East Anglia THREE
Offshore Windfarm

East Anglia THREE

Information for the Habitats Regulations Assessment:

Interim Marine Mammal Assessment Southern North Sea pSAC

Document Reference: Deadline 3 / Interim HRA

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SCOTTISHPOWER RENEWABLES

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1 Introduction

1.1 Purpose of this report

1. The purpose of this report is to provide information required for a Habitats Regulations Assessment (HRA) on harbour porpoise for the proposed East Anglia THREE project (as requested by the Examining Authority 6th July 2016 –Ref. EN010056). It is anticipated that it will be necessary to update this report due to the current status of the Southern North Sea possible Special Area of Conservation (pSAC).

2. In its final form the report will be updated with relevant information on Conservation Objectives and conclude on the potential of LSE from the proposed East Anglia THREE project. If appropriate, the updated report will provide the relevant information required by the Competent Authority to undertake an Appropriate Assessment of the proposed East Anglia THREE project with respect to its potential implications for the Southern North Sea pSAC for harbour porpoise.

3. Following a brief introduction, including a summary of the current status of the Southern North Sea pSAC, this report re-states the conclusions of the East Anglia THREE Information for the Habitats Regulations Assessment (Document Reference 5.4 of the East Anglia THREE DCO application). It then provides an overview of the draft Conservation Objectives and Management Measures for the Southern North Sea pSAC. Based on information provided in the Environmental Statement (Document Reference 5.4) a summary is provided of the current harbour porpoise baseline, which is followed by an interim assessment of the potential effects of the proposed East Anglia THREE project in isolation. Information is provided on management and mitigation measures which are secured in the DCO. Finally the summary confirms the conclusions drawn in the interim assessment, and suggests the next steps.

1.2 Harbour porpoise possible Special Area of Conservation

4. At the time of the submission of the Information for the Habitats Regulations Assessment (Document Reference 5.4) in 2015, draft SACs (dSACs) for harbour porpoise *Phocoena phocoena* in UK waters were being considered, one of which was located in the Southern North Sea. As such, it was agreed at the final Evidence Plan Steering Group meeting (held on the 21st October 2015 between EATL, Natural England and the Marine Management Organisation (MMO)) that it was not possible to make any further assessment against this site in its current status, and that it was appropriate for East Anglia Three Limited (EATL) to provide additional information at a later date following public release of full details of the potential designation.

5. Since submission of the Environmental Statement and Information for the Habitats Regulations Assessment (Document Reference 5.4) for the proposed East Anglia THREE project, Joint Nature Conservation Committee (JNCC) and Natural Resources

Wales (NRW) have undertaken consultation on five sites to be considered as possible Special Areas of Conservation (pSAC) for harbour porpoise.

6. The consultation included:

a) The scientific basis on which the proposed boundaries are based; and

b) The draft UK Socio-Economic Impact Assessment, analysing the possible impacts of the sites on human activity, including likely management scenarios for each site.

7. The key supporting information within the consultation used as the basis of this report are:

- Harbour Porpoise (*Phocoena phocoena*) possible Special Area of Conservation: Southern North Sea Draft Conservation Objectives and Advice on Activities (JNCC & Natural England 2016); and
- Inshore and Offshore Special Area of Conservation: Southern North Sea SAC Selection Assessment Document (JNCC 2015).

8. The consultation closed on the 3rd May 2016. Ministers will take the final decisions on whether to proceed with the pSACs based solely on the scientific case presented following the initial selection process and consultation responses.

9. Until final decisions have been made, the Conservation Objectives for each site remain as draft and management measures are yet to be confirmed. As such, this report does not draw any firm conclusions on the potential for Likely Significant Effects (LSE) from the proposed East Anglia THREE project. The report should therefore be considered as an interim assessment until further guidance from JNCC and Natural England is provided.

1.3 Consultation

10. EATL met with Natural England on the 8th June 2016 where the HRA was discussed. This meeting reaffirmed the pre-application position with regard to sufficiency of information required to undertake the assessment. This position is reflected in the Statement of Common Ground (SoCG) between EATL and Natural England.

11. EATL has engaged with JNCC and Natural England on development of casework advice guidance in relation to management measures where a number of scenarios and potential approaches have been discussed. However, interim guidance from JNCC on the possible management measures was not available at the time of writing. In the absence of confirmed management measures no further consideration is given to modelling due to the speculative nature of these discussions.

12. EATL provided a draft of this report to Natural England for comment on the 20th July 2016. Natural England had no comments on the text itself, but provided the following response via email (5th August 2015).

"Natural England is supportive of the approach that has been taken to the assessment at this time, given the limitations of the Conservations Objectives only being in draft form and the management measures having not been finalised yet. We note the assessment is interim and is subject to change.

We look forward to working with EATL to progress the assessment including undertaking a cumulative assessment, once further information becomes available and will continue to engage with EATL to progress this."

2 Screening of marine mammal designated sites

2.1 Conclusions from HRA Screening

13. The East Anglia THREE HRA Screening (Document Reference 5.4) concluded no LSE for all currently designated SACs and Sites of Community Importance (SCIs) with marine mammal features. Therefore these have been screened out for further assessment. Following consultation, Natural England agreed with the conclusions reached in the screening assessment (via email 13th August 2015). This conclusion has been confirmed post-submission of the DCO application and is stated in the SoCG between EATL and Natural England.

14. The HRA Screening (Document Reference 5.4, Section 2.5.4) and consultation with Natural England (*Appendix 12.1* (Document Reference 6.3.12 (1)) of the East Anglia THREE DCO application) identified the proposed Southern North Sea dSAC (now pSAC) for harbour porpoise as the only Natura 2000 site for marine mammals requiring further assessment for the proposed East Anglia THREE project. Section 2.5.4 of the HRA Screening (Document Reference 5.4) identified the following potential sources of impact on the harbour porpoise qualifying feature:

- Potential disturbance and displacement as a result of increased noise levels generated during construction;
- Changes in prey availability during construction, operation and decommissioning; and
- Increased collision risk with vessels during construction, operation and decommissioning.

15. The potential for any lethal effects and auditory injury (instantaneous onset of Permanent Threshold Shift (PTS)) associated with underwater noise has been screened out of the HRA assessment, as proposed mitigation measures associated with pile driving will ensure this is not a risk for marine mammals (as agreed through the Evidence Plan process and in response to the Preliminary Environmental Information Report consultation (see section 12.1.5.3 of Document Reference 6.3.12 (1)). Whilst predicted noise levels in very close proximity to the pile are comparable to those estimated for injury and mortality the establishment of exclusion zones and soft-start, through the Marine Mammal Mitigation Protocol (MMMP), would reduce the risk to any marine mammals within a few metres of the pile during installation.

16. A European Protected Species (EPS) Licence would also be sought from the MMO supported by a detailed risk assessment of the potential risk to harbour porpoise based

on the finalised project parameters and piling schedule/details. EATL has received written confirmation from the MMO that, based on available information and current evidence provided, the MMO see no reason not to issue an EPS licence under regulation 53 of the Conservation of Habitats and Species Regulations 2010 on submission of an application (*Appendix A*).

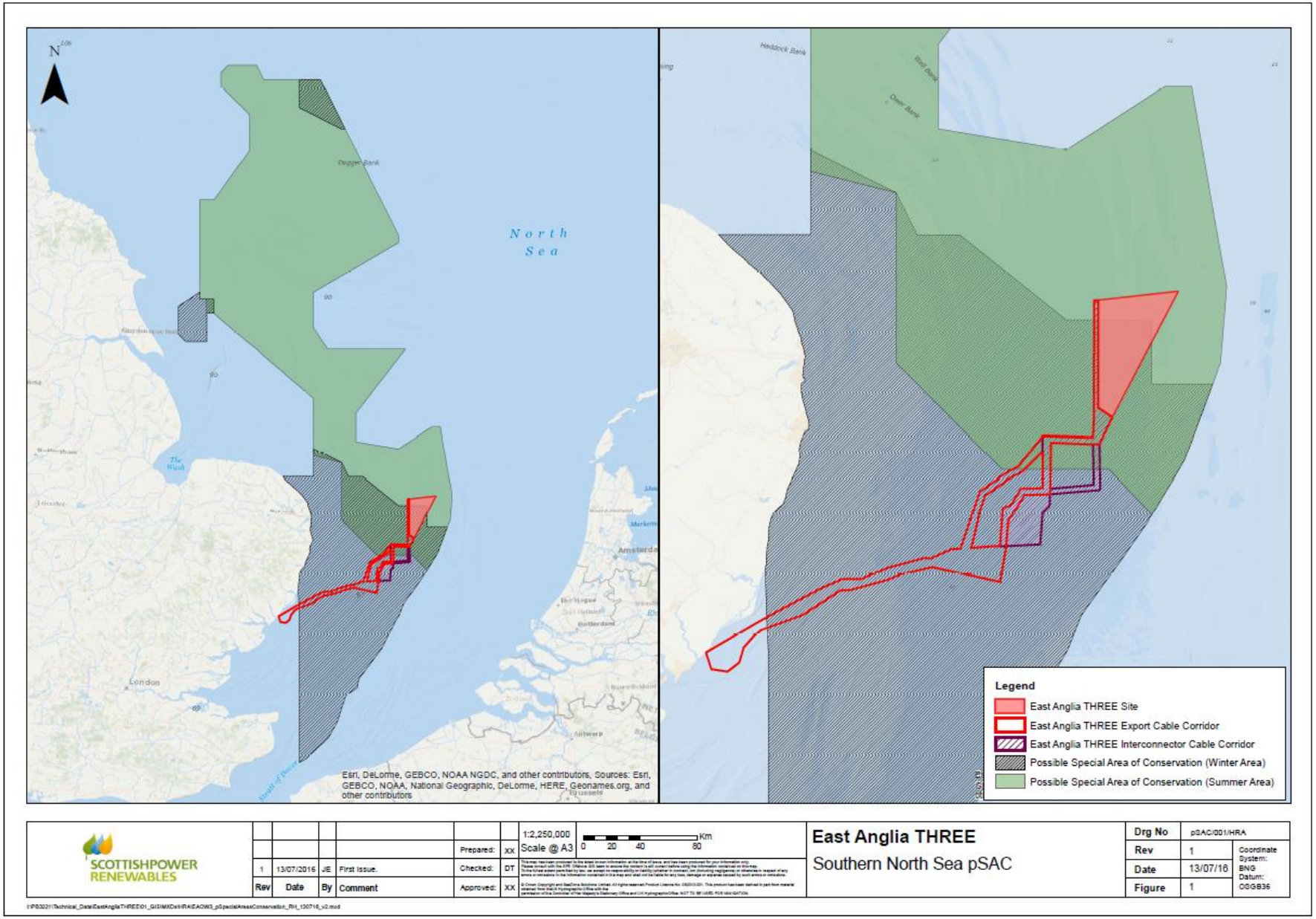
17. EATL have provided a draft marine mammal mitigation protocol (dMMMP) with the DCO application (Document Reference 8.15 of the East Anglia THREE DCO application). The final MMMP will be developed in the pre-construction period and will be based upon best available information and methodologies at that time, in consultation with the relevant authorities. Embedded mitigation has been agreed during consultation with Natural England (Document Reference 6.3.12 (1). As stated in section 12.3.2 of Chapter 12 Marine Mammal Ecology of the ES (Document Reference 6.1.12 of the East Anglia THREE DCO application), EATL will commit to the use of soft-start and exclusion zones to prevent the risk of auditory injury to EPS during pile driving activities.

18. Other sources of underwater noise (mostly low frequency noise) during installation and operation (such as vessel noise, seabed preparation, rock dumping, cable installation and maintenance, or turbine noise) are not predicted to cause lethal effects or auditory injury (defined as PTS) to marine mammals as assessed in the ES. As stated in Table 12.2 of the ES, explosives (which do have the potential to cause lethal effects or injury) will not be used during decommissioning.

19. The conclusions of the HRA Screening remain valid for all SACs and SCIs with marine mammal features. The potential impacts, as outlined above, on the dSAC (now pSAC) are assessed below. The potential impacts are assessed individually for the proposed East Anglia THREE project.

20. An in-combination assessment is not completed at this time because further advice is awaited from Natural England in relation to the geographical scale of the assessment required and which plans or projects would therefore need to be included within an in-combination assessment. Further advice is also awaited in respect of the methodology for the in-combination assessment. Discussion with Natural England is ongoing and it is EATL's understanding that the necessary advice will be provided by Natural England to enable a full assessment to be provided by Deadline 4.

21. Associated works which may give rise to potential impacts for underwater noise will be subject to additional licensing (post DCO consent) and notifications e.g. geophysical surveys and unexploded ordnance (UXO) clearance.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Legend
East Anglia THREE Site
East Anglia THREE Export Cable Corridor
East Anglia THREE Interconnector Cable Corridor
Possible Special Area of Conservation (Winter Area)
Possible Special Area of Conservation (Summer Area)
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3 Southern North Sea pSAC for Harbour Porpoise

22. The Southern North Sea pSAC is the largest of the pSACs proposed for the conservation of harbour porpoise. The only qualifying feature of the site is harbour porpoise (the Habitats Directive Annex II species).

23. The location and size of the proposed Southern North Sea pSAC for harbour porpoise is shown in Figure 1.

3.1 Conservation Objectives

24. The draft Conservation Objectives for the proposed Southern North Sea pSAC are designed to ensure that the obligations of the Habitats Directive can be met. Article 6(2) of the Directive requires that there should be no deterioration or significant disturbance of the qualifying species or to the habitats upon which they rely.

25. The draft Conservation Objectives for the site are (JNCC & Natural England 2016):

To avoid deterioration of the habitats of the harbour porpoise or significant disturbance to the harbour porpoise, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to maintaining Favourable Conservation Status (FCS) for the UK harbour porpoise.

To ensure for harbour porpoise that, subject to natural change, the following attributes are maintained or restored in the long term:

1. The species is a viable component of the site;

2. There is no significant disturbance of the species; and

3. The supporting habitats and processes relevant to harbour porpoises and their prey are maintained.

26. These draft Conservation Objectives '*are based on considerations of the ecological requirements of the species within the site, yet their interpretation is contextualised in their contribution to maintaining*[1] *FCS at a wider scale. With regard the Southern North Sea site, harbour porpoise need to be maintained rather than restored'* (JNCC & Natural England 2016).

[1] Maintain implies that, based on our existing understanding, the feature is regarded as being in favourable condition and will, subject to natural change, remain in this condition after designation (JNCC & Natural England 2016).

27. **The first draft Conservation Objective** is designed to minimise risk to species viability by activities within the site, such as activities that could kill, injure or significantly disturb harbour porpoise.

28. It is noted that as EPS under Annex IV of the Habitats Directive, harbour porpoise are already strictly protected wherever they are in European waters (JNCC et al. 2010; JNCC & Natural England 2016). As such several management measures are already in place in the UK. Harbour porpoise are protected under Article 12 of the Directive from deliberate killing (or injury), capture and disturbance throughout its range. This is enacted through The Conservation of Habitats and Species Regulations 2010 for England and Wales and the Offshore Marine Conservation (Natural Habitats, etc.) Regulations 2007 (Offshore Marine Regulations, OMR, as amended in 2009 and 2010). It is an offence under these Regulations to deliberately disturb EPS in such a way as to: a) impair their ability to survive, to breed or reproduce, or to rear or nurture their young or b) to affect significantly the local distribution or abundance of that species.

29. The Southern North Sea pSAC was selected for harbour porpoise as evidence supports long-term, preferential use by this species compared to other areas of the North Sea (JNCC 2015). However, as the number of harbour porpoise using the pSAC naturally varies, JNCC & Natural England (2016) have not defined an exact number of animals within the site above which the species is viable or below which it will become unviable. In addition, no data support the preferential use of this area for breeding and calving.

30. **The second draft Conservation Objective** aims to ensure that the site contributes, as best it can, to maintaining the FCS of the wider harbour porpoise population. Therefore, JNCC & Natural England (2016) state that '*it is how the impacts within the site translate into effects on the North Sea Management Unit (MU) population that are of greatest concern*' (see section 4.6 of this report for more information on the North Sea MU). JNCC & Natural England (2016) note that due to the mobile nature of this species the concept of a 'site population' may not be appropriate for this species. JNCC (2015) also advise that assessments of effects of plans or projects (i.e. HRA) need to take into consideration population estimates at the MU level, to account for daily and seasonal movements of the animals.

31. Disturbance of harbour porpoise may lead to displacement from an area, and the temporary loss of habitat. As such, JNCC & Natural England (2016) suggest that activities within the pSAC should be managed to ensure access to the site; and any disturbance should not lead to the exclusion of harbour porpoise from a significant portion of the site for a significant period of time.

32. Currently, JNCC and Natural England are preparing interim Casework Advice Guidance in relation to various activities to expand this supplementary advice in order

to define 'significant portion and period' in the context of impacting site integrity. However at the time of writing, this interim guidance was not available. There is currently no further guidance publicly available.

33. **The third draft Conservation Objective** is designed to ensure that harbour porpoise are able to access food resources year round, and that activities occurring in the pSAC will not affect this.

34. The Southern North Sea pSAC boundary is based on a modelling prediction of harbour porpoise habitat (Heinänen & Skov 2015), and harbour porpoise densities are linked to this modelled suitable habitat.

3.2 Management Measures

35. Specific management measures are yet to be developed for the pSAC, however JNCC & Natural England (2016) advise that '*the site should be managed in a way that ensures that its contribution to the maintenance of the harbour porpoise population at FCS is optimised, and that this may require management of human activities occurring in or around the site if they are likely to have an adverse impact on the site's Conservation Objectives either directly or indirectly identified through the assessment process'*.

36. JNCC & Natural England (2016) also state that '*management measures are the responsibility of the relevant regulatory bodies, which consider the SNCBs' advice and hold appropriate discussions with the sector concerned, but the scale and type of mitigation is decided by the Regulators*'.

37. JNCC & Natural England (2016) have completed an initial assessment and draft advice at the UK level of human activities specifically occurring within or close to the Southern North Sea pSAC that would be expected to impact the site. The advice identifies activities with potential to affect harbour porpoise using the site (site level impacts) as well as (where possible) its supporting habitats in UK waters which may impact the species' capacity to maintain FCS. The aim is that the advice should also be used to help identify the extent to which existing activities are, or can be made, consistent with the Conservation Objectives, and thereby focus the attention of Relevant and Competent Authorities and surveillance programmes to areas that may need Management Measures.

38. In the absence of management measures for the pSAC, EATL are confident that their commitment to develop a MMMP and EPS licencing in consultation with the relevant authorities in the pre-construction period will ensure that management and mitigation measures, if deemed necessary, can be enforced and will use the most appropriate methods therefore upholding the Conservation Objectives

4 Harbour porpoise

39. The following sections review available information for harbour porpoise which is relevant to the assessment of potential effects on the proposed Southern North Sea pSAC, more detail on harbour porpoise in the Southern North Sea can be found in the ES (Document Reference 6.1.12).

40. Harbour porpoise are the most abundant cetacean species in European Atlantic shelf waters (Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS) 2012; Hammond et al. 2013) and is the cetacean most likely to be found in the East Anglia THREE site as shown by the site specific surveys (*Appendix 12.2* of the ES (Document Reference 12.3.12 (2) of the East Anglia THREE DCO application)) and other available data sources.

41. Since the submission of the DCO application in November 2015 two key reports, Paxton et al. (2016) and Heinänen & Skov (2015) have been published following work commissioned by the JNCC. These reports relate to Phase-III of the Joint Cetacean Protocol (JCP) project and a project completed by DHI aimed at the identification of discrete and persistent areas of relatively high harbour porpoise density in the wider UK marine area, respectively.

42. Both projects, through the use of complex modelling were aimed at producing distribution maps and estimates of density or regulatory occurring cetacean species (including harbour porpoise) in UK waters. The JCP specifically aimed to examine abundance and changes in abundance which can be used to assist in environmental impact assessments (Paxton et al. 2016). The DHI analyses helped identify discrete and persistent areas of high harbour porpoise density in the UK marine area using habitat mapping; the aim of this project was to assist in the identification of potential harbour porpoise SACs (Heinänen & Skov 2015). Both projects used numerous data sources collated by the JCP.

43. The results of the two projects produced broadly similar modelled densities of harbour porpoise; however derivation of the results using different modelling approaches resulted in some key differences (JNCC 2016).

44. As such, JNCC have provided some advice on the use of the outputs in analyses for environmental impact assessments. JNCC (2016) concluded that the DHI density surfaces better represent the expected distribution and abundance of harbour porpoise for any given area of interest and should, therefore, be used preferentially. The densities from the DHI report are not currently available for wider use and, in the interim, JNCC advice that the JCP Phase-III density surfaces for harbour porpoises may be used.

45. Given the current status of these new reports, prior to submission of the final report, EATL will complete a review of all available data sources to ensure that data, as presented in the ES (Document Reference 6.1.12 of the East Anglia THREE DCO application) have not been superseded, and that the most appropriate data are used in the assessment.

4.1.1 Distribution

46. In Europe, harbour porpoise are distributed throughout the North Sea, the Skagerrak, Kattegat, Irish Sea, west of Ireland and Scotland, northwards to Orkney and Shetland and off the coast of Norway (Jackson and McLeod 2002; Reid et al. 2003).

47. Harbour porpoise are present throughout most of the North Sea throughout the year, with higher numbers occurring between May and October (Reid et al. 2003).

48. The Small Cetaceans in the European Atlantic and North Sea surveys (SCANS I and SCANS II), were a major international collaborative survey program carried out to provide baseline data on cetacean abundance in the North, Baltic and Celtic Seas. Surveys were undertaken in the summers of 1994 and 2005 (the extent of the 2005 survey was greater than in 1994). Results from these studies indicate that, despite no overall change in population size between the two surveys, there was a possible shift in harbour porpoise distribution. The results indicate that the main concentration has moved from the waters off the north eastern UK and Denmark to the southern North Sea (Hammond et al. 2013; Hammond and Macleod 2006; Camphuysen 1994; Hassani 2006; JNCC 2013). Such large scale changes in the distribution of harbour porpoise are likely to be the result of changes to the availability of prey within the North Sea (SCANS II 2008).

49. The SCANS III 2016 survey is currently underway with preliminary results expected in early 2017.

4.1.2 Abundance

4.1.2.1 Abundance in North Sea

50. Estimated abundance of harbour porpoise in 2005 based on the SCANS II survey was 323,968 (Coefficient of Variation (CV) = 0.22; 95% Confidence Interval (CI) = 256 300 - 549 700; Hammond et al. 2013). This can be compared to 341,366 based on the 1994 survey (CV = 0·14; 95% CI =260 000 - 449 000; SCANS II 2008). Therefore, there was no significant reported change in the overall estimated abundance in the North Sea.

51. In 2005 the Southern North Sea population was estimated to be 140,229; the Northern North Sea was 33,598; the Central North Sea was 58,623; and a European wide population was 375,358 (95% CI 256,304 - 549,713; Hammond et al. 2013).

52. The East Anglia THREE site and offshore cable corridor would be located within SCANS II survey Block B, with an estimated abundance of 40,927 (CV = 0.38; Hammond et al. 2013).

4.1.2.2 Density in East Anglia THREE site

53. The SCANS II density surfaces suggest that the highest density of harbour porpoise was to the North/West of the East Anglia THREE project. The East Anglia THREE site has a density of between 0.4-0.8 harbour porpoise per km^2. The mean density for the SCANS II survey block B, which encompasses the East Anglia THREE site is 0.331 (CV = 0.38) individuals per km^2 (Hammond et al. 2013). [2]

54. Monthly aerial surveys conducted across the East Anglia THREE site plus a survey buffer of 4km, commenced in September 2011 and were completed in August 2013. These surveys indicated that low densities of harbour porpoise were present across the East Anglia THREE site plus buffer during both survey years (*Appendix 12.2* of the ES, (Document Reference 12.3.12 (2) of the East Anglia THREE DCO application)).

55. Mean densities of positively identified harbour porpoise within the East Anglia THREE site plus buffer across the full 24 month survey period were 0.179 individuals/km^2. Taking a precautionary approach following Evidence Plan meeting 2 (see *Appendix 12.1* of the ES (Document Reference 12.3.12 (2) of the East Anglia THREE DCO application)) all sightings classified as 'Unidentified dolphin / porpoise' in the survey data have been assumed to be harbour porpoise, and used to generate a maximum density for harbour porpoise of 0.294 individuals/km^2.

56. The site specific surveys and densities generated from these surveys were determined to be more reliable and realistic for the East Anglia THREE site, compared to the SCANS II survey, due to the greater resolution and more recent dedicated survey effort.

4.2 Diet

57. Harbour porpoise in the North Sea feed mainly on demersal fish, notably small gadoids, clupeids and sandeels (Ammodytidae) (Santos and Pierce, 2003). It is believed that the balance of their diet has changed over the past 40 years from herring *Clupea harengus* to one more dominated by sandeels and whiting *Merlangius merlangus*, reflecting the change in composition of available food resources (Reid et al. 2003; Santos and Pierce 2003; Santos et al. 2004).

58. Harbour porpoise feed on a range of fish species and significant porpoise aggregations may reflect prey availability. Elsewhere in the world, harbour porpoises tend to

[2] The SCANS II surveys were completed on a single day, and abundance estimates from surveys with low survey effort such as this can have high levels of uncertainty. The uncertainty associated with the estimates for porpoise in the East Anglia region is deemed to be moderate (SMRU Ltd 2010). It has been a decade since the SCANS II surveys therefore, as the distribution of harbour porpoise may have shifted, the use of robust site-based estimates are deemed the most reliable.

concentrate their movements in small focal regions (Johnston et al. 2005), which often approximate to particular topographic and oceanographic features and are associated with prey aggregations (e.g. Raum-Suryan and Harvey 1998; Johnston et al. 2005; Keiper et al. 2005; Tynan et al. 2005, cited in JNCC 2007). Consequently, habitat use is highly correlated with prey density rather than any particular habitat type and it is highly likely that similar mechanisms operate in the eastern North Atlantic (JNCC 2007; Weir et al. 2007). However, there is currently insufficient (often no) evidence linking habitat characteristics to prey of the harbour porpoise (JNCC & Natural England 2016).

4.3 Movements

59. The seasonal movements and migratory patterns of harbour porpoise in the north-east Atlantic and North Sea are not well understood. Harbour porpoise may reside within an area for an extended period of time, although onshore / offshore migrations and movements parallel to the shore are also thought to occur (Bjørge & Tolley 2002). In the North Sea, there may be a general westward movement from the eastern North Sea and possibly from the very northern areas of the North Sea into the western edge of the northern North Sea (along the east coast of Scotland) during April to June and a further influx to the northern North Sea during July to September (Northridge et al. 1995). Seasonal movements are thought to coincide with prey availability and the calving and mating seasons.

60. Harbour porpoise are highly mobile and satellite telemetry work in Danish waters has shown an individual moving more than 1,000km from Danish waters to east of the Shetland Islands (Teilmann et al. 2004). In Danish waters, harbour porpoise have been shown to concentrate their movements in relatively large areas, ranging from approximately 400 to 1,600km^2 (Teilmann et al. 2004).

61. More recently, the modelling completed by Heinänen and Skov (2015) predicts that peaks in harbour porpoise density in the Southern North Sea vary seasonally, with variation being linked to water depth and variables within the water column. Based on this prediction delineation of the Southern North Sea pSAC also shows seasonal variation (Figure 1).

4.4 Life history

62. At present, not enough is known about harbour porpoise to determine whether some parts of their range are more important for breeding than others. Potential calving grounds have been identified in the German North Sea (Sonntag et al. 1999), but there is currently no evidence of specific habitat requirements for mating and calving in UK waters (JNCC 2002, 2015).

4.5 Reference Population

63. For conservation and management purposes, it is sensible to divide populations into smaller units, known as Management Units (MUs). Three MUs appropriate for harbour porpoise have been determined for UK waters (IAMMWG 2015).

64. The reference population used in the assessment for harbour porpoise is the North Sea MU with an estimated abundance of 227,298 (CV 0.13, 95% CI 176,360 – 292,948) based on the Hammond et al. (2013) analysis of the SCANS II data (IAMMWG 2015). The area of this MU is approximately 641,800km^2.

65. This reference population was agreed with Natural England in consultation (November 2013) and at Evidence Plan meeting 5 (6th July 2015) (see *Appendix 12.1* of the ES).

4.6 Current pressures

66. The most common sources of mortality of stranded harbour porpoise are by-catch, attack from bottlenose dolphins, starvation and infectious disease (JNCC 2013).

67. Harbour porpoise are under pressure, in particular from incidental fisheries by-catch, especially in gill nets. The principal area of concern for by-catch is the south-western waters of the western English Channel and Celtic Sea. By-catch has resulted in several thousand mortalities per year and although the problem may have been somewhat mitigated under EC Regulation 812/2004, concern remains that improved monitoring is needed, both for estimating by-catch rates and determining effective mitigation measures. However, it is likely that, based on assessment including estimated levels of by-catch, the harbour porpoise population in the North Sea has relatively low rates of potential increase (Winship 2009).

68. Data from necropsies reveal a high prevalence of infectious diseases and parasitism in harbour porpoise, which may be linked to the immunosuppressant effects of persistent organic pollutants in body tissues (Jepson et al. 2005; Hall et al. 2006; Pierce et al. 2008; Law et al. 2010). It has also been speculated that the small size, and hence low amount of energy reserves carried in the blubber, makes harbour porpoise vulnerable to prey depletion (MacLeod et al. 2007).

69. In addition, their widespread occurrence in coastal waters means that harbour porpoise are exposed to a wide range of anthropogenic impacts, including coastal and marine development and industry, pollution and disturbance by boat traffic.

70. Harbour porpoise have relatively high daily energy demands and need to consume between 4% and 9.5% of their body weight in food per day (Kastelein et al.1997). If a harbour porpoise does not capture enough prey to meet its daily energy requirements it can rely on stored energy (primarily blubber) for three to five days, depending on body condition (Kastelein et al. 1997). Thermoregulation, especially in cold water, has high energy costs in marine mammals. Kastelein et al. (1997) estimate that a harbour

porpoise may have a life expectancy of as little as three days in waters of 20°C under starvation conditions. Should harbour porpoise be excluded from an area of key prey resource it will likely seek an alternative food resource that could have an effect on the individual's fitness.

71. A more recent study by Wisnlewska et al (2016) using high-resolution movement and prey echo recording tags on five wild harbour porpoise has shown that porpoises forage nearly continuously day and night, attempting to meet their metabolic demands foraging on small prey. This further supports that even a moderate level of anthropogenic disturbance may have severe fitness consequences for individuals and populations.

72. In some areas in Scotland, the biggest single cause of mortality in recent years has been fatal attacks by resident bottlenose dolphins. Studies have shown that bottlenose dolphins will attack and kill harbour porpoise but do not actively prey on them for food (Ross and Wilson 1996).

5 Potential Effects of East Anglia THREE

73. We have not included a full description of the project as this is available in the primary application documentation (see Chapter 5 Description of the Development, (Document Reference 6.1.5) and Chapter 12 Marine Mammal Ecology). We have however extracted the key elements of relevance throughout the report.

5.1 Assessment of potential effects

74. The potential impacts associated with the proposed East Anglia THREE project will be assessed for the North Sea MU reference population for harbour porpoise. This is in line with JNCC & Natural England (2016) draft Conservation Objectives and Advice on Activities, which states that it is how the impacts within the site translate into effects on the North Sea MU population that are of greatest concern, especially with regard to the second Conservation Objective for the Southern North Sea pSAC.

75. The North Sea MU population was used as the reference population in the impact assessment in Chapter 12 Marine Mammal Ecology of the ES. This population estimate is used in this report in the absence of management measures to provide context on the significance of the effect.

76. In relation to the draft Conservation Objectives for the site, the potential effects and the results of the HRA screening (Document Reference 5.4) are summarised in *Table 5.1.1*.

Table 5.1.1 Potential effects and results of HRA Screening for the proposed East Anglia THREE project in relation to the draft Conservation Objectives for the Southern North Sea pSAC

Draft Conservation Objective	Potential effect	Screened in to assessment (Y/N)?
The species is a viable component of the site	Lethal effects and auditory injury from underwater noise during installation and operation	N
	Disturbance and displacement as a result of increased underwater noise levels during construction	Y
	Increased collision risk with vessels during installation and operation	Y
There is no significant disturbance of the species	Disturbance and displacement as a result of increased underwater noise levels during construction	Y
The supporting habitats and processes relevant to harbour porpoises and their prey are maintained	Changes in prey availability	Y
	Re-suspension of sediment during installation	N
	Accidental release of contaminants	N

5.2 Underwater noise during construction

77. The potential impacts of underwater noise on marine mammals are lethal injury, physical injury, auditory injury and behavioural disturbance. Very close to the source, the high peak pressure sound levels have the potential to cause death, or severe injury leading to death. High exposure levels from underwater sound sources can also cause auditory injury; taking the form of a permanent loss of hearing sensitivity (PTS) or, a temporary loss in hearing sensitivity (Temporary Threshold Shift or TTS). Marine mammals may exhibit varying intensities of behavioural response at lower noise levels. The response can vary due to exposure level, the hearing sensitivity of the individual, context, previous exposure history or habitation, motivation and ambient noise levels (e.g. Southall et al. 2007).

78. The greatest potential impact associated with the East Anglia THREE project that could affect marine mammals is associated with underwater noise from pile driving during construction. The National Physical Laboratory (NPL) completed underwater noise propagation modelling based on a range of hammer energies across the East Anglia THREE site (see Chapter 9 Underwater Noise and Electromagnetic Fields and Appendix 9.1 of the ES (Document References 6.1.9 and 6.3.9 (1) of the East Anglia THREE DCO application)).

79. The potential for any lethal effects associated with underwater noise was screened out of the HRA assessment, as proposed mitigation measures will ensure this is not a risk for harbour porpoise. The predicted noise levels in very close proximity to the pile are comparable to those estimated for injury and mortality and would only be expected at noise levels substantially above those necessary to cause auditory injury. The pile driving installation is thus unlikely to result in radiated noise levels sufficient to cause instantaneous mortality in harbour porpoise beyond a few metres from the pile during installation. As a result of the establishment of mitigation zones through the MMMP, there should be no harbour porpoise within a few metres of the pile during installation.

80. The potential ranges for auditory injury (instantaneous PTS onset) have been modelled and determined for harbour porpoise (Document Reference 6.1.12, Section 12.6.1.1.2.2). The establishment of a mitigation zone, out to the maximum range of exposure that could lead to instantaneous PTS onset is included as embedded mitigation, along with a soft-start procedure. As a result of the mitigation measures, through the MMMP and EPS licensing, there should be no harbour porpoise exposed to noise levels that could lead to the instantaneous onset of PTS. Therefore, the potential for the instantaneous onset of PTS was screened out and this assessment for underwater noise only considers behavioural avoidance effects.

81. Behavioural reactions that may occur as a result of exposure to noise include, orientation or attraction to a noise source, increased alertness, modification of characteristics of their own sounds, cessation of feeding or social interaction, alteration

of movement / diving behaviour, temporary or permanent habitat abandonment (Southall et al. 2007).

82. In the noise assessment (Chapter 9 Underwater Noise and Electromagnetic Fields and Appendix 9.1 of the ES) the single pulse behavioural disturbance criterion was considered for the purpose of estimating ranges where a strong aversive response might occur (100% avoidance) as it is based on the onset of TTS. This type of response may be considered likely to affect vital rates based on the potential for a severe or sustained avoidance of an area.

83. Possible avoidance has the ability to affect foraging, reproduction or survival, should an individual respond, but not all individuals that are exposed to this level of noise will respond.

84. The worst case for potential disturbance (fleeing response / TTS onset and possible avoidance) effects has been determined assuming two concurrent piling events of 12m diameter monopiles using the maximum hammer energy of 3,500kJ. The total actual piling duration for the proposed East Anglia THREE project is estimated to be 412 hours (approximately 17 days) within a total piling period of up to 8 months (based on 100 turbines). The maximum distance and approximate areas for disturbance are shown in *Table 5.1.2* (see Chapter 12 Marine Mammal Ecology for full details of the assessment).

Table 5.1.2 Summary of fleeing response /TTS onset and possible avoidance distances and approximate areas for single strike with 3,500kJ hammer energy during construction at the East Anglia THREE site

Species	Impact criteria SEL (dB re 1 μPa^2·s)	Distance for 3,500kJ hammer energy	Approximate area	Percent of North Sea MU area
Harbour porpoise	Fleeing response / TTS onset (pulse SEL 164dB re 1 μPa^2·s)	~5-8km	281.6km^2	0.04%
	Possible avoidance of area by exposed individuals (pulse SEL 145dB re 1 μPa^2·s)	~37-70km	13,469km^2	2.1%

Table 5.1.3 Summary of estimated number of harbour porpoise (based on different density estimates) that could be affected during pile driving (2 x 12m pile concurrent single strike with 3,500kJ hammer energy) at the East Anglia THREE site

Density of harbour porpoise (individuals/km^2)	Estimated number of harbour porpoise (% of MU population)			
	Fleeing response / TTS onset (pulse SEL 164dB re 1 μPa^2·s) [281.6km^2]	Possible avoidance by exposed individuals assuming response by stated % of those exposed to the stimulus (pulse SEL 145dB re 1 μPa^2·s) [13,469km^2]		
		50%	75%	100%
0.179[1]	50 (0.022%)	1,206 (0.53%)	1,808 (0.80%)	2,411 (1.06%)
0.294[2]	**83 (0.036%)**	1,980 (0.87%)	**2,970 (1.31%)**	3,960 (1.74%)

[1]Estimate of harbour porpoise density for the East Anglia THREE site plus 4km buffer (ETAL, 2015)
[2]Estimate of harbour porpoise combined with unidentified dolphin/porpoise density for the East Anglia THREE site plus 4km buffer (ETAL, 2015)

85. The fleeing response / TTS area of 281.6km^2 could affect approximately 0.04% of the North Sea MU population (83 harbour porpoise). The possible avoidance area of 13,469km^2 could affect 1.7% of the MU population (3,960 harbour porpoise), based on 100% avoidance. This was based on all sightings classified as 'unidentified dolphin / porpoise' in the East Anglia THREE survey data to generate a maximum density for harbour porpoise (0.294 individuals/km^2; *Table 5.1.3*).

86. *Table 5.1.3* shows the estimated numbers of harbour porpoise which could be disturbed based on the areas in *Table 5.1.1*. Not all individuals that are exposed to the possible avoidance noise level will respond, therefore if assuming a precautionary 75% of the harbour porpoise respond, the estimated number of individuals affected (based on the density estimate of 0.294 individuals/km^2) is 2,970 which represent 1.3% of the NS MU population. If 50% respond, then approximately 0.9% of the NS MU population could be displaced.

87. The total actual piling duration for the proposed East Anglia THREE project is estimated to be 412 hours (approximately 17 days) for 100 12MW monopiles over a total piling period of 8 months. There is no evidence that harbour porpoise displaced

from windfarms, or by vessels, suffer any mortality as a consequence of displacement; any mortality due to displacement would be most likely a result of increased density in areas outside the affected area, resulting in increased competition for food where density was elevated. The displacement of 83 individuals would increase the density in the North Sea MU population by a negligible and undetectable amount[3] (0.3542 to 0.3543 individuals/km^2).

88. The potential for a significant increase in underwater noise from vessels would be considerably less than those estimated for piling operations. The potential for increased disturbance from vessels during the proposed construction, operation and maintenance, and decommissioning of the proposed East Anglia THREE project, would be expected to be limited to the East Anglia THREE site and offshore cable corridors, as any increase in vessel movements to and from the site would be relatively small in comparison to existing vessel movements in the area and harbour porpoise North Sea MU. Therefore, their likely contribution to the overall background underwater noise is likely to be low and any further disturbance or displacement of harbour porpoise that might occur would be temporary, intermittent and short-term. Although some data support the probability that small cetaceans avoid areas of intense boat activity (Thomsen et al. 2006), studies indicate that noise levels from large surface vessels, that would be used during the proposed construction, operation and maintenance, and decommissioning of the proposed East Anglia THREE project are unlikely to cause physiological damage to harbour porpoise (Malme et al. 1989; Richardson et al. 1995).

89. This assessment indicates that, based on the worst-case scenario for the proposed East Anglia Three project, the maximum harbour porpoise density and the maximum area of possible avoidance, the percentages of the North Sea MU population that could be affected would be minimal. A significant disturbance is therefore highly unlikely.

90. In conclusion, based on currently available information, there is no potential for an LSE based on the first or second draft Conservation Objectives for the site, especially when the impacts are translated into effects on the North Sea Management Unit as advised by JNCC & Natural England (2016). With regard to the first draft Conservation Objective, to maintain the species as a viable component of the site, disturbance at the assessed level is unlikely to be detectable above natural variation. The implementation of mitigation measures through the MMMP will also prevent lethal effects or injury to harbour porpoise minimising risk to species viability by activities within the site in line with the first draft Conservation Objective.

[3] For context, SCANS II predicted a mean density for survey block B, which encompasses the East Anglia THREE site, of 0.331 with a CV of 0.38 individuals per km^2 (Hammond et al. 2013).

5.3 Impacts on prey

91. Potential indirect impacts on harbour porpoise that may result through changes in prey species could include; changes in distribution, abundance and community structure of available prey, as well as increased competition with other marine mammal species and implications for reproductive success.

92. The potential impacts on fish species during construction can result from increased suspended sediment concentrations and sediment re-deposition, and underwater noise. These potential impacts were assessed in Chapter 11 Fish and Shellfish Ecology of the ES (sections 11.6.1, 11.6.2 and 11.6.3; Document Reference 6.1.11 of the East Anglia THREE DCO application) which showed the potential impacts were assessed as minor adverse at worst.

93. Potential sources of underwater noise and vibration include piling, vessel traffic, sea bed preparation, rock dumping and cable installation. Of these, piling (particularly in relation to the installation of monopiles) is considered to produce the highest levels of underwater noise and therefore has the worst case potential to result in adverse impacts on fish and shellfish receptors (Nedwell et al. 2007 Lindeboom et al. 2011), therefore the impact assessment focused on piling noise. Piling noise has the potential to cause traumatic damage to fish in very close proximity (<1km from the piling vessel), though in general this is avoided through soft-start procedures. Consequently displacement is likely to be the most evident impact on the prey resource, and this displacement would be temporary (for the duration of the piling which is estimated to be approximately 17 days for 100 12MW monopiles over a total piling period of 8 months).

94. The maximum range for potential disturbance at which there could be a behavioural response is 34km for demersal fish and 49km for pelagic fish (Document Reference 6.1.11). Based on the largest of these ranges and a circular disturbance contour, the area which prey may be displaced from is 7,543km^2 (1.2% of the North Sea MU area). Approximately 2,218 harbour porpoise (approximately 1% of the North Sea MU) could be present in this area, based on an estimated density of 0.294 individuals/km^2. However, harbour porpoise distribution is considered to reflect prey distribution, therefore they would be expected to follow prey availability. In addition, the estimated area of potential disturbance for prey is considerably lower than the estimated area of harbour porpoise displacement and therefore it is questionable whether the possible effects upon prey resource would be expressed as indirect impacts upon harbour porpoise if they were already displaced from a larger area.

95. Potential impacts on fish species during operation and maintenance can include physical disturbance and loss or changes of seabed habitat, operational noise, and electromagnetic field (EMF) effects. These impacts would occur over the operational lifetime of the proposed East Anglia THREE project of 25 years and could be

considered permanent in the context of harbour porpoise life history. However, operational and maintenance impacts are likely to be highly localised around the project infrastructure, and any maintenance impacts would be intermittent and temporary.

96. As a very conservative approach the potential impacts on prey during operation and maintenance are assumed to occur over the East Anglia THREE site and offshore cable corridor area of 876km^2 (based on the East Anglia THREE site area of 305km^2 and the offshore cable corridor area of 571km^2). Approximately 257.5 harbour porpoise (0.11% of the NS MU) could be present in the East Anglia THREE site and offshore cable corridor area, based on an estimated density of 0.294 individuals/km^2. However it should be noted that some of the impacts could result in a positive effect (e.g. the aggregation of prey around seabed structures). As a precautionary approach it is assumed that there would be a negative effect (e.g. fish displacement).

97. During decommissioning, potential impacts on fish species include physical disturbance, loss or changes of habitat, increased suspended sediment concentrations, re-mobilisation of contaminated sediments and underwater noise. It is anticipated that this will be on a similar scale (or less) to construction impacts

98. Based on the worst-case scenario of the disturbance / displacement of prey species during piling operations the maximum area of possible disturbance is 7,543km^2. The area is only 1.2% of the harbour porpoise NS MU and the estimated maximum number of harbour porpoise that could be potentially affected is relatively low (approximately 1% of North Sea MU) and therefore unlikely to result in any significant long-term effects.

99. In conclusion, with regard to the third draft Conservation Objective, to maintain the supporting habitats and processes relevant to harbour porpoise, disturbance to prey species at the assessed level is unlikely to lead to displacement significantly above natural variation. Therefore, risk at this level will not impact the species viability of the pSAC and there would be no potential LSE.

5.4 Collision risk with vessels during construction, operation and decommissioning

100. During the construction of the proposed East Anglia THREE project there will be an increase in vessel traffic within the site associated with installation of the foundations, offshore sub-sea cables and other infrastructure. The estimated worst-case scenario could result in a maximum of 55 vessels on site at any one time, with an approximate total of 5,685 two way vessel movements based on a Single Phase approach and 7,636 two way vessel movements for a Two Phased approach (over a total of 41 and 45 months respectively). It is therefore considered that additional vessel movements during the construction period are likely to be short-term and localised in comparison to

existing shipping across the North Sea. The construction period will use mostly large vessels, which are likely to travel at slow speeds, whilst only small workboats and crew transfer vessels are likely to operate at greater speed. During the operation and maintenance of the project there will be an average of 4,000 two-way support vessel trips per year. It is estimated that the decommissioning phase will have fewer vessel trips than the construction phase (as for instance offshore sub-sea cables would be left in situ).

101. Vessel movements to and from the East Anglia THREE site are likely to be within existing vessel routes and the increase in the number of vessels is likely to be relatively low in comparison to current vessel movements in the North Sea MU.

102. The assessment of potential effects associated with collision risk as a result of the proposed East Anglia THREE project was therefore based on the area of the East Anglia THREE wind farm site and offshore cable corridors (approximately 876km^2 based on the East Anglia THREE wind farm area of 305km^2 and the export and interconnector cable corridors of 571km^2). This was agreed with Natural England at Evidence Plan meeting 5 (Document Reference 6.1.12(1)).

103. An estimated maximum of 257.5 harbour porpoise (0.11% of the NS MU population) could be present in the East Anglia THREE site and offshore cable corridor area.

104. There is very little information on the collision rates or avoidance behaviour of harbour porpoise with vessels. However, it has been estimated from post mortem examinations within the Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic (ASCOBANS) area that approximately 4% of deaths recorded could be as a result of vessel strikes, based on evidence of physical trauma (blunt trauma or propeller cuts) (Evans et al. 2011). Therefore the risk of collision is likely to be low.

105. The number of animals that could potentially be impacted has been assessed based on 0%, 50%, 90%, 95%, 98% and 99% avoidance rates (*Table 5.3.1*).

106. Based on a precautionary 95% avoidance rate, the potential numbers of harbour porpoise that could be exposed to collision risk with vessels associated with the proposed East Anglia THREE project is very low and unlikely to have any significant impact on the North Sea MU reference population (≤0.01% of the North Sea MU; *Table 5.3.1)*.

107. Risk at this level will not impact the species viability of the pSAC and therefore with regard to the first draft Conservation Objective there would be no potential LSE.

Table 5.3.1: Maximum number of harbour porpoise and percentage of the North Sea MU potentially at risk from direct impacts with vessels, with avoidance rates of 0%, 50%, 90%, 95%, 98% and 99%

Species	Maximum number of animals and percentage of NorthSea MU potentially at risk from direct impacts with vessels					
	0% avoidance	50% avoidance	90% avoidance	95% avoidance	98% avoidance	99% avoidance
Harbour porpoise	257.5 (0.11%)	137.8 (0.06%)	25.8 (0.01%)	12.9 (0.006%)	5.2 (0.002%)	2.6 (0.001%)

5.5 In-combination assessment

108. The types of plans and projects that should be included in the in-combination assessment and the approach to screening were agreed with Natural England during the Evidence Plan process (see Appendix 12.1 and Appendix 12.5 of the ES). The approach is based on the development stage of the plan or project (accounting for uncertainty in the tiered approach described in Appendix 12.5) as well as the quality of the data available.

109. An in-combination assessment is not completed at this time because further advice is awaited from Natural England in relation to the geographical scale of the assessment required and which plans or projects would therefore need to be included within an in-combination assessment. Further advice is also awaited in respect of the methodology for the in-combination assessment. Discussion with Natural England is ongoing and it is EATL's understanding that the necessary advice will be provided by Natural England to enable a full assessment to be provided by Deadline 4.

6 Management and mitigation of potential impacts on harbour porpoise

6.1 Mitigation and management for the proposed East Anglia Three Project

110. EATL has committed (as secured in the DCO) to the development of a MMMP in consultation with Natural England as well as EPS licencing to mitigate any risk of injury to harbour porpoise from pile driving noise. A dMMMP was included with the DCO application (Document Reference 8.15). The final MMMP will be developed in the pre-construction period and will be based upon best available information and methodologies at that time in consultation with the relevant authorities.

111. In the absence of current management measures for the possible Southern North Sea pSAC, EATL are confident that their commitment to develop a MMMP in consultation with the relevant authorities pre-construction period will ensure that management measures, if deemed necessary, can be enforced and will use the most appropriate methods.

112. EATL will complete an EPS licence application for harbour porpoise post consent, once the project design envelope is defined. The EPS will be agreed with the MMO and will be based on best available information at the time, including industry best practice. The MMO have confirmed that based on available information and current evidence provided, an EPS licence is required and that they would see no reason not to issue an EPS licence under regulation 53 of the Conservation of Habitats and Species Regulations 2010 on submission of an application (*Appendix A*).

113. EATL are strong supporters of industry projects established to understand the consequences of displacement on harbour porpoise based on empirical data, including active engagement in the DEPONS (www.depons.au.dk).

7 Summary and next steps

114. This assessment is based on draft Conservation Objectives for the Southern North Sea pSAC. Management measures are yet to be confirmed for this site, therefore there are no thresholds available against which to consider the effects of the proposed East Anglia THREE project. In the interim the North Sea MU has been used to provide context following JNCC & Natural England (2016) advice that '*it is how the impacts within the site translate into effects on the North Sea Management Unit (MU) population that are of greatest concern'*. This report should be considered as an interim assessment until further guidance from JNCC and Natural England is provided. It will be updated and subject to change.

115. However, based on the draft Conservation Objectives and this interim assessment there is no indication that the proposed East Anglia THREE project would not enable the draft Conservation Objectives to be upheld and there should be no potential for an LSE from the proposed East Anglia THREE project alone.

116. An in-combination assessment is not completed at this time because further advice is awaited from Natural England in relation to Conservation Objectives and management measures and the methodology to use. Discussion with Natural England is ongoing and it is EATL's understanding that the necessary advice will be provided by Natural England to enable a full assessment to be provided by Deadline 4.

117. The Conservation Objectives for the Southern North Sea pSAC remain as draft and Management Measures are yet to be confirmed. Once further guidance from JNCC and Natural England is provided this report will be updated. EATL anticipate that the next steps following such guidance will include an updated assessment of the potential for LSE of the proposed East Anglia THREE project in isolation and a full in-combination assessment.

118. The updated assessment will use (if available) the final Southern North Sea SAC boundary, Conservation Objectives and Management Measures to quantify impacts where appropriate. The methods used in the assessment will be agreed in consultation with Natural England, including the list of projects and scenarios to be included in the in-combination assessment. Conclusions will be drawn on the potential for LSE in order to inform any screening or assessment undertaken by the Competent Authority.

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9 APPENDIX A

East Anglia THREE – Approach to European Protected Species Licence, letter from the MMO.

Marine Management Organisation

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conservation@marinemanagement.org.uk
www.gov.uk/mmo

08 July 2016

Dear Sir/Madam,

East Anglia THREE – approach to European Protected Species Licence

This letter is to confirm that based on available information and current evidence provided, a European Protected Species licence is required and the Marine Management Organisation (MMO) would see no reason not to issue an EPS licence under regulation 53 of the Conservation of Habitats and Species Regulations 2010 on submission of an application.

Until a completed application is received and processed the MMO will not issue a wildlife licence.

On submission of an application the MMO will consult with our Statutory Nature Conservation Bodies (SNCBs) and a decision will be made within 6 weeks of a fully completed application submission.

For further information regarding wildlife licences please visit our website:
http://www.marinemanagement.org.uk/protecting/wildlife/index.htm

If you have any further questions please do not hesitate to contact me,

[redacted]

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