence of the Natura 2000 network. This part of the report summarises the competing imperative reasons of overriding public interest that relate to the project.

Guidance

8.1.2 According to, 'Managing Natura 2000 Sites: The Provisions of Article 6 of the 'Habitats Directive 92/43/EEC' (EC, 2000),

> *'(t)he concept of 'imperative reason of overriding public interest' is not defined in the directive. However, Article 6(4) second subparagraph mentions human health, public safety and beneficial consequences of primary importance for the environment as examples of such imperative reasons of overriding public interests. As regards the 'other imperative reasons of overriding public interest' of social or economic nature, it is clear from the wording that only public interests, promoted either by public or private bodies, can be balanced against the conservation aims of the directive. Thus, projects that lie entirely in the interest of companies or individuals would not be considered to be covered'.*

8.1.3 Thus, where the balance of public interests weighs in favour of interests other than the strict protection of the Natura 2000 site, a decision maker may consent a project, even where the possibility of that project having an adverse effect on the integrity of a particular site cannot be excluded. This is normally only the case where the public interest is long term and where the interests are clearly in accordance with the fundamental policies of the State and for the benefit of society as a whole.

8.1.4 As the project does not threaten a priority habitat or species Article 6(4) of the Habitats Directive explicitly permits the following categories of IROPI to be considered:

- human health;
- public safety;
- socio-economic;
- beneficial consequences of primary importance for the environment, and,
- other imperative reasons that are subject to the opinion of the European Commission.

The Basic Case

8.1.5 Fundamentally, the project will deliver socio-economic benefits to the UK generally and the Humber Estuary sub-region in particular by enabling the growth of the emerging renewable energy sector. It will also have beneficial consequences of primary importance for the environment by enabling Europe's necessary transition to low carbon energy production.

8.1.6 Energy is essential for society to function but current methods of energy production in Europe are damaging to the environment and rely on non-indigenous fuel sources that are not secure in the long term. To function sustainably, and to be economically competitive, it is a matter of European policy, that Member States' means of energy production must undergo a complete transition to low carbon technologies including offshore wind and tidal energy. In, 'Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions: *Energy 2020 A strategy for competitive, sustainable and secure energy*', (EC, 2010), the EC states that its,

> '*(c)ompetitiveness, (energy) supply security and climate change objectives will be undermined unless electricity grids are upgraded, obsolete plants are replaced by competitive and cleaner alternatives and energy is used more efficiently throughout the whole energy chain*'.

8.1.7 The project will address three key objectives of European Energy Policy, viz.

- Decarbonise the means of electricity production. This is a beneficial consequence of the project that is of primary importance to the environment.

- Provide secure energy supplies for the UK; this is imperative for economic development.

- Improve EU competitiveness by creating jobs and growth in a sector in which European business is a global leader. Economic growth is a socio-economic imperative.

8.1.8 None of the above objectives '*lie entirely in the interest of companies or individuals*'.

8.1.9 In particular the project will:

- provide facilities for the manufacture of large scale offshore renewable energy components;

- contribute to 'rebalancing' the UK economy by enabling the development of a significant manufacturing cluster - such a cluster will have a beneficial impact on the competitiveness of the European offshore wind industry; and

- regenerate the Humber Estuary sub-region, an economically deprived area of the UK.

8.2 DESCRIPTION OF THE IMPERATIVE PUBLIC INTERESTS

The Environmental Imperative to Decarbonise Energy Production

8.2.1 The project will assist in enabling the transition to low carbon means of energy production.

8.2.2 There is compelling scientific evidence that rising levels of greenhouse gases in the atmosphere will have a warming effect on the earth's climate through increasing the amount of infrared radiation (heat energy) trapped in the atmosphere, 'the greenhouse effect'. In total the warming effect due to all greenhouse gases [1] emitted by human activities is now equivalent to around 430 ppm of carbon dioxide and is rising at around 2.3 ppm per year. Current levels of greenhouse gases are higher now than at any time in at least the past 650 000 years.

8.2.3 The potential environmental impacts of climate change are reported in the Stern Review (HM Treasury, 2006); Figure 2 from the Executive Summary is reproduced in *Figure 8.1* below. Potential effects include: rising sea levels that threaten major cities; irreversible damage to ecosystems; major declines in crop yields and water shortages. These potential impacts are beyond any reasonable scientific doubt.

[1] Carbon dioxide (C02), Methane (CH4), Nitrous oxide (N20), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF6), as defined in the Kyoto Protocol

8.2.4 The EC fully accepts the imperative need to reduce greenhouse gas emissions. In 'Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions: A Roadmap for moving to a competitive low carbon economy in 2050' (EC, 2011), the Commission states that:

> *'In order to keep climate change below 2°C, the European Council reconfirmed in February 2011 the EU objective of reducing greenhouse gas emissions by 80-95% by 2050 compared to 1990, in the context of* ***necessary reductions*** *according to the Intergovernmental Panel on Climate Change by developed countries as a group. This is in line with the* ***position endorsed by world leaders*** *in the Copenhagen and the Cancun Agreements. These agreements include the commitment to deliver long-term low carbon development strategies.'*

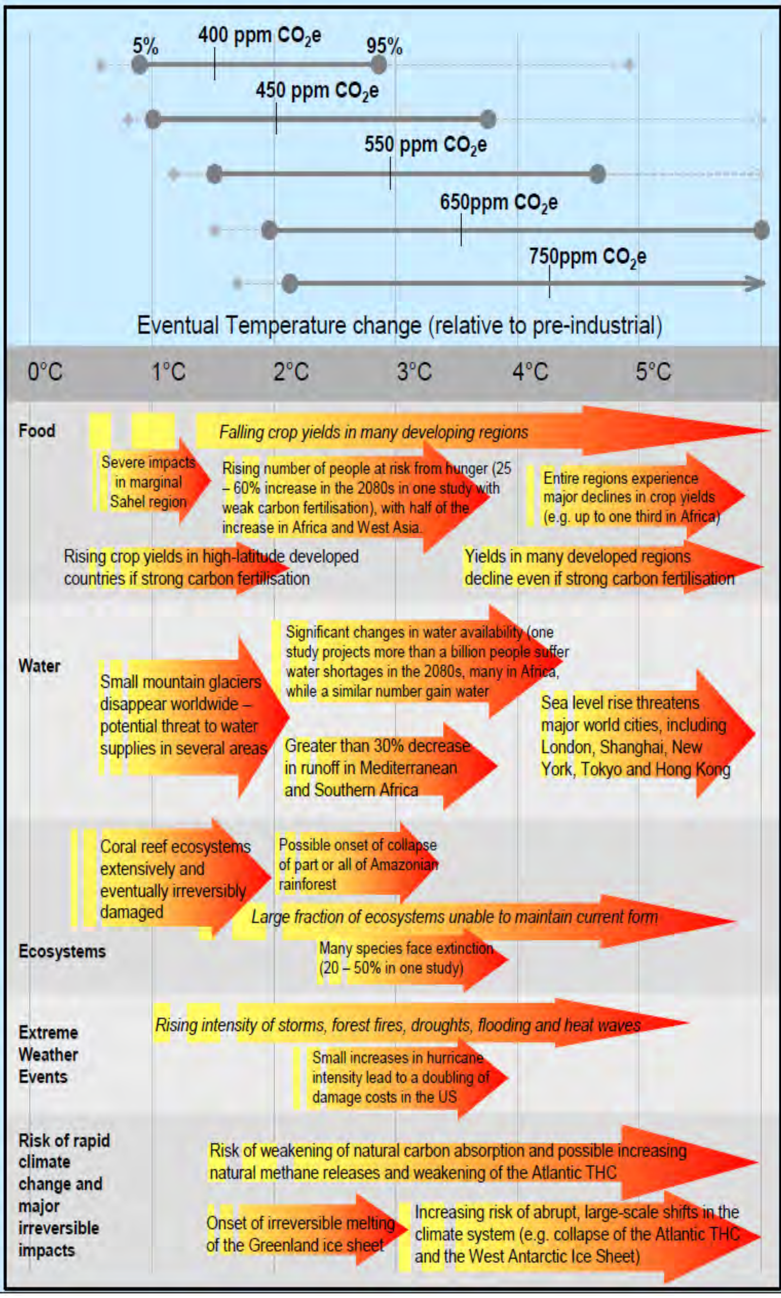
8.2.5 The EC's Roadmap recognizes the central role of electricity in the low carbon economy and of renewable energy sources in delivering the targets. EC policy is to transform its means of energy production over the next forty years. Targets for next decade are set out in the EC's Renewable Energy Directive (2009/28/EC). The 2050 Roadmap provides the longer term objective.

8.2.6 The need for offshore wind to provide a significant source of sustainable energy supplies in the future for both the UK and Europe as a whole, is set out in their respective energy policy documents, as detailed in Chapter 5 of the Environmental Statement for the project. Accordingly manufacturing capacity for offshore wind turbines must increase substantially and it must be located at ports.

Figure 8.1 Abstract from, 'STERN REVIEW: The Economics of Climate Change'

Figure 2 Stabilisation levels and probability ranges for temperature increases

The figure below illustrates the types of impacts that could be experienced as the world comes into equilibrium with more greenhouse gases. The top panel shows the range of temperatures projected at stabilisation levels between 400ppm and 750ppm CO_2e at equilibrium. The solid horizontal lines indicate the 5 - 95% range based on climate sensitivity estimates from the IPCC 2001[2] and a recent Hadley Centre ensemble study[3]. The vertical line indicates the mean of the 50^{th} percentile point. The dashed lines show the 5 - 95% range based on eleven recent studies[4]. The bottom panel illustrates the range of impacts expected at different levels of warming. The relationship between global average temperature changes and regional climate changes is very uncertain, especially with regard to changes in precipitation (see Box 4.2). This figure shows potential changes based on current scientific literature.



The Imperative Need to Secure Indigenous Energy Supplies

8.2.7 Energy is the lifeblood of society. Securing energy supplies from indigenous sources is imperative for long term economic stability within the UK.

8.2.8 The Overarching Energy National Policy Statement, EN-1, states that the need for low carbon electricity generating infrastructure is now 'urgent', and that 59 GW of new electricity generating capacity should be planned for by 2025.

8.2.9 According to, 'Communication from the Commission to the European Council and The European Parliament: An Energy Policy For Europe', (EC, 2007), Europe is becoming increasingly dependent on imported hydrocarbons and,

> *'the EU's energy import dependence will jump from 50% of total EU energy consumption today to 65% in 2030. Reliance on imports of gas is expected to increase from 57% to 84% by 2030, of oil from 82% to 93%.*
>
> *The International Energy Agency (IEA) expects global demand for oil to grow by 41% by 2030. How supply will keep up with this demand is unknown: the IEA in its 2006 World Energy Outlook stated that "the ability and willingness of major oil and gas producers to step up investment in order to meet rising global demand are particularly uncertain". **The risk of supply failure is growing**.*
>
> *In addition, the mechanisms to ensure solidarity between Member States in the event of an energy crisis are not yet in place and several Member States are largely or completely dependent on one single gas supplier.*
>
> *At the same time, EU electricity demand is, on a business as usual scenario, rising by some 1.5% per year. Even with an effective energy efficiency policy**, investment in generation alone over the next 25 years will be necessary in the order of € 900 billion**. Predictability and effective internal gas and electricity markets are essential to enable the necessary long term investments to take place and for user prices to be competitive. These are not yet in place',* (emphasis added).

8.2.10 In, 'Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions: Energy 2020 A strategy for competitive, sustainable and secure energy', (EC, 2010), the EC states that, *'(t)he well being of our people, industry and economy depends on safe, **secure**, sustainable and **affordable energy**', (emphasis added).*

8.2.11 In, 'Communication from The Commission to The European Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions: Offshore Wind Energy: Action needed to deliver on the Energy Policy Objectives for 2020 and beyond', (EC, 2008), it is stated that, *'(w)ind energy will play an essential role in meeting the objectives of the New Energy Policy for Europe'. The Communication concludes by stating that,*

> *'Offshore wind energy is an indigenous resource for electricity production with a vast potential that remains largely untapped. Offshore wind can and must make a substantial contribution to meeting the EU's energy policy objectives through a very significant increase — in the order of 30-40 times by 2020 and 100 times by 2030 — in installed capacity compared to today.'*

8.2.12 Therefore, irrespective of the significant adverse environmental impacts of climate change, the EC needs to develop new, indigenous sources of energy, in order to secure energy supplies into the future. European policy is that wind energy must make a substantial contribution to its energy requirements and that it must, in the future, be delivered from offshore. Accordingly manufacturing capacity of offshore wind turbines must increase significantly.

The Need to Develop Large Scale Wind Turbines

8.2.13 The EC has a developed a Strategic Energy Technology Plan (SET-Plan) that aims to increase, coordinate and focus EU support on key low-carbon energy technologies. Implementation of the SET-Plan began with the establishment of the European Industrial Initiatives (EIIs), which bring together industry, the research community, Member States and the Commission in risk-sharing, public-private partnerships aimed at the rapid development of key energy technologies at European level. One of these Initiatives is the European Wind Initiative (EWI).

8.2.14 The strategic objective of the EWI is to improve the competitiveness of wind energy technologies, to enable the exploitation of the offshore resources and deep water potential, and to facilitate grid integration of wind power. The Initiative has a number of technology objectives including the development of large scale wind turbines in the range 10-20 MW especially for offshore applications. Successfully meeting these objectives is essential to the competitiveness of offshore wind and will also, owing to the physical size and weight of these turbines, necessitate the development of bespoke manufacturing facilities at port locations.

The Imperative Need for Economic Growth in the UK

8.2.15 The project will enable significant investment in manufacturing in the emerging marine energy sector in the UK.

8.2.16 In November 2010 the Government published, 'The Path to Strong, Sustainable and Balanced Growth'. The first paragraph of the report states that:

> '(t)he ***overriding priority*** *of this Government is to return the UK economy to balanced, sustainable growth.* ***Growth is essential*** *for paying down the country's debts, for giving people throughout the country new opportunities, and for making sure that the UK is well placed for competing in an expanding global economy', (emphasis added)*

8.2.17 The concept of a "rebalanced" economy has become central to the debate on how the UK can emerge from recession and generate sustainable growth. One major imbalance is considered to be the level of manufacturing in the UK compared to other industrialised countries. In the UK, manufacturing has declined rapidly in recent decades, falling from 29 per cent of the UK output in 1979 to 13 per cent of output in 2007 (NESTA, 2010).

8.2.18 Independent reports evidence the significant opportunity for the UK to build a manufacturing base for renewables. For example, Renewable UK has estimated that 22 factories will be required for turbines, foundations and cable manufacturing alone (Douglas Westwood, 2010). In an earlier report they estimated that the sector could generate up to 45 000 jobs by 2020 (Bain and Company, 2008). Elsewhere the Carbon Trust has estimated that,

> *'offshore wind will provide the UK with up to 70,000 jobs and £8bn in annual revenues if delivered with a proactive UK Government manufacturing strategy',* (Carbon Trust, 2008, emphasis added)

8.2.19 The 'The UK Low Carbon Transition Plan', (DECC, 2009) recognises the potential for new business opportunities in UK manufacturing stating that:

> *'Many more of us will find ourselves working in a growing low carbon industry. Already 880,000 people in the UK work in the low carbon and environmental sector, a rapidly growing worldwide market worth £3 trillion per year and £106 billion per year in the UK.* ***By 2020, this could rise to more than a million people if we seize the opportunity to establish the UK as a global centre of low carbon industries and green manufacturing.*** *Around 200,000 of these new jobs by 2015 are expected to be in renewable energy, which could grow by a further 300,000*

additional renewables jobs by 2020 as set out in the UK Renewable Energy Strategy, a total of half a million additional UK jobs in the renewable energy industry to 2020. In doing this, the UK will need to focus on low carbon sectors where we are likely to have a competitive advantage such as offshore wind, marine energy, civil nuclear power, carbon capture and storage, renewable chemicals, low carbon construction and ultra-low carbon vehicles, and specialist financial and business services', (pg 112, author's emphasis).

8.2.20 In, 'Communication from The Commission to the European Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions: Investing in the Development of Low Carbon Technologies', the EC states that wind energy must increasingly move offshore and estimates that more than 250 000 skilled jobs could be created in this emerging industry.

8.2.21 Offshore wind component manufacturing offers a significant opportunity for the UK. Government policy on this matter is clear; at a speech to the CBI in October 2010, the Prime Minister announced support for the offshore wind sector saying:

> ***'(w)e need thousands of offshore turbines in the next decade and beyond yet neither the factories nor these large port sites currently exist.*** *And that, understandably, is putting off private investors. So we're stepping in. To help secure private sector investment in this technology, we're providing up to €67.22 million to meet the needs of offshore wind infrastructure at our ports. And to help move things forward, the Crown Estate will also work with interested ports and manufacturers to realise the potential of their sites. It's a triple win. It will help secure our energy supplies, protect our planet and the Carbon Trust says it could create 70,000 job',* (DECC, press release 2010/111, emphasis added).

8.2.22 On the same day the Secretary of State for Energy and Climate Change stated, in respect of offshore wind:

> *'**We want the jobs, manufacturing and skills base for this exciting new industry to be here in the UK,** and we are taking decisions that attract investment. We need world-class infrastructure to support our economic growth,* (emphasis added).

8.2.23 In summary, the offshore manufacturing sector has enormous potential to support economic recovery by creating financial and strategic value. In particular, it can help realise value from the country's distinctive science and technology base and provide employment opportunities for people with a wide range of abilities and skills. Growth in manufacturing is essential to the UK economy.

The Need to Regenerate the Humber Sub-region

8.2.24 A specific imbalance in the UK economy is that between the economic output of different parts of the UK. The past two decades have seen a widening of regional differences in economic growth and job creation in the UK. London and the South East have experienced robust growth, benefiting from the concentration of business and financial services in those areas, whilst the north of England, Northern Ireland and Wales have all lagged behind. This creates economic and social issues that consecutive governments have attempted to rectify. In the short term, regional disparities are likely to become accentuated as heavy public spending cuts hit all regions of the UK in the next few years. The Humber sub-region is an area of particular deprivation and regeneration of this area is essential.

8.3 THE CERTAINTY OF THE IMPERATIVE NEEDS

The Imperative Need to Decarbonise Energy Production

8.3.1 The Stern Review, Executive Summary stated that:

> *'The scientific evidence is now overwhelming: climate change presents very serious global risks, and it demands an urgent global response.'*

8.3.2 In essence, there is no credible scientific doubt that climate change will occur due to rising levels of greenhouses gases in the atmosphere and that its effects will be adverse unless action is taken to reduce emissions.

The Need for Secure Energy Supplies

8.3.3 The need for secure energy supplies is laid down in Article 194 of the Lisbon Treaty.

8.3.4 In, 'Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions: Energy 2020 A strategy for competitive, sustainable and secure energy', (EC, 2010), the EC states that,

> *'Currently, nearly 45% of European electricity generation is based on low-carbon energy sources, mainly nuclear and hydropower.* ***Parts of the EU could lose more than a third of their generation capacity by 2020 because of the limited life-time of these installations.*** *This means replacing and expanding existing capacities, finding secure non fossil fuel alternatives, adapting networks to renewable energy sources and achieving a truly integrated internal energy market',* (emphasis added).

8.3.5 The need for secure energy supplies to replace the current energy mix is certain.

The Need for Large Scale Wind Turbines

8.3.6 Energy costs need to be maintained as low as reasonably practicable. Turbine scaling increases energy capture while reducing general project infrastructure costs and landscape impacts, which ultimately reduce the cost of wind energy. The need for larger turbines is recognised in Europe's Strategic Energy Technology Plan that was endorsed by the European Council in March 2008 and is certain.

The Need for Growth in UK Manufacturing

8.3.7 The need for a healthy manufacturing sector is attested to in a number of Government documents. One of the most recent publications is, 'Growth Review Framework For Advanced Manufacturing' (BIS, 2010). The Foreword to the report notes the following:

> *'On 29 November, the Secretary of State for Business Innovation and Skills and the Chancellor launched the Growth Review - a fundamental assessment of what each part of Government is doing to provide the conditions for business success and address the barriers faced by industry. The Review forms a rolling programme to last the whole Parliament, with a first report by Budget 2011.*
>
> *It is a reflection of the importance that this Government attaches to manufacturing that Advanced Manufacturing is among the first reviews to be taken forward.*
>
> ***Our goals, over the next 10 years, are to:***
>
> ***1. Grow manufacturing in the UK***
> ***2. Make the UK Europe's leading*** **exporter** ***of high value goods and related services***
> ***3. Increase the proportion of the work force seeking, and capable of, a career in manufacturing***
>
> *These are challenging ambitions that should frame our actions for the next 10 years. They reflect the capabilities of UK manufacturing, the strengths of the UK economy, and the* ***opportunities for broad-based growth*** *from globalisation and rising incomes, technological developments, and structural changes such as the move to a* ***low carbon economy.***
>
> *We need a relentless drive for growth that provides the best environment to achieve these ambitions. We need to examine fully the barriers to growth and set out what the Government will do to address them. The*

Advanced Manufacturing Growth Review will take this process forward', (emphasis added).

8.3.8 The need for growth in the manufacturing sector is essential to the UK economy.

The Regeneration of the Humber Sub-Region

Employment

8.3.9 The Humber sub-region is an area of relative deprivation and is in need of substantial investment. Both North Lincolnshire and North East Lincolnshire are currently suffering high levels of unemployment. Even prior to the recent recession, employment growth in the area had been flat compared with the national and regional pattern as illustrated in *Figure 8.2* below. North Lincolnshire specialises in manufacturing, and some of the major sectors are manufacturing of iron, steel and construction. It is an employment structure that is in general weighted towards lower growth and lower value sectors. North East Lincolnshire similarly has a functional specialisation in terms of food processing and manufacturing, though here these sectors are skewed towards fish and chemicals related sectors. The employment structure of the local area results in average wage rates close to the regional average and below the national average.

Assisted Area Status

8.3.10 The site lies within the Humber Assisted Area, as illustrated in *Figure 8.3*; the area is thus recognised by the EC as one that requires investment to raise employment levels and its manufacturing base. (EC, 2007).

English Indicates of Deprivation

8.3.11 The Humber ports regions of North Lincolnshire, North East Lincolnshire and the City of Hull are areas of relative deprivation, which ranked 132, 49 and 11 respectively in the, 'English Indices of Deprivation 2007', (DCLG, 2008).

8.3.12 The need for action to address deprivation in the Humber sub-region is certain.

Figure 8.2 Index of Employment Change 1998 - 2008

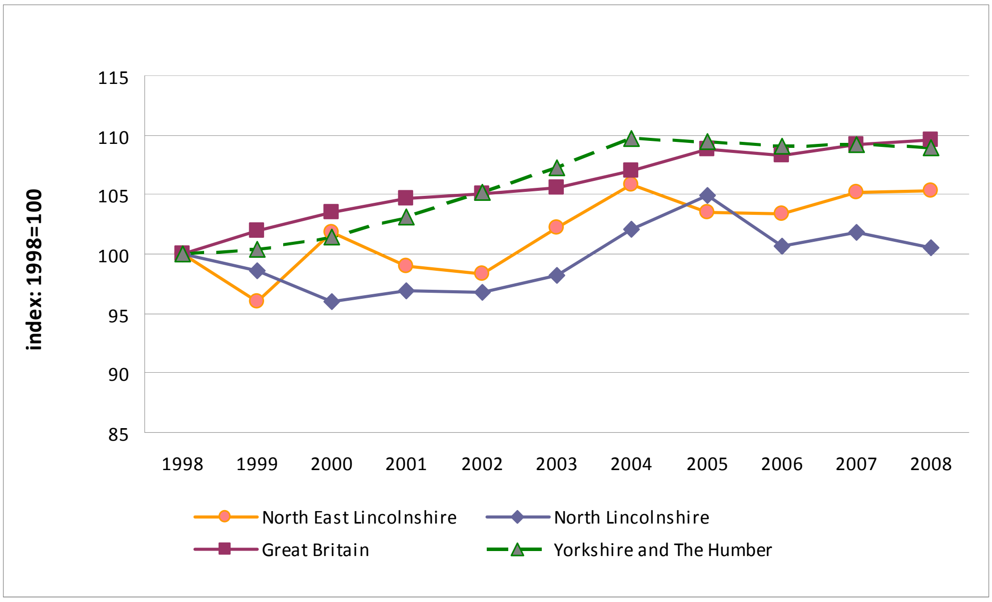
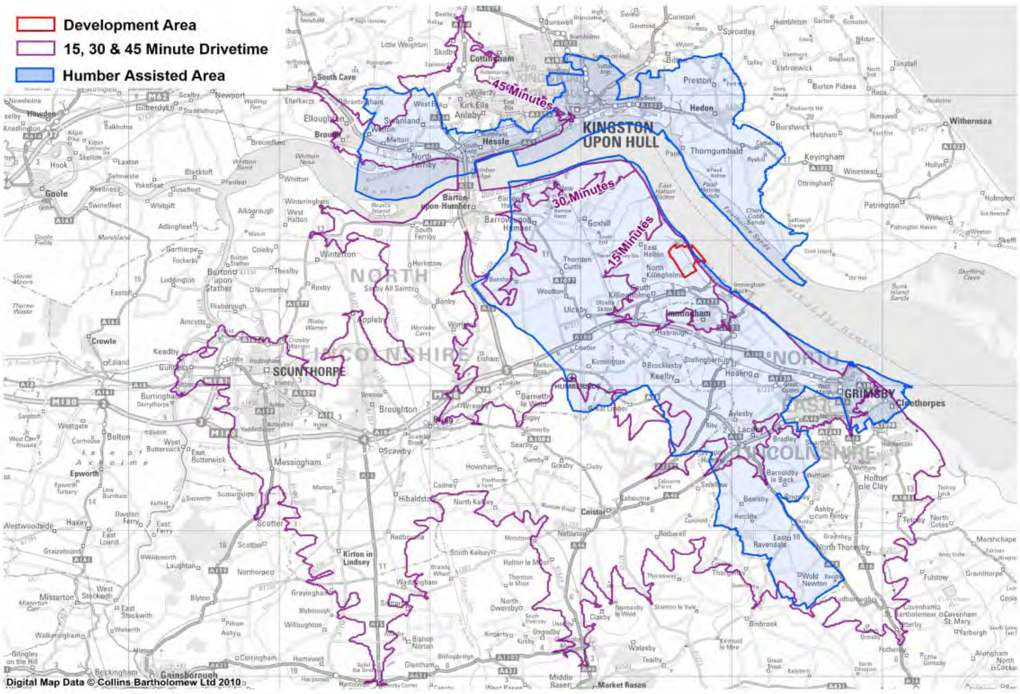


Figure 8.3 Assisted Areas Proximal to the AMEP Site



8.4 *THE IMMEDIACY OF THE NEEDS*

The Imperative to Decarbonise Energy Production

8.4.1 The need to address the overriding environmental impacts of climate change is urgent. The Stern Review, Executive Summary, states that:

> *'The effects of our actions now on future changes in the climate have long lead times. What we do now can have only a limited effect on the climate over the next 40 or 50 years. On the other hand what we do in the next 10 or 20 years can have a profound effect on the climate in the second half of this century and in the next';*
>
> and,
>
> *'the evidence gathered by the Review leads to a simple conclusion: the benefits of strong, early action considerably outweigh the costs'.*

8.4.2 The need for action on climate change is immediate.

Security of Energy Supply

8.4.3 The transition to low carbon means of energy production has commenced but needs to escalate rapidly. Offshore wind is now a substantially proven technology but investor confidence is imperative and the provision of sites that enable significant commercial development is an immediate need. Failure to provide such sites will constrain offshore development.

8.4.4 The UK's Low Carbon Transition Plan (DECC, 2009) records that, because of the lead times for energy infrastructure and the scale of investment required, security of energy supplies during the transition to a low carbon economy is a particular challenge. Accordingly the Plan recognises that *'a supportive climate for timely investment in a diverse mix of low carbon technologies'* is required.

8.4.5 The transition to secure energy supplies cannot be delayed.

Need for Large Scale Offshore Wind Turbines

8.4.6 World production of offshore wind energy is rising. European targets for the next ten years are set out in EU Member States Renewable Energy Action Plans; the total installed capacity is planned to be around 40 GW by 2020, as detailed on *Table 8.1* below.

Table 8.1 EU Member State National Action Plan Targets

	Total renewable energy generation as a percentage of total energy produced			**Offshore wind**		
	2005	**2010**	**2020 target**	**Today**	**2020**	**Offshore wind % of renewable electricity 2020**
UK	1%	4%	15%	1 390 MW	12 990 MW	38%
Germany	6%	8%	18%	67 MW	10 000 MW	15%
France	10%	13%	23%	0 MW	6 000 MW	12%
Netherlands	2%	5%	14%	246 MW	5 178 MW	39%
Spain	9%	11%	20%	0 MW	3 000 MW	5%
Denmark	17%	20%	30%	868 MW	1 339 MW	26%
Italy	5%	8%	17%	-	680 MW	2%
Ireland	3%	6%	16%	25 MW	555 MW	13%
Greece	7%	9 %	18%	-	300 MW	3%
Sweden	40%	42%	49%	164 MW	182 MW	0.5%
Malta	0%	2%	10%	-	95 MW	50%
Portugal	21%	23%	31%	-	75 MW	0.5%

8.4.7 The scale of development in the next decade and beyond represents a step change in offshore development to date. Europe's Strategic Energy Technology Plan has recognised that doubling the output of the largest wind turbines (to >10 MW) is a key challenge for meeting the 2020 targets.

8.4.8 The need for large scale wind turbines to be manufactured is therefore immediate.

The Need for Growth in UK Manufacturing

8.4.9 The UK is currently emerging from recession and is experiencing low but very weak growth. In its report, 'Growth Review Framework for Advanced Manufacturing' (BIS, 2010), the Government identified three key trends in the global economy with *'huge potential for UK manufacturing*'. One of these trends was growth in low carbon and environmental technologies.

8.4.10 The report identified that,

> *'(o)ne of the biggest challenges facing Europe and the rest of the world is the transition to a green economy that is energy and resource efficient. However, environmental considerations can create opportunities for sustainable growth in manufacturing.*
>
> *The global Low Carbon Environmental Goods and Services sector was worth £3.2 trillion in sales in 2008/09 and is estimated to grow by*

approximately 4% per year over the next five years. The sector in the UK recorded sales of £112bn in 2008/09, which represented a nominal annual increase of 4.3% from 2007/08, and exported £10.8bn, with a positive net trade position of £4.5bn (2008).

As traditional manufacturing sectors will have to transform their goods and their energy and resource use, there are also opportunities for the production of energy efficient products and services, and the production of new and innovative environmental products and solutions.'

8.4.11 It is imperative that the UK promotes, in the immediate term, the development of manufacturing sites that serve emerging low carbon technology sectors. Manufacturers in the marine energy market need to have facilities constructed and operational by 2015, meaning that development sites must be consented urgently.

Regeneration of the Humber Sub-region

8.4.12 'The English Indices of Deprivation, 2010', (DCLG, 2011) was published in March 2011. Whilst they are not directly comparable to the 2007 Indices they nevertheless show that North East Lincolnshire is, relatively, one of the ten most deprived districts in England. The 2007 Indices ranked it the eleventh most deprived area in the country. The site lies just outside the boundary of North East Lincolnshire and is within 45 minute travel distance for the entire population of the area.

8.4.13 The need for investment to improve socio-economic indicators in the City of Hull and Humberside region is demonstrably immediate.

8.5 THE DURATION OF PUBLIC NEED

The Need to Decarbonise the Means of Energy Production

8.5.1 The need to avoid the overriding environmental impacts of climate change is permanent. The Stern Review, Executive Summary, states that:

> *'The effects of our actions now on future changes in the climate have long lead times. What we do now can have only a limited effect on the climate over the next 40 or 50 years. On the other hand what we do in the next 10 or 20 years can have a profound effect on the climate in the second half of this century and in the next'.*

Security of Energy Supply

8.5.2 The need for secure energy supplies will always exist.

The Need for Growth in UK Manufacturing

8.5.3 In November 2010 the Government published, 'The Path to Strong, Sustainable and Balanced Growth'. The first paragraph of the report states that:

> *'(t)he overriding priority of this Government is to return the UK economy to balanced, sustainable growth. **Growth is essential for paying down the country's debts, for giving people throughout the country new opportunities, and for making sure that the UK is well placed for competing in an expanding global economy'**, (emphasis added)*

8.5.4 Economic growth is a long-term objective and is an imperative for the UK.

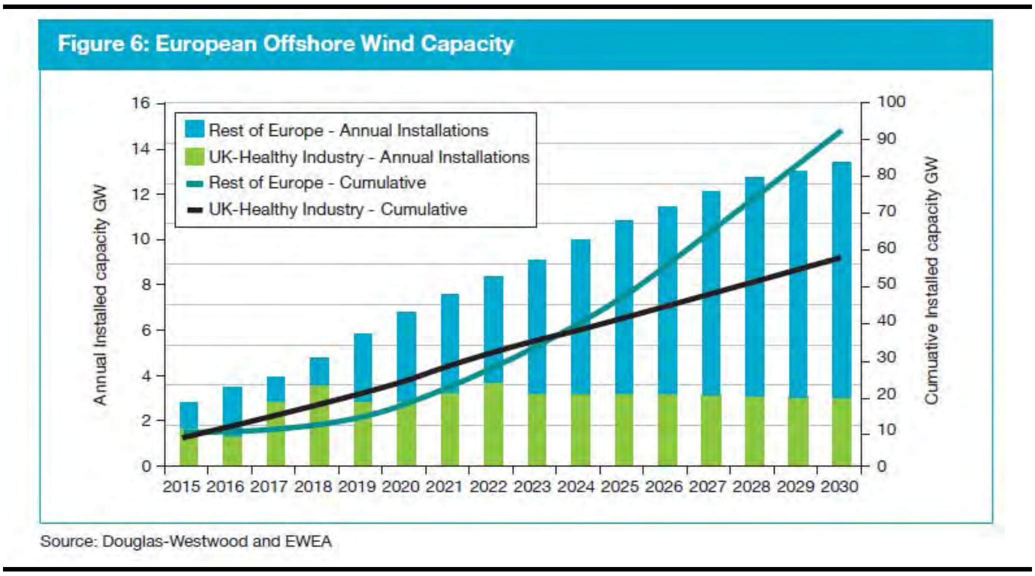
Manufacturing of Large Scale Wind Turbines

The European Market to 2030

8.5.5 The European Wind Energy Association, which promotes the development of wind power worldwide, is targeting 150 GW of installed capacity by 2030. This is consistent with the Commission Communication on Offshore Wind Energy (EC, 2008) which stated that, '*the potential exploitable by 2020 is likely to be some 30-40 times the current installed capacity (1.1 GW in 2008), and in the 2030 time horizon it could be up to 150 GW*'. Achieving such a target would require an installation rate of 10 GW/year in the decade beginning in 2020, and demonstrates the potential long term sustainability of this emerging industry. Furthermore, it is also anticipated that many development sites will be "re-powered" with newer and more powerful turbines when the existing units reach the end of their operating life (around 20-25 years).

8.5.6 In, 'UK Offshore Wind: Building and Industry – Analysis and Scenarios for Future Development', (Douglas Westwood 2010), predictions were presented for OWT installation up to 2030. *Figure 8.4* reproduces Figure 6 of the report and shows UK installation at a relatively constant level of 3.5 GW per year and total installation in European waters rising incrementally towards around 13 GW per year.

Figure 8.4 *European Demand 2015 - 2030*



The European Market beyond 2030

8.5.7 In July 2010, the Government published '2050 Pathway Analysis' (DECC, 2010), which projected that by 2050, UK electricity supply needs were likely to double compared to 2010. This is due to the use of electricity for significant parts of the industrial, heating and transport sectors (including the transition to electric cars) causing demand for electricity to rise, even as overall energy use declines. A significant proportion of this increased capacity would need to be from renewable sources. Accordingly the report states that,

> *'(t)he transmission grid would need to become bigger and more sophisticated. It* ***would draw in electricity from a wider range of providers, likely to include offshore wind turbines*** *and electricity imports,'* (emphasis added).

8.5.8 The EC is also beginning to set out a roadmap towards a zero carbon energy sector by 2050. The prospects for offshore wind manufacturing, installation, operation and maintenance are therefore demonstrably substantial and long term.

8.5.9 A broad estimate of the likely long term need for wind energy in the UK can be calculated using some basic data.

- The National Grid's current assessment of annual electricity demand is 325 TWh (National Grid, 2010).
- The Governments 2050 Pathway Analysis, states that the demand in 2040 will double, so can be taken to be 650 TWh.

- Allowing for 40 percent penetration of wind as a reasonable, economic limit at this time, wind power can be used to generate 260 TWh by 2040 (Millborrow, 2009).

- The average generating capacity of plant needed to generate 260 TWh is 30 GW.

- Taking a weighted average capacity for wind power plant of 30 percent, 100 GW of installed wind generating capacity by 2040 is a robust estimate for the UK alone.

8.5.10 The above is considered a conservative estimate of the UK's long term needs for wind energy generation as it ignores the potential development of economic means of electrical storage. Since offshore wind is more efficient than onshore, due to higher wind speeds across flat ocean surfaces and the ability to use much larger turbines, offshore can be the dominant wind sector in the future. Taking into account the need for re-powering of obsolete turbines at the end of their service life (currently assumed to be 25 years), a long term need for the UK to produce 3.5 GW of offshore turbines per year is a sound assumption. The UK could sustain a much higher level of manufacturing if it became a location of choice for offshore wind manufacturing and thus a net exporter of components.

8.5.11 In conclusion of the above the public need for AMEP is long term.

Regeneration of the Humber Sub-Region

8.5.12 The regeneration of the Humber sub-region is a long term objective and will require major investment over many decades. The proposed project will make a significant contribution to this objective by creating ca 4 100 direct FTE jobs on the site related to manufacturing of offshore wind turbines and 5 000 direct FTE jobs in the Yorkshire and Humber region and elsewhere in the UK (excluding installation works). Further details are contained within the Environmental Statement.

8.6 CONCLUSION

The Balance of Interests

8.6.1 Where the balance of public interests weighs in favour of interests other than the strict protection of the Natura 2000 site, a decision maker may consent a project, even where the possibility of that project having an adverse effect on the integrity of a particular site cannot be excluded. This is normally only the case where the public interest is long term and where the interests are clearly in accordance with the fundamental policies of the State and for the benefit of society as a whole.

The Competing Imperative Reasons of Overriding Public Interest

8.6.2 The adverse effects on the Natura 2000 site are set out in Chapter 6.

8.6.3 As the project does not threaten a priority habitat or species Article 6(4) of the Habitats Directive explicitly permits the following categories of IROPI to be considered:

- human health;
- public safety;
- socio-economic;
- beneficial consequences of primary importance for the environment, or,
- other imperative reasons that are subject to the opinion of the European Commission.

8.6.4 Fundamentally, the project will deliver socio-economic benefits to the UK generally and the Humber Estuary sub-region in particular by enabling the growth of the emerging renewable energy sector. It will also have beneficial consequences of primary importance for the environment by enabling Europe's necessary transition to low carbon energy production.

Beneficial Consequences of Primary Importance to the Environment

8.6.5 There is compelling scientific evidence that rising levels of greenhouse gases in the atmosphere will have a warming effect on the earth's climate through increasing the amount of infrared radiation (heat energy) trapped in the atmosphere, 'the greenhouse effect'. Potential effects include: rising sea levels which threaten major cities; irreversible damage to ecosystems; major declines in crop yields and water shortages. These potential impacts are beyond any reasonable scientific doubt.

8.6.6 The project would enable the development of a harbour facility that is designed to support the manufacture, export and installation of renewable energy components for the marine environment. This sector is essential to the delivery of Europe's renewable energy targets that aims to make energy production in Europe carbon neutral by 2050.

8.6.7 The need for transition to a low carbon economy is certain and is necessary in the immediate term. The project will assist in enabling this transition.

The Beneficial Effect of Large Scale OWT Components

8.6.8 Energy costs need to be maintained as low as reasonably practicable. Turbine scaling increases energy capture while reducing general project infrastructure costs (as well as landscape impacts) that ultimately reduce the cost of wind energy. The need for larger turbines is recognised in Europe's Strategic Energy Technology Plan that was endorsed by the European Council in March 2008.

8.6.9 The scale of development in the next decade and beyond represents a step change in offshore development to date. Europe's Strategic Energy Technology Plan has recognised that doubling the output of the largest wind turbines (to >10 MW) is a key challenge for meeting the 2020 targets.

8.6.10 The project will provide facilities suitable for the manufacture and assembly of these large scale OWTs.

The Need for Security of Energy Supplies

8.6.11 According to, 'Communication from the Commission to the European Council and The European Parliament: An Energy Policy For Europe', (EC, 2007), Europe is becoming increasingly dependent on imported hydrocarbons and,

> *'the EU's energy import dependence will jump from 50% of total EU energy consumption today to 65% in 2030. Reliance on imports of gas is expected to increase from 57% to 84% by 2030, of oil from 82% to 93%'.*

8.6.12 In, 'Communication from The Commission to The European Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions: Offshore Wind Energy: Action needed to deliver on the Energy Policy Objectives for 2020 and beyond', (EC, 2008), it is stated that, '*(w)ind energy will play an essential role in meeting the objectives of the New Energy Policy for Europe*'. The Communication concludes by stating that,

> *'Offshore wind energy is an indigenous resource for electricity production with a vast potential that remains largely untapped. Offshore wind can and must make a substantial contribution to meeting the EU's energy policy objectives through a very significant increase – in the order of 30-40 times by 2020 and 100 times by 2030 – in installed capacity compared to today.'*

8.6.13 Therefore, irrespective of the significant adverse environmental impacts of climate change, the EC needs to develop new, indigenous sources of energy, in order to secure energy supplies into the future and European policy is that offshore wind energy must make a substantial contribution. The project will enable this objective to be realised.

The Socio-Economic Benefit to the UK Economy

8.6.14 In November 2010 the Government published, 'The Path to Strong, Sustainable and Balanced Growth'. The first paragraph of the report states that:

> *'(t)he **overriding priority** of this Government is to return the UK economy to balanced, sustainable growth. Growth is essential for paying down the country's debts, for giving people throughout the country new opportunities, and for making sure that the UK is well placed for competing in an expanding global economy', (emphasis added)*

8.6.15 The 'The UK Low Carbon Transition Plan', (DECC, 2009) recognises the potential for new business opportunities in UK manufacturing stating that:

> *'Many more of us will find ourselves working in a growing low carbon industry. Already 880,000 people in the UK work in the low carbon and environmental sector, a rapidly growing worldwide market worth £3 trillion per year and £106 billion per year in the UK. **By 2020, this could rise to more than a million people if we seize the opportunity to establish the UK as a global centre of low carbon industries and green manufacturing.** Around 200,000 of these new jobs by 2015 are expected to be in renewable energy, which could grow by a further 300,000 additional renewables jobs by 2020 as set out in the UK Renewable Energy Strategy, a total of half a million additional UK jobs in the renewable energy industry to 2020. In doing this, the UK will need to focus on low carbon sectors where we are likely to have a competitive advantage such as offshore wind, marine energy, civil nuclear power, carbon capture and storage, renewable chemicals, low carbon construction and ultra-low carbon vehicles, and specialist financial and business services',* (pg 112, author's emphasis).

8.6.16 Economic growth is a long-term objective and is an imperative for the UK. The UK must promote, in the immediate term, the development of manufacturing sites that serve emerging low carbon technology sectors. The project will provide a significant number of manufacturing jobs and has the potential to generate many more because of its cluster potential.

The Socio-Economic Benefit to the Humber Sub-Region

8.6.17 The Humber ports regions of North Lincolnshire, North East Lincolnshire and the City of Hull are areas of relative deprivation, which ranked 132, 49 and 11 respectively in the, 'English Indices of Deprivation 2007', (DCLG, 2008). In addition, certain wards within all three local authorities are classified as 'Assisted Areas' under criteria established by the EC and are thereby further recognised as being economically disadvantaged from a national perspective. The need for action to address the local and regional deprivation is certain.

8.6.18 AMEP will comprise a facility that will not only produce wind turbines but will also provide a base for their installation. Many activities will involve companies based in the region, elsewhere in the UK, or in Europe. It is estimated that the completed Project will create ca 4 100 direct FTE jobs on the site related to manufacturing of offshore wind turbines and 5 000 direct FTE jobs in the Yorkshire and Humber region and elsewhere in the UK (excluding installation works). In addition there will be up to 3 200 direct FTE jobs in total (ie locally, in the rest of the region, and the rest of the UK) related to the installation of the wind turbines. This includes vessels for export and array cable laying, installation of foundations, installation of turbines, installation of offshore sub-stations, and other related port activities.

8.6.19 Indirect jobs will include a variety of suppliers to businesses located at AMEP. The 200 FTE supplier jobs in the wider local area will be those providing a number of goods and services required to run premises, equip the workforce, and run the business (eg professional services such as accounting and legal). More of such supplier jobs - 880 FTEs – will be created in the rest of the region.

8.6.20 More jobs will be created through the spending of workers employed in direct and indirect jobs. Their salaries will be spent in the local economy supporting existing businesses and creating an estimated 920 FTE jobs in the wider local area (North and North East Lincolnshire) and 720 FTE jobs in the rest of the region. These jobs, in a variety of sectors, from retail to leisure, will boost local business growth.

8.6.21 AMEP activities will contribute to the economy in terms of Gross Value Added (GVA). The direct on-site GVA is estimated at £264.5 million annually.

8.6.22 Wider economic impacts include additional inward investment that will potentially be attracted regionally, for example in Research and Development (R&D). The AMEP development can potentially influence education and skills development in Yorkshire and Humber because the majority of the offshore wind jobs require higher qualified employees with strong skills in STEM (Science, Technology, Engineering and Mathematics) subjects.

8.6.23 AMEP has the potential to encourage certain types of firms to locate in the sub-region. The presence of several major Original Equipment

Manufacturers is required to enable clustering in offshore wind and AMEP would provide such opportunity.

The Significance of the Competing Interests

8.6.24 There is a compelling case that the overriding public interest to:

- decarbonise the means of energy production;
- secure energy supplies from indigenous sources;
- manufacture large scale offshore generators;
- grow manufacturing in the UK; and
- regenerate the Humber sub-region'

outweighs the loss of 45 ha of a Natura 2000 site.

8.6.25 The project addresses these objectives by providing a new quay with direct access to a significant land parcel that is to be developed to support the manufacture of components for the offshore renewable energy sector. This is a sector that must grow to enable the delivery of European Energy policy. The sector has specific locational requirements that are realised with the least possible environmental harm.

8.6.26 The imperative overriding needs detailed above are both certain and immediate and the project will make a significant contribution towards them over a long period of time.

9 COMPENSATION MEASURES

9.1 INTRODUCTION

9.1.1 The findings of the Shadow Appropriate Assessment in *Chapter 6* were that AMEP will result in an adverse effect on the integrity of the European sites of the Humber Estuary. Where an adverse effect is concluded, and it has been shown that there are no alternative solutions (see *Chapter 7*) and also that IROPI has been demonstrated (see *Chapter 8*), the decision-maker can only approve the application once it is satisfied that suitable compensation measures have been secured.

9.1.2 This chapter lists the requirements of that compensation, and summarises how it will be achieved. Further details are contained within a separate Environmental Statement for the compensation site (see *Volume 2* of the ES).

9.2 COMPENSATION REQUIREMENTS

Intertidal Habitats

9.2.1 The assessment showed that it will be necessary to compensate for the direct and indirect loss of approximately 40 ha of intertidal mudflat and the direct loss of 13.5 ha of estuary habitat (see *Tables 5.5* and *5.6* in *Section 5.4 HRA Screening for Likely Significant Effect*), the latter of which comprises sub-tidal habitat. The intertidal mudflats requirement of approximately 40 ha takes account of the slightly greater area of mudflat required to compensate for the effects on the Humber Estuary SPA, compared to the SAC. However, the creation of the compensation site (see *Section 9.3*) will result in the transformation of approximately 2 ha of existing saltmarsh into intertidal mudflat around the breach creation. Hence the overall requirement for intertidal mudflat creation is reduced by 2 ha to 38 ha.

The temporary loss of sub-tidal habitat is not expected to be an issue for the Humber Estuary in the longer term given the predicted effects of rising sea levels over the next 50 years (CHaMP, 2005) which will lead to the creation of several hundred hectares of new sub-tidal habitat within this site alone. NE has confirmed that as part of the broad estuarine feature of the Humber Estuary SAC, the replacement of the lost sub-tidal with another estuarine feature would be acceptable [(1)] ,

(1) Letter from Natural England to Able UK Ltd dated 6 April 2011.

and that the compensation for estuary habitat loss should be on a 1:1 basis [1]. In this case the replacement estuarine habitat type will be saltmarsh, which is predicted to colonise a significant proportion of the Compensation Site over time (see below).

9.2.2 In addition, evidence from the managed re-alignment schemes elsewhere in the Humber Estuary has shown it can be difficult to maintain the extent of newly created intertidal mudflats (Hemingway, Cutts & Pérez-Dominguez, 2008 [2]). Several of these managed realignment schemes along the Humber Estuary have found that over time large areas of the intertidal mudflats transform into saltmarsh. This is not unexpected on the Humber Estuary given the high suspended sediment loading of the water which is a specific feature of this estuary, combined with the rates of accretion within the more sheltered areas within the realignment sites.

9.2.3 To address this issue it has also been agreed with NE that the target compensation should comprise a 2:1 ratio for intertidal mudflat loss (see letter from NE to Able on 26 August 2011). The larger initial area of intertidal mudflat allows for the retention in the long term of an appropriate area of intertidal mudflat assuming a proportion of the initial area will be lost if it transforms to saltmarsh. Monitoring of the development of the managed re-alignment site at Paull Holme Strays has found that newly created intertidal mudflat takes at least three years for the abundance levels to develop to levels similar to that of the existing intertidal mudflat outside the managed re-alignment site [3]. The larger area of mudflat which will be created at the Compensation Site from the outset will also help offset the lower benthic abundance in the initial years, whilst the newly created intertidal mudflat develops in quality.

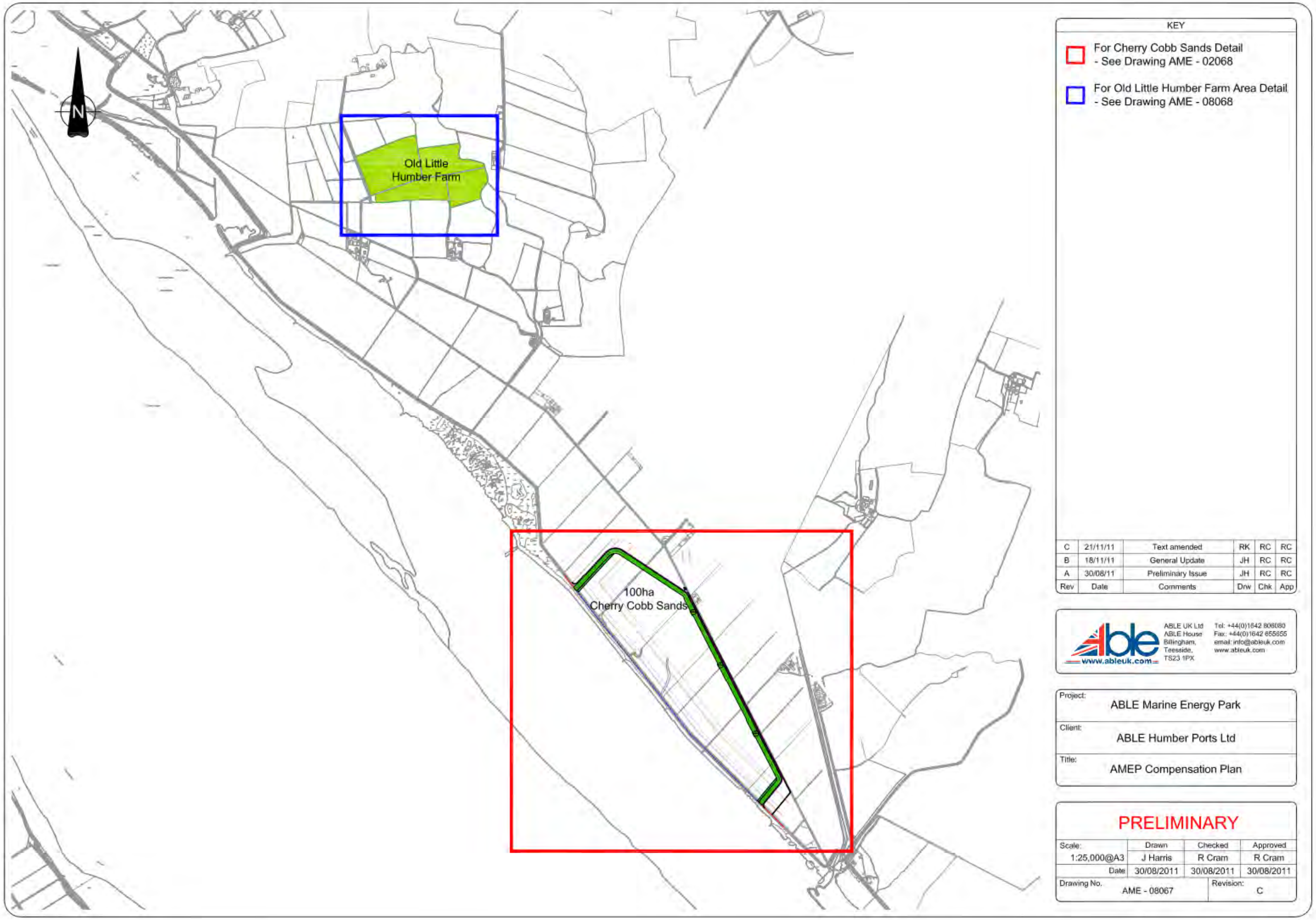
Hence the overall requirements are for 76 ha of intertidal mudflat and 13.5 ha of estuary habitat (*ie* a total of approximately 90 ha). The Compensation Site will be designed to maximise the retention of intertidal mudflat by developing areas where the tidal velocities inundating the site are high enough to prevent or severely limit deposition which would otherwise encourage saltmarsh development. The velocities that are anticipated within the Compensation Site, and how these are expected to limit deposition to part of the area, are described in Volume 2 of the ES in *Chapter 32* and *Annexes 32.4* and *32.6*.

(1) Letter from Natural England to Able Uk Ltd on 26 August 2011.
(2) Hemingway K L, Cutts N C & Perez-Dominguez R (2008) *Managed Realignment in the Humber Estuary, UK.* Institute of Estuarine and Coastal Studies (IECS).
(3) Mander, L. Phelps, A., Thomson, S & Cutts, N. (2010) Waterbirds Monitoring at Paull Holme Strays: Annual Report #7. Report for Halcrow Group Ltd.

Detailed design of the ground profile will be carried out in consultation with NE and will aim to maximise the likely long term retention of intertidal mudflat habitat. Given the inherent difficulties and uncertainties associated with creation and retention of the habitats involved, Able has decided to increase the area of the intertidal Compensation Site by an additional 10% over an above that described above. Hence the overall area of the intertidal Compensation Site will be 100 ha, and it will be provided at a site adjacent to Cherry Cobb Sands (see *Figure 9.1*). NE has confirmed its agreement with both the location and the size of the intertidal Compensation Site (1). Further details about the selection of the site location are contained in the ES, , *Chapter 30*. An overview of how it will be created is provided in *Section 9.3* below.

(1) In letter to Able UK Ltd from Natural dated 11 November 2011.

Figure 9.1 AMEP Compensation Site- Cherry Cobb Sands and Old Little Humber Farm



9.2.4 The proposed compensation site for AMEP is very similar in character to the Paull Holme Strays managed realignment site which lies up river along the northern shore of the Humber Estuary. Experience at Paull Holme Strays has found that the habitats on the realignment site created there have taken approximately three years to generate benthic biomass densities comparable with intertidal mudflat habitats outwith the realignment site, although the species diversity and abundance still remain lower (IECS, 2007). The use of Paull Holme Strays by waders such as bar and black-tailed godwits, curlew, dunlin and redshank was low in year one, although bird numbers had increased markedly by year three (Mander *et al*, 2007[(1)]). Whilst foraging wildfowl, including shelduck, were present in on the realignment site in the first winter after the breach, the numbers of foraging waders rose greatly in year three, reflecting the increased benthic biomass availability, which was becoming more typical of that of the upper shore of existing established mudflats. Upper shore areas are typically favoured by waders such as redshank and bar-tailed godwit.

9.2.5 If the intertidal Compensation Site were created a few years prior to the construction work on AMEP commencing, then the functional value of the habitat to the bird assemblage would have time to develop. As the needs of the offshore energy industry are more immediate this will not be possible and additional wet grassland habitat will therefore be created inland to provide foraging and roosting opportunities for some of the bird species affected by the development, especially black-tailed godwit in the short term (see *Section 9.4)*.

9.2.6 In addition to the creation of the wet grassland, there is also likely to be a reduction in the levels of disturbance at the existing intertidal mudflats at Cherry Cobb Sands in the immediate vicinity of the compensation site due to the permanent re-alignment of the coastal footpath adjacent to the compensation site (see *Figure 9.4*). The path will be re-aligned landward of, and level with, the base of the embankment wall. This will remove a source of disturbance to birds. Bird hides will be created along the new embankment to facilitate views across the mudflats whilst avoiding disturbance to birds. Had the footpath been diverted across the top of the new flood defence, the disturbance effect of walkers would have reduced the functional value of the new habitat to the SPA assemblage and a greater amount of productive farmland would have been lost.

(1) Mander L, Cutts N D, Allen J & Mazik K (2007) Assessing the Development of Newly Created Habitat for Wintering Estuarine Birds. *Estuarine, Coastal and Shelf Science* **75** pp 163-174.

9.2.7 Any regrading work on the compensation site will be undertaken prior to the breach being created in the existing flood defence wall. Hence any construction work will be undertaken behind the existing flood defence embankments. This will provide screening for birds on the foreshore, shielding them from possible visual disturbance from the construction workforce and from noise, and no piling will be required.

9.2.8 It is possible therefore that the existing mudflats at Cherry Cobb Sands adjacent to the compensation site may be able to accommodate more bird-days with this reduction in disturbance. This would provide an additional area in which birds displaced from Killingholme Marshes foreshore, and particularly those which are more restricted to intertidal mudflats could forage in the short term whilst the compensation site matures.

9.2.9 The creation of the compensation site will displace wetland birds which currently use these fields predominantly at high tide; in particular important numbers of curlew were present in September 2010 (640 birds) and in October 2010 (600 birds) (see *Annex G Supporting Information on Impact of Loss of Farmland on Sunk Island*). A single record of lapwing in important numbers was made in the fields during February 2011 (787 birds). The survey findings indicated that the upper foreshore was the birds' preferred roosting area, and that they seem to use these fields when spring high tides remove their preferred areas and force them off the foreshore, as they are adjacent to the estuary.

9.2.10 There are a number of reasons why the creation of the compensation site and the displacement of the birds from the existing arable fields are not predicted to result in an adverse effect on the European site. These are listed below.

- The compensation site will comprise new intertidal habitat, its creation will simply move the field /estuary interface inland a field. Hence arable fields would still be available adjacent to the estuary. In addition arable fields similar to those lost will be readily accessible over a wide area in this location.

- The fields which would then be available for the birds are of a similar type and size to those which would be lost, and are subject to similar land management. Hence it is considered likely that the food resource and availability will be dissimilar. There is also no indication of any wide scale change in land use / management in this area which might restrict the opportunities for birds to find suitable fields.

- Whilst the immediate fields are closer to areas of habitation, the buildings are largely screened by shelterbelts, and hence it not envisaged that there will be significant additional risk of disturbance from people around these properties. The footpath which currently runs along the edge of the estuary will be diverted between the new embankment and Cherry Cobb Sands Road. The influence of Cherry Cobb Sands Road is not considered to be any greater than at present.

- The extent of shooting and use of bird scarers in this area is uncertain, however, it is considered unlikely that the magnitude of such risks will be any greater on the fields available in the future compared with the ones they currently use.

Inland Fields

9.2.11 An area of 38.5 ha of existing agricultural land at Old Little Humber Farm (OLHF), 1.5 km inland between Cherry Cobb Sands and Paull Holme Strays, will be converted to wet grassland. This grassland will provide an additional feeding resource for bird species including black-tailed godwits and curlew, whilst the intertidal Compensation Site becomes established. The duration over which these fields are required will be determined by the findings of ongoing bird monitoring, and through discussions about the implications of the survey findings with NE.

9.2.12 Black-tailed godwit is the species most adversely affected by the loss of estuarine habitat due to AMEP, and hence the compensation requirements have focused particularly on this species. Evidence of black-tailed godwits feeding on grassland fields comes from a variety of sources including:

- at Clonakilty Bay in County Cork, the birds spend part of their time inland foraging on grassland fields from November onwards, supplementing the food obtained from the estuary mudflats (Hutchinson & O'Halloran, 1994[1]);

- the Irish Callows, where supplementary feeding was recorded on grassland fields (*pers comm* J Gill, 2011); and

(1) Hutchinson C D & O'Halloran J (1994) The Ecology of Black-tailed Godwits at an Irish South Coast Estuary. *Irish Birds* **5**: 165-172.

- at Poole harbour where terrestrial fields were considered of vital importance for shorebirds such as black-tailed godwit (Durell *et al*, 2006).

9.2.13 An assessment of the likely available feeding resource provided by the intertidal compensation site and the wet grassland at OLHF predicts the potential food resource available to be considerably more than that required to compensate for the loss of intertidal habitat as a result of the AMEP development (see *Annex 35.6* in *Volume 2* of the *ES*).

9.2.14 The conversion of these fields will take place in 2012 to allow the fields time to develop prior to the AMEP works commencing (see *Section 9.4*).

9.2.15 The fields are located in an area which is readily accessible by birds from the estuary. Whilst information about shooting in this area is uncertain, it is considered unlikely that the magnitude of such risks will be any greater than at present. The fields are also close to the developing Paull Holme Strays managed re-alignment site. .

9.2.16 NE has confirmed that it is agrees with the location and size of OLHF as an inland Compensation Site.

9.3 *THE INTERTIDAL COMPENSATION SITE*

9.3.1 The Compensation Site is located on existing agricultural land adjacent to the estuary at Cherry Cobb Sands (see *Figure 9.2*).

Figure 9.2 Cherry Cobb Phase 1 Habitat Map

9.3.2 The development of the Compensation Site will begin with the creation of a new flood embankment approximately 3 km long, a crest width of 4 m, a side slope gradient of 1:3, and a crest of approximately 5 m above existing ground level (typically around 2.5 m AOD). Approximately 300 000 m^3 of material sourced from within the Compensation Site will be reused as embankment fill. It is most likely to come from the middle of the site, however, exact areas will be determined from a detailed Site Investigation and from on site testing of material as construction takes place.

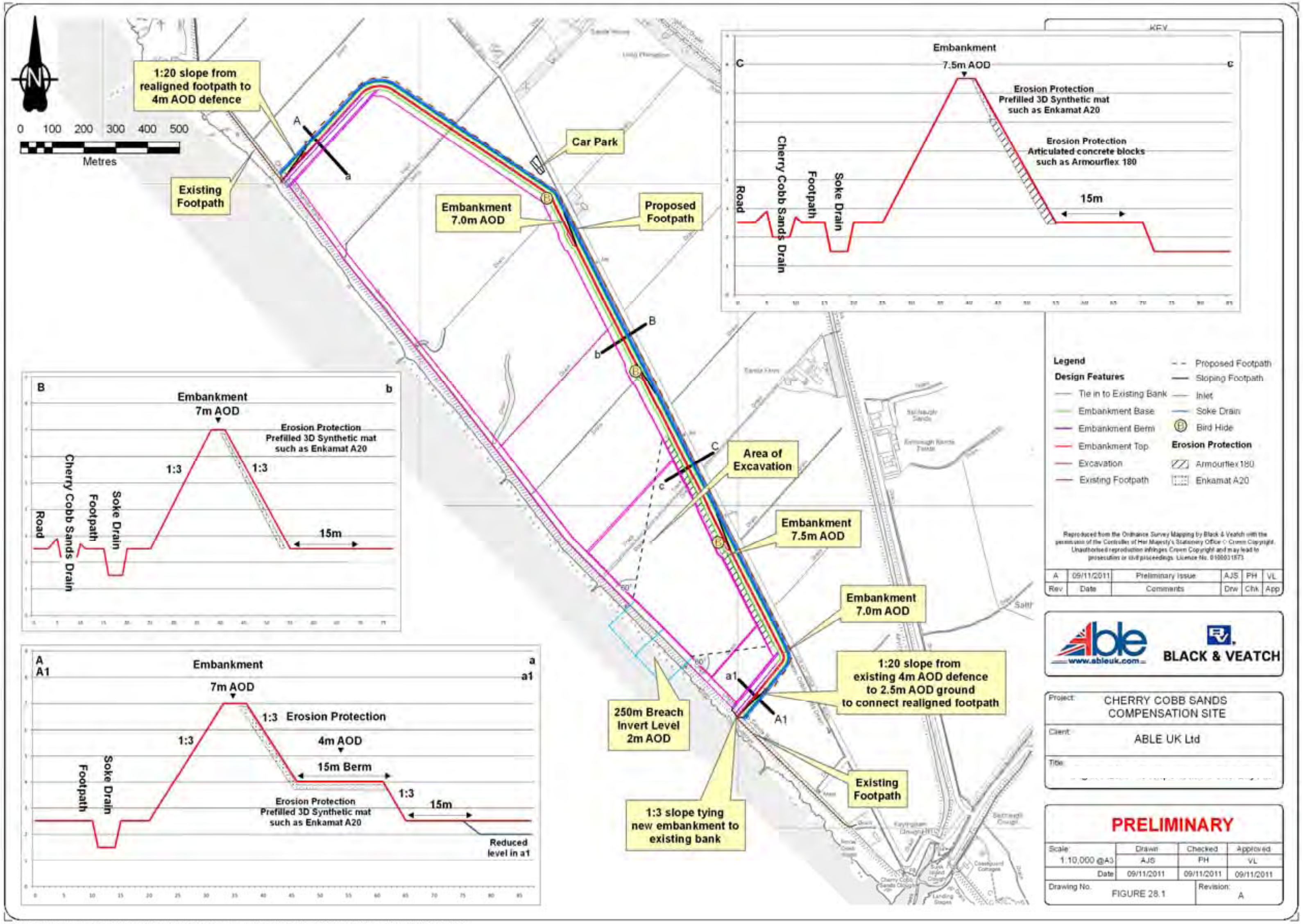
9.3.3 Profiling of the finished ground levels within the Compensation Site (between 3.5 and 1.5 mAOD with the lowest levels likely to be near to the breach location) will be undertaken to maximise the provision of long term intertidal mudflat. The actual finished ground levels will be determined following further detailed modelling studies and in consultation with NE. Topsoil stripped from the excavation will be removed, stockpiled and replaced within the excavation to help form the agreed initial profile of the site. As the site evolves the processes of erosion and accretion within the site will influence the future ground levels. A preliminary estimate of ground levels after five years is given in *Figure 9.3*, although this will be refined by further detailed modelling to increase the accuracy of the predicted area of mudflat that is likely to be created.

Figure 9.3 Possible Ground Levels at Compensation Site After Five Years

9.3.4 On the landward side of the new embankment a soke dyke will be provided to catch seepage water, and prevent the risk of saline contamination of Cherry Cobb Sands Drain.

9.3.5 Once the embankment and the profiling has been completed the existing embankment will be breached to allow tidal waters to enter the site. It is likely that this breach will occur in the year after it is completed to allow time for sufficient grass cover to establish on the new embankment; the timing of the breach will be agreed with the Environment Agency. The material from the breached section of embankment will be placed within the intertidal area of the compensation site. The optimum location for the single breach will be towards the southern end of the site and should be 250 m long (see *Figure 9.4*), although the precise level of the breach area will be chosen during detailed design to maximise the sustainable creation of intertidal mudflat. A channel will also be cut through the saltmarsh fronting the breach to allow water to enter, and the saltmarsh will be re-laid within the Compensation Site at the same level to encourage the generation of saltmarsh within defined areas of the site. The base and ends of the breached section will not be protected from erosion. The modelling suggests that a creek is likely to cut through the breached section within the first five years which will cause the Cherry Cobb Sands site to fully drain (see ES *Volume 2*, *Annexes 32.4 and 32.6*).

Figure 9.4 Compensation Site Layout



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In the fifth year after breaching it is expected that parts of the Compensation Site, especially at the north and south ends (where velocities are low), will be developing into saltmarsh. Modelling of a preliminary design for a 90 ha site predicted that after 5 years approximately 48 ha of intertidal mudflat will remain, predominantly in the central part of the site, where velocities are higher (1) (see *Figure 9.3*). An increase in the area of the compensation site to approximately 100 ha will result in increased velocities in the intertidal area and hence the mudflat area is predicted to increase significantly.

9.3.6 Construction of the intertidal Compensation Site will be undertaken over two spring/summer periods, with the work most likely to take place between March and October. It is anticipated that the new embankment will be constructed in a single summer season.

9.3.7 A programme of monitoring of the Compensation site will be discussed and agreed with NE.

9.3.8 Further details about the intertidal Compensation Site can be found in *Volume 2, Chapter 28 – Description of the Project*.

9.4 TERRESTRIAL COMPENSATION AT OLD LITTLE HUMBER FARM (OLHF)

9.4.1 The habitat at OLHF comprises fields which have supported arable crops for many years. Given the absence of grassland fields in the surrounding area, seeding of the fields (using a mix of a few common grass species) will be required to encourage a more rapid sward development. The ground will be re-graded to create wet grassland and the seed will be sown onto the surface and then rolled where possible to improve the soil – seed contact. A good soil structure will be created and compaction of the soil avoided.

9.4.2 It is important that the grassland develops as soon as possible and hence the sowing of the grass seed will then be undertaken in the spring. To achieve this, the ground preparation is intended to be undertaken in 2012, subject to any necessary approvals and any necessary weed controls.

9.4.3 The organic content of the soil will be assessed prior to the conversion, and the need for any supplementary additional organic matter, to help boost earthworm populations, will be considered. The use of low rates

(1) Letter from Black & Veatch to Able UK Ltd on 2 November 2011.

of well rotted farmyard manure will also be considered, as this is known to have beneficial effects on invertebrates such as earthworms.

9.4.4 The management required will be unique for this site and will depend on how the site develops. Able will adopt a flexible approach to the management which can respond to the specific conditions at OLHF (*eg* topping, cutting/grazing frequencies).

9.4.5 The approach to creation and management of the wet grassland will be agreed with NE, along with a monitoring both of the grassland and its use by wintering waterfowl.

9.5 CONCLUSIONS

9.5.1 The AMEP proposals include for compensatory habitat in the form of intertidal habitat (100 ha adjacent to Cherry Cobb Sands), and wet grassland on inland fields (38.5 ha at Old Little Humber Farm). The wet grassland will provide supplementary foraging habitat in the short term, whilst the intertidal habitat is developing. The time over which the grassland is required as compensation will be subject to the findings of bird monitoring, and discussions of these findings with NE.

9.5.2 Additional benefits will be provided through the realignment of the existing coastal footpath inland of the new Compensation Site, behind the embankment. This will result in a reduction in the risk of disturbance to birds on the existing intertidal mudflats at Cherry Cobb Sands, and may facilitate its use by a greater number of waterfowl species.

9.5.3 The locations and areas of these compensation measures have been accepted by NE as suitable compensation for the effects of the AMEP development. The design details of both the intertidal site and the grassland fields will be subject to further discussion and agreement with NE, along with appropriate monitoring and management regimes.

Annex A

Supporting Information Consultations

Schedule of Meetings Held with Consultees

Meetings held before the formal s42 consultation

Date	Present	Matters discussed
2010-03-30	ABP Harbourmaster	Berthing Line Consultation
2010-04-07	E.ON	General AMEP Consultation
2010-04-08	Anglian Water	General AMEP Consultation
2010-06-09	NE, NLC	Consultation for AHPF - Phase 3
2010-07-06	Network Rail	Consultation on Masterplan
2010-07-14	NLC, HA	AMEP Transport Consultation
2010-07-27	EA, Anglian Water	Elsham Waste Water Treatment Effluent Diversion
2010-08-02	IPC	Project Inception
2010-08-17	Network Rail	Consultation of Land purchase
2010-09-10	ABP Harbourmaster	General AMEP Consultation
2010-09-11	NLC	Archaeology Consultation 1
2010-09-20	EA	General AMEP Consultation
2010-09-21	NE	Ecology Consultation Meeting 1
2010-10-07	NLC, NELC, HINCA	NLC Consultation 1
2010-10-10	HST, Cobelfret	General AMEP Consultation
2010-10-11	NELDB	Surface Water Drainage Strategy
2010-10-13	Anglian Water	Foul and Surface Water Drainage
2010-10-19	NE, NLC, HINCA	Ecology Consultation Meeting 2
2010-10-27	ERYC (Humber Archaeology Partnership)	Cherry Cobb Sands Archaeology
2010-11-03	EA	General AMEP Consultation
2010-11-09	NLC, HA	A160/A180 Scheme Status

Date	Present	Matters discussed
2010-11-10	Network Rail	Consultation of Land purchase
2010-11-16	NE, RSPB, HINCA	Ecology Consultation Meeting 3
2010-11-17	ERYC	General AMEP Consultation
2010-11-18	E.ON	Consultation on the Masterplan
2010-11-18	Centrica	Consultation on the Masterplan
2010-12-08	MMO	General AMEP Consultation
2010-12-09	EA, NE	General AMEP Consultation
2010-12-10	ABP Harbourmaster	General AMEP Consultation
2010-12-14	ABP	General AMEP Consultation
2010-12-16	NE, RSPB, HINCA	Ecology Consultation Meeting 4
2011-01-28	English Heritage	General AMEP Consultation

Meetings held during and following on from the section 42 consultation

Date	Present	Matters discussed	Changes made
2011-02-01	NE, NLC, RSPB, HINCA	Ecology Consultation Meeting 5	Mitigation and compensation site designs developed further.
2011-02-10	IPC	Project Update	Approach to documentation improved in line with IPC's advice.
2011-02-28	NE, NLC, RSPB, HINCA	Ecology Consultation Meeting 6	Scope and format of Habitats Regulations Assessment agreed.
2011-03-03	NLC	PROW meeting	Preferred footpath diversion route adopted in design.
2011-03-09	HM, EA, NE, MMO, CEFAS,	Dredge Workshop	Substantial changes to dredging strategy and application documentation agreed.
2011-03-17	ERYC	PROW Meeting	Some changes to proposed footpath diversion adopted.

Date	Present	Matters discussed	Changes made
2011-03-17	NE, NLC, RSPB, HINCA	Ecology Consultation Meeting 7	Mitigation proposals refined.
2011-03-18	CAA	Aviation Consultation	Lighting requirements clarified and OHS defined.
2011-04-06	NLC, EH	Archaeology Consultation Meeting	Mitigation strategy substantially developed.
2011-04-07	Paull Parish Council	Compensation Site Consultation	None
2011-04-08	NE, RSPB, HINCA	Ecology Consultation Group 8	None
2011-04-20	MMO, EA, CEFAS	General AMEP Consultation	Dredge proposals refined, and quay design subjected to amendments and further modelling.
2011-05-03	NE, RSPB, HINCA	Ecology Consultation Meeting 9	Mitigation proposals developed. Additional wet grassland proposed for compensation site.
2011-05-12	Cobelfret	Stakeholder Consultation	None
2011-05-18	ABP	Stakeholder Consultation	None
2011-05-18	Paull Parish Council	Compensation Site Consultation	None
2011-05-23	NE, NLC, RSPB, HINCA	Ecology Consultation Meeting 10	Principle of how mitigation would be refined agreed.
2011-06-17	NE, NLC, RSPB, HINCA	Ecology Consultation Meeting 11	None
2011-07-06	NELC	General AMEP Consultation	None
2011-07-11	EA	General AMEP Consultation	Quay design reconfigured.
2011-07-15	ERYC	General AMEP Consultation	Walkers' car park included at Cherry Cobb Sands.
2011-07-18	EA, NE, MMO, NLC, RSPB, HINCA	Multi-Agency AMEP Consultation	Major underlying principles of compensation scheme agreed. Mitigation buffering explored. Assessment of effects on migratory fish included in EIA. Proposed

Date	Present	Matters discussed	Changes made
			pumping-station relocated.
2011-08-09	NE, RSPB, HINCA	Ecology Consultation Meeting 12	Broad quanta and habitat types of compensation agreed, subject to further more detailed discussions.
2011-08-23	NE	Ecology Consultation Meeting 13	More detailed discussion of compensation options.
2011-09-28	CABE	General AMEP Consultation, including a site visit	None
2011-10-12	NE	Ecology Consultation Special Meeting	More detailed discussion of compensation and mitigation strategy.
2011-10-25	ABP Harbour Master	Marine matters	Discussion of effects of AMEP on Humber Conservancy
2011-11-10	E.ON	Quay Impacts Consultation	More detailed discussion of modelling results.
2011-11-17	HST	General AMEP Consultation	None.
2011-11-22	NE	Piling Compensation Site	Discussions of information provided about the effects of noise from piling on birds and migratory fish, and effects of creating compensation site on SPA birds
2011-11-31	NE	Piling Compensation Site	Discussion about updated report on piling, grassland compensation on north bank and effects of compensation site on SPA birds
2011-12-13	NE	Piling Compensation Site	Further discussion about supplementary noise information provided on birds and migratory fish, and effects on SPA birds from compensation site

Annex B

European Designated Site Citations

Humber Estuary SAC

EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora

Citation for Special Area of Conservation (SAC)

Name:	Humber Estuary
Unitary Authority/County:	City of Kingston upon Hull, East Riding of Yorkshire, Lincolnshire, North East Lincolnshire, North Lincolnshire
SAC status:	Designated on 10 December 2009
Grid reference:	TA345110
SAC EU code:	UK0030170
Area (ha):	36657.15
Component SSSI:	Humber Estuary

Site description:
The Humber is the second largest coastal plain **Estuary** in the UK, and the largest coastal plain estuary on the east coast of Britain. The estuary supports a full range of saline conditions from the open coast to the limit of saline intrusion on the tidal rivers of the Ouse and Trent. The range of salinity, substrate and exposure to wave action influences the estuarine habitats and the range of species that utilise them; these include a breeding bird assemblage, winter and passage waterfowl, river and sea lamprey, grey seals, vascular plants and invertebrates.

The Humber is a muddy, macro-tidal estuary, fed by a number of rivers including the Rivers Ouse, Trent and Hull. Suspended sediment concentrations are high, and are derived from a variety of sources, including marine sediments and eroding boulder clay along the Holderness coast. This is the northernmost of the English east coast estuaries whose structure and function is intimately linked with soft eroding shorelines. The extensive mud and sand flats support a range of benthic communities, which in turn are an important feeding resource for birds and fish. Wave exposed sandy shores are found in the outer/open coast areas of the estuary. These change to the more moderately exposed sandy shores and then to sheltered muddy shores within the main body of the estuary and up into the tidal rivers.

Habitats within the Humber Estuary include **Atlantic salt meadows** and a range of sand dune types in the outer estuary, together with **Sandbanks which are slightly covered by sea water all the time**, extensive intertidal mudflats, ***Salicornia*** **and other annuals colonising mud and sand**, and **Coastal lagoons**. As salinity declines upstream, reedbeds and brackish saltmarsh communities fringe the estuary. These are best-represented at the confluence of the Rivers Ouse and Trent at Blacktoft Sands.

Upstream from the Humber Bridge, the navigation channel undergoes major shifts from north to south banks, for reasons that have yet to be fully explained. This section of the estuary is also noteworthy for extensive mud and sand bars, which in places form semi-permanent islands. The sand dunes are features of the outer estuary on both the north and south banks particularly on Spurn peninsula and along the Lincolnshire coast south of Cleethorpes. Examples of both **Fixed dunes with herbaceous vegetation (`grey dunes`)** and **Shifting dunes along the shoreline with *Ammophila arenaria* (`white dunes)** occur on both banks of the estuary and along the coast. Native sea buckthorn **Dunes with *Hippophae rhamnoides*** also occurs on both sides of the estuary.

Significant fish species include **river lamprey** *Lampetra fluviatilis* and **sea lamprey** *Petromyzon marinus* which breed in the River Derwent, a tributary of the River Ouse. **Grey seals** *Halichoerus grypus* come ashore in autumn to form breeding colonies on the sandy shores of the south bank at Donna Nook.

Qualifying habitats: The site is designated under **article 4(4)** of the Directive (92/43/EEC) as it hosts the following habitats listed in Annex I:

- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Coastal lagoons*
- Dunes with *Hippophae rhamnoides*
- Embryonic shifting dunes
- Estuaries
- Mudflats and sandflats not covered by seawater at low tide
- Fixed dunes with herbaceous vegetation (`grey dunes`)*
- *Salicornia* and other annuals colonising mud and sand
- Sandbanks which are slightly covered by sea water all the time
- Shifting dunes along the shoreline with *Ammophila arenaria* (`white dunes')

Qualifying species: The site is designated under **article 4(4)** of the Directive (92/43/EEC) as it hosts the following species listed in Annex II:

- Grey seal *Halichoerus grypus*
- River lamprey *Lampetra fluviatilis*
- Sea lamprey *Petromyzon marinus*

Annex I priority habitats are denoted by an asterisk (*)

This citation relates to a site entered in the Register of European Sites for Great Britain.
Register reference number: UK0030170
Date of registration:10 December 2009

Signed: [redacted]

On behalf of the Secretary of State for Environment, Food and Rural Affairs

Humber Estuary SPA

EC Directive 79/409 on the Conservation of Wild Birds
Special Protection Area (SPA)

Name: Humber Estuary

Unitary Authorities/Counties: City of Kingston-upon-Hull, East Riding of Yorkshire, Lincolnshire, North East Lincolnshire, North Lincolnshire

Component SSSIs: The SPA encompasses all or parts of the following Sites of Special Scientific Interest (SSSIs): Humber Estuary SSSI, North Killingholme Haven Pits SSSI, Saltfleetby-Theddlethorpe Dunes SSSI, and The Lagoons SSSI.

Site description: The Humber Estuary is located on the east coast of England, and comprises extensive wetland and coastal habitats. The inner estuary supports extensive areas of reedbed, with areas of mature and developing saltmarsh backed by grazing marsh in the middle and outer estuary. On the north Lincolnshire coast, the saltmarsh is backed by low sand dunes with marshy slacks and brackish pools. Parts of the estuary are owned and managed by conservation organisations. The estuary supports important numbers of waterbirds (especially geese, ducks and waders) during the migration periods and in winter. In summer, it supports important breeding populations of bittern *Botaurus stellaris*, marsh harrier *Circus aeruginosus*, avocet *Recurvirostra avosetta* and little tern *Sterna albifrons*.

Size of SPA: The SPA covers an area of 37,630.24 ha.

Qualifying species:
The site qualifies under **article 4.1** of the Directive (79/409/EEC) as it is used regularly by 1% or more of the Great Britain populations of the following species listed in Annex I in any season:

Annex I species	Count and season	Period	% of GB population
Avocet *Recurvirostra avosetta*	59 individuals – wintering	5 year peak mean 1996/97 – 2000/01	1.7%
Bittern *Botaurus stellaris*	4 individuals – wintering	5 year peak mean 1998/99 – 2002/03	4.0%
Hen harrier *Circus cyaneus*	8 individuals – wintering	5 year peak mean 1997/98 – 2001/02	1.1%
Golden plover *Pluvialis apricaria*	30,709 individuals – wintering	5 year peak mean 1996/97 – 2000/01	12.3%
Bar-tailed godwit *Limosa lapponica*	2,752 individuals – wintering	5 year peak mean 1996/97 – 2000/01	4.4%
Ruff *Philomachus pugnax*	128 individuals – passage	5 year peak mean 1996-2000	1.4%
Bittern *Botaurus stellaris*	2 booming males – breeding	3 year mean 2000-2002	10.5%
Marsh harrier *Circus aeruginosus*	10 females – breeding	5 year mean 1998-2002	6.3%
Avocet *Recurvirostra avosetta*	64 pairs – breeding	5 year mean 1998 – 2002	8.6%
Little tern *Sterna albifrons*	51 pairs – breeding	5 year mean 1998-2002	2.1%

The site qualifies under **article 4.2** of the Directive (79/409/EEC) as it is used regularly by 1% or more of the biogeographical populations of the following regularly occurring migratory species (other than those listed in Annex I) in any season:

Migratory species	Count and season	Period	% of subspecies/ population
Shelduck *Tadorna tadorna*	4,464 individuals – wintering	5 year peak mean 1996/97 – 2000/01	1.5% Northwestern Europe (breeding)
Knot *Calidris canutus*	28,165 individuals – wintering	5 year peak mean 1996/97 – 2000/01	6.3% *islandica*
Dunlin *Calidris alpina*	22,222 individuals – wintering	5 year peak mean 1996/97 – 2000/01	1.7% *alpina*, Western Europe (non-breeding)
Black-tailed godwit *Limosa limosa*	1,113 individuals – wintering	5 year peak mean 1996/97 – 2000/01	3.2% *islandica*
Redshank *Tringa totanus*	4,632 individuals – wintering	5 year peak mean 1996/97 – 2000/01	3.6% *brittanica*
Knot *Calidris canutus*	18,500 individuals – passage	5 year peak mean 1996 – 2000	4.1% *islandica*
Dunlin *Calidris alpina*	20,269 individuals – passage	5 year peak mean 1996 – 2000	1.5% *alpina*, Western Europe (non-breeding)
Black-tailed godwit *Limosa limosa*	915 individuals – passage	5 year peak mean 1996 – 2000	2.6% *islandica*
Redshank *Tringa totanus*	7,462 individuals – passage	5 year peak mean 1996 – 2000	5.7% *brittanica*

Bird counts from: Wetland Bird Survey (WeBS) database and *The Humber Estuary: A comprehensive review of its nature conservation interest* (Allen *et al.* 2003).

Assemblage qualification:
The site qualifies under **article 4.2** of the Directive (79/409/EEC) as it is used regularly by over 20,000 waterbirds (waterbirds as defined by the Ramsar Convention) in any season:

In the non-breeding season, the area regularly supports 153,934 individual waterbirds (five year peak mean 1996/97 – 2000/01), including dark-bellied brent goose *Branta bernicla bernicla*, shelduck *Tadorna tadorna*, wigeon *Anas penelope*, teal *Anas crecca*, mallard *Anas platyrhynchos*, pochard *Aythya ferina*, scaup *Aythya marila*, goldeneye *Bucephala clangula*, bittern *Botaurus stellaris*, oystercatcher *Haematopus ostralegus*, avocet *Recurvirostra avosetta*, ringed plover *Charadrius hiaticula*, golden plover *Pluvialis apricaria*, grey plover *P. squatarola*, lapwing *Vanellus vanellus*, knot *Calidris canutus*, sanderling *C. alba*, dunlin *C. alpina*, ruff *Philomachus pugnax*, black-tailed godwit *Limosa limosa*, bar-tailed godwit *L. lapponica*, whimbrel *Numenius phaeopus*, curlew *N. arquata*, redshank *Tringa totanus*, greenshank *T. nebularia* and turnstone *Arenaria interpres*.

Non-qualifying species of interest: The SPA is used by non-breeding merlin *Falco columbarius*, peregrine *F. peregrinus* and short-eared owl *Asio flammeus*, and breeding common tern *Sterna hirundo* and kingfisher *Alcedo atthis* (all species listed in Annex I to the EC Birds Directive) in numbers of less than European importance (less than 1% of the GB population).

Status of SPA:
1) Humber Flats, Marshes and Coast (Phase 1) SPA was classified on 28 July 1994.
2) The extended and renamed Humber Estuary SPA was classified on 31 August 2007.

This citation relates to a site entered in the Register of European Sites for Great Britain.
Register reference number: UK9006111
Date of registration: 31 August 2007

Signed: [redacted]

On behalf of the Secretary of State for Environment, Food and Rural Affairs

Humber Estuary Ramsar Site

Ramsar Convention on
Wetlands of International Importance Especially as Waterfowl Habitat

Name: Humber Estuary

Unitary Authority/County: City of Kingston-upon-Hull, East Riding of Yorkshire, Lincolnshire, North East Lincolnshire, North Lincolnshire

Component SSSIs: The Ramsar site encompasses all or parts of the following Sites of Special Scientific Interest (SSSIs): Humber Estuary SSSI, North Killingholme Haven Pits SSSI, Saltfleetby-Theddlethorpe Dunes SSSI, and The Lagoons SSSI.

Site description: The Humber Estuary is located on the east coast of England, and comprises extensive wetland and coastal habitats. The inner estuary supports extensive areas of reedbed with areas of mature and developing saltmarsh backed by grazing marsh in the middle and outer estuary. On the north Lincolnshire coast, the saltmarsh is backed by low sand dunes with marshy slacks and brackish pools. Parts of the estuary are owned and managed by conservation organisations. The estuary supports important numbers of waterbirds (especially geese, ducks and waders) during the migration periods and in winter. It also supports important populations of seals, amphibians and migratory fish.

Size of Ramsar site: The Ramsar site covers an area of 37,987.80 ha.

International importance of Ramsar site: The Ramsar site is a Wetland of International Importance because:

The site qualifies under **Criterion 1** because it contains a representative, rare, or unique example of a natural or near-natural wetland type:

The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons.

It is a large macro-tidal coastal plain estuary with high suspended sediment loads, which feed a dynamic and rapidly changing system of accreting and eroding intertidal and subtidal mudflats, sandflats, saltmarsh and reedbeds. Examples of both strandline, foredune, mobile, semi-fixed dunes, fixed dunes and dune grassland occur on both banks of the estuary and along the coast. The estuary supports a full range of saline conditions from the open coast to the limit of saline intrusion on the tidal rivers of the Ouse and Trent. Wave exposed sandy shores are found in the outer/open coast areas of the estuary. These change to the more moderately exposed sandy shores and then to sheltered muddy shores within the main body of the estuary and up into the tidal rivers. The lower saltmarsh of the Humber is dominated by common cordgrass *Spartina anglica* and annual glasswort *Salicornia* communities. Low to mid marsh communities are mostly represented by sea aster *Aster tripolium*, common saltmarsh grass *Puccinellia maritima* and sea purslane *Atriplex portulacoides* communities. The upper portion of the saltmarsh community is atypical, dominated by sea couch *Elytrigia atherica* (*Elymus pycnanthus*) saltmarsh community. In the upper reaches of the estuary, the tidal marsh community is dominated by the common reed *Phragmites australis* fen and sea club rush *Bolboschoenus maritimus* swamp with the couch grass *Elytrigia repens (Elymus repens)* saltmarsh community. Within the Humber Estuary Ramsar site there are good examples of four of the five physiographic types of saline lagoon.

The site qualifies under **Criterion 3** because it supports populations of animal species important for maintaining the biological diversity of the biogeographic region:

The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast. The dune slacks at Saltfleetby-Theddlethorpe on the southern extremity of the Ramsar site are the most north-easterly breeding site in Great Britain of the natterjack toad *Bufo calamita*.

The site qualifies under **Criterion 5** because it regularly supports 20,000 or more waterbirds:

In the non-breeding season, the area regularly supports 153,934 individual waterbirds (5 year peak mean 1996/97 – 2000/01).

The site qualifies under **Criterion 6** because it regularly supports 1% of the individuals in the populations of the following species or subspecies of waterbird in any season:

Species	Count and season	Period	% of subspecies/population
Shelduck *Tadorna tadorna*	4,464 individuals – wintering	5 year peak mean 1996/97 – 2000/01	1.5% Northwestern Europe (breeding)
Golden plover *Pluvialis apricaria*	30,709 individuals – wintering	5 year peak mean 1996/97 – 2000/01	3.8% *altifrons*, NW Europe, W Continental Europe, NW Africa
Knot *Calidris canutus*	28,165 individuals – wintering	5 year peak mean 1996/97 – 2000/01	6.3% *islandica*
Dunlin *Calidris alpina*	22,222 individuals – wintering	5 year peak mean 1996/97 – 2000/01	1.7% *alpina*, Western Europe (non-breeding)
Black-tailed godwit *Limosa limosa*	1,113 individuals – wintering	5 year peak mean 1996/97 – 2000/01	3.2% *islandica*
Bar-tailed godwit *Limosa lapponica*	2,752 individuals – wintering	5 year peak mean 1996/97 – 2000/01	2.3% *lapponica*
Redshank *Tringa totanus*	4,632 individuals – wintering	5 year peak mean 1996/97 – 2000/01	3.6% *brittanica*
Golden plover *Pluvialis apricaria*	17,996 individuals – passage	5 year peak mean 1996 – 2000	2.2% *altifrons*, NW Europe, W Continental Europe, NW Africa
Knot *Calidris canutus*	18,500 individuals – passage	5 year peak mean 1996 – 2000	4.1% *islandica*
Dunlin *Calidris alpina*	20,269 individuals – passage	5 year peak mean 1996 – 2000	1.5% *alpina*, Western Europe (non-breeding)
Black-tailed godwit *Limosa limosa*	915 individuals – passage	5 year peak mean 1996 – 2000	2.6% *islandica*
Redshank *Tringa totanus*	7,462 individuals – passage	5 year peak mean 1996 – 2000	5.7% *britannica*

Bird counts from: Wetland Bird Survey (WeBS) database.

The site qualifies under **Criterion 8** because it is a migration path on which fish stocks, either within the wetland or elsewhere, depend:

The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.

Non-qualifying species of interest:
The Ramsar site supports nationally important non-breeding numbers of hen harrier *Circus cyaneus* (based on five year peak mean 1997/98 – 2001/02), and nationally important breeding numbers of marsh harrier *Circus aeruginosus*, avocet *Recurvirostra avosetta*, little tern *Sterna albifrons* (based on five year means 1998 – 2002) and bittern *Botaurus stellaris* (based on three year mean 2000 – 2002).

Status of Ramsar site:
i) Humber Flats, Marshes and Coast (Phase 1) Ramsar site was designated on 28 July 1994.
ii) The extended and renamed Humber Estuary Ramsar site was designated on 31 August 2007

Annex C

Supporting Ornithological Information

C1 WATERBIRD DATA SUMMARY

C1.1 HUMBER ESTUARY ASSEMBLAGE

Table C1.1 Wetland Bird Assemblage of the Humber Estuary over a Ten Year Period - WeBS (Wetland Bird Survey) Data

Year	Peak Monthly Total	Spring Peak	Autumn Peak	Winter Peak
1999/00	146,224 (NOV)	24,316	106,823	163,961
2000/01	131,247 (OCT)	42,233	153,888	132,788
2001/02	116,859 (FEB)	1,868	102,278	151,228
2002/03	152,269 (DEC)	38,983	105,755	166,999
2003/04	142,931 (DEC)	37,318	74,064	161,358
2004/05	127,528 (JAN)	11,884	102,306	155,210
2005/06	131,926 (JAN)	36,161	116,943	158,949
2006/07	113,814 (DEC)	29,318	132,788	154,442
2007/08	95,645 (NOV)	35,005	126,089	123,185
2008/09	94,182 (JAN)	33,519	89,006	109,197
10 Year Mean		29,061	110,994	147,732
Last 5 Year Mean		29,177	113,426	**140,197**

Spring (March to June), Autumn (July to October), Winter (November to February)
Source: BTO WeBS data; Sector 38590 Humber Estuary (TA205205) from 1999/00 - 2008/09

C1.1.1 Assemblage counts for the estuary, as given in *Table C1.1* above, show the peak counts for the three main periods of bird usage across the estuary. *Table C1.1* uses data from the British Trust for Ornithology (BTO) Wetland Bird Survey (WeBS). Spring, autumn and winter peaks are derived from the sum of maximum counts for each species recorded across the four month period (1), while monthly peaks are derived from the maximum of the sum of the counts of all species recorded during any one month (which is usually only on one day). Mean peaks are given for spring, autumn and winter, across 10 and 5 years.

C1.1.2 Due to the method by which spring, autumn and winter peaks are calculated, the actual number of birds presented in *Table C1.1* is not an exact reflection of the number of birds found on the Humber estuary at any one time. However this data does allow for general conclusions to

(1) For example the Autumn Peak for 2008/09 was calculated by adding together the peak count for each species in the assemblage irrespective of the time the peak count was established, e.g. Mute swan 377 birds in August, Greylag goose 747 birds in September.

be drawn about the importance of the Humber estuary to assemblage species at certain times of year. *Table C1.1* shows that the use of the Humber estuary by assemblage bird species peaks in the winter period. The 'peak monthly total' values reiterate this point; the majority of the values fall within the winter period between November and February.

Table C1.2 Humber WeBS data from 2004/5 to 2008/9

Species	2004/2005	2005/2006	2006/2007	2007/2008	2008/2009	Mean Peak	Mean Explanation
Assemblage	127,528	131,926	113,814	95,645	94,182	112,619	5
Arctic tern	(4)	9	(2)	20	8	12	3
Avocet	425	374	652	529	486	493	5
Bar headed goose	(0)	(0)	(0)	(1)	2	2	1
Barnacle goose	(200)	88	318	631	(200)	346	3
Bar-tailed godwit	(2,460)	(2,227)	(1,871)	(1,490)	(5,926)	(5,926)	1
Bewicks swan	(0)	7	0	(0)	(0)	4	5
Bittern	3	(2)	3	(2)	3	3	3
Black throated diver	0	0	3	5	1	2	5
Black-headed gull	(1,028)	(2,298)	(819)	(6,689)	(7,865)	(7,865)	1
Black-tailed godwit	2,435	3,296	5,323	4,554	3,828	3,887	5
Canada goose	868	729	363	361	(572)	580	4
Common gull	2,005	(120)	(74)	(298)	(415)	2,005	1
Common sandpiper	(39)	(14)	(13)	(46)	(19)	(46)	1
Common scoter	200	157	280	66	(97)	175	4
Common tern	(160)	(61)	(19)	(330)	7,000	7,000	1
Coot	861	(1,059)	1,404	1,103	1,298	1,166	4
Cormorant	(135)	(93)	(108)	(156)	(219)	(219)	1
Curlew	3, 768	(4,818)	5,180	3,993	(3,071)	4,440	4
Curlew sandpiper	(13)	10	18	10	(6)	13	4
Dark bellied brent goose	(2,667)	(2,636)	(4,586)	(2,430)	(2,801)	(4,586)	1
Dunlin	(14,733)	(26,305)	(14,951)	16,730	(15,444)	21,518	2
Egyptian goose	2	(0)	0	1	0	1	4
Eider	(16)	(3)	(64)	(18)	(19)	(64)	1
European white-fronted goose	3	1	0	(0)	(0)	1	3
Gadwall	(82)	(112)	(179)	(144)	178	179	2
Garganey	1	6	(1)	(0)	0	2	3
Golden plover	43,473	47,118	50,188	(23,526)	(29,172)	46,926	3
Goldeneye	595	449	401	577	302	465	5
Goosander	(5)	(0)	(1)	1	(1)	3	2
Great black-backed gull	(226)	(66)	(20)	(165)	(176)	(226)	1
Great crested grebe	(36)	(27)	(37)	(41)	(25)	(41)	1
Green sandpiper	(10)	5	(9)	(12)	13	10	3

Species	2004/2005	2005/2006	2006/2007	2007/2008	2008/2009	Mean Peak	Mean Explanation
Greenshank	(34)	33	21	(47)	(52)	37	5
Grey heron	(37)	(29)	(33)	74	(48)	74	1
Grey plover	(1,901)	(2,792)	1,923	(3,417)	3,530	2,916	4
Greylag goose	821	(525)	(785)	(906)	775	834	3
Herring gull	(10)	37	14	183	234	117	4
Jack snipe	(2)	(3)	5	5	(3)	5	2
Kingfisher	6	9	3	(8)	(5)	7	4
Kittiwake	0	2	0	0	5	1	5
Knot	(37,015)	(35,004)	(33,529)	41,772	(17,552)	41,772	1
Lapwing	(16,856)	27,421	(19,403)	16,500	11,700	18,756	4
Lesser black-backed gull	70	12	(23)	170	120	93	4
Light bellied brent goose	(0)	10	(8)	2	3	6	4
Little egret	3	14	36	41	95	38	5
Little grebe	60	64	94	150	(91)	92	5
Little ringed plover	7	3	4	(4)	8	6	4
Little stint	3	5	16	10	5	8	5
Little tern	(0)	51	(59)	44	(12)	48	2
Long tailed duck	(2)	(0)	(0)	(2)	(1)	2	1
Mallard	2,455	2,155	(1,911)	2,166	1,607	2,096	4
Mediterranean gull	0	(2)	(1)	(2)	(2)	(2)	1
Moorhen	(170)	(142)	136	166	114	146	5
Mute swan	269	178	350	266	377	288	5
Oystercatcher	(4,582)	(3,468)	2,942	(3,121)	(2,746)	3,528	4
Pink footed goose	5,638	3,909	4,151	3,703	7,108	4,902	5
Pintail	223	(112)	156	124	(177)	170	4
Pochard	(289)	457	210	378	222	317	4
Red breasted goose	0	0	2	0	0	<1	5
Red throated diver	2	8	9	14	7	8	5
Redshank	(8,494)	4,682	3,886	(4,059)	4,716	5,445	4
Ringed plover	(1,277)	(2,168)	(783)	(860)	(781)	(2,168)	1
Roseate tern	(0)	0	0	2	0	2	1
Ruddy duck	84	(27)	59	(31)	(14)	72	2
Ruddy shelduck	(1)	(0)	(0)	(0)	0	1	2
Ruff	35	84	61	62	79	64	5
Sanderling	(589)	(576)	(362)	(706)	(662)	(706)	1
Scaup	2	7	0	2	(7)	4	5
Shag	0	0	3	0	1	1	5
Shelduck	(4,188)	(5,223)	4,823	5,804	(2,892)	5,314	2
Shoveler	99	(128)	(186)	171	124	145	4
Smew	(2)	(3)	2	2	1	2	5
Snipe	110	86	164	124	106	118	5
Spoonbill	2	1	2	3	3	2	5
Spotted redshank	21	10	25	13	13	16	5
Teal	2,349	(3,739)	(2,009)	2,137	3,234	2,865	4
Tufted duck	419	288	444	459	476	417	5
Turnstone	(570)	(183)	(542)	(344)	(447)	(570)	1
Water rail	(5)	(5)	3	(10)	(7)	7	2

Species	2004/2005	2005/2006	2006/2007	2007/2008	2008/2009	Mean Peak	Mean Explanation
Whimbrel	(82)	107	78	36	57	88	5
Whooper swan	8	(115)	32	(44)	84	60	4
Wigeon	(3,570)	3,662	3,892	3,289	3,187	3,520	5
Wood sandpiper	(0)	1	2	1	0	1	4
Woodcock	0	(2)	3	(3)	3	2	3
Yellow-legged gull	1	(3)	0	(11)	(3)	6	2

Humber mean explanation
Within the Humber mean explanation column the numbers relate to the following list. This serves as an explanation as to how the mean values were calculated and is related to the number and nature of incomplete counts published. This method is consistent with WeBS approach. Incomplete counts are only included if they are higher than the complete counts and their inclusion results in a higher mean. The mean value therefore represents the largest average attainable from the counts published.

1) Maxima.
2) 2 year mean of peak.
3) 3 year mean of peak.
4) 4 year mean of peak
5) 5 year mean of peak

C1.2 KILLINGHOLME MARSHES

Table C1.3 Killingholme Marshes WeBS Assemblage Count from 2004/05 to 2008/09

Year	Peak Monthly Total		Spring Peak	Autumn Peak	Winter Peak
04/05	173	(MAR)	107	27	293
05/06	300	(OCT)	105	309	214
06/07	205	(DEC)	38	62	272
07/08	445	(DEC)	49	130	488
08/09	226	(DEC)	127	59	303
MEAN			85	117	314

Spring (March to June), Autumn (July to October), Winter (November to February)
Source: BTO WeBS data; Sector 38406 Killingholme Marshes (TA178187) from 2004/05 -2008/09

C1.2.1 *Table C1.3* gives an overview of the bird assemblage use of Killingholme Marshes throughout the year over a five year period (2004/05-2008/09). As for *Table C1.3* spring, autumn and winter peaks are calculated from the sum of maximum counts for each species recorded across the four month period. The peak monthly total is derived from the maximum of the sum of the counts of all species recorded during one month.

C1.2.2 Once again, due to the method of calculating the spring, autumn and winter peak values, there are some difficulties in determining the actual number of birds present. However, general comparisons can be made between the seasons. *Table C1.3* shows that the bird assemblage use of Killingholme Marshes is consistent with the bird assemblage use of the Humber estuary as a whole with peak use of the site occurring mainly during the winter period, although peak counts have also been recorded in autumn and spring.

Table C1.4 Killingholme Marshes WeBS data from 2004/5 to 2008/9

Species	2004/2005	2005/2006	2006/2007	2007/2008	2008/2009	Mean Peak
Mute Swan	2	4	4	4	2	3
Canada Goose			2			<1
Shelduck	13	7	7	11	7	9
Gadwall	2	9	3	6		4
Teal	41	16	1	4	4	13
Mallard	29	15	7	11	2	13
Shoveler	24	14	7	6	3	11
Pochard	2					<1
Tufted Duck		6	7	6		4
Smew	1	1				<1
Little Grebe	2	2	2	1	1	2
Grey Heron	3		2	1		1
Moorhen	5	3	6	2	2	4
Coot	33	24	19	68	13	31
Oystercatcher				2		<1
Ringed Plover	2					<1
Lapwing	39	30	2	2		15
Knot				7		1
Dunlin	14	62	15	267	76	87
Black-tailed Godwit	17	145	3	2	83	50
Curlew	61	51	58	41	92	61
Redshank	38	76	127	89	86	83
Turnstone		1	1	5		1

Species listed in yellow text are individual Special Protected Area (SPA) Qualifying Interests

Those counts in dark blue represent ≥1%of the Humber population.

Source: BTO WeBS data; Sector 38406 Killingholme Marshes (TA178187) from 2004/05 -2008/09

C1.2.3 *Table C1.4* shows the use of Killingholme Marshes, per species, across a five year period (2004/05-2008/09). The data presented per year is the peak WeBS count within that year. The mean of the peak count across the five year period per species is also shown.

C1.2.4 The table shows that Special Protected Area (SPA) qualifying interest species, Dunlin, Black-tailed godwit and Redshank were all recorded in significant numbers (≥1 percent of the Humber population) at the Killingholme Marshes site. Dunlin was observed in significant numbers in 2007/08 (267 birds), however on average there were 87 birds using this site over the five year period. Black-tailed godwit had a peak of 145 birds recorded in 2005/06 and showed a mean peak of 50 birds over the five year period, both of these figures represent greater than 1 percent of the Humber estuary population. Redshank were recorded in significant numbers over all but one of the five years, with a peak of 89 birds recorded in 2007/08 and a mean peak of 83 birds.

C1.2.5 SPA qualifying interest species, Shelduck, Ringed plover and Knot were also recorded at Killingholme Marshes. These birds were not observed in significant numbers over the five year period.

C1.2.6 Assemblages species where the mean peak exceeded 1 percent of the Humber population included Mute swan, Gadwall, Teal, Mallard, Shoveler, Tufted duck, Smew, Little grebe, Grey heron, Moorhen, Coot and Curlew.

Table C1.5 Killingholme Marshes WeBS Five Year Peak Monthly Bird Counts for 2004/05 to 2008/09

			Autumn				Winter			Spring			
Species	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Max**
Mute swan		2	2			1	4	2	2	4	2		4
Greylag goose (re-established)									4				4
Canada goose										2			2
Shelduck		1	1		11		10	2	5	11	13		13
Gadwall				2	4	6	6	9	2				9
Teal		1				41	7		29	16			41
Mallard			10	15	13	2	9	14	29	11	3		29
Shoveler			3	7	10	1	4	2	24	14			24
Pochard								2	1				2
Tufted duck			6	6			1	2	7		4		7
Smew							1	1	1				1
Little grebe		2		1				2	1	1			2
Grey heron							3		1	2	2		3
Moorhen		1	3	1	1	2	3	1	6	5	3		6
Coot		12	12	14	31	68	33	25	18	10	8		68
Oystercatcher									2	2	3		3
Ringed plover									2				2
Lapwing				30	1	19	19	7	39	3	2		39
Knot					7								7
Dunlin		3		29	76	276	48	16	63	5			276
Black-tailed godwit		3	1	145	4	15	21		11	8			145
Curlew		43	15	45	20	92	36	6	14	51	28		92
Redshank		13	66	52	82	127	76	76	86	38			127
Turnstone			5		1								5

Species listed in yellow text are individual SPA Qualifying Interests.

Those counts in dark blue represent ≥1%of the Humber population.

Source: BTO WeBS data; Sector 38406 Killingholme Marshes (TA178187) from 2004/05 -2008/09

C1.2.7 *Table C1.5* depicts the peak monthly count of WeBS data recorded across the five year period (2004/05-2008/09) for the Killingholme Marshes WeBS sector. The maximum peak count across the same five year period is also given for each species. This is useful in helping identify temporal patterns of abundance for each species.

C1.2.8 This table reiterates that Killingholme Marshes is most heavily used over the Autumn/Winter period. Significant numbers (≥1 percent of the Humber population) of Gadwall, Teal, Mallard, Shoveler, Tufted duck, Smew, Little grebe, Grey heron, Moorhen, Coot, and Curlew and SPA qualifying interest species; Dunlin, Black-tailed godwit, and Redshank were observed over the five year WeBS count data between August and February. Significant numbers of some of these species were also observed at the start of the spring period, March through to May.

C1.2.9 Dunlin showed peak usage of Killingholme Marshes in December with a peak of 276 birds recorded during this month. They were recorded as using this site throughout the winter and for a marginal period either side of the winter period. Black-tailed godwit peaked in October with 145 birds recorded. They appear to use the site through the end of the autumn, start of the winter and also at the start of spring. Redshank was recorded in significant numbers all through the winter and was also observed in autumn and spring.

C1.2.10 SPA qualifying interest species, Shelduck, Ringed plover and Knot were not observed in significant numbers at Killingholme Marshes.

Table C1.6 Killingholme Marshes WeBS Low Tide Count Data for 2003-04

		Autumn				Winter				Spring		
Species	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Shelduck								2	1	4	9	30
Mallard	2						14	22	4	6	27	
Oystercatcher									2		1	
Ringed Plover	1		5									
Lapwing						875	93	10	10			
Sanderling		2										
Dunlin	6		110	124	3	149	223	128				
Black-tailed Godwit	506	486	961									
Curlew	13	6	10	6	5	1	77	30	24		1	34
Redshank	12	30	100	28	13	69	51	59	24			1
Turnstone		11	16	7	4		22	10				

Species listed in Yellow are individual SPA Qualifying Interests

Those counts in dark blue represent ≥1%of the Humber population.

Source: BTO (2003/04) WeBS Low Tide Count data for the Humber Estuary

C1.2.11 *Table C1.6* shows the monthly counts of species recorded during the WeBS Low Tide Count across undertaken in 2003-04.

C1.2.12 This table helps to illustrate the seasonal, low tide, use of Killingholme Marshes. Some species such as Black-tailed godwit are found in significant numbers (≥1 percent of the Humber population) at Killingholme Marshes between July and September whereas other species, such as Lapwing can be found at the site from December to March (with significant numbers observed in December).

C1.2.13 SPA qualifying interest species, Dunlin, Black-tailed godwit and Redshank were all recorded in significant numbers (≥1 percent of the Humber population). These species were observed in autumn and winter periods with peak number of Dunlin in January (223 birds), Black-tailed godwit in September (961 birds) and Redshank also in September (100 birds).

C1.2.14 SPA qualifying interest species Shelduck and Sanderling were also recorded at low tide on Killingholme Marshes but not in significant numbers. Shelduck were mainly observed during the spring, with a peak of 30 birds in June and 2 Sanderling were recorded at low tide in August.

C1.2.15 Other assemblage species recorded in significant numbers are Mallard (February), Curlew (January) and Turnstone (August-October, and January-February inclusive).

Table 1.7 Killingholme Marshes IECS (Institute of Estuarine and Coastal Studies) Through the Tide Wetland Bird Counts for April 2010 - March 2011

Species	Apr	May	Jun	Jul (1)	Jul (2)	Aug	Aug (2)	Sep	Oct	Oct (2)	Nov	Dec	Jan	Jan (2)	Feb	Feb (2)	Mar	Mar (2)	Apr	MAX
Mute swan												2		2						2
Shelduck	20	19	20	16	9	68	91	19	64	66	41	3	31	39	50	109	106	36	48	109
Wigeon														2						2
Teal								12				4	1	2						12
Mallard	5	3	4	14			7			2	1	3		1	2		2		1	14
Cormorant				1				1			2									2
Coot												2								2
Oystercatcher	5	4	2	6	11	5			1							3	10	12	8	12
Avocet							4													4
Ringed plover	10	11	12	1	5	20	210	152	15	5						2	1	3	5	210
Golden plover				1																1
Grey plover									4	6	4	4								4
Lapwing				3					11	1	187	40		291	123	45				291
Knot			2				4	1										1		4
Dunlin			1			6	140	156	742	452	1,029	645	571	524	102	404	431	89		1,029
Ruff							1	1												1
Black-tailed godwit	250	64	1	88	100	818	983	57	2,566	1,859			66	16	96	184	205	193	121	2,566
Bar-tailed godwit			16	26	55	1		1	23	26	12	48	42	27	7	37	2	123		123
Whimbrel					1	2														2
Curlew	26	40	15	126	109	141	126	92	60	83	143	31	58	122	74	118	121	158	72	158
Common sandpiper					1		3													3
Black-headed	2	4	63	163	150	252	128	15	53	79	12	36	33	10	8	100	2		17	252

Species	Apr	May	Jun	Jul (1)	Jul (2)	Aug	Aug (2)	Sep	Oct	Oct (2)	Nov	Dec	Jan	Jan (2)	Feb	Feb (2)	Mar	Mar (2)	Apr	MAX
gull																				
Mediterranean gull						2														2
Common gull		15	3	8	13	17	6	4			1	8	73	8	4	42	4	2	12	73
Yellow-legged gull					1															1
Herring gull	1	1		7	5	1	1	3		3	1		2	1	1	2	3		1	7
Lesser black-backed gull				3	6	3														6
Great black-backed gull	3	3	2	4	2	13	16	40	1	12	3	8	1	2	1	2	3			40
Redshank					5	183	540	119	226	177	206	67	154	163	157	135	94	84	8	540
Assemblage	164	164	141	467	473	1,532	2,260	673	3,766	2,771	1,642	901	1,032	1,210	625	1,183	984	701	293	3,766

Species listed in Blue text are individual SPA Qualifying Interests

Those counts in dark blue represent ≥1%of the SPA Qualifying interest population.

Source: *IECS Through the Tide Counts April 2010 to April 2011*

C1.2.16 Institute of Estuarine Coastal Studies (IECS) data for Killingholme Marshes is displayed in *Table C1.7*. Here, counts per species are presented across the survey period; April 2010-March 2011 and through the tide from low to high. If more than one survey took place within a month, each survey is represented individually. The count of the assemblage per survey is also shown. This is the sum of the counts of each species in any given survey. The maximum count per species for the survey period is given in the last column.

C1.2.17 IECS count data, as seen in *Table C1.7*, shows a slightly different overall trend to WeBS count data from the same area with significant numbers (>1 percent of the Humber population) of a few species observed throughout the season, such as Black-tailed godwit. Birds still appear to be present in greatest numbers in the autumn and winter periods, with Black-tailed godwit peak count of 2 566 birds occurring in October. Dunlin and Redshank follow a similar trend, with peak counts of 1,029 and 540 occurring in November and August, respectively.

C1.2.18 SPA qualifying interest species; Shelduck, Avocet, Ringed Plover, Dunlin, Ruff, Black-tailed Godwit, Bar-tailed Godwit and Redshank were all observed in significant numbers. The assemblage over the autumn/winter period was also present in significant numbers with a peak count of 3,766 birds in October. Black-tailed godwit were present on site over much of the year with significant numbers present in 14 out of 18 surveys. Peak numbers of birds were recorded in August (983 birds). Bar-tailed godwit were recorded through the year, with significant numbers present in March (123 birds). Shelduck were observed on site throughout the year with significant numbers present in August, October and February (peak count of 109 birds). Redshank were also recorded at the site through much of the year, absent only in May, June and July. Significant numbers were present from August to March with the peak recorded in August of 540 birds. Dunlin were recorded at Killingholme Marshes from August to March, with one bird observed in June. Significant numbers of Dunlin were recorded from October to March with the peak number occurring in November (1,029 birds). Likewise Ruff were recorded in August and September, 1 bird each month, which is a significant count in terms of the Humber population (64 birds).

C1.2.19 Other species not listed in the SPA citation as individual qualifying interest species were also recorded in significant numbers by IECS in Killingholme Marshes. These species are listed in the citation as part of the entire assemblage. Notably Curlew was recorded throughout the year and in significant numbers, 14 out of 18 surveys and 8 out of 12 months with a peak count occurring in March of 158 birds.

C1.3 NORTH KILLINGHOLME HAVEN PITS

Table C1.8 North Killingholme Haven Pits WeBS Assemblage Count from 2004/5 to 2008/09

Year	Peak Monthly Total	Autumn Peak	Winter Peak	Spring Peak
2004/05	2,526 (SEP)	2,977	1,239	178
2005/06	5,457 (NOV)	3,835	5,511	92
2006/07	4,256 (SEP)	4,409	362	163
2007/08	3,872 (OCT)	4,041	1,903	52
2008/09	3,569 (SEP)	3,675	405	103
MEAN		3,787	1,884	118

Spring (March to June), Autumn (July to October), Winter (November to February)
Those counts in dark blue represent ≥1%of the Humber population.
Source: BTO WeBS data; Sector 38201 North Killingholme Haven Pits (TA166196) from 2004/05 -2008/09

C1.3.1 *Table C1.8* gives an overview of the assemblage use of North Killingholme Haven Pits across the seasons. The peak monthly total is derived from the maximum of the sum of the counts of all species recorded during one month where as spring, autumn and winter peaks are derived from the sum of maximum counts for each species recorded across the four month period.

C1.3.2 Due to the method used to calculate the seasonal peaks, little information can be gleaned from the number of birds presented. However, from the table, it can be noted that the estuary is most heavily used by assemblage species during the autumn period. Significant numbers (≥1 percent of the Humber population) of the assemblage can be found in the autumn of all years and the winter period in two years, but not at all in Spring.

Table C1.9 North Killingholme Haven Pits WeBS data from 2004/5 to 2008/9

Species	2004/2005	2005/2006	2006/2007	2007/2008	2008/2009	Mean Peak
Mute swan		1		2		1
Canada goose	1			2		1
Shelduck	8	6	7	2	11	7
Gadwall				2		<1
Teal	10	73	26	19	21	30
Mallard	19	45	84	130	77	71
Shoveler	46	34	34	20	10	29
Tufted duck	5					1
Little grebe	3		1			1
Cormorant	1		1		1	1
Grey heron	3	2	5	5	2	3
Moorhen	3	4	1	2	2	2
Coot	5	3	1	4	1	3
Oystercatcher	2	2	4			2
Avocet	17	33	42	29	15	27
Ringed plover		4	2			1
Golden plover			1			<1
Grey plover				1		<1
Lapwing	341	775	104	162		276
Dunlin	375	1,510	12	1		380
Ruff		3				1
Snipe	1	6		10	3	4
Black-tailed godwit	2,150	3,105	4,150	3,735	3,550	3,338
Curlew	7	16	22	8	8	12
Redshank	451	435	86	55	46	215

Species listed in yellow text are individual SPA Qualifying Interests

Those counts in dark blue represent ≥1%of the Humber population.

Source: BTO WeBS data; Sector 38201 North Killingholme Haven Pits (TA166196) from 2004/05 -2008/09

C1.3.3 *Table C1.9* shows the use of North Killingholme Haven Pits, per species, across a five year period (2004/05 - 2008/09). The data presented per year is the peak WeBS count within that year. The mean of the peak count across the five year period per species is also shown.

C1.3.4 SPA, qualifying interest species, Avocet, Dunlin, Ruff, Black-tailed godwit and Redshank were all observed in significant numbers (≥1 percent of the Humber population) in North Killingholme Haven Pits across the five year period. Avocet peak usage of the site occurred in 2006/07 (42 birds) with a mean peak of 27 birds over the five year period. Dunlin were recorded in significant numbers in 2004/05 (375 birds) and 2005/06 (1,510 birds) with a mean peak of 380 birds over the five year period. Ruff were observed in significant numbers in 2005/06 (3 birds). Black-tailed godwits were recorded in significant numbers consistently across the five year period with a mean peak number of birds in North Killingholme Marshes of 3,338 birds. Redshank were recorded in significant numbers in all but one of the five years with a mean peak of 215 birds.

C1.3.5 SPA, qualifying interest species, Shelduck, Ringed plover, Golden plover and Grey plover were also recorded at Killingholme Pits but not in significant numbers.

C1.3.6 Birds that are not listed individually as SPA qualifying interest species but are part of the overall assemblage, Gadwall, Teal, Mallard, Shoveler, Tufted duck, Little grebe, Grey heron, Moorhen and Lapwing were also recorded in significant numbers.

Table C1.10 North Killingholme Haven Pits WeBS Five Year Peak Monthly Bird Counts for 2004/05 to 2008/09

			Autumn			Winter				Spring			
Species	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**MAX**
Mute Swan			1	1				2					2
Canada Goose										2			2
Shelduck		7	7					7	11	8	8		11
Gadwall					2								2
Teal		19	15	14	73	26	21	19	12	6			73
Mallard		29	130	45	54	84	77	35	22	18	6		130
Shoveler		5		34	20	46	27	34	19	7			46
Tufted Duck			5										5
Little Grebe			3			1							3
Cormorant		2	3				1						3
Grey Heron		2	5	5	3	2	2	1		1	2		5
Moorhen			4	2	2	3		2	3	1	3		4
Coot		4	2		3	1		4	5	2	4		5
Oystercatcher		4							2	2			4
Avocet									42	33	17		42
Ringed plover		4											4
Golden Plover								1					1
Grey Plover								1					1
Lapwing		341	32	104	775	477	74	134		5			775
Dunlin		12	76	51	1,510	37	3	375		2			1,510
Ruff			3							2			3
Jack Snipe					1								1
Snipe				10		2			3				10

Black-tailed Godwit	3,140	4,150	3,735	2,710	11	1	390	222	86	42		4,150
Curlew	16	6	7	8	2	5	22	7	12	3		22
Redshank	451	345	52	355	141	91	232	70	43	1		451
Kingfisher		2										2

Species listed in yellow text are individual SPA Qualifying Interests.

Those counts in dark blue represent ≥1% of the Humber population.

Source: BTO WeBS data; Sector 38201 North Killingholme Haven Pits (TA166196) from 2004/05 -2008/09

C1.3.7 The monthly use of North Killingholme Haven Pits per species according to WeBS Core Counts is shown in *Table C1.9*. Monthly data points per species depict the peak count of WeBS data across a five year period (2004/05-2008/09). The maximum peak count across the same five year period is also given.

C1.3.8 Significant numbers (≥1 percent of the Humber population) of birds occur at North Killingholme Haven Pits between August and May with the majority of species occurring in significant numbers in the autumn and winter periods. Significant numbers of some species are also recorded in the spring such as Avocet, Redshank and Black-tailed godwit.

C1.3.9 SPA, qualifying species, Avocet, Dunlin, Ruff, Black-tailed godwit, Redshank and Kingfisher were all recorded in significant numbers over the five year period. Avocet were recorded March to May with a peak of 42 birds in March. Dunlin were recorded from August to February and April with a peak of 1 510 birds in November. Ruff were observed in September and April with a peak of 3 birds in September, this is a significant number in terms of the Humber population of 64 birds. Black-tailed godwit were observed in significant numbers over much of the season over the five year period. Peak numbers occurred at the site in September (4,150 birds) Redshank followed a similar pattern with birds recorded from August to May and peak numbers occurring in August (451 birds). Two kingfisher were observed in October which is a significant number in terms of the Humber population of 6 birds.

C1.3.10 SPA, qualifying species, Shelduck, Golden plover and Grey plover were also recorded at North Killingholme Haven Pits, however not in significant numbers over the five year period.

C1.3.11 Assemblage species Gadwall, Teal, Mallard, Shoveler, Tufted duck, Little grebe, Cormorant, Grey heron, Moorhen, Lapwing, Jack snipe and Snipe were all recorded in significant numbers at North Killingholme Haven Pits.

Table C1.11 North Killingholme Haven Pits WeBS 2003-04 Low Tide Count Data

	Autumn				Winter				Spring			
Species	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**
Shelduck										6	6	2
Teal			16	2	13	8	62	26	8	6		
Mallard				30		14	14	18	16	6	2	8
Oystercatcher												2
Avocet				2						3	4	
Black-tailed Godwit	215	705	927	651						4		
Curlew	3		2	5	3	2	18	15	15	5		
Redshank				15	14	10	25	11	4	5		12

Species listed in yellow text are individual SPA Qualifying Interests

Those counts in dark blue represent ≥1%of the Humber population

Source: BTO (2003/04) *WeBS Low Tide Count data for the Humber Estuary*

C1.3.12 *Table C1.11* shows the monthly counts recorded at North Killingholme Haven Pits during the WeBS Low Tide Count undertaken in 2003-04.

C1.3.13 Significant numbers (≥1 percent of the Humber population) of SPA qualifying interest species, Black-tailed godwit, were recorded between July and October with peak site usage between 215 and 927 birds across this period. SPA, qualifying interest species Shelduck, Avocet and Redshank were also observed but not in significant numbers at this site. Assemblage only species were also recorded in significant numbers, Teal in January (62 birds) and Mallard in October (30 birds).

Table C1.12 North Killingholme Haven Pits IECS Through the Tide Wetland Bird Counts for April 2010-March 2011

Species	Apr	May	Jun	Jul	Jul (2)	Aug	Aug (2)	Sep	Oct	Oct (2)	Nov	Dec	Jan	Jan (1)	Feb	Feb (2)	Mar	Mar (2)	Apr	Max
Mute swan					1					1			1							1
Greylag goose																		2	5	2
Shelduck		9			5								5			2	8	3	5	9
Teal								4	46	15	23		18	19	29	26	12	16	3	46
Mallard	7	1	2	2	3				34	12	22		16	4	7	17	4	1	1	34
Shoveler										61								4		61
Tufted duck					1															1
Smew													1							1
Cormorant						1														1
Little egret			1	1																1
Water rail			2		1		1													2
Moorhen	2		1	4			1							1	1			2	4	4
Coot		2			1								1			2		2	1	2
Grey heron		1	1	1	3	1		1	3	2	2				1			1		3
Oystercatcher	2			2		2	1										4		2	4
Avocet	3					2	4										16			16
Little ringed plover	2				1															2
Golden plover							1													1
Lapwing									4	5										5
Knot					1	3	12													12
Dunlin	1					6			25	270				1						270
Snipe	1									6									1	6

Species	Apr	May	Jun	Jul	Jul (2)	Aug	Aug (2)	Sep	Oct	Oct (2)	Nov	Dec	Jan	Jan (1)	Feb	Feb (2)	Mar	Mar (2)	Apr	Max
Black-tailed godwit	500	64		270	250	2200	3800	86	800	3500					1		18	1	136	3800
Bar-tailed godwit						1		1	1											1
Curlew	1			1	6	4	1	3	7	2	3			1	2	4	7	3	2	7
Common sandpiper				1		1	1													1
Redshank	17	1		4	10	205	249	102	50	147	53		4	34	27	51	57	3	21	249
Black-headed gull	1			3	16	15	41			4			3		11					41
Common gull															2					2
Great black-backed gull													1							1
Assemblage	537	78	7	289	299	2441	4112	197	970	4025	103	0	50	60	81	102	126	36	181	4112

Species listed in yellow text are individual SPA Qualifying Interests

Those counts in dark blue represent ≥1% of the Humber population

Source: IECS *Through the Tide Count April 2010 to April 2011*.

C1.3.14 IECS data for North Killingholme Haven Pits is displayed in *Table C1.12*. Here, counts per species are presented across the survey period; April 2010-March 2011 and through the tides from low to high. If more than one survey took place within a month, each survey is represented individually. The count of the assemblage per survey is also shown. This is the sum of the counts of each species in any given survey. The maximum count per species for the survey period is given in the last column.

C1.3.15 This table shows observations of birds in North Killingholme Haven Pits through the seasons. Significant numbers (≥1 percent of the Humber population) of species occur across most months. Distribution of significant counts is patchy but the highest absolute numbers and greatest diversity of species recorded in significant numbers occurs during July to October.

C1.3.16 SPA qualifying interest species are found in significant numbers throughout the survey period, Avocet, Dunlin, Black-tailed godwit and Redshank. The assemblage is also observed in significant numbers in August and in October when it peaks at 4,025 birds. Black-tailed godwit peak usage ranges from 64 birds in May to a maximum of 3,800 birds in August. Significant numbers of Avocet and Redshank occur in the spring with 16 and 57 birds recorded respectively in March. Dunlin show peak use of the site in October with 270 birds recorded.

C1.3.17 Some SPA qualifying interest species were recorded at the site but not in significant numbers in terms of the Humber population. Shelduck, Golden plover, Knot and Bar-tailed godwit were observed.

C1.3.18 Species that are not individually listed on the qualifying interests of the SPA were also found in significant numbers. These species are important in terms of the assemblage which is a qualifying interest on the SPA citation. Teal, Mallard, Shoveler, Smew, Little egret, Water rail, Moorhen, Grey heron, Little ringed plover, Snipe and Common sandpiper were all recorded in significant numbers over the survey period.

C1.4 KILLINGHOLME FIELDS

Table C1.13 IECS Killingholme Fields Surveys April 2010 - March 2011

Species	Apr	May	Jun	Jul(1)	Jul(2)	Aug	Aug(2)	Sep	Oct	Oct (2)	Nov	Dec	Jan	Jan (2)	Feb	Feb(2)	Mar	Mar(2)	MAX
Lapwing										1									
Black-tailed godwit									1										
Curlew					1		8	54	7	36		31		72	12				72

Species listed in Blue text are individual SPA Qualifying Interests

Those counts in dark blue represent ≥1% of the SPA Qualifying interest population.

Source: IECS *Through the Tide Counts April 2010 to April 2011* and subsequent data provided in excel format.

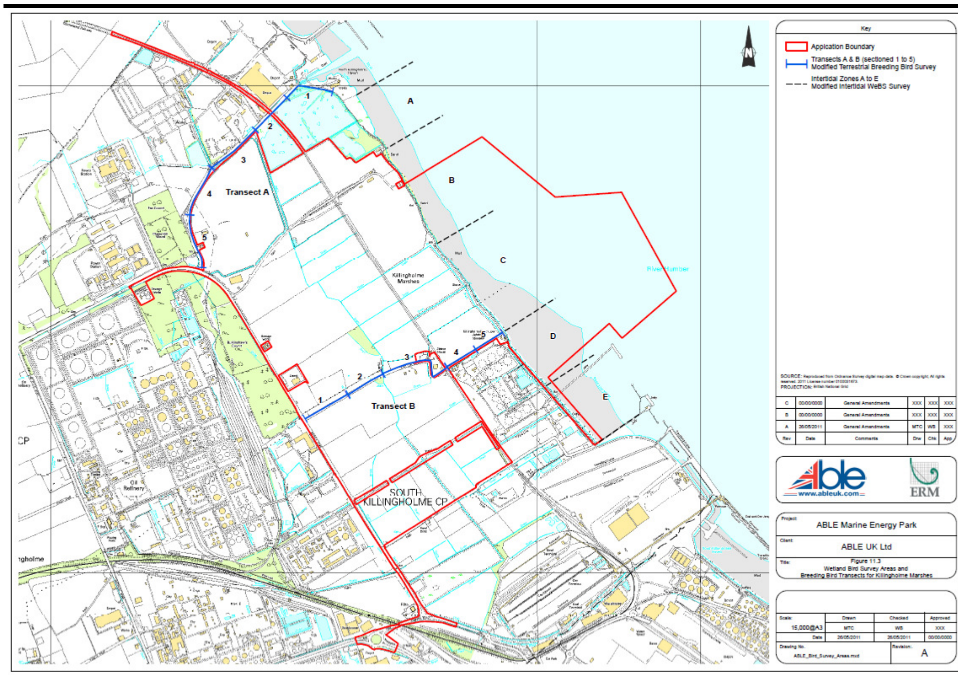
C1.4.1 Institute of Estuarine Coastal Studies (IECS) data for Killingholme Fields is displayed in *Table C1.13*. Here, counts per species are presented across the survey period; April 2010-March 2011 and through the tides from low to high. If more than one survey took place within a month, each survey is represented individually. The maximum count per species for the survey period is given in the last column.

C1.4.2 Species were observed from July 2010 to February 2011. Significant numbers (≥1 percent of the Humber population) of Curlew were observed in September and January (54 and 72 birds, respectively). 1 Black-tailed godwit and 1 Lapwing were recorded in October.

C2 TEMPORARAL AND SPATIAL USE OF KILLINGHOLME MARSHES BY WETLAND BIRDS

C2.1.1 The IECS TTTC surveys split the Killingholme Marshes area into a series of discreet sectors and data was collected in order to evaluate the differences in both the spatial and temporal distribution of birds over the mudflats.

Figure C2.1 Count Sections A-E Used During TTTC Survey of Foreshore



C2.1.2 The following sections provide a table and charts depicting the distribution of all the species plus the overall assemblage feature that are taken forward from the HRA screening process to the AA stage. The data helps illustrate the area of mudflat most favoured by each qualifying feature, and the pattern of distribution over time.

C2.2 ASSEMBLAGE

Table C2.1 Maximum hourly count at Killingholme Marshes over survey period.

Survey Date	A	B	C	D	E	TOTAL	HOUR of TIDE*
Apr-22	0	20	30	284	-	334	0
May-07	4	9	11	78	-	102	+1
Jun-07	1	1	15	81	-	98	0
Jul-05	32	129	104	117	30	412	0
Jul-09	0	0	9	0	0	9	+4,+5 &+6
Aug-02	8	0	26	33	1	68	-3
Aug-24	0	0	47	37	7	91	-1
Sep-05	0	0	6	12	1	19	0
Oct-05	0	0	48	16	0	64	+2
Oct-13	0	0	0	31	35	66	0
Nov 18	0	0	12	29	0	41	0
Dec-24	0	0	0	2	1	3	-1
Jan-25	0	0	2	23	6	31	-2
Jan-31	0	1	28	8	2	39	+3
Feb-08	0	0	5	37	8	50	0
Feb-16	0	2	34	63	10	109	-6
Mar-18	4	13	34	12	43	106	-5
Mar-30	0	0	4	17	15	36	+6
Apr-19	0	6	1	5	36	48	-1

* HOUR of TIDE column gives an indication of the state of the tide. 0 is equal to low tide. +/- Gives an indication of how many hours before or after low tide the survey occurred, e.g. +1 indicates the survey took place 1 hour **after** low tide and -1 indicates the survey took place 1 hour **before** low tide.

Table C2.2 Peak presence of the assemblage per sector by month in Killingholme Marshes

	Peak count (per sector)				
Survey Date	A	Survey Date	A	Survey Date	A
Apr-22	5	Apr-22	5	Apr-22	5
May-07	8	May-07	8	May-07	8
Jun-07	2	Jun-07	2	Jun-07	2
Jul-05	42	Jul-05	42	Jul-05	42
Jul-09	11	Jul-09	11	Jul-09	11
Aug-02	72	Aug-02	72	Aug-02	72
Aug-24	124	Aug-24	124	Aug-24	124
Sep-05	19	Sep-05	19	Sep-05	19
Oct-05	7	Oct-05	7	Oct-05	7
Oct-13	54	Oct-13	54	Oct-13	54
Nov 18	25	Nov 18	25	Nov 18	25
Dec-24	28	Dec-24	28	Dec-24	28
Jan-25	52	Jan-25	52	Jan-25	52
Jan-31	205	Jan-31	205	Jan-31	205
Feb-08	13	Feb-08	13	Feb-08	13
Feb-16	43	Feb-16	43	Feb-16	43
Mar-18	27	Mar-18	27	Mar-18	27
Mar-30	7	Mar-30	7	Mar-30	7
Apr-19	5	Apr-19	5	Apr-19	5

Figure C2.2 *Peak presence of the assemblage per sector by month in Killingholme Marshes*

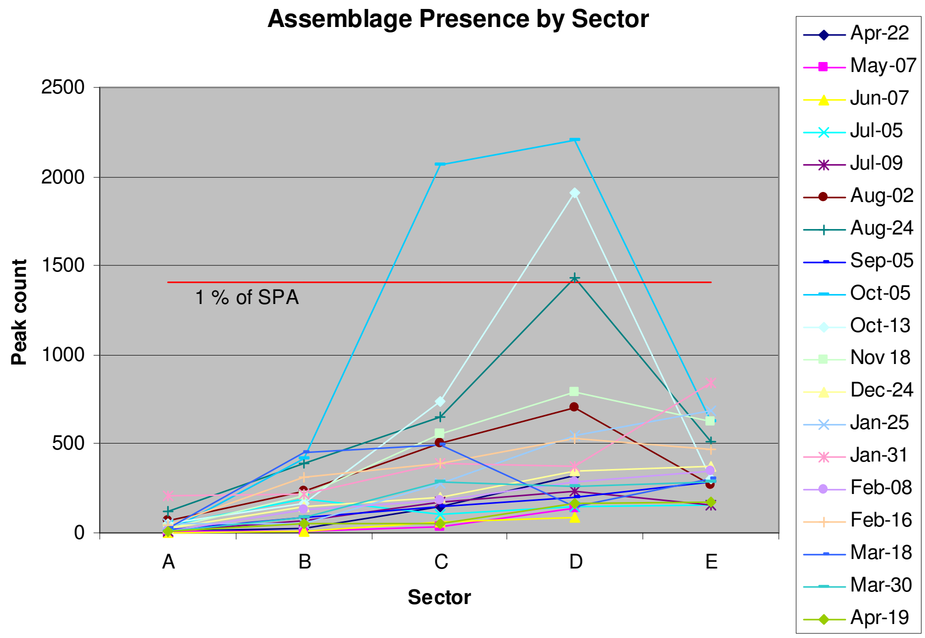
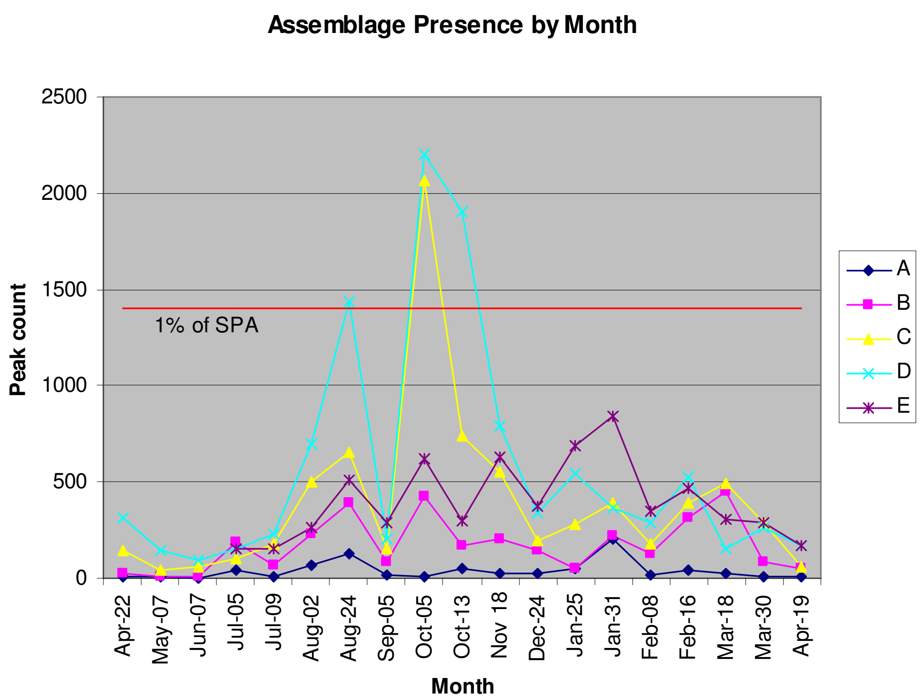


Figure C2.3 *Peak presence of the assemblage per month by sector in Killingholme Marshes*



C2.3 SHELDUCK

Table C2.3 Maximum hourly count at Killingholme Marshes over survey period

Survey Date	A	B	C	D	E	TOTAL	HOUR of TIDE*
Apr-22	0	2	7	11	-	20	-1
May-07	1	3	6	9	-	19	+6
Jun-07	2	2	13	3	-	20	+2
Jul-05	0	0	0	16	0	16	+6
Jul-09	0	0	9	0	0	9	+4, +5 & +6
Aug-02	8	0	26	33	1	68	-3
Aug-24	0	0	47	37	7	91	-1
Sep-05	0	0	6	12	1	19	0
Oct-05	0	0	48	16	0	64	+2
Oct-13	0	0	0	31	35	66	0
Nov 18	0	0	12	29	0	41	0
Dec-24	0	0	0	2	1	3	-1
Jan-25	0	0	2	23	6	31	-2
Jan-31	0	1	28	8	2	39	+3
Feb-08	0	0	5	37	8	50	0
Feb-16	0	2	34	63	10	109	-6
Mar-18	4	13	34	12	43	106	-5
Mar-30	0	0	4	17	15	36	+6
Apr-19	0	6	1	5	36	48	-1

Figure C2.4 Peak count of Shelduck per sector by month in Killingholme Marshes

	Peak count (per sector)				
Survey Date	A	Survey Date	A	Survey Date	A
Apr-22	0	Apr-22	0	Apr-22	0
May-07	1	May-07	1	May-07	1
Jun-05	2	Jun-05	2	Jun-05	2
Jun-07	9	Jun-07	9	Jun-07	9
Jul-09	0	Jul-09	0	Jul-09	0
Aug-02	8	Aug-02	8	Aug-02	8
Aug-24	0	Aug-24	0	Aug-24	0
Sep-05	0	Sep-05	0	Sep-05	0
Oct-05	0	Oct-05	0	Oct-05	0
Oct-13	0	Oct-13	0	Oct-13	0
Nov-18	0	Nov-18	0	Nov-18	0
Dec-24	0	Dec-24	0	Dec-24	0
Jan-25	0	Jan-25	0	Jan-25	0
Jan-31	0	Jan-31	0	Jan-31	0
Feb-08	0	Feb-08	0	Feb-08	0
Feb-16	0	Feb-16	0	Feb-16	0
Mar-18	4	Mar-18	4	Mar-18	4
Mar-30	2	Mar-30	2	Mar-30	2
Apr-19	2	Apr-19	2	Apr-19	2

Figure C2.4 Peak presence of Shelduck per sector by month in Killingholme Marshes

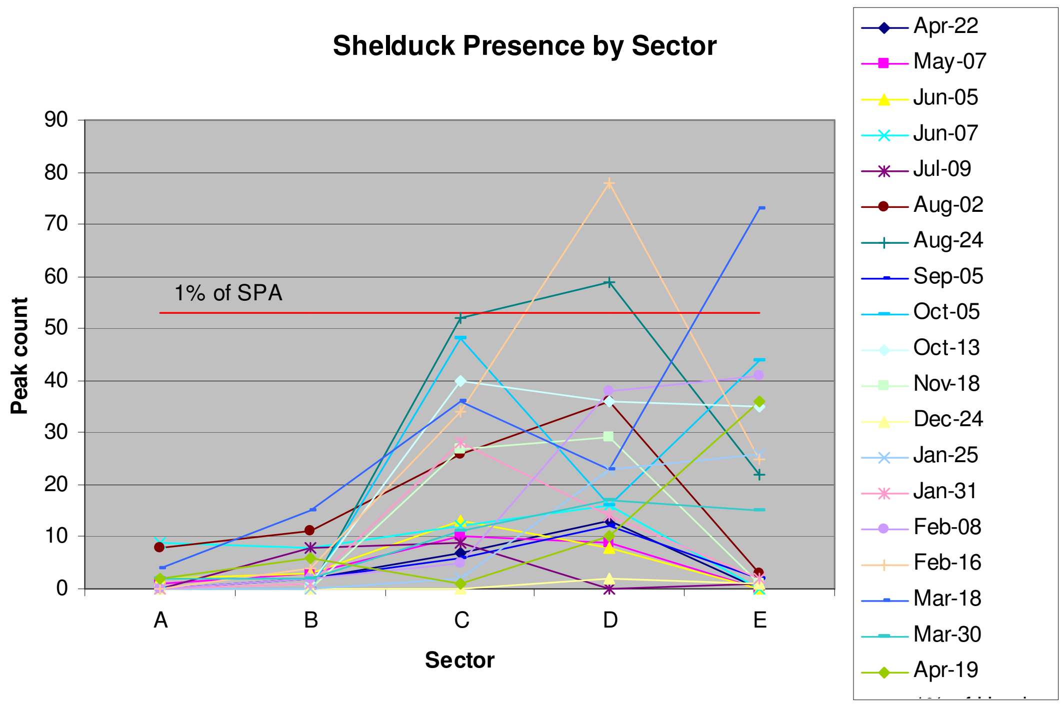
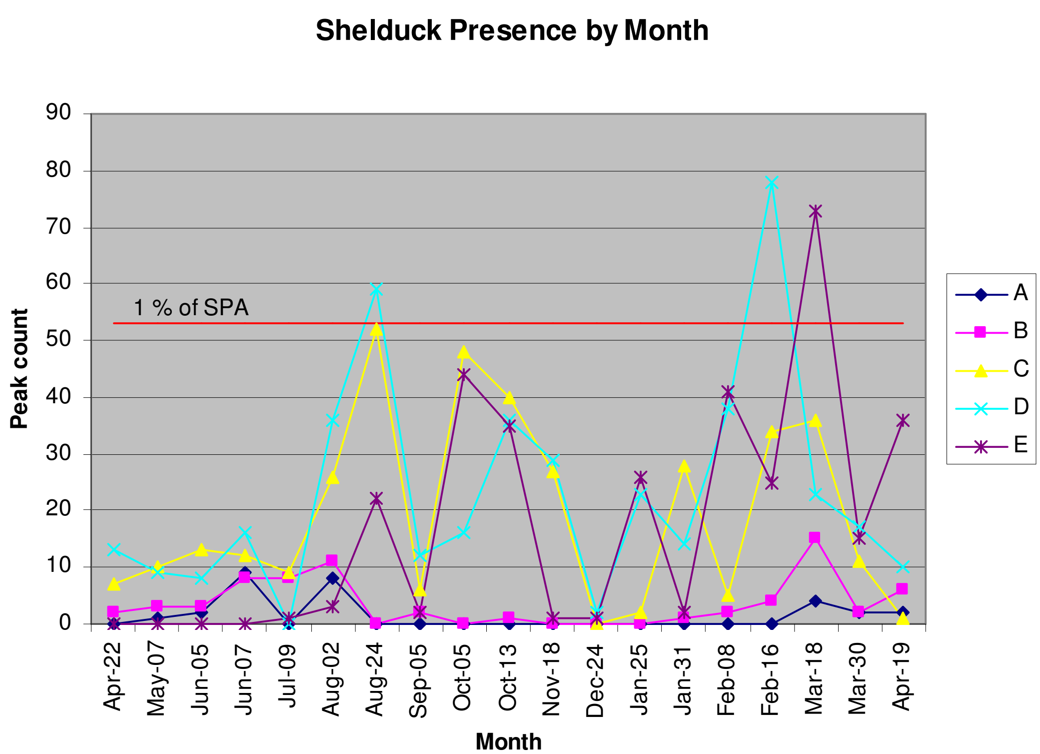


Figure C2.5 Peak presence of Shelduck per month by sector in Killingholme Marshes



C2.4 LAPWING

Table C2.5 Maximum hourly count at Killingholme Marshes over survey period

Survey Date	A	B	C	D	E	TOTAL	HOUR of TIDE*
Apr-22	0	0	0	0	-	0	All
May-07	0	0	0	0	-	0	All
Jun-07	0	0	0	0	-	0	All
Jul-05	0	0	0	0	3	3	+3
Jul-09	0	0	0	0	0	0	All
Aug-02	0	0	0	0	0	0	All
Aug-24	0	0	0	0	0	0	All
Sep-05	0	0	0	0	0	0	All
Oct-05	0	12	0	0	0	12	+5
Oct-13	0	0	1	0	0	1	-5
Nov 18	0	0	0	0	187	187	+4
Dec-24	1	3	5	6	25	40	-5
Jan-25	0	0	0	0	0	0	All
Jan-31	76	0	0	0	249	325	0
Feb-08	0	0	0	0	123	123	-6
Feb-16	0	0	0	31	14	45	0
Mar-18	0	0	0	0	0	0	All
Mar-30	0	0	0	0	0	0	All
Apr-19	0	0	0	0	0	0	All

* HOUR of TIDE column gives an indication of the state of the tide. 0 is equal to low tide. +/- Gives an indication of how many hours before or after low tide the survey occurred, e.g. +1 indicates the survey took place 1 hour **after** low tide and -1 indicates the survey took place 1 hour **before** low tide.

Table C2.6 Peak count of Lapwing per sector by month at Killingholme Marshes

	Peak count (per sector)				
Survey Date	**A**	**Survey Date**	**A**	**Survey Date**	**A**
Apr-22	0	Apr-22	0	Apr-22	0
May-07	0	May-07	0	May-07	0
Jun-05	0	Jun-05	0	Jun-05	0
Jun-07	0	Jun-07	0	Jun-07	0
Jul-09	0	Jul-09	0	Jul-09	0
Aug-02	0	Aug-02	0	Aug-02	0
Aug-24	0	Aug-24	0	Aug-24	0
Sep-05	0	Sep-05	0	Sep-05	0
Oct-05	0	Oct-05	0	Oct-05	0
Oct-13	0	Oct-13	0	Oct-13	0
Nov-18	0	Nov-18	0	Nov-18	0
Dec-24	1	Dec-24	1	Dec-24	1
Jan-25	0	Jan-25	0	Jan-25	0
Jan-31	78	Jan-31	78	Jan-31	78
Feb-08	0	Feb-08	0	Feb-08	0
Feb-16	0	Feb-16	0	Feb-16	0
Mar-18	0	Mar-18	0	Mar-18	0
Mar-30	0	Mar-30	0	Mar-30	0
Apr-19	0	Apr-19	0	Apr-19	0

Figure C2.6 Peak count of Lapwing per sector by month at Killingholme Marshes

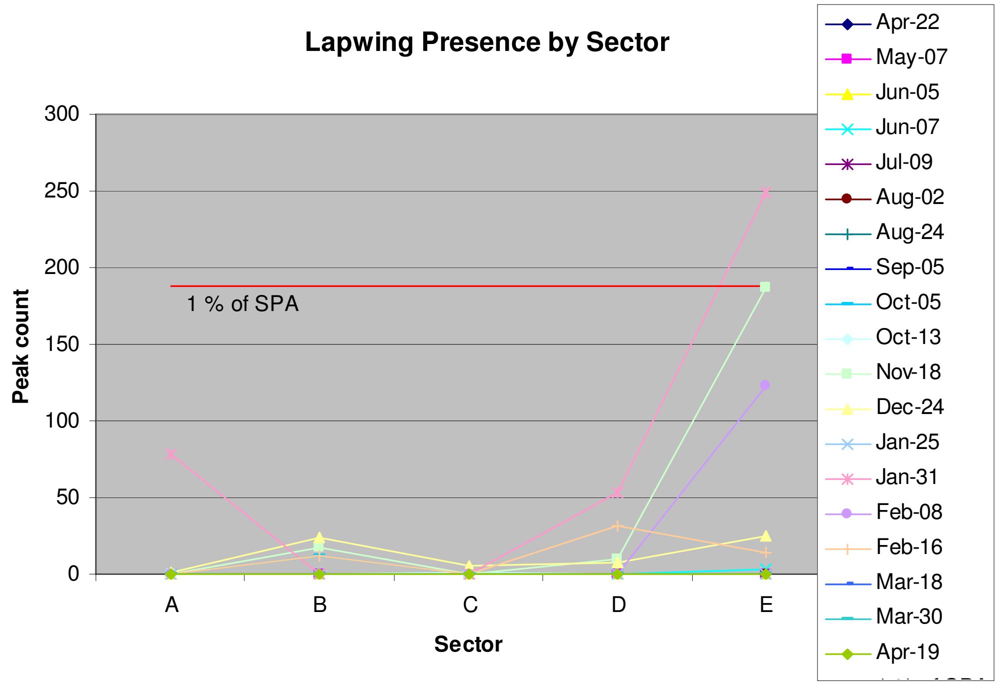
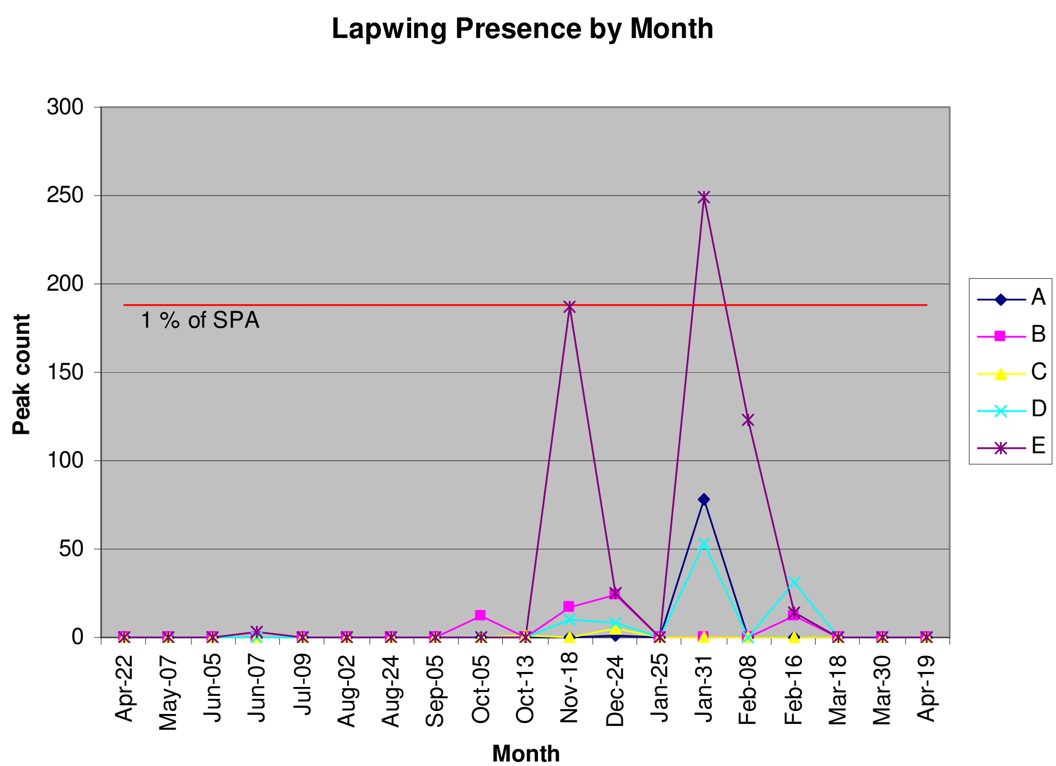


Figure C2.7 Peak count of Lapwing per month by sector at Killingholme Marshes



C2.5 DUNLIN

Table C2.7 Maximum hourly count at Killingholme Marshes over survey period

Survey Date	A	B	C	D	E	TOTAL	HOUR of TIDE*
Apr-22	0	0	0	0	-	0	All
May-07	0	0	0	0	-	0	All
Jun-07	0	0	1	0	-	1	+4 & +5
Jul-05	0	0	0	0	0	0	A
Jul-09	0	0	0	0	0	0	All
Aug-02	0	0	5	0	1	6	-1
Aug-24	0	0	0	55	85	140	0
Sep-05	0	28	2	37	89	156	+3
Oct-05	0	44	152	347	199	742	0
Oct-13	0	41	215	195	1	452	-1
Nov 18	0	76	444	348	161	1029	+1
Dec-24	0	82	99	257	207	645	-3
Jan-25	33	23	17	350	148	571	-1
Jan-31	32	60	0	0	432	524	+6
Feb-08	0	73	0	20	9	102	-4
Feb-16	0	146	193	0	65	404	-2
Mar-18	0	79	186	0	183	448	-3
Mar-30	0	0	0	47	42	89	+6
Apr-19	0	0	0	0	0	0	All

* HOUR of TIDE column gives an indication of the state of the tide. 0 is equal to low tide. +/- Gives an indication of how many hours before or after low tide the survey occurred, e.g. +1 indicates the survey took place 1 hour **after** low tide and -1 indicates the survey took place 1 hour **before** low tide.

Table C2.8 Peak count of Dunlin per sector in Killingholme Marshes

	Peak count (per sector)				
Survey Date	A	Survey Date	A	Survey Date	A
Apr 22	0	Apr 22	0	Apr 22	0
May 07	0	May 07	0	May 07	0
Jun 07	0	Jun 07	0	Jun 07	0
Jul 05	0	Jul 05	0	Jul 05	0
Jul 09	0	Jul 09	0	Jul 09	0
Aug 02	0	Aug 02	0	Aug 02	0
Aug 24	0	Aug 24	0	Aug 24	0
Sep 05	0	Sep 05	0	Sep 05	0
Oct 05	0	Oct 05	0	Oct 05	0
Oct 13	23	Oct 13	23	Oct 13	23
Nov 18	6	Nov 18	6	Nov 18	6
Dec 24	17	Dec 24	17	Dec 24	17
Jan 25	35	Jan 25	35	Jan 25	35
Jan 31	115	Jan 31	115	Jan 31	115
Feb 08	0	Feb 08	0	Feb 08	0
Feb 16	20	Feb 16	20	Feb 16	20
Mar 18	0	Mar 18	0	Mar 18	0
Mar 30	0	Mar 30	0	Mar 30	0
Apr 19	0	Apr 19	0	Apr 19	0

Figure C2.8 Peak count of Dunlin per sector by month in Killingholme Marshes

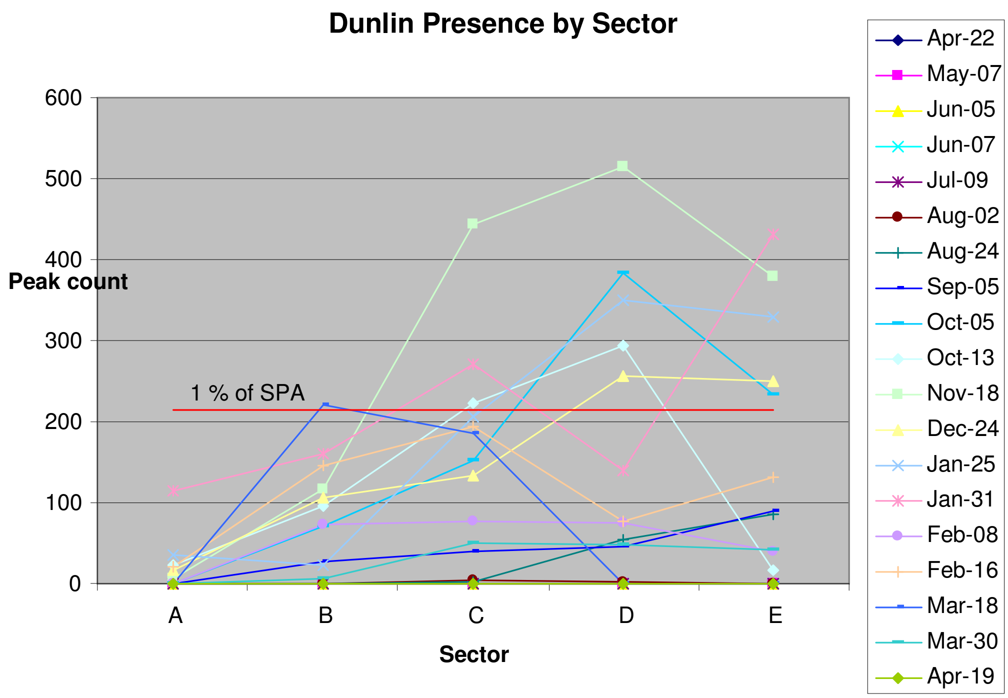
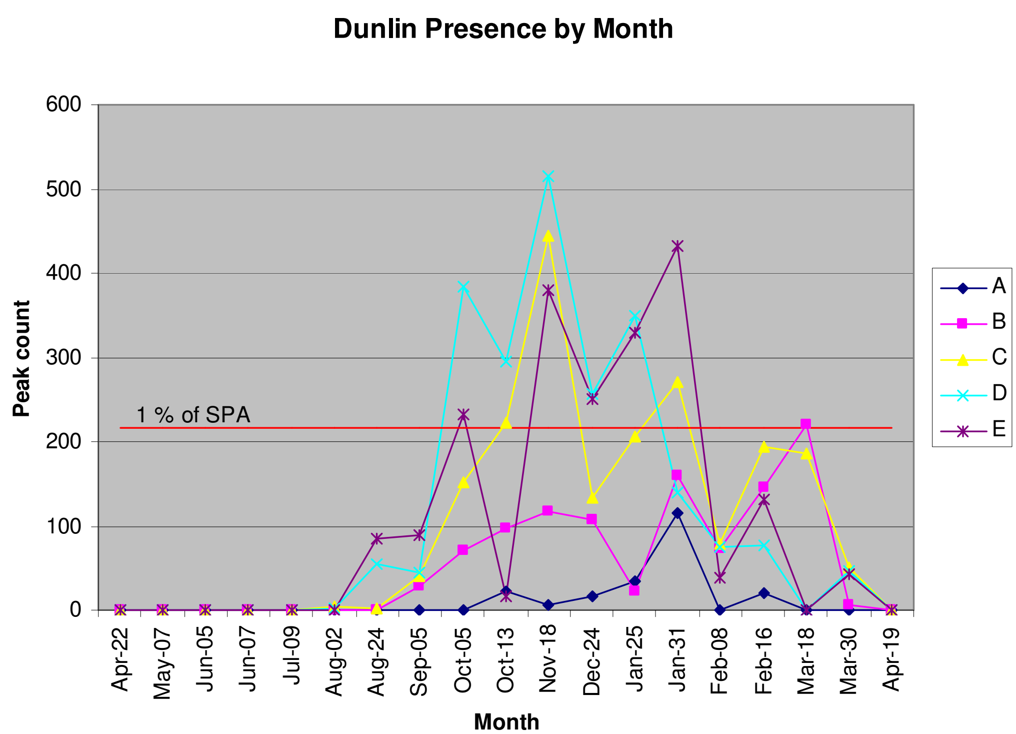


Figure C2.9 Peak count of Dunlin per month by sector in Killingholme Marshes



C2.6 *BLACK-TAILED GODWIT*

Table C2.9 Maximum hourly count at Killingholme Marshes over survey period

Survey Date	A	B	C	D	E	TOTAL	HOUR of TIDE*
Apr-22	0	0	0	250		250	0
May-07	0	0	0	64		64	+1
Jun-07	0	0	1	0		1	+5 & +6
Jul-05	0	56	0	32	0	88	0
Jul-09	0	0	0	100	0	100	+2
Aug-02	32	118	264	400	4	818	0
Aug-24	15	49	50	863	6	983	-1
Sep-05	0	0	0	0	0	0	All
Oct-05	6	108	750	1700	2	2566	+2
Oct-13	0	2	285	1400	172	1859	-5
Nov 18	0	0	0	0	0	0	All
Dec-24	0	0	0	0	0	0	All
Jan-25	0	0	0	0	66	66	-6
Jan-31	0	1	0	5	10	16	+4
Feb-08	0	0	0	0	96	96	-6
Feb-16	0	0	64	73	47	184	-2
Mar-18	0	190	7	2	6	205	-5
Mar-30	0	34	79	51	29	193	+3
Apr-19	0	0	0	121	0	121	-2

* HOUR of TIDE column gives an indication of the state of the tide. 0 is equal to low tide. +/- Gives an indication of how many hours before or after low tide the survey occurred, e.g. +1 indicates the survey took place 1 hour **after** low tide and -1 indicates the survey took place 1 hour **before** low tide.

Table C2.10 Peak count of Black-tailed godwit per sector by month for Killingholme Marshes

	Peak count (per sector)				
Survey Date	A	Survey Date	A	Survey Date	A
Apr-22	0	Apr-22	0	Apr-22	0
May-07	1	May-07	1	May-07	1
Jun-05	0	Jun-05	0	Jun-05	0
Jun-07	0	Jun-07	0	Jun-07	0
Jul-09	0	Jul-09	0	Jul-09	0
Aug-02	32	Aug-02	32	Aug-02	32
Aug-24	82	Aug-24	82	Aug-24	82
Sep-05	0	Sep-05	0	Sep-05	0
Oct-05	6	Oct-05	6	Oct-05	6
Oct-13	0	Oct-13	0	Oct-13	0
Nov-18	0	Nov-18	0	Nov-18	0
Dec-24	0	Dec-24	0	Dec-24	0
Jan-25	0	Jan-25	0	Jan-25	0
Jan-31	0	Jan-31	0	Jan-31	0
Feb-08	0	Feb-08	0	Feb-08	0
Feb-16	0	Feb-16	0	Feb-16	0
Mar-18	1	Mar-18	1	Mar-18	1
Mar-30	0	Mar-30	0	Mar-30	0
Apr-19	0	Apr-19	0	Apr-19	0

Figure C2.10 Peak count of Black-tailed godwit per sector by month for Killingholme Marshes

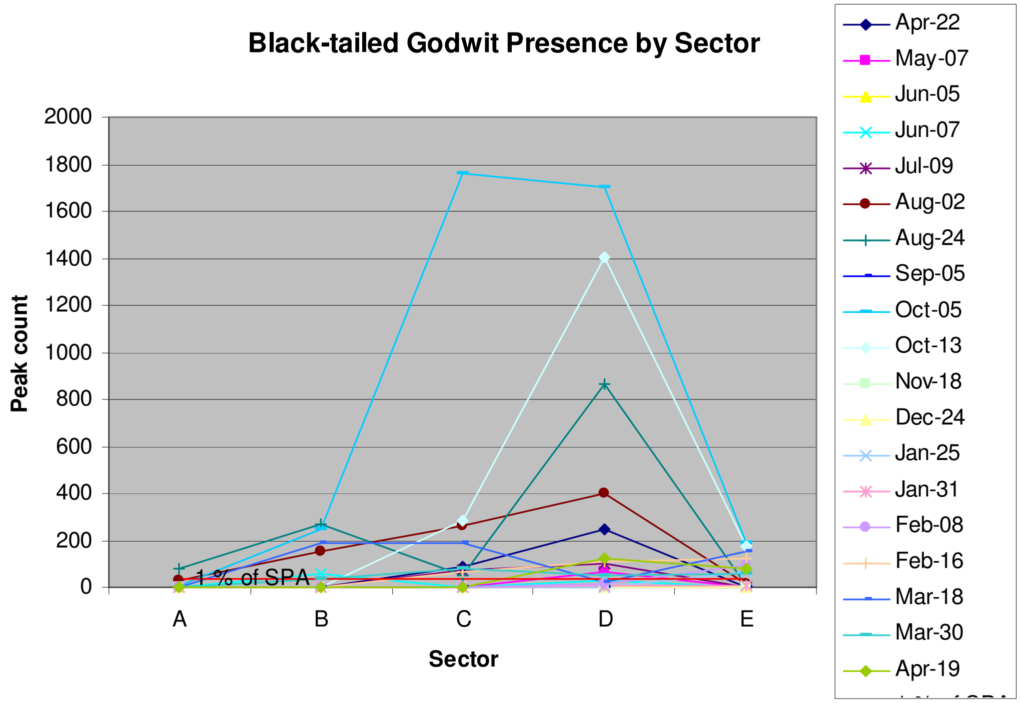
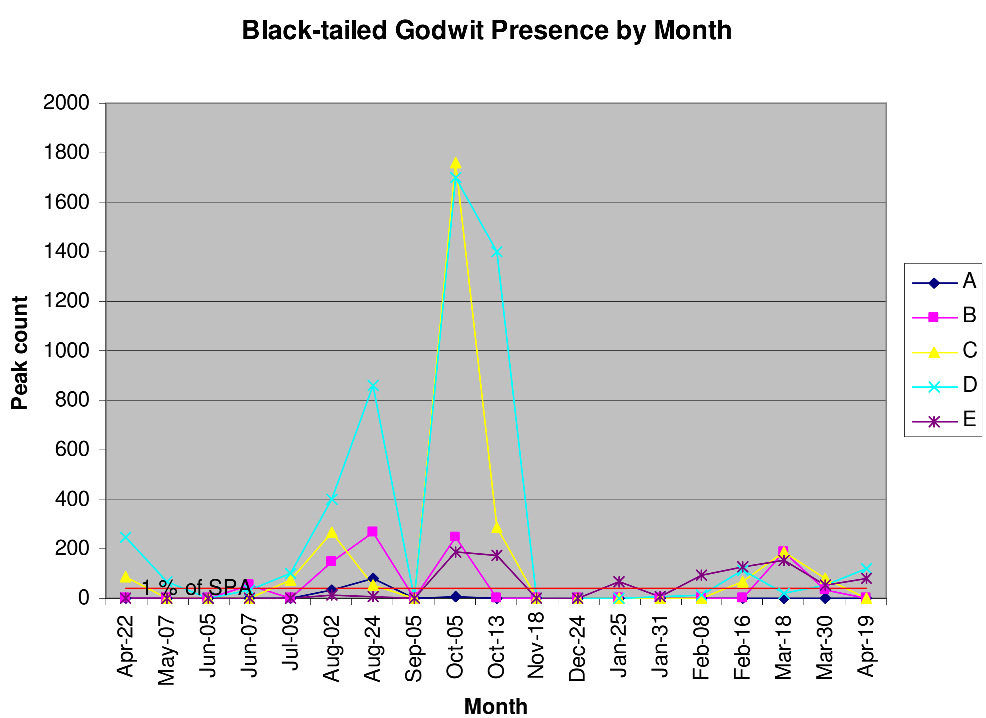


Figure C2.11 Peak count of Black-tailed godwit per month by sector for Killingholme Marshes



C2.7 BAR-TAILED GODWIT

Table C2.11 Maximum hourly count at Killingholme Marshes over survey period

Survey Date	A	B	C	D	E	TOTAL	HOUR of TIDE*
Apr-22	0	0	0	0	-	0	All
May-07	0	0	0	0	-	0	All
Jun-07	0	0	16	0	-	16	+3
Jul-05	0	0	0	23	3	26	+2
Jul-09	0	0	5	47	3	55	0
Aug-02	0	0	1	0	0	1	-1
Aug-24	0	0	0	0	2	2	-2
Sep-05	0	0	0	0	1	1	+5
Oct-05	0	4	6	6	7	23	0
Oct-13	0	3	3	1	19	26	-1
Nov 18	0	0	0	2	10	12	+6
Dec-24	0	0	4	6	38	48	-5
Jan-25	0	0	0	0	42	42	-2
Jan-31	0	0	0	0	27	27	+6
Feb-08	0	0	0	0	7	7	-1
Feb-16	0	0	0	1	36	37	0
Mar-18	0	0	0	2	0	2	-6 & -5
Mar-30	0	0	0	89	34	123	+5
Apr-19	0	0	0	0	0	0	All

* HOUR of TIDE column gives an indication of the state of the tide. 0 is equal to low tide. +/- Gives an indication of how many hours before or after low tide the survey occurred, e.g. +1 indicates the survey took place 1 hour **after** low tide and -1 indicates the survey took place 1 hour **before** low tide.

Table C2.12 Peak count of Bar-tailed Godwit per sector by month

	Peak count (per sector)				
Survey Date	A	Survey Date	A	Survey Date	A
Apr-22	0	Apr-22	0	Apr-22	0
May-07	0	May-07	0	May-07	0
Jun-05	0	Jun-05	0	Jun-05	0
Jun-07	0	Jun-07	0	Jun-07	0
Jul-09	0	Jul-09	0	Jul-09	0
Aug-02	0	Aug-02	0	Aug-02	0
Aug-24	0	Aug-24	0	Aug-24	0
Sep-05	0	Sep-05	0	Sep-05	0
Oct-05	0	Oct-05	0	Oct-05	0
Oct-13	2	Oct-13	2	Oct-13	2
Nov-18	0	Nov-18	0	Nov-18	0
Dec-24	0	Dec-24	0	Dec-24	0
Jan-25	0	Jan-25	0	Jan-25	0
Jan-31	0	Jan-31	0	Jan-31	0
Feb-08	0	Feb-08	0	Feb-08	0
Feb-16	0	Feb-16	0	Feb-16	0
Mar-18	0	Mar-18	0	Mar-18	0
Mar-30	0	Mar-30	0	Mar-30	0
Apr-19	0	Apr-19	0	Apr-19	0

Figure C2.12 Peak Count of Bar-tailed godwit per sector by month

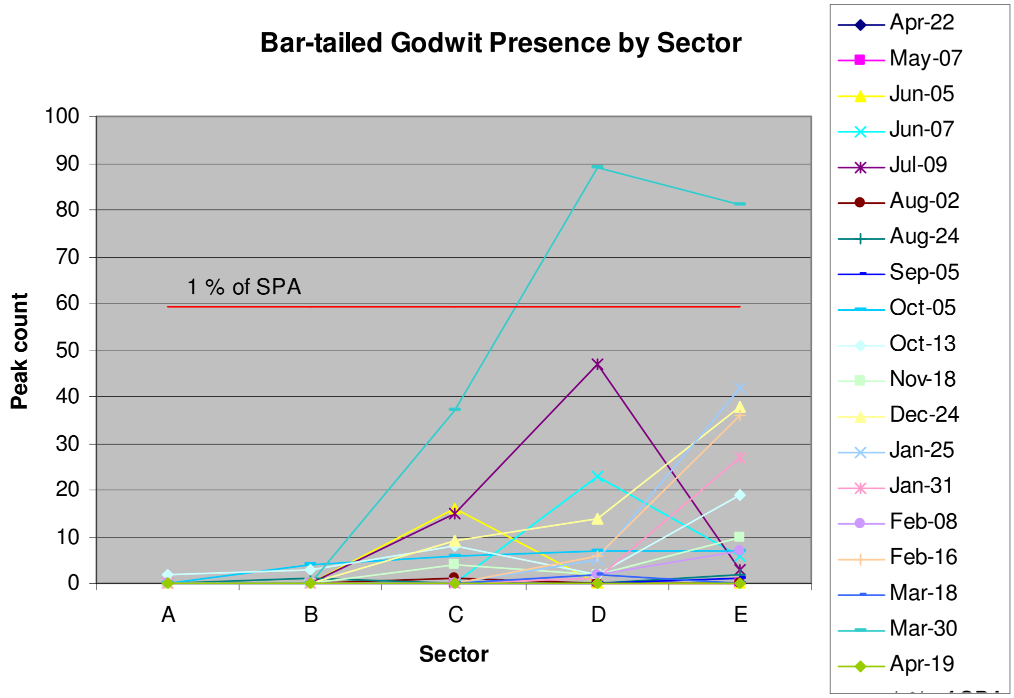
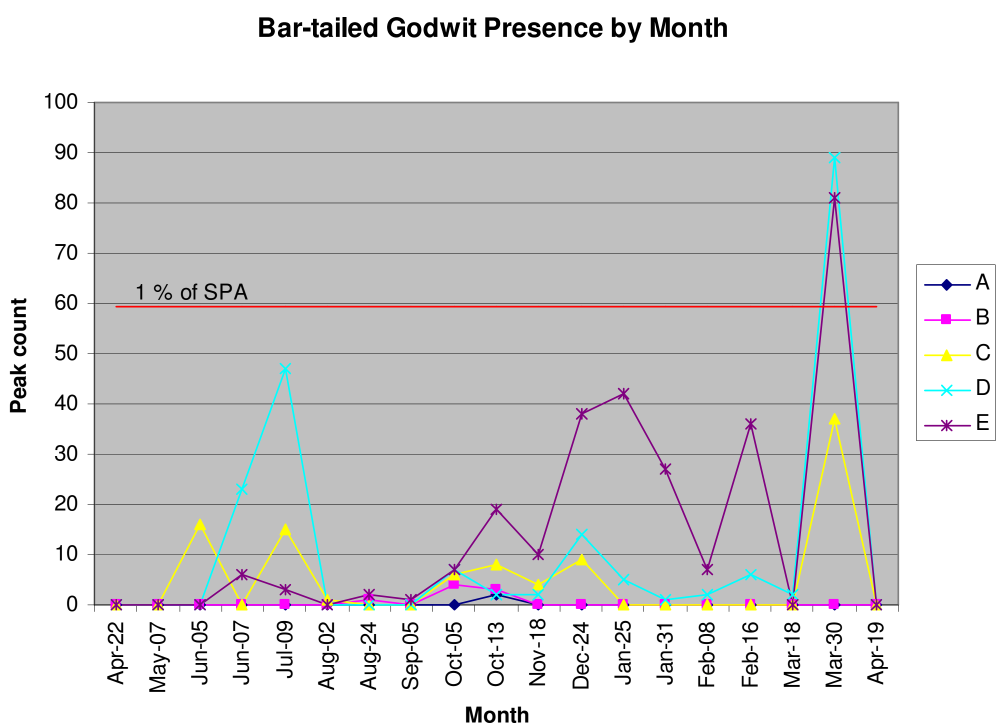


Figure C2.13 Peak count of Bar-tailed godwit per month by sector



C2.8 CURLEW

Table C2.13 Maxiumum hourly count at Killingholme Marshes over survey period

Survey Date	A	B	C	D	E	TOTAL	HOUR of TIDE*
Apr-22	0	1	1	24	-	26	-2
Apr-22	0	2	4	20	-	26	0
May-07	0	1	1	38	-	40	0
Jun-07	0	1	0	14	-	15	+1
Jul-05	1	21	48	36	20	126	0
Jul-09	0	3	44	49	13	109	+1
Aug-02	0	0	0	71	70	141	-6
Aug-24	0	3	18	93	12	126	-2
Sep-05	1	4	32	41	14	92	+1
Oct-05	1	5	2	39	13	60	+3
Oct-13	1	2	5	56	13	77	-1
Nov 18	0	0	0	126	10	136	+6
Dec-24	1	6	3	12	9	31	-3
Dec-24	0	4	7	7	13	31	-2
Jan-25	0	0	0	28	31	59	-6
Jan-31	0	4	3	106	9	122	+3
Feb-08	0	0	1	55	18	74	-5
Feb-16	2	3	9	89	15	118	-5
Mar-18	0	3	12	81	25	121	-5

* HOUR of TIDE column gives an indication of the state of the tide. 0 is equal to low tide. +/- Gives an indication of how many hours before or after low tide the survey occurred, e.g. +1 indicates the survey took place 1 hour **after** low tide and -1 indicates the survey took place 1 hour **before** low tide.

Table C2.2 Peak count of Curlew per sector by month at Killingholme Marshes

	Peak count (per sector)				
Survey Date	A	Survey Date	A	Survey Date	A
Apr-22	0	Apr-22	0	Apr-22	0
May-07	0	May-07	0	May-07	0
Jun-05	0	Jun-05	0	Jun-05	0
Jun-07	2	Jun-07	2	Jun-07	2
Jul-09	2	Jul-09	2	Jul-09	2
Aug-02	3	Aug-02	3	Aug-02	3
Aug-24	1	Aug-24	1	Aug-24	1
Sep-05	1	Sep-05	1	Sep-05	1
Oct-05	1	Oct-05	1	Oct-05	1
Oct-13	1	Oct-13	1	Oct-13	1
Nov-18	0	Nov-18	0	Nov-18	0
Dec-24	1	Dec-24	1	Dec-24	1
Jan-25	0	Jan-25	0	Jan-25	0
Jan-31	1	Jan-31	1	Jan-31	1
Feb-08	2	Feb-08	2	Feb-08	2
Feb-16	2	Feb-16	2	Feb-16	2
Mar-18	1	Mar-18	1	Mar-18	1
Mar-30	2	Mar-30	2	Mar-30	2
Apr-19	1	Apr-19	1	Apr-19	1

Figure C2.14 Peak count of Curlew per sector by month at Killingholme Marshes

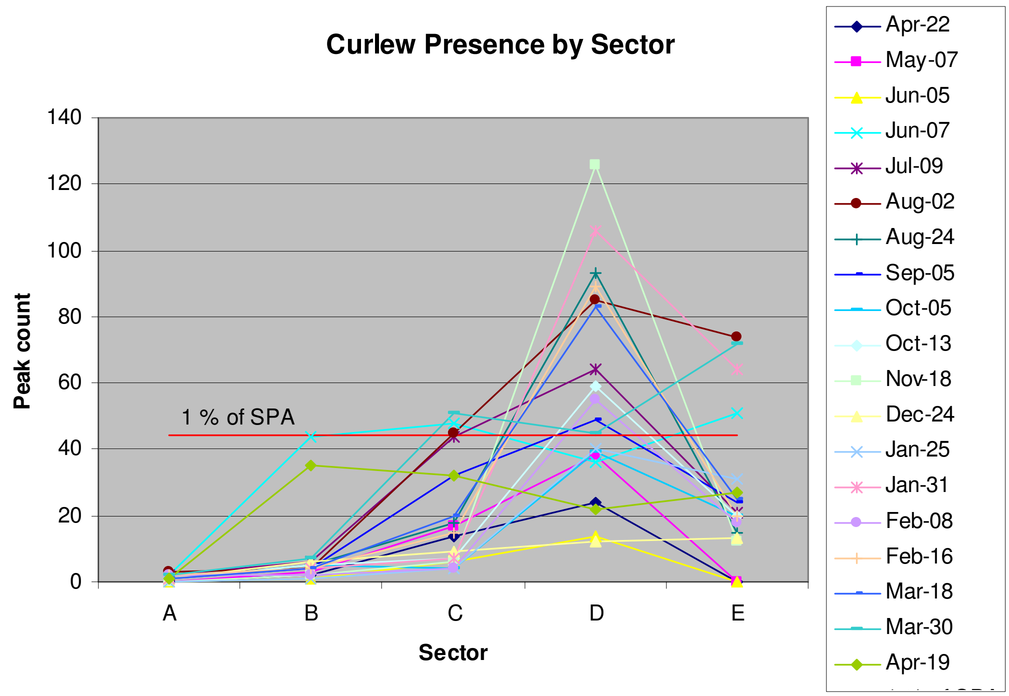
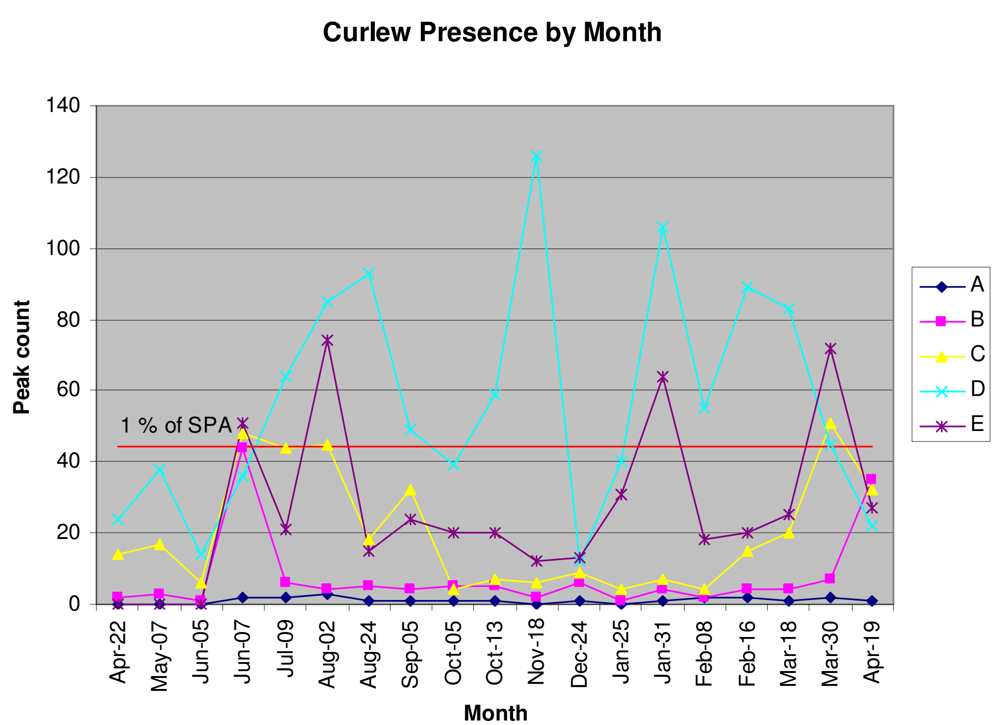


Figure C2.15 Peak count of Curlew per month by sector at Killingholme Marshes



C2.9 REDSHANK

Table C2.3 Maxiumum hourly count at Killingholme Marshes over survey period

Survey Date	A	B	C	D	E	TOTAL	HOUR of TIDE*
Apr-22	0	0	28	27	-	55	-2
May-07	0	0	0	0	-	0	All
Jun-07	0	0	0	0	-	0	All
Jul-05	0	0	0	0	0	0	All
Jul-09	3	0	2	0	0	5	+4
Aug-02	8	5	75	95	0	183	0
Aug-24	1	66	55	260	158	540	-1
Sep-05	16	25	35	6	37	119	0
Oct-05	0	14	90	28	94	226	+4
Oct-13	0	38	88	29	22	177	-5
Nov 18	19	67	41	47	32	206	0
Dec-24	1	4	32	17	13	67	-5
Jan-25	0	0	0	111	43	154	-5
Jan-31	8	9	70	47	29	163	+3
Feb-08	10	37	93	7	10	157	-4
Feb-16	0	13	2	90	30	135	0
Mar-18	13	14	29	15	23	94	-2
Mar-30	0	31	50	2	1	84	+3
Apr-19	0	0	0	0	8	8	-3
Survey Date	A	B	C	D	E	TOTAL	HOUR of TIDE*

* HOUR of TIDE column gives an indication of the state of the tide. 0 is equal to low tide. +/- Gives an indication of how many hours before or after low tide the survey occurred, e.g. +1 indicates the survey took place 1 hour **after** low tide and -1 indicates the survey took place 1 hour **before** low tide.

Table 2.4 Peak count of Redshank per sector by month at Killingholme Marshes

	Peak count (per sector)				
Survey Date	A	Survey Date	A	Survey Date	A
Apr-22	1	Apr-22	1	Apr-22	1
May-07	0	May-07	0	May-07	0
Jun-05	0	Jun-05	0	Jun-05	0
Jun-07	0	Jun-07	0	Jun-07	0
Jul-09	3	Jul-09	3	Jul-09	3
Aug-02	17	Aug-02	17	Aug-02	17
Aug-24	15	Aug-24	15	Aug-24	15
Sep-05	16	Sep-05	16	Sep-05	16
Oct-05	0	Oct-05	0	Oct-05	0
Oct-13	22	Oct-13	22	Oct-13	22
Nov-18	19	Nov-18	19	Nov-18	19
Dec-24	3	Dec-24	3	Dec-24	3
Jan-25	17	Jan-25	17	Jan-25	17
Jan-31	8	Jan-31	8	Jan-31	8
Feb-08	10	Feb-08	10	Feb-08	10
Feb-16	15	Feb-16	15	Feb-16	15
Mar-18	16	Mar-18	16	Mar-18	16
Mar-30	2	Mar-30	2	Mar-30	2
Apr-19	0	Apr-19	0	Apr-19	0

Figure C2.16 Peak count of Redshank per sector by month at Killingholme Marshes

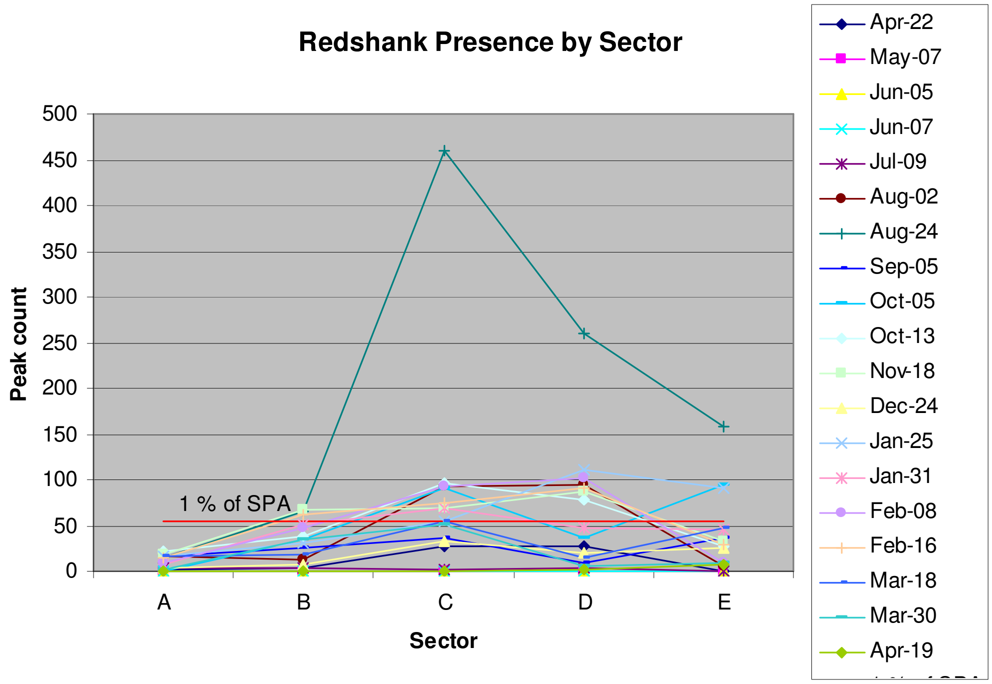
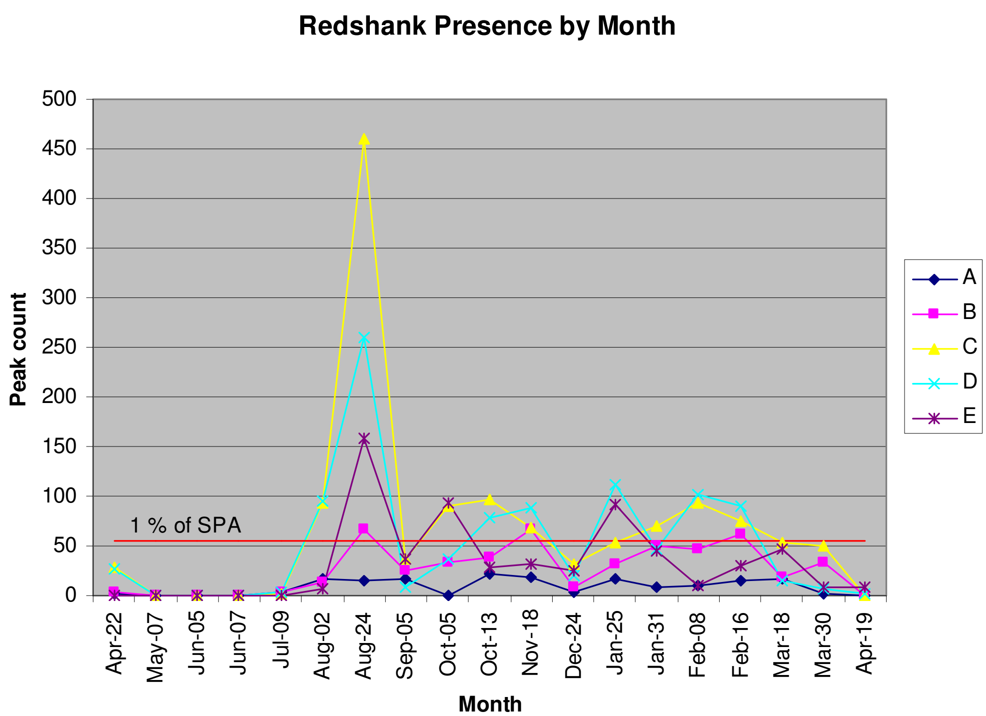


Figure C2.17 Peak count of Redshank per sector by month at Killingholme Marshes



C2.10 RINGED PLOVER

Table C2.5 Maximum hourly count at Killingholme Marshes over survey period

Survey Date	A	B	C	D	E	TOTAL	HOUR of TIDE*
Apr-22	0	9	0	1		10	0
May-07	0	0	0	11		11	+1
Jun-07	0	3	9	8		20	+5
Jul-05	0	1	0	0	0	1	+3
Jul-09	1	4	0	0	0	5	+3
Aug-02	0	0	0	0	20	20	-1
Aug-24	0	0	7	73	130	210	0
Sep-05	0	0	4	45	103	152	+2
Oct-05	0	0	0	4	11	15	0
Oct-13	0	0	0	0	5	5	+1,+3,+5 & +6
Nov 18	0	0	0	0	0	0	All
Dec-24	0	0	0	0	0	0	All
Jan-25	0	0	0	0	0	0	All
Jan-31	0	0	0	0	0	0	All
Feb-08	0	0	0	0	0	0	All
Feb-16	0	0	0	2	0	2	0
Mar-18	0	0	0	0	1	1	-4, -3 & -2
Mar-30	0	0	2	0	1	3	+4
Apr-19	0	0	0	0	5	5	-4

* HOUR of TIDE column gives an indication of the state of the tide. 0 is equal to low tide. +/- Gives an indication of how many hours before or after low tide the survey occurred, e.g. +1 indicates the survey took place 1 hour **after** low tide and -1 indicates the survey took place 1 hour **before** low tide.

Table C2.6 Peak count of Ringed Plover per sector by month at Killingholme Marshes

	Peak count (per sector)				
Survey Date	A	Survey Date	A	Survey Date	A
Apr-22	0	Apr-22	0	Apr-22	0
May-07	0	May-07	0	May-07	0
Jun-05	0	Jun-05	0	Jun-05	0
Jun-07	0	Jun-07	0	Jun-07	0
Jul-09	1	Jul-09	1	Jul-09	1
Aug-02	0	Aug-02	0	Aug-02	0
Aug-24	0	Aug-24	0	Aug-24	0
Sep-05	0	Sep-05	0	Sep-05	0
Oct-05	0	Oct-05	0	Oct-05	0
Oct-13	0	Oct-13	0	Oct-13	0
Nov-18	0	Nov-18	0	Nov-18	0
Dec-24	0	Dec-24	0	Dec-24	0
Jan-25	0	Jan-25	0	Jan-25	0
Jan-31	0	Jan-31	0	Jan-31	0
Feb-08	0	Feb-08	0	Feb-08	0
Feb-16	0	Feb-16	0	Feb-16	0
Mar-18	0	Mar-18	0	Mar-18	0
Mar-30	0	Mar-30	0	Mar-30	0
Apr-19	0	Apr-19	0	Apr-19	0

Figure C2.18 Peak count of Ringed Plover per sector by month at Killingholme Marshes

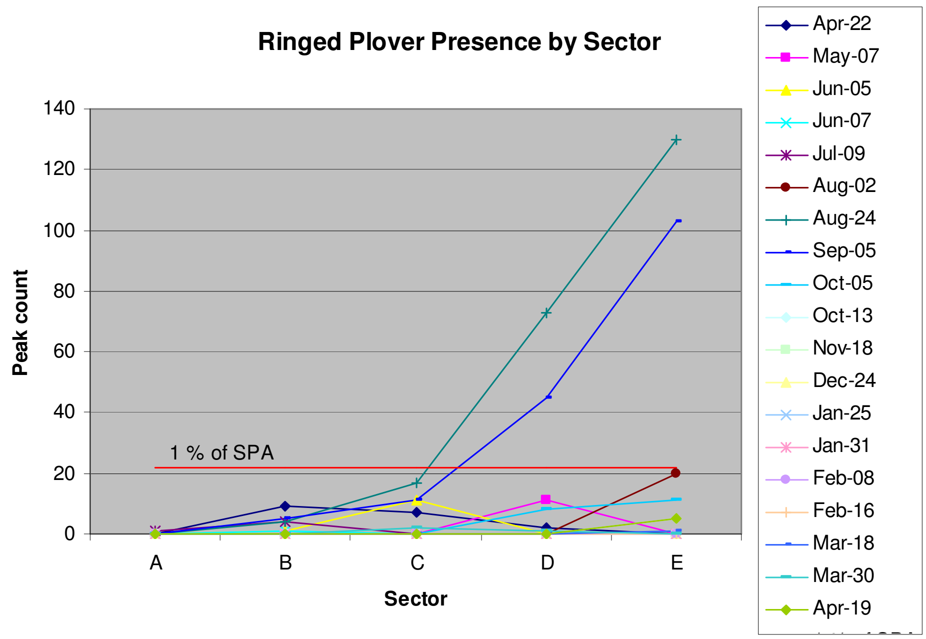
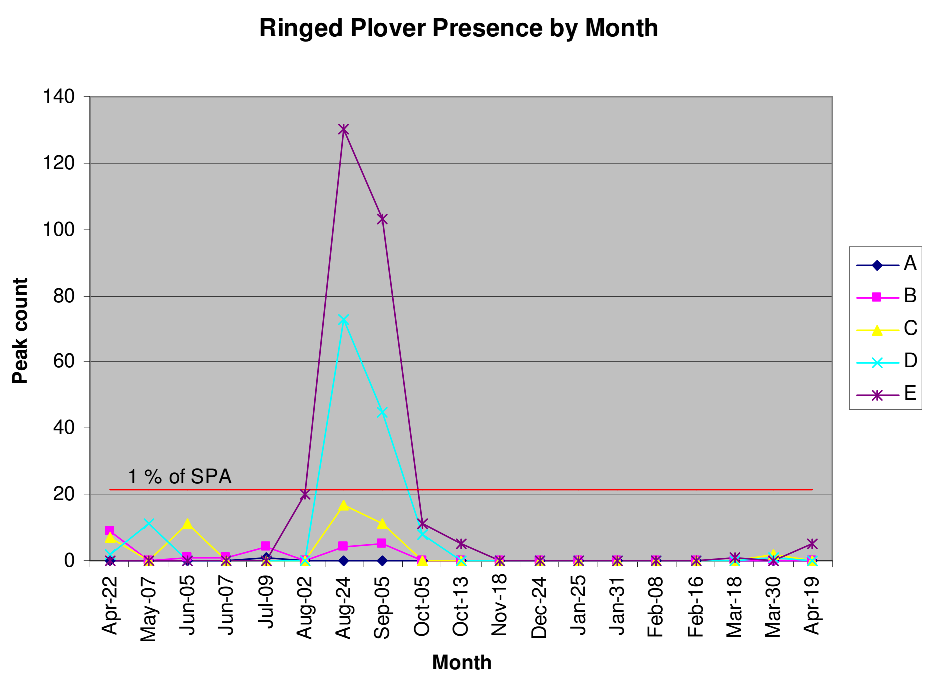


Figure C2.19 Peak count of Ringed Plover per month by sector at Killingolme Marshes



Annex D

Screening Assessment Humber Estuary Habitats and Non-Bird Fauna Species

Screening Assessment - Humber Estuary Habitat and Non-Bird Species

Information used in this table is from Natural England (December 2009) *Conservation Objectives and Definitions of Favourable Condition for Designated Features of Interest - Humber Estuary SSSI,* Draft Version 2, NE and from the JNCC website (UK_SAC_DATA_20110210.zip which was updated on 11 February 2011- http://jncc.defra.gov.uk/page-1461). There are some minor differences in the figures quoted in these different sources.

Qualifying feature (species or assemblage) according to designation citation	Qualifying feature(species or assemblage) according to conservation objectives	Attribute	Site Specific Target	Likely Significant Effect from AMEP
Habitats (**SAC**)				
Estuaries	Estuary	Total: 36657.15 ha	No reduction in extent of estuary feature, except due to natural processes.	**Yes.** Area of estuarine environment directly reduced by 31.5 ha of intertidal and 13.5 ha if subtidal area respectively. Further indirect impacts on habitats will also occur with the loss of 9.83 ha of subtidal, a net indirect loss of 2.47 ha of intertidal mudflat and a gain of 12.3 ha of saltmarsh.
Estuaries	Estuary sub-tidal	Total: 16 800 ha	No reduction in extent of estuary feature, except due to natural processes.	**Yes.** Area of estuarine subtidal habitat directly reduced by 13.5 ha and indirectly by a further indirect loss of 9.83 ha
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) *Salicornia* and other annuals colonising mud and sand	Littoral sediment: (Coastal Saltmarsh)	Total: 1643.61 ha Source: Humber Estuary SSSI – Supporting information – Issued by English Nature's Humber to Pennines Team on 3 February 2004.	No reduction in extent from the established baseline, subject to natural change.	**Yes but a positive likely significant effect.** 12.3 ha of saltmarsh will be created in the longer term as a result of indirect effects on coastal processes from the presence of the quay.
Mudflats and sandflats not covered by seawater at low tide	Littoral sediment (mudflats and sandflats)	9382.46 ha Estimated using Ordnance Survey (OS) Landline intertidal and OS Mastermap.	No reduction in extent of the littoral sediment biotope(s) identified for the site allowing for natural succession/known cyclical change.	**Yes**. There will be a direct loss of 31.5 ha of mudflat and an indirect loss of 10.35 ha. However, there will be an indirect gain of 7.88 ha of mudflat. Therefore there will be a net loss of 33.97 ha of intertidal mudflat.

Qualifying feature (species or assemblage) according to designation citation	Qualifying feature(species or assemblage) according to conservation objectives	Attribute	Site Specific Target	Likely Significant Effect from AMEP
Sandbanks which are slightly covered by seawater all the time	Inshore sublittoral sediment (Sandbanks which are slightly covered by sea water at all times)	Grimsby Middle; 206-236Ha Middle Shoal; 252-340Ha Bull Sand; 355-486Ha Extents were calculated in 2000, 2002, 2005, 2007. Source: Humber Subtidal Sandbanks (R.1489) 2008. ABPmer Ltd.	No reduction in extent of inshore sublittoral sandbanks allowing for natural succession / known cyclical change.	**No.** Sandbanks are not immediately affected by project, and indirect morphodynamic change as a result of the project is not likely to affect the extent of the sandbanks.

Qualifying feature (species or assemblage) according to designation citation	Qualifying feature(species or assemblage) according to conservation objectives	Attribute	Site Specific Target	Likely Significant Effect from AMEP
Coastal lagoons (a priority *Annex I* habitat)	Saline Lagoons	Total: 22.77 ha Humberston Fitties: 1.75ha Northcoates Point A 1.82ha Northcoates point B 2.2ha Blacktoft Sands 17 Ha Source: Humber Estuary SSSI – Supporting information – Issued by English Nature's Humber to Pennines Team on 3 February 2004.	No reduction in extent of saline lagoon area. N.B. Northcoates Point lagoons lie outside the coastal protection works and are subject to natural coastal processes which may affect extent.	**No.** No reduction in area or in water quality

Qualifying feature (species or assemblage) according to designation citation	Qualifying feature(species or assemblage) according to conservation objectives	Attribute	Site Specific Target	Likely Significant Effect from AMEP
Fixed dunes with herbaceous vegetation ('grey dunes' a priority habitat)	Sand dunes (Fixed-dunes with herbaceous vegetation, "grey dunes"	Total: 31.63 Ha Source: Bullens (2001), Dargie (2001) as summarised in Humber Estuary SSSI – Supporting information – Issued by English Nature's Humber to Pennines Team on 3 February 2004.	No reduction in extent from the established baseline, subject to natural change.	**No**. No reduction in area or in quality.

Qualifying feature (species or assemblage) according to designation citation	Qualifying feature(species or assemblage) according to conservation objectives	Attribute	Site Specific Target	Likely Significant Effect from AMEP
Dunes with *Hippophae rhamnoides*	Dunes with *Hippophae rhamnoides*	Total: 66.13 Ha *Hippophae rhamnoides* scrub Source: Bullens (2001), Dargie (2001) as summarised in Humber Estuary SSSI – Supporting information – Issued by English Nature's Humber to Pennines Team on 3 February 2004.	No reduction in extent from the established baseline, subject to natural change.	**No.** No reduction in area, or in quality.

Qualifying feature (species or assemblage) according to designation citation	**Qualifying feature(species or assemblage) according to conservation objectives**	**Attribute**	**Site Specific Target**	**Likely Significant Effect from AMEP**
Shifting dunes along the shoreline with *Ammophilia arenaria* ('white dunes'); and Embryonic shifting dunes	Sand dunes Strandline, embryo and mobile dunes	Total: 39.14 Ha Source: Bullens (2001), Dargie (2001) as summarised in Humber Estuary SSSI – Supporting information – Issued by English Nature's Humber to Pennines Team on 3 February 2004.	No reduction in extent from the established baseline, subject to natural change, although location may change.	**No.** No reduction in area, or in quality.

Qualifying feature (species or assemblage) according to designation citation	Qualifying feature(species or assemblage) according to conservation objectives	Attribute	Site Specific Target	Likely Significant Effect from AMEP
Habitats (SSSI)				
Fauna Species				
Grey seal *Halichoerus grypus*		Population: 1800 Pup production in the SAC/SSSI	A stable or increasing number of breeding female grey seals in the SAC/SSSI/ASSI	**No.** No effect on pup production (Donna Nook beyond airborne and waterborne noise disturbance limit).
		Distribution of grey seal pups within the SAC/SSSI	A stable or increasing area of usage within the SAC/SSSI/ASSI	**No.** Underwater noise will create temporary disturbance but this should not prevent pups from permanently entering estuary, or affect its food supply. Most seals will prefer to hunt for food at sea and so not approach the AMEP site within 6.9-10.6 km (ie distances up to which potential auditory damage may occur if regular approaches occurred for scenarios of 20,000 to 40,000 pile strikes per day respectively).
		Accessibility of SAC/SSSI for breeding	An accessible breeding site	**No.** There will be no impact on accessibility.

Qualifying feature (species or assemblage) according to designation citation	Qualifying feature(species or assemblage) according to conservation objectives	Attribute	Site Specific Target	Likely Significant Effect from AMEP
River lamprey (*Lampetra fluviatilis*) Sea lamprey (*Petromyzon marinus*)		River lamprey pop: >10,000 Sea lamprey pop: 251 - 500 Population a. Age structure (*Lampetra* sp. only)	For samples of 50 or less, at least two distinct size classes should normally be present. If more than 50 ammocoetes are collected, at least three size classes should be present.	**Uncertain** Population structure is unlikely to be affected from dredge plume/disposal or from changes hydrodynamic regime. However, there will be some loss of subtidal habitat and possibly an effect on migratory movement from underwater noise. The increase in turbidity is temporary and within natural range of variability. Turbidity levels above 14 g/l have been found to have a physiological effect on fish (eg clogging of the gills with suspended solids) (Marshall and Elliott, 1998). This value is more than double the maximum concentrations found naturally within the Humber and significantly higher than concentrations predicted by the plume dispersion modelling. With the exception of very localised changes around the AMEP site, the overall flow regime in the estuary will not change. Loss of habitat and noise disturbance from piling may have an impact. Further details are also contained within the ES *Chapter 10 Aquatic Ecology*.

Qualifying feature (species or assemblage) according to designation citation	Qualifying feature(species or assemblage) according to conservation objectives	Attribute	Site Specific Target	Likely Significant Effect from AMEP
		Population b. Distribution within catchment	Lampreys should be present at not less than 2/3 of sites surveyed. As a minimum, there should be no reduction in the distribution of ammocoetes within the catchment. Where barriers to migration or pollution issues are thought to be a problem, the population should be classed as being in unfavourable condition and targets for an appropriate increase should be set.	**No.** No Impacts are predicted from dredge plume/disposal, no impacts from changes in hydrodynamic regime, Project has no effect on catchment area.
		Population c. Ammocoete density	*Lampetra* spp: Optimal habitat: >10 m^{-2}, Chalk streams >5 m^{-2}, Overall catchment mean:>5m^{-2} *Petromyzon*: Ammocoetes should be present in at least four sampling sites, each not less than 5 km apart.	**No.** River lamprey ammocoetes not affected, their presence is confined to upriver locations. **Uncertain**. Sea lamprey ammocoetes density may be affected by habitat loss.
		Population d. Spawning Activity (Sea Lamprey only)	No reduction in extent of spawning activity year on year.	**No.** Spawning will not be affected.
		River morphology	No artificial barriers significantly impairing adults from reaching existing and historical spawning grounds.	**No.** Barriers will not be introduced.
		Negative indicators	No stocking of other fish species at excessively high densities.	**No.** There will be no stocking of other fish.

Qualifying feature (species or assemblage) according to designation citation	Qualifying feature(species or assemblage) according to conservation objectives	Attribute	Site Specific Target	Likely Significant Effect from AMEP
		Water quality	Biological GQA Class: b/B Chemical GQA Class: B Dissolved Oxygen (DO): - DO should not fall below 2mg/l - DO should not fall below 5mg/l for more than 5 consecutive days - Following a period of DO of less than 5mg/l there should be at least 2 consecutive days where DO remains above 5mg/l Suspended solids: Annual mean <25 mg/l	**No.** Water quality not affected. DO in estuary will remain high as a consequence of strong tidal mixing. The current good dissolved oxygen concentrations in the Humber Estuary oxygen levels are unlikely to be reduced to potentially adverse levels. Reduced dissolved oxygen concentration due to sediment resuspension is expected to be localised and short term (Jabusch *et al*., 2008). HOWEVER, concentrations of suspended solids in estuary already exceed 25 mg/l annually, so this is not a realistic limit measure in the area of interest.
		Flow	As a guideline, flow should be at least 90% and not more than 110% of the naturalised daily flow throughout the year.	**No.** Daily flow is not affected by project.
		River morphology	Maintain the characteristic physical features of the river channel, banks and riparian zone.	**No.** River morphology not affected.
Invertebrate Assemblages		Assemblage score	Using defined invertebrate sampling protocols, thresholds to be met for saltmarsh, estuary and wetland (W531 = 10).	**No.** The local AMEP site level is often not the most appropriate scale to judge the effects on the wider European site. However, only localised effects are predicted within the small areas affected by the quay and the dredging activities.

Qualifying feature (species or assemblage) according to designation citation	Qualifying feature(species or assemblage) according to conservation objectives	Attribute	Site Specific Target	Likely Significant Effect from AMEP
Natterjack Toad		Range including toadlet production, aquatic macrophyte cover and shading, breeding pond presence and persistence, extent and condition of terrestrial habitat and in saltmarsh sites water quality.	Baseline toadlet production for at least one in every four years. ≥90% of breeding ponds have aquatic macrophyte covering/shading less than 25% of the surface and no scrub solidly shading southern margins of pond. No net loss in number of breeding ponds, or loss of area or fragmentation compared with status at time of listing. No encroachment of dense scrub and maintenance of low (1cm) sward, bare/sparsely vegetated areas (*eg* bare sand, slag or rock piles). Maintain minimum summer water depth of 5cm for at least 75% of breeding ponds. Exposure of ponds in saltmarsh to seawater inundation.	**No**. The toads are only recorded from the Saltfleetby-Theddlethorpe Dunes SSSI which lies in the outer estuary some distance south of AMEP and will not be affected.

Annex E

Screening Assessment Humber Estuary Birds

E1 SCREENING ASSESSMENT - HUMBER ESTUARY BIRDS

E1.1 INTRODUCTION

Information used in these table is from Natural England (December 2009) Conservation Objectives and Definitions of Favourable Condition for Designated Features of Interest - Humber Estuary SSSI, Draft Version 2, NE and from the JNCC website (UK_SAC_DATA_20110210.zip which was updated on 11 February 2011- http://jncc.defra.gov.uk/page-1461). There are some minor differences in the figures quoted in these different sources.

Where percentages are provided based on observations at Killingholme Marshes (KM) and North Killingholme Haven Pits (NKHP) these may be overestimates and should be considered precautionary. Observation were made using through-the-tide counts (TTTC) and the Humber Estuary population figures against which the percentage is determine is based on WeBS core counts at high tide. Counts through the tidal cycle are likely to record more birds than those undertaken around high tide, particularly of species which favour the lower and mid tidal cycles. In contrast the TTTC may be influenced by the very occasional use of an area by birds (*eg* a large group of birds alighting briefly during passage).

The assessments in the table assume that lighting levels at NKHP remain similar to current levels (see *Section 11.6* of *Chapter 11* in the ES).

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E1.1.2 Screening Assessment

Qualifying Species	Species Records	Humber mean explanation	Summary of Conservation Objectives Relating to Bird Interest				Likely Significant Effect from AMEP
			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Assemblage (including all waterbirds as defined under the Ramsar Convention) (1)	Humber 140,197 **K Pits 3787 (2.7%)** K Marshes 314 (0.2%) **Observed K Pits 4112 (2.9%)** **Observed K Marshes 3766 (2.7%)**	5	Assemblage present at Killingholme Pits (KP) with 2.9% of Humber population. Also present on Killingholme Marshes (KM) in similar numbers with 2.7% of population observed. Peak counts are observed in Autumn when large passage populations occur. Loss of KM likely to be significant for these birds particularly black-tailed godwit. The loss of KM may also have an indirect effect on the assemblage population utilising KP which are largely thought to be the same birds.	2.7% of the Humber assemblage population will be permanently displaced from KM. Indirect impacts may also reduce the population size at KP during construction and operation.	There will be displacement of 2.7% of the assemblage population. Indirect impacts on the KP population may also result from birds being displaced from KM. It is not thought likely that birds using KP that form part of the assemblage will be displaced directly as a result of AMEP.	Local declines in species diversity of the assemblage population may occur if some species are permanently displaced from KM, or indirectly affected due to the loss of KM. No species are predicted to be lost from the European sites	**Yes** Up to 2.7% of the Humber Estuary waterbird assemblage will be permanently displaced. Furthermore indirect impacts from the loss of KM may also cause LSE on the assemblage usage of KP.

Qualifying Species	Species Records	Humber mean explanation	Summary of Conservation Objectives Relating to Bird Interest				Likely Significant Effect from AMEP
			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
						on the Humber as a result of AMEP.	
Mute swan *Cygnus olor* (5)	Humber 288 K Pits 1 (0.3%) **K Marshes 3 (1.1%)** Observed K Pits 1 (0.3%) Observed K Marshes 2 (0.7%)	5	Maximum 1.1% at KM but species not reliant on mudflats therefore no significant impact anticipated.	No change in population anticipated.	Numbers affected and severity of displacement low.	Will remain as part of assemblage.	**No** Low numbers present and not reliant on area lost.
Dark-bellied brent goose *Branta branta bernicula* (1)	Humber (4586) K Pits 0 K Marshes 0 Observed 0	1	Not affected.	Not affected.	Not affected.	Not affected.	**No** Not present
Canada goose *Branta Canadensis* (5)	Humber 580 K Pits 1 (0.2%) K Marshes <1 bird Observed 0	4	Not affected.	Not affected.	Not affected.	Not affected.	**No** Very small numbers use sites.

Qualifying Species	Species Records	Humber mean explanation	Summary of Conservation Objectives Relating to Bird Interest				Likely Significant Effect from AMEP
			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Tufted duck *Aythya fuligula* (5)	Humber 417 K Pits 1 (0.2%) K Marshes 4 (0.9%) Observed K Pits 1 (0.2%) Observed K Marshes 0	5	No loss of habitat or ability to support populations is predicted for KP site. Small population sporadically present in Humber Estuary	Unlikely displacement from KM area of up to 4 birds (0.9%) will cause population level decline greater than that expected by natural fluctuation in a quarry species.	There will displacement of up to 4 birds (0.9%).	Unlikely to lead to loss from assemblage	**No** Rarely occurs and not reliant on lost habitat.
Shelduck ***Tadorna tadorna* (1,4,5)**	Humber 5314 K Pits 7 (0.1%) K Marshes 9 (0.2%) Observed K Pits 9 (0.2%) **Observed K Marshes 109 (2%)**	2	Although WeBS counts indicated low usage IECS counts indicate 2% of Humber population may use the KM site that will be lost due to development.	Uncertain-IECS count suggests KM site may be important for up to 2% of population.	Up to 2% of population will be displaced.	Not affected.	**Yes** Up to 2% of population will be displaced from mudflats with uncertain impact on total population levels.

Qualifying Species	Species Records	Humber mean explanation	Summary of Conservation Objectives Relating to Bird Interest				Likely Significant Effect from AMEP
			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Wigeon *Anas penelope* (1)	Humber 3520 K Pits 0 K Marshes 0 Observed K Pits 0 Observed K Marshes 24 (0.6%)	5	KP not used by this species. Insignificant numbers using habitats at KM.	Not affected	Not affected	Not affected	**No**
Teal *Anas crecca* (1)	Humber 2865 **K Pits 30 (1%)** K Marshes 13 (0.5%) **Observed K Pits 46 (1.6%)** Observed K Marshes 12 (0.4%)	4	No loss of habitat at KP site. KM counts indicate that 13 birds (0.5% of Humber population) can be present at KM site. It is unlikely loss of habitat would be sufficient to prevent the estuary being able to support current populations. Only small numbers of birds make sporadic use of the site, and the highest counts are derived from diurnal high water counts when this primarily nocturnal feeder will be loafing rather than feeding. This species also has a broad dietary range and feeds readily	Unlikely displacement from KM area of up to 13 birds (0.5%) will cause population level decline greater than that expected by natural fluctuation in a quarry species.	There will be displacement of up to 13 birds (0.5%). Numbers >1% may be affected by piling noise at KP	Not affected.	**Uncertain** Depends on effects of piling noise on KP

Qualifying Species	Species Records	Humber mean explanation	Summary of Conservation Objectives Relating to Bird Interest				Likely Significant Effect from AMEP
			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
			in fields. (Lack, 1986).				
Pochard *Aythya ferina*, (1)	Humber 317 K Pits 0 K Marshes <1 bird Observed 0	4	Insignificant numbers using either site. 2 Birds recorded at KM in one year.	Not affected	Not affected	Not affected	**No**
Scaup *Aythya marila* (1)	Humber 4 K Pits 0 K Marshes 0 Observed 0	5	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Goldeneye *Bucephala clangula* (1)	Humber 465 K Pits 0 K Marshes 0 Observed 0	5	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Pintail *Anas acuta* (5)	Humber 170 K Pits 0 K Marshes 0 Observed 0	4	Not affected.	Not affected.	Not affected.	Not affected.	**No**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Mallard *Anas platyrhynchos* (5)	Humber 2096 **K Pits 71 (3.4%)** K Marshes 13 (0.6%) **Observed K Pits 34 (1.6%)** Observed K Marshes 14 (0.7%)	4	No loss of habitats at KP site. Large proportion of mudflats at KM will be lost but only support 0.6 % of Humber population.	Level of use of KM site unlikely to be critical to maintenance of Humber population.	Displacement of maximum of 13 birds (0.6%) not significant. Numbers greater than 1% may be affected by piling noise on KP.	Not affected.	**Uncertain** Depends on effects of piling noise on KP
Shoveler *Anas clypeata* (5)	Humber 145 **K Pits 29 (20.0%)** **K Marshes 11 (7.6%)** **Observed K Pits 61 (42.1%)** Observed K Marshes 0	4	No loss of habitat at KP site. Up to 7.6% of population recorded at KM based on WeBS counts, although none observed during TTTC surveys. Shoveler is a highly specialised feeder filtering large numbers of zooplankton from shallow and often ephemeral waterbodies where competition with fish is much reduced. It is highly unlikely therefore that the numbers recorded sporadically at KM use it for feeding	Unlikely that the level of use of KM is critical to maintenance of the Humber population.	Displacement of up to 11 birds from KM site. Effects on population at KP depend on effects of piling noise.	Unlikely to be lost to species assemblage. Almost half population can occur at KP site which is subject to mitigation.	**Uncertain** Depends on effects of piling noise on KP

Qualifying Species	Species Records	Humber mean explanation	Summary of Conservation Objectives Relating to Bird Interest				Likely Significant Effect from AMEP
			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
			or that it is an important roost site. It is likely that the small number of largely passage birds which are likely to be affected (mean peak of 11 birds) will be accommodated elsewhere within the European site including at KP.				
Gadwall *Anas strepera* (5)	Humber 179 K Pits <1 bird **K Marshes 4 (2.2%)** Observed 0	2	No impacts on habitat at KP site where only 2 birds recorded in 5 year period. KM populations recorded of up to 4 birds (2.2%). This is primarily a freshwater duck species and unlikely to be reliant on mudflat. Records at the Killingholme sites are sporadic and may reflect the increasing population on the Humber.	Mainly dependant on freshwater, overall population unlikely to be affected by loss of KM.	Up to 4 birds (2.2%) could be displaced from KM. No effects predicted at KP	Unlikely to be lost to species assemblage through loss of mudflat.	**No**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Garganey *Anas querquedula* (5)	Humber 2 K Pits 0 K Marshes 0 Observed 0	3	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Smew *Mergus albellus* (5)	Humber 2 K Pits 0 **K Marshes 1 (50%)** **Observed K Pits 1 (50%)** Observed K Marshes 0	5	Rare winter visitor randomly distributed over Humber. Over the 5 year period, 1 bird was recorded in each of 2 years. However, the Humber Estuary is not an important wintering area for this bird and non we recorded on the mudflats at KM during the TTTC surveys.	Population numbers are driven by conditions at continental wintering grounds in the low countries and Rhine. This is reflected in the presence of only individuals on two occasions.	Naturally randomly distributed. Disturbance depends on effect of piling noise at KP	Not affected.	**Uncertain** Depends on effects of piling noise at KP

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Ruddy duck *Oxyura jamaicensis* (5)	Humber 72 K Pits 0 K Marshes 0 Observed 0	2	Not present.	Not present.	Not present.	Subject to state sponsored eradication programme that may remove it eventually from assemblage.	**No**
Great crested grebe *Podiceps cristatus* (5)	Humber (41) K Pits 0 K Marshes 0 Observed 0	1	Not present.	Not affected..	Not present.	Not affected.	**No**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Little grebe *Tachybaptus ruficollis* (5)	Humber 92 K Pits 1 (0.9%) **K Marshes 2 (1.7%)** Observed 0	5	Habitat at KP not affected. Sporadic records at KM with peak of only 2 birds (1.7%). Intertidal habitat at KM not likely to maintain population as species prefers ponds or lakes. Considerable areas of sub-tidal habitat remains adjacent to AMEP given the small numbers recorded.	Mainly dependant on lake and pond habitat. Small numbers which are not constrained to areas of mudflat likely to be retained and hence overall population unlikely to be affected	Significant effects not predicted as occasional birds likely to use waters adjacent to AMEP.	Not affected	**No**
Cormorant *Phalacrocorax carbo* (5)	Humber (219) K Pits 1 (0.5%) K Marshes 0 Observed K Pits 1 (0.5%) Observed K Marshes 2 (0.9%)	1	Occasional birds. Not reliant on KP or KM habitat to maintain their populations.	Not affected.	Numbers involved and severity of displacement (in terms of impact on population) insignificant.	Not affected.	**No**
Bittern *Botaurus stellaris* (1,2,3)	Humber 3 K Pits 0 K Marshes 0 Observed 0	3	Not present.	Not affected.	Not affected.	Not affected.	**No**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Grey heron *Ardea cineria* (5)	Humber 74 **K Pits 3 (4.1%)** **K Marshes 1 (1.6%)** **Observed K Pits 3 (4.1%)** Observed K Marshes 0	1	Habitat at KP will not be affected. Only occasional birds records at KM.	AMEP only affects occasional use of this site by single birds and any loss will not affect the population of this species.	One bird (1.6%) may be displaced from KM and no impacts are predicted to this species at KP.	Not affected.	**No**
Little egret *Egretta garxetta* (5)	Humber 38 K Pits 0 K Marshes 0 **Observed K Pits 1 (2.6%)** Observed K Marshes 0	5	No effects on habitat at KP. No birds recorded at KM where habitat loss will occur.	Rapidly expanding national population means numbers are likely to increase.	Impacts on birds at KP are not predicted. No birds at KM	Not affected.	**No**
Water rail *Rallus aquaticus* (5)	Humber 7 K Pits 0 K Marshes 0 **Observed K Pits 2 (28%)** Observed K Marshes 0	2	No loss of habitat at KP. Not recorded on KM.	Not affected.	Not present at KM. Impacts at KP depend on effects of piling noise.	Not affected.	**Uncertain** Depends on effects of piling noise at KP

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Moorhen ***Gallinula chloropus*** **(5)**	Humber 146 **K Pits 2 (1.6%)** **K Marshes 4 (2.5%)** **Observed K Pits 4 (2.7%)** Observed K Marshes 0	5	No loss of habitat at KP. Data suggest that moorhens' use of KM is highly sporadic and confined to high water. There is little indication that this shy mainly freshwater species relies on the open mudflat for feeding, even during freezing weather. Counts indicate birds are as likely to occur in spring or autumn as in winter, possibly as a result of birds on migration.	Primarily reliant on freshwater habitats not intertidal mudflats and hence only sporadic use of KM. Effects on population size are not predicted.	Up to 4 birds (2.5%) will be displaced from KM site, but only sporadic use and none were recorded during the TTTC. Effects at KP depends on effects of piling noise	Not affected.	**Uncertain** Depends on effects of piling noise on KP
Coot ***Fulica atra*** **(5)**	Humber 1166 K Pits 3 (0.3%) **K Marshes 31 (2.7 %)** Observed K Pits 2 (0.2%) Observed K Marshes 2 (0.2%)	4	Coot is primarily reliant on freshwater habitats which do not occur at KP or KM. There will also be no habitat loss at KP. TTTC suggest coots make little or no use of the mudflats at KM away from high tide. A maximum of two birds were recorded both over the period of HT±2 hours. Numbers are generally	WeBS suggest up to 31 birds (2.6%) of population could be lost, however, given their focus on high tide and poorer quality habitats (which will be retained) compared with the main areas of	The main area used by coot will be retained and it is likely that any birds displaced will be accommodated elsewhere within the estuary, and significant effects.	Not affected.	**No**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
			highest during the winter months (peak in December) and WeBS data shows considerable inter-annual variation. Use perhaps coincides with more extreme weather conditions that make food less available at sites inland). TTTC recorded only two birds (in December 2010 in Sector A) where the mudflat habitat is poorest, at its thinnest extent and the most predators were seen suggesting that mudflat isn't really important to them. This area will also be retained by AMEP.	mudflat, it is likely that birds will be accommodated elsewhere within the estuary. It is unlikely that significant numbers will be affected and hence the population size will not be affected.			

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Avocet ***Recurvirostra avoceta*** **(1,2)**	Humber 493 **K Pits 27 (5.5%)** K Marshes 0 **Observed K Pits 16 (3.2%)** Observed K Marshes 4 (0.8%)	5	Habitat at KP will not be affected. Avocet is only a sporadic feeder at KM and in low numbers.	KM site appears to be used only occasionally for feeding by small numbers of birds. The population on the Humber is also increasing, partly due to managed realignment schemes such as Paull Holme Strays on the north bank. The population size will not be affected by AMEP.	Only small numbers of birds will be displaced at KM. Effect on birds at KP depends on the effects of piling noise.	Not affected.	**Uncertain** Depends on effects of piling noise on KP
Avocet ***Recurvirostra avoceta*** **(3)**	Humber 250-300 pairs Observed K Pits 8 pairs (2.7 - 3.2%)		Habitat at KP will not be affected. Potential feeding habitat at KM for breeding avocet will be lost but mudflat adjacent to KP will be retained as will mudflat north of the Pits at East Halton	Avocet population is expanding on Humber Estuary and breeding at KP is currently at a high in comparison for the last 5/6 years.	Birds using KP are already habituated to some disturbance as shown by recent breeding success under current	Not affected.	**Uncertain** Depends on the effects of piling at KP

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
				Population at KP unlikely to be directly affected. However, indirect impacts from the loss of KM may reduce the population size at KP during construction and operation.	conditions, but effect at KP depends on effects of piling noise..		
Ringed plover *Charadrius hiaticula* **(1)**	Humber (2168) K Pits 1 (0.1%) K Marshes 0 Observed K Pits 0 **Observed K Marshes 210 (9.7%)**	1	During passage (Aug-Sept) rapid movement of groups through KM site of up to 210 (9.7%). Few individuals recorded at K Pits. The ringed plover population is declining nationally apparently due to shifts in core wintering range and declines in breeding success (Calbrade *et al*, 2010).	The much larger numbers recorded by the TTTC at low and mid tides suggest that this species is under recorded by core count WeBS methods around high tide, when no birds were recorded by the WeBS counts.	KM is used primarily during autumn passage with sectors D & E being preferred. There will be direct loss of habitat within sector D and disturbance to birds in Sector E. Birds will therefore be	Not affected	**Yes**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
					permanently displaced from some habitat.		
Little ringed plover *Charadrius dubius* (5)	Humber 6 K Pits 0 K Marshes 0 **Observed K Pits 2 (34%)** Observed K Marshes 0	4	No loss of habitat at KP and no birds recorded using mudflats at KM.	Not affected.	Depends on the effects of piling noise at KP.	Not affected	**Uncertain** Depends on the effects of piling noise at KP
Golden plover *Pluvialis apricaria* (1,2)	Humber 46, 926 K Pits 0 K Marshes 0 Observed K Pits 1 (<0.1%) Observed K Marshes 1 (<0.1%)	3	No habitat loss at KP. Insignificant use of mudflats at KM.	Not affected	Only single birds recorded at KM and KP.	Not affected	**No**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Grey plover *Pluvialis squatarola* (1,2)	Humber 2916 K Pits <1 bird K Marshes 0 Observed K Pits 0 Observed K Marshes 6 (0.2)	4	1 bird recorded in 5 year period. Insignificant use of mudflats at KM.	Not affected	Not affected	Not affected	**No**.
Lapwing *Vanellus vanellus* (1)	Humber 18756 **K Pits 276 (1.5%)** K Marshes 15 (0.1%) Observed K Pits 5 (<0.1%) **Observed K Marshes 325 (1.7%)**	4	No habitat loss at KP site. WeBS core counts suggest insignificant use of KM mudflats by this species. TTTC suggest higher use especially towards lower tides (up to 325 birds), although majority of birds roosting/ loafing, as the birds feed on inland fields. Large proportion of these mudflats will be lost.	Loss of birds from KM mudflats may reduce overall population, if alternative roost/ loafing sites not available.	Construction of AMEP likely to displace large numbers of birds which are unlikely to be accommodated locally.	Not affected	**Yes**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Dunlin *Calidris alpine alpina* **(1,4)**	Humber 21518 **K Pits 380 (1.8%)** K Marshes 87 (0.4%) **Observed K Pits 270 (1.3%)** **Observed K Marshes 1029 (4.8%)**	2	Habitat at KP not affected. WeBS counts indicate low usage of KM mudflats, however, TTTC recorded much greater use. Large proportion of these mudflats will be lost.	Loss of birds from KM mudflats may reduce overall population.	Construction of AMEP likely to displace large numbers of birds which are unlikely to be accommodated locally.	Not affected	**Yes**
Black-tailed godwit *Limosa limosa islandica* **(1,2,4)**	Humber 3887 **K Pits 3338 (85.9%)** **K Marshes 50 (1.3%)** **Observed K Pits 3800 (97.8%)** **Observed K Marshes 2566 (66%)**	5	Habitat at KP not affected although KP roost linked to KM feeding site so indirect effects may occur. Large numbers recorded from mudflats at KM and large proportion of these mudflats will be lost.	Loss of birds from KM and potentially from KP due to association of roosting birds at KP with feeding birds at KM, likely to have significant impact on Humber population.	Construction of AMEP likely to displace large numbers of birds which are unlikely to be accommodated locally. Noise from piling may affect birds at KP	Not affected	**Yes**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Bar-tailed godwit *Limosa lapponica* (1)	Humber (5926) K Pits 0 K Marshes 0 Observed K Pits 1 (<0.1%) **Observed K Marshes 123 (2.1%)**	1	Habitat at KP not affected. Not recorded at KM by WeBS core counts. TTTC found mudflats at KM supported up to 123 birds, (2.1% of population based on WeBS core counts). Large proportion of these mudflats will be lost.	Loss of birds from KM mudflats may reduce overall population.	Construction of AMEP likely to displace large numbers of birds which are unlikely to be accommodated locally.	Not affected	**Yes**
Curlew *Numenius arquata* (1)	Humber 4440 K Pits 12 (0.3%) **K Marshes 61 (1.4%)** Observed K Pits 7 (0.2%) **Observed K Marshes 158 (3.6%)**	4	No loss of habitat at KP. KM however, can support large percentages of winter population (1.4 – 3.6%) and a large proportion of these mudflats will be lost. 2% of the wintering population of curlew feeds inland on agricultural fields at Killingholme Fields. Several important fields for this species will be lost by the inland areas of AMEP although mitigation for this loss at inland fields is provided within the AMEP site boundary.	Potential for impacts to size of the wintering population.	Construction of AMEP likely to displace large numbers of wintering birds which are accommodated locally within the Killingholme Fields and which also regularly utilise KM.	Not affected.	**Yes**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Oystercatcher ***Haematopus ostralegus*** (1)	Humber 3528 K Pits 2 (<0.1%) K Marshes <1 bird Observed K Pits 4 (0.1%) Observed K Marshes 12 (0.3%)	4	No loss of habitat at KP. KM not an important site for this species with none recorded by WeBS core counts and low numbers by TTTC.	Population size will not be affected given the low numbers likely to be affected.	Birds using KM and KP in insignificant numbers	Not affected	**No**
Knot *Calidris canutus* (1,2)	Humber 41772 K Pits 0 K Marshes 1(<0.1%) Observed K Pits 12 (<0.1%) Observed K Marshes 4 (<0.1%)	1	No loss of habitat at KP. KM not an important site for this species.	Only a few individuals likely to be affected with no significant effect on the population size.	Not affected at KP and effects on birds using KM not significant due to small numbers	Not affected	**No**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Redshank *Tringa totanus* (1)	Humber 5445 **K Pits 215 (3.9%)** **K Marshes 83 (1.5%)** **Observed K Pits 249 (4.6%)** **Observed K Marshes 540 (9.9%)**	4	No loss of habitat at KP. Mudflats at KM site, however, can support large percentages of winter population (1.5%) and large numbers during passage (540 birds, 9.9%) and large proportion of these mudflats will be lost.	Potential for impacts to size of the autumn passage and wintering populations.	Construction of AMEP likely to displace large numbers of wintering and passage birds which are unlikely to be accommodated locally. Effects at KP depend on the effects of piling noise	Not affected	**Yes**
Snipe *Gallinago Gallinago* (5)	Humber 118 **K Pits 4 (3.4%)** K Marshes 0 **Observed K Pits 6 (5.1%)** Observed K Marshes 0	5	No habitat loss will occur at KP, and not present at KM site.	Not affected	Effects at KP depends on the effects of piling noise	Not affected	**Uncertain** Depends on the effects of piling noise at KP

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Turnstone *Arenaria interpres* (1)	Humber (570) K Pits 0 K Marshes 1 (0.2%) Observed 0	1	Not present at KP. Peak mean of single bird recorded at KM, so not an important habitat for this species which prefers rocky coasts rather than mudflats.	Not affected.	Not significantly affected.	Mean of peaks only a single bird	**No**
Sanderling *Calidris alba* (1)	Humber (706) K Pits 0 K Marshes 0 Observed 0	1	Not present.	Not present.	Not present.	Not affected.	**No**
Ruff *Philomachus pugnax* (1,2)	Humber 64 K Pits 1 (0.9%) K Marshes 0 Observed K Pits 0 **Observed K Marshes 1 (1.6%)**	5	No loss of habitat at KP. Only a single bird on passage and KM mudflats not an important area for this species.	Only single birds recorded in August and September. which is unlikely to be lost to the population and size will not be affected.	Only single birds recorded and likely to still use remaining areas or be accommodated in surrounding areas.	Unlikely to be lost to assemblage.	**No**.

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Whimbrel ***Numenius phaeopus*** (1)	Humber 88 K Pits 0 K Marshes 0 Observed K Pits 0 **Observed K Marshes 2 (2.2%)**	5	Not recorded at KP. Small passage population randomly distributed and not reliant on KM site. Considerable alternative habitat available for such small numbers.	Effects on small number of passage migrants which use KM sporadically not predicted to affect population size.	Use of KM on passage likely to be random and sufficient habitat remains locally to continue to support sporadic occurrence.	Unlikely to be lost to assemblage.	**No**
Greenshank *Tringa nebularia* (1)	Humber 37 K Pits 0 K Marshes 0 Observed 0	5	Not present.	Not present.	Not present.	Not affected.	**No**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Common gull *Larus canus* (5)	Humber 2005 K Pits 0 K Marshes 0 Observed K Pits 2 (0.1%) **Observed K Marshes 73 (3.6%)**	1	Habitat at KP not affected. Not recorded by WeBS counts. Up to 73 sporadically present at KM but not reliant on mudflat.	Significant effects on population not predicted as species populations driven by wider countryside issues (*eg* waste management, agricultural activity). Population also likely to be under recorded on the Humber Estuary.	Up to 73 birds may be displaced but species not reliant the KM site and any disturbance unlikely to have a significant effect.	Not affected.	**No**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Black-headed gull *Larus ridibundus* (5)	Humber (7865) K Pits 0 K Marshes 0 Observed K Pits 41 (0.5%) **Observed K Marshes 252 (3.2%)**	1	Habitat at KP not affected. Not recorded by WeBS counts. Larger numbers present at KM post breeding, but many loafing rather than foraging. Unlikely to be reliant on mudflats at KM and also many likely to still use remaining areas or in surrounding areas.	Significant effects on population not predicted, as loafing birds not reliant on KM mudflats. Species populations also driven by wider countryside issues (*eg* waste management, agricultural activity). Population also likely to be under recorded on the Humber Estuary.	Up to 252 birds may be displaced during post breeding period, but species not reliant the KM site and any disturbance unlikely to have a significant effect.	Not affected.	**No**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Great black-backed gull *Larus marinus* (5)	Humber (226) K Pits 0 K Marshes 0 Observed K Pits 1 (0.4%) **Observed K Marshes 40 (17.7%)**	1	Not recorded at KP. Up to 40 birds sporadically present at KM over post breeding / passage period. Species primarily a scavenger and predator and unlikely to be reliant on mudflat at KM, where most were observed loafing rather than foraging.	Unlikely to be affected as species populations driven by wider countryside issues (*eg* waste management, agricultural activity, fish discards). Population also likely to be under recorded on the Humber Estuary.	Up to 40 birds may be displaced but not reliant on the KM site and any disturbance unlikely to have a significant effect.	Not affected.	**No**
Mediterranean gull *Larus melanocephalus* (5)	Humber (2) K Pits 0 K Marshes 0 Observed K Pits 0 **Observed K Marshes 2 (100%)**	1	Not recorded at KP or KM by WeBS. Sporadic occurrence of a rare species. Unlikely to be reliant on mudflats at KM. Birds likely to still use remaining areas or be accommodated in surrounding areas.	Recorded post breeding in August and only two birds observed. No effects on what is an expanding breeding population in the UK and increasingly widespread in winter.	Use of KM likely to be random and sufficient habitat remains locally to continue to support sporadic occurrence	Unlikely to be affected.	**No**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Herring gull *Larus argentatus* (5)	Humber (117) K Pits 0 K Marshes 0 Observed K Pits 0 Observed K Marshes 7 (5.9%)	4	Not recorded at KP or KM by WeBS. Not reliant on habitat at KM. Birds likely to still use remaining areas or be accommodated in surrounding areas.	Insignificant numbers present and birds unlikely to be lost. Effects on population not predicted. Population also likely to be under recorded on the Humber Estuary.	Only localised effects predicted.	Not affected	**No**
Lesser black-backed gull *Larus fuscus* (5)	Humber 93 K Pits 0 K Marshes 0 Observed K Pits 0 Observed K Marshes 6 (6.5%)	4	Not recorded at KP or KM by WeBS. Not reliant on habitat at KM. Birds likely to still use remaining areas or be accommodated in surrounding areas.	Insignificant numbers present and birds unlikely to be lost. Effects on population not predicted. Population also likely to be under recorded on the Humber Estuary.	Only localised effects predicted.	Not affected	**No**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Common sandpiper *Actitis hypoleucos* (5)	Humber (46) K Pits 0 K Marshes 0 **Observed K Pits 1 (2.2%)** **Observed K Marshes 3 (6.5%)**	1	Extent of habitat at KP not affected, not reliant on habitat at KM	Only sporadic occurrence as species migrates in small or single numbers and Humber population likely to be under-recorded. Neither KP nor KM important for the species in the Humber context.	Depends on effects of piling noise at KP	Not affected	**Uncertain** Depends on effects of piling noise at KP
Little tern *Sterna albifrons* (3)	Humber 48 K Pits 0 K Marshes 0 Observed 0	2	Not affected.	Not affected	Not affected	Not affected	**No**
Hen harrier *Circus cyaneus* (2)	Humber 8* K Pits 0 K Marshes 0 Observed 0		Not affected.	Not affected	Not affected	Not affected	**No**

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			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Marsh harrier *Circus aeruginosus* **(3)**	Humber 10 females* K Pits 0 K Marshes 0 Observed K Pits 0 **Observed K Marshes 1 (10%)**		Breeding site at KP not affected directly by habitat loss. Foraging habitat mostly outside AMEP and flight line data provided by Percival (2011) indicates remaining semi-natural habitat within AMEP is of low importance for the species. Loss of intertidal mudflats present at KM unlikely to affect species.	Population size expanding on the Humber and utilising new areas for breeding where records are previously scarce. Breeding at KP for 2011 represents first record in 5 years. As no works scheduled to occur at KP, expanding Humber population unlikely to be affected.	In 2011 1 pair of birds bred at KP. As such it is thought birds at KP are habituated to current noise levels. During construction and operation predicted levels for noise are similar to current levels and as such no impact is predicted.	Not affected	**No**

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Jack snipe *Lymnocryptes minimus* (5)	Humber 5 K Pits <1 bird K Marshes 0 Observed 0	2	Extent of habitat at KP not affected and not recorded from KM.	Rare passage / winter visitor to the Humber with only one bird recorded at KP during five years of WeBS core counts. No effects on KP and hence no impact on population numbers.	Not affected	Not affected.	**No**
Kingfisher *Alcedo atthis* (5)	Humber 7 K Pits <1 bird K Marshes 0 Observed 0	4	Habitat at KP not affected. Species not recorded at KM.	Humber population is small and liable to fluctuate depending on weather. Only one record of two birds at KP and supporting habitat at this site will not be affected. No effects on population size predicted from AMEP.	Will not be affected at KP and only one record of two birds.	Not affected	**No**

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Yellow-legged gull *Larus arg. michahellis* (5)	Humber 6 K Pits 0 K Marshes 0 Observed K Pits 0 **Observed K Marshes 1 (25%)**	2	Not recorded at KP and KM not an important area for this species	Rare passage / winter visitor and only a single bird observed during TTTC. Not restricted to KM and unlikely to be lost and effects on population not predicted.	Naturally randomly distributed and single bird will be accommodated in adjacent areas which remain.	Not affected.	**No**
Arctic tern *Sterna paradisaea* (5)	Humber 12 K Pits 0 K Marshes 0 Observed 0	3	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Bar-headed goose *Anser indicus* (5)	Humber 2 K Pits 0 K Marshes 0 Observed 0	1	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Barnacle goose *Branta leucopsis* (5)	Humber 346 K Pits 0 K Marshes 0 Observed 0	3	Not affected.	Not affected.	Not affected.	Not affected.	**No**

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Bewick's swan *Cygnus colombianus* (5)	Humber 4 K Pits 0 K Marshes 0 Observed 0	5	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Black-throated diver *Gavia arctica* (5)	Humber 2 K Pits 0 K Marshes 0 Observed 0	5	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Common scoter *Melanitta nigra* (5)	Humber 175 K Pits 0 K Marshes 0 Observed 0	4	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Common tern *Sterna hirundo* (5)	Humber 7000 K Pits 0 K Marshes 0 Observed 0	1	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Curlew sandpiper *Calidris ferruginea* (5)	Humber 13 K Pits 0 K Marshes 0 Observed 0	4	Not affected.	Not affected.	Not affected.	Not affected.	**No**

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Egyptian goose *Alopochen aegyptiacus* (5)	Humber 1 K Pits 0 K Marshes 0 Observed 0	4	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Eider *Somateria mollissima* (5)	Humber (64) K Pits 0 K Marshes 0 Observed 0	1	Not affected.	Not affected.	Not affected.	Not affected.	**No**
European white-fronted goose *Anser albifrons* (5)	Humber 1 K Pits 0 K Marshes 0 Observed 0	3	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Goosander *Mergus merganser* (5)	Humber 3 K Pits 0 K Marshes 0 Observed 0	2	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Green Sandpiper *Tringa ochropus* (5)	Humber 10 K Pits 0 K Marshes 0 Observed 0	3	Not affected.	Not affected.	Not affected.	Not affected.	**No**

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Greylag goose (re-established) *Anser anser* (5)	Humber 834 K Pits 0 K Marshes 1 (0.1%) Observed K Pits 5 (0.6%) Observed K Marshes 0	3	KP habitat not affected. KM not an important area for this species.	Peak count of only four birds which will not affect the population if lost.	Not affected	Not affected	**No**
Kittiwake *Rissa trydactyla* (5)	Humber 1 K Pits 0 K Marshes 0 Observed 0	5	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Light-bellied brent goose *Branta hrota*	Humber 6 K Pits 0 K Marshes 0 Observed 0	3	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Little stint *Calidris minutus* (5)	Humber 8 K Pits 0 K Marshes 0 Observed 0	5	Not affected.	Not affected.	Not affected.	Not affected.	**No**

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Long-tailed duck *Stercorarius longicaudus* (5)	Humber (2) K Pits 0 K Marshes 0 Observed 0	1	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Pink-footed goose *Anser brachyrhynchus* (5)	Humber 4902 K Pits 0 K Marshes 0 Observed 0	5	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Red-breasted goose *Branta ruficollis* (5)	Humber <1 K Pits 0 K Marshes 0 Observed 0	5	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Red-throated diver *Gavia stellata* (5)	Humber 8 K Pits 0 K Marshes 0 Observed 0	5	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Roseate tern *Sterna dougallii* (5)	Humber 2 K Pits 0 K Marshes 0 Observed 0	1	Not affected.	Not affected.	Not affected.	Not affected.	**No**

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Ruddy shelduck *Tadorna ferruginea* (5)	Humber 1 K Pits 0 K Marshes 0 Observed 0	2	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Shag *Phalacrocorax arisotelis* (5)	Humber 1 K Pits 0 K Marshes 0 Observed 0	5	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Spoonbill *Platalea leucorodia* (5)	Humber 2 K Pits 0 K Marshes 0 Observed 0	5	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Spotted redshank *Tringa erythropus* (5)	Humber 16 K Pits 0 K Marshes 0 Observed 0	5	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Whooper swan *Cygnus Cygnus* (5)	Humber 60 K Pits 0 K Marshes 0 Observed 0	4	Not affected.	Not affected.	Not affected.	Not affected.	**No**

Qualifying Species	Species Records	Humber mean explanation	Summary of Conservation Objectives Relating to Bird Interest				Likely Significant Effect from AMEP
			Habitat Extent No decrease in extent of listed habitats from established baselines, subject to natural change. Maintain the ability of the estuary to support bird populations.	**Population Size** Maintain the population based on known natural fluctuations at or above the minimum for the site based on either the 5yr mean peak count at designation OR any 5yr period since designation-whichever is highest.	**Disturbance & Displacement** No specific reduction in numbers either on the site, or from one part of the site to another attributable to anthropogenic factors	**Variety of Species** Maintain diversity as at designation (2004) OR as at any other 5 year period since designation – whichever is most diverse.	
Wood sandpiper *Tringa glareola* (5)	Humber 1 K Pits 0 K Marshes 0 Observed 0	4	Not affected.	Not affected.	Not affected.	Not affected.	**No**
Woodcock *Lullula arborea* (2)	Humber 2 K Pits 0 K Marshes 0 Observed 0	3	Not affected.	Not affected.	Not affected.	Not affected.	**No**

Species Records

Assemblage – Assemblage population counts show the peak number of birds present on the Humber on any one day. Data taken from taken from Mean of Peak data from 5 Year WeBS Core Count Data between 2004/05 – 08/09 for Sector 38950 the Humber Estuary and as updated from Waterbirds in the UK 2008/09, Calbrade *et al*. 2010.

Humber – Population taken from Mean of Peak data from 5 Year WeBS Core Count Data between 2004/05 – 08/09 for Sector 38950 the Humber Estuary and as updated from Waterbirds in the UK 2008/09, Calbrade *et al*. 2010. ( ) indicates that population count is incomplete at time of print.

Humber mean explanation

Within the Humber mean explanation column the numbers relate to the following list. This serves as an explanation as to how the mean values were calculated and is related to the number and nature of incomplete counts published. This method is consistent with WeBS approach. Incomplete counts are only included if they are higher than the complete counts and their inclusion results in a higher mean. The mean value therefore represents the largest average attainable from the counts published.

1) **Maxima.**
2) **2 year mean of peak.**
3) **3 year mean of peak.**
4) **4 year mean of peak**
5) **5 year mean of peak**

K Pits - The Mean of Peak data recorded within North Killingholme Haven Pits derived from WeBS 5 Year Core Count Data from 2004/05 - 08/09 for Sector 38201 North Killingholme Haven Pits (TA166196). Figures are rounded to the nearest bird,<1 bird indicates that on average less than one bird was recorded over the 5 year period.

K Marshes – The Mean of Peak data recorded within Killingholme Marshes derived from WeBS 5 Year Core Count Data from 2004/05 - 08/09 for Sector 38201 Killingholme Marshes (TA166196). Figures are rounded to the nearest bird, <1 bird indicates that on average less than one bird was recorded over the 5 year period.

Observed (K Pits or K Marshes)– Waterbird Surveys undertaken at Killingholme Marshes and Killingholme Pits by Institute of Estuarine Coastal Studies (IECS) between April 2010 – April 2011. Surveys undertaken at K Marshes were through the tide counts, those at K Pits were undertaken at high tide. Figures display the maximum count at any one point and are rounded to the nearest bird.

Qualifying Interests

Within the Qualifying Species column the numbers next to each species relate to the following list.

1) Aggregation of non-breeding birds: Wintering and Passage (listed in the SPA citation as part of the assemblage)
2) Annex I wintering passage species
3) ≥ 1% of the GB populations of the following Annex I breeding species
4) ≥ 1% of the bio-geographical populations of the following regularly occurring migratory species
5) Other assemblage species not listed in the citation

Conservation Objectives

Conservation Objectives were taken from: Natural England (2009) Humber Estuary: Conservation objectives and definitions of favourable condition for designated features of interest.

KM – Killingholme Marshes
KP – North Killingholme Haven Pits

References

Calbrade N, Holt C, Austin G, Mellan H, Hearn R, Stroud D, Wotton S & Musgrove A (2010) Waterbirds in the UK – The Wetland Bird Survey. BTO/RSPB/JNCC/WWT.

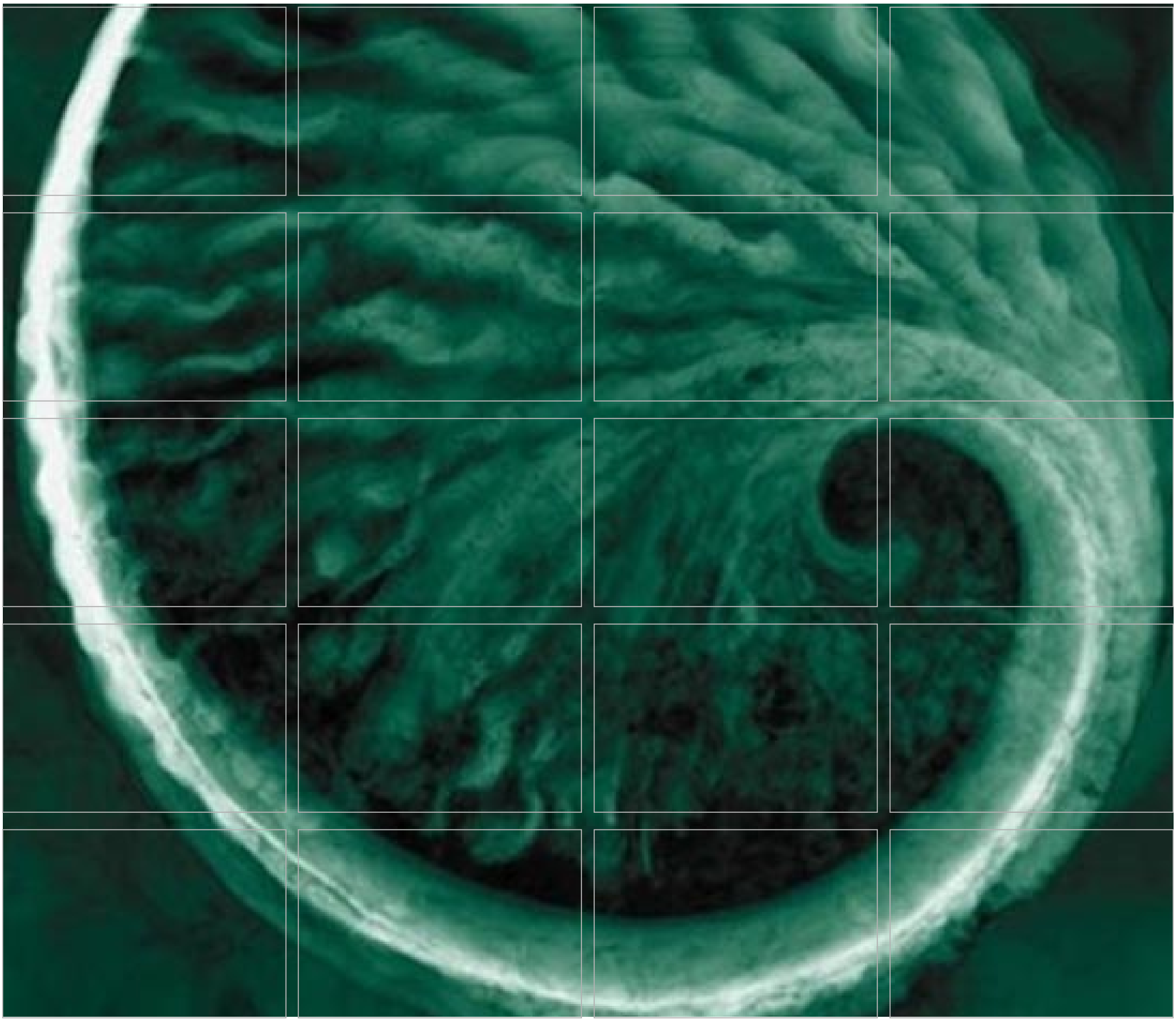
Cutts N, Phelps A & Burdon D (2008) *Construction and Waterfowl:Defining Sensitivity, Response, Impacts and Guidance*. Institute of Estuarine and Coastal Studies (IECS).

Lack P (1986) *The Atlas of Wintering Birds in Britain and Ireland*. T & A D Poyser.

Stillman R A, West A D, Goss-Custard J D, McGrorty S, Frost N J, Morrisey D J, Kenny A J & Drewitt A L (2005) Predicting Site Quality for Shorebirds Communities: A Case Study on the Humber Estuary. *Marine Ecology Progress Series* Vol 305 pp 203-217. Inter-Research.

Annex F

Supporting Information for Assessment of Effects of Piling



Piling Impacts on Birds from AMEP

25th November 2011

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Piling Impacts on Birds from AMEP

November 2011

ERM Reference 0120872

For and on behalf of: Environmental Resources Management (ERM) Approved by: Steve Purnell Signed: [redacted] Position: Partner Date: 25th November 2011

Environmental Resources Management Limited
Incorporated in the United Kingdom with registration number 1014622
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1 PILING IMPACTS ON BIRDS FROM AMEP

1.1 INTRODUCTION

The Able Marine Energy Park (AMEP) includes the development of a new quay on intertidal and subtidal habitats within the Humber Estuary. The intertidal mudflats currently support wetland bird species which form part of the qualifying interest of the designation of the Humber Estuary Special Protection Area (SPA) and Ramsar site.

Development likely to significantly affect European sites is controlled by, *inter alia,* the EC Habitats Directive (92/43/EC). The construction of the quay will require piling to establish the front wall and foundations. Piling has the potential to cause significant disturbance to birds that remain in areas surrounding the construction site, including at North Killingholme Haven Pits (NKHP), which is a component of the European designated site.

Article 6(2) of the Habitats Directive requires that,

> *'Member States …take appropriate steps to avoid, in the special areas of conservation, the deterioration of natural habitats and the habitats of species as well* ***as disturbance of the species*** *for which the areas have been designated, in so far as such disturbance could be significant in relation to the objectives of this Directive',* (author's emphasis)

In 2010 the Court of Appeal considered the meaning of '*deliberate disturbance'* in relation to Article 12(1)(b) of the Directive, and their judgement was later considered by the Supreme Court. The meanings of '*deliberate'* and of '*disturbance'* were considered separately. The Court made no distinction between the meaning of '*disturbance'* in Article 12 and Article 6, except for noting that in Article 6(2), only '*significant*' disturbance is to be avoided.

In the event, The Supreme Court adopted a more cautious approach than the Court of Appeal to the meaning of *'disturbance'*. It agreed with the Court of Appeal that the provision relates to protection of the species (not specimens of the species). However, it stated that the Court of Appeal had set the threshold too high in ruling that "*disturbance*" requires an impact "*on the conservation status of the species at population level*" or an impact which "*affects the survival chances of a protected species*". Beyond that, the Supreme Court was reluctant to state what the minimum threshold for "*disturbance*" of the species would be, although it did cite the EU Commission's guidance referring to the need for the disturbance to be "*harmful*". Ultimately the Supreme Court has confirmed that the judgement as to whether an act causes '*disturbance*' is one for the relevant decision maker to make (for example, the licensing authority or the LPA), based on all the facts of the case.

The effect of piling on birds and any mitigation measures which are required will be included as part of the Environmental Impact Assessment (EIA), and the assessment against the requirements of the Habitats Regulations. Natural

England (NE) has raised concerns during consultations about the effects of piling on birds and whether there is a need for a restriction on piling activity over the winter period to avoid significant disturbance. Piling methods will include a soft-start, a well recognised and effective procedure for avoiding impacts to marine mammals which follows guidance produced by the Joint Nature Conservation Committee (JNCC), and hence significant effects on cetaceans are unlikely. Discussions are ongoing with NE about the likely impacts on lamprey.

This document therefore focuses on the effects of piling on birds. It provides a summary of the proposed piling activities (see *Section 1.2*), the existing and proposed unmitigated noise levels that will result (see *Section 1.3*), the bird species which are likely to be affected (see *Section 1.4*), and an assessment of the effects including mitigation (see *Section 1.5*). The assessment considers the effects on birds in the following locations:

- on the remaining areas of intertidal mudflats on the foreshore at Killingholme Marshes;
- North Killingholme Haven Pits (NKHP);
- Killingholme Fields;
- the mitigation area which will be located at either Killingholme Fields, or at East Halton; and
- the compensation area which will be located on the north bank of the Humber Estuary near Cherry Cobb Sands.

Supporting information is provided in the *Annexes* listed below.

- *Annex A* Baseline Noise Sample Locations.
- *Annex B* Supporting Bird Data.
- *Annex C* Curlew usage of Killingholme Fields.
- *Annex D* Noise Contour Plots.

1.2 *PROPOSED PILING ACTIVITIES*

The proposed quay is a solid berth structure with a combi-pile front wall that comprises a combination of large diameter tubular steel piles alternating with steel sheet piles. The tubular piles will be tied back with flap anchors that fix the piles in position at their top. These anchors then rely on the passive resistance of the quay backfill material. This system avoids the use of anchor piles, and thereby avoids further noise generating activity associated from their installation.

The front wall will return at the northern and southern ends of the quay and tie into a rock revetment which will extend from the line of the existing flood defences. A piled relieving slab will be constructed behind the front wall and will enable a range of plant including large dock cranes, up to 1 600 tonne capacity, to operate anywhere on the quay.

Initially the piles will be vibrated through the soft superficial deposits. In the event that refusal occurs (*ie* the piles cease to go in further), before the required depth, they will be driven to their design depth using hydraulically operated piling hammers on a piling rig. The piling rig which will be used will be approximately 30 m in height.

The start date of the piling will depend on factors including the date on which approval is given to the AMEP proposals, and any other timing restrictions that may be enforced to protect species such as salmon and lamprey. Piling will occur over a 16 hour period each day (between 06:00 and 22:00), and it is estimated that continuous piling will be in operation for at least 15 of those 16 hours. Piling will occur over a six month period, with two piling units operating independently from separate barges, moving along the pile line to install the tubular piles. A third piling unit will also be operating at the same time to install the sheet piles. The start times of the two units for the tubular piles will be offset, and hence it is envisaged that piling operations will be continuous throughout the period specified above. There will therefore be periods when both units will be in operation and times when only one of the two tubular pile units will be operational. The order in which the piling is undertaken is yet to be confirmed.

It is estimated that there will be between 20 and 40,000 blows administered per rig per day, which means a total of between 40 and 80,000 blows per day based on two rigs installing four to five piles per day between them (*pers comm* HOCHTIEF Solutions AG**)**.

The piling units will be operated using a noise shroud, however, this shroud can only extend to the level of the pile gates (1) (partial mitigation), and not to the water surface (full mitigation) until the gates are removed. The gates are required to remain for a large proportion of the time taken to install a pile hence only partial mitigation will be possible for much of the piling period.

The piling procedures used will incorporate a soft-start at the beginning of each day before any piling commences, and in the event that all piling activity on the site stops for periods of 10 minutes or longer. This is in accordance with the guidance produced by Joint Nature Conservation Committee (JNCC) (http://jncc.defra.gov.uk/pdf/JNCC_Guidelines_Piling%20protocol_August%202010.pdf). However, as stated above it is envisaged that at least one of the two tubular piling units will always be operating.

(1) Pile gates support the piles whilst they are being installed.

1.3 BASELINE AND PREDICTED LEVELS OF NOISE AND VIBRATION

1.3.1 *Baseline Noise Levels*

The existing acoustic environment was characterised by long term noise monitoring at locations which reflect areas currently used by wetland birds as follows (see *Annex A* for a map showing these sample locations):

- on Station Road close to Killingholme Marshes foreshore (Location S1);
- on Station Road close on Killingholme fields (Location S2);
- on Killingholme fields (Location S3); and
- in North Killingholme Haven Pits (NKHP) (ECO 1).

Noise levels monitored at these locations are considered to be representative of the noise levels in the general area. Hence the survey data recorded at ECO1 on the northern side of NKHP are representative of the existing levels across NKHP. Location S1 is located to the west of the flood defences, as it was not practical to undertake measurements actually on the mudflats. As the marine environment has a significant effect on the acoustic environment, it is possible that existing levels may actually be slightly higher on the foreshore, however, it is still considered that the noise levels recorded at S1 are representative of the foreshore area.

Tables 1.1 – 1.4 contain details of noise levels which have been recorded at each location. They include the average LA1 noise level and the range of LA1 noise levels recorded. The LA1 noise level descriptor represents the noise level that is exceeded for 1% of the measurement period, and often reflects the noise level associated with more infrequent and noisy events. The LA1 noise level could be considered as a "repeatable maximum" noise level.

Table 1.1 Baseline Noise Sampling from Killingholme Marshes Foreshore (S1)

Date	Average Day Time LA90 (dB (A))	Average Day Time LAeq (dB (A))	Average Day Time LA10 (dB (A))	Average Day Time LA1 (dB (A))	Range LA1 (dB (A))
09-12-10	45	52	50	54	73 – 50
10-12-10	46	51	51	54	69 – 48
11-12-10	40	47	47	51	64 – 43
12-12-10	35	45	45	50	63 – 37
13-12-10	43	51	50	54	72 – 39
14-12-10	29	39	36	43	63 – 31
Overall Level	**40**	**49**	**47**	**51**	

Table 1.2 Baseline Noise Sampling from Station Road close to Killingholme Fields (S2)

Date	Average Day Time LA90 (dB (A))	Average Day Time LAeq (dB (A))	Average Day Time LA10 (dB (A))	Average Day Time LA1 (dB (A))	Range LA1 (dB (A))
09-12-10	46	56	55	65	79 – 56
10-12-10	48	56	55	65	76 - 53
11-12-10	40	51	48	53	74 - 45
12-12-10	38	52	45	51	73 - 42
13-12-10	39	56	50	66	76 - 49

Date	Average Day Time LA90 (dB (A))	Average Day Time LAeq (dB (A))	Average Day Time LA10 (dB (A))	Average Day Time LA1 (dB (A))	Range LA1 (dB (A))
14-12-10	38	58	52	67	77 - 41
Overall Level	**42**	**55**	**51**	**61**	

Table 1.3 *Baseline Noise Measurements for Killingholme Fields (S3)*

Date	Average Day Time LA90 (dB (A))	Average Day Time LAeq (dB (A))	Average Day Time LA10 (dB (A))	Average Day Time LA1 (dB (A))	Range LA1 (dB (A))
06-01-11	47	55	55	59	72 - 54
07-01-11	55	59	62	65	74 – 52
08-01-11	54	59	60	65	69 – 60
09-01-11	47	53	55	58	65 – 55
10-01-11	52	59	62	64	71 – 58
11-01-11	56	59	61	64	73 – 58
Overall Level	**52**	**58**	**59**	**63**	

Table 1.4 *Baseline Noise Measurements for North Killingholme Haven Pits (ECO-1)*

Date	Average Day Time LA90 (dB (A))	Average Day Time LAeq (dB (A))	Average Day Time LA10 (dB (A))	Average Day Time LA1 (dB (A))	Range LA1 (dB (A))
09-12-10	45	53	54	59	75 - 53
10-12-10	43	52	53	58	69 – 48
11-12-10	45	51	52	55	67 – 47
12-12-10	42	51	54	57	64 – 45
13-12-10	42	53	55	59	67 – 44
14-12-10	42	55	56	61	70 – 42
Overall Level	**43**	**53**	**54**	**58**	

The data shows that along the foreshore and at NKHP, typical average L_{A1} noise levels during the mid winter can, at times, reach 75 dB(A). Similarly at S2, up to 79 dB(A) at S2, a short distance inland typical average L_{A1} noise levels can reach 79 dB(A), although average levels are generally lower, particularly along the foreshore at S1 and at NKHP compared to the Killingholme Fields (see *Table 1.3*).

Statistical analysis of the noise monitoring data, reveals maximum (L_{AMax}) noise levels of up to 87 dB(A) at both ECO1 and S1 where L_{AMax} noise levels exceeded 55 dB(A) for a large proportion of the time. The analysis shows that L_{AMax} noise levels exceed 55 dB(A) for 91% of the time at ECO1 (see *Table 1.5*). The range of L_{AMax} noise levels extend up to 72 dB(A) at ECO1 and to 68 dB(A) at S1 within one standard deviation of the statistical mean.

Table 1.5 *Analysis of L_{AMax} Noise Levels (December 2010)*

Parameter	*ECO1*	*S1*
Occurrence of LAMax noise levels > 55 dB(A)	91%	71%
Occurrence of LAMax noise levels ≥ 75 dB(A)	5%	2%
Statistical Mean	65	60
Standard Deviation (SD)	7	8

Parameter	*ECO1*	*S1*
Mode (noise level which occurs the most frequently)	68 (7%)	64 (7%)
Range within 1 SD	58 – 72	52 - 68
Occurrence of LAMax noise levels within 1 SD	73%	69%
Occurrence of LAMax between 55 dB(A) and 75 dB(A)	86%	79%
Occurrence of LAMax between 58 dB(A) and 72 dB(A)	73%	-
Occurrence of LAMax between 52 dB(A) and 68 dB(A)	-	69%

The findings of the noise survey indicated that the key noise sources contributing to the existing noise climate were from related to typical activities at the docks (see below). Whilst the survey was undertaken over a period of six days in December 2010, the activities recorded are considered typical of those which will occur at the docks throughout the year.

The noise survey reported that the environmental noise at ECO1 was *"….significantly dominated by activities from Immingham Docks. The use of vehicle tugs was witnessed carrying loads to and from the docked vessels, which created bangs and clatters along with the vehicle movement itself. A stream of local HGV movements was also noted as lorries queued in that area"*. In addition the report states that:

- *"Two large vessels were noted to be docked at the Immingham Dock* (1) *north of the site during the observational periods. Engine noise could be heard from the vessels along with loading activities from the same area"*; and
- *"Industrial noise was noticeable emanating from the metal work yard to the east of measurement position ECO1. Specific noises from this location were observed as intermittent bangs and clatters of steelwork, along with loading and unloading of lorries. Given the infrequency of noises from this location, the overall influence of noise from this source is considered to be relatively low when compared to noises from Immingham Docks"*.

Survey location S1 at the eastern end of Station Road was defined as *"….a reasonably remote location on the bank of the Humber River; with little pass through traffic and remote houses about a coastal lighthouse. Local traffic noise at this location was noted to be very low, with no moving vehicles witnessed in the area during the observational periods. Ambient traffic could be heard as a consistent source in the distance towards the south-west of the site"*.

In addition *"… frequent vehicle movements could be heard at a similar level north-west of the site in the direction of the docks. Two large vessels were noted to be docked at the Immingham Dock north of the site during the observational periods. Engine noise could be clearly heard from the vessels along with loading activities from the same area. Typically, loading noise would constitute of intermittent clatters and bangs, being heard over engine and vehicle movement noises. Industrial noise to the west of this location could be identified by intermittent sirens at approximately 800Hz-1kHz, with no apparent constant pattern to the frequency of alarms. The noise level of alarms heard at this location was noticeable and at a similar level to the ambient traffic. Industrial noise from the west was subjectively less significant than north-west dock activities during the daytime"*.

(1) This is referring to Humber Sea Terminals.

During the observation period, a single helicopter was noted to fly along the river Humber from south to north.

Further details can be found in the survey report (Soundsolution Consultants, 2011 (1)).

The bird surveys commissioned by Able UK Ltd have recorded important numbers of bird species associated with the SPA/Ramsar designations particularly along the foreshore (S1) and in NKHP (ECO1). The noise surveys were not undertaken at the same time as the bird surveys, so it is not possible to draw conclusions on the exact effect of specific noise levels on the birds at the time, or determine whether the existing noise climate is having any effects currently on birds. However, these levels are considered to be indicative of the general noise climate in these areas, and important numbers of birds are still being maintained.

1.3.2 *Predicted Noise Levels with Piling*

Table 1.6 shows the predicted noise levels at the sample locations during piling activities, based on a maximum piling source sound power level of 134 dB(A). It also contains the average L_{A1} levels and a comparison of the predicted levels against the average L_{A1} noise level at each respective receptor location with respect to the piling location (north or south extent of the quay).

Table 1.6 Predicted L_{A1} Noise Levels During Piling (Unmitigated)

Site	Average LA1 baseline level dB (A)	North Quay, dB (A)	Difference from baseline, dB (A)	South Quay, dB (A)	Difference from baseline, dB (A)
S1	51	69	+18	75	+24
S2	61	67	+6	68	+7
S3	63	57	-6	59	-4
ECO-1	58	65	+7	61	+3

It is clear from *Table 1.6* that predicted noise levels from piling at Killingholme Fields (S3) are less than the existing average L_{A1} levels. There will therefore be no discernable noise effects from these levels at this site. This location is representative of the mitigation area if located on the AMEP site.

Noise levels which are higher than the baseline are also predicted at the other locations and particularly along the foreshore at S1 with piling at the southern part of the quay. The levels in *Table 1.5* from piling activities at the northern part of the quay are lower than at the southern end; however, this reflects the distance between the northern piling and location of S1. Assuming baseline noise levels are relatively constant along the foreshore, it is likely that the increase in noise experienced at S1 from piling in the southern part of the quay

(1) Soundsolution Consultants (2011) ABLE Marine Energy Park, Humber Port, North Lincolnshire - Assessment of Baseline Conditions. Report for Able UK Ltd.

will be representative of the increase in noise on the foreshore in the north when northern piling activity is occurring.

The compensation area at Cherry Cobb Sands on the north bank of the Humber Estuary is approximately 4 km away from piling activity. The noise modelling predicts levels of approximately 50 dB (A) at this compensation site. Slightly higher noise levels up to approximately 55 dB (A) are predicted on the adjacent existing intertidal mudflats at Cherry Cobb Sands.

A further comparison of the predict noise levels from piling with the existing LAMax noise levels is provided in *Figure 1.1* and *Figure 1.2*. These figures draw on data contained in *Table 1.5*. It is evident that predicted LA1 noise levels (*ie* repeatable maximum) fall below the existing mean LAMax noise level at ECO1, and that the predicted range of LA1 noise levels is well within the range (around the average) of LAMax levels recorded during the baseline surveys. At S1, however, the predicted LA1 noise levels, with piling occurring at the southern end of the quay, are largely towards the upper end and above the range around the recorded average.

Figure 1.1 *Predicted Piling Noise Levels and Existing LMax Noise Levels ECO1*

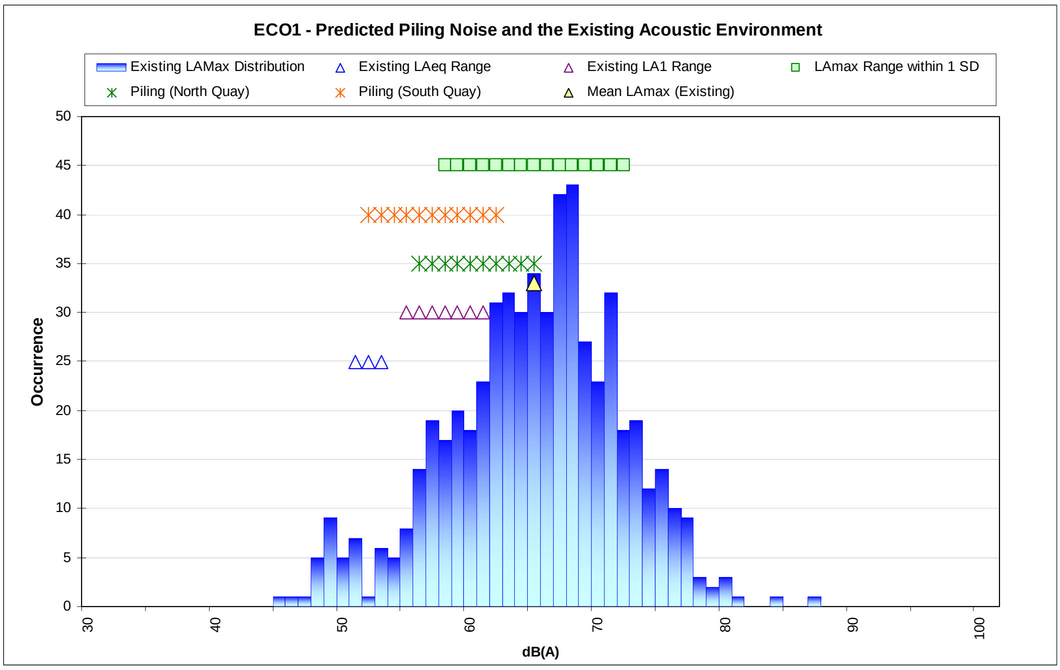
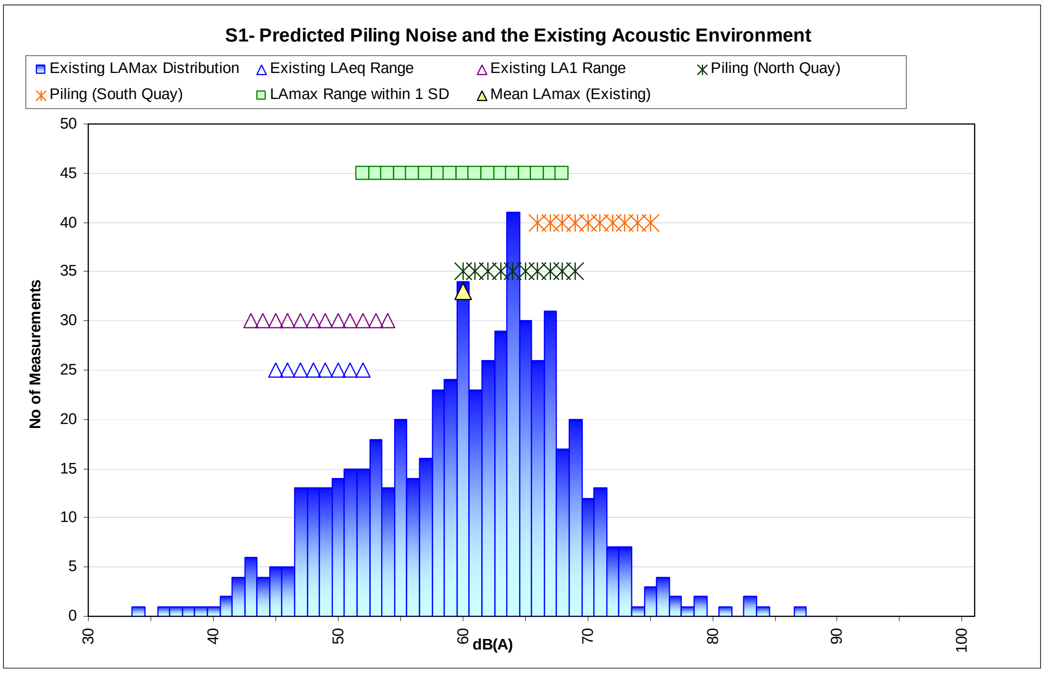


Figure 1.2 *Predicted Piling Noise Levels and Existing LMax Noise Levels S1*



Piling noise is the dominant noise source in terms of LAMax noise emissions. Other construction noise levels have been assessed over a 1 hr period, and are not expected to generate LAMax levels in the range that piling is expected too.

1.3.3 *Vibration*

The most significant source of vibration during the construction works will be from the installation of the tubular steel piling and sheet piling for the quayside wall. BS 5228 provides guidance for the prediction of an estimate of vibration from piling operations which is based on the energy per blow or cycle (determined by the type of piler and ram weight), the distance of the receptor from piling and generalised soil conditions.

Reference vibration levels from Table D8 Item C32 of BS 5228 for similar piling operations, indicated a measured PPV of 7.4 mm/s and 3.3 mm/s at plan distances of 27m and 55m respectively. The calculation formulae provided in Annex E of BS 5228 were adjusted to these measured values to calculate expected vibration emissions.

Table 1.5 *Estimated Vibrations from Tubular Piling and Sheet Piling Operations*

Threshold Value, PPV mm/s	Sheet Piling Plan Distance, m	Tubular Steel Piling Plan Distance, m		
		500 KJ	300 KJ	200 KJ
50	2	6	5	4
25	3	11	9	8
20	4	13	20	9
10	6	22	18	15

Threshold Value, PPV mm/s	Sheet Piling Plan Distance, m	Tubular Steel Piling Plan Distance, m		
		500 KJ	300 KJ	200 KJ
5	10	37	30	26
1	32	126	104	89
0.5	52	213	175	150
0.3	75	300	258	220

Ground vibration from pile driving is likely to be perceptible at the nearest sensitive receptors S1 and S2 when piling activities approach within a distance of 150 m to 300 m based on 500 KJ hammer energy.

Location S1 is potentially within 50 m of the nearest piling location and could experience vibration levels in the order of 5 to 10 mm/s. Such levels would be noticeable to human occupants and would normally result in adverse comments or complaints. In the absence of any information about effects on birds it has been assumed that birds would also perceive these vibrations and may be affected.

1.4 *EXISTING BIRD USAGE*

Killingholme Marshes Foreshore (KM)

KM has been identified as an important resource for eight species of the Humber Estuary based on information collated by through the tide counts (TTTC) (IECS, 2010 - 2011) and published Wetland Bird Survey (WeBS) core count data (2004/05 - 2008/09). These species include bar-tailed godwit (maximum of 2.1 percent of Humber population), black-tailed godwit (66 percent), curlew (3.6 percent), dunlin (4.8 percent), lapwing (1.7 percent), redshank (9.9 percent), shelduck (2 percent) and ringed plover (9.7 percent).

The autumn period is consistently an important time of year for these species. Redshank, curlew, dunlin and lapwing also exploit the resource throughout the winter period. Shelduck use KM intermittently throughout the autumn and winter in important numbers. For black-tailed godwit KM is an important resource particularly in autumn and over the winter, whilst bar-tailed godwits are present in important numbers in spring. The section of mudflat surveyed at KM was split into a number of count sectors as shown in *Figure B1.1, Annex B* which illustrates that Sectors C, D and E support the largest assemblage of birds.

Sectors C and D will both be lost to the footprint of the new quay. The effects of the construction of AMEP and its operation are predicted to disturb birds over part of the remaining mudflats in Sector E, such that approximately a third of the mudflats in this count sector will remaining for waterfowl (ERM, 2011 [(1)]). A full list of species which were recorded on the mudflats within

(1) Environmental Resources Management (2011) *AMEP Compensation Site on North Bank of Humber.* Report to Able UK Ltd. ERM

Count Sector E and estimates (pro rata) of the numbers that will use the remaining area within Count Sector E are listed in *Annex B*. The estimates of birds remaining on the mudflats form the baseline against which the effects of piling will be assessed. No allowance has been made for any attempts to use the remaining areas of mudflat by birds displaced from the other Count Sectors (*eg* C and D) and from the disturbed part of Count Sector. Compensatory habitat for the loss of these areas of mudflat has already been agreed.

Count Sector E supports a range of waterfowl, with one or more species present in numbers which are equal to, or greater than, 1% of the Humber Estuary SPA population across the autumn passage and winter months (see *Table 1.1* and *Figures 1.3* to *1.10* in *Annex B*). The remaining areas of mudflat on Sector E support the following species of waterfowl in numbers exceeding ≥1% (see *Table 1.2* in *Annex B*):

- black-tailed godwit (October / March);
- ringed plover (August / September).

Several gull species are also likely to be present in numbers including ≥1%, however, that is based on very low numbers (*eg* one or two herring gulls and up to four great black-backed gulls).

A review of the presence of waterfowl on the mudflats in Count Sector E through the tidal cycle, based on the findings of the Through-the-Tide Counts (TTTC) undertaken in 2010/2011, has shown that several species are present in greater numbers at high tide than at lower tidal states (see *Figures 1.11* to *1.29* in *Section B1.4* of *Annex B*. Black-tailed godwits numbers in particular seem to be lower around low tide compared with later stages in the tidal cycle. In contrast ringed plovers are often present in greater numbers around low tide and are typically absent from Count Sector E around high tide.

Count Sector A supports very few birds reflecting the paucity of suitable intertidal habitat. The mudflat in this sector is narrower, more stoney, has a steeper profile, and had regular records of predators (avian and mammalian). The only record of note was one of the August surveys which recorded over 2% of the SPA population of black-tailed godwit on the second survey in August (see *Table 1.3* in *Annex B*). A survey earlier in August recorded this species in numbers less than 1%.

KM is also an important resource for the Humber waterbird assemblage, a qualifying interest feature of the SPA (maximum of 2.7 percent of the Humber assemblage present in KM). The assemblage of waterbirds at KM exceeds the ≥1 percent threshold of the Humber population in August and October (see *Annex B*). This is likely to represent birds on passage.

North Killingholme Haven Pits (NKHP)

NKHP provides an important resource for 11 species during the autumn/winter period as well as the overall waterbird assemblage (up to 2.9 percent of the Humber assemblage population). Individual species using NKHP in important numbers include avocet (5.5 percent of the Humber population), black-tailed godwit (97.8 percent), dunlin (1.8 percent), lapwing (1.5 percent), little ringed plover (34 percent), mallard (3.4 percent), moorhen (2.7 percent), redshank (4.6 percent), shoveler (42.1 percent), teal (1.6 percent) and water rail (28 percent). A full list fo species and further details are provided in *Table 1.4* in *Annex B*. Two SPA qualifying breeding bird species avocet (eight breeding pairs) and marsh harrier (one breeding pair) were also recorded in NKHP during the 2011 breeding season.

Killingholme Fields

Only six wetland bird species were recorded using the fields on the proposed AMEP site (black-tailed godwit (*Limosa limosa*), lapwing (*Vanellus vanellus*), redshank (*Tringa totanus*), whimbrel (*Numenius phaeopusare*), shelduck (*Tadorna tadorna*) and curlew (*Numenius arquata)*. A further four species (pink-footed goose (*Anser brachyrhynchus*), gadwall (*Anas strepera*), mallard (*Anas platyrhynchos*) and snipe (*Gallinago gallinago*) were recorded in fields to the south of the AMEP site.

The surveys undertaken by Catley showed that the fields to be lost were not of importance for shelduck, black-tailed godwit, whimbrel and redshank, either in terms of frequency of use, or the numbers of birds

Lapwings were recorded on a greater number of occasions (15 records) but a number of these (six records) were on fields which will be retained as part of AMEP scheme (*eg* Field 226), or are not affected by the AMEP scheme (Field 225). A further five records were of seven birds or less. Only four records were made of any note, a combined total of 142 birds in two fields (in December 2007), one of 49 birds (December 2010), and one of 18 (December 2007 / January 2008). None of these records was of a flock which was ≥1% of the population of the Humber Estuary.

The fields are important for curlew, supporting up to 1.6 % of the Humber population (Catley, 2007/08), with the birds favouring grassland fields, especially permanent pasture, in which to forage. Four grassland fields (240, 235, 226 and 225, see *Annex C* for Catley 2010/11 data) were identified as being of particular importance for this species which was present between July and March.

1.5 *POTENTIAL EXPOSURE AND GENERIC IMPACTS*

1.5.1 *Responses of Birds to Piling Noise*

There is little information available about the effects of construction on birds including from piling. What information there is in the scientific literature shows a degree of variation in the responses by birds, but does not indicate that significant effects are certain to occur. ERM's experience of monitoring the effects of piling and construction across the mudflats at the South Humber Bank Power Station was that disturbance resulted predominantly from third party recreational sources, especially walkers with dogs (see below). Able UK Ltd's own experience at the TERRC facility also recorded

Information presented in Cutts (2008a [(1)]) states that irregular piling noise (>70 dB(A)) elicits a high to moderate response by waterfowl, whilst regular piling noise (>70 dB(A)) resulted in a moderate response. These levels include reference to the findings of a study of construction work adjacent to an estuarine mudflat on the Humber Estuary monitored by the Institute of Estuarine and Coastal Studies (IECS) in the late 1990s (Cutts, 2004 [(2)]). This report stated that levels of > 85 dB(A) provoked a flight response in waterfowl, whilst below 50 dB(A) there was no effect. Noise levels of between 55 dB(A) and 85 dB(A) were likely to result in a variable response, but for the most part regular noise only resulted in a heads up response by wildfowl with no apparent variation in feeding rates by waders.

Table 1.6 summarises the reaction of waterbirds to varying levels of noise resulting from piling activity, as reported in a review of the effects of construction on waterfowl, a document which includes reference to various studies on the Humber Estuary (Cutts *et al*, 2008b[(3)]). The author does acknowledge that information about the effects of construction impacts on birds, including from noise, is limited. There are also difficulties in obtaining relevant data in areas supporting significant numbers of birds, as naturally development likely to cause significant effects to European sites would not be allowed under the *Habitat Regulations*.

(1)Cutts N D (2008a) Conservation Goals for Waterfowl in Estuaries. Harbasins Report. Institute of Estuarine and Coastal Studies (IECS)

(2) Cutts N D (2004) Avifaunal Disturbance Assessment. Flood Defence Work, Saltend. report to the Environment Agency. IECS.

(3) Cutts N, Phelps A & Burdon D (2008b) *Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance.* Report to Humber INCA.

Table 1.6 *Waterbird Reactions to Piling Noise (Source: Cutts et al, 2008b)*

Activity	dB (A)	Effect level	Response (feeding / roosting)	Impact	Reaction
Piling noise below 70 dB (A)	0 – 50	Low	Level 1	No impact	No reaction
	51 – 70	Moderate	Level 2	Behavioural change (alarm calls, heads up, change in feeding/roosting activity)	Head turning, scanning behaviour, reduced feeding, movement to
Piling noise above 70 dB (A)	71 – 85	Moderate-High	Level 3	Movement within zone	other areas close by
	86 - 120	High	Level 4	Movement within zone but remaining on site	Maximum response preparing to fly away and flying
			Level 5	Movement off site	away, may leave area altogether

Cutts *et al* (2008b) also discusses the impact of piling activity on birds as part of the South Humber Bank Power Station construction, where bird activity was monitored during the construction phase and included works across the foreshore. It was found that when piling occurred behind a sea wall the birds showed no reaction to the increase in noise. However, when piling occurred on the other side of the seawall birds were noted to be disturbed over a small area, leaving that area as a result. The absence of effects when piling occurred behind the seawall suggested that the visual presence of people was a more important factor in the effects on birds than simply the noise itself, with the seawall acting as a screen. Monitoring in the month of April at this site recorded birds remaining approximately 200 m away from the construction works. It was suggested that the distance at which the birds remained from the activity may have been exaggerated at this time of the year, compared with other months monitored, by the presence of unhabituated migratory species, which may be more susceptible to disturbance effects than wintering birds.

The review by Cutts *et al* (2008b) also recommends that "*ambient construction noise levels should be restricted to below 70 dB(A), birds habituate to regular noise below this level. Where possible sudden irregular noise above 50 dB(A) should be avoided as this causes maximum disturbance to birds* (emphasis added)" Excluding the initial start up of each piling unit each day, construction of the new quay at the AMEP site will entail regular piling each day. The presence of two rigs on the AMEP site will result in a relatively stable (regular), albeit increased, ambient noise level.

More recently piling has been undertaken as part of the construction of the construction of the South Killingholme Oil Jetty. NE has advised that a condition on the FEPA licence prevented the works from being undertaken during months when significant numbers of SPA birds were likely to be present. Despite this some 3,500 birds were observed following piling (*pers comm* Darren Clarke, HINCA, 2011). Whilst the extent and duration of this piling is much smaller scale than that proposed as part of AMEP, there appears to be no evidence of a significant change in the use of the adjacent mudflats by birds due to the piling activities.

Able UK Ltd's own experience on the River Tees during the construction of the TERRC facility also found that for the majority of the time construction including piling activities, including around low tide at times, did not cause significant levels of disturbance to waterfowl in the area, in areas approximately 400 m from the work ((Scott Wilson, 2008) (1). Only one major disturbance incident was recorded throughout the six week monitoring period. The majority of disturbance events were related to activities unrelated to Able UK Ltd's activities.

We are also aware that bird monitoring work is being undertaken for the Environment Agency (EA) by IECS at a location on the Humber Estuary. Whilst the findings of the monitoring have yet to be reported, preliminary information indicates that noise levels of up to 70 dB(A) have been recorded, with no significant effects on the birds (*pers comm* Nick Cutts, IECS, 2011).

Historically, on other projects potentially affecting the designated bird interest of the Humber Estuary, NE has required predicted noise levels to be limited to 55dB(A) or less, as a precautionary measure. If levels of less than 55 dB(A) can be achieved, then no likely significant effect can be concluded, and the need to consider the effects as part of an Appropriate Assessment under the *Habitats Regulations* will not required. The basis for this figure is understood to be the findings of monitoring of flood defence works at Saltend (IECS, 2004). However, reference within this report to the absence of effects at ambient noise levels of up to 55 dB (A) largely appears to stem from work undertaken by Smit & Visser (1993 (2)) on the Wadden Sea. The main sources of disturbance on the Wadden Sea were however, leisure activities, aircraft and military shooting activities, not construction and piling.

The overall effects of noise will also depend on the relative sensitivities of the different bird species, including on a seasonal basis. For example birds on passage are likely to be more sensitive to disturbance than over wintering birds, which can often exhibit a degree of habituation (Cutts *et al*, 2008b). Some species are typically more tolerant of disturbance, for example shelduck at any time of year. The sensitivities of different waterfowl species are illustrated in *Table 1.2* in *Annex B*.

Overall therefore, whilst the exact effects on birds remains uncertain the evidence from construction disturbance studies, including piling, suggests

(1) Scott Wilson (2009) Estuarine Bird Monitoring TERRC Facility. Report for Hartlepool Borough Council. SW.
(2) Smit C J & Visser G J M (1993) Effects of Disturbance on Shorebirds: A Summary of Existing Knowledge from the Dutch Wadden Sea and Delta Area. In Disturbance to Waterfowl on Estuaries. Wader Study Group Bulletin 68. Special Issue. WSG.

that effects from piling are likely to be localised and that birds can tolerate level of much greater than 55 dB(A) without any obvious signs of adverse effects.

1.5.2 *Predicted Impacts and Mitigation from AMEP Piling*

The development of the AMEP scheme will permanently displace wetland bird species from a large proportion of the Killingholme Marsh foreshore. As a consequence, compensatory habitat will be provided for these species on the north bank of the Humber Estuary at Cherry Cobb Sands. Similarly wetland bird species using the Killingholme Fields which lie within the AMEP site will also be displaced. Able UK Ltd's submission will include for mitigation to offset these losses within the AMEP site, elsewhere on Killingholme Fields. The following assessment focuses only on the effects of piling which is a temporary impact.

The noise levels at the existing intertidal mudflats at Cherry Cobb Sands, and the proposed compensation area are not predicted to exceed 55 dB (A). Hence based on NE's previous precautionary approach no likely significant effect is concluded on birds in these locations.

Whilst the predicted unmitigated noise levels from piling at location S3 exceed 55 dB(A) (57 / 59 dB (A), see *Table 1.8*) they are lower than the existing average L_{A1} noise level of 63 dB(A). So again birds using these areas will not be affected by the piling. Other parts of the proposed mitigation area lie north and east of S3 (*ie* closer to the piling source) and are likely to experience slightly higher unmitigated noise levels (*ie* between those levels predicted at locations S2 and S3, see *Table 1.8*), but they are likely to be considerably below 70 dB (A) and not dissimilar to the existing average L_{A1} noise levels. If this area is used for mitigation then monitoring will be undertaken to record the effects of the piling work on birds and partial mitigation may be implemented if necessary, as it will reduce the noise to acceptable levels.

The remaining areas which support wetland bird species from the designated European sites are NKHP and areas of intertidal habitat that remain at the northern and southern ends of the Killingholme Marshes foreshore. Piling has the potential to disturb birds which may be foraging or roosting in both of these areas.

The noise levels set out in *Table 1.8* show predicted unmitigated L_{A1} noise levels from piling of approximately 65 dB(A) at NKHP and 75 dB(A) along the foreshore. Based on the effect categories described in Cutts *et al* (2008), these levels would fall within the moderate effect category at NKHP, and moderate to high effect category along the foreshore. Such levels could affect the foraging efficiency of birds, particularly in the areas of intertidal mudflats which remain at the southern end of the foreshore, in Count Sector E (see *Annex B*).

Table 1.7 presents information supplied by Hochtief (a construction services specialist) about the noise reductions which can be achieved through the use of partial and full mitigation of the piling units. The data show that partial mitigation (*ie* incomplete enclosure of the pile) achieves a reduction in noise by 4 dB(A) (1), and full mitigation (*ie* complete enclosure of the pile down to the water level) achieves a reduction of 9 dB(A).

Table 1.7 ***Predicted Effectiveness of Noise Shroud as Piling Mitigation (Source: HOCHTIEF Solutions AG)***

No.	Sound power level		Impulse adjustment	Comments to Noise shroud
	L_{WAeq}	L_{WATeq}	K_{IN}	
1	133,7 db (A)	141,4 db (A)	7,6 dB	Noise shroud completely lifted / Piles free-standing
2	129,9 db (A)	136,8 db (A)	6,9 dB	Incomplete enclosure of piles by noise shroud
3	124,4 db (A)	129,6 db (A)	5,2 dB	complete enclosure of piles down to water level

Table 1.8 shows the adjusted noise predictions taking account of this mitigation and these levels are illustrated in *Figures 1.3* and *1.4*, with contour plots in *Annex D*. Fully mitigating the piling activities reduces the predicted noise levels along the foreshore to a worst case scenario of approximately 66 dB (A), based on piling occurring in the south of the quay close to monitoring location S1. Similar mitigation will result in the worst case levels at NKHP of 56 dB (A) when piling activity is being undertaken in the northern part of the quay and lower levels of approximately 52 dB(A) if work is being undertaken solely in the southern part of the quay.

Table 1.8 ***Predicted Noise Levels Incorporating Partial and Full Mitigation***

Site	Average L_{A1} dB (A)	Predicted Noise Levels with Mitigated Piling at North Quay (dB(A))			Predicted Noise Levels with Mitigated Piling at South Quay (dB(A))		
		None	Partial	Full	None	Partial	Full
S1	51	69	65	60	75	71	66
S2	61	67	63	58	68	64	59
S3	63	57	53	48	59	55	50
ECO-1	58	65	61	56	61	57	52

None- piles free standing, no shroud or completely lifted.
Partial- Incomplete enclosure of piles by noise shroud.
Full- Complete enclosure of piles down to water level.

(1) Mitigation effects rounded to the nearest whole number from data in *Table 1.7*.

As highlighted in *Section 1.2* of this report, the supplier of the piling units (HOCHTIEF Solutions AG) has advised that the use of full mitigation will not be possible until the piling gate has been removed. This means that the majority of the work will only be possible with partial mitigation.

Figure 1.3 Potential Noise Reduction from Piling Mitigation in North Quay

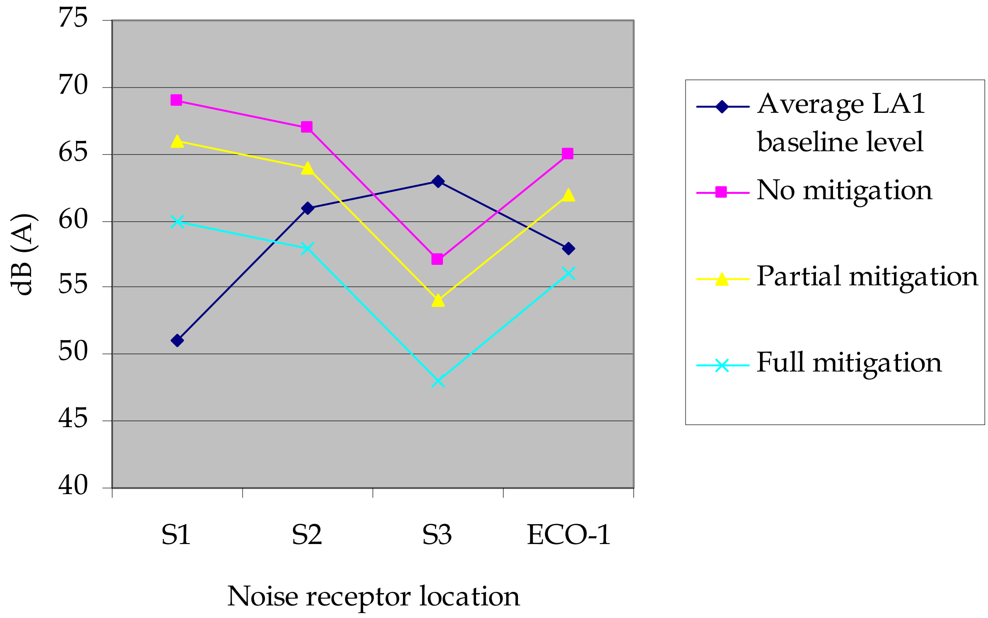
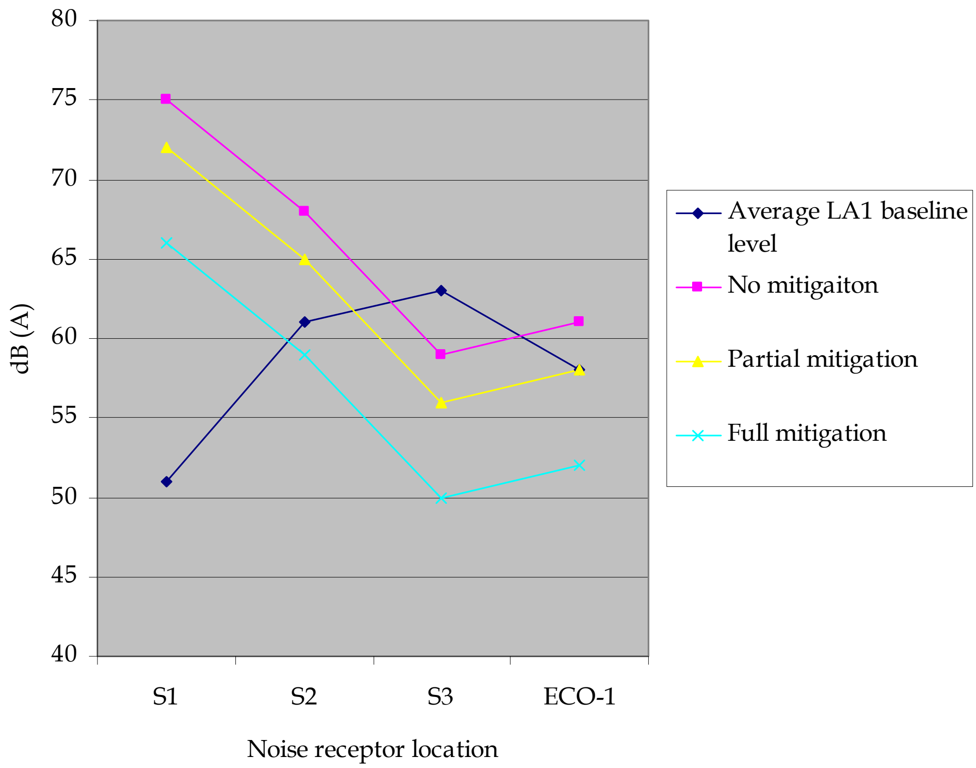


Figure 1.4 *Potential Noise Reduction from Piling Mitigation in South Quay*



It is clear from these data that the precautionary noise limit of 55 dB(A), that have previously been imposed, or limits that are unlikely to affect birds (*ie* less than existing average LA1 noise levels), could only be achieved at NKHP during times that full mitigation of the piling works is possible in the northern part of the quay. However, the existing acoustic environment around NKHP is one that is already dominated by noise emanating from the nearby port activities (see *Section 1.3.1*), and LAMax levels are already above 55 dB (A) for most of the time (91%) (see *Section 1.3.1*).

Partial mitigation will reduce the predicted noise levels at NKHP to approximately 61 dB (A), a level at which at least some birds might be expected to habituate to the noise (Cutts, 2008b). This level is only marginally greater than the existing average LA1 noise levels at NKHP (58 dB (A)), and much lower than the highest recorded LA1 noise level of 75 dB (A). It also lies within the range of LAMax noise levels recorded at ECO1 (58 – 72 dB (A)) within one standard deviation of the mean LAMax of 65 dB (A), and is less than the highest LAMax noise level recorded during the noise survey in December 2010 of 87 dB (A).

It is evident from the above that the existing climate at NKHP is already very noisy and includes irregular noise events. The predicted noise levels from piling are not predicted to results in significant changes to this existing noisy environment. As a result the birds using NKHP are expected to continue to do so over the temporary six month construction period.

The existing acoustic environment at S1 is less noisy than at NKHP but L_{AMax} levels are still above 55 dB (A) for almost three quarters of the time (71%) (see *Section 1.3.1*). L_{AMax} noise levels are between 55 and 75 dB (A) for 79% of the time.

The predicted L_{A1} noise level at the foreshore with partial mitigation is 71 dB (A) which is above the existing average L_{A1} noise levels along the foreshore (51 dB (A)), and the L_{AMax} noise level range within one standard deviation of the mean L_{AMax} noise level of 60 dB (A) at S1 (52 – 68 dB (A)) . It is however, less than the highest recorded L_{A1} noise level of 73 dB (A), and the highest L_{AMax} level recorded during the noise survey in December 2010 of 87 dB (A). The predicted noise level is within the moderate to high effect category described in Cutts *et al* (2008b) (see *Section 1.5.1*).

The intertidal habitat along the foreshore at Killingholme Marshes will, however, only remain in count Sectors A and E (see *Annex B*), with the remainder lost to AMEP. The bird surveys along the foreshore showed that Sector A supported few birds, with only one record of bird species being present in numbers ≥1% of the Humber Estuary population (black-tailed godwit on one of the August surveys). Predicted levels across Count Sector A are between 65 dB (A) and 75 dB(A) L_{A1}. As discussed above the existing noise climate in this area is very noisy, and much of it arises from dock activities including at Humber Sea Terminals which adjoins Count Sector A. Hence bird species using this area are likely to be able to tolerate such noise conditions. Whilst black-tailed godwit is listed in the high sensitivity category in the review by Cutts *et al* (2008b), it is a species which is not regarded as being particularly sensitive to disturbance (Gill *et al*, 2001 [(1)]; Gill 2007 [(2)]).

In addition the AMEP proposals include wet grassland fields at Old Little Humber Farm (OLHF) on the northern banks of the Humber Estuary as part of the compensation package. The terrestrial compensation proposals for AMEP will be initiated prior to works commencing on the AMEP site at Killingholme Marshes foreshore. It is expected that the wet grassland mitigation at Old Little Humber Farm will be started in 2012, prior to works commencing on the AMEP site in 2013. The compensatory fields will provide feeding potential over and above that required for the birds displaced as a result of the direct habitat loss from the scheme. There will also be additional grassland fields created inland from the Killingholme Marshes foreshore as part of the mitigation package. Hence it is likely that the food resource could accommodate some further birds, especially over a short period of time.

It has already been acknowledged in correspondence with NE, that birds using the intertidal mudflats will retain a standoff distance from the construction works. This means that they are unlikely to utilise all the mudflats in this area and will remain towards the southern end. Allowing for

(1) Gill J A, Norris K & Sutherland W (2001). The Effects of Disturbance on Habitat Used by Black-tailed Godwits. *Journal of Applied Ecology* **38**:846-856.
(2) Gill J A (2007) Approaches to Measuring the Effects of Human Distrubance on Birds. *Ibis* **149**:9-14.

this extra distance from the quay, the unmitigated noise levels are likely to be in the order of 70 – 75 dB (A) (*ie* moderate to high category) across much of the area where the birds are likely to be (see *Annex D)*. Given these mudflats are located between two jetties and near the Iron Ore terminal, birds using this area must be used to a degree of disturbance. Partial mitigation is likely to reduce these levels to between 65 and 70 dB (A).

A more detailed analysis of the bird numbers which are likely to remain on these mudflats shows that the majority of species are present in numbers well below 1% of the Humber Estuary SPA population. Several of the gull species are present in numbers which ≥1%, however, this is often on the basis of very small numbers (*eg* 1- 4 birds). The gulls are also unlikely to be significantly affected by noise, especially given the main sources which are dock and vessel related.

The other species which occur in numbers ≥1% are black-tailed godwit in October and March, and ringed plover in August and September. Ringed plover favour the periods around low tide, whilst black-tailed godwits prefer the mid and higher ranges of the tidal cycle (see *Annex B*). Given the need for the piling works to be undertaken in a continuous six month period, and the other restrictions which are expected in respect of fish species, it is unlikely that the work will be able to occur over the autumn / winter passage period without potentially affecting important numbers of birds, particularly in the autumn passage period when ringed plover are present on the mudflats in Count Sector E.
As discussed above grassland fields will be created as part of the compensation and mitigation packages and it is expected that these fields could accommodate additional foraging black-tailed godwit (and other species can forage in wet grassland) over short periods during the piling works.

For species which are more reliant on the mudflats such as ringed plover, and other species in lower numbers such as shelduck, dunlin and bar-tailed godwit, it is expected that they will be able to use the existing mudflats including at Cherry Cobb Sands, or the other developing realignment sites such as that at Paull Holme Strays. In this regard it is noted that distribution maps detailing bird usage of the Estuary show these species to be widely distributed within the SPA (English Nature, 2005).

The most sensitive period is therefore August to October, particularly due to the presence of passage ringed plover, with numbers less than 1% over the winter months on the remaining areas of Count Sector E.

A soft start will be implemented as a mitigation measure This gradual increase of piling power over a period of time to full power is primarily intended to mitigate the effects of piling on marine fauna (*eg* cetaceans) by encouraging these species to move away from affected areas before any harm occurs. However, it is also likely that it will help avoid sudden effects that could otherwise arise from the sudden start up of piling, and have a greater effect on birds in surrounding areas.

Consideration has been given to the effects of ground vibration from pile driving. The predictions suggest that it is likely to be perceptible at the nearest sensitive receptors when piling activities approach within a distance of 150 m to 300 m based on 500 KJ hammer energy. As stated above it is likely that the main areas of intertidal mudflats which will be used by the birds during construction will be over 300 m from the works at their closest point. Hence ground vibration is not predicted to affect the birds.

1.5.3 Conclusion

The noise characteristic of two rigs on the AMEP site would be less intermittent than a single rig, albeit at an increased, ambient noise level. Regular noise or noise of a more constant or continuous nature is considered to cause less disturbance to birds than intermittent noise; noise levels would be much more variable with a single rig.

The unmitigated piling works on the quay site will not have adverse effects on birds using the compensation site on the northern banks of the Humber Estuary or its adjacent intertidal mudflats.

The main species affected will be black-tailed godwit in October and March and ringed plover in August and September. The autumn passage period is therefore the most sensitive period. Birds occur in numbers less than 1% over the remaining months.

The existing noise environments have been monitored and found to be noisy largely from existing dock related sources. The activities regularly create clatters and bangs. Existing levels recorded are in excess of the thresholds currently used to trigger the need for Appropriate Assessment, with high L_{Amax} and L_{A1} levels recorded. Birds are currently using the mudflats and NKHP despite these levels, and the predicted piling noise levels are within the existing L_{Amax} range and are not expected to significantly alter the noise environment at this location. The predicted piling noise levels at S1 are slightly above L_{Amax} range, predominantly when piling is occurring in the southern part of the quay area, and there is the potential for effects to birds using the mudflats which are likely to remain in use by birds in Count Sector E. It is possible that birds present in numbers ≥1% of the Humber Estuary SPA population may be affected, notably ringed plover and black-tailed godwit over the autumn passage period.

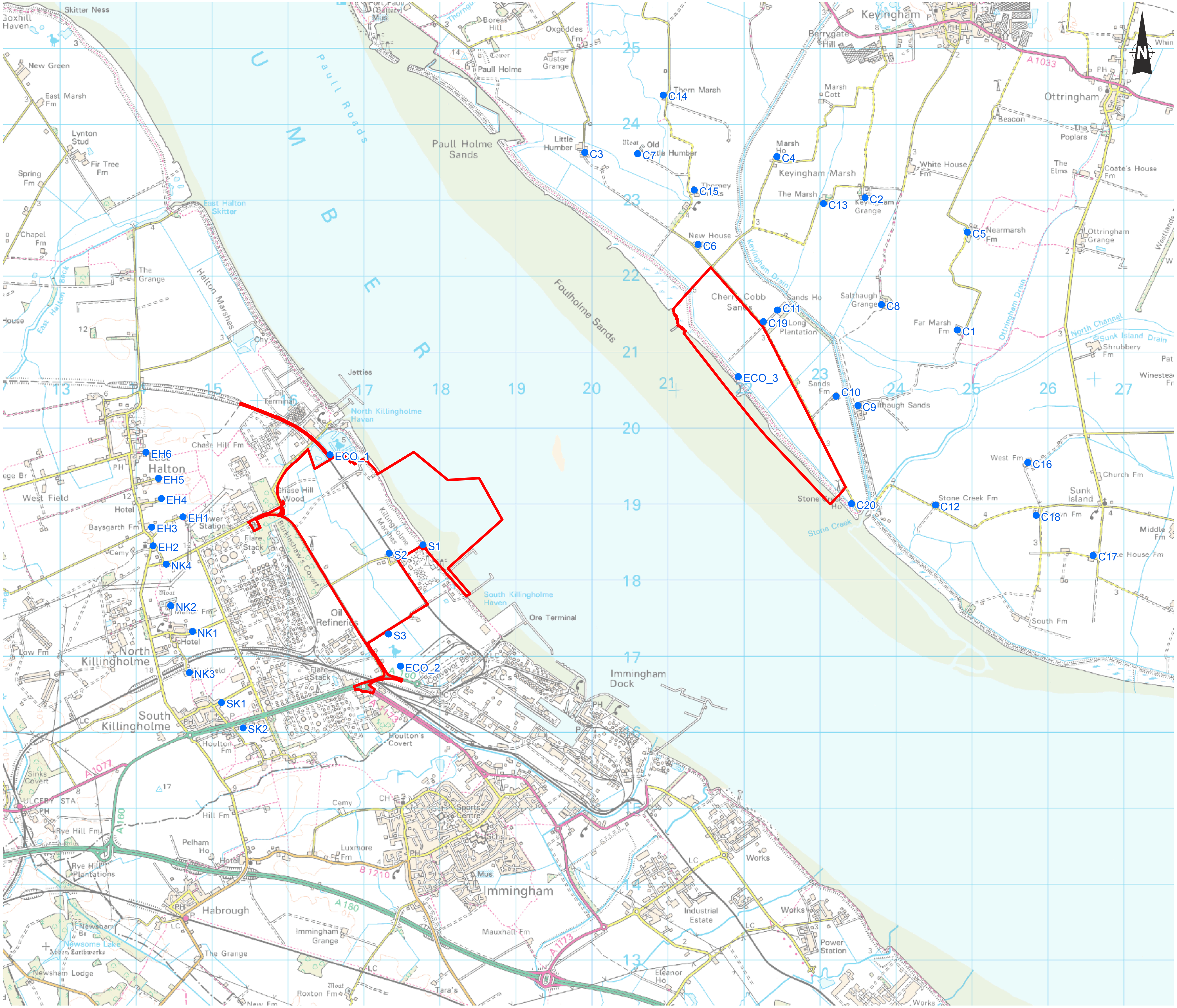
The responses of the birds on the mudflats to the piling works are, however, likely to be highly variable. Based on the scientific literature and by reference to previous monitoring studies on the Tees and the Humber, the predicted noise levels are less than those that are expected to cause birds to leave the mudflats. Ongoing monitoring on the Humber suggests that birds are tolerating levels of up to 70 dB (A) without significant effects.

Creation of the compensation area at Old Little Humber Farm, in advance of the start of construction on the AMEP site, will provide some alternative foraging / roosting opportunities for any birds (that will use wet grassland fields) which are affected by the piling works and do leave. Other species which are more restricted to the use of intertidal mudflats, already use a wide range of areas within the Humber Estuary, and will be able to utilise other existing mudflat habitats, including that developing as part of other managed realignment schemes, during the very short period during which they might be affected by piling.

Ground vibration is not predicted to affect the birds.

Annex A

Baseline Noise Sample Locations



Key

Application Boundary

Noise Receptors

SOURCE: Reproduced from Ordnance Survey digital map data. © Crown copyright, All rights reserved. 2011 License number 0100031673.

PROJECTION: British National Grid

Rev	Date	Comments	Drw	Chk	App
A	01/11/2011	Preliminary Issue	MTC	WB	SP

www.ableuk.com

ERM

Project: ABLE Marine Energy Park

Client: ABLE UK Ltd

Title: Figure A1
Baseline Noise Monitoring Locations

PRELIMINARY

Scale:	Drawn	Checked	Approved
1:50,000@A3	MTC	WB	SP
Date	01/11/2011	01/11/2011	01/11/2011

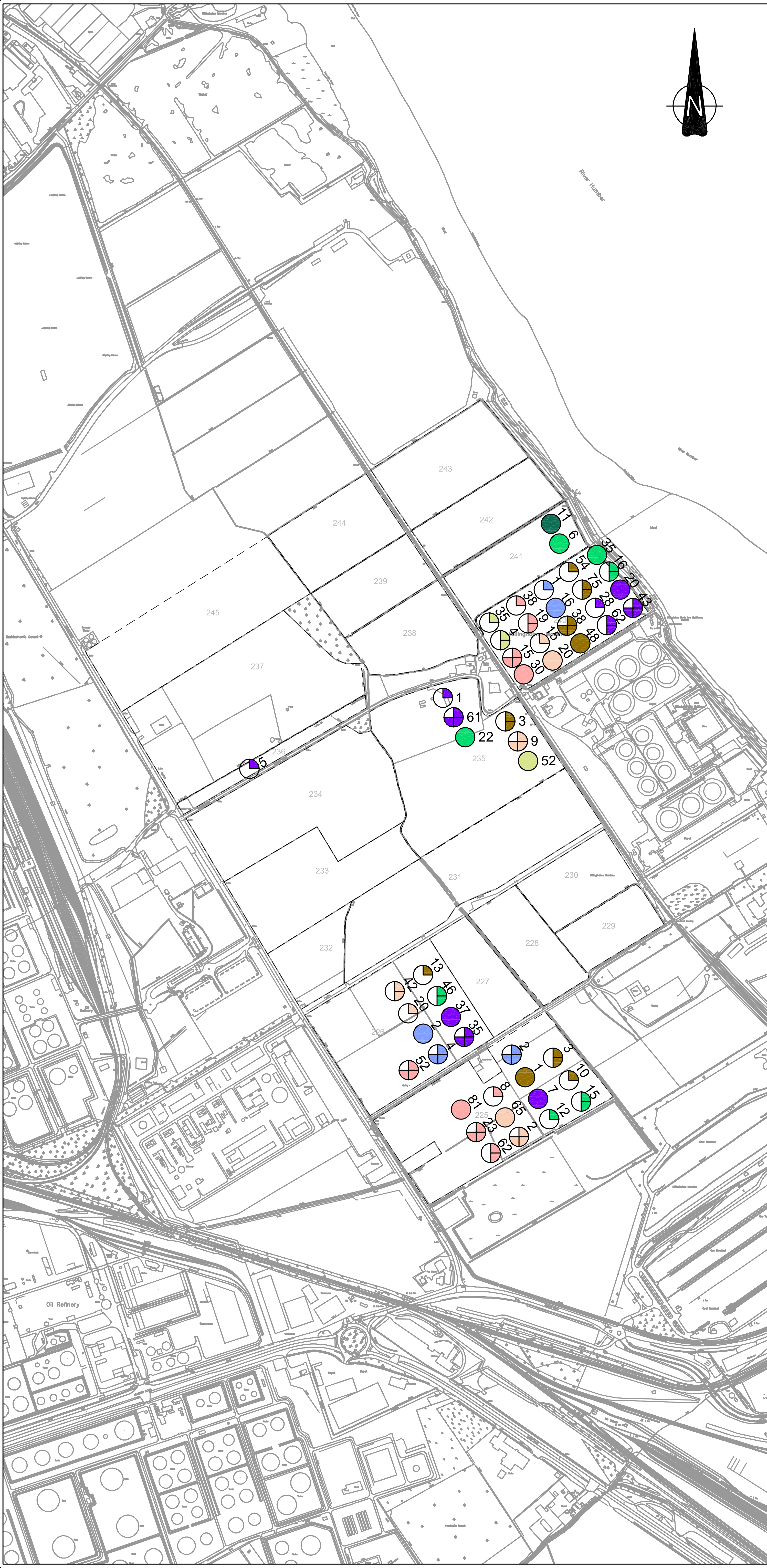
Drawing No. ABLE_NoiseMonitoringLocations.mxd

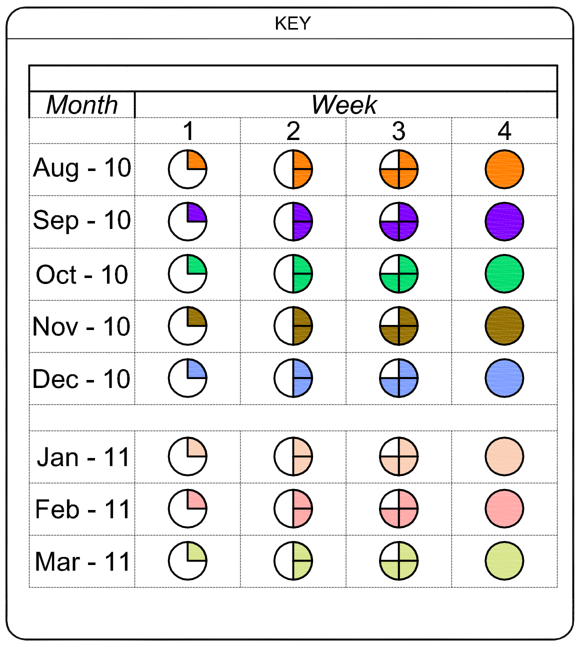
Revision: B

File: 0120872AHP_MarineEnergyPark\GIS_MTC_MK\MAPS\ERM Template Maps\ABLE_NoiseMonitoringLocations.mxd

Annex C

Curlew Usage of Killingholme Fields





Rev	Date	Description	By	Chk	App
A	27/07/11	Preliminary Issue	JH	RC	RC

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Project: ABLE Marine Energy Park

Client: ABLE UK Ltd

Title: G. Catley Bird Data 2010-11 - Curlew

PRELIMINARY

Scale:	Drawn By	Checked By	Approved By
N.T.S@A3	J Harris	R Cram	R Cram
Date:	27/07/2011	27/07/2011	27/07/2011

Drawing No.: AME - 09269

Revision: A

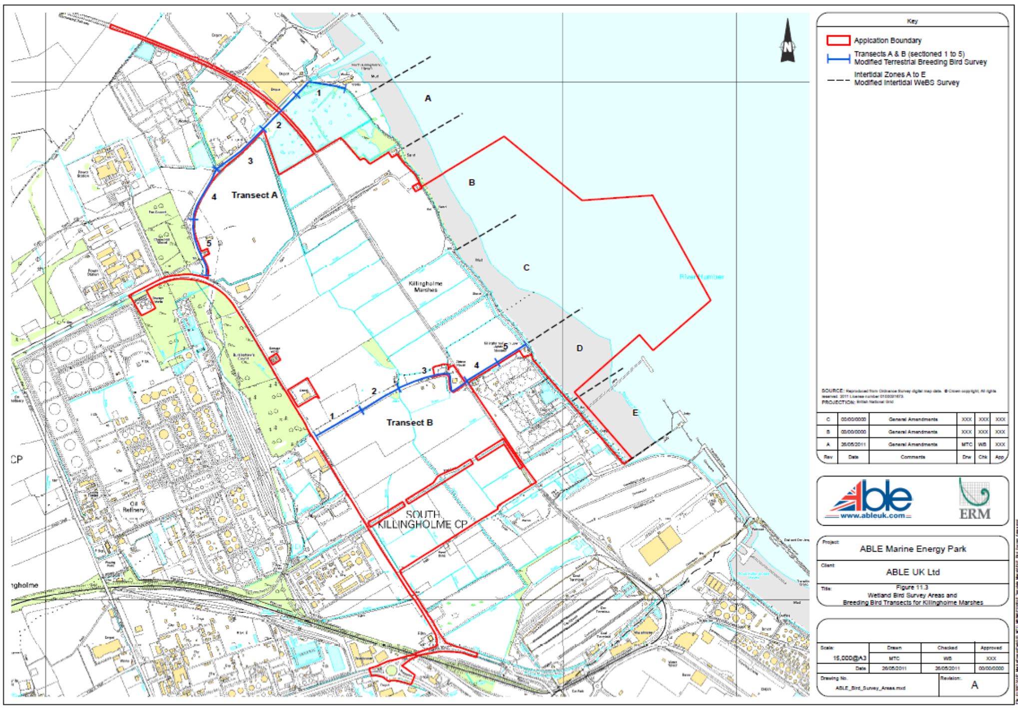
Annex B

Supporting Bird Data

B1.1 *INTRODUCTION*

The following annex presents the distribution of birds at Killingholme Marshes Foreshore. It presents data collected from April 2010 to April 2011 by the Institute of Estuarine and Coastal Studies (IECS) (1). *Figure 1.1* Wetland Bird Survey Areas and Breeding Bird Transects for Killingholme Marshes in 2010/11 illustrates the survey area and count sectors A to E. *Section B1.2* looks at the distribution of birds pre-construction over the year in the count sectors. *Section B1.3* looks in more detail at the number of birds predicted to be subject to any disturbance from construction noise, ie piling during construction of the quay.

Figure 1.1 ***Wetland Bird Survey Areas and Breeding Bird Transects for Killingholme Marshes in 2010/11***



(1) IECS (2011) Institute of Estuarine and Coastal Studies (IECS) *Marine Energy Park: Bird Survey Results- April 2010 to April 2011*. Report for Able UK Ltd.

B1.2 *PRESENCE OF BIRDS, PRE-CONSTRUCTION, PER MONTH BY SECTOR ON KILLINGHOLME MARSHES FORESHORE*

The following figures illustrate the peak number of birds observed over the year (April 2010 – April 2011) in sectors A to E. A red line on each graph illustrates the number of birds that represents one percent of the Humber SPA population.

Figure 1.2 Peak presence of the assemblage per month by sector in Killingholme Marshes Foreshore 2010/11

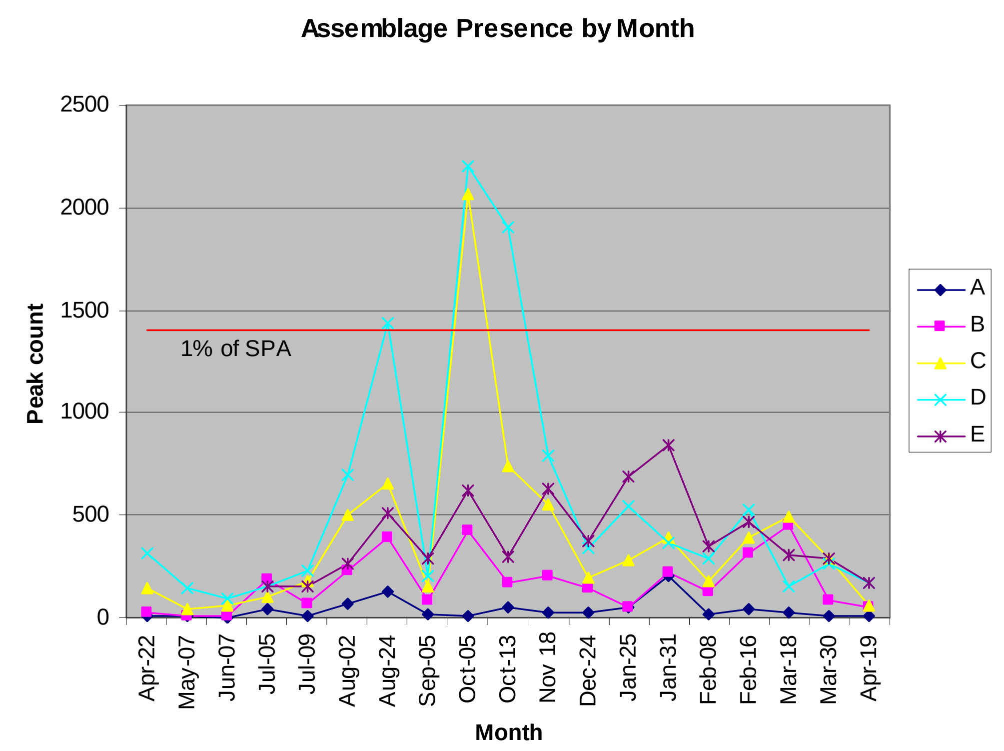


Figure 1.3 Peak count of Ringed Plover per month by sector at Killingholme Marshes Foreshore 2010/11

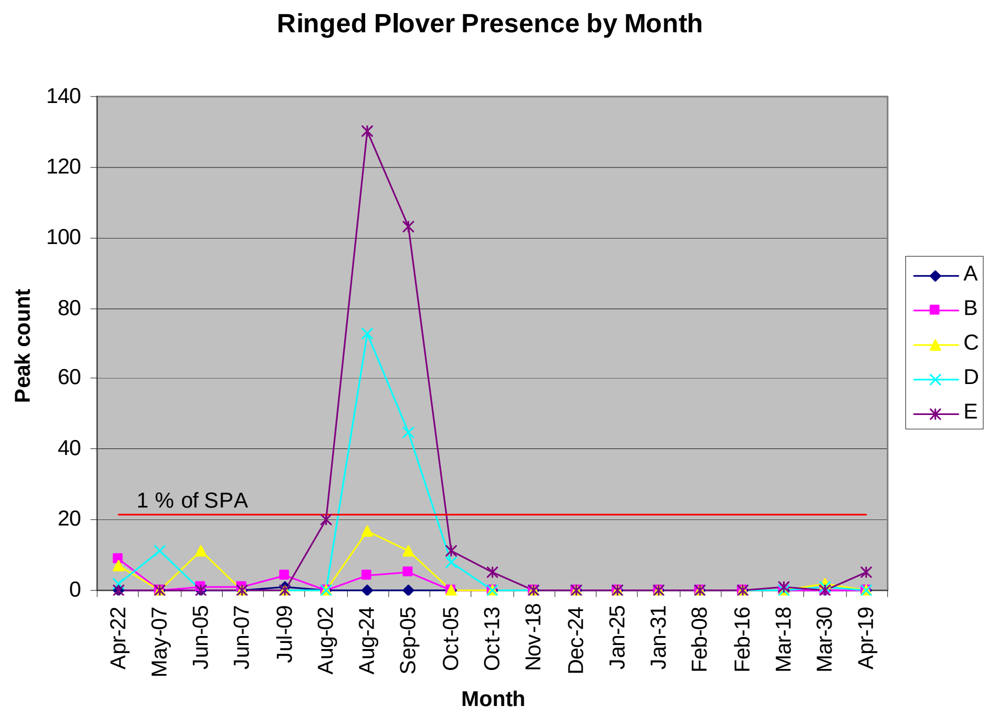


Figure 1.4 *Peak count of Redshank per sector by month at Killingholme Marshes Foreshore 2010/11*

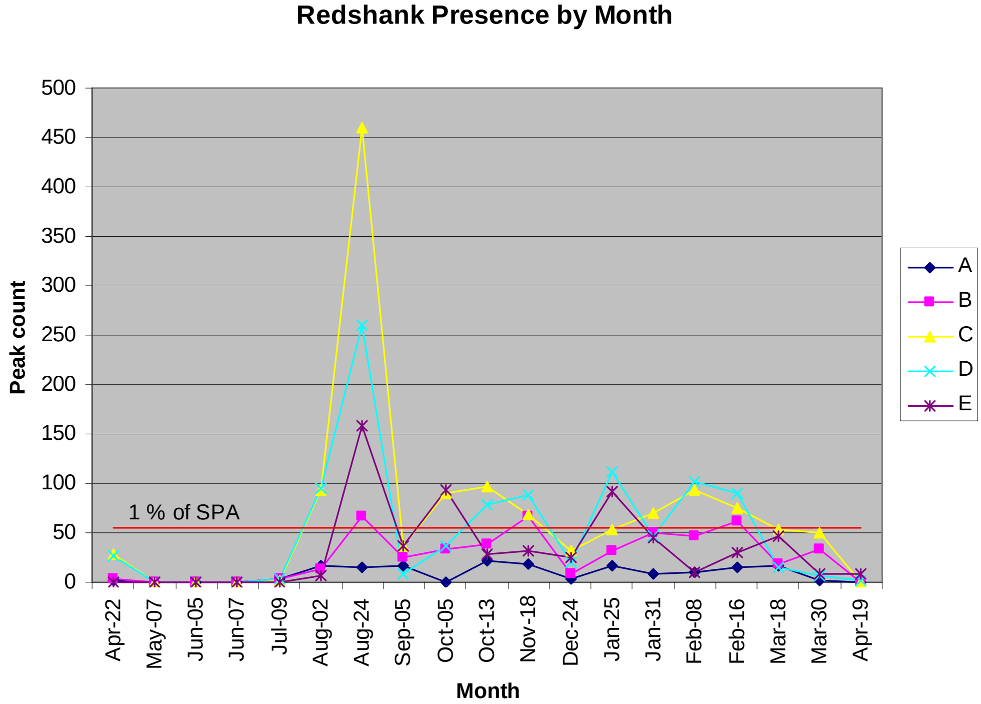


Figure 1.5 Peak count of Curlew per month by sector at Killingholme Marshes Foreshore 2010/11

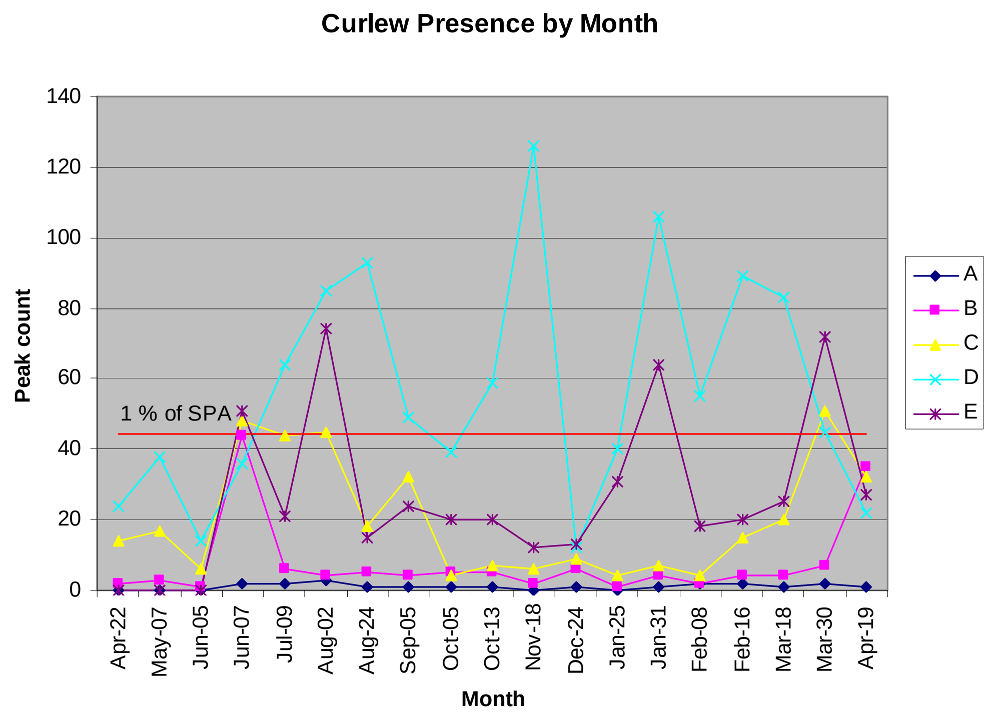


Figure 1.6 Peak count of Bar-tailed godwit per month by sector at Killingholme Marshes Foreshore 2010/11

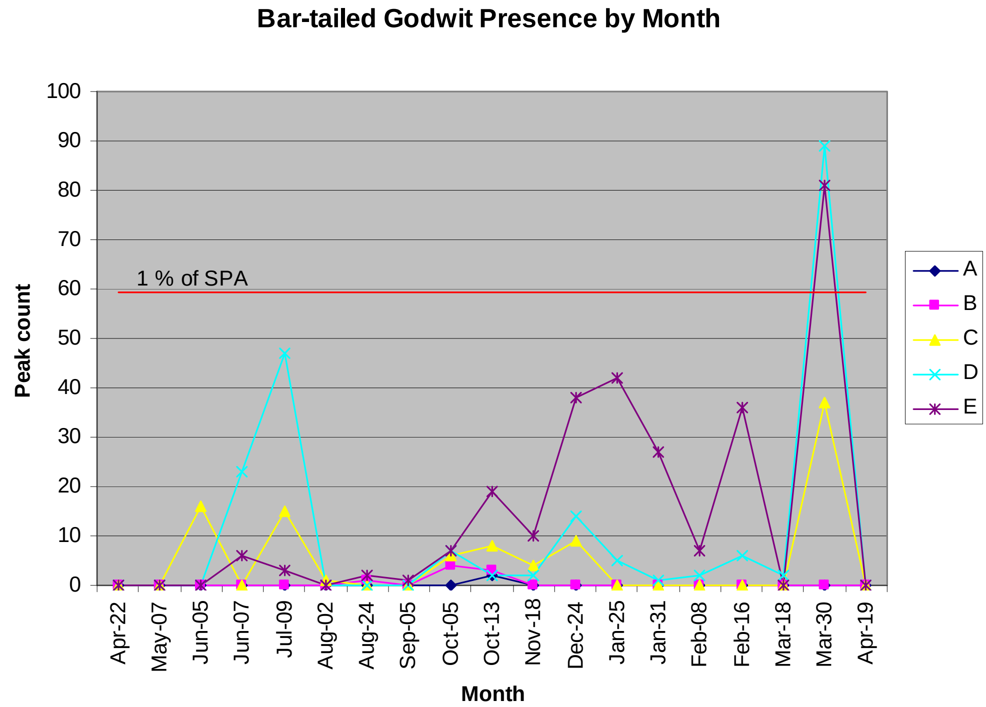


Figure 1.7 *Peak count of Black-tailed godwit per month by sector at Killingholme Marshes Foreshore 22010/11*

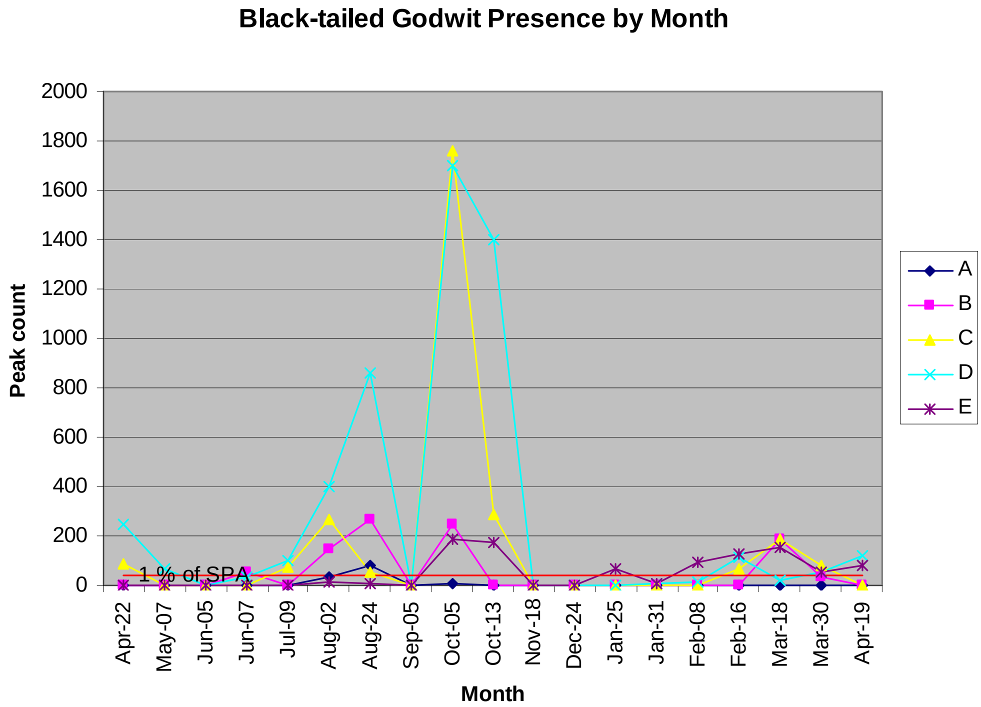


Figure 1.8 *Peak count of Dunlin per month by sector at Killingholme Marshes Foreshore 22010/11*

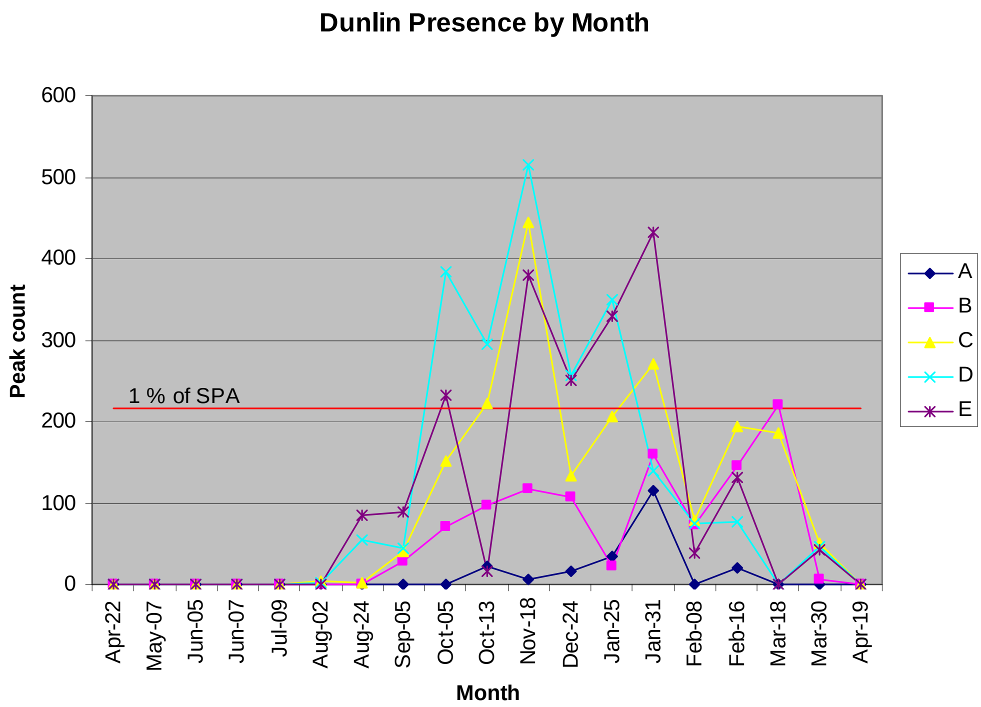


Figure 1.9 Peak count of Lapwing per month by sector at at Killingholme Marshes Foreshore 22010/11

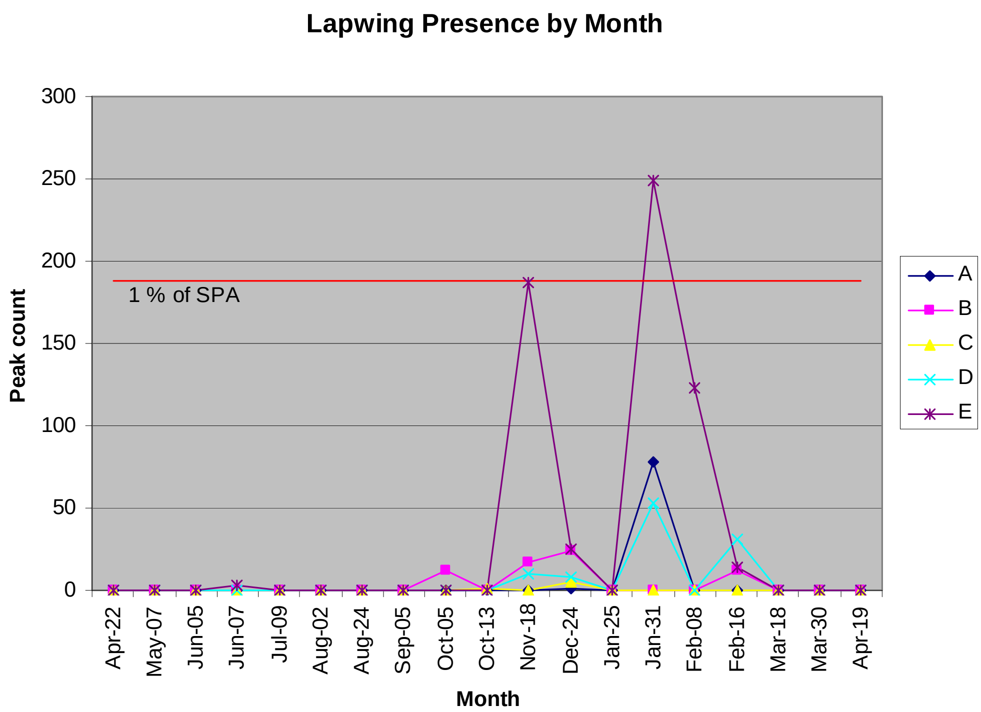
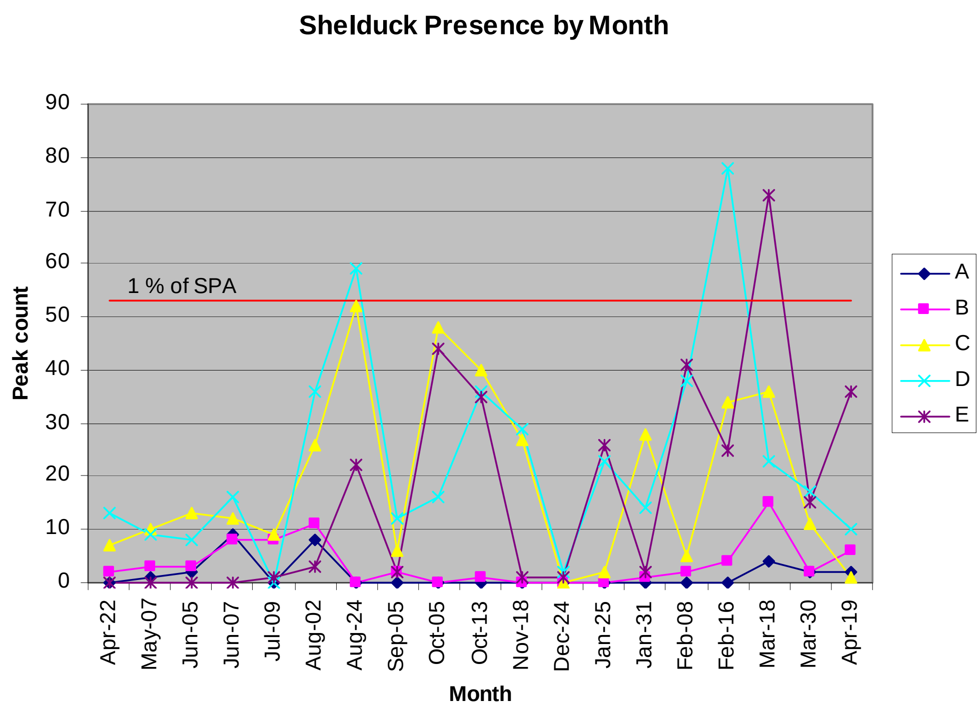


Figure 1.10 Peak presence of Shelduck per month by sector at Killingholme Marshes Foreshore 2010/11



B1.3 *PREDICTED NUMBERS LIKELY TO BE AFFECTED BY PILING NOISE IN SECTORS A AND E*

This section details the species that are predicted to be present in Sectors A and E during construction of the quay (see *Figure 1.1* for location of Sector A and E).

Table 1.1 shows the peak number of birds observed throughout the year in Sector E and acts as a point of reference for *Table 1.2*which details the number of birds predicted to remain in Sector E during construction.

Part of Sector E lies within the footprint of the proposed quay. While all species will be displaced within the construction zone of 33 ha, approximately 11 ha of intertidal mudflat (in Sector E) will in fact remain outside the development area and so it is probable that not all birds will be displaced from this area even though they will be subject to noise, visual and light emissions above baseline levels caused by the construction activities. Given the effects are from construction, and taking a precautionary approach based on curlew as the species most likely to be disturbed at greater distances [(1)], it is likely that some species (eg curlew) could be affected within an area approaching two thirds of Sector E (ie approximately 7 ha of the 11 ha). Using these parameters *Table* 1.1 Estimated Species Abundance in Count Sector E per Month with predicted sensitivity level details one third of the peak number of birds observed in Sector E throughout the year. The table also reflects the sensitivity of species to construction noise according to Cutts *et al* (2008 b) [(1)].

There are six species predicted to be present in numbers ≥1% of the Humber population; ringed plover, common gull, great-black backed gull, herring gull, lesser black-backed gull and SPA qualifying interest species black-tailed godwit. Of these species ringed plover and black-tailed godwit are highly sensitive to construction noise. Redshank are also predicted to be present on the mudflat (however not in numbers ≥1% of the Humber population) and utilise the resource almost entirely as a feeding resource, this species is also highly sensitive to construction noise (see *Table 1.2*).

Black-tailed godwit are predicted to be present in important numbers in October and March and predominantly use Sector E for foraging,

(1) Cutts N, Phelps A & Burdon D (2008) Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance. Report for HINCA. IECS

however the site also appears to be utilised by the species when they are not foraging, for example roosting or loafing. This species is highly sensitive to construction noise. Ringed plover are present on the site in important numbers in August and September during the autumn passage and principally use the site as a foraging resource.

No habitat will be lost at sector A as a result of the quay construction.

Table 1.2 Estimated Species Abundance in Count Sector A per Month with predicted sensitivity level presents the peak number of birds present per month in Sector A. Black-tailed godwit are the only species present in Sector A in numbers ≥1% of the Humber population.

Table 1.1 Estimated Species Abundance in Count Sector E per Month with predicted sensitivity level

Species	Jul (1)	Jul (2)	Aug (1)	Aug (2)	Sep	Oct (1)	Oct (2)	Nov	Dec	Jan (1)	Jan (2)	Feb (1)	Feb (2)	Mar (1)	Mar (2)	Apr	1% of Humber
Black-headed gull	24 4 F 20 R	34 34 R	38 23 F 15 R	27 27 R	3 3 R	7 4 F 3 R	1 1 R	1 1 R	3 3 F	8 7 F	1 1 R	3 2 F 1 R	12 12 F			3 3 F	79
Bar-tailed Godwit	2 1 F 1 R	1 I R		1 1 F		2 2 F	6 6F	3 1 F 2 R	13 13 F	14 9 F 5 R	9 9 F	2 2 F	12 12 F		27 26 F 1 R		59
Black-tailed Godwit*			4 2 F 1 R	2 2 F		63* 58 F* 5 R	57* 39 F* 18 R			22 22 R	3 3 R	32 1 F 31 R	42 13 F 29 R	51* 50 F* 1 R	18 16 F 2 R	27 27 F	39
Common gull*	3 3 R	4 4 R	6 6 R	2 2 R	1 1 R				1 1 R	24* 17 F 7 R	3 3 R	1 1 R	14 14 R		1 1 R		20
Curlew	17 14 F 3 R	7 3 F 4 R	25 1 F 23 R	5 3 F 2 R	8 3 F 5 R	6 1 F 5 R	7 3 F 4 R	4 1 F 3 R	4 4 F	5 2 F 3 R	21 2 F 19 R	6 6 R	7 4 F 3 R	8 3 F 5 R	24 20 F 4 R	9 9 F	44
Dunlin				28 27 F 1 R	30 30 F	77 14 F 63 R	6 5 F 1 R	126 53 F 73 R	83 83 F	110 105 F 5 R	144 140 F 4 R	13 13 F	44 38 F 6 R	61 61 F	14 14 F		215
Great black-backed gull*		1 1 R	4* 4 R*	2 2 R	4* 4 R*				2* 2 R*		1 1 R		1 1 R	1 1 R			2
Grey plover									1 1 F								29
Herring gull*	2* 2 F*	2* 2 R*			1* 1 R*					1* 1 F*			1* 1 R*	1* UNK			1
Lesser black-backed gull*			1* 1 R*														<1
Lapwing	1 1 R							62 23 F 39 R	8 7 F 1 R		83 83 R	41 41 R	5 5 R				188
Mallard												1 1 R		1 1 R			21
Oystercatcher	2 1 F	3 1 F	1 1 R										1 0.5 F	1 1 R	2 2 R	1 1 R	35

Species	Jul (1)	Jul (2)	Aug (1)	Aug (2)	Sep	Oct (1)	Oct (2)	Nov	Dec	Jan (1)	Jan (2)	Feb (1)	Feb (2)	Mar (1)	Mar (2)	Apr	1% of Humber
	1 R	2 R											0.5 R				
Pintail																1 1 F	2
Redshank			2 2 F	53 53 F	12 12 F	31 28 F 3 R	9 9 F	11 11 F	8 8 F	14 14 F	15 15 F	10 4 F 6 R	10 10 F	16 6 F 10 R	3 1 F 2 R	3 3 F	54
Ringed plover*			7 7 F	**43*** **38 F*** 5 R	**34*** **31 F*** 3 R	3 1 F 2 R	2 1 F 1 R									2 2 F	22
Shelduck			1 1 R	7 7 R	1 0.5 F 0.5 R	15 2 F 13 R	12 3 F 9 R			9 9 R	1 1 R	14 13 F 1 R	8 3 F 5 R	24 24 R	5 2.5 F 2.5 R	12 8 F 4 R	53
Teal									1 1 F								29
Turnstone					1 1 F	1 1 R											6
Assemblage	51	52	84	170	90	205	100	207	122	182	281	123	156	163	94	58	1126

Source: Annex 11.3; IECS *Spring Passage & Breeding Bird Survey April to August 2010 and subsequent data provided in excel format*.

Counts represent one third of the original count in order to represent the potential number of birds left on available habitat at sector E.
Species counts that reach ≥1% of the Humber population are highlighted in bold in the table.
F – Feeding
R- Roosting/other activity, eg loafing
UNK – Unknown proportion of count feeding or roosting/other activity
Counts are to the nearest bird, therefore species that were present in <0.5 are not included.
Where counts of birds feeding or roosting do not add up to the total count in sector E, the total count is rounded down, for example;

Total count, 5.67	5
Feeding count, 1.33	1F
Roosting count, 5.33	5 R

Shading relates to species sensitivities as described in Cutts *et al.* (2008). Where a species or count is not shaded, species or time of year was not described in Cutts *et al.* (2008). Shading on species name represents the highest level of sensitivity assigned to that species;

	Species highly sensitive to disturbance from construction
	Species moderately sensitive to disturbance from construction
	Species moderate to low sensitivity to disturbance from construction

Table 1.2 ***Estimated Species Abundance in Count Sector A per Month with predicted sensitivity level***

Species	Jul (1)	Jul (2)	Aug (1)	Aug (2)	Sep	Oct (1)	Oct (2)	Nov	Dec	Jan (1)	Jan (2)	Feb (1)	Feb (2)	Mar (1)	Mar (2)	Apr	1% of Humber
Black-headed gull	31 15 F 16 R	5 3 F 2 R	12 11 F 1 R	16 16 F	2 2 R		2 2F				1 1 R		3 3 F	2 2F			79
Bar-tailed godwit							2 2F										59
Black-tailed godwit*			32 32 F	82* 80 F* 2 R		6 6 F								1 1 F			39
Common gull											2 2 R	1 1 R	3 3 R	3 3 R			20
Common sandpiper				1 1 R													<1
Coot									2 2 R								12
Curlew	2 1 F 1 R	2 1 F 1 R	3 2 F 1 R	1 1 R	1 1 R	1 1 R	1 1F		1 1 R	1 1 F	1 1 F	2 2 F	2 2 R	1 1 F	2 1 F 1 R	1 1 R	44
Dunlin							23 23 R	6 6 F	17 17 F	35 26 F 9 R	115 115 F		20 20 F				215
Great black-backed gull				4 4 R													2
Grey plover									1 1 F								29
Herring gull				1 1 R													1
Knot				1 1 F													418
Lapwing									1 1 R		78 78 R	1 1 F					188
Mallard								1 1 R	1 1 R								21

Species	Jul (1)	Jul (2)	Aug (1)	Aug (2)	Sep	Oct (1)	Oct (2)	Nov	Dec	Jan (1)	Jan (2)	Feb (1)	Feb (2)	Mar (1)	Mar (2)	Apr	1% of Humber
Oystercatcher								1 1 F							1 1 R	2 2 R	35
Redshank		3 2 F 1 R	17 17 F	15 15 F	16 16 F		22 7 F 15 R	19 19 F	3 3 F	17 3 F 14 R	8 7 F 1 R	10 10 F	13 7 F 6 R	16 16 F	2 2 F		54
Ringed plover		1 1 F															22
Shelduck	9 8 F 1 R		8 8 F											4 4 F	2 2 F	2 2 F	53
Teal									2 2 R								29
Turnstone				3 3 F			4 4 F										6
Assemblage	42	11	72	124	19	7	54	27	28	53	205	14	41	27	7	5	1126

Source: Annex 11.3; IECS *Spring Passage & Breeding Bird Survey April to August 2010 and subsequent data provided in excel format.*

* Indicates species that for some months of the year are present in numbers ≥1% of the Humber population (specific counts are highlighted in bold in the table)
F – Feeding
R- Roosting/other activity, eg loafing

Shading relates to species sensitivities as described in Cutts *et al.* (2008). Where a species or count is not shaded, species or time of year was not described in Cutts *et al.* (2008). Shading on species name represents the highest level of sensitivity assigned to that species;

	Species highly sensitive to disturbance from construction
	Species moderately sensitive to disturbance from construction
	Species moderate to low sensitivity to disturbance from construction

B1.4 *PREDICTED USE OF KILLINGHOLME MARSHES FORESHORE THROUGH THE TIDE AT SECTOR E DURING CONSTRUCTION*

Figure 1.11 Predicted number of Black-headed gull through the tide at sector E

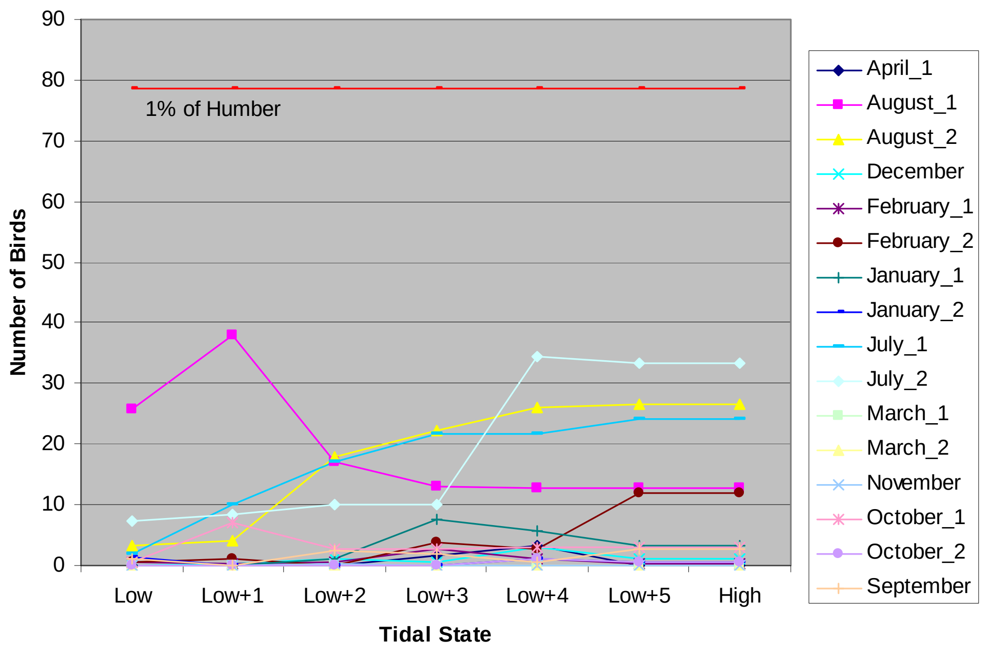


Figure 1.12 Predicted number of Bar-tailed godwit through the tide at sector E

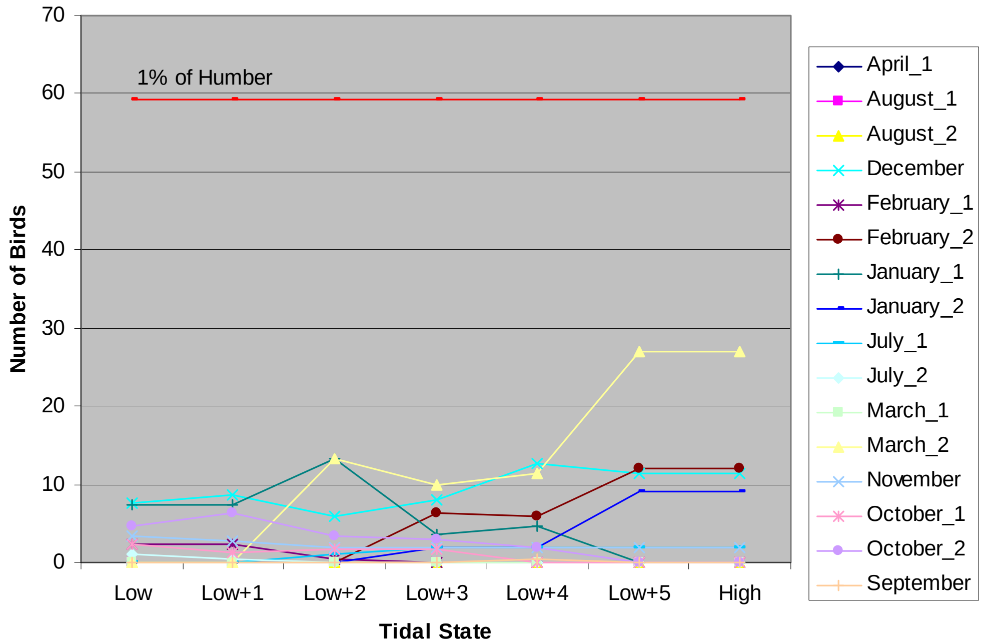


Figure 1.13 Predicted number of Black-tailed godwit through the tide at sector E

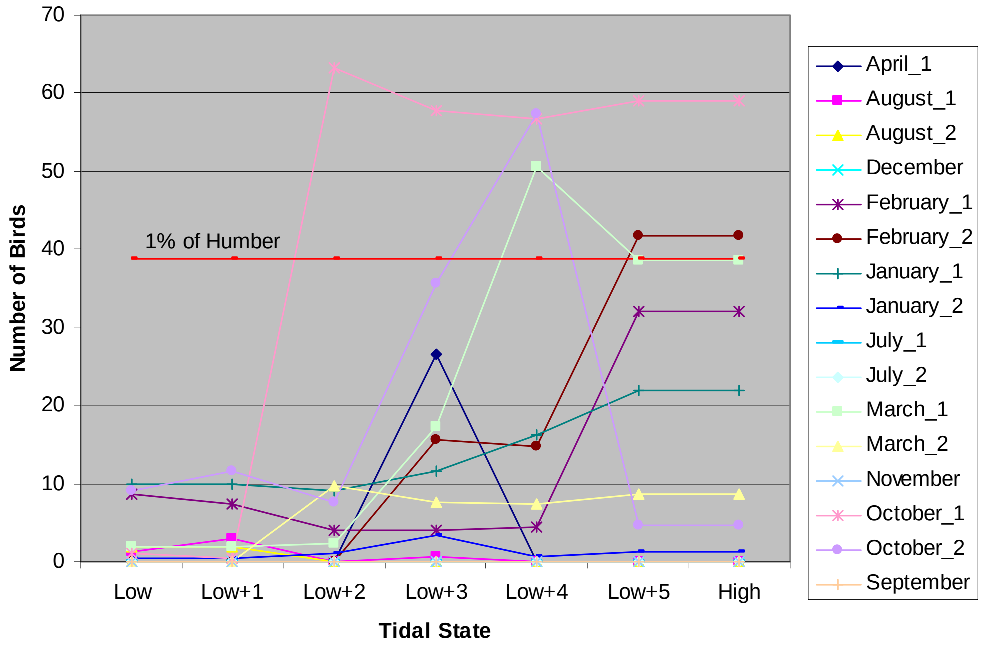


Figure 1.14 Predicted number of Common gull through the tide at sector E

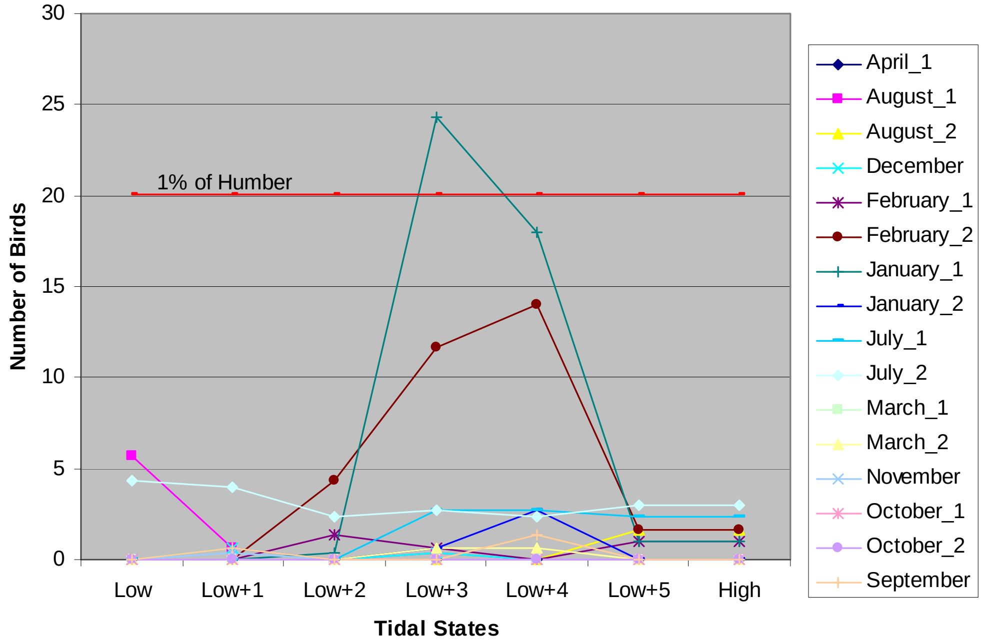


Figure 1.15 Predicted number of Curlew through the tide at sector E

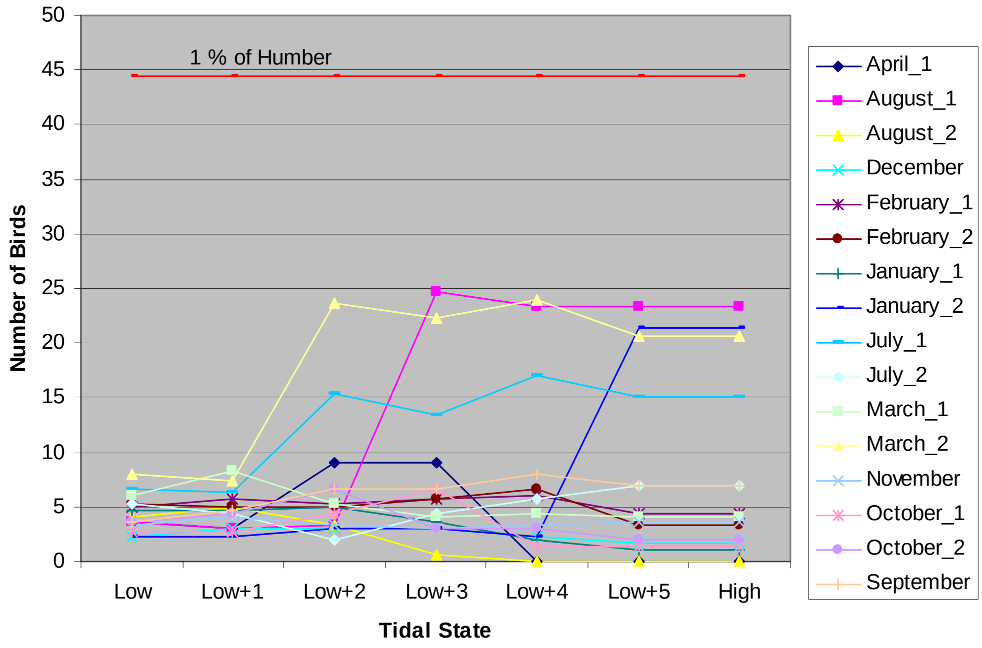


Figure 1.16 Predicted number of Dunlin through the tide at sector E

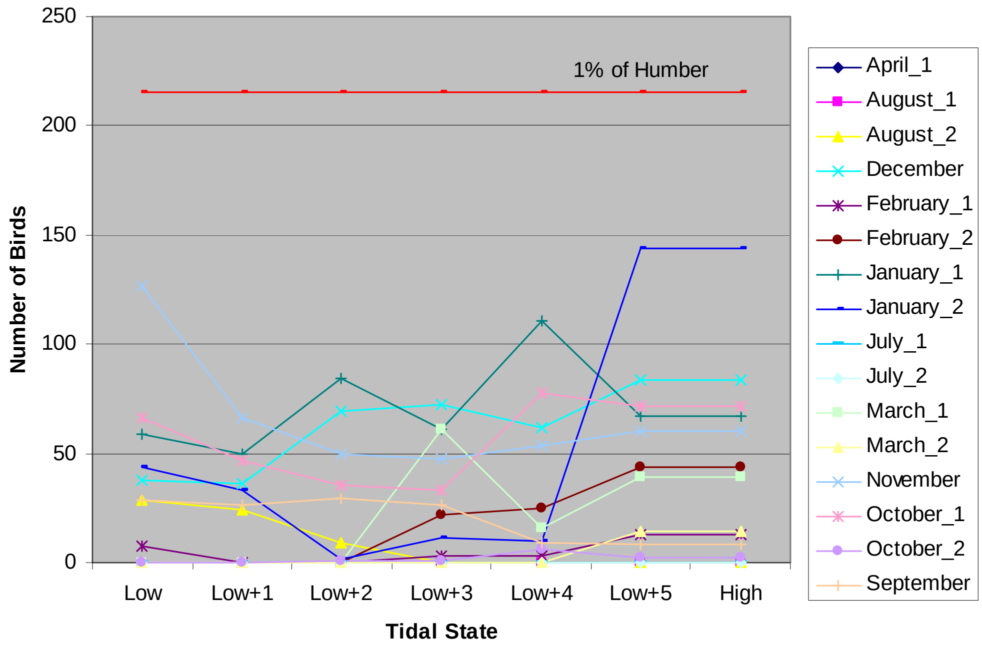


Figure 1.17 Predicted number of Great black-backed gull through the tide at sector E

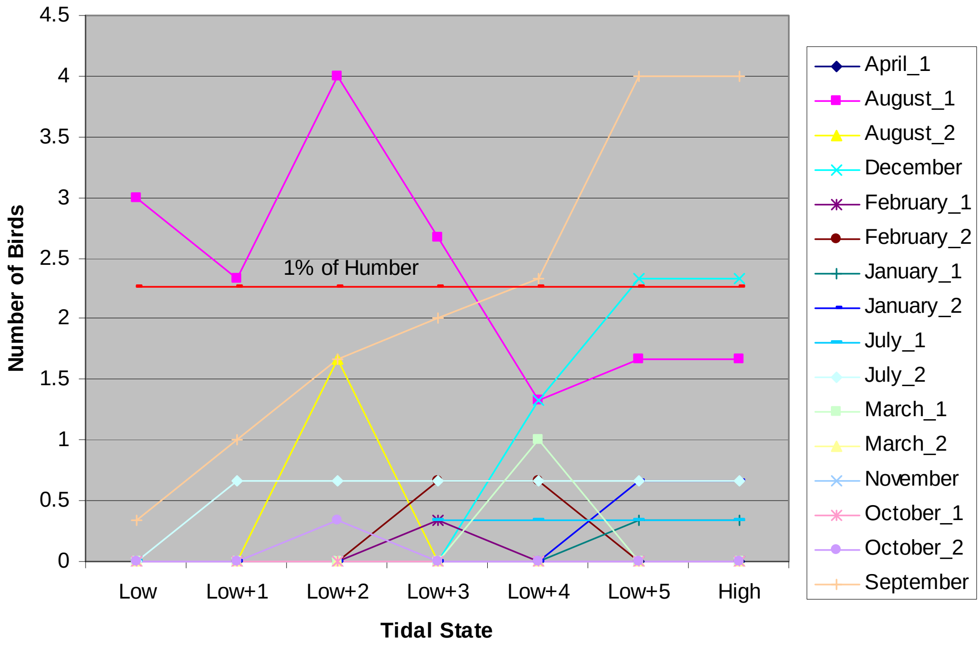


Figure 1.18 Predicted number of Grey plover through the tide at sector E

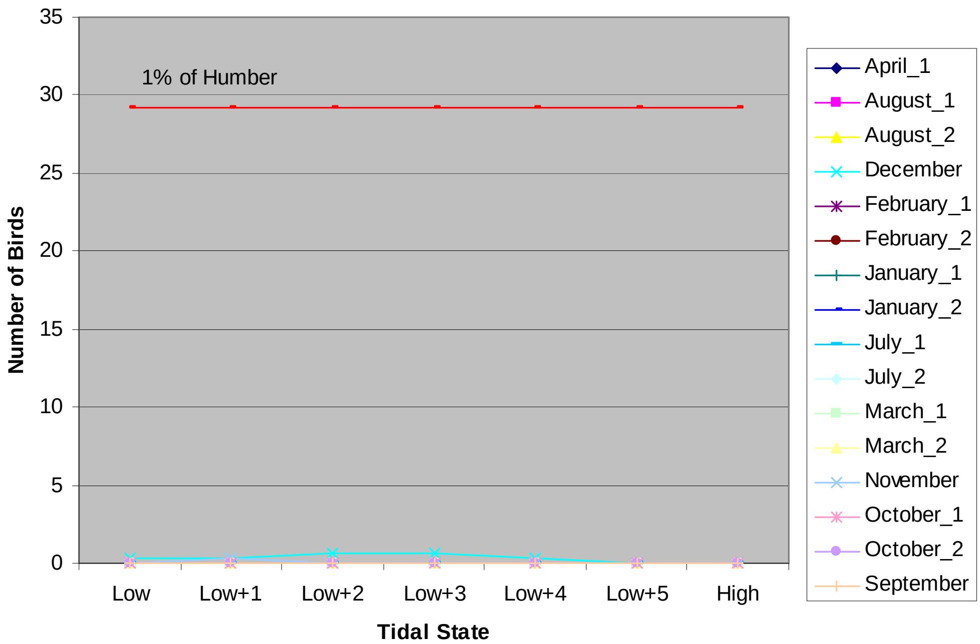


Figure 1.19 Predicted number of Herring gull through the tide at sector E

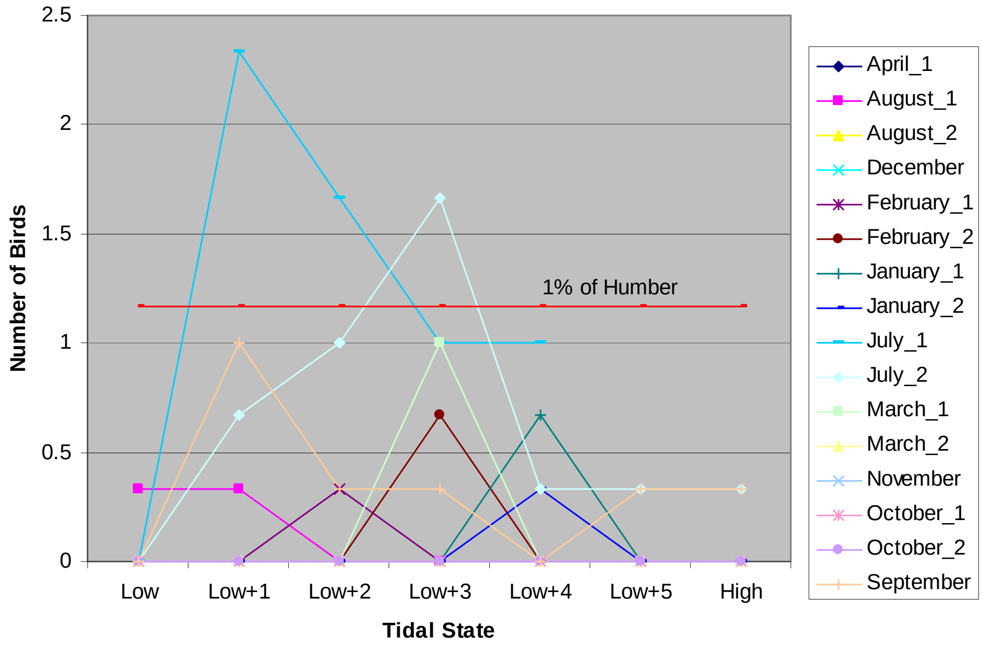


Figure 1.20 Predicted number of Lesser black-backed gull through the tide at sector E

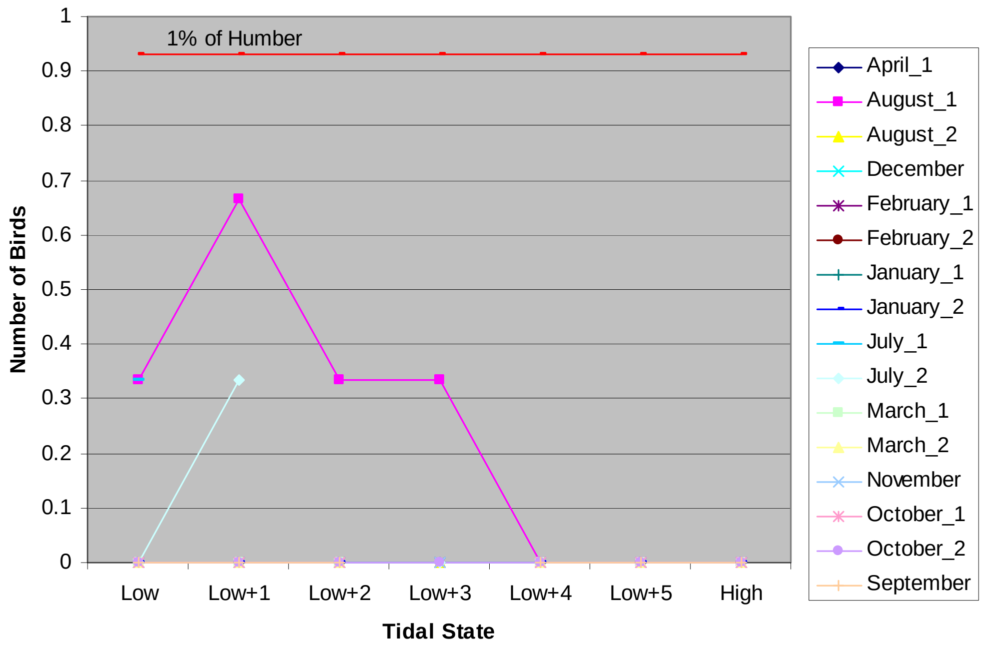


Figure 1.21 Predicted number of Lapwing through the tide at sector E

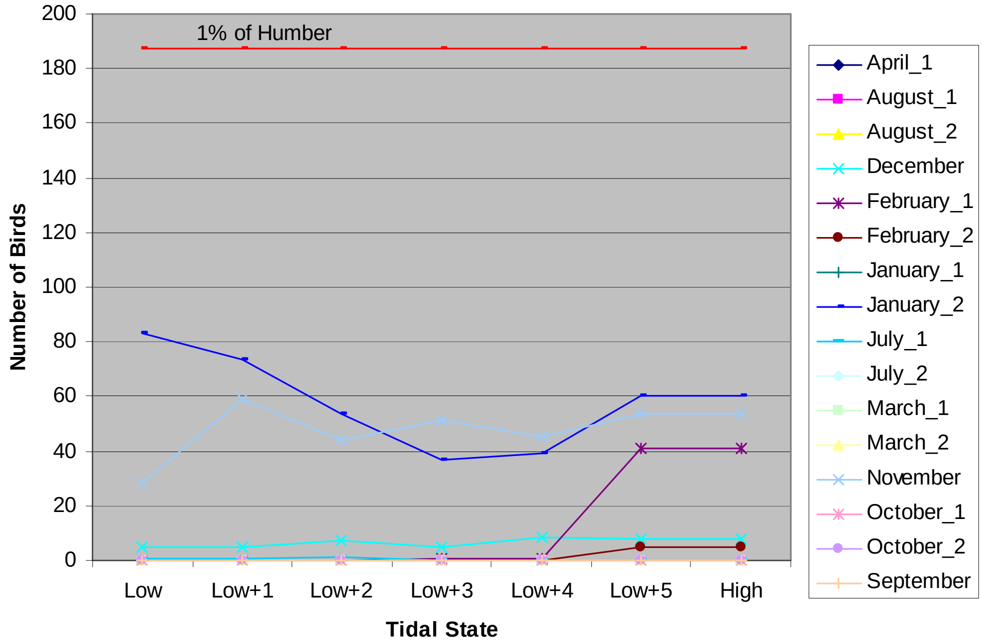


Figure 1.22 Predicted number of Mallard through the tide at sector E

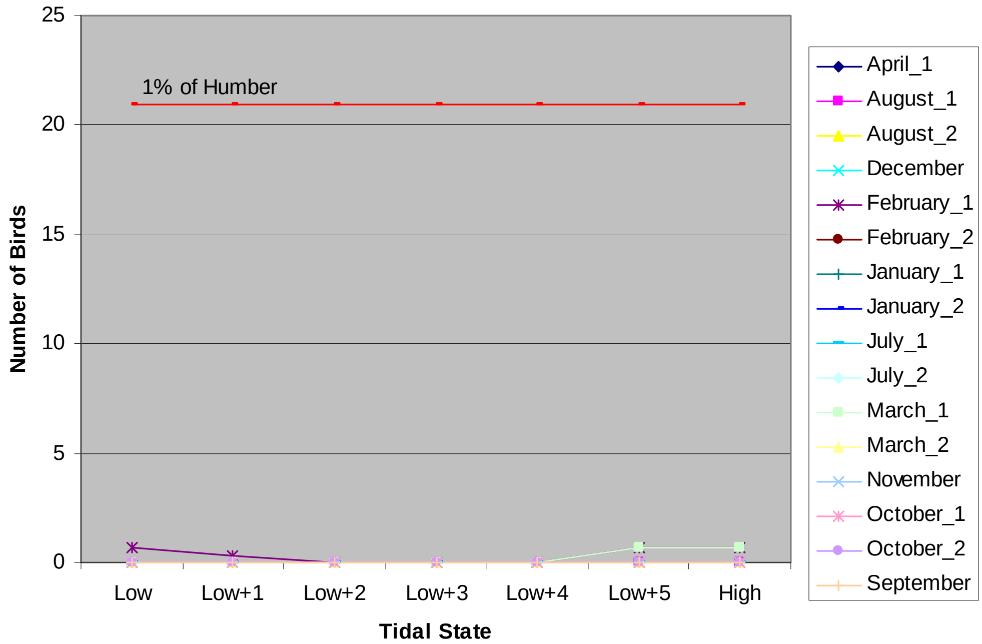


Figure 1.23 Predicted number of Oystercatcher through the tide at sector E

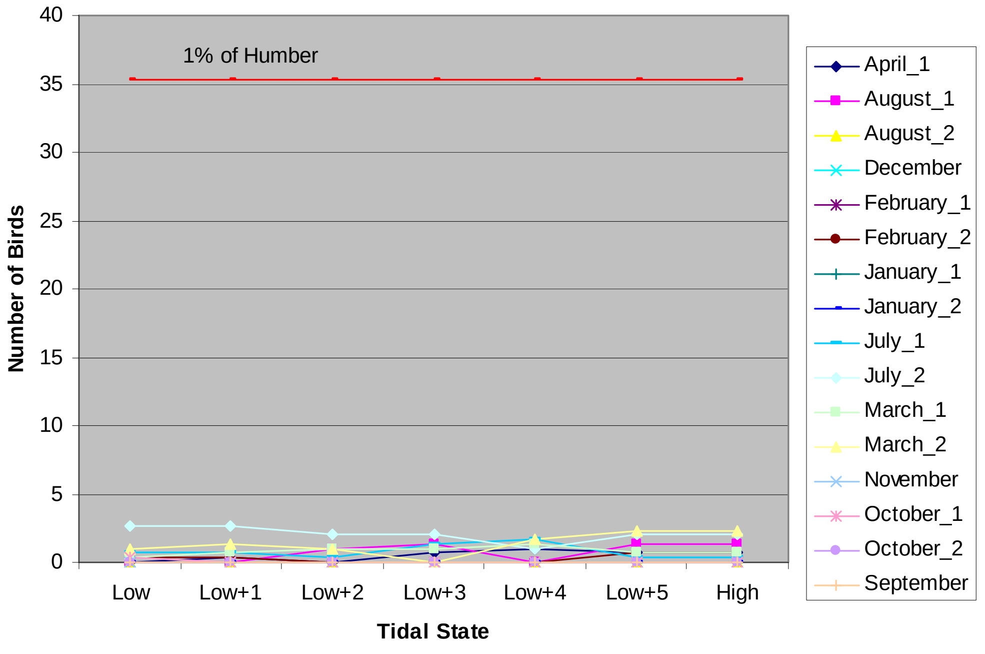


Figure 1.24 Predicted number of Pintail through the tide at sector E

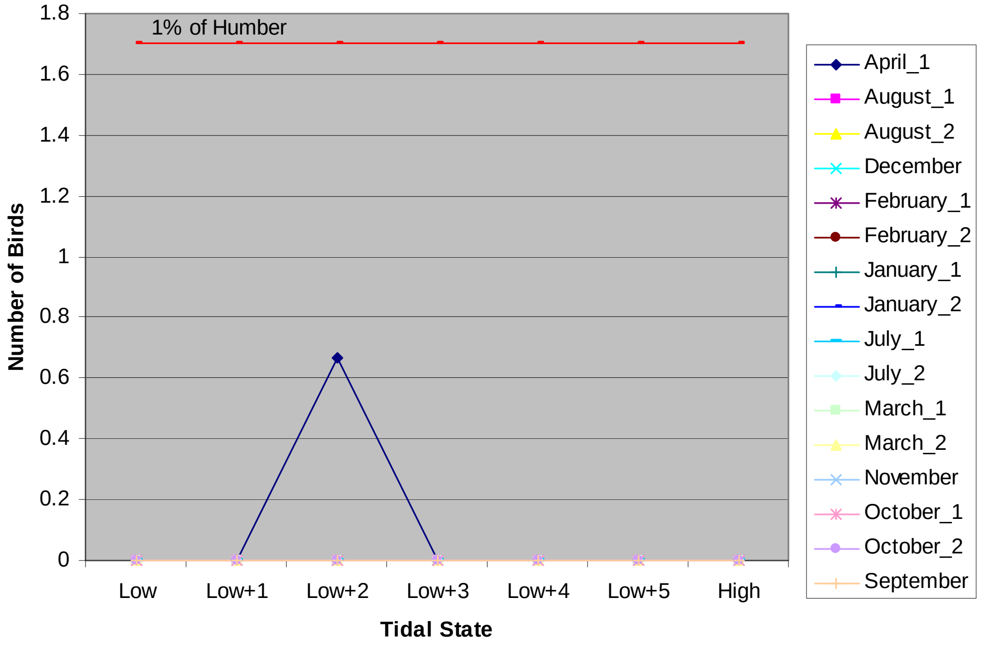


Figure 1.25 Predicted number of Redshank through the tide at sector E

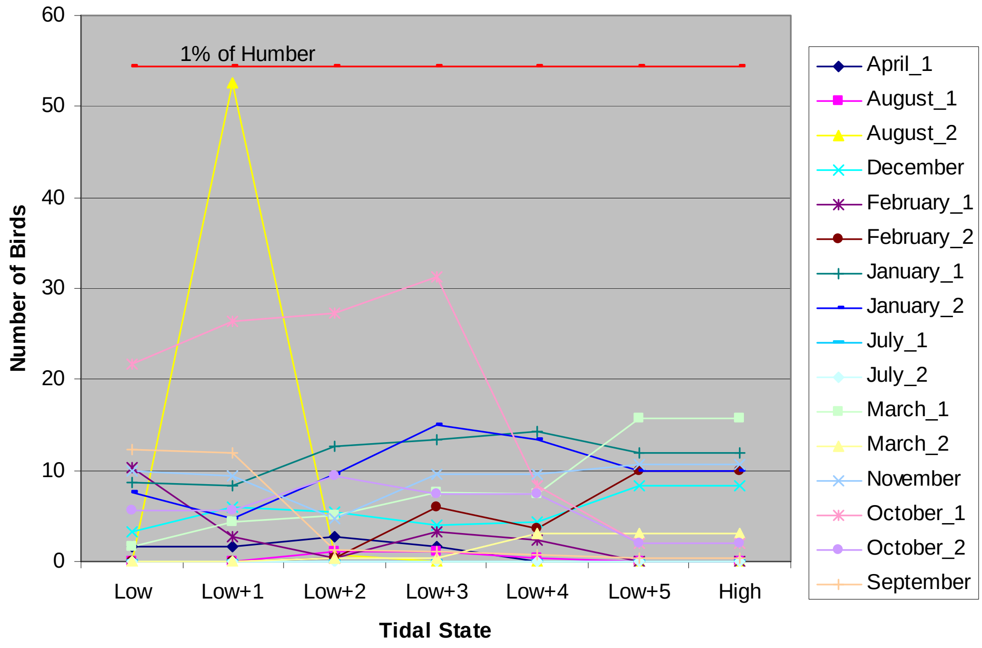


Figure 1.26 Predicted number of Ringed plover through the tide at sector E

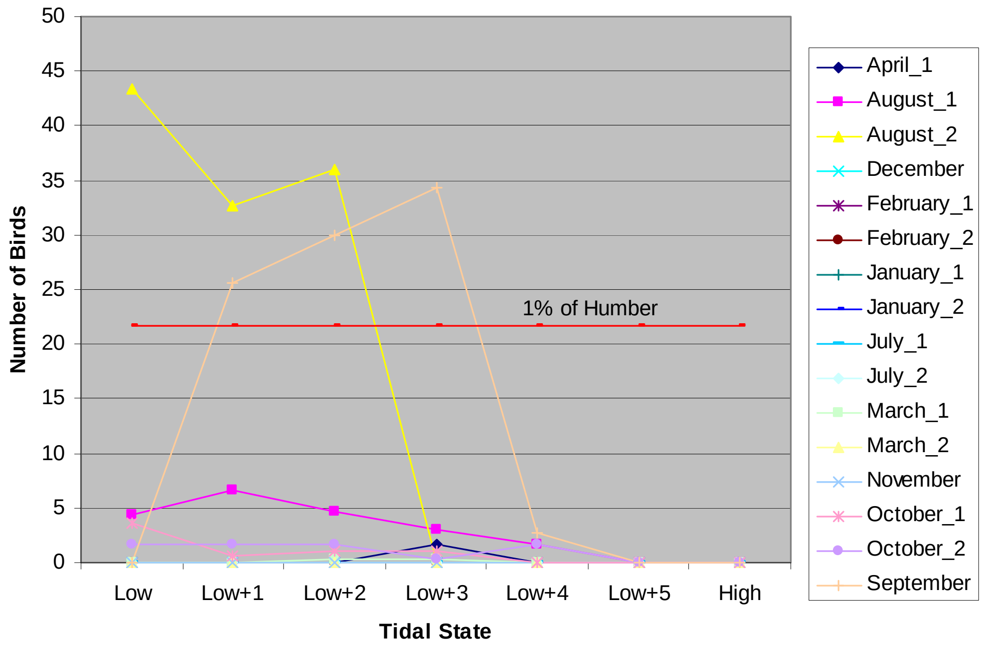


Figure 1.27 Predicted number of Shelduck through the tide at sector E

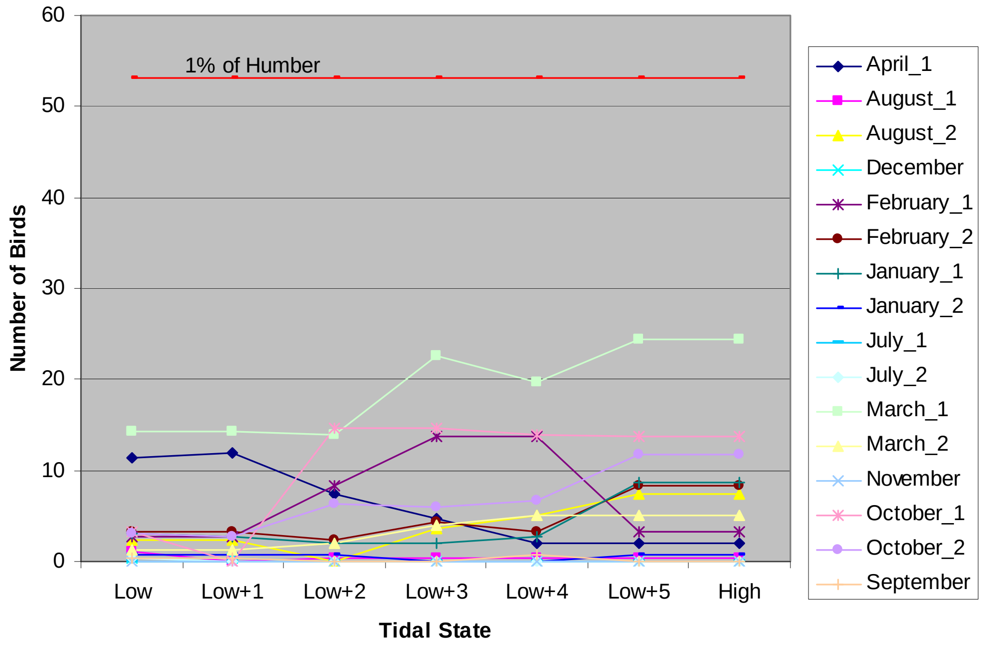


Figure 1.28 Predicted number of Teal through the tide at sector E

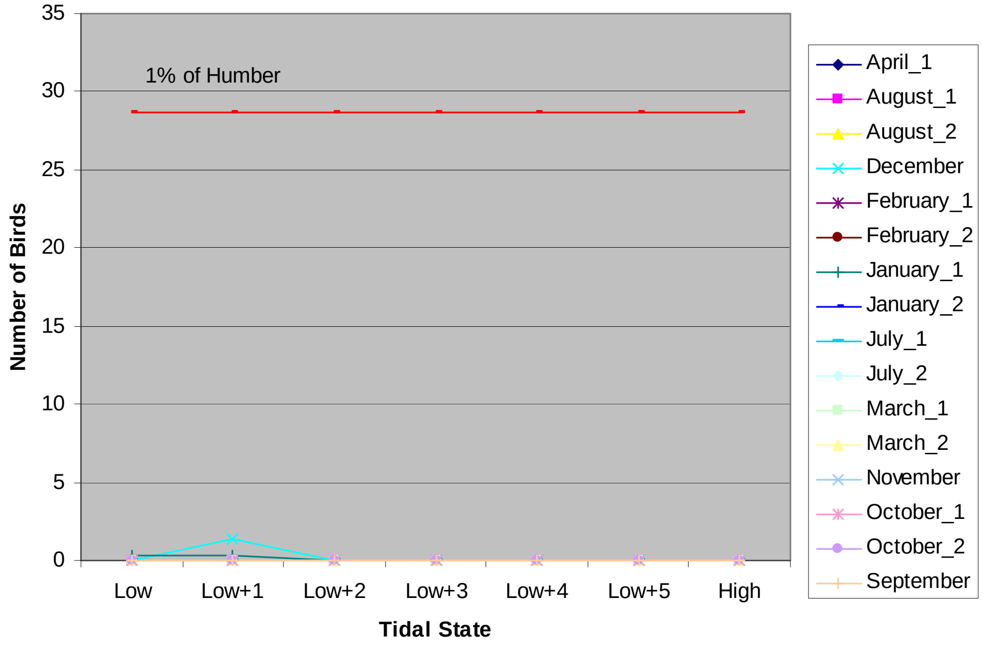
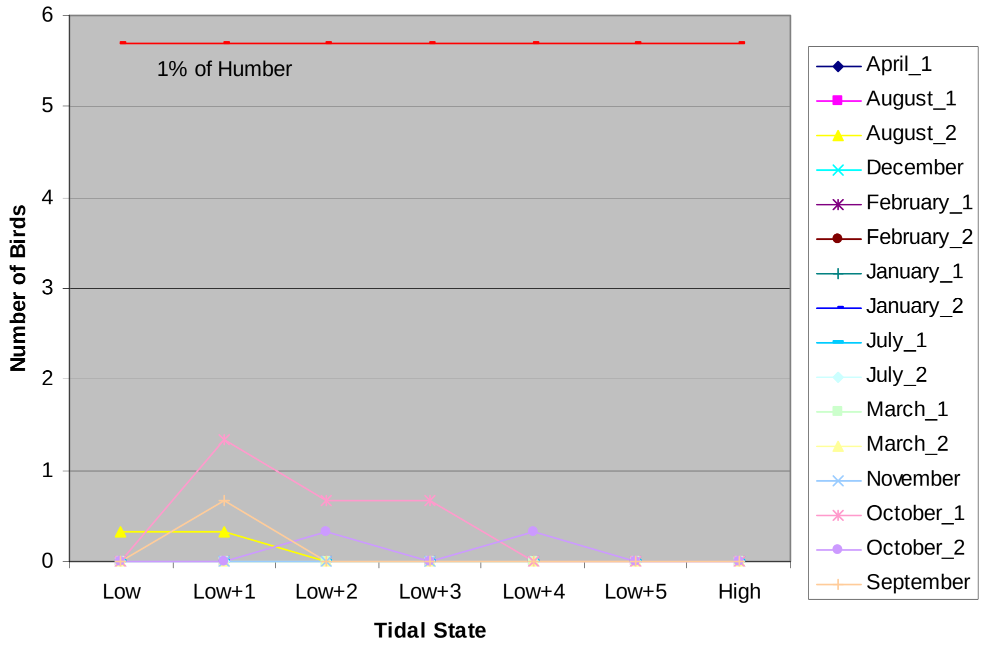


Figure 1.29 Predicted number of Turnstone through the tide at sector E



B1.5 *PREDICTED NUMBERS LIKELY TO BE AFFECTED BY PILING NOISE IN KILLINGHOLME PITS*

Table 1.3 *Species Abundance in Killingholme Pits per Month with predicted sensitivity level*

Species	Apr	May	Jun	Jul	Jul (2)	Aug	Aug (2)	Sep	Oct	Oct (2)	Nov	Dec	Jan	Jan (1)	Feb	Feb (2)	Mar	Mar (2)	Apr	1% of Humber
Mute swan					1					1			1							3
Greylag goose																		2	5	8
Shelduck		9			5								5			2	8	3	5	53
Teal								4	46	15	23		18	19	29	26	12	16	3	2+9
Mallard*	7	1	2	2	3				**34***	12	22		16	4	7	17	4	1	1	21
Shoveler*										61*								**4***		1
Tufted duck					1															4
Smew*													**1***							<1
Cormorant						1														2
Little egret*			**1***	**1***																<1
Water rail*			**2***		**1***		**1***													<1
Moorhen*	**2***		**1***	**4***			**1***							**1***	**1***			**2***	**4***	1
Coot		2			1								1			2		2	1	12
Grey heron*		**1***	**1***	**1***	**3***	**1***		**1***	**3***	**2***	**2***				**1***			**1***		<1
Oystercatcher	2			2		2	1										4		2	35
Avocet*	3					2	4										**16***			5
Little ringed plover*	**2***				**1***															<1
Golden plover							1													469
Lapwing									4	5										188
Knot					1	3	12													418
Dunlin*	1					6			25	**270***				1						215
Snipe*	**1***									**6***									**1***	1
Black-tailed godwit*	**500***	**64***		**270***	**250***	**2200***	**3800***	**86***	**800***	**3500***					1		18	1	**136***	39
Bar-tailed godwit						1		1	1											59
Curlew	1			1	6	4	1	3	7	2	3			1	2	4	7	3	2	44

Species	Apr	May	Jun	Jul	Jul (2)	Aug	Aug (2)	Sep	Oct	Oct (2)	Nov	Dec	Jan	Jan (1)	Feb	Feb (2)	Mar	Mar (2)	Apr	1% of Humber
Common sandpiper*				**1***		**1***	**1***													<1
Redshank*	17	1		4	10	**205***	**249***	102*	50	**147***	53		4	34	27	**51***	**57***	3	21	54
Black-headed gull	1			3	16	15	41			4			3		11					79
Common gull															2					20
Great black-backed gull													1							2
Assemblage	537	78	7	289	299	**2441***	**4112***	197	970	**4025***	103	0	50	60	81	102	126	36	181	1126

Source: Annex 11.3; IECS Spring Passage & Breeding Bird Survey April to August 2010 and subsequent data provided in excel format.

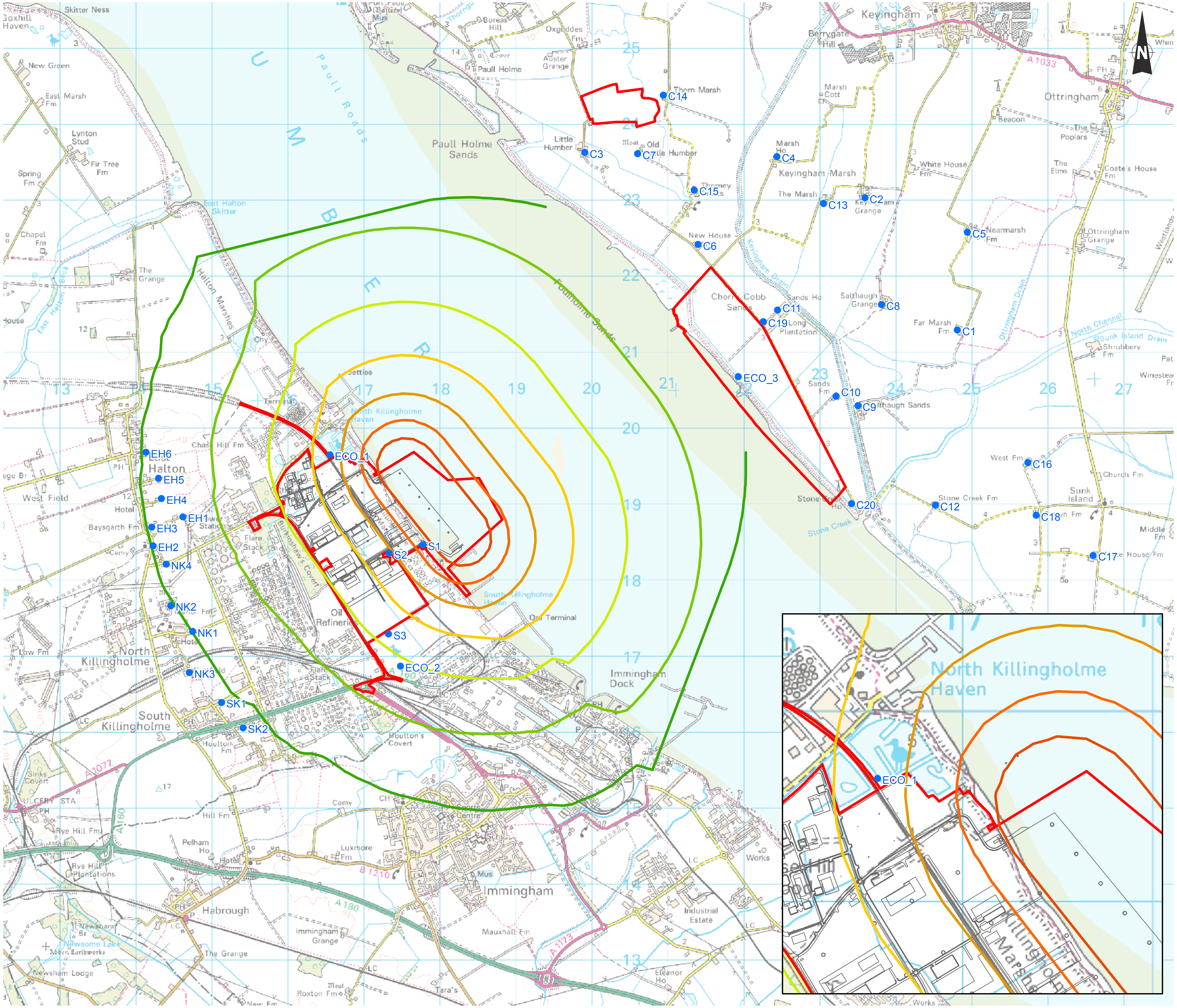
* Indicates species that for some months of the year are present in numbers ≥1% of the Humber population (specific counts are highlighted in bold in the table)

Shading relates to species sensitivities as described in Cutts *et al.* (2008). Where a species or count is not shaded, species or time of year was not described in Cutts *et al.* (2008). Shading on species name represents the highest level of sensitivity assigned to that species;

	Species highly sensitive to disturbance from construction
	Species moderately sensitive to disturbance from construction
	Species moderate to low sensitivity to disturbance from construction

Annex D

Noise Contour Figures



Key

- Application Boundaries
- Site Layout
- Noise Receptors

LA1 Noise Levels, Piling No Mitigation Q2 to Q8, dB(A)

- 50
- 55
- 60
- 65
- 70
- 75
- 80

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PROJECTION: British National Grid

Rev	Date	Comments	Drw	Chk	App
A	24/11/2011	Preliminary Issue	MTC	WB	SP

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Project: ABLE Marine Energy Park

Client: ABLE UK Ltd

Title: Figure 1
Piling No Mitigation LA1 Q2 to Q8

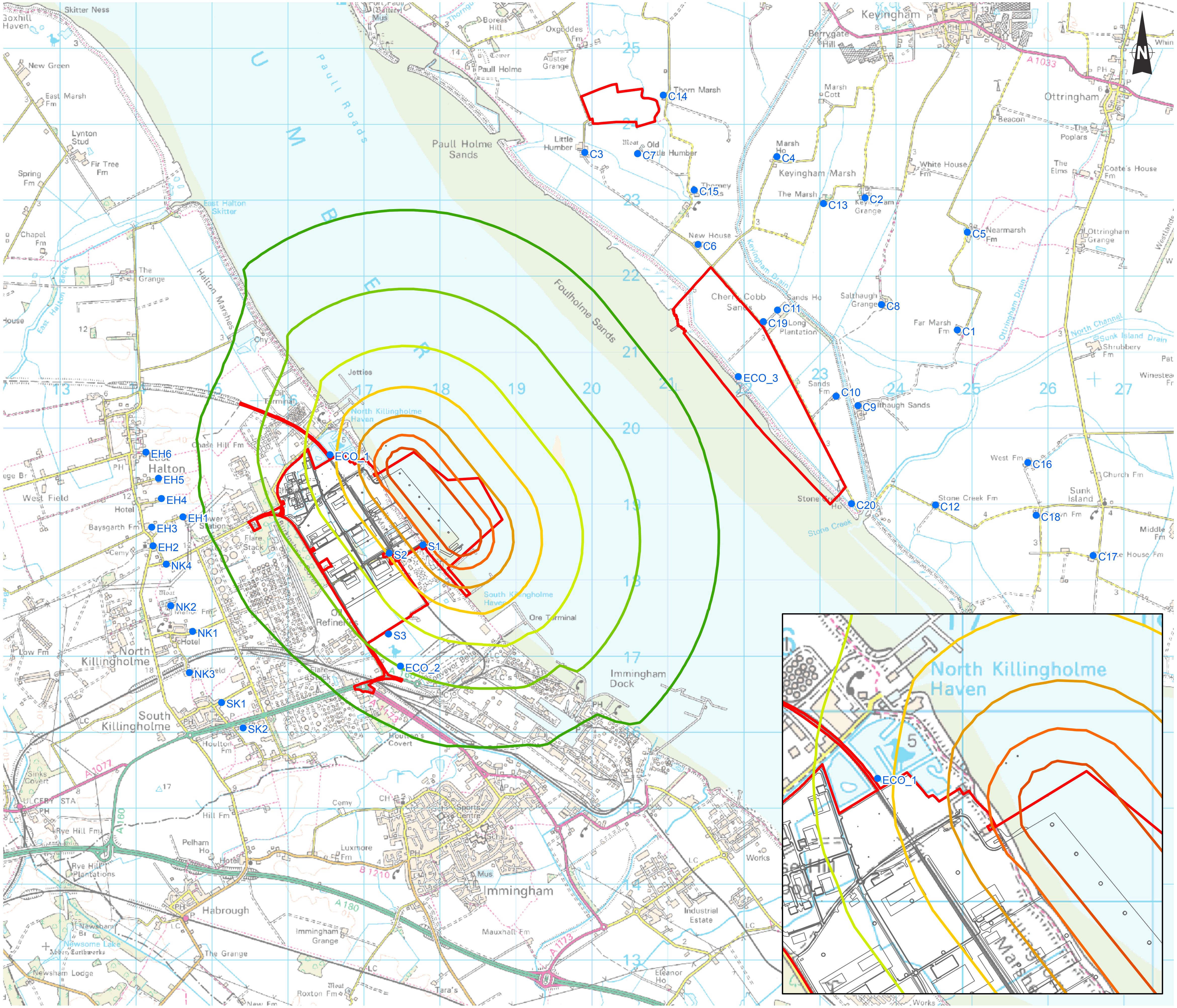
PRELIMINARY

Scale:	Drawn	Checked	Approved
1:50,000@A3	MTC	WB	SP
Date	24/11/2011	24/11/2011	24/11/2011

Drawing No.: ABLE_Piling_NoMit_LA1_Q2_Q8.mxd

Revision: A

File: 0120872AHP_MarineEnergyParkGIS_MTC_MK\MAPS\ABLE Template Maps\ABLE_Piling_NoMit_LA1_Q2_Q8.mxd



Key

- Application Boundaries
- Site Layout
- Noise Receptors

LA1 Noise Levels,
Piling Part Mitigation Q2 to Q8, dB(A)

- 50
- 55
- 60
- 65
- 70
- 75
- 80

PROJECTION: British National Grid

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Client: ABLE UK Ltd

Title: Figure 2
Piling Part Mitigation LA1 Q2 to Q8

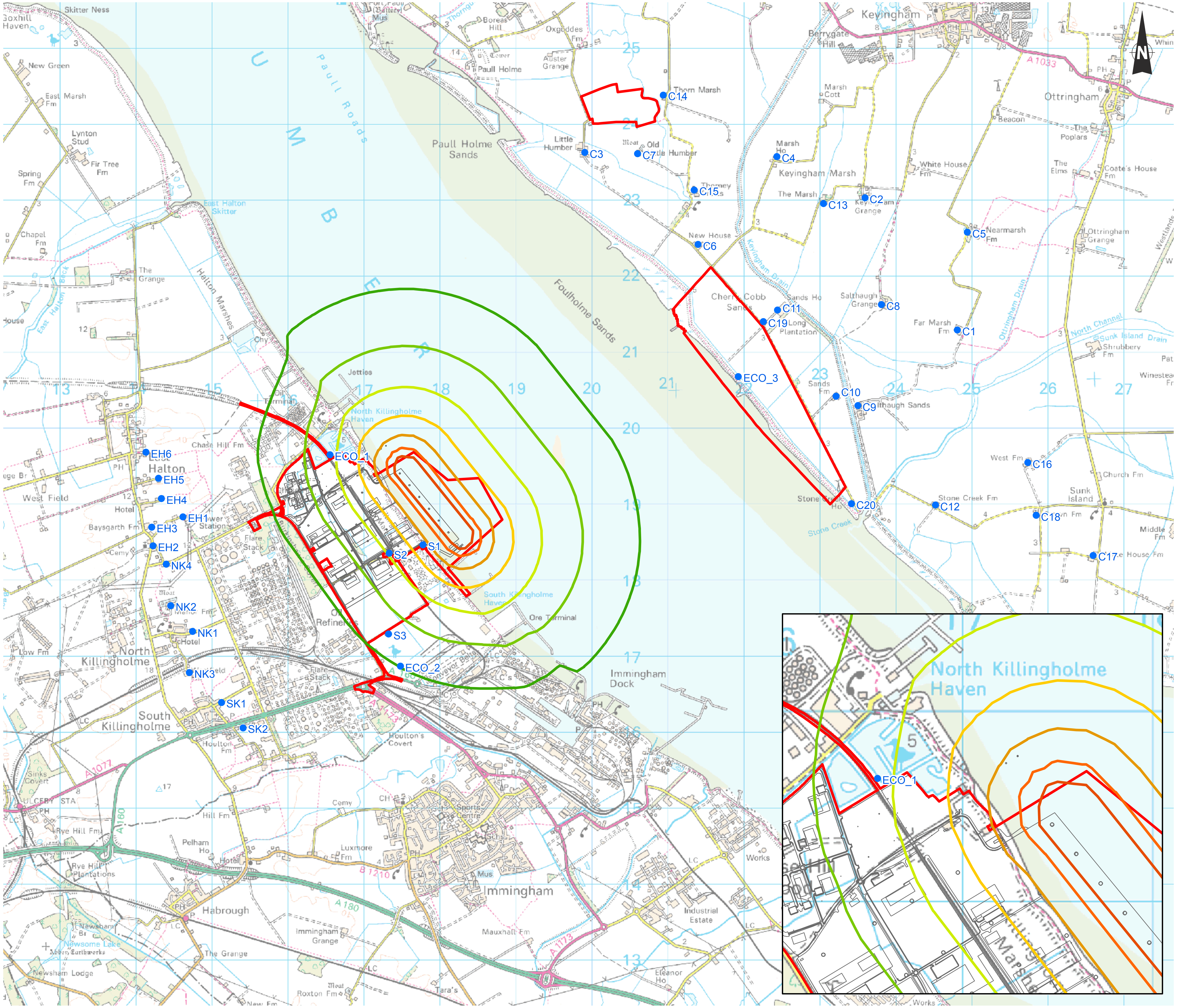
PRELIMINARY

Scale:	Drawn	Checked	Approved
1:50,000@A3	MTC	WB	SP
Date	24/11/2011	24/11/2011	24/11/2011

Drawing No. ABLE_Piling_PartMit_LA1_Q2_Q8.mxd

Revision: A

File: 0120872AHP_MarineEnergyParkGIS_MTC_MKMAPS\ABLE Template Maps\ABLE_Piling_PartMit_LA1_Q2_Q8.mxd



Key

- Application Boundaries
- Site Layout
- Noise Receptors

LA1 Noise Levels, Piling Full Mitigation Q2 to Q8, dB(A)

- 50
- 55
- 60
- 65
- 70
- 75
- 80

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Client: ABLE UK Ltd

Title: Figure 3
Piling Full Mitigation LA1 Q2 to Q8

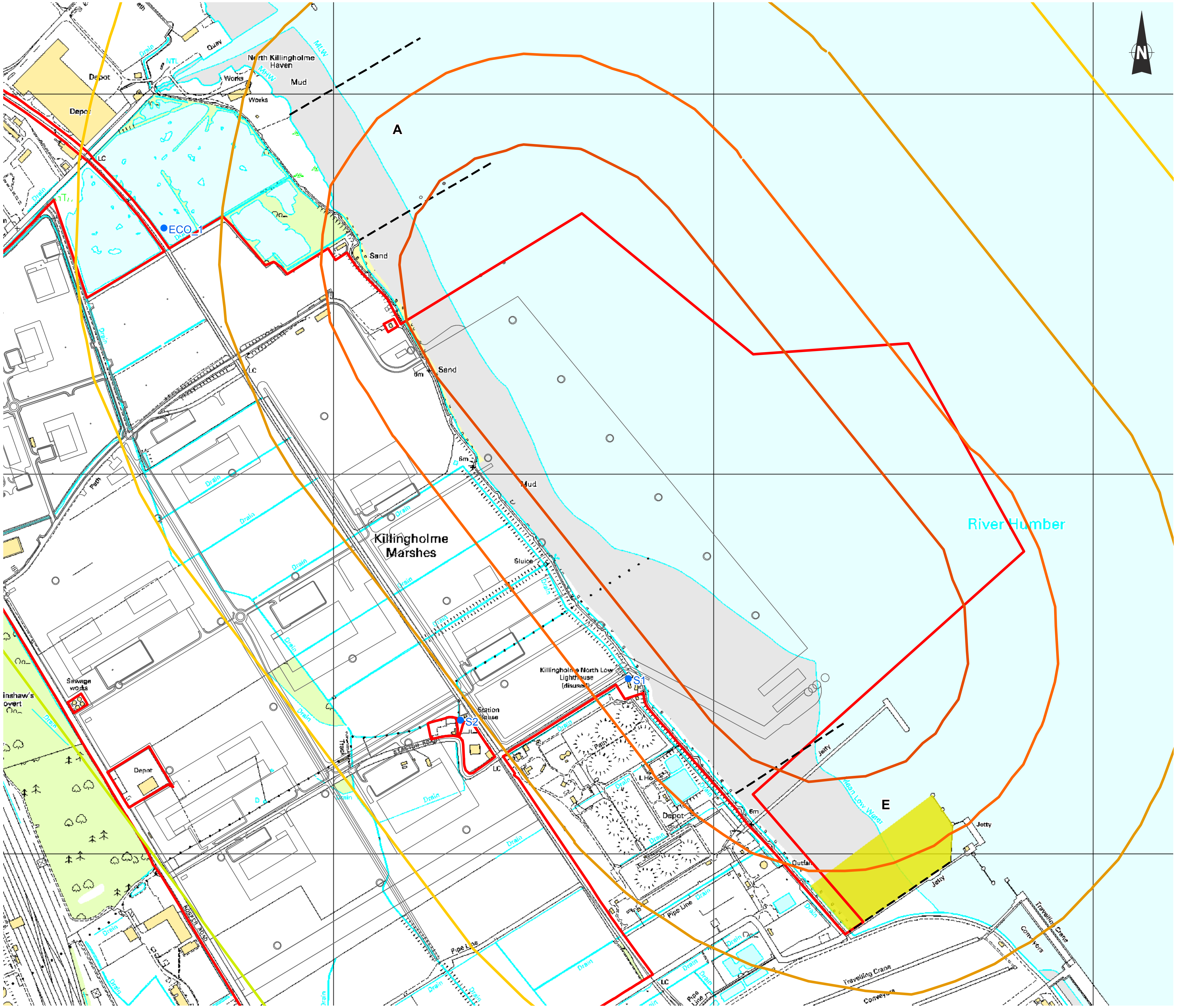
PRELIMINARY

Scale:	Drawn	Checked	Approved
1:50,000@A3	MTC	WB	SP
Date	24/11/2011	24/11/2011	24/11/2011

Drawing No.: ABLE_Piling_FullMit_LA1_Q2_Q8.mxd

Revision: A

File: 0120872AHP_MarineEnergyParkGIS_MTC_MK\MAPS\ABLE Template Maps\ABLE_Piling_FullMit_LA1_Q2_Q8.mxd



Key

(red outline)	Application Boundaries
(grey outline)	Site Layout
(dashed line)	Intertidal Zones A & E Modified Intertidal WeBS Survey
(yellow fill)	Southern Third of Sector E
(blue dot)	Noise Receptors

LA1 Noise Levels,
Piling No Mitigation Q2 to Q8, dB(A)

- 50
- 55
- 60
- 65
- 70
- 75
- 80

PROJECTION: British National Grid

Rev	Date	Comments	Drw	Chk	App
A	25/11/2011	Preliminary Issue	MTC	WB	SP

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Project: ABLE Marine Energy Park

Client: ABLE UK Ltd

Title: Figure 4
Piling No Mitigation LA1 Q2 to Q8 and Survey Areas
A and E Highlighting the Southern Third of Sector E

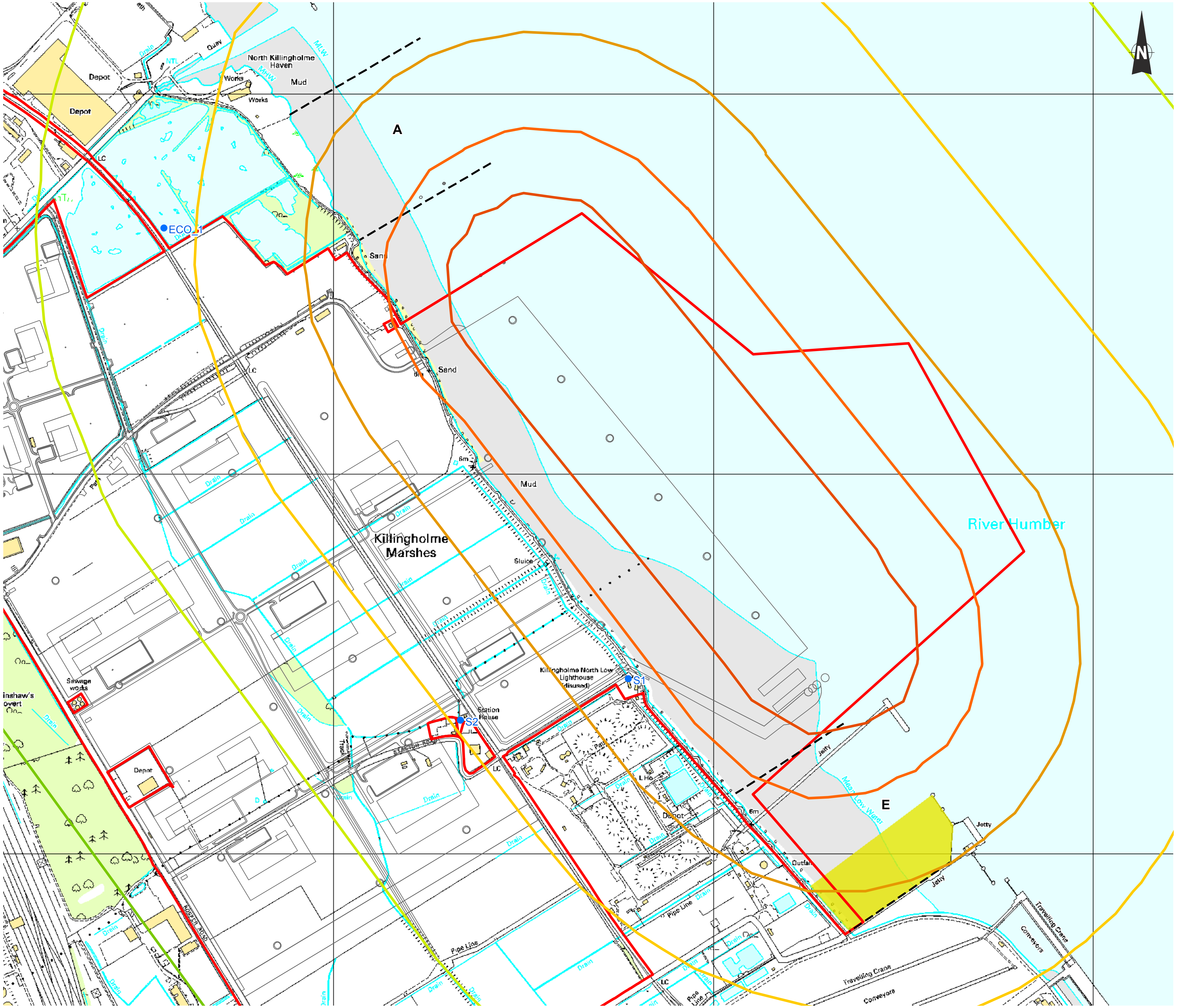
PRELIMINARY

Scale:	Drawn	Checked	Approved
1:10,000@A3	MTC	WB	SP
Date	25/11/2011	25/11/2011	25/11/2011

Drawing No. ABLE_PilingNoMit_IntertidalZones.mxd

Revision: A

File: 0120872AHP_MarineEnergyPark\GIS_MTC_MK\MAPS\ABLE Template Maps\ABLE_PilingNoMit_IntertidalZones.mxd



Key

(red outline)	Application Boundaries
(grey outline)	Site Layout
(dashed line)	Intertidal Zones A & E Modified Intertidal WeBS Survey
(yellow fill)	Southern Third of Sector E
(blue dot)	Noise Receptors

LA1 Noise Levels, Piling Part Mitigation Q2 to Q8, dB(A)

- 50
- 55
- 60
- 65
- 70
- 75
- 80

PROJECTION: British National Grid

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Project: ABLE Marine Energy Park

Client: ABLE UK Ltd

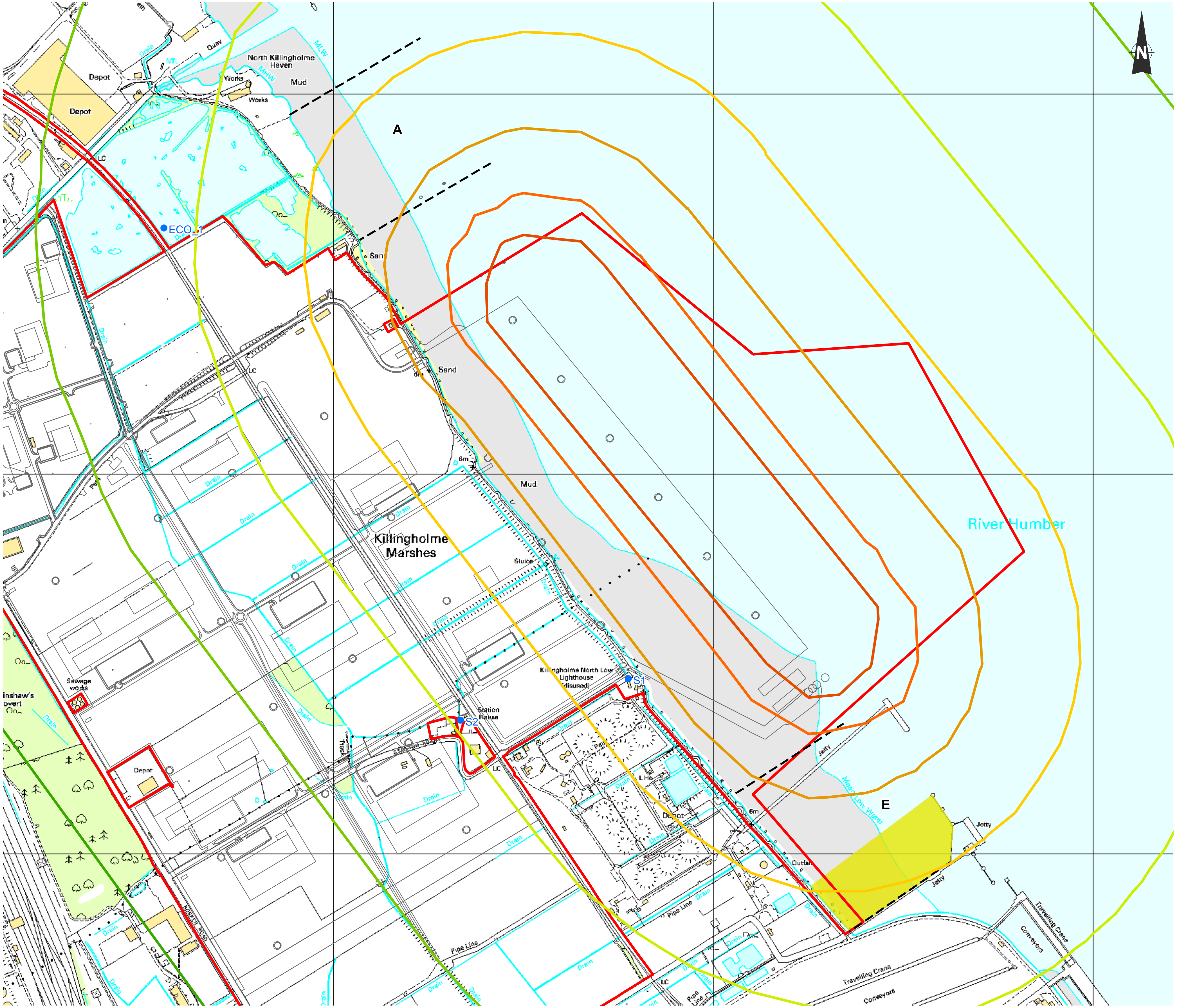
Title: Figure 5
Piling Part Mitigation LA1 Q2 to Q8 and Survey Areas A and E Highlighting the Southern Third of Sector E

PRELIMINARY

Scale:	Drawn	Checked	Approved
1:10,000@A3	MTC	WB	SP
Date	25/11/2011	25/11/2011	25/11/2011

Drawing No. ABLE_PilingPartMit_IntertidalZones.mxd

Revision: A



Key

- Application Boundaries
- Site Layout
- Intertidal Zones A & E Modified Intertidal WeBS Survey
- Southern Third of Sector E
- Noise Receptors

LA1 Noise Levels, Piling Full Mitigation Q2 to Q8, dB(A)

- 50
- 55
- 60
- 65
- 70
- 75
- 80

PROJECTION: British National Grid

Rev	Date	Comments	Drw	Chk	App
A	25/11/2011	Preliminary Issue	MTC	WB	SP

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Project: ABLE Marine Energy Park

Client: ABLE UK Ltd

Title: Figure 6
Piling Full Mitigation LA1 Q2 to Q8 and Survey Areas A and E Highlighting the Southern Third of Sector E

PRELIMINARY

Scale:	Drawn	Checked	Approved
1:10,000@A3	MTC	WB	SP
Date	25/11/2011	25/11/2011	25/11/2011

Drawing No.: ABLE_PilingFullMit_IntertidalZones.mxd

Revision: A

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Update of Predicted Noise Levels from AMEP Piling Activity

1 UPDATE OF PREDICTED NOISE LEVELS FROM AMEP PILING ACTIVITY

1.1 BACKGROUND

This note presents an update on the predicted noise levels from piling operations at the AMEP site, following consultations with Natural England on 1 December 2011. It reflects the outcome of more detailed discussions with the Hochtief, a suitably qualified and experienced piling contractor, in particular about the maximum noise levels that will result from the piling activities at important areas for birds North Killingholme Haven Pits (NKHP – location ECO_1) and an area representative of the Killingholme Marshes foreshore (location S1).

1.2 SUMMARY OF EXISTING NOISE CLIMATE

The data in *Table 1.1* are based on the findings of the surveys undertaken in December 2010. This clearly shows that the existing maximum noise levels exceed 55 dB (A) for the vast majority of the daytime, and occasionally exceed 75 dB (A). The range of existing maximum noise levels recorded during the surveys are up to 72 dB (A) at NKHP and 68 dB (A) on the Killingholme Marshes foreshore (within one standard deviation of the mean).

Table 1.1 Baseline Analysis of L_{Amax} Daytime Noise Levels (December 2010)

Parameter	*ECO-1*	*S1*
Occurrence of L_{Amax} noise levels > 55 dB(A)	91%	71%
Occurrence of L_{Amax} noise levels ≥ 75 dB(A)	5%	2%
Statistical Mean	65	60
Standard Deviation (SD)	7	8
Mode (noise level which occurs the most frequently)	68 (7%)	64 (7%)
Range within 1 SD	58 – 72	52 - 68
Occurrence of L_{Amax} noise levels within 1 SD	73%	69%
Occurrence of L_{Amax} between 55 dB(A) and 75 dB(A)	86%	79%
Occurrence of L_{Amax} between 58 dB(A) and 72 dB(A)	73%	-
Occurrence of L_{Amax} between 52 dB(A) and 68 dB(A)	-	69%

1.3 PREDICTED L_{A1} NOISE LEVELS (25/11/2011)

The report of Piling Impacts on Birds from AMEP contained predicted piling L_{A1} noise levels (*ie* repeatable maximum levels) which took account of partial and full mitigation of the piling unit with a noise shroud (see *Table 1.2*). For the vast majority of the time the noise shroud could only be used up to the piling gate (ie partial mitigation) and hence the focus was on predicted, partially mitigated, piling noise levels.

Table 1.2 *Predicted L_{A1} Noise Levels Incorporating Partial and Full Mitigation (as of 25/11/2011)*

Site	Mean L_{A1} dB (A)	Predicted L_{A1} Noise Levels with Mitigated Piling at North Quay (dB(A))			Predicted L_{A1} Noise Levels with Mitigated Piling at South Quay (dB(A))		
		None	*Partial*	*Full*	*None*	*Partial*	*Full*
S1	51	69	**65**	60	75	**71**	66
S2	61	67	**63**	58	68	**64**	59
S3	63	57	**53**	48	59	**55**	50
ECO_1	58	65	**61**	56	61	**57**	52

None- piles free standing, no shroud or completely lifted.
Partial- Incomplete enclosure of piles by noise shroud.
Full- Complete enclosure of piles down to water level.

1.4 *PREDICTED L_{AMAX} NOISE LEVELS (08/12/2011)*

Further discussions with Hochtief have allowed the prediction of maximum levels (L_{Amax}) for the piling activities (see *Table 1.3*).

The data provided by Hochtief shows values for L_{WAeq}, L_{WATeq} and Impulse adjustment; which upon investigation are respectively:

L_{WAeq} - the sound power level, Lw (L_{Aeq}),
L_{WATeq} - "maximum" Lw (L_{Max}); and
Impulse adjustment - the adjustment from the L_{Aeq} to the L_{Max} sound power values

Table 1.3 *Predicted Effectiveness of Noise Shroud as Piling Mitigation (Source: HOCHTIEF Solutions AG)*

No.	Sound power level		Impulse adjustment	Comments to Noise shroud
	L_{WAeq}	L_{WATeq}	K_{IN}	
1	133,7 db (A)	141,4 db (A)	7,6 dB	Noise shroud completely lifted / Piles free-standing
2	129,9 db (A)	136,8 db (A)	6,9 dB	Incomplete enclosure of piles by noise shroud
3	124,4 db (A)	129,6 db (A)	5,2 dB	complete enclosure of piles down to water level

The maximum predicted piling noise levels are dependant on the distance of noise source from the receptor and have been predicted for the worst case. For example maximum predicted piling noise level experienced at North Killingholme Haven Pits (NHKP: ECO_1) are based on piling occurring in the northern part of the quay closest to NKHP, and for the foreshore (S1) in the southern part of the quay.

Table 1.4 ***Predicted LAmax Noise Levels Incorporating Partial and Full Mitigation***

Site	Mean LAMax dB(A)	Predicted Maximum LAmax Noise Levels from piling with No, Partial and Fully Mitigation (dB(A))		
		None	*Partial*	*Full*
S1	**60**	**72**	**68**	66
S2	**68**	**64**	**61**	59
S3	**69**	**57**	**53**	51
ECO_1	**65**	**63**	**60**	58

None- piles free standing, no shroud or completely lifted.
Partial- Incomplete enclosure of piles by noise shroud.
Full- Complete enclosure of piles down to water level.

From *Table 1.4* it is clear that the maximum predicted piling noise level, even with no mitigation is 72 dB (A) at Killingholme Marshes foreshore (S1), and with partial mitigation it will be 68 dB (A). Hence with partial mitigation in place, piling activity will be <70 dB (A) at the foreshore. At NKHP the predicted piling noise level will be substantially less than 70 dB (A).

Even with no mitigation the maximum noise levels predicted from piling at the foreshore are within the range of existing maximum noise levels which were recorded during the noise survey in December 2010.

1.5 NOISE LEVEL PREDICTIONS

NE raised a query around the attenuation of piling noise from what seems to be a "high" level, the source or sound power level, Lw = 134 dB(A) to the predicted noise levels around the 70 dB(A) range at the receptor locations.

To address this, the simple formula for the calculation of noise is provided below in Equation 1.

(1) $Lw = Lp + 20 (\log_{10} D) + K$

Where Lw is sound power level in dB(A)
Lp is sound pressure level in dB(A)
D is distance from source the SPL was measured in metres
K is a constant relating to the measurement environment (ranges from 3 to 11).

Equation 1 does not allow for additional attenuation due to air absorption, ground absorption and the frequency content and is a general equation that provides an approximate noise level at a given distance from a source of known sound power.

Hence, where K=11, the attenuation over a distance of 250 metres is:

48 (20xlog 250) +11 = 59

For an Lw of 134 dB(A). the Lp at 250 metres from the source is 134 – 56 = 75dB(A).

1.6 *IMPLICATIONS OF THE UPDATED MAXIMUM NOISE LEVEL PREDICTIONS*

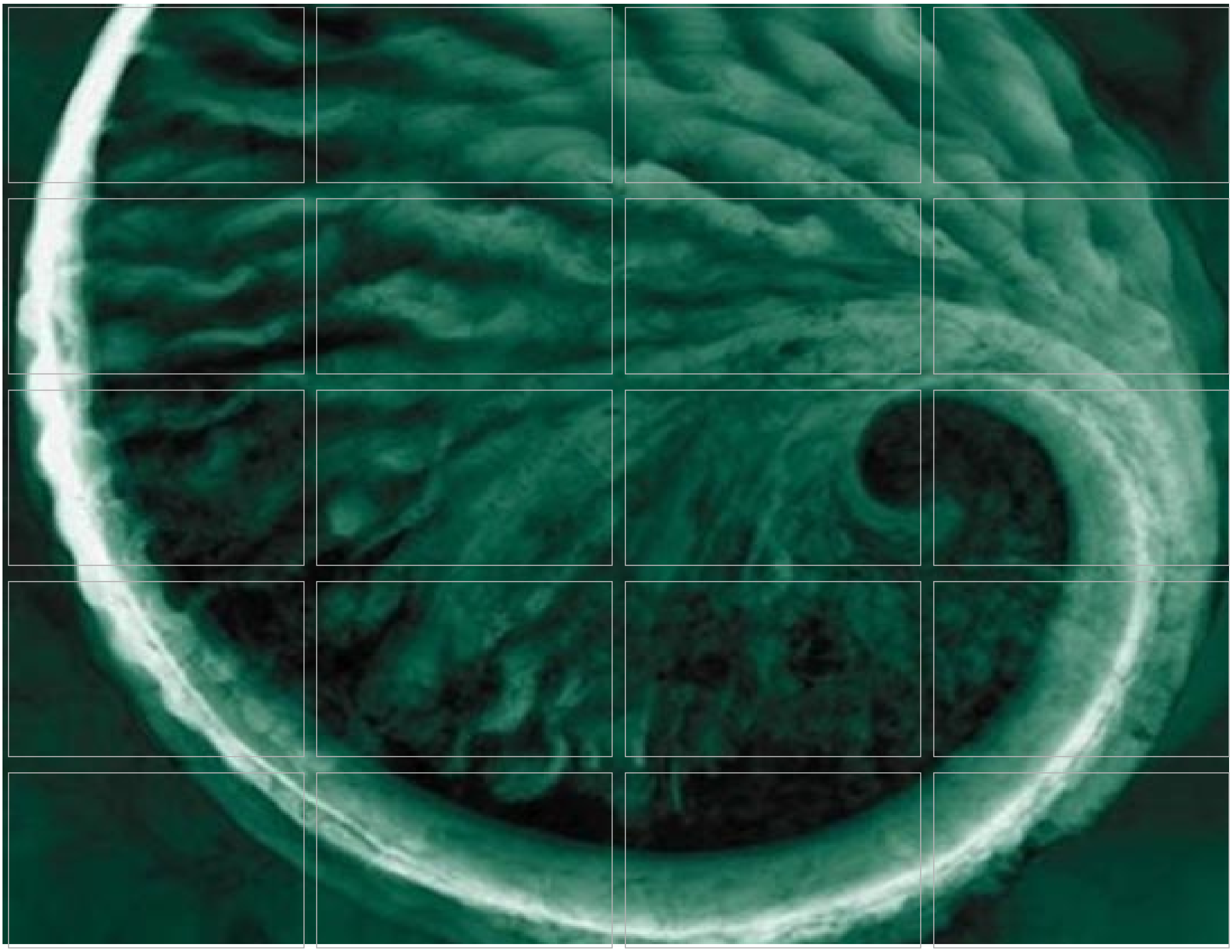
The predictions of maximum noise levels contained in *Table 1.4* show that with partial mitigation, noise levels of less than 70 dB (A) will be achieved. Predicted piling levels of <70 dB (A) are likely to result in only moderate impacts to birds based on the information that is currently available (Cutts *et al*. 2008[(1)]). This is further supported by ongoing monitoring of piling activities around development on the foreshore on the south bank of the Humber Estuary in close proximity to the AMEP site, where no significant effects on birds have been recorded (*pers comm* Nick Cutts, 2011).

In addition the predicted noise levels from piling with partial mitigation are also within the existing range of maximum noise levels that occur at both NKHP and along the foreshore. There will, therefore, be no discernable change to the existing situation, and hence the effects on birds are not expected to be any greater than they are at present.

(1)Cutts N, Phelps A & Burdon D (2008) *Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance.* Report to Humber INCA.

Annex G

Supporting Information on Impact of Loss of Farmland on Sunk Island



Effect of the Loss of Farmland on Waterfowl From the Humber Estuary SPA/Ramsar Site due to the Creation of the Proposed AMEP Intertidal Compensation Site

November 2011

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Able UK Ltd

Effect of the Loss of Farmland on Waterfowl From the Humber Estuary SPA/Ramsar Site due to the Creation of the Proposed AMEP Intertidal Compensation Site

November 2011

Prepared by: Andy Coates

For and on behalf of Environmental Reources Management

Approved by: Steve Purnell

Signed:

[redacted]

Position: Partner

Date: 16 November 2011

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1 INTRODUCTION

1.1 BACKGROUND AND PURPOSE OF THIS DOCUMENT

The Able Marine Energy Park (AMEP) development will have an adverse effect on bird species of the Humber Estuary Special Protection Area (SPA) and Ramsar site by virtue of displacing them from an existing feeding area. A new area of intertidal habitat, including areas of mudflat, will be created on existing farmland along the northern bank of the Humber Estuary at Cherry Cobb Sands to maintain the food resource available to the bird assemblage

The farmland that is proposed to be developed into intertidal habitat is currently used by the assemblage for roosting and, to a lesser extent, feeding. This document considers the effects of the permanent loss of that farmland on the site assemblage.

This note only considers the impacts of the loss of the farmland on the SPA/Ramsar assemblage once the development of the Compensation Site is complete and 'operational'.

1.2 THE COMPENSATION SITE

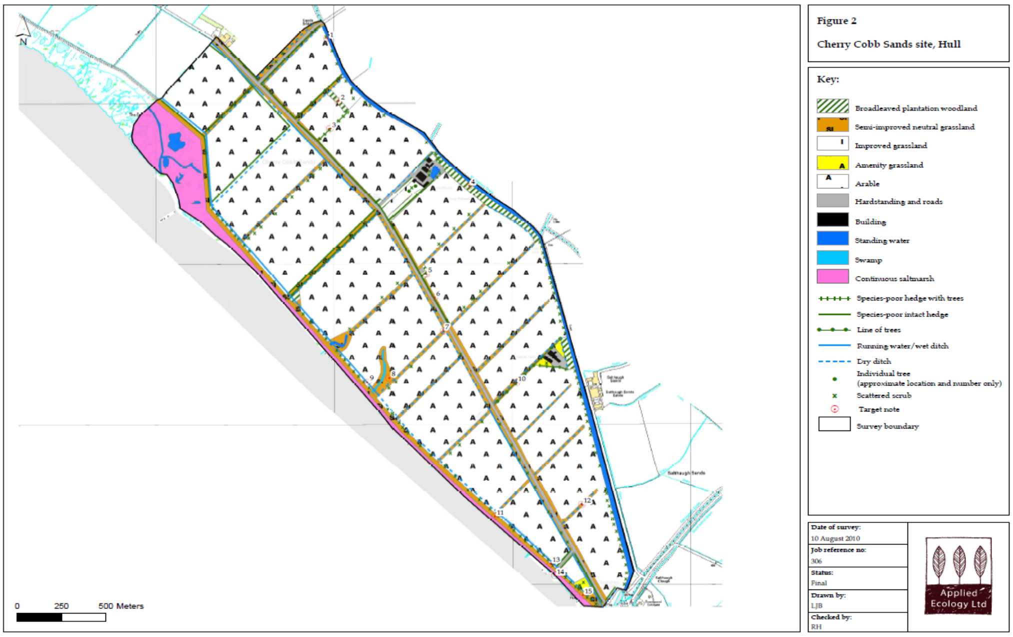
The Compensation Site is located on farmland which is bordered by the Humber Estuary and other farmland to the south and west, and by the Cherry Cobb Sands Road along the northern and eastern edge. Farmland lies beyond the Compensation site to the west, north and east, with the Humber Estuary to the south.

A Phase 1 Habitat Survey of the proposed Cherry Cobb Sands Compensation Site and immediate surrounds was undertaken in September 2010 (Applied Ecology Ltd, 2010) [(1)] using standard Phase 1 Habitat Survey methodology and plant nomenclature (English and scientific names) (JNCC, 1993) [(2)] extended for use in the EIA (IEA, 1995) [(3)] .

The survey found that the Compensation Site was predominantly agricultural farmland, dominated by arable fields, with a narrow strip of saltmarsh where the land meets the estuary (see *Figure 1.1*). The site is crossed by several drainage ditches (some of which are dry in total or in part), and the occasional species-poor hedgerow. The field margins include strips of semi-improved neutral grassland running alongside the ditches and/or hedgerows.

(1) Applied Ecology Ltd (2010) South Killingholme Phase 1 Ecology Survey
(2) Joint Nature Conservation Committee (1993) *Handbook for Phase 1 Habitat Survey - A technique for Environmental Audit.*Joint Nature Conservation Committee, Peterborough
(3) Institute of Environmental Assessment (1995) *Guidelines for Baseline Ecological Assessment.* Spon, London.

Figure 1.1 Phase 1 Habitat Survey Map



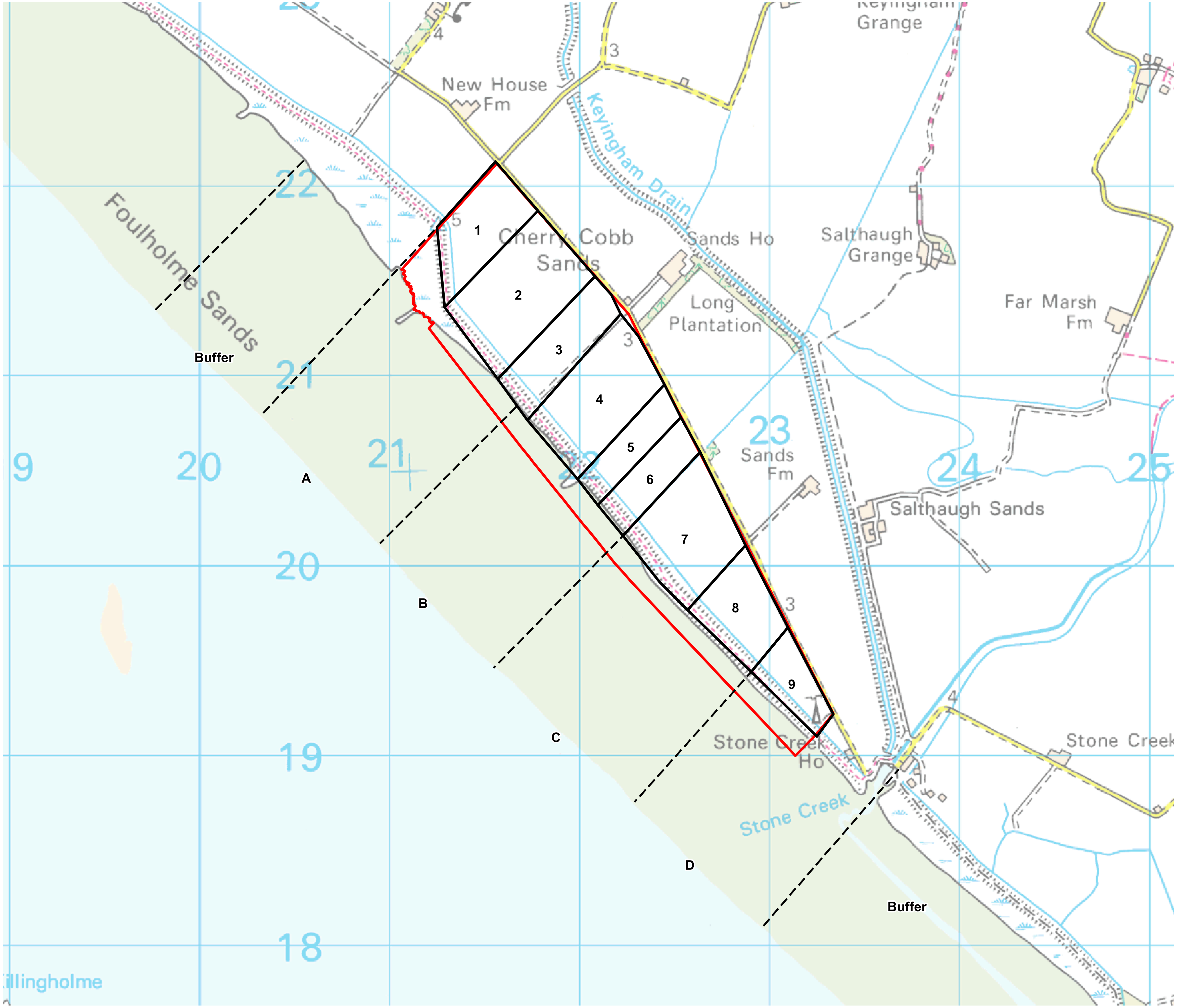
Source: Annex 35.1: South Kilingholme Phase 1 Ecology Report. Cherry Cobb Sands

2 AMEP COMPENSATION SITE AND EXISTING BIRD USE

2.1 INFORMATION SOURCES

Data are available from the Wetland Bird Survey (WeBS) Low Tide Count Data 2003/04 and the Core Count Data between 2004/05 and 2008/09. However, these data do not distinguish between the Cherry Cobb Sands intertidal area and the farmland areas of the Compensation Site. Hence the main source of information about the bird species and use of the Compensation Site has been the weekly surveys undertaken around low tide and high tide between August 2010 and April 2011 (1) (see *Figure 2.1* for the main survey area).

(1) Institute of Estuarine and Coastal Studies (2011) *Cherry Cobb Sands Compensation Site Bird Survey Results – August 2010 to April 2011*. Report for Able UK Ltd.



Key

- Compensation Site Boundary
- Field Boundary
- Foreshore Zone

PROJECTION: British National Grid

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Title: Figure 2.1
Compensation Site Bird Survey Area

PRELIMINARY

Scale:	Drawn	Checked	Approved
1:20,000@A3	MTC	WB	WB
Date	16/11/2011	16/11/2011	16/11/2011

Drawing No.: ABLE_CompensationSite_BirdSurveyArea.mxd

Revision: A

File: 0120872AHP_MarineEnergyParkGIS_MTC_MK\MAPS\ABLE Template Maps\ABLE_CompensationSite_BirdSurveyArea.mxd

2.2 *EXISTING BIRD USAGE OF COMPENSATION SITE*

2.2.1 *General*

The surveys of the Compensation Site in 2010/2011 showed that the bird assemblage and use of the site was typical of arable fields beyond the flood embankments (IECS, 2011) [1] . Several qualifying interest species of the Humber Estuary SPA/Ramsar site (either individually or as part of the assemblage) were recorded (see *Sections 2.2.2 – 2.2.17*). Of these curlew was the most common and widespread species on the Compensation Site. It was not, however, considered to be the preferred roost site for birds from the SPA/Ramsar, possibly due to the lack of suitable roosting habitat (IECS, 2011) [1] . The use of the Compensation Site as a roost by waterfowl typically coincided with spring high tides which covered the preferred roosting habitats on the foreshore (IECS, 2011) [1].

2.2.2 *Curlew*

Compensation Site

Curlew favour the Compensation Site at high tide for roosting, particularly in Zones 8 and 9 (see *Figure 2.1*), and when the highest tides push the birds off the intertidal areas fronting the Compensation Site. Curlew numbers peaked at 640 birds in September 2010, with all but one of the birds within Zones 6 – 9 and comprised a mixture of birds feeding and roosting. Field usage by curlew around high tide was largely recorded between September and December 2010, with the only record outside this period being of 19 birds in February 2011. The main period of use was September and October with peaks of 640 and 600 respectively. Peaks of 27 birds or less were recorded at other times. In contrast curlews were present on the foreshore even at high tide throughout the survey period, with a peak of 994 birds in January 2011.

Curlews were also recorded on the Compensation Site fields around low tide in all months surveyed except December 2010, February and April 2011; although the peak numbers were lower than the high tide peak (148 in March 2011).

The surveys also recorded small numbers of curlews foraging / roosting on the farmland fields north of those comprising the Compensation Site (*ie* the fields north of Cherry Cobb Sands Road).

Foreshore

It is evident from the survey findings that the foreshore at Cherry Cobb Sands can at times support large and important numbers of curlew, with up to 1,703 recorded at low tide in August 2010 (the majority in Zone C).

(1) Institute of Estuarine and Coastal Studies (2011) *Cherry Cobb Sands Compensation Site Bird Survey Results – August 2010 to April 2011*. Report for Able UK Ltd.

The pattern of use of the Cherry Cobb Sands foreshore is variable. It is evident that on some high tides the number of birds recorded on the foreshore exceeds that at low tide (*eg* September and October 2010 and January 2011) indicating that curlews have moved into the Cherry Cobb Sands foreshore from elsewhere in the Humber Estuary. Around the highest tides when the birds have been pushed off the foreshore, high numbers were found on the Compensation Site Fields (*eg* September / October 2010). At less extreme tides the birds were recorded roosting on the foreshore (*eg* January 2011). However, in some months the reverse was recorded with much lower numbers present around high tide (*eg* 418 on the foreshore in August 2010), compared with numbers in excess of 1,700 recorded on the foreshore around low tides on the same survey.

2.2.3 *Lapwing*

Lapwings were recorded within the survey area, predominantly between October 2010 and February 2011, with only four birds present in September 2010. The birds were present in the area in greater numbers around low tide, with up to 2,073 birds recorded on the foreshore in November 2010.

The birds were predominantly on the foreshore, making only occasional use of the fields on the Compensation Site, generally in low numbers (*eg* three in September 2010), although 787 birds were recorded on the fields in February 2011 in Zones 2 and 3. A small flock of 15 lapwings was also recorded in the fields north of the Compensation Site in late February 2011. Except for this record lapwings were generally uncommon on the fields at both high and low tides, with little apparent difference in their use between the two tidal states (IECS, 2011) [1] .

Around high tide, lapwing were recorded on the fields in October 2010 and February 2011 (56 and 196 birds respectively), with a single bird in December 2010. Small numbers were also recorded on the foreshore throughout the period October 2010 to February 2011, ranging between 4 and 72 birds.

2.2.4 *Mallard*

Mallards were found across the foreshore throughout the survey period however, few birds were recorded on the Compensation Site fields. Around low tide a single bird was recorded in October 2010 and four birds were recorded across Zones 3 and 4 in March 2011. Around high tide two birds were recorded in the latter half of December 2010, and nine birds were recorded in late March 2011 across Zones 3, 4 and 6.

2.2.5 *Greylag Goose*

Greylag geese were recorded on the fields of the Compensation site on five occasions including both at low tide and high tide. A peak of 65 birds was

(1) Institute of Estuarine and Coastal Studies (2011) Cherry Cobb Sands Compensation Site Bird Survey Results – August 2010 to April 2011. Report for Able UK Ltd.

recorded around low tide in early January 2011 in Zone 5, with a smaller flock of 18 birds later in the same month in the same zone. The other records were also largely in January but around high tide with 25 – 49 birds recorded. A flock of 50 birds was recorded in December 2010. All these high tide counts were in Zones 3 and 4.

2.2.6 Little Egret

Individual records of little egrets were recorded on the Compensation Site fields on three occasions including one bird in October 2010, another two individuals in mid March and one in late March 2011. This species favoured soak drains and drainage channels across the site (IECS, 2011) [(1)].

2.2.7 Grey Plover

This species favours intertidal habitats and was present throughout the survey period predominantly on the foreshore around low tide (peak of 623 in February 2011). Much lower numbers were recorded on the foreshore around high tide over the period August 2010 to January 2011.

Grey plovers were recorded roosting on the inland fields on the Compensation Site on only two occasions, at both times during a high tide in October 2010, with a peak of 26 birds. Their preferred roosting areas are however, the saltmarshes at Welwick and Cherry Cobb Sands (IECS, 2011) [(1)].

2.2.8 Ruff

Six birds were recorded on the fields in the Compensation Site around high tide in early September 2010.

2.2.9 Bar-tailed Godwit

Bar-tailed godwits were recorded largely on the intertidal habitats, with a peak of 358 at high tide in December 2010. This is typical for this species which favours mudflats and occurs in peak numbers on the Humber Estuary typically in the early to mid winter period. This species was rarely seen roosting in the arable fields, with only two records: once in September 2010 (21 birds) and once in October 2010 (3 birds) (IECS, 2011) [(1)].

2.2.10 Dunlin

Dunlins were recorded only twice on the Compensation Site fields, in early and late September 2010 respectively, with a peak count of 65 birds in Zone 1 in early September. The survey findings show that this species predominantly used the intertidal habitat where they occurred in large numbers, with a peak of 2,940 in early October 2010 (IECS, 2011) [(1)].

(1) Institute of Estuarine and Coastal Studies (2011) Cherry Cobb Sands Compensation Site Bird Survey Results – August 2010 to April 2011. Report for Able UK Ltd.

2.2.11 *Pink-footed Goose*

Pink-footed geese were recorded on two occasions on the Compensation Site fields with a peak of 61 birds in the second half of January 2011 and 58 birds in the early part of the same month. Pink-footed geese are typically found in the upper estuary, with important roosting areas on Reade's Island and the geese then foraging in the surrounding farmland habitats (IECS, 2011) [1].

2.2.12 *Peregrine*

Two peregrines were observed in mid December 2010 both over Zone 2 on the Compensation Site. Peregrine is a regular wintering bird around the Humber Estuary, largely hunting across the intertidal mudflats (IECS, 2011) [1].

2.2.13 *Golden Plover*

Golden plovers were recorded throughout the survey period between August 2010 and March 2011. The numbers present on occasions exceeded the thresholds of both international and national importance (9,300 and 4,000 respectively (Holt *et al*, 2011[2])), with a peak of 11,735 birds recorded on the foreshore in September 2010. Golden plovers largely use the intertidal area for roosting, as they forage on inland grassland areas.

There was only one record of 42 birds roosting on the Compensation Site fields at high tide in October 2010, and none at low tide. A single bird was recorded on the fields north of Zone 1 of the Compensation Site earlier in the same month around low tide. The lack of grassland habitat both on the Compensation Site and in the adjacent fields probably contributed to the lack of use of the inland fields by golden plover.

2.2.14 *Teal*

A flock of 42 teals was recorded in Zone 3 of the Compensation Site around low tide in February 2011.

2.2.15 *Grey Heron*

A single roosting bird was recorded on the fields inland and to the north of the Compensation Site. This species is more typical in the upper estuary and also on the associated waterways rather than the intertidal mudflats (IECS, 2011) [3].

(1) Institute of Estuarine and Coastal Studies (2011) Cherry Cobb Sands Compensation Site Bird Survey Results – August 2010 to April 2011. Report for Able UK Ltd.
(2) Holt C, Austin G, Calbrade N, Mellan H, Mitchell C, Stroud D, Wotton S & Musgrove A (2011) *Waterbirds in the UK 2009/10 - The Wetland Bird Survey (WeBS)*. BTO/RSPB/JNCC/WWT.
(3) Institute of Estuarine and Coastal Studies (2011) Cherry Cobb Sands Compensation Site Bird Survey Results – August 2010 to April 2011. Report for Able UK Ltd.

2.2.16 *Gulls*

There were few records of gulls during the surveys, and the only records of gulls on the fields comprising the Compensation Site were around high tide during the latter part of September 2010:

- black-headed gull – 115;
- great black-backed gull – 3;
- herring gull – 16; and
- lesser black-backed gull - 2.

2.2.17 *Other Species*

A range of other species was recorded during the surveys between August 2010 and March 2011 that were restricted to the intertidal habitats and did not frequent the fields on the Compensation Site. These included species such as shelduck, marsh harrier, oystercatcher, ringed plover, black-tailed godwit, whimbrel, redshank, greenshank and knot, all of which largely avoided the site at high tide, preferring to forage on or across the intertidal zone, or roost on it.

3 EFFECTS OF THE LOSS OF FARMLAND ON BIRDS

3.1 IMPACT ASSESSMENT

The creation of the Compensation Site for AMEP will result in the loss of 110 ha (1) of existing farmland. The fields are used at times by up to 640 feeding/roosting curlew at high tide (average of 144 birds over the nine month survey period), and 148 feeding/roosting curlew at low tide (average of 36 birds). There is one significant record of 787 lapwings on the farmland at low tide (196 at high tide), but only small numbers of a range of other SPA/Ramsar bird species.

The surveys found these fields to be *"…typical of arable fields situated immediately beyond the flood defence"* (IECS, 2011) (2). That the general landscape in this area is dominated by similar arable farmland comprising large fields, is evident from aerial photographs. The Phase 1 Habitat Survey of the Compensation Site and immediate surrounds also clearly shows that the fields immediately north of the Compensation Site are also arable fields of a comparative size to those which will be lost.

The creation of intertidal habitat on the Compensation Site will simply move the intertidal/farmland interface inland by a field. The fields which lie to the immediate north of the Compensation Site are already used by small numbers of curlew (and other species) on occasions, and there is every reason to expect that the birds will use these fields once the Compensation Site is created.

The intertidal habitat on the upper shores including Cherry Cobb Saltmarsh provide a key high tide roost for a range of waterfowl including dunlin, curlew, redshank, bar-tailed godwit, grey plover and occasionally knot (IECS, 2011) (2) . However, a review of existing knowledge about high tide roost areas undertaken for Natural England noted that the fields beyond Cherry Cobb Saltmarsh (including those on the Compensation Site) are also used by these species for roosting during the highest tides when the Cherry Cobb Saltmarsh is inundated, and that the use of fields adjacent to the intertidal / farmland interface by roosting/foraging birds is already widespread both locally and throughout the Estuary (3). *Table 1.1* lists examples of these fields and a number of other locations, which show that fields in this part of the Humber Estuary are used regularly by many of the roosting and foraging bird species that will be displaced to allow the creation of the Compensation Site.

(1) This allows for the loss of an additional 10 ha beneath the footprint of the newly created sea defence wall.
(2) Institute of Estuarine and Coastal Studies (2011) Cherry Cobb Sands Compensation Site Bird Survey Results – August 2010 to April 2011. Report for Able UK Ltd.
(3) Mander L, Cutts N C & Thomson S (2006) Review of High Tide Roosting and Foraging Sites on the Humber Estuary. *English Nature Research Reports* Pre-Publication Draft.

Table 3.1 ***Fields Used by Foraging / Roosting Birds in the Wider Area Around Cherry Cobb Saltmarsh***

Site (for number locations see *Figure X)*	**Species Supported**	**Activity**	**Tidal State**
14. Fields between South Farm and Stone Creek	Curlew	Roosting	Used during high spring tides
15. Fields on Sunk Island	Golden plover, lapwing	Roosting / foraging	Unknown
17. Fields beyond Cherry Cobb Saltmarsh	Dunlin, redshank, curlew, grey plover	Roosting	High tide
18. Paull Holme Strays	Golden plover, lapwing, black-tailed godwit, shelduck, teal, mallard, wigeon	Roosting	High tide
19. Fields Between Saltend and Little Humber Farm	Curlew	Foraging	Not influenced
20. South Pasture, Saltend	Curlew, golden plover, lapwing	Roosting	Unknown

Source: Institute of Estuarine and Coastal Studies (2011) Cherry Cobb Sands Compensation Site Bird Survey Results – August 2010 to April 2011. Report for Able UK Ltd.

The findings of the 2010/2011 surveys showed that the birds tended to prefer to roost on the upper intertidal areas and that they used the adjacent fields outside the designated site predominantly on the highest spring tides, when there was little or no intertidal habitat remaining for them to use. So whilst waterfowl will be displaced on occasions from the existing foreshore and from the Compensation Site), they can be expected to use the designated site and the adjacent arable fields in the same way that they currently use adjacent fields behind the existing flood defences. Whilst localised disturbance may prevent birds from using one or more of these adjacent fields from time to time, that disturbance is not likely to be any greater than at present.

Taking into consideration all of the above, an adverse effect on the integrity of the Humber Estuary SPA/Ramsar site due to the loss of 110 ha of farmland at this location is not likely; no specific mitigation is therefore required.

Consideration has been given to the management of part of the Old Little Humber Farm (OLHF) to accommodate roosting birds. However, the available evidence suggest that the birds are likely to roost on arable fields closer to the estuary / farmland interface, rather than fly over these fields to roost at OLHF. The creation of wet grassland at OLHF is expected to draw foraging birds from the estuary, as there is little of this habitat type present in the local area, and several species will favour the grassland over arable fields as foraging habitat.

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