REPORT

Boston Alternative Energy Facility

Chapter 17 Marine and Coastal Ecology and Appendix 17.1 Habitats Regulations Assessment - Ornithology Addendum

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Acronyms

Acronym	Definition
BTO	British Trust for Ornithology
CI	Confidence Interval
CIB	Changes In Behaviour
dB	Decibel
DML	Deemed Marine Licence
DCO	Development Consent Order
ES	Environmental Statement
HRA	Habitats Regulations Assessment
JNCC	Joint Nature and Conservation Committee
km	Kilometre
km^2	Squared kilometre
LWT	Lincolnshire Wildlife Trust
m	Metre
MOTH	Mouth of The Haven
MU	Management Unit
NMP	Navigation Management Plan
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SPA	Special Protection Area
WCS	Worst Case Scenario
WeBS	Wetland Bird Survey

1 Ornithology Addendum Report

1.1.1 This 'Ornithology Addendum Report' has been produced in relation to the Boston Alternative Energy Facility (the Facility) on behalf of Alternative Use Boston Projects Limited (the Applicant), to support the application for a Development Consent Order (DCO) (the DCO application) that has been made to the Planning Inspectorate under Section 37 of the Planning Act 2008 (the Act).

1.1.2 The purpose of this report is to provide additional information and assessment in response to relevant representations received by the Applicant following DCO submission.

1.1.3 The additional information and assessment relate to further baseline information on estuarine birds that has become available since submission of the DCO application.

1.1.4 The updates included within this report relate to both Chapter 17 Marine Ecology[1], and Appendix 17.1 Habitats Regulations Assessment (HRA)[2] of the Environmental Statement (ES), submitted as part of the DCO Application for the Facility. This report should be read alongside Chapter 17 Marine Ecology and Appendix 17.1 Habitats Regulation Assessment.

1.2 Relevant Representations Requiring Further Assessment Work

1.2.1 Within each section of this report a table is included which references the Relevant Representations which have been responded to regarding

[1] 6.2.17 Environmental Statement - Chapter 17 - Marine and Coastal Ecology [document reference 6.2.17, APP-055]. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010095/EN010095-000440-6.2.17.%20Chapter%2017%20Marine%20and%20Coastal%20Ecology.pdf

[2] 6.4.18 Environmental Statement - Appendix 17.1 - Habitats Regulations Assessment [document reference 6.4.18, APP-111]. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010095/EN010095-000490-6.4.18.%20Appendix%2017.1%20Habitats%20Regulations%20Assessment.pdf

additional baseline information or impacts on estuarine birds.

1.3 Structure of this Report

1.3.1 This report contains the following parts:

- **Section 1**: Ornithology Addendum Report;
- **Section 2**: Errata to the ES and HRA;
- **Section 3**: Updates to Ornithology Baseline Information;
- **Section 4**: Updates to the Environmental Impact Assessment; and
- **Section 5**: Updates to the Habitats Regulations Assessment.

2 Errata to the ES and HRA

2.1.1 **Table 2-1** sets out details of missing references in the ES that are now provided in response to a Relevant Representation.

Table 2-1 Errata to ES and HRA

Organisation	Relevant Representation	Response
Natural England	B14: Natural England notes that under calculation of energetic consequence of disturbance reference to Krist et al (2001) and Collop et al (2016) are seemingly missing.	References for Collop et al. (2016) and Krist [sic] et al. (2001) Collop, C., Stillman, R.A., Garbutt, A., Yates, M.G., Rispin, E. and Yates, T. 2016. Variability in the area, energy and time costs of wintering waders responding to disturbance. Ibis, 158(4), pp.711-725. Kvist, A., Lindstrom, A., Green, M., Piersma, T. & Visser, G.H., 2001. Carrying large fuel loads during sustained bird flight is cheaper than expected. Nature 413, pp.730–732

3 Updates to Ornithology Baseline Information

3.1 Introduction

3.1.1 Additional data has been collated since the submission of the ES and HRA in order to further inform the assessment process. This has resulted from the ongoing discussions with relevant stakeholders (Natural England, Environment Agency, Royal Society for the Protection

of Birds and Lincolnshire Wildlife Trust) and the Relevant Representations made by the stakeholders. Additional survey data has been provided to stakeholders during the ongoing consultation as soon as it has become available.

3.1.2 The Relevant Representations that have been made relating to data sources are provided in **Table 3-1.** A summary of the data that has been collated since the DCO submission is provided below. This comprises of the following:

- Wetland Birds Survey (WeBS) trend data for The Wash;
- WeBS Core Count data for the area around the Mouth of The Haven;
- Additional survey data for the Mouth of The Haven; and
- Additional survey data for the Application Area.

3.1.3 Paragraph 17.4.6 within ES Chapter 17 (Marine and Coastal Ecology) sets out the spatial scales over which impacts were considered. This is now updated as the potential impacts on ornithology are now considered over the following geographic areas:

- The proposed development site – the area of and adjacent to, the footprint of the proposed development site, including The Haven river channel in section A (in line with the development and the site of the proposed wharf construction) and section B (downstream for a similar length). Section A and B are shown on **Figure 3.2**.
- The mouth of The Haven (MOTH) – the shipping channel through which all vessels relating to i) construction and ii) operation of the proposed development must pass in order to approach and leave the Facility. At its mouth The Haven enters The Wash, and the final 3.9 km of The Haven is within the boundary of The Wash Special Protection Area (SPA). This area is shown in **Appendix A1**.
- The local area around The Haven corresponds with the WeBS sectors at the MOTH and additional WeBS Sectors that cover the local area and is discussed further in **Section 3.3** and **3.4** and in detail in **Appendix A1.**

3.1.4 The Haven - During the design of the surveys during the pre-DCO application phase there was very little information known about the bird usage in the area and anecdotal evidence confirmed that the areas that were key areas for birds were focussed around areas of The Haven

within the SPA rather than further along The Haven. The presence of The Wash SPA and the WeBS sectors confirm that these are key areas for The Haven. There was also a WeBS sector further along The Haven (as shown in

3.1.5 **Figure *3-1 WeBS sectors for data analysis***

3.1.6) at Slippery Gowt Pits, although counts for this sector have not been undertaken in recent years. Surveys were therefore focussed around the MOTH and the specific habitats that would be directly affected by the proposed development site together with collation of WeBS data for the Slippery Gowt Pits. There are no known populations of birds that use other areas of The Haven.

Table 3-1 Relevant Representations

Organisation	Relevant Representation
RSPB	There is outstanding work to be reported around Wetland Bird Survey (WeBS) data to assess the full impact of the significant increase in vessel movements on all relevant WeBS sectors (see Relevant Representation Appendix 2 in Annex 1 and Appendix 2 in Annex 2).
RSPB	More robust assessments on the scale of impact are needed to enable the nature, scale, and effectiveness of mitigation measures to be assessed. This will inform discussions on whether there is a need for compensation measures. For example, greater understanding of how The Wash SPA/Ramsar/SSSI waterbirds use The Haven and the surrounding area is required to understand the full scale of impact of vessel movements on these protected areas.
RSPB	Impact on birds roosting and foraging at the mouth of The Haven: More robust assessment is necessary to inform the scale and significance of predicted impacts on the SPA/Ramsar/SSSI birds using this important area. This will in turn inform the need and potential options for compensation measures.
Natural England	Key Consenting Issue 7. ii) Natural England would need to see further analysis of the impact of the increased level of vessels in this area including the impact on low tide feeding grounds before the scale and the significance of the impacts can be determined including additional visual and physical disturbance and erosion of supporting habitats. Further analysis of relevant WeBS sectors could be undertaken to help determine the significance of the impacts. The information on the scale and significance of the impacts will then help determine the scope of any compensation package should an AEoI remain.
RSPB	A full two years of [site-specific survey] data have not been completed. This is good practice for developments, especially where there are potential adverse effects on protected sites and species. This is necessary to enable variation across seasons and years to be better understood.
Natural England	B1: Please be advised that bird data required for March to June 2021 has not yet been submitted. Natural England advises for birds, a minimum of

Organisation	Relevant Representation
	two years site specific data is collected to allow for variation in bird use between years.

3.2 WeBS trend data on estuarine bird numbers for The Wash SPA

3.2.1 The British Trust for Ornithology (BTO) provides species trend alerts for both designated feature waterbird species and non-feature species of SPAs (Woodward *et al.* 2019). Alerts are classified as Medium for a decline of magnitude 25% to 49%, and High alert for a decline of magnitude 50 % or greater. Species trends for which alerts are flagged are calculated over four time periods: short term (five years), medium (med-) term (ten years), long term (up to 25 years) and since the baseline from which the Alerts commence. For The Wash SPA the baseline recording year is 1982/83.

3.2.2 **Designated feature waterbird species exhibiting High alert trends within The Wash SPA are Bewick's swan** (all time periods), **shelduck** (medium and long term since baseline), **pintail** (long term since baseline) and **goldeneye** (long-term since baseline). WeBS Alerts species accounts suggest that the declines in numbers underpinning the alerts for goldeneye and Bewick's swan "result from broad-scale population trends," as their site (The Wash SPA) trends are similar to those in the wider region and Great Britain as a whole. Conversely, species accounts for **shelduck and pintail** highlight site trends that contrast with those over larger spatial scales, suggesting that their declines within the SPA "are most likely due to site-specific pressures."

3.2.3 Designated feature species (excluding those listed in **Table 3-2**) **exhibiting Medium alert trends within The Wash SPA are dark-bellied brent goose** (medium and long term), **gadwall** (short term since baseline), **common scoter** (short term), **grey plover** (long term), **curlew** (short term), **black-tailed godwit** (short and medium term), **turnstone** (long term) and **dunlin** (long term). Of these, species accounts for **dark-bellied brent goose and black-tailed godwit** highlight negative trends which contrast with those for larger spatial scales and suggest that their SPA declines underpinning their WeBS Alerts "are most likely due to site-specific pressures." Species accounts for gadwall, common scoter, and grey plover do not currently compare SPA trends to those at broader scales due to high interannual variation, and those for curlew, turnstone and dunlin suggest that the SPA

declines underpinning their WeBS Alerts result from broad-scale population trends.

3.2.4 There are no WeBS Alerts for The Wash SPA populations of wigeon, oystercatcher, bar-tailed godwit, knot, sanderling or redshank.

3.2.5 **Table 3-2** provides a comparison of the WeBS data trends which provides a baseline for assessing trends in bird numbers for The Wash SPA and whether this has an implication for the assessment undertaken to date. For WeBS alerts, 'Long term' is change since 1991/2 WeBS year for waterfowl, and since 1994/5 for waders, 'medium term' is change over ten years and 'short term' is change over five years (**Table 3-2**).

Table 3-2 Updates to estuarine bird baseline characteristics.

Baseline Characteristic	Baseline within the ES / HRA	Updated Baseline	Implication to Assessment/s
5-year average peak counts at The Wash estuary as captured by WeBS, for species designated as features of The Wash SPA			
Bar-tailed godwit (*Limosa lapponica*), Non-breeding	**(2013/14 to 2017/18)** 19,101	**(2014/15 to 2018/19)** 18,579	No significant change to assessment interpretation.
Bewick's swan (*Cygnus columbianus bewickii*), Non-breeding	3	5	
Black-tailed godwit (*Limosa limosa islandica*), Non-breeding	8,376	7,805	
Common scoter (*Melanitta nigra*), Non-breeding	1,357	1,342	
Common tern (*Sterna hirundo*), Breeding	602	597	
Curlew (*Numenius arquata*), Non-breeding	6,970	6,653	
Dark-bellied brent goose (*Branta bernicla bernicla*), Non-breeding	14,687	13,545	
Dunlin (*Calidris alpina alpina*), Non-breeding	26,321	27,258	
Gadwall (*Mareca strepera*), Non-breeding	134	128	
Goldeneye (*Bucephala clangula*), Non-breeding	79	74	
Grey plover (*Pluvialis squatarola*), Non-breeding	9,462	9,132	
Knot (*Calidris canutus*), Non-breeding	170,471	177,869	

Baseline Characteristic	Baseline within the ES / HRA	Updated Baseline	Implication to Assessment/s
Little tern (*Sternula albifrons*), Breeding	105	117	
Oystercatcher (*Haematopus ostralegus*), Non-breeding	19,679	20,471	
Pink-footed goose (*Anser brachyrhynchus*), Non-breeding	34,223	34,211	
Pintail (*Anas acuta*), Non-breeding	505	458	
Redshank (*Tringa totanus*), Non-breeding	5,712	5,239	
Sanderling (*Calidris alba*), Non-breeding	6,972	9,052	
Shelduck (*Tadorna tadorna*), Non-breeding	3,175	2,359	
Turnstone (*Arenaria interpres*), Non-breeding	911	809	
Wigeon (*Mareca penelope*), Non-breeding	10,854	12,172	
WeBS Alerts relating to The Wash SPA feature bird species (Woodward et al. 2019)			
Bar-tailed Godwit	Not reported	None	No implication of site-specific trend to assessment.
Bewick's Swan	Not reported	Short-term: High Med-term: High Long-term: High Since Alerts baseline (1982/83): High	(This species was not recorded during site-specific baseline surveys.)
Black-tailed Godwit	Not reported	Short-term: Medium Med-term: Medium	Species decline indicates presence of a 'restore' conservation objective for The Wash SPA. WeBS Alert species account indicates site-specific drivers or pressures at

Baseline Characteristic	Baseline within the ES / HRA	Updated Baseline	Implication to Assessment/s
			The Wash SPA.
Common Scoter	Not reported	Short-term: Medium	Species decline indicates presence of a 'restore' conservation objective for The Wash SPA.
Common tern	Not reported	Not covered by WeBS Alerts	Impact can be assessed using WeBS average peak counts and site-specific survey data only.
Curlew	Not reported	Short-term: Medium	Species decline indicates presence of a 'restore' conservation objective for The Wash SPA.
Dark-bellied Brent Goose	Not reported	Med-term: Medium Long-term: Medium	Species decline indicates presence of a 'restore' conservation objective for The Wash SPA. WeBS Alert species account indicates site-specific drivers or pressures at The Wash SPA.
Dunlin	Not reported	Long-term: Medium	Species decline indicates presence of a

Baseline Characteristic	Baseline within the ES / HRA	Updated Baseline	Implication to Assessment/s
			'restore' conservation objective for The Wash SPA.
Gadwall	Not reported	Short-term: Medium Since Alerts baseline (1982/83): Medium	This species was not recorded during site-specific baseline surveys.
Goldeneye	Not reported	Short-term: Medium Med-term: Medium Long-term: High Since Alerts baseline (1982/83): High	This species was not recorded during site-specific baseline surveys.
Grey plover	Not reported	Long-term: Medium	Species decline indicates presence of a 'restore' conservation objective for The Wash SPA.
Knot	Not reported	None	No implication of site-specific trend to assessment.
Little tern	Not reported	Not covered by WeBS Alerts	This species was not recorded during site-specific baseline surveys.
Oystercatcher	Not reported	None	No implication of site-specific trend to assessment.
Pink-footed goose	Not reported	Not covered by WeBS Alerts	This species was not

Baseline Characteristic	Baseline within the ES / HRA	Updated Baseline	Implication to Assessment/s
			recorded during site-specific baseline surveys.
Pintail	Not reported	Med-term: Medium Long-term: High Since Alerts baseline (1982/83): High	Species decline indicates presence of a 'restore' conservation objective for The Wash SPA. WeBS Alert species account indicates site-specific drivers or pressures at The Wash SPA.
Redshank	Not reported	None	No implication of site-specific trend to assessment.
Sanderling	Not reported	None	This species was not recorded during site-specific baseline surveys.
Shelduck	Not reported	Short-term: Medium Med-term: High Long-term: High Since Alerts baseline (1982/83): High	Species decline indicates presence of a 'restore' conservation objective for The Wash SPA. WeBS Alert species account indicates site-specific drivers or pressures at The Wash SPA.

Baseline Characteristic	Baseline within the ES / HRA	Updated Baseline	Implication to Assessment/s
Turnstone	Not reported	Long-term: Medium	Species decline indicates presence of a 'restore' conservation objective for The Wash SPA.
Wigeon	Not reported	None	No implication of site-specific trend to assessment.
WeBS Alerts relating to The Wash SPA non-breeding waterbird assemblage species (Woodward et al. 2019) recorded in site-specific baseline surveys			
White-fronted goose	Not reported	Short-term: High Long-term: Medium	Species decline indicates presence of a 'restore' conservation objective for The Wash SPA.
Mallard		Short-term: Medium Med-term: Medium Long-term: High	Species decline indicates presence of a 'restore' conservation objective for The Wash SPA.
Teal		None	No implication of site-specific trend to assessment.
Red-breasted merganser		Short-term: Medium Long-term: Medium	Species decline indicates presence of a 'restore' conservation objective for The Wash SPA.
Great crested grebe		None	No implication of site-specific

Baseline Characteristic	Baseline within the ES / HRA	Updated Baseline	Implication to Assessment/s
			trend to assessment.
Little egret		None	No implication of site-specific trend to assessment.
Cormorant		None	No implication of site-specific trend to assessment.
Avocet		None	No implication of site-specific trend to assessment.
Lapwing		Med-term: High Long-term: Medium	Species decline indicates presence of a 'restore' conservation objective for The Wash SPA.
Golden plover		Med-term: High	Species decline indicates presence of a 'restore' conservation objective for The Wash SPA.
Ringed plover	Not reported	Med-term: Medium Long-term: Medium	Species decline indicates presence of a 'restore' conservation objective for The Wash SPA.

3.3 WeBS Core Count Data

3.3.1 WeBS Core Count data was previously examined for the ES and HRA, for three sectors: Slippery Gowt Pits, Frampton North 23 and Frampton North 60. Data was obtained in the form of tabulated five-year synopses

(see BTO 2010, section 'Core Count data'), for redshank and the full species assemblage ('all birds'). For the update to the assessment, Core Counts from a further 15 sectors were requested from the BTO. These sectors were suggested by RSPB to be the count sectors relevant for disturbance issues related to the movement of vessels. Data was requested in the form of monthly counts (see BTO 2010, section 'Core Count data'). Of these, 14 sectors had received sufficiently recent coverage to be relevant to site assessment. These sectors are shown in **Figure 3-1**.

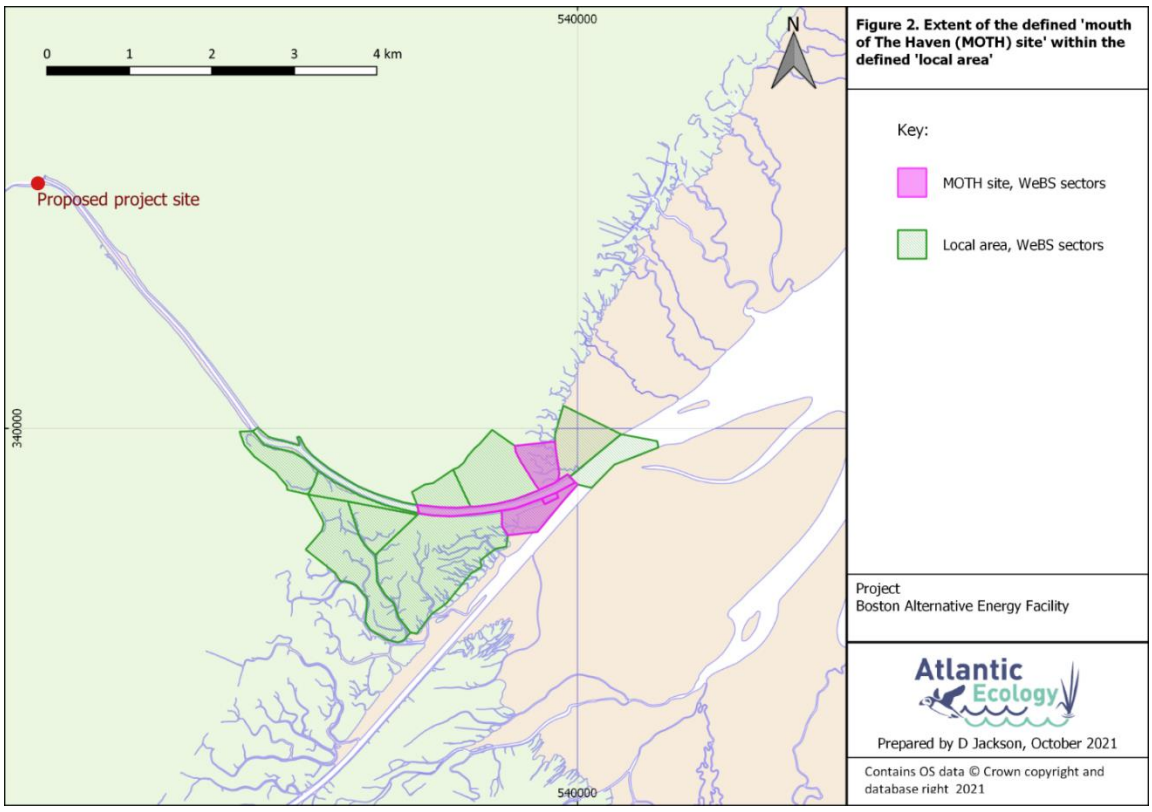

Figure 3-1 WeBS sectors for data analysis

3.3.2 Freiston 30 Core Count data was requested but had not received sufficiently recent coverage (last count in year 2008/9).

3.4 Additional data collection for the Mouth of The Haven

3.4.1 At the MOTH, Changes in Behaviour (CIB) observation sessions **have been completed over two winter seasons**: from November to March of winter 2019/20, and January to March of winter 2020/21. CIB observation sessions were also completed in May to July 2021 to quantify response to vessel traffic of waterbirds present during passage and the breeding season. Observation sessions focused on vessel

effects therefore were targeted to tidal periods where vessels were scheduled to make passage along The Haven. Surveys typically commenced within two hours before high water (before first vessel transit) and ended within three hours after high water, typically when no further vessel movements were known to be scheduled. This data has been used to carry out additional analysis of the disturbance at the MOTH which is discussed in **Paragraphs 4.3.15-4.3.18** and detailed in **Appendix A1**.

3.5 Additional data collection for the proposed Application Site

3.5.1 Surveys have been undertaken at the proposed wharf area in order to understand bird usage of this location (section A in Figure 32) and the area immediately down-river (section B in Figure 32). These commenced in Winter 2019 and have continued to date. The updated data collected since submission of the DCO has been added to **Table 3-3** and **Table 3-4** below. The survey count areas are shown in **Figure 3-2.**

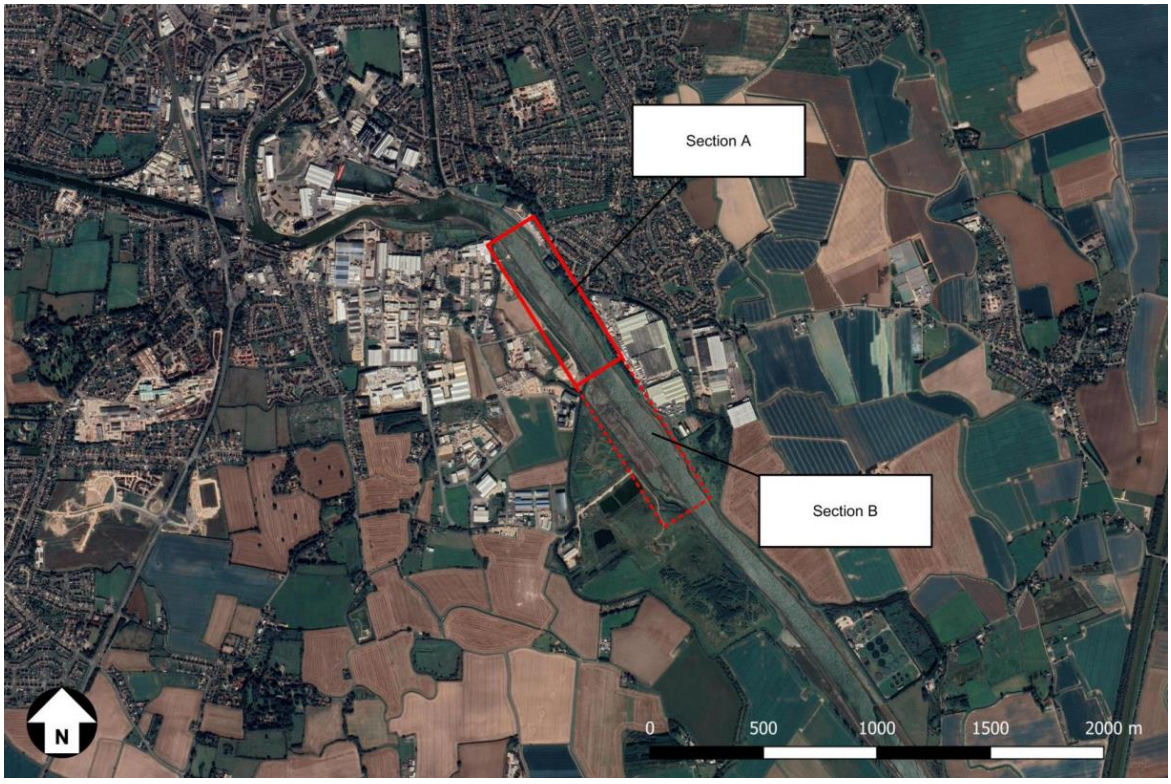

Figure 3-2 Bird count sections at the proposed wharf location

3.5.2 Update to paragraph 17.4.3 within ES Chapter 17 (Marine and Coastal Ecology): With the additional data collected at the proposed development site, monthly counts of non-breeding birds have been

conducted from October 2019 to March 2020, and January to March 2021. Surveys covered survey section A of The Haven between British National Grid references TF 33863 42815 and TF 34245 42312, a distance of approximately 700 metres which included the proposed wharf construction area; and section B immediately down-river between TF 34245 42312 and TF 34659 41763, a distance of approximately 670 metres. The river width in sections A and B was 70-75 m and 70-80 m respectively. Surveys comprised one high water and one low water visit per month, recording all bird species following the methodology of the BTO WeBS Core Counts (counting all birds present within a defined wetland area, (BTO (2021) [redacted] Surveys lasted for three hours starting 1.5 hours before the high or low tide time and ending 1.5 hours after this tide time. In total 18 survey visits were completed over the two seasons.

3.5.3 Of bird species designated as SPA feature species or part of the non-breeding waterbird assemblage of the adjacent Wash SPA; redshank, and assemblage species ruff, ringed plover, cormorant, little grebe, lesser black-backed gull, mallard and white-fronted goose were recorded on one or more occasion in numbers equivalent to more than 1% of their SPA citation population or their Wash WeBS five-year average peak counts (2014/15 to 2018/19) from the total area incorporating Section A and B together. Counts of redshank at sections A and B, and total across sections, are summarised in **Table 3-3**. Site totals (combined counts across A and B) of redshank were influenced by typically higher counts at Section B further downstream of the proposed wharf site. All but two counts of redshank at high or low tide at section A were equivalent to less than 1% of the five-year average peak Wash count. Percentages in **Table 3-3** show the % of the 5-yr WeBS average peak count for The Wash (2014/15 to 2018/19). Highlighted cells show where the count was greater than 1% of The Wash population. Grey cells = no visit or data.

Table 3-3 (Update to ES Table 17-9) Redshank counts for Sections A and B.

Redshank Counts	Count Section A (within proposed development area)		Count Section B (adjacent to proposed development area)		Combined counts Sectors A and B	
Survey month	Low Tide	High Tide	Low Tide	High Tide	Low Tide	High Tide
October 2019	18 (0.42 %)	20 (0.46 %)	25 (0.58 %)	78 (1.80 %)	43 (0.99 %)	98 (2.26 %)

Redshank Counts	Count Section A (within proposed development area)		Count Section B (adjacent to proposed development area)		Combined counts Sectors A and B	
Survey month	Low Tide	High Tide	Low Tide	High Tide	Low Tide	High Tide
November 2019	26 (0.60 %)	19 (. 044 %)	61 (1.41 %)	38 (0.88 %)	87 (2.01 %)	57 (1.32 %)
December 2019	14 (0.32 %)	27 (0.62 %)	19 (0.44 %)	33 (0.76 %)	33 (0.76 %)	60 (1.39 %)
January 2020	27 (0.62 %)	162 (3.74 %)	36 (0.83 %)	3 (0.07 %)	63 (1.45 %)	165 (3.81 %)
February 2020	26 (0.60 %)	29 (0.67 %)	21 (0.48 %)	93 (2.15 %)	47 (1.09 %)	122 (2.82 %)
March 2020	17 (0.39 %)	13 (0.30 %)	31 (0.72 %)	73 (1.69 %)	48 (1.11 %)	86 (1.99 %)
April 2020	0		0		0	
May 2020	0		0		0	
June 2020	0		0		0	
January 2021	24 (0.55 %)	44 (1.02 %)	34 (0.79 %)	43 (0.99 %)	58 (1.34 %)	87 (2.01 %)
February 2021	18 (0.42 %)	18 (0.42 %)	16 (0.37 %)	21 (0.48 %)	34 (0.79 %)	39 (0.90 %)
March 2021	15 (0.35 %)	26 (0.60 %)	34 (0.79 %)	73 (1.69 %)	49 (1,13 %)	99 (2.29 %)
April 2021	0		0		0	
May 2021	0	0	0		0	
June 2021	0	0	0		0	
July 2021		1 (0.02 %)				

Table 3-4 Peak winter high tide and low tide counts of waterbirds across the full survey area (Sections A plus B).

Species	High tide peak count	Low tide peak count
Bar-tailed godwit	10	1
Bewick's swan	0	0
Black-tailed godwit	1	5
Common scoter	0	0
Curlew	9	14

Species	High tide peak count	Low tide peak count
Dark-bellied brent goose	0	0
Dunlin	8	69
Gadwall	0	0
Goldeneye	0	0
Grey plover	6	23
Knot	0	0
Oystercatcher	4	4
Pink-footed goose	0	0
Pintail	0	0
Redshank	165	87
Sanderling	0	0
Shelduck	3	0
Turnstone	2	2
Wigeon	0	0
Ruff *Philomachus pugnax*	7	6
Lapwing *Vanellus vanellus*	7	34
Ringed plover *Charadrius hiaticula*	15	29
Black-headed gull *Chroicocephalus ridibundus*	29	72
Canada goose *Branta canadensis*	49	23
Common gull *Larus canus*	5	7
Cormorant *Phalacrocorax carbo*	7	8
Great black-backed gull *Larus marinus*	1	3
Grey heron *Ardea cinerea*	5	2
Herring gull *Larus argentatus*	3	27
Jack snipe *Lymnocryptes minimus*	1	3
Kingfisher *Alcedo atthis*	0	1
Lesser black-backed gull *Larus fuscus*	1	9

Species	High tide peak count	Low tide peak count
Little egret *Egretta garzetta*	3	4
Mallard *Anas platyrhynchos*	21	29
White-fronted goose *Anser albifrons*	1	0
Greylag goose *Anser anser*	3	3
Little grebe *Tachybaptus ruficollis*	0	1
Snipe *Gallinago gallinago*	4	6
Greenshank *Tringa nebularia*	1	0
Green sandpiper *Tringa ochropus*	1	0

3.5.4 Highlighted cells in **Table 3-4** indicate peak counts which exceed 1% of the SPA citation population size for The Wash SPA designated feature species or, for assemblage-only species, 1% of the five-year WeBS peak annual count for The Wash SPA.

3.5.5 At the proposed wharf site, breeding bird surveys **have also been completed over two full breeding seasons**: from April to June of 2020 and 2021. Surveys comprised one four-hour visit per month recording adult birds of all species following the methodology of the BTO Common Birds Census (CBC, mapping all adult birds using symbols to indicate observed breeding behaviours, Bibby, C.J., Burgess, N.D., Hill, D.A. & Mustoe, S. 2000. Bird Census Techniques. Second Edition. Academic Press, London). In all, six visits were made across the two seasons. The breeding bird surveys covered the whole Application Site and the same sections of The Haven as in the wintering bird surveys. All breeding bird surveys were carried out around low water.

3.5.6 From these surveys, 42 species were recorded , mostly within the terrestrial areas of the site. Redshank and avocet were each recorded on one occasion in 2021, as foraging birds in unsuitable habitat for breeding (open foreshore of The Haven). Therefore, neither species is considered to be breeding on or adjacent to the Application Site.

3.5.7 At the proposed wharf site, CIB observation sessions quantifying bird responses to vessel movements were also carried out on six dates. Observation sessions focused on vessel effects therefore were targeted to tide periods where vessels were scheduled to make passage. On 19 February and 20 and 21 March 2021 these were conducted secondarily

to high water counts of wintering birds. Dedicated CIB observation sessions were conducted during daytime high water on 31 May, 30 June and 17 and 19 July 2021. Surveys typically commenced within two hours before high water and ended within three hours typically when no further vessel movements were known to be scheduled. The results of these surveys are discussed further in **Section 4.3**.

4 Updates to Environmental Impact Assessment

4.1 Introduction to worst case scenarios

Table 4-1 RSBP Relevant Representation regarding WCS

Organisation	Relevant Representation
RSPB	Failure to define a realistic worst-case scenario of the proposed development to assess impacts against.

4.1.1 Section 17.8 of ES Chapter 17 (Marine and Coastal Ecology) details the ornithology impact assessment which has been updated in this report in light of additional data. The worst case scenario (WCS) for the project's activities and outputs is outlined in the ES section 17.8 and in paragraphs 16.7.3 to 16.7.26 of ES Chapter 16 Estuarine Processes (document reference: APP-054) regarding i) wharf construction (including construction noise, piling, dredging, and vessel delivery of aggregate [89 shipments over two years]) and ii) wharf operation (change to hydrodynamics, maintenance dredging [sedimentation rate of 0.5 m per year], and vessel passages [580 vessels per year] for delivery and collection of materials). Here, a WCS is additionally applied regarding vessel passage at the mouth of The Haven. At both the proposed development site and at the mouth of The Haven, the WCS entails vessels related to the project all utilising separate high-water periods to each other, such that 100% of high-water periods available for large commercial vessel passage on The Haven are used by vessel traffic (both related and unrelated to the project). This in turn entails passage of one or more pilot boats along The Haven on 100% of navigable tides. The baseline percentage of utilised tides is 75% to 80% (i.e. the tides where a commercial vessel currently transits The Haven) (Richard Walker (Harbour master, *pers com*.), therefore the increase would be 20% to 25% of tides once BAEF is operational. Under this scenario, the number of large cargo vessel passages attributable to the project (2 x 580, 1160 vessel movements per year) would divide between available tides (730 per year) to 1.6 vessel movements per tide. The baseline number of large cargo vessel movements per used

tide is one to three and there is capacity of five per tide (see ES Chapter 18 Navigational Issues (document reference 6.2.18, APP-056) paragraph 18.6.13).

4.2 Baseline Environment (Ornithology)

Table 4-2 Natural England Relevant Representation regarding Existing Environment (Ornithology)

Organisation	Relevant Representation
Natural England	B2: Natural England queries why citation text and list SPA species is [not] fully utilised as well as SSSI features. For example, no mention of key species i.e. breeding Redshank and littoral sediment, SM4-28 saltmarsh etc.
Natural England	B3: "Natural England notes that Redshank are shown as absent in table between April and July. However, we advise that they should be shown as present as they breed on The Wash. Also, Ringed Plover is missing a month, and this should be checked to be correct.

Designated sites

4.2.1 Update to ES Chapter 17 (Marine and Coastal Ecology) paragraph 17.6.2: The Wash SSSI includes the bird species designated as features of The Wash SPA, including the non-breeding waterbird assemblage, but also includes redshank as a breeding species. The SSSI also includes key coastal and estuarine habitats and plants, plus harbour or common seal *Phoca vitulina*. Updates to impacts relating to habitat and seals are documented in the relevant HRA/ES updates.

4.2.2 Update to ES Chapter 17 (Marine and Coastal Ecology) paragraph 17.6.55: Most species for which The Wash SPA/Ramsar is designated are non-breeding populations overwintering (and in some cases such as oystercatcher and shelduck, over-summering as non-breeders) in The Wash. Wader species feed on the extensive mud and sand flats exposed at low tide and roost on the marshes, saltmarshes and rocky habitats bordering the feeding grounds (including rock-armour flood defences) at high tide. The area also supports breeding birds (common tern and little tern for which the SPA and SSSI is designated and redshank for which the SSSI is designated).

4.2.3 Breeding redshank (which are a feature of The Wash SSSI) were not recorded from the Application Site during any of the surveys undertaken. Further assessment of redshank at the MOTH has been undertaken and is discussed further in **Section 6.1** and **Appendix A1.**

The Haven

4.2.4 Update to ES Chapter 17 (Marine and Coastal Ecology) paragraph 17.6.56: Published accounts from periods of severe weather on The Wash in general suggest that individuals and species were continually passing through rather than settling in refuge (Pilcher 1964) and that several waterbird species (even species with typically high winter site fidelity) moved away from The Wash, to the south and west (Dobinson & Richards 1964, JNCC 2019). The Wash is an east coast estuary and, historically, mortality of waders such as redshank has been higher on eastern coasts during severe winters than on western coasts (Burton *et al.* 1999).

WeBS Sectors

4.2.5 The names and the characterised ornithology of WeBS sectors included in the original ES are detailed in the Chapter 17 (Marine and Coastal Ecology) ES paragraph 17.6.62 to 17.6.66. For the assessment detailed in this addendum, the most recent five years of Core Counts (conducted monthly typically at high tide, BTO 2010) from a further 14 WeBS sectors were acquisitioned, as discussed in **Section 3.3**. This data is used in the updated assessments below. The rates of occurrence, mean counts and peak counts of waterbird species at the full complement of 17 WeBS Sectors are provided in **Appendix A1**.

4.3 Impact Assessment

Table 4-3 RSPB Relevant Representation regarding Impact Assessment

Organisation	Relevant Representation
RSPB	More robust assessments on the scale of impact are needed to enable the nature, scale, and effectiveness of mitigation measures to be assessed. This will inform discussions on whether there is a need for compensation measures. For example, greater understanding of how The Wash SPA/Ramsar/SSSI waterbirds use The Haven and the surrounding area is required to understand the full scale of impact of vessel movements on these protected areas.

4.3.1 Table 5.3.1 summarises the potential impacts of the proposed Facility on marine and coastal ecology. Where these impacts have been updated due to the recent information collated for ornithology, discussion is provided below, and they are shaded in the table. If there are no updates required, the impact has not been updated in this document. Other documents have also been updated and include updates to the other impacts. These are included within Addendums for Marine Ecology and Marine Mammals (document references 9.15 and

9.14, respectively) also submitted to the Examination at Deadline 1.

Table 4-4 ES Table 4-5 Potential Impacts on Marine and Coastal Ecology

Impact	Receptor
Construction	
Construction impact 1 - Loss of and/or change to estuarine habitats and associated species within the footprint of the wharf and dredging area	Saltmarsh habitat and species Mudflat habitat and species Birds
Construction impact 2 - Increased suspended sediment concentrations from capital dredging, with potential for sediment-bound contaminants to be released	Fish (migration and behaviour) Birds Benthic communities
Construction impact 3 - Disturbance due to human activity/increased human presence (excluding underwater noise but including airborne noise), including vessel movements	Birds and mammals
Construction impact 4 - Underwater noise (piling and dredging)	Fish (migration and behaviour) Birds Marine mammals
Construction impact 5 - Increased emissions to air and deposition on marine and estuarine habitats	Marine and coastal habitats
Operation	
Operation impact 1 - Habitat alteration due to hydrodynamic changes	Intertidal and subtidal habitats
Operation impact 2 - Changes in vessel traffic and movement leading to increased ship wash, underwater noise, disturbance, collision risk, and risk from invasive species	Intertidal habitat Fish Birds Marine mammals
Operation impact 3 - Increased suspended sediment concentrations due to maintenance dredging	Benthic communities Fish (migration and behaviour)
Operation impact 4 - Beaching of vessels at low tide	Benthic communities
Operation impact 5 - Increased emissions to air and deposition on marine and estuarine habitats	Marine and coastal habitats
Decommissioning	
No significant adverse impacts are anticipated	-

Construction Impact 1: Loss of and/or change to estuarine habitats and associated species within the footprint of the wharf and dredging area

Table 4-5 RSPB Relevant Representations regarding Wharf and Dredging Area

Organisation	Relevant Representation
RSPB	Loss of redshank roost and impact on foraging birds adjacent the application site [sic] – Non-breeding redshank are a feature of The Wash SPA/Ramsar and there is a restore target in the Supplementary Conservation Advice for The Wash non-breeding redshank population. Non-breeding and breeding redshank are a feature of The Wash SSSI. Significant declines in saltmarsh

Organisation	Relevant Representation
	breeding redshank on The Wash have also occurred and are being explored with Natural England to identify what measures are needed to restore the breeding population. Any impacts from the project alone or in-combination with other activities that affect the redshanks using The Haven therefore has serious implications for restoring both the non-breeding and breeding populations.
RSPB	Loss of redshank roost and impact on foraging birds adjacent the application site [sic] – The presented evidence indicates that the roost would be lost and that there would be impacts to foraging birds. Like other redshanks, the redshanks using The Haven are highly site faithful during the non-breeding season and will be formed from a mixture of resident, breeding birds and migrants from breeding populations elsewhere in the UK and abroad (e.g. Iceland, continental Europe). Where roost sites have been lost from other sites (e.g. Cardiff Bay), even a relative short displacement distance of 4km has been found to reduce their body condition and survival rates. In order to maintain the redshank population there would need to be an increase in recruitment of young birds to any new habitat created to replace that lost. For The Wash redshank population, however, there has been a decline in breeding numbers and therefore it is not clear that, if The Haven roost was lost, recruitment would be sufficient to compensate for a reduction in survival. This has implications for the restoration target for The Wash SPA redshank population. This highlights the complexity of understanding and addressing impacts for this species and is an area that requires significantly more attention. It also reinforces the importance of maintaining the redshank roost and feeding function of the adjacent mudflats

4.3.2 Paragraphs 17.8.12 to 17.8.29 within ES Chapter 17 (Marine and Coastal Ecology) detail the impacts of removal of mudflat and saltmarsh habitat adjacent to the Principal Application Site on marine and coastal ecology, which are updated for ornithology here in light of additional data collection. The additional data for bird counts has not changed the original assessment.

4.3.3 The additional data collated for the CIB data has however shown that roosting birds take flight when vessels transit past the site. They do not fly to alternative roosts, but the disturbance does cause the birds to utilise energy resources. An additional level of disturbance will therefore result in additional disturbance flights, resulting in further use of energy reserves. It is not expected that the additional disturbance would force the birds to leave this roost site. Numbers of vessels have been shown to be much higher in past years and the birds have remained faithful to this site. However, it is acknowledged that the bird count data does not include historic data for this area, so it is not possible to say with complete certainty that the redshank remained there. The mitigation area has been placed approximately 250 m away from the wharf areas

in order to avoid ongoing disturbance from the presence of vessels using the wharf. However, as a precautionary measure and given the relevant representations above regarding the restore objective for redshank, as well as the mitigation proposed to ensure that Area B provides roosting and foraging habitat, additional measures linked to net gain for the birds, alternative locations are being sought in order to provide additional locations for roosting birds, particularly redshank. Such locations will be as close as possible to the existing site and provide suitable habitat away from potential disturbances.

4.3.4 The original assessment of habitat loss that was made for the loss of saltmarsh and mudflat remains unchanged from the original assessment so that without mitigation the loss of saltmarsh is considered to be of moderate adverse significance and loss of mudflat of minor adverse significance. This reflects the importance of the habitats and their respective loss in context of The Haven and also their importance for providing habitat for other species. The proposed management measures would reduce the impact significance to one of minor adverse significance as the offset measures and net gain measures would provide additional habitat and also aims to improve the existing condition of the saltmarsh through debris clearance and potential clearance of vegetation from existing saltmarsh pools.

Mitigation

Table 4-6 Natural England and RSPB Relevant Representations regarding Mitigation

Organisation	Relevant Representation
Natural England	B21: Natural England notes proposals to enhance saltmarsh for redshank. And agrees that capital works are appropriate, but mechanism to maintain the works permanently are not identified. Please be advised that works will require (1) annual management to prevent succession to poor quality (for redshank) saltmarsh; and (2) a mechanism to prevent access and associated disturbance from users of the nearby footpath. Furthermore, the proposed roost is likely to be subject to vessel disturbance which may compromise its functionality as an alternate roost.
RSPB	Loss of redshank roost and impact on foraging birds adjacent the application site [sic] – More information is needed to assess the full scale of impact on these SPA/Ramsar birds and demonstrate the proposed alternative roost would avoid the risk of an adverse effect on site integrity. This includes more detailed information on the alternative roost design, location, effectiveness, and long-term management to ensure it remains effective for the life of the project. Of particular importance is the need to clearly demonstrate that noise and visual disturbance during and post-construction, and recreational disturbance, will be effectively managed to provide sufficient confidence that the proposed alternative roost will be effective for the full period of time that nonbreeding redshank are present.

4.3.5 Paragraphs 17.8.30 to 17.8.37 of the ES Chapter 17 (Marine and Coastal Ecology) detail mitigation for Construction Impact 1 and are updated here following re-assessment of the updated baseline data. In order to mitigate the habitat loss specifically for the birds using this area, habitat enhancement in the Habitat Mitigation Area will need to provide additional foraging and roosting habitat to ensure that the same number of birds will still be able to use this overall roosting area. The proposed mitigation measures involve re-use of the rocks that have been observed to be the preferred habitat for roosting redshank within Section B adjacent to the proposed development site. The rocks would be placed approximately 250 m away or more in order to avoid disturbance issues from vessels using the wharf. There is also potential for implementing some saltmarsh enhancement and providing additional foraging areas by restoring scrapes (or saltmarsh pools) that are becoming vegetated and clearing of debris from saltmarsh along The Haven. Ongoing management of this area will be included within the updated Outline Landscape and Ecological Mitigation Strategy (OLEMS) report (document reference 7.4 (1)) to be submitted to the Examination at Deadline 2.

4.3.6 With any mitigation or offset measure there is a degree of uncertainty and for the Habitat Mitigation Area this remains as the potential for disturbance of vessels and whether birds would leave the roost. Whilst it is not expected that this increase would cause the birds to abandon this roosting area there is potential for additional energy usage with the additional disturbance. The additional disturbance is predicted as 1.6 vessels per day which would be 3.2 movements per day, equating to 1.6 vessel movements per tide. On the basis of the baseline observations, the majority of the birds affected by the additional vessel disturbance at the Habitat Mitigation Area are likely to respond by flying to another area within the roosting area (up to 400 m away) The great majority of the birds affected are likely to be roosting birds and therefore the additional disturbance is not anticipated to materially affect foraging time and thus energy intake rates. Given that shorebirds have a high ability for day-to-day regulation of their body mass, it is considered that an occasional increase of daily energy requirement of <1% is not likely to affect the survival chances of the birds affected. To assess this in greater detail a review of research on the energetic costs of flights for key birds within The Wash has been undertaken. Research that has been undertaken to investigate energetic costs of individual disturbance events within The Wash for key species (Collop et al, 2016) has calculated that for

redshank disturbed during feeding the energy cost per flight was equivalent to 0.074% of the daily energy budget. A flight response lasted for a mean of 17.44 seconds. Assuming a flight speed of 18.3 m/s, an average flight was 319 m. So, with a flight distance of up to 400 m (the maximum distance that birds fly to relocate from Section A to Section B and would be expected to fly within the roost site), this would be equivalent to 0.089% per flight. If there were four (as a WCS) additional flights per day this would be equivalent to 0.36% of the daily energy budget. This would not be considered to be significant.

4.3.7 In addition to this, a habitat offset area, to offset the loss of wetland habitat would also be designed to provide roosting and foraging habitat within close proximity to the Application Site. Given the existing concern over redshank and their breeding success in The Wash SPA, these measures would be designed to provide additional habitat areas for redshank, in particular.

4.3.8 Any additional areas of habitat creation for offsets that can be identified should lie within close proximity to the Principal Application Site (immediate opportunities include improvement of adjacent saltmarsh; creation, diversification and improvement of water bodies at Havenside Country Park, and conversion of agricultural fields to wetland through periodic inundation with fresh or saline water). Land will need to be secured and the mitigation in place before construction works begin, and plans will include details of ongoing management required to maintain its quality, including vegetation cutting and upkeep of any boundary measures to exclude predators or recreational entry or visual disturbance (through breaking the horizon) by pedestrian users of the England Coast Path.

4.3.9 In order to provide a net gain for birds, the habitat should be suitable in scale to support all birds and should be of suitable. habitat quality and area to support the same number of birds. Alternatively, creation of roosting and foraging habitat such as scrapes or shallow pools in local grassland or meadow habitat could be carried out, providing sufficient area to accommodate birds at the typical density in which redshank forage in such habitats. Only areas covered by water under 8 cm in depth are likely to be used or occupied by redshank (Ntiamoa-Baidu *et al.* 1998), therefore area of deeper water, i.e. unsuitable habitat, can influence density estimates at flooded sites. An equivalent site area of predominantly or entirely 8 cm water depth or less, will accommodate

more redshank, as well as ruff.

4.3.10 These measures are currently being investigated and will be reported in more detail in the updated OLEMS (document reference 7.4 (1)) to be submitted to the Examination at Deadline 2.

Construction Impact 3: Disturbance due to human activity/increased human presence

Table 4-7 Natural England and RSPB Relevant Representations regarding disturbance due to human activity

Organisation	Relevant Representation
Natural England	B4: Natural England acknowledges that monitoring by an ornithologist was undertaken for the EA Boston Haven embankment works for activities carried out during the autumn/spring passage and overwinter. Monitoring considered noise and visual disturbance and recorded species, numbers, and bird behaviour. A stop trigger (based on 1% of the cited SPA numbers) was used when works were noted to show disturbance. At that time a 500 m monitoring zone was required. For this project a 250 m zone has been suggested based on the data collected. We advise that this appears to be appropriate for BAEF considering the distance from the SPA and the reduced numbers of birds using the upper stretches of The Haven; but note data has shown numbers of Ruff and Redshank in Area A and B have exceeded the 1% threshold during monitoring so assurances that the buffer remain correct for these species is required.
RSPB	Loss of redshank roost and impact on foraging birds adjacent the application site [sic] – The Applicant's surveys have recorded over 1% of The Wash SPA/Ramsar population of redshank roosting and feeding adjacent to the application site (see Appendix 1 in Annex 1 & Table 3 in Appendix 2). The redshank using The Haven during the non-breeding season (which includes the winter, and the autumn and spring migration periods) will also include resident, breeding birds. Birds will move between the application site and The Wash SPA/Ramsar site at different times in the tidal cycle, and potentially seasonally. Therefore, the application site is functionally linked to The Wash SPA/Ramsar.
RSPB	Noise and visual disturbance - Significance of noise impacts during construction and operation on the non-breeding waterbirds using The Haven (functionally linked to The Wash SPA/Ramsar).

4.3.11 Paragraphs 17.8.67 to 17.8.88 of ES Chapter 17 (Marine and Coastal Ecology) detail the predicted impact on birds, and outline mitigation, relating to a construction-period increase in human presence and activity, which is updated here. This is also covered in the impact above with regard to the potential mitigation area and levels of disturbance and linkages to the SPA populations.

4.3.12 Update to ES 17.8.69 of Chapter 17 (Marine and Coastal Ecology): The WeBS count sectors from which Core Counts data were collected,

indicate that the preferred habitat (assessed from the density and diversity of count data) for bird species that would be sensitive to construction works is located at the mouth of The Haven, in The Wash SPA and Ramsar site. While this is sufficiently distant from the site to avoid disturbance impact directly from construction works and noise, birds at the proposed development site could be affected by construction noise, particularly piling activity. Due to the higher numbers of redshank overwintering in this area the piling activity has been restricted to the summer months when redshank are not present in the area.

4.3.13 The monitoring proposed for the construction phase would be developed as an adaptive monitoring and management plan and as such could adapt to increase or decrease the thresholds and triggers should the observations show this to be necessary.

Operation Impact 2: Changes in vessel traffic and movement leading to increased ship wash, underwater noise, disturbance and collision risk

4.3.14 Relevant representations are provided below. Responses are also provided in the formal responses to the representations.

Table 4-8 RSPB and Natural England Relevant Representations regarding changes in vessel traffic and movement

Organisation	Relevant Representation
RSPB	There is a lack of detailed assessment of ship movements, which are irregular and unlikely to allow birds to habituate to the activity. This is important, as the Applicant's surveys have demonstrated that disturbance to birds using the mouth of The Haven occurs under the current baseline level of vessel movements. The assessments need to review in more detail the implications of an increased impact of all navigable tides being used by large vessels and their associated pilot vessels over and above the baseline levels of disturbance.
RSPB	There is outstanding work to be reported around Wetland Bird Survey (WeBS) data to assess the full impact of the significant increase in vessel movements on all relevant WeBS sectors (see Appendix 2 in Annex 1 and Appendix 2 in Annex 2).
RSPB	There has been no assessment of disturbance to The Wash SPA/Ramsar/SSSI foraging and roosting birds along the entire length of The Haven. This is important to understand the full impact of the increased vessel movements and the overall scale of impact from the proposed development.
RSPB	Impact on birds roosting and foraging at the mouth of The Haven - The impacts of disturbance and boat wash arising from the predicted c.140% increase in large vessels and associated pilot vessels using The Haven as a result of the proposed Facility on the important concentrations of roosting

Organisation	Relevant Representation
	and feeding birds at the mouth of The Haven, over and above existing impacts from current vessel movements.
RSPB	Knock on effects (indirect consequences that are foreseen and will need to be robustly assessed in both the EIA and HRA) - A failure to assess the disturbance effect on features of The Wash SPA that could be created from ships stacking up along The Haven whilst vessels are turning. The Applicant's documents indicate this could result in delays of 30-45 minutes for other vessels using The Haven, which could have significant consequences for redshank and other features of The Wash SPA/Ramsar and SSSI that may be roosting and foraging within The Haven.
RSPB	Noise and visual disturbance - Lack of detailed assessment of the impacts of night-time operational noise and effects on designated sites, despite regular significant activity (including vessel deliveries and unloading) scheduled to take place at night.
Natural England	B5: Natural England notes that within the Haven there are likely to be seven SPA species likely to be disturbed by increased boat traffic i.e. dark-bellied brent goose, shelduck, lapwing, dunlin, black-tailed godwit, redshank, and turnstone.
Natural England	B6: Natural England is concerned that disturbance to roosts at the mouth of the Haven may affect 24 species including 8 at greater than 1% of site population.
Natural England	B7: Natural England notes that the area in the Mouth of the Haven likely to be disturbed by the proposed works include: - • golden plover and black-tailed godwit at over 20% of The Wash SPA total and over 2000 individuals; and • lapwing 7.5% and 1100 individuals. Therefore, we consider this to be an important area of supporting habitat of The Wash SPA. Natural England advises that an Adverse effect on integrity can't be excluded beyond all reasonable scientific doubt.
Natural England	B8: Natural England notes that it is recognised that birds are sensitive to boat disturbance.
Natural England	B9: Natural England agrees that displaced birds of some species fly 125-800 m to alternate roosts. However, it is not clear if the alternative roost/s can accommodate all individuals of all species. But we note that there is also no information on the quality of alternative roosts and if these are secondary and only used as a second choice when their preferred area is not available for whatever reason.
Natural England	B10: Natural England notes that phasing of boats up the Haven is identified, but how traffic down the Haven will be managed is not discussed. Natural England is concerned that birds would be at risk of being repeatedly pushed around over each high tide cycle.
Natural England	B11: Please be advised that most birds relocate on disturbance, but some species repeatedly return e.g. Lapwing and golden plover. Therefore, we believe that there is the potential for repeated disturbance impacts on same individuals. There is clear evidence that most birds left the area following boat passage up the channel and did not return except for Lapwing and Golden Plover that tried to return to site but were re-disturbed by subsequent vessel movements.

Organisation	Relevant Representation
Natural England	B12: Natural England notes that it is recognised that some species abandon roosts after disturbance e.g. Oystercatcher; redshank; black-tailed godwit. But this is contradictory to the HRA wording.
Natural England	B13: Natural England advises that, for species, which return to the roost it is likely to take more than 120 sec to pass by the roost from first disturbance to departure. Note this is equivalent to a fight of approx. 1.8 km (based on 15 m/s = 1800 m per 120 secs (Hedenström, A. & Åkesson, S. (2017). (Flight speed adjustment by three wader species in relation to winds and flock size. Animal Behaviour, 134, 209-215).
Natural England	B15: Natural England is concerned in relation to energy lost per flush which is quantified for repeatedly disturbed golden plover and lapwing. Range 0.39-0.51%.
Natural England	B16: Natural England is concerned that the daily loss of additional 2% energy input may be significant for species at the edge of their energy balance either as a default e.g. Black-tailed godwit (for which birds on the Wash have a negative daily energy budget in winter (Alves et al - Ecology, 94(1), 2013, pp. 11–17) or under certain conditions e.g. severe weather. Potential need for 2% increase in energy intake cannot be dismissed as insignificant or trivial.
Natural England	B17: Natural England notes that the displacement of 6980 birds is argued as being beneficial as birds are not present to be repeatedly disturbed. However, this is contradictory to the conservation objectives for The Wash SPA and HRA expectation that distribution of features within the designated site should not be affected. Therefore, we advise that the conservation objectives for the site are being hindered and an adverse effect on integrity can be ruled out.
Natural England	B18: Whilst Natural England agrees that some level of habituation may currently be occurring, there is no evidence presented to support the argument that this will be the case from a significant more than doubling of vessel disturbance, especially if preferred supporting habitat is also lost.
Natural England	B19: Natural England is unaware of any supportive evidence to say that night-time vessel movement would be less disturbing.
Natural England	B20: Natural England requests confirmation from the Applicant that with the traffic increase the current 20% of days (equivalent 46 days/yr) that are quiet would be lost. Natural England also advises that clarity is also sought on the potential for further increases in disturbance during all high tides from vessels movements i.e. will the proposed works take the Haven to the maximum carrying capacity? How would potential increases in boat traffic over the lifetime of the project be taken into account?

4.3.15 Update to paragraph 18.6.13 of ES Chapter 17 (Marine and Coastal Ecology): Paragraph 18.6.13 of the ES explained that the number of vessel movements within The Haven per tide can vary greatly, but generally up to four to five commercial vessels can sail The Haven per high tide. Due to the tidal nature of The Haven, vessels can generally transit up or down The Haven from approximately one to two hours before high tide, to 1.5 hours after high tide, giving a maximum tidal

window for vessel movements of approximately 3.5 hours around high tide. For commercial vessels to access the Port of Boston throughout the year, including at neap tides, their draught is limited to 3.5 m. Inbound and outbound commercial vessels can only pass at the intersection with Hobhole Drain. If vessels are required to be turned this is generally undertaken at high tide to maximise the draught for manoeuvrability. All ships must be at their destination (i.e. berthed or leaving Tabs Head) within the 3.5 hours. The Port of Boston currently handles approx. 420 arrivals of large vessels per year. 20-25% of tides currently have no large vessel movements, but this varies each year. The Facility will require approximately 580 vessels per year for the import and export of materials, increasing the number of vessel arrivals to 1,000 (an increase for The Haven of 138% in vessel movements). Over 730 high tides per annum this equates to on average 1.6 vessel arrivals and departures per tide, or three overall vessel movements per tide. As discussed in **Paragraph 4.3.17** The port in the past has handled over 800 vessel arrivals over one year. Anecdotal evidence from the Port Authority suggests even higher numbers in earlier years.

4.3.16 The Port of Boston and Boston Pilots coordinate all movements of commercial vessels within The Haven. All commercial vessels must have a Pilot on board before entering The Haven. Pilots are transported up and down The Haven by Pilot cutter. One cutter is sufficient for all but the most exceptionally busy high water navigation periods, so one (exceptionally two) cutter trip(s) per tide when commercial vessels would utilise The Haven occur noting that the tidal window is not long enough for three cutters. Cutters have a four-hour window per tide for movements to assist shipping movements or other requirements, such as hydrographic surveying. The cutters are certified for eight on board – two crew and six pilots. After completion of the proposed wharf, taxis are likely to be used to transport pilots from Port of Boston to the Facility by road to board vessels leaving the wharf, as using the pilot cutters to transport pilots between the Port and Facility may be inefficient or incapable of meeting time demands. The Facility is therefore unlikely to increase the number of times the Pilot cutters move up and down The Haven per day but will increase the absolute number per year as more high tides are used. The Facility would not have control over when vessels come in and out of The Haven, this is driven by the tidal cycles and the Pilots.

4.3.17 Update to paragraph 17.8.155 of Chapter 17 (Marine and Coastal

Ecology). The number of large vessels that will be arriving to and leaving (transiting) The Haven will increase from 420 per year (total visiting Port of Boston in 2019, as shown on **Figure 4-1** (DfT data source)) to approximately 1000 per year, due to the 580 vessel transits required per year during operation of the Facility. It should be noted from the figure and table below that previous numbers of vessels visiting the Port of Boston have been much higher than the current number of vessels (up to 800 in 1996). Data prior to 1994 was not available from the DfT but a search of log-book records by the Port of Boston has provided figures for vessel numbers arriving at the Port of Boston in previous years (as can be seen there were missing records, the table provides the available records). These are shown in **Table 4-9**. Numbers around 800 vessel arrivals were shown to occur for several years with even higher numbers in earlier years.

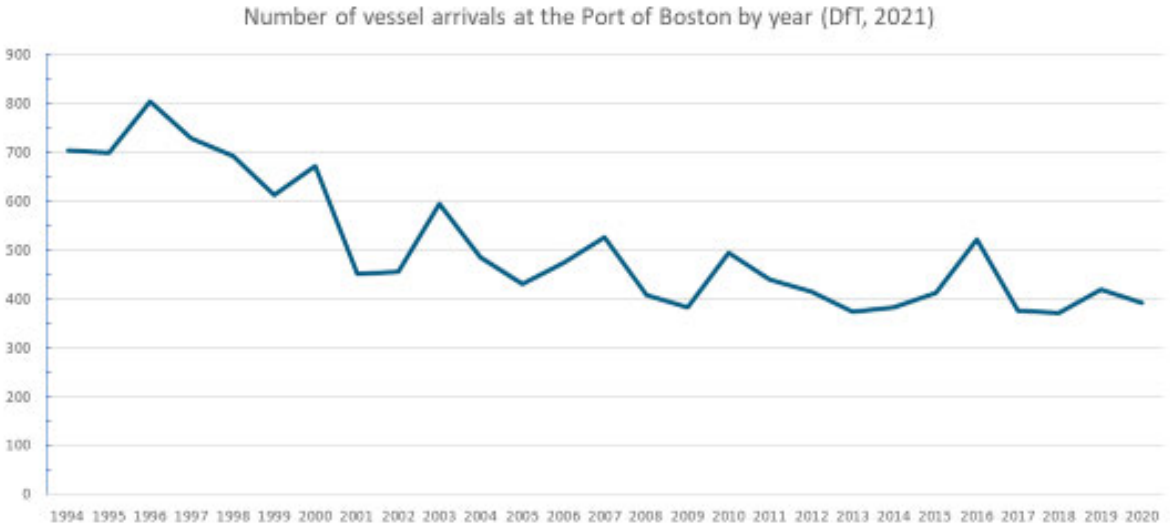

Figure 4-1 Number of vessel arrivals at the Port of Boston

Table 4-9 Log-book data for vessel arrivals at the Port of Boston (Source: Port of Boston)

Year	Number of Vessels arriving at the Port of Boston
1918	1088
1922	1354
1979	1009
1980	816
1981	815
1982	840
1983	702
1984	883
1985	896

4.3.18 Update to ES Chapter 17 (Marine and Coastal Ecology) paragraph 17.8.176: Baseline and projected activity of vessels at the mouth of The Haven is confined to approximately 3.5 hours around high water (due to the restrictions on depth of water and draft of vessels) and this causes disturbance largely to roosting birds. Disturbance observed was largely a result of visual impact of large vessels. Cargo vessels were the majority source of disturbance to feeding and land-roosting birds. Cargo and pilot boats are a disproportionate source of disturbance to birds on water/bathing (see **Appendix A1** for vessel disturbance information).

4.3.19 Update to ES Chapter 17 (Marine and Coastal Ecology) 17.8.178: Availability of alternative roost sites within 800 m of The Haven within the boundary of The Wash SPA is illustrated in **Figure 4-2**. The peak counts of key species designated as features or assemblage species for The Wash SPA at WeBS sectors surrounding The Haven suggest that there is capacity for the peak numbers of disturbed birds reported from the mouth of The Haven to receive refuge in these adjacent sites. This is discussed in further detail in **Appendix A1**. In addition, proposed management measures for the purpose of habitat offset loss for the proposed development site and net-gain will be provided and will be designed to also provide additional habitat for waterbirds using these sites.

Dark-bellied brent goose, 5-year peak WeBS counts in white, * = areas with highest densities, NC = no WeBS counting effort for species, ND = no data, all WeBS counts are over high water.

Oystercatcher, 5-year peak WeBS counts in white, * = areas with highest densities, NC = no WeBS counting effort for species, ND = no data, all WeBS counts are over high water.

Black-tailed godwit, 5-year peak WeBS counts in white, * = areas with highest densities, NC = no WeBS counting effort for species, ND = no data, all WeBS counts are over high water.

Turnstone, 5-year peak WeBS counts in white, * = areas with highest densities, NC = no WeBS counting effort for species, ND = no data, all WeBS counts are over high water.

Redshank, 5-year peak WeBS counts in white, * = areas with highest densities, NC = no WeBS counting effort for species, all WeBS counts are over high water.

Lapwing, 5-year peak WeBS counts in white, * = areas with highest densities, NC = no WeBS counting effort for species, ND = no data, all WeBS counts are over high water.

Golden plover, 5-year peak WeBS counts in white, * = areas with highest densities, NC = no WeBS counting effort for species, ND = no data, all WeBS counts are over high water.

Figure 4-2 WeBS count sectors showing peak counts for key species

Operation Impact 2: Noise levels and visual disturbance at the Application Site

4.3.20 This issue has been dealt with above (see **paragraphs 4.3.2-4.3.10**) when discussing the proposed habitat mitigation area and the potential for ongoing disturbance.

Cumulative Assessment

Table 4-10 RSPB Relevant Representation regarding Cumulative Assessment

Organisation	Relevant Representation
RSPB	The cumulative (ES) and in-combination (HRA) assessment is incomplete. For example, it incorrectly limits its scope to only considering sites and features where "project alone" impacts have been identified. This does not account for plans or projects that may have small effects but when combined they become significant. The process is deliberately designed to assess the type and scale of impacts which will be excluded by the Applicant's current approach. The RSPB fundamentally disagrees with this approach and considers it undermines the purpose of the Habitats Regulations requirements.

4.3.21 To clarify, the projects considered for cumulative and in-combination assessment considered sites and features where projects could have small effects but when combined could be potentially significant. Potential sites that could have had a temporal or spatial overlap with the proposed development were considered both for direct and indirect impacts.

5 Updates to the Habitats Regulations Assessment

5.1 Baseline Information for Protected Sites

5.1.1 Section A17.3 of the ES Appendix 17.1 Habitat Regulations Assessment details the designated feature species and assemblages, and the Conservation Objectives, of designated sites within the zone of impact of the proposed development. These remain unchanged. **Section 4** above details the additional information collated for the ornithological baseline since submission of the DCO. These data have been used to inform this addendum to the HRA.

5.1.2 This section updates the HRA for the proposed development and The Wash SPA (covering potential effects that are relevant to ornithological features (features specific to The Wash and North Norfolk Special Area of Conservation (SAC) are covered in separate reports including

habitats within the Marine Ecology Addendum and Seals in the Marine Mammal addendum). As per **ES Appendix A17.3**, the assessment also applies to The Wash Ramsar Site.

5.1.3 The proposed development has an area of potential impact that runs from the site itself, approximately 3 km from the boundary of The Wash SPA, along The Haven to the boundary and into The Wash where vessels exit The Haven at Tabs Head.

5.1.4 The update focuses on disturbance effects at the Application Site which occurs outside the boundary of the designated site, and potential effects within the site, including at the Mouth of The Haven (MOTH) where vessels enter The Wash from The Haven.

5.1.5 Disturbance effects at the MOTH are presented in detail in **Appendix A1**, and a summary of this assessment is presented here.

5.2 Conservation Objectives of The Wash SPA

5.2.1 The following conservation objectives apply to all designated bird species and the non-breeding waterbird assemblage feature for the site:

- Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the [Conservation of Habitats and Species Regulations 2017 (as amended)], by maintaining or restoring;
    - The extent and distribution of the habitats of the qualifying features
    - The structure and function of the habitats of the qualifying features
    - The supporting processes on which the habitats of the qualifying features rely
    - The population of each of the qualifying features
    - The distribution of the qualifying features within the site

5.2.2 As described in detail in **Appendix A1**, Natural England has produced detailed supplementary information and guidance on the practical application of the conservation objectives for The Wash SPA, including

targets for each qualifying feature[3].

5.3 Update to ES Appendix A17.4 Screening Exercise and Likely Significant Effect

5.3.1 Section A17.4 of the ES Appendix 17.1 Habitat Regulations Assessment proceeds through the Screening Exercise for Likely Significant Effect stage of the HRA. A further screening exercise has been undertaken to identify the qualifying features of The Wash SPA subject to LSE from the proposed development.

Non-breeding waterbirds

5.3.2 Non-breeding waterbirds designated as features of The Wash SPA or as part of the non-breeding waterbird assemblage were considered to potentially experience a Likely Significant Effect if they were present at the Application Site in numbers exceeding 1% of their population within The Wash SPA. Therefore, Redshank and the non-breeding waterbird assemblage are screened IN for Appropriate Assessment regarding impacts at the Application Site.

5.3.3 Non-breeding waterbirds designated as features of The Wash SPA or as part of the non-breeding waterbird assemblage were considered to potentially experience a Likely Significant Effect at the mouth of The Haven according to the importance of 'The Haven local area' and the mouth of The Haven 'site' for the species according to WeBS counts, and recorded mean and peak counts of the species disturbed during project-specific surveys at the mouth of The Haven. This is detailed in Appendix A4 along with Appropriate Assessment for the waterbirds screened in. Dark-bellied brent goose, black-tailed godwit, oystercatcher, redshank, turnstone, and the non-breeding waterbird assemblage are screened IN for Appropriate Assessment regarding impacts at the mouth of The Haven.

Common tern

5.3.4 Baseline surveys (breeding bird surveys, wintering bird surveys) indicate that common tern were not present during the breeding season (or winter season when generally absent from area) in proximity to the Application Site. The species was not recorded there over two breeding

[3] [redacted]

seasons. Data collated from WeBS Core Counts for The Haven Local Area, and MOTH, for April to September show that common tern were present in numbers relative to five-year average of annual peak WeBS counts for The Wash that suggest High importance of both The Haven Local Area and MOTH to the species. Changes in Behaviour surveys carried out in the breeding season show common terns were disturbed on one of three visits (33%) at the mouth of The Haven, in numbers exceeding 1% of five-year average of annual peak WeBS counts for The Wash (disturbance to ten birds which returned to their original roost within 60 s). Terns using the mouth of The Haven are loafing birds from local colonies which themselves are beyond the range for disturbance from additional vessels relating to the proposed project. Mitchell et al. (2004) indicates that the closest breeding common terns are in the south east of The Wash. There are also inland breeding birds in the area not designated as part of an SPA or other protected site. Balmer et al. (2013) also shows moderate numbers of inland common terns not far away. It is therefore reasonable to assume that only a small proportion of the late summer roosting common terns counted in WeBS counts or project-specific surveys will be breeding birds from The Wash SPA. The species is screened OUT for Appropriate Assessment.

Little tern

5.3.5 Baseline surveys (breeding bird surveys, wintering bird surveys Changes In Behaviour surveys) indicate that no little tern were present at or adjacent to the Application Site in the breeding season (or winter season when generally absent from area), and no little terns were observed to be disturbed by vessel movements. Data collated from WeBS Core Counts for The Haven Local Area, and MOTH, for April to August show that little tern were present in numbers relative to five-year average of annual peak WeBS counts for The Wash that suggest Medium to High importance of both The Haven Local Area and MOTH to the species. Terns using the mouth of The Haven are loafing birds from local colonies which themselves are beyond the range for disturbance from additional vessels relating to the proposed project. No little tern were recorded in project-specific surveys for disturbance by vessels. The species is screened OUT for Appropriate Assessment.

Table 5-1 Screening of SPA qualifying species for further assessment.

SPA qualifying species	5-year mean peak WeBS count for The Wash (2014/15 to 2018/19)	The Haven local area' mean valid WeBs count	Importance of 'The Haven local area' to Wash SPA (from Table 3)	Importance of 'MOTH site' to Wash SPA (from Table 2)	Percent of HT periods with disturbance seen	Peak no. seen disturbed as % of SPA population.	Mean no. seen disturbed as % of SPA population.	Mean no. seen disturbed as % of 'local area' mean WeBS count	Screened 'In' or 'Out' for further assessment
Bar-tailed godwit	18579	154	Medium	Low	13%	0.1%	0.1%	7%	Out
Bewick's swan	5	2	Very Low	Very low	0%	0%	0%	0%	Out
Black-tailed godwit	7805	472	**High**	**High**	**25%**	**26%**	**14%**	**233%**	**In**
Brent goose	13545	1611	**Very high**	**Very high**	**25%**	**8%**	**5%**	**43%**	**In**
Common Scoter	1342	52	Low	Very low	0%	0%	0%	0%	Out
Curlew	6653	111	High	Medium	63%	0.8%	0.2%	15%	Out
Dunlin	27258	553	High	High	63%	0.7%	0.4%	19%	Out
Gadwall	128	10	Low	Very low	0%	0%	0%	0%	Out
Golden plover [a]	13421	1281	**High**	Medium	**13%**	**19%**	**19%**	**195%**	**In**
Goldeneye	74	6	Very high	Low	0%	0%	0%	0%	Out
Grey plover	9132	124	High	Medium	13%	0.1%	0.1%	4%	Out
Knot	177869	1520	Low	Very low	13%	0.3%	0.3%	33%	Out

SPA qualifying species	5-year mean peak WeBS count for The Wash (2014/15 to 2018/19)	The Haven local area' mean valid WeBs count	Importance of 'The Haven local area' to Wash SPA (from Table 3)	Importance of 'MOTH site' to Wash SPA (from Table 2)	Percent of HT periods with disturbance seen	Peak no. seen disturbed as % of SPA population.	Mean no. seen disturbed as % of SPA population.	Mean no. seen disturbed as % of 'local area' mean WeBS count	Screened 'In' or 'Out' for further assessment
Lapwing [a]	11483	789	**Very high**	**High**	**50%**	**10%**	**5%**	**80%**	**In**
Oystercatcher	20471	943	**Very high**	**High**	**75%**	**3%**	**1%**	**23%**	**In**
Pink-footed goose	34211	403	Low	Low	0%	0%	0%	0%	Out
Pintail	458	22	High	High	0%	0%	0%	0%	Out
Redshank	5239	165	**High**	**High**	**100%**	**4%**	0.7%	**21%**	**In**
Sanderling	9052	0	Very low	Very low	0%	0%	0%	0%	Out
Shelduck	2359	99	Very high	High	38%	2%	0.6%	16%	Out
Turnstone	809	54	**Very high**	**High**	**38%**	**3%**	**2%**	**32%**	**In**
Wigeon	12172	715	High	High	50%	0.8%	0.3%	5%	Out

[a] Qualifies as a waterbird assemblage component only
[b] Valid counts are those undertaken in months when the species is present in large numbers in context of Wash population size

5.3.6 In **Table 5-1**, screened-in species are shown in bold together with the main criteria supporting the decision for their selection. MOTH = Mouth of The Haven. HT = high tide.

6 Update to ES Appendix A17.6 Information to inform an Appropriate Assessment

6.1.1 Section A17.6 of the ES Appendix 17.1 Habitat Regulations Assessment proceeds through the Appropriate Assessment for screened-in features of designated sites, which is updated here based on new information collated since the DCO submission. This information is provided to inform that Appropriate Assessment decision.

Table 6-1 RSPB and Natural England Relevant Representations regarding Information to inform an Appropriate Assessment

Organisation	Relevant Representation
RSPB	Loss of redshank roost and impact on foraging birds adjacent the application site [sic] – Non-breeding redshank are a feature of The Wash SPA/Ramsar and there is a restore target in the Supplementary Conservation Advice for The Wash non-breeding redshank population. Non-breeding and breeding redshank are a feature of The Wash SSSI. Significant declines in saltmarsh breeding redshank on The Wash have also occurred and are being explored with Natural England to identify what measures are needed to restore the breeding population. Any impacts from the project alone or in-combination with other activities that affect the redshanks using The Haven therefore has serious implications for restoring both the non-breeding and breeding populations.
RSPB	Loss of redshank roost and impact on foraging birds adjacent the application site [sic] – The presented evidence indicates that the roost would be lost and that there would be impacts to foraging birds. Like other redshanks, the redshanks using The Haven are highly site faithful during the non-breeding season and will be formed from a mixture of resident, breeding birds and migrants from breeding populations elsewhere in the UK and abroad (e.g. Iceland, continental Europe). Where roost sites have been lost from other sites (e.g. Cardiff Bay), even a relative short displacement distance of 4km has been found to reduce their body condition and survival rates. In order to maintain the redshank population there would need to be an increase in recruitment of young birds to any new habitat created to replace that lost. For The Wash redshank population, however, there has been a decline in breeding numbers and therefore it is not clear that, if The Haven roost was lost, recruitment would be sufficient to compensate for a reduction in survival. This has implications for the restoration target for The Wash SPA redshank population. This highlights the complexity of understanding and addressing impacts for this species and is an area that requires significantly more attention. It also reinforces the importance of maintaining the redshank roost and feeding function of the adjacent mudflats.
RSPB	There is a lack of detailed assessment of ship movements, which are irregular and unlikely to allow birds to habituate to the activity. This is important, as the Applicant's surveys have demonstrated that disturbance to birds using the mouth of The Haven occurs under the current baseline

Organisation	Relevant Representation
	level of vessel movements. The assessments need to review in more detail the implications of an increased impact of all navigable tides being used by large vessels and their associated pilot vessels over and above the baseline levels of disturbance.
RSPB	Impact of recreational pressure – The potential change in use of the footpath adjacent the proposed redshank compensation area due to the England Coast Path and proposed footbridge construction.
RSPB	Noise and visual disturbance - Limited detail presented regarding potential impacts of lighting on birds from the proposed facility and associated vessels.
Natural England	B27: Natural England acknowledges that the Applicant has confirmed that birds in The Haven are disturbed by vessels. But does not recognise that this will apply to the 'mitigation' roost area. And again, clarity is need in relation to vessel trip numbers etc.
Natural England	B28: Natural England notes that the loss of feeding grounds for 14- 27 redshank has not been compensated for, and as a species that is site loyal in winter there is no evidence to support the assumption that they will relocate to adjacent areas. It is not clear if The Haven is at capacity or not for its redshank population. As a Functionally Linked Population this will have a bearing on The Wash population, although as a relatively small part of the wider population and relatively distant form the SPA. It may, or may not be, of low risk to integrity. **Scheme should be aiming to compensate for this loss to mitigate impact on SPA.**
Natural England	B29: Natural England disagrees with the loss of foraging being dismissed as risk.
Natural England	B30: Natural England advises that the quality of saltmarsh as a biological community is not the issue for redshank – suitability as a roost is. This is more dependent on physical than botanical community aspects of the site. This will require active management and a monitoring regime that can feed into adaptive management. In the event that the disturbance caused by boats negates the value of the habitat enhancement.

6.1.2 This section reports updated data and assessment in order to inform an Appropriate Assessment for potential effects on bird species screened in due to vessel disturbance (visual, presence and noise during both construction and operation) at the MOTH, and habitat loss and disturbance through construction noise, vessel disturbance (visual, presence and noise during both construction and operation) and lighting at the Application Site.

Mouth of The Haven (MOTH)

6.1.3 A detailed assessment for each of the non-breeding waterfowl species screened in for disturbance effects at the MOTH is included in **Appendix**

A1.

6.1.4 For each species, **Appendix A1** considers the baseline conditions in terms of use of the MOTH; vulnerability to vessel disturbance based on relevant scientific and 'grey' literature and the results of the change in behaviour surveys commissioned for the project; and availability of alternative roost sites. An assessment is presented of the potential effect of the predicted additional vessel disturbance that would occur as result of the proposed development.

6.1.5 The potential effects are considered in relation to three tests derived from the SPA conservation objectives. These are, based on available scientific evidence and expert judgement, whether for a given species the additional disturbance would be predicted to result in a change in distribution at the MOTH, a change in abundance at the MOTH, and/or effects on survival and body condition that could have adverse effects at the SPA population level (e.g. leading to population declines).

6.1.6 A summary of the assessment for each species is included below:

Dark-bellied brent goose

6.1.7 Analysis of WeBS count data shows that brent geese potentially at risk of disturbance at the MOTH represent 5-8% of the SPA population. A number of alternative local roost locations are available to disturbed birds, both elsewhere within the MOTH and in the wider local area (as defined in **Appendix A1**) and including alternative locations within 1 km. When disturbed by vessels, which seems to be a regular occurrence, brent geese are therefore able to relocate to nearby alternative locations. It is concluded that the additional disturbance would not materially affect local distribution or abundance of brent goose across The Wash SPA.

6.1.8 Brent geese using the MOTH site over the high tide period are likely to be roosting birds and therefore the vessel disturbance is not anticipated to directly affect foraging time. Daily energy and nutrient intake rates of disturbed birds are therefore not likely to be reduced. The baseline change of behaviour study showed that vessel disturbance was caused by a single event (which comprised of pilot vessels) in any one high tide period (because the response to a vessel passing was for birds to move to an alternative site and they were thus not present when subsequent vessels passed). For brent goose, the energy expenditure associated with a single flight to a location less than 1 km away is considered to be

negligible in the context of birds' daily energy budget.

6.1.9 It is therefore concluded that additional vessel disturbance from the proposed development would not have an adverse effect on the conservation objectives of The Wash SPA for brent goose.

Black-tailed godwit

6.1.10 WeBS data show that on occasion numbers of black-tailed godwits at the MOTH are equivalent to 1-5% of The Wash SPA population, although they were absent on 77% of high tide periods. A roost site adjacent to the shipping channel is the most favoured black-tailed godwit roost site in the local area. During change of behaviour surveys, disturbed birds were observed moving to alternative sites 150 m and 800 m away, indicating that alternate roost sites are available. The change of behaviour surveys indicated that disturbance of roosting black-tailed godwit at the MOTH is likely to be caused by the first large vessel transit of the high tide period, and subsequent vessel movements therefore would not cause additional disturbance as birds moved away from the roost site close to the shipping channel.

6.1.11 Thus black-tailed godwit use the MOTH relatively infrequently, although when the species does occur it does so in relatively large numbers. This suggests that black-tailed godwit is using The Wash at a wider spatial scale than the local level of the MOTH. It is concluded that the additional disturbance would not materially affect local distribution or abundance of black-tailed godwit across The Wash SPA. The birds affected are likely to be roosting birds and therefore the disturbance is not anticipated to materially affect foraging time and energy intake rates. The additional energy expenditure associated with a single flight to a location less than 1 km away is likely to require less than 1% of a birds' daily expenditure (based on example calculation for knot in Rehfisch et al., 1996). It is also considered that the birds affected by additional vessel disturbance are not likely to be exposed to a materially higher predation risk.

6.1.12 It is therefore concluded that additional vessel disturbance from the proposed development would not have an adverse effect on the conservation objectives of The Wash SPA for black-tailed godwit.

Oystercatcher

6.1.13 WeBS data show that the MOTH area held over 1% of The Wash population on 63% of high-tide periods, and over 5% of the population

on 25% of high-tide periods, with a peak count equivalent to 20% of The Wash population.

6.1.14 The baseline disturbance surveys suggested that some parts of the MOTH used by roosting oystercatchers may be less susceptible to vessel disturbance than others, so roosting birds in this area are not always disturbed by passing vessels. When disturbance was observed, the response of oystercatchers to vessels using the MOTH was without exception to fly to an alternative site. In the vast majority of cases the birds moved to an alternative roost sites estimated to be between 150 m and 800 m away, although on one occasion a movement of 3.3 km was recorded. Therefore, roosting oystercatcher at the MOTH that are disturbed by vessels have a number of alternative local roost locations available to them, including alternative locations within 1 km. It is concluded that the additional disturbance from vessels associated with the Project would not materially affect local distribution or abundance of oystercatcher across The Wash SPA.

6.1.15 The majority of the birds affected by disturbance are likely to be roosting birds and therefore the additional disturbance is not anticipated to materially affect foraging time and energy intake rates. The additional energy expenditure associated with a single flight to a location less than 1 km away is likely to require less than 1% of a birds' daily expenditure (based on example calculation for knot in Rehfisch et al., 1996). It is also considered that the birds affected by additional vessel disturbance are not likely to be exposed to a materially higher predation risk.

6.1.16 It is therefore concluded that additional vessel disturbance from the proposed development would not have an adverse effect on the conservation objectives of The Wash SPA for oystercatcher.

Redshank

6.1.17 WeBS data show that the MOTH area held over 1% of The Wash population on 83% of high-tide periods and over 5% of the population on 20% of high-tide periods, with a peak count equivalent to 13% of the SPA population.

6.1.18 Observations during baseline disturbance surveys indicated that the response of redshank to vessels at the MOTH was always to fly to an alternative site, in the vast majority of cases between 250 m and 800 m away. On three occasions, all involving relatively small numbers, birds moved to feeding habitat between 5 and 100 m away and commenced

foraging. In these cases, it appears that the vessel disturbance stimulated an early departure from the high tide roost to nearby feeding grounds. Redshank roosting at the MOTH were usually disturbed by the first large or fast vessel transit of the observed high tide period. Subsequent vessel movements tended to result in no disturbance or disturbance of only a few individuals because there were generally no, or relatively few redshank, remaining at the roost site close to the shipping channel.

6.1.19 Thus roosting redshank at the MOTH that are disturbed by vessels are able to relocate to nearby alternative roost sites. Based on an analysis of ringing data of redshank wintering in The Wash, Rehfisch et al. (1996) showed that redshank refuges (roost sites) should be not more than 3.5 km apart if they are to be within reach of at least 90% of individuals. The distances that vessel-disturbed redshank are required to fly in moving to the alternative roost sites are therefore relatively small in the context of this study.

6.1.20 It is concluded that the additional disturbance from the Proposed Development would not materially affect local distribution or abundance of redshank across The Wash SPA. Any change in distribution or abundance would be at a sub-local level only.

6.1.21 The great majority of the birds affected are likely to be roosting birds and therefore the additional disturbance is not anticipated to materially affect foraging time and thus energy intake rates. The additional energy expenditure associated with a single flight to a location less than 1 km away is likely to require less than 1% of a birds' daily expenditure (based on example calculation for knot in Rehfisch et al., 1996).

6.1.22 It is therefore concluded that additional vessel disturbance from the proposed development would not have an adverse effect on the conservation objectives of The Wash SPA for redshank.

Turnstone

6.1.23 WeBS data show that the MOTH area held over 1% of The Wash population on 63% of high-tide periods and over 5% of the population on 20% of high-tide periods, with a peak count equivalent to 29% of the SPA population.

6.1.24 A roost site adjacent to the shipping channel is the most favoured turnstone roost site in the local area. The most frequently observed

response of turnstone at the MOTH to vessels was to fly to alternative roost sites between 100 and 800 m away, indicating that alternative roost sites are available in the local area. These distances are below the theoretical minimum ideal inter-roost distances discussed by Rehfisch et al. (1996) for a range of wader species wintering at The Wash. The change of behaviour surveys indicated that disturbance of roosting turnstone at the MOTH is likely to be caused by the first large vessel transit of the high tide period, and subsequent vessel movements therefore would not cause additional disturbance as birds moved away from the roost site close to the shipping channel.

6.1.25 It is concluded that the additional disturbance from vessels associated with the proposed development would not materially affect distribution or abundance of turnstone across The Wash SPA. The birds affected are likely to be roosting birds and therefore the disturbance is not anticipated to materially affect foraging time and energy intake rates. The additional energy expenditure associated with a single flight to a location less than 1 km away is likely to require less than 1% of a birds' daily expenditure (based on example calculation for knot in Rehfisch et al., 1996). It is also considered that the birds affected by additional vessel disturbance are not likely to be exposed to a materially higher predation risk.

6.1.26 It is therefore concluded that additional vessel disturbance from the proposed development would not have an adverse effect on the conservation objectives of The Wash SPA for turnstone.

Waterfowl assemblage

6.1.27 Lapwing and golden plover are cited as components of The Wash SPA non-breeding waterbird assemblage feature. it is concluded that the small to moderate local-scale changes (as described in **Appendix A1**) that could affect these species as a result of increased vessel disturbance from the proposed project would not have an adverse effect on the conservation objectives of The Wash SPA for the waterbird assemblage feature.

Application Site

6.1.28 At the Application Site, the screened-in taxa for assessment are i) redshank and ii) the non-breeding waterbird assemblage (via effects on named assemblage species ruff, ringed plover, cormorant, little grebe, lesser black-backed gull, mallard and white-fronted goose). Mark and

recapture studies indicate that during the non-breeding season, redshank tend to be fairly sedentary on estuaries, moving relatively small distances between roosting and feeding sites and tending to remain in the same area of an estuary. On The Wash, the mean and median within-year distances moved by adult and juvenile redshank between subsequent captures were less than 1km (the smallest distance for all species included in the study, the others being oystercatcher, grey plover, knot and dunlin; the range of recorded movements for redshank is not given, although some movements of adults between different sections of the estuary were also recorded (Rehfisch et al. 1993, 1996) indicating that birds sometimes moved considerably further than 1km (again distances are not given but comparison with a map of The Wash indicates that flights of 10-15km or more appear to have been made). Given a distance of approximately 3km between the Application Site and the SPA boundary, this indicates that most of the time redshanks at the application site would not be expected to travel to the SPA, but on occasion they might. Thus, for redshank, and on a precautionary basis for other species of the non-breeding waterbird assemblage, connectivity between the occurrence of these species at the Application Site and The Wash SPA non-breeding waterbird populations cannot be ruled out.

6.1.29 Update to ES Appendix 17.1 HRA paragraph A17.6.13: Bird counts of the intertidal area where the development site is proposed, were carried out over two winter and two breeding seasons as detailed in **Section 3.5.** Peak count results are reported in **Table 3-4** (for wintering birds) and **Appendix A2** (for all overwintering data for all species).

6.1.30 Update to ES Appendix 17.1 HRA paragraph A17.6.14: Counts of wintering waterbirds of each species exceeded 1% of The Wash SPA population for a minority of species as detailed in **paragraph 4.5.3.**

Redshank

6.1.31 Update to ES Appendix 17.1 HRA paragraph A17.6.15: Redshank numbers at high tide frequently exceeded 1% of The Wash SPA citation population, and on two occasions exceeded 1% at low tide. This was driven largely by counts at Section B, as detailed in Paragraphs 5.3.4 and 5.3.9. Redshank numbers at low tide during the breeding season (April to June) ranged from 0 to 1, indicating that the overwhelming majority of birds are absent from the proposed development site during the spring and summer breeding months. In **Table 6-2**, percentages

show the % of the SPA citation population of redshank for The Wash SPA. Highlighted cells show where the percentage was greater than 1%. Grey cells = no visit or data.

Table 6-2 Redshank counts for Sections A and B.

Redshank Counts	Count Section A (within proposed development area)		Count Section B (adjacent to proposed development area)		Combined counts Sectors A and B	
Survey month	Low Tide	High Tide	Low Tide	High Tide	Low Tide	High Tide
October 2019	18 (0.42 %)	20 (0.46 %)	25 (0.58 %)	78 (1.80 %)	43 (0.99 %)	98 (2.26 %)
November 2019	26 (0.60 %)	19 (0.44 %)	61 (1.41 %)	38 (0.88 %)	87 (2.01 %)	57 (1.32 %)
December 2019	14 (0.32 %)	27 (0.62 %)	19 (0.44 %)	33 (0.76 %)	33 (0.76 %)	60 (1.39 %)
January 2020	27 (0.62 %)	162 (3.74 %)	36 (0.83 %)	3 (0.07 %)	63 (1.45 %)	165 (3.81 %)
February 2020	26 (0.60 %)	29 (0.67 %)	21 (0.48 %)	93 (2.15 %)	47 (1.09 %)	122 (2.82 %)
March 2020	17 (0.39 %)	13 (0.30 %)	31 (0.72 %)	73 (1.69 %)	48 (1.11 %)	86 (1.99 %)
April 2020	0		0		0	
May 2020	0		0		0	
June 2020	0		0		0	
January 2021	24 (0.55 %)	44 (1.02 %)	34 (0.79 %)	43 (0.99 %)	58 (1.34 %)	87 (2.01 %)
February 2021	18 (0.42 %)	18 (0.42 %)	16 (0.37 %)	21 (0.48 %)	34 (0.79 %)	39 (0.90 %)
March 2021	15 (0.35 %)	26 (0.60 %)	34 (0.79 %)	73 (1.69 %)	49 (1,13 %)	99 (2.29 %)

Redshank Counts	Count Section A (within proposed development area)		Count Section B (adjacent to proposed development area)		Combined counts Sectors A and B	
April 2021	0		0		0	
May 2021	0	0	0		0	
June 2021	0	0	0		0	
July 2021		1 (0.02 %)				

Baseline vessel disturbance

6.1.32 Redshank were disturbed on 100% (3 of 3) of the high-tide periods watched during the baseline disturbance study at the proposed development site in winter, with five vessel disturbance events witnessed. The mean and peak numbers of redshank showing a disturbance response during the three winter high-tide periods monitored (based on the sum of birds disturbed in any one high tide period) was 46 and 120 birds respectively. These numbers correspond to approximately 1.1% and 2.8% of The Wash SPA population respectively. The mean number of redshank (15 birds) witnessed to be disturbed across all instances and high tide periods corresponds to approximately 17% of the mean project-specific winter high tide count (90 birds) for combined Section A and B. It is concluded that there is a high likelihood that any redshank roosting at sections A and B will be disturbed by passing vessels.

6.1.33 The number of redshank disturbed by vessels exceeded 1% of The Wash population during only one of the seven (14%) high tide periods monitored at the proposed development site between February and July 2021. On two of the seven (29%) high tide periods watched, the number of redshank disturbed was between 1 and 8 birds (<0.2% of The Wash population). Two of the five redshank disturbance events witnessed were cause by large cargo vessels, one was caused by the transit of a pilot boat, and two were caused by transit of a fishing boat. The response of redshank to vessels was predominantly to fly to an alternative site. In the vast majority of case the birds moved to an alternative roost sites estimated to be between 100 m and 400 m away. In all cases involving a cargo vessel or pilot boat, some roosting birds returned to their original location (within 60 seconds). For one cargo vessel disturbance this was undertaken by 2 birds compared to 13 that moved elsewhere. For the other cargo vessel this was 77 birds compared to 40 that moved elsewhere. Repeat disturbance to redshanks is therefore a possibility at the proposed development site.

Availability of alternative sites

6.1.34 It is not apparent that there are alternative roost sites locally available to redshank which offer the potential for avoiding disturbance from vessel movements. The observations of the vessel-disturbed redshanks moving to alternative roost locations between 150 and 300 m away entailed birds moving between survey Sections A and B, and

disturbance from vessels was recorded at both (Appendix A3). Measures proposed for re-using the rocks from Area A to provide additional roosting areas in Area B are expected to provide enough roosting habitat to support all of the redshank using this area. However, this does not mitigate for the increased vessel numbers causing disturbance in this area. Given that disturbance in this area appears to happen for the majority of vessels (including fishing and pilot vessels) it is likely that the birds are habituated to this disturbance.

6.1.35 However, as an offset for the loss of saltmarsh and mudflat for construction of a wharf in Section A habitat, opportunities are being sought for habitat enhancement and creation and these areas will be designed to also provide additional foraging and roosting habitat for redshank. Sites are being sought within 3.5 km but ideally, as close as possible to the proposed development site. The site would be of a suitable scale to support the redshank and the aim is that the area will be secured and in place before construction of the facility commences.

6.1.36 It is concluded that roosting redshank at the proposed development site that are disturbed by vessels will be able to either resettle on the roosting area at Section B (or relocate to nearby alternative roost sites created as an offset for the habitat loss within the local area). Based on an analysis of ringing data of redshank wintering in The Wash, Rehfisch et al. (1996) showed that redshank refuges (roost sites) should be not more than 3.5 km apart if they are to be within reach of at least 90% of individuals. The distances that vessel-disturbed redshank are required to fly in moving to the alternative roost sites are considered to be relatively small in the context of the results of the study by Rehfisch et al. (1996).

Predicted change due to proposed project

6.1.37 Disturbance of redshank always occurred in response to the first vessel transit of the watched high tide period. Thus, the key metric for predicting how the additional vessel movements associated with the proposed project could affect redshank is the number of additional high-tide periods in which transits by vessels would occur. As outlined in the definition in paragraph 5.3.5, the increase in rate of navigable tide use would be 0.8 vessels (based on an average increase in vessel use of 1.6 vessels per day). However, given that redshank are also disturbed by pilot and fishing vessels the likelihood of some disturbance on every tide will not change from the baseline as it is likely that vessels do use

The Haven on every tide. However, there would be an additional disturbance level as outlined above from 0.8 vessels per tide. Using a WCS this would be taken as 2 extra vessel movements per tide (or 4 per day).If redshank utilisation of the defined MOTH site and defined local area in terms of numbers and frequency of occurrence remained the same as under baseline conditions, and redshank return to roost sites after disturbance, the projected increase in vessels per tide of approximately 2 vessels per day (average of 1.6 per day) will apply as the increase in number of disturbance events to redshank per tide. (The average and peak number of redshank affected by vessel disturbance is not anticipated to materially change.)

Assessment

6.1.38 For assessing whether additional disturbance by vessels at the proposed development site would compromise the SPA's conservation objectives the relevant test questions are considered to be as follows:

- Test 1. Would the predicted additional vessel disturbance change the local distribution of the non-breeding redshank qualifying feature of The Wash SPA on a continuing basis?
- Test 2. Would the predicted additional vessel disturbance change the local abundance of the non-breeding redshank qualifying feature of The Wash SPA on a sustained basis?
- Test 3. Would the predicted additional vessel disturbance reduce the ability of a significant number of individuals of the non-breeding redshank qualifying feature of The Wash SPA to survive, breed, or rear their young?

6.1.39 For the non-breeding redshank qualifying feature, the answer to all three of the test questions is considered to be 'no'. It is therefore considered that potential additional vessel disturbance that would result from the proposed project would not compromise The Wash SPA conservation objectives for this qualifying interest. The reasoning behind considering that a 'no' answer is appropriate for the three test questions is summarised below.

6.1.40 Tests 1 and 2. The numbers likely to show a disturbance response in winter form only a small proportion (on average 1.1%, largest event witnessed 2.8%) of the SPA population. **Redshank are absent from the proposed development site area in spring and summer.** It is expected that the redshank using this area are habituated to vessel

disturbance, given that they are already disturbed regularly by any vessels using The Haven (including fishing vessels) and continue to use this roost site. Additionally, by the time of the increase in vessel numbers for construction and operation, redshank would have access to further alternative local roost locations in the local area created through the habitat offset measures. It is concluded that the additional disturbance would not materially affect local distribution or abundance of redshank across The Wash SPA. Any change in distribution or abundance would be at a sub-local level only.

6.1.41 Test 3. The Wash SPA redshank qualifying feature concerns non-breeding birds. Although some individuals are known to breed in the region the great majority of individuals move away from the local area during the breeding season. Therefore, the Test 3 question for redshank is limited to considering the potential for the proposed project to reduce the ability to survive of a significant number of SPA individuals. The ability to survive could be reduced if a significant number of individuals were subject to higher predation risk and/or energy stress caused by additional energy demands or reduced food intake. In applying this test, the terms 'significant number' and 'ability to survive' are not easily defined. Here a judgement is made by combining information on the likely frequency and duration of additional vessel disturbance events and the anticipated number and behavioural response of the birds that would be affected.

6.1.42 The baseline disturbance study and analysis of wintering bird counts showed that winter disturbance events typically affected approximately 1.1% of The Wash redshank population; the largest number disturbed in a high tide period corresponded to approximately 2.8% of the population. The numbers of redshank at risk of disturbance from the predicted additional vessel transits is anticipated to be the same as that at risk from vessel disturbance under baseline conditions. The number of birds disturbed is not anticipated to materially change, with most events anticipated to involve <1% and peak numbers not exceeding 5% of the SPA population. The great majority of the birds affected are likely to be roosting birds as vessel movements are restricted to high water, and therefore the additional disturbance is not anticipated to materially affect foraging time and thus energy intake rates. The additional energy expenditure associated with a single flight to a location less than 1 km away is likely to require less than 1% of a birds' daily expenditure (based on example calculation for knot in Rehfisch et al., 1996). Given that

shorebirds have a high ability for day-to-day regulation of their body mass, it is considered that an occasional increase of daily energy requirement of <1% per disturbance event (maximum of four additional vessel movements per day (i.e. two vessels moving up and down past the roost area) which would equate to one vessel per tide is not likely to affect the survival chances of the birds affected. Research that has been undertaken to investigate energetic costs of individual disturbance events within The Wash for key species (Collop et al, 2016) has calculated that for redshank disturbed during feeding the energy cost per flight was equivalent to 0.074% of the daily energy budget. A flight response lasted for a mean of 17.44 seconds. Assuming a flight speed of 18.3 m/s, an average flight was 319 m. So, with a flight distance of up to 400 m (the maximum distance that birds fly to relocate from Section A to Section B and expected to be the maximum flight distance within the HMA), this would be equivalent to 0.089% per flight. If there were four additional flights per day, as a WCS, this would be equivalent to 0.36% of the daily energy budget.

6.1.43 The birds using Sections A and B have been observed to move between these areas as part of their daily feeding behaviour whilst using the roost areas. It is also considered that the birds affected by additional vessel disturbance are not likely to be exposed to a materially higher predation risk. This is because the range and density of potential predators at the alternative roost locations within 1 km of the roost site adjacent to the Application Site are unlikely to be materially different, and the additional time spent in flight (flying individuals may be more vulnerable to birds of prey) is anticipated to be very small.

6.1.44 In addition, with the habitat offset measures in place, there will be additional locations, within the localised area, for redshank to use, providing additional roosting habitat.

6.1.45 Integrating the information above, it is considered very unlikely that additional vessel disturbance could reduce the ability of a significant number of The Wash SPA redshank population to survive.

Non-breeding waterbird assemblage

Baseline vessel disturbance

6.1.46 Sources and rates of vessel-based disturbance to birds at the proposed development site are presented, broken down by vessel type and by bird activity from which they were disturbed, in **Table 6-3**. Baseline

activity of vessels at the wharf site causes disturbance largely to roosting birds. Disturbance is largely a result of visual impact of both large (cargo) and small (fishing) commercial vessels. Cargo vessels were the majority cause of disturbance of foraging and land-roosting birds. Pilot boats were a disproportionate source of disturbance to birds on the water or bathing. Intervals between successive cargo vessels at the proposed development site and numbers of birds disturbed on each passage are detailed in **Table 6-3**. Where successive passages were recorded, birds exhibiting a response on the first and second passages did not strongly differ in number, indicating that repeat disturbance is possible at the proposed development site. Of assemblage species flagged as potentially occurring in important numbers at the proposed development site, disturbance to little grebe and ringed plover was not recorded during Changes In Behaviour surveys.

Table 6-3 Occurrences and rates of disturbance of waterbirds by vessel type at the proposed development site.

Vessel	Total vessel movements		No. of disturbance events		Reason for disturbance occurring				No. of events impacting specific bird activity: F = foraging R = roosting on land OW = On water					
	No. recorded	%	Total	%	Presence	%	Wave wash	%	F	By-vessel type %	R	By-vessel type %	OW	By-vessel type %
Cargo (large)	6	26	6	100	6	100	2	33	4	50	5	45	2	22
Pilot (small)	5	22	4	80	4	100	0		1	12.5	2	18	3	33
Fishing (small)	5	22	5	100	5	100	0		2	25	3	27	1	11
Recreation (small)	7	30	4	57	4	100	0		1	12.5	1	9	3	33
Total	23	-	19	83	19	100	2	11	8	42	11	58	9	47

6.1.47 **Table 6-3** is based on data found in Appendix A3.1.

Table 6-4 Intervals between successive cargo vessels per high tide observation session at the proposed development site, and numbers of birds successively displaced.

Month	Vessel type	Time interval between movements (mins)		Birds displaced by successive vessel movements		
		1-2	2-3	Vessel 1	Vessel 2	Vessel 3
Mar-21 (vis1)	Cargo (large)	-		23		
Mar-21 (vis2)	Cargo (large)	-		89		
Jun-21	Cargo (large)	16		16	15	
Jul-21	Cargo (large)	3		94	68	

6.1.48 **Table 6-4** is based on data found in **Appendix A3.1.**

Availability of alternative sites

6.1.49 It is apparent that there are alternative roost sites locally available to some species in the assemblage. The observation of the vessel-disturbed birds (bar-tailed godwit, cormorant, curlew, herring gull, lesser black-backed gull, ruff, shelduck) moving to alternative roost locations between 200 and 400 m away show that there are alternative roost sites within Section A and B. However, disturbance has been recorded in both sections A and B. Roosting birds disturbed by vessels that moved 500 m or more to a new roost site were cormorant and shelduck. Gull species and ruff showed a significant proportion of instances of returning to their original location having taken flight. Given the short distances for flights to alternative locations this is not expected to have a significant effect on energy usage for the birds.

6.1.50 Measures for habitat offset and re-use of roosting rocks, already planned due to loss of habitat for wharf construction would be designed to also provide additional foraging and roosting habitat for assemblage birds within the localised area. This would be completed before construction starts and vessel traffic increases. It is therefore predicted that already-planned habitat offsets can provide refugia for species otherwise prone to repeat disturbance. Little egret, oystercatcher, cormorant and shelduck were recorded in flight beyond view and the location and activity after disturbance for these birds was unknown.

Predicted change due to Proposed Development

6.1.51 As for redshank above, a WCS vessel usage increase of up to 2

additional cargo vessel movements per tide. For gull species and ruff, there is heightened likelihood of repeat disturbance within a tide. As for redshank above, the vessels per tide are projected under a WCS to increase by an average of two vessel movements per tide (using an average increase of 1.6 vessel movements per tide).

Assessment

6.1.52 For assessing whether additional disturbance by vessels at the proposed development site would compromise the SPA's conservation objectives the relevant test questions are considered to be as follows:

- Test 1. Would the predicted additional vessel disturbance change the local distribution of the non-breeding waterbird assemblage of The Wash SPA on a continuing basis?
- Test 2. Would the predicted additional vessel disturbance change the local abundance of the non-breeding waterbird assemblage of The Wash SPA on a sustained basis?
- Test 3. Would the predicted additional vessel disturbance reduce the ability of a significant number of individuals of the non-breeding waterbird assemblage of The Wash SPA to survive, breed, or rear their young?

6.1.53 For the non-breeding waterbird assemblage, the answer to all three of the test questions is considered to be 'no'. It is therefore considered that potential additional vessel disturbance that would result from the proposed project would not compromise The Wash SPA conservation objectives for this qualifying interest. The reasoning behind considering that a 'no' answer is appropriate for the three test questions is summarised below.

6.1.54 Tests 1 and 2. The assemblage of non-breeding waterbirds at the proposed development site is outside the boundary of The Wash SPA and dependent on species could have limited connectivity with the species' populations in The Wash SPA, although connectivity cannot be ruled out. The analysis also shows that some waterbirds in the assemblage already have alternative local roost locations available to them, in Section A and B and in the wider local area and including alternative locations within 1 to 2 km. Other species (such as redshank and ruff) are predicted to benefit from planned habitat offset measures prepared in response to habitat loss from construction. The baseline disturbance study showed that when disturbed by vessels, some

waterbird species routinely relocate to nearby alternative locations, typically also outside the SPA. It is concluded that the additional disturbance would not materially affect local distribution or abundance of waterbird assemblage species across The Wash SPA. Any change in distribution or abundance would be at a sub-local level only.

6.1.55 Test 3. The Wash SPA waterbird assemblage concerns non-breeding birds. Although some individuals are known to breed in the region the great majority of individuals move away from the local area during the breeding season. Therefore, the Test 3 question is limited to considering the potential for the proposed project to reduce the ability to survive of a significant number of SPA individuals. The ability to survive could be reduced if a significant number of individuals were subject to higher predation risk and/or energy stress caused by additional energy demands or reduced food intake. On the basis of the baseline observations, the birds affected by the additional vessel disturbance are likely to respond by flying directly to an alternative location less than 1 km way. The great majority of the birds affected are likely to be roosting birds and therefore the additional disturbance is not anticipated to materially affect foraging time and thus energy intake rates. The additional energy expenditure associated with a single flight to a location less than 1 km away is likely to require less than 1% of a birds' daily expenditure (based on example calculation for knot in Rehfisch et al., 1996). Given that shorebirds have a high ability for day-to-day regulation of their body mass, it is considered that an occasional increase of daily energy requirement of <1% is not likely to affect the survival chances of the birds affected. Given the average increase in vessel numbers of up to 1.6 per day this would equate to up to 1 additional vessel per tide. To assess this in greater detail a review of research on the energetic costs of flights for key birds within The Wash has been undertaken. Research that has been undertaken to investigate energetic costs of individual disturbance events within The Wash for key species (Collop et al, 2016) has calculated that for redshank disturbed during feeding the energy cost per flight was equivalent to 0.074% of the daily energy budget. A flight response lasted for a mean of 17.44 seconds. Assuming a flight speed of 18.3 m/s, an average flight was 319 m. So, with a flight distance of up to 400 m (the maximum distance that birds fly to relocate from Section A to Section B), this would be equivalent to 0.089% per flight. If there were four additional flights per day this would be equivalent to 0.36% of the daily energy budget. It is also considered that the birds affected by additional vessel disturbance are not likely to be exposed to

a materially higher predation risk. This is because the range and density of potential predators at the alternative roost locations within 1 km the MOTH roost site are unlikely to be materially different, and the additional time spent in flight (flying individuals may be more vulnerable to birds of prey) is anticipated to be very small.

6.1.56 Update to ES **Appendix A17.6.73** Reaching conclusion of no Adverse Effect On Integrity

Table 6-5 Natural England Relevant Representations regarding No Adverse Effect on Integrity

Organisation	Relevant Representation
Natural England	B41: Natural England disagrees with the assertion made that displaced birds are subjected to no further disturbance at alternate, and presumably sub -optimal (as they have not been selected initially), roosts. Please be advised that **no evidence from monitoring of receiver roosts has been provided so cannot assume that birds are able to occupy nearby alternates or that they are not subject to additional energy depletion as a consequence of relocation.**
Natural England	B42: Natural England is concerned that the Applicant believes that there is no impact along Haven, when there has been no assessment and support evidence provided.
Natural England	B43: Natural England advises that increased disturbance by a minimum (depending on final agreed figures for vessel movements) of 20-25% because of move to daily boat traffic, including an increase of 34% of days in the key winter period is not insignificant and therefore should not be dismissed.

6.1.57 Given the updates above there is no change to the conclusion of no Adverse Effect on Integrity. Analysis of additional bird data has been used to provide additional evidence for the conclusions drawn. The measures proposed to address the habitat loss outside of the SPA also provide additional habitat for birds to use. This provides a gain for the birds using the area that are already disturbed by the vessels moving up and down The Haven during the baseline levels of disturbance.

6.2 Update to ES Appendix A17.5 In-combination effects

Table 6-6 RSPB Relevant Representations regarding In-combination Effects

Organisation	Relevant Representation
RSPB	There is a lack of wider assessment of baseline disturbance effects to assess cumulative and in combination impacts.
RSPB	The cumulative (ES) and in-combination (HRA) assessment is incomplete. For example, it incorrectly limits its scope to only considering sites and features where “project alone” impacts have been identified. This does not account for plans or projects that may have small effects but when

Organisation	Relevant Representation
	combined they become significant. The process is deliberately designed to assess the type and scale of impacts which will be excluded by the Applicant's current approach. The RSPB fundamentally disagrees with this approach and considers it undermines the purpose of the Habitats Regulations requirements.
RSPB	Knock on effects (indirect consequences that are foreseen and will need to be robustly assessed in both the EIA and HRA) - No information to assess the effect on foraging and roosting birds arising from potential changes in fishing vessel activity and behaviour to avoid the potential delays caused by the additional vessels turning.
RSPB	Knock on effects (indirect consequences that are foreseen and will need to be robustly assessed in both the EIA and HRA) - Failure to provide more detail on the potential that the fishing fleet could relocate downstream of the facility should it be developed, as this would also have the potential to cause an adverse effect on integrity of The Wash SPA/Ramsar and result in additional habitat loss and disturbance to SPA/Ramsar and SSSI features, as a consequence of the proposed facility.

6.2.1 Section A17.6 of the ES (Appendix 17.1 Habitat Regulations Assessment) proceeds through the identification of In-Combination Effects for the HRA.

6.2.2 The projects considered for cumulative and in-combination assessment considered sites and features where projects could have small effects but when combined could be potentially significant. Potential sites that could have had a temporal or spatial overlap with the proposed development were considered both for direct and indirect impacts.

6.2.3 A Navigational Risk Assessment is being submitted to the examination at Deadline 2 which will confirm the ability of fishing vessels to continue to transit The Haven similarly to the current case. It is not considered that the facility will operate in any way that significantly affects fishing vessel movements and mitigation (in the form of a Navigational Management Plan) is identified to help achieve this (Environmental Statement Chapter 18 (Navigational Issues) (document reference 6.2.18, APP-056). The Navigational Risk Assessment will provide further certainty on this matter.

6.3 Update to ES Appendix A17.7 Conclusion

6.3.1 Following assessment of additional data with respect to all features and designated sites, including in relation to more recently collected data, the conclusion remains that there will be no Adverse Effect on Site Integrity. This is evident in the scale of impacts including the quantitative description of disturbance to species at the mouth of The Haven and the Application Site, and the availability of alternative roosting sites in particular within reach of the mouth of The Haven. Impacts will be further limited through the inclusion of management actions for net-gain within the localised area to provide additional habitat. These measures will include for ongoing maintenance of these areas to ensure that they remain fit for purpose.

7 References

BTO, 2010. WeBS Data Request Service Overview | Guidance Notes revision 3.0. Available at:

Balmer, D.E., Gillings, S., Caffrey, B.J., Swann, R.L., Downie, I.S. and Fuller, R.J., 2013. *Bird Atlas 2007-11: the breeding and wintering birds of Britain and Ireland*. Thetford: BTO.

Barnard, C. J., Thompson, D. B. A., & Stephens, H. (1982). Time budgets, feeding efficiency and flock dynamics in mixed species flocks of lapwings, golden plovers and gulls. *Behaviour*, 80 (1-2): 44-69.

Burton, N.H.K., Rehfisch, M.M., and Clark, N.A., 1999. *The Effect of the Cardiff Bay Barrage on Waterfowl Populations 10. Distribution and Movement Studies August 1998-May 1999. BTO Research Report No. 233***.** British Trust for Ornithology, Thetford.

Collop, C., Stillman, R.A., Garbutt, A., Yates, G., Rispin, E. and Yates, T. 2016. Variability in the areas, energy and time costs of wintering waders responding to disturbance.

Cresswell, W and Whitfield, D., 2008. The effects of raptor predation on wintering wader populations at the Tyninghame Estuary, Southeast Scotland. Ibis. 136. 223 - 232. 10.1111/j.1474-919X.1994.tb01088.x

Cresswell, W., 2008. Non-lethal effects of predation in birds. Ibis, 150: 3-17.

Cutts, N., Hemingway, K. and Spencer, J., 2013. Waterbird Disturbance Mitigation Toolkit Informing Estuarine Planning & Construction Projects Version 3.2, March 2013 Copyright University of Hull https://gat04-live-1517c8a4486c41609369c68f30c8-aa81074.divio-media.org/filer_public/8f/bd/8fbdd7e9-ea6f-4474-869f-ec1e68a9c809/11367.pdf

Dobinson, H.M. and Richards, A.J., 1964. The effects of the severe winter of 1962/63 on birds in Britain. *British Birds* **57**(10), pp.373-434.

Fox, A., and Madsen, J. (1997). Behavioural and Distributional Effects of Hunting Disturbance on Waterbirds in Europe: Implications for Refuge Design. Journal of Applied Ecology, 34(1), 1-13. doi:10.2307/2404842

Inger, R., Inger, R., Harrison, X.A., Ruxton, G.D., Newton, J., Colhoun, K., Gudmundsson, G.A., McElwaine, G., Pickford, M., Hodgson, D. and Bearhop, S., 2010. Carry-over Effects Reveal Reproductive Costs in a Long-distance Migrant. *Journal of Animal Ecology*, vol. 79, no. 5, 2010, pp. 974-82.

Mitchell, P. I., Newton, S. F., Ratcliffe, N., & Dunn, T. E. (2004). *Seabird populations of Britain and Ireland.* T. & AD Poyser, London.

JNCC (Joint Nature Conservation Committee), 2019. Severe Weather Scheme | JNCC – Adviser to Government on Nature Conservation. Available at: [redacted]

Natural England, 2017. The Wash SPA – Advice on seasonality. Last updated: 20 Mar 2017. Available at: [redacted] Accessed 13 Sep 2021

Natural England 2021. The Wash SPA – Advice on operations. Last updated: 19 Mar 2021. Available at: [redacted] Last accessed 19 Sep 2021

Ntiamoa-Baidu, Y., Piersma, T., Wiersma, P., Poot, M., Battley, P. and Gordon, C., 1998. Water depth selection, daily feeding routines and diets of waterbirds in coastal lagoons in Ghana. *Ibis*, *140*(1), pp.89-103. Available at: [redacted]

Pilcher, R.E.M., 1964. Effects of the cold winter of 1962-63 on birds of north coast of The Wash. *Wildfowl* **15**, pp. 23-26

Rehfisch, M.M., Langston, R.H.W, Clark N.N and Forrest, C. (1993). A guide to the provision of refuges for roosting waders. BTO Research Report No. 120, Thetford, Norfolk.

Rehfisch, M M, Clark, N A, Langston R H W, and Greenwood, J J D., 1996. A Guide to the Provision of Refuges for Waders: An Analysis of 30 Years of Ringing Data from The Wash, England. *Journal of Applied Ecology*, Aug., 1996, Vol. 33, No. 4, pp. 673-687

Summers, R. W., and Critchley, C. N., 1990. Use of Grassland and Field Selection by Brent Geese Branta Bernicla. *Journal of Applied Ecology*, vol. 27, no. 3, pp. 834-46

Woodward, I.D., Frost, T.M., Hammond, M.J., and Austin, G.E., 2019. Wetland Bird Survey Alerts 2016/2017: Changes in numbers of wintering waterbirds in the Constituent Countries of the United Kingdom, Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSIs) and Areas of Special Scientific interest (ASSIs). BTO Research Report 721. BTO, Thetford. Available at: [redacted]

A1 Atlantic Ecology Analysis of WeBS data and disturbance at the Mouth of The Haven

Appendix A1. Assessment of the Potential Additional Vessel Disturbance at the Mouth of The Haven

Contents

1. Approach to assessment

The fundamental question that is addressed in this Habitat Regulations Assessment (HRA) report appendix is whether the additional vessel disturbance at the mouth of The Haven (MOTH) that would result from the Proposed Development would have an adverse effect on integrity (AEOI) of The Wash Special Protection Area (SPA). The Appropriate Assessment (AA) of this effect requires an examination of which qualifying interests could be affected by such disturbance, and whether the degree of disturbance would compromise The Wash SPA conservation objectives.

1.1 Conservation objectives, targets and guidance

The conservation objectives for The Wash SPA are as follows:

Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely
- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site.

These conservation objectives are set for each SPA bird feature.

These Conservation Objectives are those referred to in the Conservation of Habitats and Species Regulations 2017 (as amended) ('the Habitats Regulations'). They must be considered when a competent authority is required to make a 'Habitats Regulations Assessment' including an Appropriate Assessment, under the relevant parts of this legislation.

Natural England (NE) has produced detailed supplementary information and guidance on the practical application of the conservation objectives for the Wash SPA, including targets for each qualifying feature. This guidance is available online at:

[redacted]

One of the attributes considered in the NE conservation objectives guidance is "Disturbance caused by human activity". The guidance includes information on how disturbance can impact the conservation objectives and under what circumstance disturbance it should be considered to be significant. The guidance also includes a general target for The Wash SPA relating to the levels of disturbance of qualifying interests and its management.

For all qualifying features the stated target with regard to disturbance for The Wash SPA as a whole is: "*Reduce the frequency, duration and/or intensity of disturbance affecting roosting and/or foraging birds so that they are not significantly disturbed*".

The NE guidance on disturbance is used to inform the approach to assessment of the disturbance that could result due to the Proposed Development.

The NE conservation objectives guidance also contains targets relating to the abundance of each SPA qualifying feature. Through comparison with recent counts for the SPA, these abundance targets give an indication of a qualifying feature's approximate current conservation status and are therefore relevant to the assessment of the Proposed Development. The SPA abundance targets for key species are stated in the species accounts below.

The NE conservation objectives guidance also contains targets and supporting information that has relevance to the potential measures to manage disturbance (see species accounts below). Two targets that apply to all The Wash SPA qualifying interest wader species that have particularly high relevance are:

- Maintain a vegetation structure of key roost sites dominated by bare ground or a short sparsely vegetated sward.
- Maintain the area of open and unobstructed terrain around roosting and feeding sites.

2. Scope of assessment

The assessment presented in this appendix considers the scale, frequency, duration and significance of the vessel disturbance on The Wash SPA qualifying interests at the MOTH that are predicted to result from the Proposed Development.

It is beyond the scope of this HRA to assess what impact the baseline MOTH vessel disturbance may be having on The Wash SPA qualifying interests and whether it may compromise the SPA conservation

objectives. However, it is relevant to comment on the levels of baseline MOTH vessel disturbance, both for putting the predicted additional disturbance from the Proposed Development into context and in making the case for management measures that could avoid or reduce vessel disturbance. Where appropriate, comments on the baseline MOTH vessel disturbance are provided in the species accounts.

2.1 Significance of vessel disturbance

The NE conservation objectives guidance for The Wash SPA advises that the definition of significant disturbance adopted by The Agreement on the Conservation of African-Eurasian Migratory Waterbirds, 2016 (AEWA) is appropriate to apply when considering the significance of disturbance to The Wash SPA qualifying interests. The definition adopted by AEWA is based on the review paper by Fox and Madsen (1997). Significant disturbance is defined as:

"Disturbance should be judged as significant if an action (alone or in combination with other effects) impacts on (water)birds in such a way as to be likely to cause impacts on populations of a species through either:

I. changed local distribution on a continuing basis; and/or
II. changed local abundance on a sustained basis; and/or
III. the reduction of ability of any significant group of birds to survive, breed, or rear their young.

The practical application of this definition in this HRA requires the word 'local' to be defined and this is considered below. The words 'continuing' and 'sustained' are taken to mean disturbance that is both reasonably frequent and long-term.

2.2 Definition of local

The word 'local' is not defined in the NE SPA conservation objective guidance website. In a general sense local implies something that has a geographic scale that is below both the regional and district/county scale. The Wash SPA is a very large site (620 km^2) of a size corresponding to district/county scale of everyday use of these words – i.e. areas of at least 100 km^2. Thus it is reasonable to assume that in the context of The Wash SPA the term 'local' implies a geographic scale below the whole SPA. Defining what is meant by 'local' could also take into consideration the ecology of the bird species of interest. In this respect local might equate to the area over which wintering individuals have at least a reasonable knowledge gained from their regular day to day activities. This will vary species to species, but for individuals of many wintering wader species is likely to be a relatively small part of the Wash. Thus it is considered that in the case of The Wash, local should be taken as referring to a geographic area of up to a few 10's of km^2. For the purposes of the AA 'local' is taken to refer to those parts of the SPA that are adjacent to The Haven. For practical purpose this is defined as the area included within the following WeBS count sectors:

- Frampton North 21
- Frampton North 22
- Frampton North 23
- Frampton North 24
- Frampton North 25
- Frampton North 26

- Frampton North 27
- Frampton North 31
- Frampton North 60
- Witham 20
- Witham 40
- Witham 41
- Witham 51
- Witham 52
- Witham 60

The defined **'The Haven local area'** is illustrated in Figures 1 and 2. The defined local area covers an area of 5.2 km^2, corresponding to 0.8% of the area of The Wash SPA.

2.3 Definition of Mouth of the Haven (MOTH) site

In the case of The Wash SPA, it is considered that individual WeBS sectors are below the local scale on account of their very small size (typically they cover <1 km^2). The MOTH covers a relatively small part of the defined local area and is therefore considered to be a site within the local area. For practical purposes the MOTH is defined as a site within the local area comprising the following WeBS count sectors:

- Frampton North 27
- Frampton North 31
- Witham 20
- Witham 60

The defined '**MOTH site**' is illustrated in Figure 2.The defined MOTH site covers an area of 0.65 km^2. The extent of the defined MOTH site corresponds to 12% of the defined local area and 0.1% of the area of The Wash SPA.

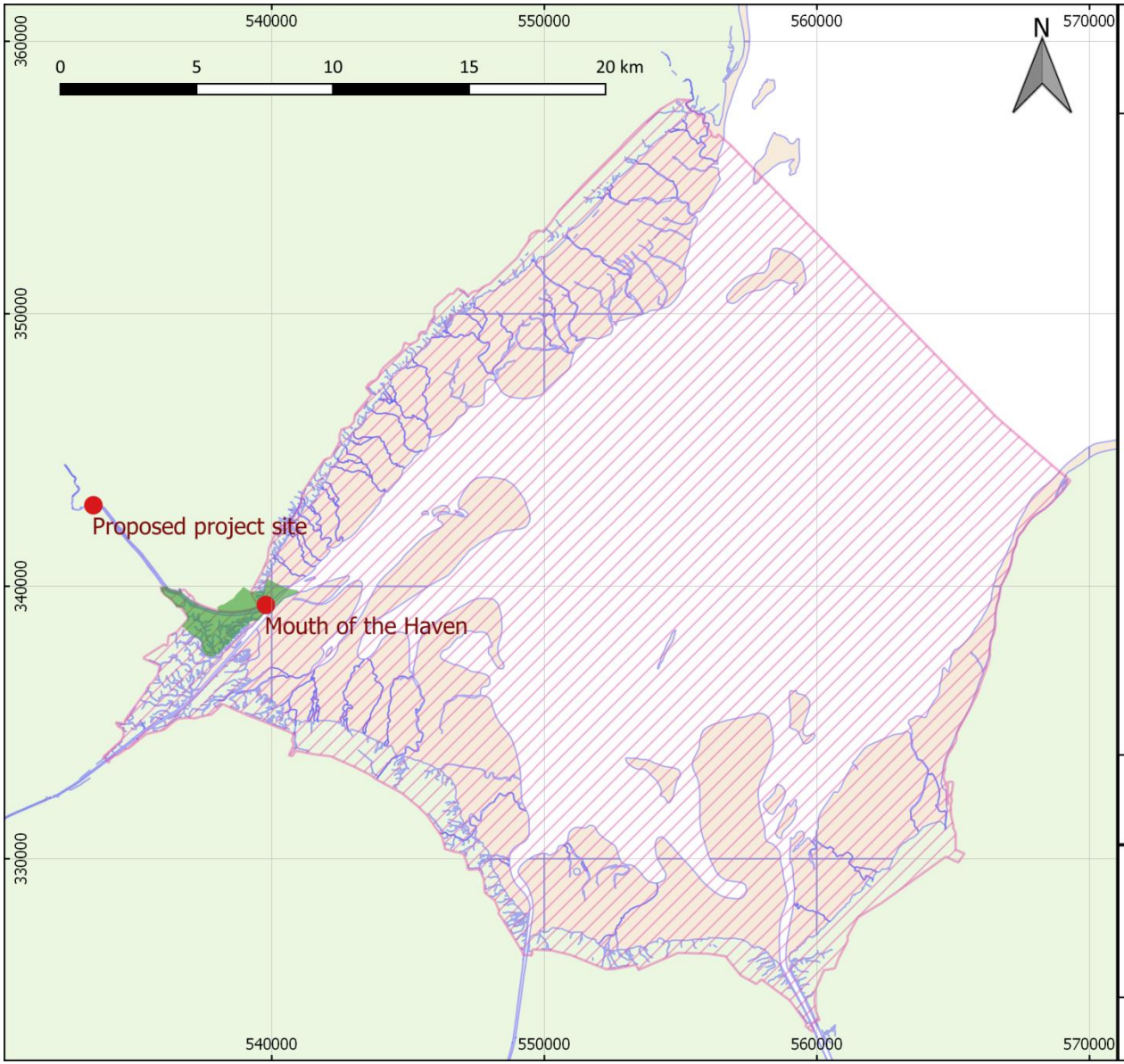

Figure 1. Extent of the defined 'local area' within The Wash SPA

Key:

Local area WeBS sectors

The Wash SPA

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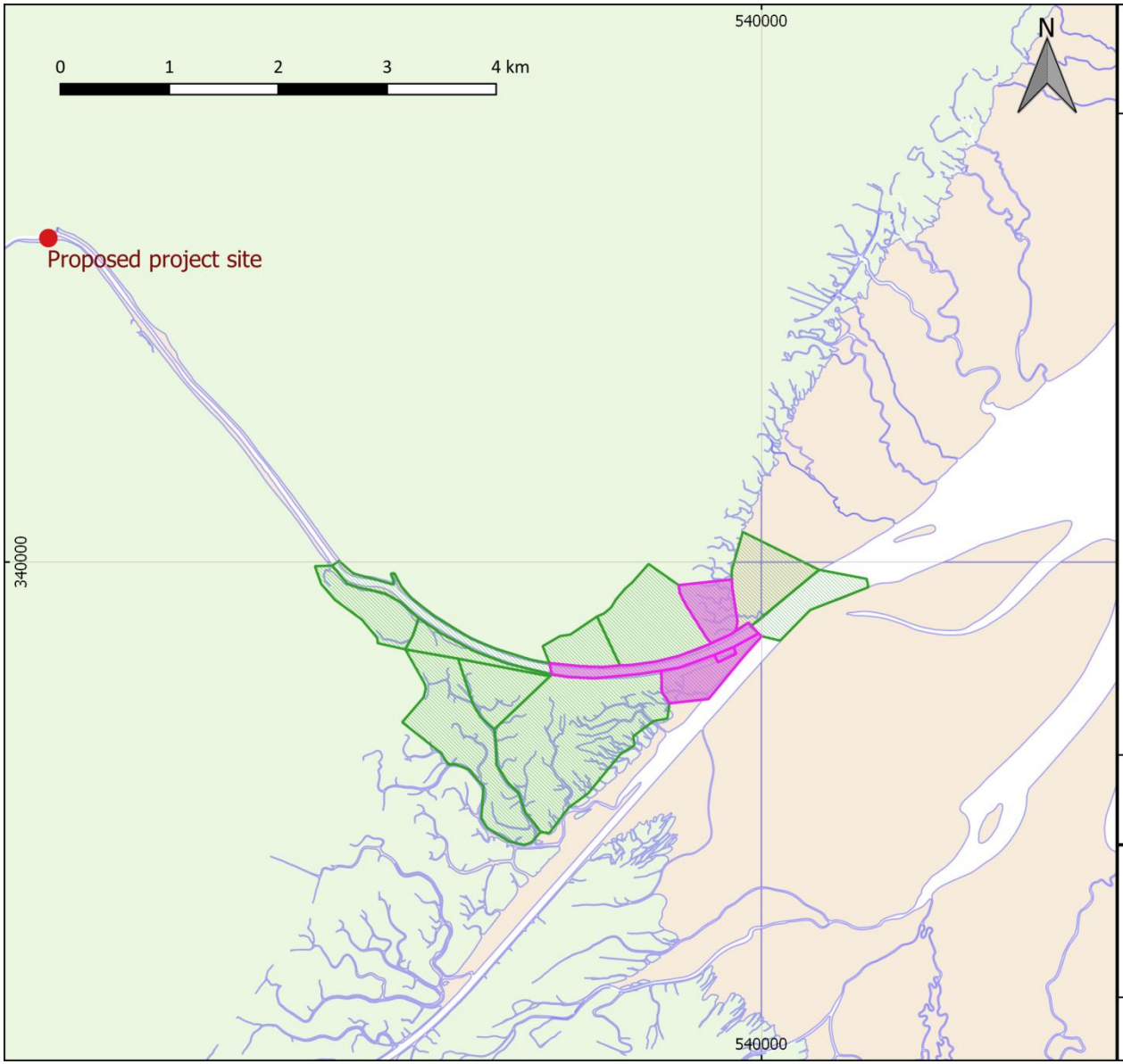

Figure 2. Extent of the defined 'mouth of The Haven (MOTH) site' within the defined 'local area'

Key:

MOTH site, WeBS sectors

Local area, WeBS sectors

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2.4 HRA tests

Applying the term 'local' as defined above and adopting the AWEA definition of 'significant disturbance', it is considered that for the purposes of this HRA, the appropriate tests for the significance of the potential additional MOTH vessel disturbance can be framed as follows:

Is the additional disturbance likely to cause impacts on SPA qualifying interests through:

- changed distribution within The Haven local area (as defined) on a continuing basis;
- changed abundance within The Haven local area (as defined) on a sustained basis;
- the reduction of ability of any significant number of birds in the context of SPA numbers of birds to survive, breed, or rear their young.

Before addressing these questions information is needed to establish the importance of The Haven local area and the MOTH site within this to the SPA. Specifically for each qualifying interest the following needs to be established:

- The importance of 'The Haven local area' (as defined) to the SPA population,
- The importance of the 'MOTH site' (as defined) to the SPA population,
- The importance of the 'MOTH site' (as defined) to the birds using 'The Haven local area' (as defined).

The importance of the 'The Haven local area' (as defined) and the 'MOTH site' (as defined) in the context of the SPA is categorised as Very low, Low, Medium, High or Very high on the basis of the size and frequency of WeBS count data conducted between 2014 and 2019 and according to the criteria in Table 1. The analysis of WeBS count data is restricted to seasonally valid high tide counts, i.e. only counts made in months of the year when that species occurs in the Wash in large numbers in the context of the Wash population size.

Table 1. Definitions used to categorise the importance of the 'Mouth of the Haven site' and 'The Haven local area' to Wash SPA qualifying species, based on magnitude of seasonally valid WeBS counts made between 2014 and 2019

Importance category	0.2% - 1% of Wash 5-year peak count	1% - 5% of Wash 5-year peak count	>5% of Wash 5-year peak count
Very high	Any	Any	Very Frequent, Guide: ≥25% of valid counts
High	Any	Very Frequent, Guide: ≥25% of valid counts	Frequent, Guide: ≥5-25% of valid counts
Medium	Any	Frequent, Guide: ≥5-25% of valid counts	Seldom, Guide: <5% of counts
Low	Frequent, Guide: ≥5-25% of valid counts	Seldom, Guide: <5% of count	Never or very occasionally
Very low	Seldom, Guide: <5% of count	Never or very occasionally	Never or very occasionally

Summary WeBS count information and importance category for each qualifying interest are presented in Table 2 and Table 3 for the defined 'The Haven local area' and defined 'MOTH site' respectively.

In the context of The Wash SPA, The Haven local area (as defined) is determined to have very high importance for four species (dark-bellied brent goose, lapwing, goldeneye and shelduck) and high importance for nine (black-tailed godwit, curlew, dunlin, grey plover, oystercatcher, redshank, turnstone, pintail and wigeon) (Table 2).

In the context of The Wash SPA, the MOTH site (as defined) is determined to have very high importance for one species (dark-bellied brent goose) and high importance for eight species (black-tailed godwit, lapwing, oystercatcher, redshank, turnstone, pintail, shelduck and wigeon) (Table 3). The MOTH site (as defined) was determined to have medium importance for four species (curlew, dunlin, golden plover, and grey plover) (Table 3).

Table 2. The importance of the defined 'The Haven local area' (see text for WeBS count sectors included) for Wash SPA non-breeding qualifying species. Based on on valid WeBS counts made between 2014 and 2019.

SPA qualifying species	Valid WeBS counts.	Negligible numbers present (<0.2% of Wash)	Small numbers present (0.2% - <1% of Wash)	Moderate numbers present (>1 - 5% of Wash)	Large numbers present (>5% of Wash)	Maximum count	Average when present	Importance category
Bar-tailed godwit	30	83%	10%	7%	0%	260	154	Medium
Bewick's swan	25	96%	0%	0%	4%	2	2	Very Low
Black-tailed godwit	35	74%	9%	6%	11%	2061	472	High
Brent goose	35	6%	3%	14%	77%	4500	1611	Very high
Common scoter	30	97%	0%	3%	0%	21	52	Low
Curlew	40	8%	40%	53%	0%	295	111	High
Dunlin	44	18%	34%	41%	7%	1920	553	High
Gadwall	30	93%	3%	3%	0%	6	10	Low
Golden plover [a]	30	67%	3%	10%	20%	4012	1281	High
Goldeneye	25	48%	0%	24%	28%	19	6	Very high
Grey plover	35	17%	51%	31%	0%	390	124	High
Knot	35	89%	9%	3%	0%	1908	1520	Low
Lapwing [a]	30	37%	3%	27%	33%	2200	789	Very high
Oystercatcher	40	13%	25%	38%	25%	4150	943	Very high
Pink-footed goose	25	84%	12%	4%	0%	900	403	Low
Pintail	25	36%	16%	28%	20%	80	22	High
Redshank	40	0%	18%	63%	20%	685	165	High
Sanderling	35	100%	0%	0%	0%	0	0	Very low
Shelduck	35	9%	17%	49%	26%	408	99	Very high
Turnstone	40	28%	10%	38%	25%	237	54	High
Wigeon	30	20%	10%	47%	23%	5167	715	High
Common Tern	23	17%	9%	43%	30%	151	34	Very high
Little Tern	23	83%	0%	9%	9%	23	9	Medium

[a] Qualifies as a waterbird assemblage component only
[b] Valid counts are those undertaken in months when the species is present in large numbers in context of Wash population size

Table 3. The importance of defined 'Mouth of the Haven site' (see text for WeBS count sectors included) for Wash SPA non-breeding qualifying species. Based on on valid WeBS counts made between 2014 and 2019.

SPA qualifying species	No. of valid WeBS counts.	Negligible numbers present (<0.2% of Wash)	Small numbers present (0.2% - <1% of Wash)	Moderate numbers present (>1 - 5% of Wash)	Large numbers present (>5% of Wash)	Max	Average when present	Importance to Wash SPA (based on criteria in Table 1)
Bar-tailed godwit	30	90%	7%	3%	0%	216	117	Low
Bewick's swan	25	96%	0%	0%	4%	2	2	Very low
Black-tailed godwit	35	77%	6%	9%	9%	2021	484	High
Brent goose	35	17%	3%	29%	51%	2100	881	Very high
Common scoter	30	100%	0%	0%	0%	1	N/R	Very low
Curlew	40	38%	43%	20%	0%	250	70	Medium
Dunlin	44	41%	32%	25%	2%	1620	440	High
Gadwall	30	100%	0%	0%	0%	4	N/R	Very low
Golden plover [a]	30	80%	10%	3%	7%	2800	675	Medium
Goldeneye	35	94%	0%	3%	3%	4	3	Low
Grey plover	35	66%	31%	3%	0%	100	57	Medium
Knot	30	97%	3%	0%	0%	450	1774	Very low
Lapwing [a]	30	53%	3%	30%	13%	1480	496	High
Oystercatcher	25	20%	32%	36%	12%	4150	890	High
Pink-footed goose	25	88%	8%	4%	0%	900	467	Low
Pintail	30	64%	8%	20%	8%	52	19	High
Redshank	35	40%	23%	37%	0%	250	84	High
Sanderling	35	100%	0%	0%	0%	0	N/R	Very low
Shelduck	35	29%	11%	46%	14%	350	83	High
Turnstone	40	28%	13%	40%	20%	237	45	High
Wigeon	30	30%	10%	47%	13%	5167	662	High
Common Tern	20	15%	10%	50%	25%	141	29	Very High
Little Tern	20	85%	0%	10%	5%	13	9	Medium

[a] Qualifies as a waterbird assemblage component only
[b] Valid counts are those undertaken in months when the species is present in large numbers in context of Wash population size

3. Species screening

Although all The Wash SPA qualifying interests are potentially vulnerable to vessel disturbance from the Proposed Development, it is apparent from the baseline disturbance study results (Bentley, 2020; Chick, 2021) and WeBS counts for the MOTH site that there is much greater potential for some species to be affected than others. It is necessary to prioritise the qualifying interests and focus the assessment on those that have greatest potential to be affected. It follows that whatever level of impact and significance is identified for these priority species, the level of impact and significance on the lower priority species must be smaller.

Species are screened for assessment on the basis of the importance of The Haven local area (as defined) (Table 2) and the MOTH site (as defined) to the Wash population (the mean five-year (2014-2019) peak WeBS count for the Wash) (Table 3) and the susceptibility to vessel disturbance as

indicated by the results of the baseline disturbance study (Table 4). Species were screened in if they met the following criteria:

- The Haven local area was categorised as at least High importance (Table 2), and
- The MOTH site was categorised as having at least Medium importance (Table 3), and
- The average number of birds disturbed by vessels at the MOTH site in a high tide period exceeded 20% of local area mean count and/or,
- The average number of birds disturbed by vessels at the MOTH site in a high tide period exceeded 1% of the Wash 5-year mean peak count.

3.1 Screened-in species

Seven species met the screening criteria:

- Dark-bellied brent goose
- Black-tailed godwit
- Oystercatcher
- Redshank
- Turnstone
- Lapwing
- Common tern

Although golden plover did not quite meet the criteria for high local site importance, it was screened in on a precautionary basis, because very large numbers of this species are sometimes disturbed by vessels at the MOTH.

3.2 Screened-out species

Dunlin and curlew were screened out. Although both these species regularly use the MOTH site and The Haven local area in reasonable large numbers, the numbers witnessed to be disturbed by vessels during the baseline disturbance surveys were generally small (<1%) in the context of their SPA population sizes.

Several species are screened out of requiring assessment due to their low baseline use of the MOTH roost sites. In this respect the low use of two wader species stand out, knot and bar-tailed godwit. These two species appear to make only low use of MOTH site despite there being extensive intertidal mudflat feeding habitat nearby and having large to very large non-breeding populations overwintering in The Wash. Both these species are considered to have a relatively high sensitivity to noise and visual disturbance (Cutts *et al*., 2003) and their low utilisation of the MOTH site and local area (as defined) for roosting may indicate they are not able to tolerate the relatively high frequency of baseline vessel disturbance at the MOTH. This cannot be confirmed, but if true would indicate that baseline vessel disturbance is affecting the local distribution and abundance of these species within The Wash SPA, and therefore could be considered to be having an AEOI.

Several of the screened-out species are wildfowl species (e.g. wigeon, goldeneye, pintail and shelduck). Although these species commonly occur at the MOTH site and Local Area as defined, they appear not to use the rock revetment close to the shipping channel for roosting and are therefore probably less vulnerable to vessel disturbance than the species that do. Wildfowl species are able to

roost on the sea and therefore, unlike waders, are not obliged to find a safe terrestrial roost location when their tidal feeding areas are covered by the sea.

Table 4. Screening of SPA qualifying species for further assessment. Screened-in species are shown in bold together with the main criteria supporting the decsion for their selection.

SPA qualifying species	5-year mean peak WeBS count for The Wash (2014-2019)	The Haven local area' mean valid WeBs count	Importance of 'The Haven local area' to Wash SPA (from Table 3)	Importance of 'MOTH site' to Wash SPA (from Table 2)	Percent of HT periods with disturbance seen	Peak no. seen disturbed as % of SPA populatn.	Mean no. seen disturbed as % of SPA populatn.	Mean no. seen disturbed as % of 'local area' mean WeBS count	Screened 'In' or 'Out' for further assessment
Bar-tailed godwit	18579	154	Medium	Low	13%	0.1%	0.1%	7%	Out
Bewick's swan	5	2	Very Low	Very low	0%	0%	0%	0%	Out
Black-tailed godwit	7805	472	**High**	**High**	**25%**	**26%**	**14%**	**233%**	**In**
Brent goose	13545	1611	**Very high**	**Very high**	**25%**	**8%**	**5%**	**43%**	**In**
Common Scoter	1342	52	Low	Very low	0%	0%	0%	0%	Out
Curlew	6653	111	High	Medium	63%	0.8%	0.2%	15%	Out
Dunlin	27258	553	High	High	63%	0.7%	0.4%	19%	Out
Gadwall	128	10	Low	Very low	0%	0%	0%	0%	Out
Golden plover [a]	13421	1281	**High**	Medium	**13%**	**19%**	**19%**	**195%**	**In**
Goldeneye	74	6	Very high	Low	0%	0%	0%	0%	Out
Grey plover	9132	124	High	Medium	13%	0.1%	0.1%	4%	Out
Knot	177869	1520	Low	Very low	13%	0.3%	0.3%	33%	Out
Lapwing [a]	11483	789	**Very high**	**High**	**50%**	**10%**	**5%**	**80%**	**In**
Oystercatcher	20471	943	**Very high**	**High**	**75%**	**3%**	**1%**	**23%**	**In**
Pink-footed goose	34211	403	Low	Low	0%	0%	0%	0%	Out
Pintail	458	22	High	High	0%	0%	0%	0%	Out
Redshank	5239	165	**High**	**High**	**100%**	**4%**	0.7%	**21%**	**In**
Sanderling	9052	0	Very low	Very low	0%	0%	0%	0%	Out
Shelduck	2359	99	Very high	High	38%	2%	0.6%	16%	Out
Turnstone	809	54	**Very high**	**High**	**38%**	**3%**	**2%**	**32%**	**In**
Wigeon	12172	715	High	High	50%	0.8%	0.3%	5%	Out
Common Tern	597	34	**Very high**	**Very high**	**33%**	**2%**	**2%**	**30%**	**In**
Little Tern	117	9	Medium	Medium	0%	0%	0%	0%	Out

[a] Qualifies as a waterbird assemblage component only
[b] Valid counts are those undertaken in months when the species is present in large numbers in context of Wash population size

4. Species accounts

For the seven screened-in species, the accounts below examine in detail the baseline conditions in terms of the use of the MOTH site and vulnerability to vessel disturbance. The accounts also provide an assessment of the potential impact of the predicted additional vessel disturbance that could occur if the Proposed Development went ahead. Potential measures to manage disturbance are also briefly considered.

In the accounts below:

- Analysis of WeBS count data is restricted to seasonally valid high tide counts, i.e. only counts made in months of the year when that species occurs in the Wash in large numbers (in the context of the Wash population size). The months considered to be valid are listed in the species account.
- Percentage values greater than 1% are rounded to the nearest integer.
- The defined local area comprises the fifteen WeBS count sectors adjacent to The Haven, as previously listed.
- The defined MOTH site comprises the three WeBS count sectors adjacent to MOTH, previously listed.

4.1 Dark-bellied brent goose

The 5-year peak mean WeBS (2014-2019) brent goose count for the Wash is 13,545 birds; 1% of the Wash population corresponds to approximately 130 birds. The months when a large numbers of non-breeding brent goose are typically present in The Wash SPA are October to April. Thus WeBS counts for these months were considered to be valid for the purposes of the analysis below. The Wash SPA abundance target for dark-bellied brent goose is: “maintain the size of the non-breeding population at a level which is above 17,000 individuals” (NE online guidance on SPA conservation objectives).

The Waterbird Disturbance Mitigation Toolkit (Cutts *et al*., 2013) categories brent goose as having high sensitivity to disturbance. It states that roosting and loafing birds are far more sensitive to disturbance than feeding birds, showing a response to disturbance at distances up to 350 m during the shooting season and 205 m at other times.

4.1.1 MOTH site importance

On average the WeBS counts for the defined MOTH site account for 48% of all the brent geese counted in the defined local area. The defined MOTH site held over 1% of the Wash population on 80% of high-tide periods and over 5% of the population on 51% of high-tide periods (Table 5). The peak count was 2,100 birds and the average count when present was 881 birds (Table 5). It is concluded that the defined MOTH site has **very high importance** both in the context of the defined local area in which it lies and the Wash as a whole.

4.1.2 Local area importance

Based on 35 seasonally valid WeBS counts, The Haven local area (as defined) held over 1% of the Wash population on 91% of high-tide periods and over 5% of the population on 77% of high-tide periods (Table 5). The peak count was 4,500 birds (33% of Wash 5-year mean peak count) and the average count when present was 1,611 birds (12% of Wash 5-year mean peak count) (Table 5). Based on the

criteria in Table 1, it is concluded that the defined local area has **very high importance** for The Wash SPA.

Table 5. The importance of the defined 'Mouth of the Haven (MOTH) site' and the defined 'The Haven local area' for the Wash SPA non-breeding brent goose qualifying interest. Based on 39 seasonally valid WeBS high tide counts made between 2014 and 2019 and using the importance categorisation criteria in Table 1.

Frequency of WeBS count totals				Maximum count (% of Wash total)	Average count when present (% of Wash total)	SPA Importance category
% of counts <0.2% of Wash total	% of counts 0.2 to <1% of Wash total	% of counts 1 to <5% of Wash total	% of counts ≥ 5% of Wash total			
MOTH site						
17%	3%	29%	51%	2,100 (16%)	881 (7%)	Very High
Local area						
6%	3%	14%	77%	4,500 (33%)	1,611 (12%)	Very High

4.1.3 Baseline vessel disturbance

Brent geese were disturbed on 25% (2 of 8) of the high-tide periods watched during the baseline disturbance study, with two incidents of vessel disturbance witnessed. The number of brent geese showing a disturbance response during these incidents was 250 and 1,150 birds respectively, corresponding to approximately 2% and 8% of the Wash population, and a mean value of 5% of the Wash population.

WeBS counts show that brent geese were absent or present only in negligible numbers in the defined MOTH site on 17% of high tide periods. It is therefore likely that no brent geese were present on most of the baseline survey high tide watches. The mean number of brent geese witnessed to be disturbed by vessels (700 birds) corresponds to 79% of the mean number using the MOTH site (as defined), suggesting that when birds use the MOTH, they have a very high likelihood of being disturbed by passing vessels. However the mean number of birds disturbed corresponds to only slightly more than a third of the mean number using the local area (as defined).

Both of the brent goose disturbance events witnessed were caused by pilot boats, in both cases these were the first vessels of the high tide period to pass by the MOTH roost site. On one of these occasions a small fishing boat that was travelling at a slower speed also passed the roost site at the same time and this may have contributed to the disturbance stimuli. The lack of records of disturbance by large cargo vessels reflects the lack of cargo vessels passing when brent geese were present.

Brent geese responded to MOTH vessel disturbance by flying to an alternative nearby location. On one occasion the birds moved to an area of saltmarsh approximately 300 m away and the other occasion the birds moved to an area of grassland approximately 500 m away.

4.1.4 Availability of alternative roost sites

Brent geese are able to roost on a wide range of sites, including open water, saltmarsh and even agricultural fields. Although the sample size of observations in the baseline disturbance study was small it is clear that brent geese disturbed by vessels at the MOTH are able to move to nearby alternative roosting (and feeding) sites available locally. The observation of the vessel-disturbed brent geese flying to alternative locations only 300 m and 500 m away show that there are alternative locations within the defined MOTH site. The regular occurrence of large numbers of brent geese during the high tide period (i.e., as shown by the WeBS counts) elsewhere in the defined local area indicates there are also alternative sites suitable for this species within the defined local area.

It is concluded that roosting brent goose using the MOTH that are disturbed by vessels are able to relocate to nearby alternative roosting and feeding sites either within the MOTH site (typically within 500 m) or more widely within the defined local area (including sites within approximately 2 km).

4.1.5 Baseline conditions summary

Baseline conditions for brent goose are summarised in Table 6 based on interpreting the results of the baseline disturbance study and the seasonally valid counts for the local area (as defined) WeBS sectors. The interpretation takes into account that the baseline disturbance study was based on observations of only eight high tide periods and thus the results are inevitably affected by stochastic variation, for example with respect to the numbers of birds using the roost site by the shipping channel on survey visits. The valid WeBS count data are based on a much larger sample size (35 counts) and are therefore likely to give a more representative and accurate indication of the use of the MOTH site and the potential for disturbance.

Table 6. Summary of baseline conditions for brent goose.

Characteristic	Value/category
Proportion of high tides when >1% of Wash population uses MOTH site	80%
Importance of 'MOTH site' (as defined) to SPA (Table 1 criteria)	Very High
Importance of 'Local Area' (as defined) to SPA (Table 1 criteria)	Very High
High tide study watches with disturbance of any individuals	25%
High tide study watches with disturbance of >1% of SPA total	25%
High tide study watches with disturbance of >5% of SPA total	13%
Typical response to disturbance	Move to alternative site nearby (500 – 800m away), including grassland and saltmarsh sites
Vulnerability to disturbance by large cargo vessels	Probably high
Vulnerability to disturbance by small fast vessels (pilot boats)	High
Vulnerability to disturbance by small slow vessels (fishing boats)	Unknown
Alternative roosts available elsewhere within defined 'MOTH site'	Yes
Alternative roosts available elsewhere within defined local area	Yes

4.1.6 Predicted change due to the Proposed Development

The two instances of recorded disturbance of brent goose were caused by the first vessel transit of the high tide period. Subsequent vessel movements did not cause additional disturbance as there were no brent goose remaining at the roost site close to the shipping channel. Thus the key metric for predicting how the additional vessel movements associated with the Proposed Development could affect brent goose using the MOTH site is not the number of additional vessel movements *per se*, rather it is the number of additional high-tide periods in which transits by large and/or fast vessels would occur.

Under baseline conditions transits by large vessels (e.g. cargo vessels) and/or fast vessels (e.g. pilot boats) typically occurs on 75-80% of the year's navigable tides (ref). The Proposed Development would result in transits by large and/or fast vessels occurring on up to 100% of navigable tides.

If brent goose utilisation of the defined MOTH site and defined local area in terms of numbers and frequency of occurrence remained the same as under baseline conditions, the predicted consequence of the project would be an increase of approximately 19% in the number of high tide periods that

brent goose are disturbed (Table 7). The average and peak number of brent goose affected by each instance of vessel disturbance is not anticipated to materially change.

Table 7. Summary of baseline vessel dissturbance of the non-breeding brent goose qualifying interest at the mouth of The Haven for The Wash SPA during the high tide (HT) period and prediction of changes that would occur as a result of the Proposed Development.

Vessel disturbance metric	Baseline disturbance study observations	Baseline conditions interpretation [a]	Project prediction	Change
Average disturbance in a HT period	Very short-term disturbance [b] of ca. 5% of SPA population on 25% of HT periods. Typically up to one incident per HT period.	Very short-term disturbance [b] of ca. 6% of SPA population on ca. 64% of HT periods. Usually one disturbance event per HT period only, sometimes more than one.	Very short-term disturbance [b] of ca. 6% of SPA population on ca. 83% of HT periods. Usually one disturbance event per HT period only, sometimes more than one.	No change to disturbance intensity. ca. 19% increase in number of HT periods in which disturbance occurs
Peak disturbance in any HT period	Very short-term disturbance [b] of ca. 8% of SPA population.	Very short-term disturbance [b] of ca. 16% of SPA population.	Very short-term disturbance [b] of ca. 16% of SPA population.	No change

[a] The interpretation allows for the possibility that the baseline study results may not be wholly representative due to the relatively small sample size of observations. It is therefore assumed that the WeBS count data, which are based on much larger sample size, give a more representative indication of the number of birds at risk of disturbance. The average percentage of birds likely to be disturbed under baseline conditions is based on the average number using the MOTH site (as defined) on occasions that the species is present in more than negligible numbers (>0.2% of Wash population). This number is adjusted downwards as appropriate where there is evidence from the baseline study that a significant proportion of the birds using the MOTH site are not susceptible to vessel disturbance. The peak percentage of birds likely to be disturbed is based on the peak number using the MOTH site and cautiously assumes that all birds present would be disturbed. The baseline frequency of disturbance is calculated from the proportion of WeBS counts when the species used the MOTH site in more than negligible numbers (>0.2% of Wash population) multiplied by 77.5% to take account that under baseline conditions vessel transits of The Haven is limited to 75-80% of high tide periods. It is assumed that if the project goes ahead, vessel transits of The Haven would increase to 100% of high tide periods.

[b] Vessel disturbance incidents are considered to be very short-term in their duration because they typically last a few minutes only before birds resume roosting or foraging behaviour. Nevertheless under both baseline and project scenarios the issue of vessel disturbance is clearly a long term, frequently occurring and continuing impact.

4.1.7 Assessment

For assessing whether additional disturbance by vessels at the MOTH would compromise the SPA's conservation objectives the relevant test questions are considered to be as follows:

- **Test 1**. Would the predicted additional MOTH vessel disturbance change the local distribution of the non-breeding brent goose qualifying feature of The Wash SPA on a continuing basis?

- **Test 2**. Would the predicted additional MOTH vessel disturbance change the local abundance of the non-breeding brent goose qualifying feature of The Wash SPA on a sustained basis?
- **Test 3**. Would the predicted additional MOTH vessel disturbance reduce the ability of a significant number of individuals of the non-breeding brent goose qualifying feature of The Wash SPA to survive, breed, or rear their young.

For the non-breeding brent goose qualifying feature, the answer to all three of the test questions is considered to be 'no'. It is therefore considered that potential additional vessel disturbance that would result from the Proposed Development would not compromise The Wash SPA conservation objectives for this qualifying interest. The reasoning behind considering that a 'no' answer is appropriate for the three test questions is summarised below.

Tests 1 and 2. The analysis of WeBS count data shows that the brent geese potentially at risk of disturbance at MOTH form a moderate proportion (55% on average) of the brent geese that use the local area (as defined), and that the numbers likely to show a disturbance response form a relatively small proportion (on average 5%, largest event witnessed 8%) of the SPA population (Table 4). Brent geese have a number of alternative local roost locations available to them, both elsewhere within the MOTH site (as defined) and in the wider local area (as defined) and including alternative locations within 1 km. The baseline disturbance study showed that when disturbed by vessels, brent geese are able to relocate to nearby alternative locations, which seems to be a regular occurrence as things stand. It is concluded that the additional disturbance would not materially affect local distribution or abundance of brent goose across The Wash SPA. Any change in distribution or abundance would be at a sub-local level only

Test 3. The Wash SPA brent goose qualifying feature concerns non-breeding birds. Brent geese breed in the high Artic but partly rely on body reserves accumulated on the wintering grounds to sustain them through the early part (egg laying and incubation) of the breeding cycle (i.e., capital breeding strategy). Thus brent goose productivity can be linked to body condition before the spring migration (Inger *et al*., 2010) and this in turn can be affected by conditions on the wintering grounds. In theory additional disturbance could reduce the birds' ability to accumulate body reserves before spring migration to the Arctic and thus affect breeding success. Therefore in applying the Test 3 question to brent goose it is considered relevant to address if the Proposed Development would reduce the ability to survive and breed (but not rear young) of a significant number of SPA individuals. The ability to survive could be reduced if a significant number of individuals were subject to higher predation risk and/or energy stress caused by additional energy demands or reduced food intake. The ability to breed could be reduced if birds have a reduced ability to accumulate body reserves before spring migration, for example due to reduced feeding opportunities or increased energy demands. In applying this test, the terms 'significant number' and 'ability to survive/breed' are not easily defined. Here a judgement is made by combining information on the likely frequency and duration of additional vessel disturbance events and the anticipated number and behavioural response of the birds that would be affected.

The baseline disturbance study and analysis of WeBS counts showed that MOTH disturbance events typically affect approximately 5% of The Wash brent goose population; the largest number witnessed disturbed in a high tide period corresponded to approximately 8% of the population (Table 4). The

numbers of brent goose at risk of disturbance from the predicted additional vessel transits is anticipated to be the same at that at risk from vessel disturbance under baseline conditions.

The baseline study showed that vessel disturbance was limited to a single event in any one high tide period (this is because the response to a vessel passing was for birds to move to an alternative site and they were thus not present when subsequent vessels passed). If the Proposed Development went ahead, it is predicted that the proportion of high tide periods subject to a vessel disturbance risk would increase by approximately 20-25%, from 75-80% to 100%. So, based on how often brent geese use the MOTH site from WeBS count, the frequency of disturbance is expected to increase from a baseline of approximately 64% of the high tide periods to approximately 83% of high tide periods – a moderate increase in frequency (Table 7). Thus the additional disturbance potentially caused by the Proposed Development is anticipated on average to affect approximately 6% of the SPA population and occur on 19% of high tide periods (i.e. equivalent to approximately three high tides per week), with the affected bird typically responding by flying directly to an alternative location less than 1 km away.

Brent geese using the MOTH site over the high tide period are likely to be roosting birds and therefore the vessel disturbance is not anticipated to directly affect foraging time. Daily energy and nutrient intake rates of disturbed birds are therefore not likely to be reduced. For brent goose, the energy expenditure associated with a single flight to a location less than 1 km away is considered to be negligible in the context the birds' daily energy budget. To put this is context, wintering brent geese in Norfolk daily fly to and from roost sites to access feeding area approximately 8 km away (Summers and Critchley, 1990). They also typically spend on average between 1.3% and 2.4% of their time in feeding areas undertaking flight activity (Riddington *et al*., 1996), which corresponds to approximate flight distances of between 4 and 8 km per day (this assumes 5.5 hours per day spent in feeding areas (Riddington *et al*., 1996), and an average flight speed of 17.7 m/s (Alerstam *et al*., 2007).

Brent geese have few predators on the Wash being physically too large to be targeted by most raptors. Disturbance is therefore unlikely to materially affect predation risk. In any case the range and density of potential predators at the alternative locations within 1 km the MOTH roost site are unlikely to be materially different.

Based on all of the information presented above, it is considered unlikely that additional vessel disturbance could reduce the ability of a significant number of The Wash SPA brent goose population to either survive or breed.

4.1.8 Management of disturbance

The additional vessel disturbance that would result if the project went ahead is considered not likely to compromise the conservation objectives for The Wash SPA non-breeding brent goose qualifying interest. However the baseline disturbance study showed that this species is affected by relatively high levels of baseline vessel disturbance at the mouth of The Haven. It is also recognised that any additional disturbance of this qualifying feature is undesirable. Therefore measures that aim to manage vessel disturbance (baseline and project) and its consequences are considered desirable.

Measures to manage vessel disturbance that would potentially benefit brent goose include:

- Provision of one or more artificial roost sites in the vicinity of MOTH but far enough from the shipping channel for roosting birds not to be vulnerable to vessel disturbance.

- Speed restrictions for vessels using The Haven, particularly for pilot vessels.

4.2 Black-tailed godwit

The 5-year peak mean WeBS (2014-2019) black-tailed godwit count for the Wash is 7,805 birds; 1% of the Wash population therefore corresponds to approximately 80 birds. The months when a large numbers of non-breeding black-tailed godwit are typically present in The Wash SPA are September to March. Thus WeBS counts for these months were considered to be valid for the purposes of the analysis below. The Wash SPA abundance target for black-tailed godwit is: "maintain the size of the non-breeding population at a level which is above 260 individuals" (NE online guidance on SPA conservation objectives). The 260 individuals figure refers to the size of the population in 1988 at the time of designation; this species has undergone a very large population increase at the Wash SPA since then.

The Waterbird Disturbance Mitigation Toolkit (Cutts *et al.*, 2013) categories black-tailed godwit as a species with moderate sensitivity to disturbance. It states that birds closer than 250 m to a potential disturbance source should be considered to be at risk of disturbance.

4.2.1 MOTH site importance

On average the WeBS counts for the defined MOTH site account for 91% of all the black-tailed godwits counted in the defined The Haven local area. The defined MOTH site held over 1% of the Wash population on 17% of high-tide periods and over 5% of the population on 9% of high-tide periods (Table 8). The peak count was 2,021 birds and the average count when present was 484 birds (Table 8). No black-tailed godwits were present on 77% of the valid high tide counts. It is concluded that the defined MOTH site has **high importance** in the context the Wash as a whole, and very high importance in the context of the local area.

4.2.2 Local area importance

Based on 35 seasonally valid WeBS counts, The Haven local area (as defined) held over 1% of the Wash population on 17% of high-tide periods and over 5% of the population on 11% of high-tide periods (Table 8). The peak count was 2,061 birds (26% of Wash 5-year mean peak count) and the average count when present was 472 birds (6% of Wash 5-year mean peak count) (Table 8). Based on the criteria in Table 1, it is concluded that the defined local area has **high importance** for The Wash SPA.

Table 8. The importance of the the defined 'Mouth of the Haven (MOTH) site' and the defined 'The Haven local area' for the Wash SPA non-breeding black-tailed godwit qualifying interest. Based on 39 seasonally valid

WeBS high tide counts made between 2014 and 2019 and using the importance categorisation criteria in Table 1.

Frequency of WeBS count totals				Maximum count (% of Wash total)	Average count when present (% of Wash total)	SPA Importance category
% of counts <0.2% of Wash total	% of counts 0.2 to <1% of Wash total	% of counts 1 to <5% of Wash total	% of counts ≥ 5% of Wash total			
MOTH site						
77%	6%	8%	9%	2021 (26%)	484 (6%)	High
Local area						
74%	9%	6%	11%	2061 (26%)	472 (6%)	High

4.2.3 Baseline vessel disturbance

Black-tailed godwits were disturbed on 25% (2 of 8) of the high-tide periods watched during the baseline disturbance study. Three incidents of vessel disturbance witnessed, involving estimated flocks sizes of 2,000, 200 and 5 birds and corresponding to 26%, 3% and 0.1% the Wash population respectively. The mean numbers of black-tailed godwits showing a disturbance response during these high-tide periods was 1,100 birds, corresponding to approximately 14% of the Wash population.

WeBS counts show that black-tailed godwits were absent in the defined MOTH site on 77% of high tide periods. It is therefore likely that no black-tailed godwit were present on most of the baseline survey high tide watches. It is concluded that there is a very high likelihood that any black-tailed godwit roosting at MOTH will be disturbed by passing vessels.

Two of the three black-tailed godwit disturbance events witnessed were caused by large cargo vessels, and one was caused by a pilot boat.

On two of the three occasions disturbance was seen the response was to fly to an alternative roost sites located approximately 150 m and 800 m away respectively. On one occasion the flock (of 200 birds) flew around for approximately 90 seconds before returning to the original roost location.

4.2.4 Availability of alternative roost sites

Based on the counts for individual WeBS sectors it appears that the MOTH roost site adjacent to the shipping channel is by far the most favoured black-tailed godwit roost site in the local area, perhaps because it provides a rocky substrate. However, the WeBS high tide counts show that this species also sometimes roosts in other count sectors in The Haven local area, i.e. there are alternative roosts available locally. The observation of the vessel-disturbed black-tailed godwits that were witnessed to move to an alternative roost location 150 m away show that there is at least one alternative roost within the defined MOTH site. The observation of the vessel-disturbed black-tailed godwits that were witnessed to move to an alternative roost location 800 m away also show that there is at least one additional alternative roost elsewhere within The Haven local area (as defined) local area.

That one of the disturbed flocks chose to remain airborne whilst the vessel passed and then returned to the same roost site may indicate that on that occasion at least there were no alternative suitable sites locally available, or it could indicate a preference for the MOTH roost compared to alternatives. The generally low counts of this species using the other WeBS sectors in the defined The Haven local area is may also indicate that there is a shortage of suitable alternative roost sites locally.

It is concluded that black-tailed godwit roosting at the MOTH that are disturbed by vessels are, on at least some occasions, able to relocate to nearby alternative roost sites within the local area (as defined), including sites within approximately 1 km of the MOTH roost. This is below the theoretical minimum ideal inter-roost distances discussed by Rehfisch *et al*. (1996) for a range of wader species wintering at the Wash. However, it is also concluded that there is evidence that there are relatively few suitable roost sites for this species in the local area.

4.2.5 Baseline conditions summary

Baseline conditions for black-tailed godwit are summarised in Table 9 based on the interpreting the results of the baseline disturbance study and the seasonally valid counts for the local area (as defined) WeBS sectors. The interpretation takes into account that the baseline disturbance study was based on observations of only eight high tide periods and thus the results are inevitably affected by stochastic variation, for example with respect to the numbers of birds using the roost site by the shipping channel on survey visits. The valid WeBS count data are based on a much larger sample size (40 counts) and are therefore likely to give a more representative and accurate indication of the use of the MOTH site and the potential for disturbance.

Table 9. Summary of baseline conditions for black-tailed godwit.

Characteristic	Value/category
Proportion of high tides when >1% of Wash population uses MOTH site	17%
Importance of 'MOTH site' (as defined) to SPA (Table 1 criteria)	High
Importance of 'Local Area' (as defined) to SPA (Table 1 criteria)	High
High tide study watches with disturbance of any individuals	25%
High tide study watches with disturbance of >1% of SPA total	25%
High tide study watches with disturbance of >5% of SPA total	25%
Typical response to disturbance	Move to alternative site nearby (within 1 km), sometimes flies around and returns to same site
Vulnerability to disturbance by large cargo vessels	High
Vulnerability to disturbance by small fast vessels (pilot boats)	Medium
Vulnerability to disturbance by small slow vessels (fishing boats)	Low
Alternative roosts available elsewhere within defined 'MOTH site'	Yes, sometimes
Alternative roosts available elsewhere within defined local area	Yes, but may have be of low quality

4.2.6 Predicted change due to the Proposed Development

As a consequence of moving to an alternative roost site away from the immediate vicinity of the shipping channel, disturbance of black-tailed godwit were usually caused by the first large vessel transit of the high tide period. Subsequent vessel movements generally did not cause additional disturbance as there were usually no black-tailed godwit remaining at the roost site close to the shipping channel. However, on occasions they choose to return to the same roost site they would be vulnerable to repeat disturbance should there be further vessel movements during that hide tide period. Thus for this species, both the number of additional high-tide periods in which transits by large and/or fast vessels would occur and, to a lesser extent, the number of additional vessel movements *per se* are both predicted to lead to an increase in disturbance.

Under baseline conditions, transits by large vessels (e.g. cargo vessels) and/or fast vessels (e.g. pilot boats) typically occurs on 75-80% of navigable high tides. The Proposed Development would result in transits by large and/or fast vessels occurring on up to 100% of navigable high tides.

If black-tailed godwit utilisation of the defined MOTH site and defined local area in terms of numbers and frequency of occurrence remained the same as under baseline conditions, the predicted

consequence of the project would be an increase of approximately 5% in the number of high tide periods that black-tailed godwit are disturbed (Table 10). The average and peak number of black-tailed godwit affected by vessel disturbance is not anticipated to materially change.

Table 10. Summary of baseline vessel disturbance of the non-breeding black-tailed godwit qualifying interest at the mouth of The Haven for The Wash SPA during the high tide (HT) period and prediction of changes that would occur as a result of the Proposed Development.

Disturbance metric	Baseline disturbance study observations	Baseline conditions interpretation [a]	Project prediction	Change
Average disturbance in a HT period	Very short-term disturbance [b] of ca. 14% of SPA population on 25% of HT periods. Typically up to one incident per HT period.	Very short-term disturbance [b] of ca. 6% of SPA population on ca. 18% of HT periods. Usually one disturbance event per HT period only, sometimes more than one.	Very short-term disturbance [b] of ca. 6% of SPA population on ca. 23% of HT periods. Usually one disturbance event per HT period only, sometimes more than one.	No change to disturbance intensity. ca 5% increase in number of HT periods in which disturbance occurs
Peak disturbance in any HT period	Very short-term disturbance [b] of ca. 26% of SPA population.	Very short-term disturbance [b] of ca. 26% of SPA population.	Very short-term disturbance [b] of ca. 26% of SPA population.	No change

[a] The interpretation allows for the possibility that the baseline study results may not be wholly representative due to the relatively small sample size of observations. It is therefore assumed that the WeBS count data, which are based on much larger sample size, give a more representative indication of the number of birds at risk of disturbance. The average percentage of birds likely to be disturbed under baseline conditions is based on the average number using the MOTH site (as defined) on occasions that the species is present in more than negligible numbers (>0.2% of Wash population). This number is adjusted downwards as appropriate where there is evidence from the baseline study that a significant proportion of the birds using the MOTH site are not susceptible to vessel disturbance. The peak percentage of birds likely to be disturbed is based on the peak number using the MOTH site and cautiously assumes that all birds present would be disturbed. The baseline frequency of disturbance is calculated from the proportion of WeBS counts when the species used the MOTH site in more than negligible numbers (>0.2% of Wash population) multiplied by 77.5% to take account that under baseline conditions vessel transits of The Haven is limited to 75-80% of high tide periods. It is assumed that if the project goes ahead, vessel transits of The Haven would increase to 100% of high tide periods.

[b] Vessel disturbance incidents are considered to be very short-term in their duration because they typically last a few minutes only before birds resume roosting or foraging behaviour. Nevertheless under both baseline and project scenarios the issue of vessel disturbance is clearly a long term, frequently occurring and continuing impact.

4.2.7 Assessment

For assessing whether additional disturbance by vessels at the MOTH would compromise the SPA's conservation objectives the relevant test questions are considered to be as follows:

- **Test 1**. Would the predicted additional MOTH vessel disturbance change the local distribution of the non-breeding black-tailed godwit qualifying feature of The Wash SPA on a continuing basis?

- **Test 2**. Would the predicted additional MOTH vessel disturbance change the local abundance of the non-breeding black-tailed godwit qualifying feature of The Wash SPA on a sustained basis?
- **Test 3**. Would the predicted additional MOTH vessel disturbance reduce the ability of a significant number of individuals of the non-breeding black-tailed godwit qualifying feature of The Wash SPA to survive, breed, or rear their young.

For the non-breeding black-tailed godwit qualifying feature, the answer to all three of the test questions is considered to be 'no'. It is therefore considered that potential additional vessel disturbance that would result from the Proposed Development would not compromise The Wash SPA conservation objectives for this qualifying interest. The reasoning behind considering that a 'no' answer is appropriate for the three test questions is summarised below.

Tests 1 and 2. The analysis of WeBS count data shows that the black-tailed godwits at risk of disturbance at MOTH form a high proportion (90% on average) of the black-tailed godwit that use the local area (as defined), and that the numbers likely to show a disturbance response form a high proportion (on average 14%, largest event witnessed 26%) of the SPA population (Table 4). However the analysis also shows that the black-tailed godwit use the local area and MOTH site relatively infrequently, with no birds or only negligible numbers counted in approximately three quarters of the seasonally valid WeBS counts. Thus although absent for most of the time, when this species does occur it does so in relatively large numbers. This indicates that individuals of this species use the Wash at a wider spatial scale than the local level as defined here. Although the sample size of observations is small, the baseline disturbance study showed that when disturbed by vessels, black-tailed godwits are usually able to relocate to nearby alternative locations, both elsewhere within the MOTH site (as defined) and elsewhere in the wider local area (as defined) and including alternative locations within 1 km. Bearing in mind that the day-to-day ranging behaviour of this species is likely to be at a wider geographic scale than the limits of the local area defined here, it is concluded that the additional disturbance would not materially affect local distribution or abundance of black-tailed godwit across The Wash SPA.

Test 3. The Wash SPA black-tailed godwit qualifying feature concerns non-breeding birds. Therefore the Test 3 question for black-tailed godwit is limited to considering the potential for the Proposed Development would reduce the ability to survive of a significant number of SPA individuals. The ability to survive could be reduced if a significant number of individuals were subject to higher predation risk and/or energy stress caused by additional energy demands or reduced food intake. In applying this test, the terms 'significant number' and 'ability to survive' are not easily defined. Here a judgement is made by combining information on the likely frequency and duration of additional vessel disturbance events and the anticipated number and behavioural response of the birds that would be affected.

The baseline disturbance study and analysis of WeBS counts showed that MOTH vessel disturbance typically affects relatively large numbers of birds, but occurs relatively infrequently. When present at the MOTH, on average 14% of the Wash population was affected; the largest number disturbed corresponded to approximately 26% of the Wash population (Table 4). The numbers of black-tailed godwit at risk of disturbance from the predicted additional vessel transits is anticipated to be the same as that at risk from vessel disturbance under baseline conditions. Under baseline conditions

disturbance of more than a negligible number (<0.2% of SPA population) of black-tailed godwits is estimated to occur on 16% of the high tide periods (Table 10). If the Proposed Development went ahead, it is predicted that the proportion of high tide periods subject to a vessel disturbance risk would increase by approximately 20-25%, from 75-80% to 100%. So, based on how often birds use the MOTH from WeBS count, the frequency of disturbance is expected to increase from a baseline of approximately 16% of the high tide periods to approximately 23% of high tide periods – a moderate increase in frequency. Thus the additional disturbance potentially caused by the Proposed Development is anticipated on average to affect approximately 14% of the SPA population and occur on 7% of high tide periods (i.e. equivalent to approximately once every six days), with the affected bird typically responding by flying directly to an alternative location less than 1 km away. The birds affected are likely to be roosting birds and therefore the disturbance is not anticipated to materially affect foraging time and thus energy intake rates. The additional energy expenditure associated with a single flight to a location less than 1 km away is likely to require less than 1% of a birds' daily expenditure (based on example calculation for knot in Rehfisch *et al.*, 1996). Given that shorebirds have a high ability for day-to-day regulation of their body mass, it is considered that an occasional increase of daily energy requirement of <1% is not likely to affect the survival chances of the birds affected. It is also considered that the birds affected by additional vessel disturbance are not likely to be exposed to a materially higher predation risk. This is because the range and density of potential predators at the alternative roost locations within 1 km the MOTH roost site are unlikely to be materially different, and the additional time spent in flight (flying individuals may be more vulnerable to birds of prey) is anticipated to be very small.

Integrating together the above information, it is considered very unlikely that additional vessel disturbance could reduce the ability of a significant number of The Wash SPA black-tailed godwit population to survive.

4.2.8 Management of disturbance

The additional vessel disturbance that would result if the project went ahead is considered not likely to compromise the conservation objectives for The Wash SPA non-breeding black-tailed godwit qualifying interest. However, the baseline disturbance study showed that relatively large numbers of this species are affected by the baseline vessel disturbance at the mouth of The Haven, albeit relatively infrequently. It is also recognised that any additional disturbance of this qualifying feature is undesirable. Therefore measures that aim to reduce vessel disturbance (baseline and project) and its consequences are considered desirable.

Measures to manage vessel disturbance that would benefit black-tailed godwit include:

- Provision of one or more artificial roost sites in the vicinity of MOTH but far enough from the shipping channel for roosting birds not to be vulnerable to vessel disturbance. This species is known to readily take to roosting at suitably located artificial lagoon-and-island type roost sites, including those created at bird reserves in The Wash.
- Speed restrictions for vessels using The Haven, particularly for pilot vessels.
- Removal of scrub and trees along The Haven sea embankments to lower habitat suitability for predators (in particular sparrowhawk), and thereby reduce predation risk and 'predation fear' (Cresswell, 2008).

4.3 Oystercatcher

The 5-year peak mean WeBS (2014-2019) oystercatcher count for the Wash is 20,471 birds; 1% of the Wash population therefore corresponds to approximately 200 birds. The months when a large numbers of non-breeding oystercatcher are typically present in The Wash SPA are August to March. Thus WeBS counts for these months were considered to be valid for the purposes of the analysis below. The Wash SPA abundance target for oystercatcher is: "maintain the size of the non-breeding population at a level which is above 24,000 individuals" (NE online guidance on SPA conservation objectives).

The Waterbird Disturbance Mitigation Toolkit (Cutts *et al*., 2013) categories oystercatcher as a species with moderate sensitivity to disturbance. It states that birds closer than 200 m to a potential disturbance source should be considered to be at risk of disturbance and that the birds' sensitivity at a site is depends on the extent of habituation.

4.3.1 MOTH site importance

On average the valid WeBS counts for the defined MOTH site account for 54% of all the oystercatchers counted in the defined local area. The defined MOTH site held over 1% of the Wash population on 48% of high-tide periods, and over 5% of the population on 12% of high-tide periods (Table 3, summarised in Table 11). The peak count was 4,150 birds (20% of the Wash population) and the average count when present in more than negligible numbers was 890 birds (4% of the Wash population) (Table 3, summarised in Table 11). Based on the criteria in Table 1, it is concluded that the defined MOTH site has **high importance** in the context Wash as a whole (Table 11). In the context of the defined local area the MOTH site has very high importance.

4.3.2 Local area importance

Based on 40 seasonally WeBS counts, The Haven local area (as defined) held over 1% of the Wash population on 63% of high-tide periods and over 5% of the population on 25% of high-tide periods (Table 2, summarised in Table 11). The peak count was 4,150 birds (20% of the Wash population) and the average count when present was 943 birds (5% of the Wash population) (Table 2, summarised in Table 11). Based on the criteria in Table 1, it is concluded that the defined local area has very **high importance** in for The Wash SPA (Table 11).

Table 11. The importance of the the defined 'Mouth of the Haven (MOTH) site' and the defined 'The Haven local area' for the Wash SPA non-breeding oystercatcher qualifying interest. Based on 39 seasonally valid WeBS high tide counts made between 2014 and 2019 and using the importance categorisation criteria in Table 1.

Frequency of WeBS count totals				Maximum count (% of Wash total)	Average count when present (% of Wash total)	SPA Importance category
% of counts <0.2% of Wash total	% of counts 0.2 to <1% of Wash total	% of counts 1 to <5% of Wash total	% of counts ≥ 5% of Wash total			
Local area						
13%	25%	38%	25%	4,150 (20%)	943 (5%)	Very high

Frequency of WeBS count totals				Maximum count (% of Wash total)	Average count when present (% of Wash total)	SPA Importance category
% of counts <0.2% of Wash total	% of counts 0.2 to <1% of Wash total	% of counts 1 to <5% of Wash total	% of counts ≥ 5% of Wash total			
MOTH site						
20%	32%	36%	12%	4,150 (20%)	890 (2%)	High

4.3.3 Baseline vessel disturbance

Oystercatchers were disturbed on 75% (6 of 8) of the high-tide periods watched during the baseline disturbance study, with nine vessel disturbance events witnessed (non-breeding season watches only, see below). The mean and peak numbers of oystercatchers showing a disturbance response during the eight high-tide periods monitored (based on the sum of birds disturbed in any one high tide period) was 219 and 700 birds respectively. These numbers correspond to approximately 1% and 3% of the Wash population respectively. The mean number of oystercatchers (219 birds) witnessed to be disturbed during a high tide period corresponds to approximately a quarter of the mean WeBS count (890 birds) for the defined MOTH site. It is concluded that there is only moderate likelihood that oystercatchers roosting within the MOTH site (as defined) will be disturbed by passing vessels. This suggests that some parts of the MOTH site used by roosting oystercatchers may be less susceptible to vessel disturbance. The disturbance study field report alludes to oystercatchers regularly roosting at a location near the mouth of the River Welland. This location is within the MOTH site (as defined) but further away from the shipping channel and therefore is probably less susceptible to disturbance by vessels .

The WeBS counts show that oystercatchers were either absent, or present in very small numbers (0.2% of Wash population, equivalent to 41 birds) in the defined MOTH site on 20% of the seasonally valid high tide period counted (n=39). This figure is broadly in line with the baseline disturbance study results, with disturbance of no birds being recorded on two of the eight watches. This suggests that despite the modest sample size the baseline watches were broadly representative in terms of the numbers of bird using the defined MOTH site.

The mean number of oystercatchers (219 birds) recorded being disturbed during a high tide period corresponds to 23% of the mean WeBS count for the defined local area (mean 971 birds), thus in a local area context there is only a moderate likelihood that an individual bird will experience vessel disturbance in a given high tide period.

The number of oystercatcher disturbed by vessels exceeded 1% of the Wash 5-year mean peak count during three of the eight (38%) high tide periods monitored. On the other three high tide periods with disturbance of oystercatchers the numbers disturbed (2 to 50 birds) were much lower, in all cases below 0.3% of the Wash total and therefore considered to be negligible in the context of the population.

Six of the nine oystercatcher vessel disturbance events recorded were apparently caused by large cargo vessels, and three were caused by the transit of a small boat. On two of these occasions the

disturbance was initiated by passing pilot boats, on the other occasion it was due to a pilot boat and a slower moving fishing boat simultaneously passing the MOTH roost site).

The response of oystercatchers using the MOTH site that were seen disturbed by vessels was without exception to fly to an alternative site. In the vast majority of case the birds moved to an alternative roost sites estimated to be between 150 m and 800 m away from the original site. On one occasion, involving a single bird only, the response was to fly to a location 10 m away where the bird commenced foraging.

The above account of baseline disturbance excludes observations of a high tide watch conducted in May 2021 as this was considered to be outside the seasonally valid period for the Wash SPA non-breeding oystercatcher qualifying interest (May is within the breeding season of this species). During this watch a flock of 175 roosting oystercatcher were witnessed showing a disturbance response to a transiting large cargo vessel. The birds flew directly to alternative roost at the saline lagoon at RSPB Freiston Shore reserve, 3.3 km to the north. On the same watch two oystercatchers were disturbed by a pilot boat and responded by moving to an alternative roost site 250 m away.

4.3.4 Availability of alternative roost sites

It is apparent that there are alternative roost sites locally available to oystercatcher. The observation of the vessel-disturbed oystercatchers moving to alternative roost locations between 150 and 400 m away show that there are alternative roost sites within the defined MOTH site. The observation of the vessel-disturbed oystercatchers that were witnessed to move to an alternative roost location 800 m away also show that there is at least one additional alternative roost elsewhere within the defined local area.

The WeBS high tide counts for oystercatchers provide further evidence of the availability and approximate location of alternative roost sites within the defined local area. The counts show that oystercatchers regularly occur in at least moderate numbers in almost all of the count sectors within the defined local area that do not form part of the defined MOTH site. Indeed, 46% of the oystercatcher counted in the defined local area sectors were in the sectors that do not form part of the defined MOTH site, in particular the Frampton North sector 26.

It is concluded that roosting oystercatcher at the MOTH that are disturbed by vessels are able to relocate to nearby alternative roost sites either within the MOTH site (typically within 500 m) and more widely within the defined local area (including sites within approximately 2 km). These distances are below the theoretical minimum ideal inter-roost distances discussed by Rehfisch *et al*. (1996) for a range of wader species wintering at the Wash.

4.3.5 Baseline conditions summary

Baseline conditions for oystercatcher are summarised in Table 12 based on the interpreting the results of the baseline disturbance study and the seasonally valid counts for the local area (as defined) WeBS sectors. The interpretation takes into account that the baseline disturbance study was based on observations of only eight high tide periods (excluding the May 2021 high tide watch) and thus the results are inevitably affected by stochastic variation, for example with respect to the numbers of birds using the roost site by the shipping channel on survey visits. The valid WeBS count data are based on

a much larger sample size (39 counts) and are therefore likely to give a more representative and accurate indication of the use of the MOTH site and the potential for disturbance.

Table 12. Summary of baseline conditions for oystercatcher.

Characteristic	Value/category
Proportion of high tides when >1% of Wash population uses MOTH site	48%
Importance of 'MOTH site' (as defined) to SPA (Table 1 criteria)	High
Importance of 'Local Area' (as defined) to SPA (Table 1 criteria)	High
High tide study watches with disturbance of any individuals	75%
High tide study watches with disturbance of >1% of SPA total	38%
High tide study watches with disturbance of >5% of SPA total	None
Typical response to disturbance	Move to alternative site nearby (within 1 km)
Vulnerability to disturbance by large cargo vessels	High
Vulnerability to disturbance by small fast vessels (pilot boats)	Medium
Vulnerability to disturbance by small slow vessels (fishing boats)	Low
Alternative roosts available elsewhere within defined 'MOTH site'	Yes
Alternative roosts available elsewhere within defined local area	Yes

4.3.6 Predicted change due to Proposed Development

As a consequence of moving to an alternative roost sites away from the immediate vicinity of the shipping channel, disturbance of oystercatchers were usually caused by the first large or fast vessel transit of the watch high tide period. Subsequent vessel movements tended result in no disturbance or disturbance of only a few individuals because there were generally no or relatively few oystercatcher remaining at the roost site close to the shipping channel. Thus the key metric for predicting how the additional vessel movements associated with the Proposed Development could affect oystercatcher is not the number of additional vessel movements *per se*, rather it is the number of additional high-tide periods in which transits by large and/or fast vessels would occur.

Under baseline conditions, transits by large vessels (e.g. cargo vessels) and/or fast vessels (e.g. pilot boats) typically occurs on 75-80% of navigable high tides. The Proposed Development would result in transits by large and/or fast vessels occurring on up to 100% of navigable high tides.

If oystercatcher utilisation of the defined MOTH site and defined local area in terms of numbers and frequency of occurrence remained the same as under baseline conditions, the predicted consequence of the project would be an approximate 18% increase in the number of high tide periods that

oystercatcher are disturbed (Table 13). The average and peak number of oystercatcher affected by vessel disturbance is not anticipated to materially change.

Table 13. Summary of baseline vessel dissturbance of the non-breeding oystercatcher qualifying interest at the mouth of The Haven for The Wash SPA during the high tide (HT) period and prediction of changes that would occur as a result of the Proposed Development.

Disturbance metric	Baseline disturbance study observations	Baseline conditions interpretation [a]	Project prediction	Change
Average disturbance in a HT period	Very short-term disturbance [b] of ca. 1% of SPA population on 75% of HT periods. Typically up to one incident per HT period.	Very short-term disturbance [b] of up to ca. 4% of SPA population on ca. 62% of HT periods. Usually one disturbance event per HT period only, sometimes more than one.	Very short-term disturbance [b] of up to ca. 4% of SPA population on ca. 80% of HT periods. Usually one disturbance event per HT period only, sometimes more than one.	No change to disturbance intensity. ca. 18% increase in number of HT periods in which disturbance occurs
Peak disturbance in any HT period	Very short-term disturbance [b] of ca. 3% of SPA population.	Very short-term disturbance [b] of ca. 20% of SPA population.	Very short-term disturbance [b] of ca. 20% of SPA population.	No change

[a] The interpretation allows for the possibility that the baseline study results may not be wholly representative due to the relatively small sample size of observations. It is therefore assumed that the WeBS count data, which are based on much larger sample size, give a more representative indication of the number of birds at risk of disturbance. The average percentage of birds likely to be disturbed under baseline conditions is based on the average number using the MOTH site (as defined) on occasions that the species is present in more than negligible numbers (>0.2% of Wash population). This number is adjusted downwards as appropriate where there is evidence from the baseline study that a significant proportion of the birds using the MOTH site are not susceptible to vessel disturbance. The peak percentage of birds likely to be disturbed is based on the peak number using the MOTH site and cautiously assumes that all birds present would be disturbed. The baseline frequency of disturbance is calculated from the proportion of WeBS counts when the species used the MOTH site in more than negligible numbers (>0.2% of Wash population) multiplied by 77.5% to take account that under baseline conditions vessel transits of The Haven is limited to 75-80% of high tide periods. It is assumed that if the project goes ahead, vessel transits of The Haven would increase to 100% of high tide periods.

[b] Vessel disturbance incidents are considered to be very short-term in their duration because they typically last a few minutes only before birds resume roosting or foraging behaviour. Nevertheless under both baseline and project scenarios the issue of vessel disturbance is clearly a long term, frequently occurring and continuing impact.

4.3.7 Assessment

For assessing whether additional disturbance by vessels at the MOTH would compromise the SPA's conservation objectives the relevant test questions are considered to be as follows:

- **Test 1**. Would the predicted additional MOTH vessel disturbance change the local distribution of the non-breeding oystercatcher qualifying feature of The Wash SPA on a continuing basis?
- **Test 2**. Would the predicted additional MOTH vessel disturbance change the local abundance of the non-breeding oystercatcher qualifying feature of The Wash SPA on a sustained basis?

- **Test 3**. Would the predicted additional MOTH vessel disturbance reduce the ability of a significant number of individuals of the non-breeding oystercatcher qualifying feature of The Wash SPA to survive, breed, or rear their young.

For the non-breeding oystercatcher qualifying feature, the answer to all three of the test questions is considered to be 'no'. It is therefore considered that potential additional vessel disturbance that would result from the Proposed Development would not compromise The Wash SPA conservation objectives for this qualifying interest. The reasoning behind considering that a 'no' answer is appropriate for the three test questions is summarised below.

Tests 1 and 2. The analysis of WeBS count data shows that the number of oystercatchers using the MOTH site form a high proportion (54% on average) of the oystercatcher that use the local area (as defined), but that the numbers likely to show a disturbance response form only a small proportion (on average 1%, largest event witnessed 3%) of the SPA population (Table 4). The analysis also shows that oystercatcher have a number of alternative local roost locations available to them, both elsewhere within the MOTH site (as defined) and in the wider local area (as defined) and including alternative locations within 1 km. The baseline disturbance study showed that when disturbed by vessels, oystercatchers are able to relocate to nearby alternative locations. It is concluded that the additional disturbance would not materially affect local distribution or abundance of oystercatcher across The Wash SPA. Any change in distribution or abundance would be at a sub-local level only.

Test 3. The Wash SPA oystercatcher qualifying feature concerns non-breeding birds. Therefore the Test 3 question for oystercatcher is limited to considering the potential for the Proposed Development to reduce the ability to survive of a significant number of SPA individuals. The ability to survive could be reduced if a significant number of individuals were subject to higher predation risk and/or energy stress caused by additional energy demands or reduced food intake. In applying this test, the terms 'significant number' and 'ability to survive' are not easily defined. Here a judgement is made by combining information on the likely frequency and duration of additional vessel disturbance events and the anticipated number and behavioural response of the birds that would be affected.

The baseline disturbance study and analysis of WeBS counts showed that MOTH disturbance events typically affected approximately 1% of The Wash oystercatcher population; the largest number disturbed in a high tide period corresponded to approximately 3% of the population (Table 4). The numbers of oystercatcher at risk of disturbance from the predicted additional vessel transits is anticipated to be the same at that at risk from vessel disturbance under baseline conditions. Under baseline conditions disturbance of more than a negligible number (<0.2% of SPA population) of oystercatcher is estimated to occur on 62% of the high tide periods (Table 13). The baseline study also showed that disturbance of more than a negligible number of individuals was essentially limited to a single event in any one high tide period (this is because the response to a vessel passing was for birds to move to an alternative site and they were thus not present, at least in large numbers, when subsequent vessels passed). If the Proposed Development went ahead, it is predicted that the proportion of high tide periods subject to a vessel disturbance risk would increase by approximately 20-25%, from 75-80% to 100%. The frequency of high tides when more than negligible number of oystercatcher is disturbed is expected to increase from a baseline of approximately 62% to approximately 80% – a moderate increase in frequency. Thus, disregarding 20% of high tides periods when only very small numbers could be disturbed, the additional disturbance as a consequence of the

project would occur on approximately 18% of high tide periods (i.e. equivalent to approximately three times per week). The number of birds disturbed is not anticipated to materially change. On the basis of the baseline observations, the birds affected by the additional vessel disturbance are likely respond by flying directly to an alternative location less than 1 km away. The great majority of the birds affected are likely to be roosting birds and therefore the additional disturbance is not anticipated to materially affect foraging time and thus energy intake rates. The additional energy expenditure associated with a single flight to a location less than 1 km away is likely to require less than 1% of a birds' daily expenditure (based on example calculation for knot in Rehfisch *et al*., 1996). Given that shorebirds have a high ability for day-to-day regulation of their body mass, it is considered that an occasional increase of daily energy requirement of <1% is not likely to affect the survival chances of the birds affected. It is also considered that the birds affected by additional vessel disturbance are not likely to be exposed to a materially higher predation risk. This is because the range and density of potential predators at the alternative roost locations within 1 km the MOTH roost site are unlikely to be materially different, and the additional time spent in flight (flying individuals may be more vulnerable to birds of prey) is anticipated to be very small.

Integrating together the above information, it is considered very unlikely that additional vessel disturbance could reduce the ability of a significant number of The Wash SPA oystercatcher population to survive.

4.3.8 Management of disturbance

The additional vessel disturbance that would result if the project went ahead is considered not likely to compromise the conservation objectives for The Wash SPA non-breeding oystercatcher qualifying interest. However the baseline disturbance study showed that this species is affected by relatively high levels of baseline vessel disturbance at the mouth of The Haven. It is also recognised that any additional disturbance of this qualifying feature is undesirable. Therefore mitigation measures that aim to reduce vessel disturbance (baseline and project) and its consequences are considered desirable.

Measures to manage vessel disturbance that would benefit oystercatcher include:

- Provision of one or more artificial roost sites in the vicinity of MOTH but far enough from the shipping channel for roosting birds not to be vulnerable to vessel disturbance.
- Speed restrictions for vessels using The Haven, particularly for pilot vessels.
- Removal of scrub and trees along The Haven sea embankments to lower habitat suitability for predators (in particular sparrowhawk), and thereby reduce predation risk and 'predation fear' (Cresswell, 2008).

4.4 Redshank

The 5-year peak mean WeBS (2014-2019) redshank count for the Wash is 5,239 birds; 1% of the Wash population therefore corresponds to approximately 50 birds. The months when a large numbers of non-breeding redshank are typically present in The Wash SPA are August to March. Thus WeBS counts for these months were considered to be valid for the purposes of the analysis below. The Wash SPA abundance target for redshank is: "*maintain the size of the population at a level which is above 4,331 individuals*" (NE online guidance on SPA conservation objectives).

The Waterbird Disturbance Mitigation Toolkit (Cutts *et al*., 2013) categories redshank as a species with high sensitivity to noise disturbance but low sensitivity to visual disturbance. It states that redshank are only likely to show a response if they are within 100m of a visual disturbance source, but typically show a strong response to noise for overflying aircraft (no specific information on vessel disturbance is given.)

4.4.1 MOTH site importance

On average the valid WeBS counts for the defined MOTH site account for 27% of all the redshanks counted in The Haven local area (as defined). The defined MOTH site held over 1% of the Wash population on 37% of high-tide periods: no high-tide counts exceeded 5% of the population (Table 3, summarised in Table RK1). The peak count was 250 birds and the average count when present was 84 birds, corresponding to 5% and 2% respectively of the Wash 5-year mean peak population (Table 3, summarised in Table 14). Based on the criteria in Table 1, it is concluded that the defined MOTH site has **high importance** both in the context of the defined local area in which it lies and the Wash as a whole (Table 14).

4.4.2 Local area importance

Based on 40 seasonally WeBS counts, The Haven local area (as defined) held over 1% of the Wash population on 83% of high-tide periods and over 5% of the population on 20% of high-tide periods (Table 2, summarised in Table 14). The peak count was 685 birds (13% of the Wash population) and the average count when present was 165 birds (3% of the Wash population) (Table 2, summarised in Table 14). Based on the criteria in Table 1, it is concluded that the defined local area has **high importance** for The Wash SPA (Table 14).

Table 14. The importance of the the defined 'Mouth of the Haven (MOTH) site' and the defined 'The Haven local area' for the Wash SPA non-breeding redshank qualifying interest. Based on 39 seasonally valid WeBS high tide counts made between 2014 and 2019 and using the importance categorisation criteria in Table 1.

Frequency of WeBS count totals				Maximum count (% of Wash total)	Average count when present (% of Wash total)	SPA Importance category
% of counts <0.2% of Wash total	% of counts 0.2 to <1% of Wash total	% of counts 1 to <5% of Wash total	% of counts ≥ 5% of Wash total			
Local area						
0%	18%	63%	20%	685 (13%)	165 (3%)	High
MOTH site						
40%	23%	37%	0%	250 (5%)	84 (2%)	High

4.4.3 Baseline vessel disturbance

Redshanks were disturbed on 100% (8 of 8) of the high-tide periods watched during the baseline disturbance study, with 12 vessel disturbance events witnessed (non-breeding season watches only,

see below). The mean and peak numbers of redshanks showing a disturbance response during the eight high-tide periods monitored (based on the sum of birds disturbed in any one high tide period) was 39 and 220 birds respectively. These numbers correspond to approximately 0.8% and 4% of the Wash population respectively. The mean number of redshank (39 birds) witnessed to be disturbed during a high tide period corresponds to approximately half of the mean WeBS count (76 birds) for the defined MOTH site. It is concluded that there is a high likelihood that any redshank roosting at MOTH will be disturbed by passing vessels.

The WeBS counts show that redshanks were absent in, or present in only very small numbers (0.2% of Wash population, equivalent to 10 birds), the defined MOTH site on 40% of the seasonally valid high tide periods counted (n=39). This figure is in line with the baseline disturbance study results, with disturbance of no more than 10 birds being recorded on five of the eight watches. This suggests that despite the modest sample size, the baseline watches were broadly representative in terms of the numbers of bird using the site.

The mean number of redshank (39 birds) witnessed to be disturbed during a high tide period corresponds to 23% of the mean WeBS count for the defined local area (mean 169 birds), thus in a local area context there is only a moderate likelihood that an individual bird will experience vessel disturbance in a given HT period.

The number of redshank disturbed by vessels exceeded 1% of the Wash 5-year mean peak count during only one of the eight (13%) high tide periods monitored. On five of the eight (63%) high tide periods watched the number of redshank disturbed was between 1 and 10 birds (<0.2 of the Wash population).

Nine of the 12 redshank disturbance events witnessed were cause by large cargo vessels, and three were caused by the transit of a pilot boat (on one of these occasions a small and slower moving fishing boat also passed the MOTH roost site simultaneously).

The response of redshank to MOTH vessel was always to fly to an alternative site. In the vast majority of case the birds moved to an alternative roost sites estimated to be between 250 m and 800 m away. On three occasions, all involving relatively small numbers, the birds moved to feeding habitat between 5 and 100 m away and commenced foraging. In these cases it appears that the vessel disturbance stimulated an early departure from the high tide roost to nearby feeding grounds.

The above account of baseline disturbance excludes observations of a high tide watch conducted in May 2021 as this was outside the seasonally valid period for the non-breeding redshank (May is in the breeding season of this species). During this high tide watch small flocks (21 and 23 birds) of roosting redshank were witnessed showing a disturbance response to a transiting large cargo vessel and later to a pilot boat. The birds affected flew to alternative roost locations estimated to be 250 m and 400 m away respectively.

4.4.4 Availability of alternative roost sites

It is apparent that there are alternative roost sites locally available to redshank. The observation of the vessel-disturbed redshanks moving to alternative roost locations between 250 and 400 m away show that there are alternative roost sites within the defined MOTH site. The observation of the vessel-disturbed redshanks that were witnessed to move to an alternative roost location 800 m away

also show that there is at least one additional alternative roost elsewhere within the defined local area.

The WeBS high tide counts for redshanks provide further evidence of the availability and approximate location of alternative roost sites within the defined local area. The counts show that redshank regularly occur in at least reasonable numbers in almost all of the count sectors within the defined local area that do not form part of the defined MOTH site. Indeed, 77% of the redshank counted in the defined local area sectors were in the sectors that do not form part of the defined MOTH site, in particular the Frampton North sectors 23 to 26.

It is concluded that roosting redshank at the MOTH that are disturbed by vessels are able to relocate to nearby alternative roost sites either within the MOTH site (typically within 500 m) and more widely within the defined local area (including sites within approximately 2 km). Based on an analysis of ringing data of redshank wintering in the Wash, Rehfisch *et al*. (1996) showed that redshank refuges (roost sites) should be not more than 3.5 km apart if they to be within reach of at least 90% of individuals. The distances that vessel-disturbed redshank are required to fly in moving to the alternative roost sites are considered to be relatively small in the context of the results of the study by Rehfisch *et al*. (1996).

4.4.5 Baseline conditions summary

Baseline conditions for redshank are summarised in Table 15 based on the interpreting the results of the baseline disturbance study and the seasonally valid counts for the local area (as defined) WeBS sectors. The interpretation takes into account that the baseline disturbance study was based on observations of only eight high tide periods (excluding the May 2021 high tide watch) and thus the results are inevitably affected by stochastic variation, for example with respect to the numbers of birds using the roost site by the shipping channel on survey visits. The valid WeBS count data are based on a much larger sample size (39 counts) and are therefore likely to give a more representative and accurate indication of the use of the MOTH site and the potential for disturbance.

Table 15. Summary of baseline conditions for redshank.

Characteristic	Value/category
Proportion of high tides when >1% of Wash population uses MOTH site	37%
Importance of 'MOTH site' (as defined) to SPA (Table 1 criteria)	High
Importance of 'Local Area' (as defined) to SPA (Table 1 criteria)	High
High tide study watches with disturbance of any individuals	100%
High tide study watches with disturbance of >1% of SPA total	13%
High tide study watches with disturbance of >5% of SPA total	None
Typical response to disturbance	Move to alternative site nearby (within 1 km)
Vulnerability to disturbance by large cargo vessels	High
Vulnerability to disturbance by small fast vessels (pilot boats)	Medium
Vulnerability to disturbance by small slow vessels (fishing boats)	Low
Alternative roosts available elsewhere within defined 'MOTH site'	Yes
Alternative roosts available elsewhere within defined local area	Yes

4.4.6 Predicted change due to Proposed Development

As a consequence of moving to an alternative roost sites away from the immediate vicinity of the shipping channel, disturbance of redshank were usually caused by the first large or fast vessel transit of the watch high tide period. Subsequent vessel movements tended result in no disturbance or disturbance of only a few individuals because there were generally no or relatively few redshank remaining at the roost site close to the shipping channel. Thus the key metric for predicting how the additional vessel movements associated with the Proposed Development could affect redshank is not the number of additional vessel movements *per se*, rather it is the number of additional high-tide periods in which transits by large and/or fast vessels would occur.

Under baseline conditions, transits by large vessels (e.g. cargo vessels) and/or fast vessels (e.g. pilot boats) typically occurs on 75-80% of navigable high tides. The Proposed Development would result in transits by large and/or fast vessels occurring on up to 100% of navigable high tides.

If redshank utilisation of the defined MOTH site and defined local area in terms of numbers and frequency of occurrence remained the same as under baseline conditions, the predicted consequence of the project would be an increase of approximately 14% in the number of high tide periods that redshank are disturbed (Table 16). The average and peak number of redshank affected by vessel disturbance is not anticipated to materially change.

Table 16. Summary of baseline vessel dissturbance of the non-breeding redshank qualifying interest at the mouth of The Haven for The Wash SPA during the high tide (HT) period and prediction of changes that would occur as a result of the Proposed Development.

Vessel disturbance metric	Baseline disturbance study observations	Baseline conditions interpretation [a]	Project prediction	Change
Average disturbance in a HT period	Very short-term disturbance [b] of ca. 0.8% of SPA population on 100% of HT periods. Typically up to one incident per HT period.	Very short-term disturbance [b] of ca. 1.5% of SPA population on ca. 47% of HT periods. Usually one disturbance event per HT period only, sometimes more than one.	Very short-term disturbance [b] of ca. 1.5% of SPA population on ca. 60% of HT periods. Usually one disturbance event per HT period only, sometimes more than one.	No change to disturbance intensity. ca. 14% increase in number of HT periods in which disturbance occurs
Peak disturbance in any HT period	Very short-term disturbance [b] of ca. 4% of SPA population.	Very short-term disturbance [b] of ca. 5% of SPA population.	Very short-term disturbance [b] of ca. 5% of SPA population.	No change

[a] The interpretation allows for the possibility that the baseline study results may not be wholly representative due to the relatively small sample size of observations. It is therefore assumed that the WeBS count data, which are based on much larger sample size, give a more representative indication of the number of birds at risk of disturbance. The average percentage of birds likely to be disturbed under baseline conditions is based on the average number using the MOTH site (as defined) on occasions that the species is present in more than negligible numbers (>0.2% of Wash population). This number is adjusted downwards as appropriate where there is evidence from the baseline study that a significant proportion of the birds using the MOTH site are not susceptible to vessel disturbance. The peak percentage of birds likely to be disturbed is based on the peak number using the MOTH site and cautiously assumes that all birds present would be disturbed. The baseline frequency of disturbance is calculated from the proportion of WeBS counts when the species used the MOTH site in more than negligible numbers (>0.2% of Wash population) multiplied by 77.5% to take account that under baseline conditions vessel transits of The Haven is limited to 75-80% of high tide periods. It is assumed that if the project goes ahead, vessel transits of The Haven would increase to 100% of high tide periods.

[b] Vessel disturbance incidents are considered to be very short-term in their duration because they typically last a few minutes only before birds resume roosting or foraging behaviour. Nevertheless under both baseline and project scenarios the issue of vessel disturbance is clearly a long term, frequently occurring and continuing impact.

4.4.7 Assessment

For assessing whether additional disturbance by vessels at the MOTH would compromise the SPA's conservation objectives the relevant test questions are considered to be as follows:

- **Test 1**. Would the predicted additional MOTH vessel disturbance change the local distribution of the non-breeding redshank qualifying feature of The Wash SPA on a continuing basis?
- **Test 2**. Would the predicted additional MOTH vessel disturbance change the local abundance of the non-breeding redshank qualifying feature of The Wash SPA on a sustained basis?
- **Test 3**. Would the predicted additional MOTH vessel disturbance reduce the ability of a significant number of individuals of the non-breeding redshank qualifying feature of The Wash SPA to survive, breed, or rear their young.

For the non-breeding redshank qualifying feature, the answer to all three of the test questions is considered to be 'no'. It is therefore considered that potential additional vessel disturbance that would result from the Proposed Development would not compromise The Wash SPA conservation objectives for this qualifying interest. The reasoning behind considering that a 'no' answer is appropriate for the three test questions is summarised below.

Tests 1 and 2. The analysis of WeBS count data shows that the redshanks at risk of disturbance at MOTH form only a moderate proportion (27% on average) of the redshank that use the local area (as defined), and that the numbers likely to show a disturbance response form only a small proportion (on average 0.7%, largest event witnessed 4%) of the SPA population (Table 4). The analysis also shows that redshank have a number of alternative local roost locations available to them, both elsewhere within the MOTH site (as defined) and in the wider local area (as defined) and including alternative locations within 1 km. The baseline disturbance study showed that when disturbed by vessels, redshanks are able to relocate to nearby alternative locations. It is concluded that the additional disturbance would not materially affect local distribution or abundance of redshank across The Wash SPA. Any change in distribution or abundance would be at a sub-local level only.

Test 3. The Wash SPA redshank qualifying feature concerns non-breeding birds. Although some individuals are known to breed in the region the great majority of individuals move away from the local area during the breeding season. Therefore the Test 3 question for redshank is limited to considering the potential for the Proposed Development to reduce the ability to survive of a significant number of SPA individuals. The ability to survive could be reduced if a significant number of individuals were subject to higher predation risk and/or energy stress caused by additional energy demands or reduced food intake. In applying this test, the terms 'significant number' and 'ability to survive' are not easily defined. Here a judgement is made by combining information on the likely frequency and duration of additional vessel disturbance events and the anticipated number and behavioural response of the birds that would be affected.

The baseline disturbance study and analysis of WeBS counts showed that MOTH disturbance events typically affected approximately 0.7% of The Wash redshank population; the largest number disturbed in a high tide period corresponded to approximately 4% of the population (Table 4). The numbers of redshank at risk of disturbance from the predicted additional vessel transits is anticipated to be the same at that at risk from vessel disturbance under baseline conditions. Under baseline conditions disturbance of more than a negligible number (<0.2% of SPA population) of redshank is estimated to occur on 47% of the high tide periods (Table 16). The baseline study also showed that disturbance of more than a negligible number of individuals was essentially limited to a single event in any one high tide period (this is because the response to a vessel passing was for birds to move to an alternative site and they were thus not present, at least in large numbers, when subsequent vessels passed). If the Proposed Development went ahead, it is predicted that the proportion of high tide periods subject to a vessel disturbance risk would increase by approximately 20-25%, from 75-80% to 100%. So the frequency of high tides when more than negligible number of redshank is disturbed is expected to increase from a baseline of approximately 47% to approximately 60% – a moderate increase in frequency. Thus, disregarding 40% of high tides periods when only very small numbers could be disturbed, additional disturbance as a consequence of the project would occur on approximately 17% of high tide periods (i.e. equivalent to approximately twice per week). The number of birds disturbed is not anticipated to materially change, with most events anticipated to involve <1% and peak numbers

not exceeding 5% of the SPA population. On the basis of the baseline observations, the birds affected by the additional vessel disturbance are likely respond by flying directly to an alternative location less than 1 km away. The great majority of the birds affected are likely to be roosting birds and therefore the additional disturbance is not anticipated to materially affect foraging time and thus energy intake rates. The additional energy expenditure associated with a single flight to a location less than 1 km away is likely to require less than 1% of a birds' daily expenditure (based on example calculation for knot in Rehfisch *et al*., 1996). Given that shorebirds have a high ability for day-to-day regulation of their body mass, it is considered that an occasional increase of daily energy requirement of <1% is not likely to affect the survival chances of the birds affected. It is also considered that the birds affected by additional vessel disturbance are not likely to be exposed to a materially higher predation risk. This is because the range and density of potential predators at the alternative roost locations within 1 km the MOTH roost site are unlikely to be materially different, and the additional time spent in flight (flying individuals may be more vulnerable to birds of prey) is anticipated to be very small.

It is therefore considered very unlikely that additional vessel disturbance could reduce the ability of a significant number of The Wash SPA redshank population to survive.

4.4.8 Management of disturbance

The additional vessel disturbance that would result if the project went ahead is considered not likely to compromise the conservation objectives for The Wash SPA non-breeding redshank qualifying interest. However the baseline disturbance study showed that this species is affected by relatively high levels of baseline vessel disturbance at the mouth of The Haven. It is also recognised that any additional disturbance of this qualifying feature is undesirable. Therefore measures that aim to reduce vessel disturbance (baseline and project) and its consequences is considered desirable.

Measures to manage vessel disturbance that would benefit redshank include:

- Provision of one or more artificial roost sites in the vicinity of MOTH but far enough from the shipping channel for roosting birds not to be vulnerable to vessel disturbance.
- Speed restrictions for vessels using The Haven, particularly for pilot vessels.
- Removal of scrub and trees along The Haven sea embankments to lower habitat suitability for predators (in particular sparrowhawk), and thereby reduce predation risk and 'predation fear' (Cresswell, 2008). Redshank are known to have a high vulnerability to sparrowhawk predation (Cresswell and Whitfield, 2008).

4.5 Turnstone

The 5-year peak mean WeBS (2014-2019) turnstone count for the Wash is 809 birds; 1% of the Wash population therefore corresponds to approximately eight birds. The months when a large numbers of non-breeding turnstone are typically present in The Wash SPA are August to March. Thus WeBS counts for these months were considered to be valid for the purposes of the analysis below. The Wash SPA abundance target for turnstone is: "restore the size of the non-breeding population at a level which is above 980 individuals" (NE online guidance on SPA conservation objectives).

The Waterbird Disturbance Mitigation Toolkit (Cutts *et al*., 2013) categories turnstone as a species with low sensitivity to disturbance and that can be extremely tolerant with habituation. It states that

birds are normally tolerant of visual disturbances over 50m away, but occasionally show a flushing response to stimuli as far as 100 m away.

4.5.1 MOTH site importance

On average the WeBS counts for the defined MOTH site account for 83% of all the turnstone counted in The Haven local area (as defined). The defined MOTH site held over 1% of the Wash population on 60% of high-tide periods and over 5% of the population on 20% of high-tide periods. The peak count was 237 birds and the average count when present was 45 birds, corresponding to 29% and 6% respectively of the Wash 5-year mean peak population (Table 3, summarised in Table 17). It is concluded that the defined MOTH site has **high importance** in the context the Wash as a whole, and very high importance in the context of the local area.

4.5.2 Local area importance

Based on 40 seasonally valid WeBS counts, The Haven local area (as defined) held over 1% of the Wash population on 63% of high-tide periods and over 5% of the population on 25% of high-tide periods. The peak count was 237 birds (29% of Wash 5-year mean peak count) and the average count when present was 54 birds (7% of Wash 5-year mean peak count) (Table 17). Based on the criteria in Table 1, it is concluded that the defined local area has **very high importance** for The Wash SPA.

Table 17. The importance of the the defined 'Mouth of the Haven (MOTH) site' and the defined 'The Haven local area' for the Wash SPA non-breeding turnstone qualifying interest. Based on 39 seasonally valid WeBS high tide counts made between 2014 and 2019 and using the importance categorisation criteria in Table 1.

Frequency of WeBS count totals				Maximum count (% of Wash total)	Average count when present (% of Wash total)	SPA Importance category
% of counts <0.2% of Wash total	% of counts 0.2 to <1% of Wash total	% of counts 1% - <5% of Wash total	% of counts ≥ 5% of Wash total			
MOTH site						
28%	13%	40%	20%	237 (29%)	45 (6%)	High
Local area						
28%	10%	38%	25%	237 (29%)	54 (7%)	Very High

4.5.3 Baseline vessel disturbance

Turnstones were disturbed on 38% (3 of 8) of the high-tide periods watched during the baseline disturbance study, with four incidents of vessel disturbance witnessed. The mean and peak numbers of turnstones showing a disturbance response during these high-tide periods was 17 and 22 birds respectively, corresponding to approximately 2-3% of the Wash population. The mean number of turnstone (17 birds) witnessed to be disturbed during a vessel disturbance event corresponds to just

over a quarter mean WeBS count (62 birds) for the defined MOTH site and approximately a third of the mean WeBS count for the defined local area (mean 56 birds). It is concluded that there is probably a relatively low likelihood that turnstone roosting at MOTH will be disturbed by passing vessels. However, during the baseline study, disturbance event involving >1% of the SPA mean peak count occurred on 38% of the HT periods monitored.

The WeBS counts show that turnstone were absent, or present in only very small numbers (0.2% of Wash population, equivalent to 2 birds) in the defined MOTH site on 30% of high tide periods. It is therefore likely that no turnstone were present on several of the baseline survey high tide watches.

Two of the three turnstone disturbance events witnessed were caused by large cargo vessels, and one was caused by a combination of a pilot boat and small fishing boat passing the MOTH roost site simultaneously.

The most frequently observed response of turnstone to MOTH vessel was to fly to an alternative roost sites between 100 and 800 m away (mean = 400 m, n =3). However on one occasion, part of the flock that was flushed flew around for approximately 60 seconds before returning to the original roost location, whilst the other birds moved to an alternative roost site 300 m away.

4.5.4 Availability of alternative roost sites

The MOTH roost site on the revetment alongside the shipping channel is almost certainly the most favoured turnstone roost site in the local area, probably because it provides a rocky substrate, the preferred substrate of roosting turnstone. However, it is apparent that there are alternative roosts available locally. The observation of turnstones responding to vessel disturbance by moving to an alternative roost location 300 m away from the original location show that there is at least one alternative roost within the defined MOTH site. The observation of the vessel-disturbed turnstones that were witnessed to move to an alternative roost location 800 m away also show that there is at least one additional alternative roost elsewhere within the defined local area.

The WeBS counts show that turnstone seldom use alternative roost sites elsewhere within The Haven local area (as defined). Indeed, only 17% of the turnstones counted in the defined local area sectors were in sectors not included in the defined MOTH site. These birds were mainly seen in the Frampton North 26 count sector.

It is concluded that roosting turnstone using the MOTH that are disturbed by are able to relocate to nearby alternative roost sites either within the MOTH site (typically within 500 m) or the Frampton North 26 count sector (most parts of this sector is within approximately 2 km of the MOTH). These distances are below the theoretical minimum ideal inter-roost distances discussed by Rehfisch *et al*. (1996) for a range of wader species wintering at the Wash.

4.5.5 Baseline conditions summary

Baseline conditions for turnstone are summarised in Table 18 based on the interpreting the results of the baseline disturbance study and the seasonally valid counts for the local area (as defined) WeBS sectors. The interpretation takes into account that the baseline disturbance study was based on observations of only eight high tide periods and thus the results are inevitably affected by stochastic variation, for example with respect to the numbers of birds using the roost site by the shipping channel on survey visits. The valid WeBS count data are based on a much larger sample size (39 counts)

and are therefore likely to give a more representative and accurate indication of the use of the MOTH site and the potential for disturbance.

Table 18. Summary of baseline conditions for turnstone

Characteristic	Value/category
Proportion of high tides when >1% of Wash population uses MOTH site	63%
Importance of 'MOTH site' (as defined) to SPA (Table 1 criteria)	High
Importance of 'Local Area' (as defined) to SPA (Table 1 criteria)	High
High tide study watches with disturbance of any individuals	38%
High tide study watches with disturbance of >1% of SPA total	38%
High tide study watches with disturbance of >5% of SPA total	None
Typical response to disturbance	Move to alternative site nearby (within 1 km)
Vulnerability to disturbance by large cargo vessels	High
Vulnerability to disturbance by small fast vessels (pilot boats)	Medium
Vulnerability to disturbance by small slow vessels (fishing boats)	Low
Alternative roosts available elsewhere within defined 'MOTH site'	Yes
Alternative roosts available elsewhere within defined local area	Yes

4.5.6 Predicted change due to the Proposed Development

As a consequence of moving to an alternative roost site away from the immediate vicinity of the shipping channel, disturbance of turnstones was usually caused by the first large or fast vessel transit of the high tide period. Subsequent vessel movements generally did not cause additional disturbance as there were usually no turnstone remaining at the roost site close to the shipping channel.

However, on those occasions that birds choose to return to the same roost site, they would be vulnerable to repeat disturbance should there be further vessel movements during the same hide tide period. Thus for this species, both the number of additional high-tide periods in which transits by large and/or fast vessels would occur and, to a lesser extent, the number of additional vessel movements *per se* are both predicted to lead to an increase in disturbance.

Under baseline conditions, transits by large vessels (e.g. cargo vessels) and/or fast vessels (e.g. pilot boats) typically occurs on 75-80% of navigable high tides. The Proposed Development would result in transits by large and/or fast vessels occurring on up to 100% of navigable high tides.

If turnstone utilisation of the defined MOTH site and defined local area in terms of numbers and frequency of occurrence remained the same as under baseline conditions, the predicted consequence

of the project would be an increase of approximately 16% in the number of high tide periods that turnstone are disturbed (Table 19). The average and peak number of turnstone affected by vessel disturbance is not anticipated to materially change.

Table 19. Summary of baseline vessel disturbance of the non-breeding turnstone qualifying interest at the mouth of The Haven for The Wash SPA during the high tide (HT) period and prediction of changes that would

Vessel disturbance metric	Baseline disturbance study observations	Baseline conditions interpretation [a]	Project prediction	Change
Average disturbance in a HT period	Very short-term disturbance [b] of ca. 2% of SPA population on 38% of HT periods. Typically up to one incident per HT period.	Very short-term disturbance [b] of up to ca. 6% of SPA population on ca. 56% of HT periods. Usually one disturbance event per HT period only, sometimes more than one.	Very short-term disturbance [b] of up to ca. 6% of SPA population on ca. 73% of HT periods. Usually one disturbance event per HT period only, sometimes more than one.	No change to disturbance intensity. ca 16% increase in number of HT periods in which disturbance occurs
Peak disturbance in any HT period	Very short-term disturbance [b] of ca. 3% of SPA population.	Very short-term disturbance [b] of up to ca. 29% of SPA population.	Very short-term disturbance [b] of up to ca. 29% of SPA population.	No change

[a] The interpretation allows for the possibility that the baseline study results may not be wholly representative due to the relatively small sample size of observations. It is therefore assumed that the WeBS count data, which are based on much larger sample size, give a more representative indication of the number of birds at risk of disturbance. The average percentage of birds likely to be disturbed under baseline conditions is based on the average number using the MOTH site (as defined) on occasions that the species is present in more than negligible numbers (>0.2% of Wash population). This number is adjusted downwards as appropriate where there is evidence from the baseline study that a significant proportion of the birds using the MOTH site are not susceptible to vessel disturbance. The peak percentage of birds likely to be disturbed is based on the peak number using the MOTH site and cautiously assumes that all birds present would be disturbed. The baseline frequency of disturbance is calculated from the proportion of WeBS counts when the species used the MOTH site in more than negligible numbers (>0.2% of Wash population) multiplied by 77.5% to take account that under baseline conditions vessel transits of The Haven is limited to 75-80% of high tide periods. It is assumed that if the project goes ahead, vessel transits of The Haven would increase to 100% of high tide periods.

[b] Vessel disturbance incidents are considered to be very short-term in their duration because they typically last a few minutes only before birds resume roosting or foraging behaviour. Nevertheless under both baseline and project scenarios the issue of vessel disturbance is clearly a long term, frequently occurring and continuing impact.

4.5.7 Assessment

For assessing whether additional disturbance by vessels at the mouth of The Haven would compromise the SPA's conservation objectives the relevant test questions are considered to be as follows:

- **Test 1**. Would the predicted additional MOTH vessel disturbance change the local distribution of the non-breeding turnstone qualifying feature of The Wash SPA on a continuing basis?

- **Test 2**. Would the predicted additional MOTH vessel disturbance change the local abundance of the non-breeding turnstone qualifying feature of The Wash SPA on a sustained basis?
- **Test 3**. Would the predicted additional MOTH vessel disturbance reduce the ability of a significant number of individuals of the non-breeding turnstone qualifying feature of The Wash SPA to survive, breed, or rear their young.

For the non-breeding turnstone qualifying feature, the answer to all three of the test questions is considered to be 'no'. It is therefore considered that potential additional vessel disturbance that would result from the Proposed Development would not compromise The Wash SPA conservation objectives for this qualifying interest. The reasoning behind considering that a 'no' answer is appropriate for the three test questions is summarised below.

Tests 1 and 2. The analysis of WeBS count data shows that the turnstones that use the MOTH form a high proportion (83% on average) of the turnstone that use the local area (as defined). The numbers of birds showing a disturbance response in the baseline study was a relatively small proportion of The Wash SPA (on average 2%, largest event witnessed 3%) (Table 4), and it is likely that on average a relatively high proportion (estimated at around 75%) of the birds present are not disturbed when a vessel passes through The Haven. The analysis also shows that birds showing a disturbance response to vessels are able to you alternative locations, both elsewhere within the MOTH site (as defined) and in the wider local area (as defined). It is concluded that the additional disturbance would not materially affect local distribution or abundance of turnstone across The Wash SPA. Any change in distribution or abundance would be at a sub-local level only.

Test 3. The Wash SPA turnstone qualifying feature concerns non-breeding birds, and the individuals concerned do not breed in the UK (they breed in the Arctic). Therefore the Test 3 question for turnstone is limited to considering the potential for the Proposed Development would reduce the ability to survive of a significant number of SPA individuals. The ability to survive could be reduced if a significant number of individuals were subject to higher predation risk and/or energy stress caused by additional energy demands or reduced food intake. In applying this test, the terms 'significant number' and 'ability to survive' are not easily defined. Here a judgement is made by combining information on the likely frequency and duration of additional vessel disturbance events and the anticipated number and behavioural response of the birds that would be affected.

The baseline disturbance study and analysis of WeBS counts showed that MOTH vessel disturbance events typically affect approximately 2% of The Wash turnstone population; the largest number disturbed in a high tide period corresponded to approximately 3% of the population (Table 4). The numbers of turnstone at risk of disturbance from the predicted additional vessel transits is anticipated to be the same at that at risk from vessel disturbance under baseline conditions.

Under baseline conditions disturbance of more than a negligible number of turnstone is estimated to occur on 56% of the high tide periods (Table 19). The baseline study also showed that disturbance of more than a negligible number of individuals was essentially limited to a single event in any one high tide period (this is because the response to a vessel passing was for birds to move to an alternative site and they were thus not present, at least in large numbers, when subsequent vessels passed). If the Proposed Development went ahead, it is predicted that the proportion of high tide periods subject to a vessel disturbance risk would increase by approximately 20-25%, from 75-80% to 100%. The frequency of disturbance is therefore expected to increase from a baseline of 56% of the high tide

periods to approximately 73% of high tide periods – a moderate increase in frequency. Thus the additional disturbance potentially caused by the Proposed Development is anticipated on average to affect approximately 2% of the SPA population and occur on 20% of high tide periods (i.e. equivalent to approximately thrice per week), with the affected bird typically responding by flying directly to an alternative location less than 1 km away. The birds affected are likely to be roosting birds and therefore the disturbance is not anticipated to materially affect foraging time and thus energy intake rates. The additional energy expenditure associated with a single flight to a location less than 1 km away is likely to require less than 1% of a birds' daily expenditure (based on example calculation for knot in Rehfisch *et al*., 1996). Given that shorebirds have a high ability for day-to-day regulation of their body mass, it is considered that an occasional increase of daily energy requirement of <1% is not likely to affect the survival chances of the birds affected. It is also considered that the birds affected by additional vessel disturbance are not likely to be exposed to a materially higher predation risk. This is because the range and density of potential predators at the alternative roost locations within 1 km the MOTH roost site are unlikely to be materially different, and the additional time spent in flight (flying individuals may be more vulnerable to birds of prey) is anticipated to be very small.

It is therefore considered very unlikely that additional vessel disturbance could reduce the ability of a significant number of The Wash SPA turnstone population to survive.

4.5.8 Management of disturbance

The additional vessel disturbance that would result if the project went ahead is considered not likely to compromise the conservation objectives for The Wash SPA non-breeding turnstone qualifying interest. However the baseline disturbance study showed that this species is affected by relatively high levels of baseline vessel disturbance at the mouth of The Haven. It is also recognised that any additional disturbance of this qualifying feature is undesirable. Therefore measures that aim to reduce vessel disturbance (baseline and project) and its consequences are considered desirable.

Measures to manage vessel disturbance that would benefit turnstone include:

- Provision of one or more artificial roost sites in the vicinity of MOTH but far enough from the shipping channel for roosting birds not to be vulnerable to vessel disturbance. Turnstone how a strong habitat preference for roosting (and feeding) on rocky substrates and this should be borne in mind when designing artificial roosts.
- Speed restrictions for vessels using The Haven, particularly for pilot vessels.
- Removal of scrub and trees along The Haven sea embankments to lower habitat suitability for predators (in particular sparrowhawk), and thereby reduce predation risk and 'predation fear' (Cresswell, 2008).

4.6 Lapwing and golden plover

Neither lapwing nor golden plover are qualifying interests of The Wash SPA in their own right despite the fact that numbers of birds regularly using the Wash are considered to be of international importance. Numbers of both species comfortably exceed the 1% threshold of the UK non-breeding population of these species. For lapwing, the Wash birds make up approximately 2% of the UK non-breeding population (11,483 birds out of 635,000). For golden plover, the Wash birds make up approximately 3% of the UK non-breeding population (13,421 birds out of 410,000).

Lapwing and golden plover are cited as contributing to The Wash SPA non-breeding waterbird assemblage feature. However neither species is listed as a 'main component species' of the waterbird assemblage, despite occurring in numbers that considerably exceeding that of many of the species that are listed as main components. For these reasons it is doubtful if the small to moderate local-scale changes that could affect these species as a result of the Proposed Development could be judged as having an AEOI on the The Wash SPA waterbird assemblage feature. Indeed, because these species have low relevance to The Wash SPA for the reasons listed, it follows that potential concerns are lower and that they should be given lower priority in the HRA. For this reason the potential for the Proposed Development to cause disturbance to these two species is not examined in as much detail as it is for the other species assessed.

The Waterbird Disturbance Mitigation Toolkit (Cutts *et al*., 2013) categories lapwing and golden plover as a species with moderate sensitivity to disturbance. It states that lapwings closer than 300 m, and golden plovers closer than 200 m to a potential disturbance source should be considered to be at risk of disturbance.

4.6.1 MOTH site importance

On the basis of the WeBS count data and the criteria in Table 1 it is determined that in the context of The Wash SPA the MOTH site (as defined) has **high importance** for roosting lapwing and **medium importance** for roosting golden plover. When present in more than negligible numbers, the average and peak numbers of lapwing was 496 and 1,480 birds respectively, corresponding to approximately 4% and 13% respectively of the Wash population. The average and peak numbers of golden plover is 675 and 2,800 birds, corresponding to approximately 5% and 22% respectively of the Wash population. However, both species use the MOTH site relatively infrequently; lapwing are only present in more than negligible numbers on 47% of high tides, and golden plover on only 20% (Table 3).

4.6.2 Baseline vessel disturbance

The baseline disturbance study showed that these species have relatively high vulnerability to vessel disturbance. Disturbance of lapwings by vessels occurred on 50% of watches (4 of 8), with a total of nine incidents witnessed. The numbers of birds disturbed in these incidents ranged from 120 to a peak of 1,100. The mean number disturbed was 539. These mean and peak values are similar to the mean and peak WeBS count for MOTH site, indicating that lapwing using the MOTH site have a very high likelihood of being disturbed by vessels. Disturbance of golden plover occurred during only one watch (they were not present on any of the other watches), with a total of three incidents witnessed. The numbers of birds disturbed in these incidents ranged from 500 to a peak of 2,500. In all three occasions that golden plover were seen to be disturbed, lapwing were also present and both species showed a similar and simultaneous disturbance responses. Five of the disturbance incidents involving lapwing and/or golden plover were in response to passing large cargo vessels and four were in response to pilot boats.

The usual response (5 of 9 incidents) of lapwing and golden plover to vessel disturbance was to fly around until the vessel passed and then return to the same roost site. The estimated flight time (flushing to return to roost site) of the birds that responded in this way ranged from 90 to 125 seconds (assuming a flight speeds in the range 12.8 – 17.9 m/s (Alerstam *et al*., 2007) these flight durations correspond to distances flown of approximately 1 to 2 km). As a consequence of returning to the same location, the birds were susceptible to being disturbed on multiple occasions in the same high tide

period. For example, on one watch a lapwing flock was disturbed in this way on four occasions in a period of one and a half hours. On the final occasion the birds relocated to alternative roosting site 800 m away. On four occasions (80%) lapwing and golden plover responded to vessel disturbance by moving to alternative roosting locations, all between 250 and 800 m away, indicating that there are suitable alternative locations nearby for these species. The apparent reluctance to move to alternative sites may indicate that the alternatives available of low quality.

4.6.3 Predicted change due to the Proposed Development

The predicted consequence of the Proposed Development for lapwing would be an approximate 11% increase in the number of high tide periods in which disturbance occurs. This would mean that percentage of high tide periods in which more than negligible numbers of lapwing are disturbed by vessels would increase from approximately 36% to 47%.

The predicted consequence of the Proposed Development for golden plover would be an approximate 5% increase in the number of high tide periods in which disturbance occurs. This would mean that percentage of high tide periods in which more than negligible numbers of golden plover are disturbed by vessels would increase from approximately 15% to 20%.

Following a vessel disturbance event, both these species have a tendency to return to the same roost site. Therefore the project would also potentially increase the numbers of occasions during a high tide period that they are disturbed. The numbers of birds affected by disturbance is not anticipated to be different to that under baseline conditions.

Assessment

Following the same reasoning as set out for the other wader species examined, any changes to lapwing and golden plover status resulting from the Proposed Development are likely to be small and localised, and unlikely to affect the overall size of the Wash populations of these species. The SPA conservation targets are relevant to lapwing and golden plover only insofar as they apply to the waterbird assemblage feature as a whole. With this in mind, three conservation targets relating to the water birds assemblage are considered relevant.

It is not plausible that effects on lapwing and golden plover could compromise the conservation target to "*maintain the overall abundance of the assemblage at a level which is above 214,000 birds*". Together lapwing and golden plover make up only approximately 6% of the waterbird assemblage total. Furthermore, the 2014-2019 5-year mean peak counts for the Wash (371,000 birds) greatly exceeds the target total.

It is not plausible that effects on lapwing and golden plover could compromise the conservation target to "*maintain the species diversity of the bird assemblage*". The guidance on this target states that "*To meet the target, the populations of each of the 'main component' assemblage species is to be maintained*". Neither lapwing nor golden plover are categorised as main component species of the assemblage and therefore this clause is not relevant. However the guidance also states that "*other components should be considered as these contribute collectively to the assemblage diversity, in particular proportionally abundant populations of species of conservation importance. Examples are those red-listed as Birds of Conservation"* and *"The species composition of an assemblage may change over time. However, to meet this target, the total number of all native waterbird species contributing*

to the assemblage diversity should not decline significantly." Lapwing is a red-listed species and therefore qualifies for consideration in this respect. The predicted impacts on lapwing and golden plover are small and therefore could not be considered of concern with respect to maintaining the diversity of the bird assemblage.

Finally, as for all the qualifying species considered in isolation, it is a conservation target for the waterbird assemblage feature to "*reduce the frequency, duration and/or intensity of disturbance affecting roosting and/or foraging birds so that they are not significantly disturbed*." Following the same reasoning set out for the other wader species examined, it is considered that the consequences of the additional disturbance to lapwing and golden plover with respect to their ability to survive and their local distribution and abundance within the Wash would be very small, and therefore would contribute only in a very minor and not significant way to disturbance of the waterbird assemblage as a whole.

4.6.4 Management of disturbance

The additional vessel disturbance that would result if the project went ahead is considered not likely to compromise the conservation objectives for The Wash SPA non-breeding waterbirds assemblage qualifying interest, of which lapwing and golden plover form a part. However the baseline disturbance study showed that lapwing and golden plover are affected by relatively high levels of baseline vessel disturbance at the mouth of The Haven, and possibly also that there is a shortage of high quality alternative local roost locations. It is also recognised that any additional disturbance is undesirable. Therefore measures that aim to reduce vessel disturbance (baseline and project) and its consequences are considered desirable.

Measures to manage vessel disturbance that would benefit lapwing and golden plover include:

- Provision of one or more artificial roost sites in the vicinity of MOTH but far enough from the shipping channel for roosting birds not to be vulnerable to vessel disturbance.
- Speed restrictions for vessels using The Haven, particularly for pilot vessels.
- Removal of scrub and trees along The Haven sea embankments to lower habitat suitability for predators (in particular sparrowhawk), and thereby reduce predation risk and 'predation fear' (Cresswell, 2008).

4.7 Common tern

The 5-year peak mean WeBS (2014-2019) common tern count for the Wash is 597 birds; 1% of the Wash WeBS-count population therefore corresponds to approximately six birds. The common tern qualifying interest for The Wash SPA is breeding birds, with a SPA citation population of 220 breeding pairs. The months when The Wash SPA breeding common tern are present in the Wash is May to September, though active breeding (colony attendance) is essentially limited to May, June and July. Common terns, continue to use the Wash in the post-breeding months of August and September, before migrating to Africa for the winter. Thus WeBS counts for May to September were considered to be valid for the purposes of the analysis below.

The Wash SPA abundance target for common tern is: "maintain the size of the population at a level which is above 220 pairs" (NE online guidance on SPA conservation objectives).

The closet breeding colonies within the Wash SPA are located on the east coast of the Wash between approximately 24 and 30 km from the MOTH. Small numbers of non-SPA birds also breed at inland sites approximately 20 – 30 km to the NW of the MOTH (Mitchell *et al*, 2004). The mean maximum foraging range of breeding common terns is 18km, and the maximum range reported is 30km (Woodward *et al*., 2019). Therefore, when they are attending their breeding colonies, the MOTH is likely to lie close to the limit of, or beyond, the day-to-day range of most common terns breeding in The Wash SPA.

When assessing the potential for MOTH vessel disturbance to affect The Wash SPA breeding common tern qualifying feature, it should be borne in mind that WeBS counts of common tern made in August and September (the months when peak numbers are counted at the MOTH site and the local area) will include juvenile birds. Also, August and September WeBS counts are made after common terns have departed their breeding colonies and therefore may include birds that are not from The Wash SPA breeding colonies.

For all the reasons discussed above, there is uncertainty as to what proportion (if any) of the common terns recorded at the MOTH site (as defined) and The Haven local area (as defined) constitute individuals of The Wash SPA breeding population.

The Waterbird Disturbance Mitigation Toolkit (Cutts *et al*., 2013) does not consider common tern. A review of sensitivity to disturbance (Goodship and Furness, 2019) categorised common tern as having medium sensitivity to disturbance.

4.7.1 MOTH site importance

On average the valid WeBS counts for the defined MOTH site account for 82% of all the common terns counted in The Haven local area (as defined). The defined MOTH site held over 1% of the Wash population (i.e., the WeBS 5-yr peak count) on 75% of high-tide periods and over 5% of the population on 25% of high-tide periods. The peak count was 141 birds and the average count when present was 29 birds, corresponding to 24% and 5% respectively of the Wash 5-year mean peak population (Table 3, summarised in Table 20). The WeBS counts show that the number of common terns using the MOTH site during months when breeding occurs (May to July) are relatively modest (mean eight birds, peak count 16 birds) and much lower than in the post-breeding months of August and September (mean of 48 birds, peak count 141 birds). Thus there is a strong seasonal component to this species use of the MOTH site.

Based on the criteria in Table 1, it is concluded that on the defined MOTH site has **very high importance** in the context the numbers counted in the Wash as a whole and that the categorisation of very high importance is a consequence of the relatively high numbers using the site in the post-breeding period (August and September).

The above categorisation of importance of the MOTH site considers importance in terms of the population as defined by the WeBS 5-year peak count and not The Wash SPA common tern breeding population. For the reasons discussed earlier, in particular remoteness from breeding colonies, it is likely that the importance of the MOTH site (as defined) to The Wash SPA breeding common tern qualifying interest is lower, possibly substantially so, than the importance category based on the above analysis of WeBS common tern counts.

4.7.2 Local area importance

Based on 23 seasonally valid WeBS counts, The Haven local area (as defined) held over 1% of the Wash population (i.e., the WeBS 5-yr peak count) on 73% of high-tide periods and over 5% of the population on 30% of high-tide periods. The peak count was 151 birds (25% of Wash 5-year mean peak count) and the average count when present was 34 birds (6% of Wash 5-year mean peak count) (Table 20). Based on the criteria in Table 1, it is concluded that the defined local area has **very high importance** in the context the numbers counted in the Wash as a whole.

The above categorisation of importance of The Haven local area (as defined) site considers importance in terms of the population as defined by the WeBS 5-year peak count and not The Wash SPA common tern breeding population. For reasons discussed earlier, it is likely that the importance of the local area (as defined) to The Wash SPA breeding common tern qualifying interest is lower, possibly substantially so, than the importance category based on the above analysis of WeBS common tern counts.

Table 20. The importance of the the defined 'Mouth of the Haven (MOTH) site' and the defined 'The Haven local area' for common tern. Based on 23 seasonally valid WeBS high tide counts made between 2014 and 2019 and using the importance categorisation criteria in Table 1. Note, for the reasons explained in the text, the importance categories for this species refer to importance to the WeBS-count defined Wash population, and not The Wash SPA common tern breeding population.

Frequency of WeBS count totals				Maximum count (% of Wash total)	Average count when present (% of Wash total)	The Wash WeBS total importance category
% of counts <0.2% of Wash total	% of counts 0.2 to <1% of Wash total	% of counts 1% - <5% of Wash total	% of counts ≥ 5% of Wash total			
MOTH site						
15%	10%	50%	25%	141 (24%)	29 (5%)	Very High
Local area						
17%	9%	43%	30%	151 (25%)	34 (6%)	Very High

4.7.3 Baseline vessel disturbance

Only three baseline disturbance watches were undertaken (in 2021) at the MOTH during the period common terns use the Wash (May to September). Therefore there is relatively little information available on the baseline levels of vessel disturbance of common terns at the MOTH.

Common terns were disturbed on 33% (1 of 3) of the high-tide periods watched during the baseline disturbance watches conducted between May and July. The single vessel disturbance incident that was seen involved a flock of 10 common terns which were flushed from the MOTH in response to a passing large cargo vessel. The bird flew around for approximately 60 seconds before returning to the roost site. Ten birds correspond to 1.7% of the Wash 5-year mean peak WeBS count population.

4.7.4 Availability of alternative roost sites

The baseline disturbance study provided no information on the potential for common terns disturbed by vessel to relocate to nearby alternative roost sites; the birds involved in the only disturbance incident seen returned to the same roost site. The WeBS counts show that common tern seldom use alternative roost sites elsewhere within The Haven local area (as defined). Indeed, only 13% of the common terns counted in the defined local area WeBS sectors were in sectors not included in the defined MOTH site. The MOTH roost site on the revetment alongside the shipping channel is almost certainly the most favoured common tern roost site in the local area, probably because it provides a rocky substrate, the preferred substrate of roosting common tern.

4.7.5 Baseline conditions summary

Baseline conditions for common tern are summarised in Table 21 based on the interpreting the results of the baseline disturbance study and the seasonally valid counts for the local area (as defined) WeBS sectors. The interpretation takes into account that the baseline disturbance study was based on observations of only three high tide periods and thus the results are inevitably affected by stochastic variation, for example with respect to the numbers of birds using the roost site by the shipping channel on survey visits. The valid WeBS count data are based on a much larger sample size (23 counts) and are therefore likely to give a more representative and accurate indication of the use of the MOTH site and the potential for disturbance.

Table 21. Summary of baseline conditions for common tern

Characteristic	Value/category
Proportion of high tides when >1% of Wash population uses MOTH site	63%
Importance of 'MOTH site' (as defined) to the Wash WeBS count defined population (Table 1 criteria)	High
Importance of 'Local Area' (as defined) to the Wash WeBS count defined population (Table 1 criteria)	High
High tide study watches with disturbance of any individuals	33% (based on only three watches)
High tide study watches with disturbance of >1% of the Wash WeBS count total (5-year mean peak count)	33% (based on only three watches)
High tide study watches with disturbance of >5% of the Wash WeBS count total (5-year mean peak count)	None (based on only three watches)
Typical response to disturbance	Return to original roost site (based on single event overserved)
Vulnerability to disturbance by large cargo vessels	High (based on only three watches)
Vulnerability to disturbance by small fast vessels (pilot boats)	Low (based on only three watches)
Vulnerability to disturbance by small slow vessels (fishing boats)	Low (based on only three watches)
Alternative roosts available elsewhere within defined 'MOTH site'	Probably few
Alternative roosts available elsewhere within defined local area	Probably few

4.7.6 Predicted change due to the Proposed Development

If common terns roosting at the MOTH that are disturbed by vessels choose to return to the same roost site (as was the case for the birds in the single disturbance incident seen), they would be vulnerable to repeat disturbance should there be further vessel movements during the same hide tide period. Thus for this species, both the number of additional high-tide periods in which transits by large and/or fast vessels would occur and the number of additional vessel movements *per se* are both predicted to lead to an increase in disturbance.

Under baseline conditions, transits by large vessels (e.g. cargo vessels) and/or fast vessels (e.g. pilot boats) typically occurs on 75-80% of navigable high tides. The Proposed Development would result in transits by large and/or fast vessels occurring on up to 100% of navigable high tides.

If common tern utilisation of the defined MOTH site and defined local area in terms of numbers and frequency of occurrence remained the same as under baseline conditions, the predicted consequence of the project would be an increase of approximately 19% in the number of high tide periods that common tern are disturbed (Table 22). The average and peak number of common tern affected by vessel disturbance is not anticipated to materially change.

Table 22. Summary of baseline vessel dissturbance of the non-breeding common tern qualifying interest at the mouth of The Haven for The Wash SPA during the high tide (HT) period and prediction of changes that would

Vessel disturbance metric	Baseline disturbance study observations	Baseline conditions interpretation [a]	Project prediction	Change
Average disturbance in a HT period	Very short-term disturbance [b] of ca. 2% of SPA population on 33% of HT periods.	Very short-term disturbance [b] of up to ca. 5% of SPA population on ca. 66% of HT periods. Potential for more than one	Very short-term disturbance [b] of up to ca. 5% of SPA population on ca. 85% of HT periods. Usually one disturbance event per HT period only, sometimes more than one.	No change to disturbance intensity. ca 19% increase in number of HT periods in which disturbance occurs
Peak disturbance in any HT period	Very short-term disturbance [b] of ca. 3% of the Wash WeBS count population.	Very short-term disturbance [b] of up to ca. 24% of the Wash WeBS count population.	Very short-term disturbance [b] of up to ca. 24% of the Wash WeBS count population.	No change

[a] The interpretation allows for the possibility that the baseline study results may not be wholly representative due to the relatively small sample size of observations. It is therefore assumed that the WeBS count data, which are based on much larger sample size, give a more representative indication of the number of birds at risk of disturbance. The average percentage of birds likely to be disturbed under baseline conditions is based on the average number using the MOTH site (as defined) on occasions that the species is present in more than negligible numbers (>0.2% of Wash population). This number is adjusted downwards as appropriate where there is evidence from the baseline study that a significant proportion of the birds using the MOTH site are not susceptible to vessel disturbance. The peak percentage of birds likely to be disturbed is based on the peak number using the MOTH site and cautiously assumes that all birds present would be disturbed. The baseline frequency of disturbance is calculated from the proportion of WeBS counts when the species used the MOTH site in more than negligible numbers (>0.2% of Wash population) multiplied by 77.5% to take account that under baseline conditions vessel transits of The Haven is limited to 75-80% of high tide periods. It is assumed that if the project goes ahead, vessel transits of The Haven would increase to 100% of high tide periods.

[b] Vessel disturbance incidents are considered to be very short-term in their duration because they typically last a few minutes only before birds resume roosting or foraging behaviour. Nevertheless under both baseline and project scenarios the issue of vessel disturbance is clearly a long term, frequently occurring and continuing impact.

4.7.7 Assessment

For assessing whether additional disturbance by vessels at the mouth of The Haven would compromise the SPA's conservation objectives the relevant test questions are considered to be as follows:

- **Test 1**. Would the predicted additional MOTH vessel disturbance change the local distribution of the breeding common tern qualifying feature of The Wash SPA on a continuing basis?
- **Test 2**. Would the predicted additional MOTH vessel disturbance change the local abundance of the breeding common tern qualifying feature of The Wash SPA on a sustained basis?
- **Test 3**. Would the predicted additional MOTH vessel disturbance reduce the ability of a significant number of individuals of the breeding common tern qualifying feature of The Wash SPA to survive, breed, or rear their young.

For the breeding common tern qualifying feature, the answer to all three of the test questions is considered to be 'no'. It is therefore considered that potential additional vessel disturbance that would result from the Proposed Development would not compromise The Wash SPA conservation objectives for this qualifying interest. The reasoning behind considering that a 'no' answer is appropriate for the three test questions is summarised below.

Tests 1 and 2. The analysis of WeBS count data shows that the common terns that use the MOTH form a high proportion (87% on average) of the common terns that use The Haven local area (as defined). The numbers of common tern showing a disturbance response in the single MOTH vessel disturbance event seen during the baseline study was a relatively small proportion (1.7%) of numbers using the Wash (Table 4). However, based on the WeBS counts for the MOTH site, there is clearly potential for disturbance events to sometimes affect higher proportions, especially in August and September (by when birds have finished breeding and no longer attend breeding colonies) when numbers using the MOTH site are greatest. The baseline disturbance study observations and analysis of WeBS count do not provide strong evidence that common terns affected by vessel disturbance have opportunities to move to alternative roost sites in the local area. However it did show, albeit for a disturbance single event only, that common terns disturbed by vessels can quickly resettle at the MOTH roost site.

Breeding common terns are known to range relatively large distance from breeding colonies to forage, with a reported mean maximum foraging range of 18 km and a maximum foraging range of 30 km (Woodward et al., 2019). Thus the common terns breeding at the colonies in The Wash SPA can potentially use almost the whole of the Wash (including the vicinity of the MOTH) for foraging.

It is concluded that the additional disturbance would not materially affect local distribution or abundance of common tern across The Wash SPA. Any change in distribution or abundance would only affect birds away from the breeding colonies and be at a sub-local level only.

Test 3. The Wash SPA common tern qualifying feature concerns breeding birds. Therefore the Test 3 question for common tern includes considering the potential for the Proposed Development to reduce the ability to breed and rear their young, as well as the ability to survive.

It is not likely that additional vessel disturbance at the MOTH would affect the ability of The Wash SPA common terns to breed or year young because the disturbance would occur well away from (>20 km) the SPA breeding colonies and would not compromise adults' ability to forage when provisioning young. Any additional vessel disturbance in August and September, the months when the greatest number of common tern use of the MOTH peaks, would be after the breeding season and therefore could not affect breeding.

The ability to survive could be reduced if a significant number of individuals were subject to higher predation risk and/or energy stress caused by additional energy demands or reduced food intake. Given that the numbers of common terns likely to be disturbed by vessels is relatively small, that disturbed birds are likely to quickly resettle and that disturbance would not reduce foraging time, it is judged that the additional vessel disturbance is not likely to compromise the ability of a significant number of The Wash SPA common tern population to survive.

4.7.8 Management of disturbance

The additional vessel disturbance that would result if the project went ahead is considered not likely to compromise the conservation objectives for The Wash SPA breeding common tern qualifying interest. However the baseline disturbance study showed that this species is potentially affected by relatively high levels of baseline vessel disturbance at the mouth of The Haven, especially the post-breeding months of August and September (i.e., after birds have finished breeding but continue to use the Wash). It is also recognised that any additional disturbance of this qualifying feature is undesirable. Therefore measures that aim to reduce vessel disturbance (baseline and project) and its consequences are considered desirable.

Measures to manage vessel disturbance that would benefit common tern include:

- Provision of one or more artificial roost sites in the vicinity of MOTH but far enough from the shipping channel for roosting birds not to be vulnerable to vessel disturbance. Common tern how a strong habitat preference for roosting on rocky or bare sand substrates and this should be borne in mind when designing artificial roosts.
- Speed restrictions for vessels using The Haven, particularly for pilot vessels.

5. References

Alerstam T, Rosén M, Bäckman J, Ericson PGP, Hellgren O (2007) Flight Speeds among Bird Species: Allometric and Phylogenetic Effects. PLoS Biol 5(8): e197. doi:10.1371/journal.pbio.0050197

Bentley, A. (2020). Changes in Water Bird Behaviour Due to River Traffic at the Mouth of The Haven, Boston, Lincolnshire. November 2019 to March 2020. Unpublished field report to Royal Haskoning DHV.

Chick, A.P. (2021). Changes in Water Bird Behaviour Due to River Traffic at the Mouth of The Haven, Boston, Lincolnshire. January 2021 to July 2021. Unpublished field report to Royal Haskoning DHV.

Cutts, N, Hemingway, K & Spencer, J (2013). Waterbird Disturbance Mitigation Toolkit Informing Estuarine Planning & Construction Projects Version 3.2, March 2013 Copyright University of Hull [redacted]

Cresswell, W & Whitfield, D. (2008). The effects of raptor predation on wintering wader populations at the Tyninghame Estuary, Southeast Scotland. Ibis. 136. 223 - 232. 10.1111/j.1474-

Cresswell, W. (2008), Non-lethal effects of predation in birds. Ibis, 150: 3-17. [redacted]

Fox, A., & Madsen, J. (1997). Behavioural and Distributional Effects of Hunting Disturbance on Waterbirds in Europe: Implications for Refuge Design. Journal of Applied Ecology, 34(1), 1-13. doi:10.2307/2404842

Goodship, N. & Furness, R.W. 2019. Seaweed hand-harvesting: literature review of disturbance distances and vulnerabilities of marine and coastal birds. Scottish Natural Heritage Research Report No. 1096.

Inger, R., et al. (2010) Carry-over Effects Reveal Reproductive Costs in a Long distance Migrant. *Journal of Animal Ecology*, vol. 79, no. 5, 2010, pp. 974-82. 919X.1994.tb01088.x.

Mitchell, P.I., Newton S.F., Ratcliffe, N. and Dunn, T.E. (2004). Seabird populations of Britain and Ireland. Christopher Helm, London.

Rehfisch, M M, Clark, N A, Langston R H W, and Greenwood, J J D. (1996). A Guide to the Provision of Refuges for Waders: An Analysis of 30 Years of Ringing Data from the Wash, England. Journal of Applied Ecology , Aug., 1996, Vol. 33, No. 4, pp. 673-687.

Summers, R. W., and Critchley, C. N. (1990) Use of Grassland and Field Selection by Brent Geese *Branta Bernicla*. *Journal of Applied Ecology*, vol. 27, no. 3, pp. 834-46.

Woodward, I, Thaxter, C.B., Owen, E. and Cook, A.S.C.P. (2019). Desk-based revision of seabird foraging ranges used for HRA screening. BTO Research Report No. 724. Report of work carried out by the British Trust for Ornithology on behalf of NIRAS and The Crown Estate.

6. Acknowledgment

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A2 Winter Bird Survey Data

Application Site survey data

A.2.1 Winter Bird Survey data

Date	30/10/2019	13/11/2019	12/12/2019	10/01/2020	12/02/2020	07/03/2020	31/01/2021	13/02/2021	14/03/2021
Tide visit: low	Low	L	L	L	L	L	L	L	L
Sector A	A	A	A	A	A	A	A	A	A
Bar-tailed Godwit									3
Black-tailed Godwit					3	1		3	
Common Scoter									
Curlew	5	1	2	1	3	4	5	9	3
Dark-bellied Brent Goose									
Dunlin								44	
Gadwall									
Goldeneye									
Grey plover	4	5	8	5	3		1	6	
Knot									
Oystercatcher	1					2			3
Pink-footed goose									
Pintail									

Date	30/10/2019	13/11/2019	12/12/2019	10/01/2020	12/02/2020	07/03/2020	31/01/2021	13/02/2021	14/03/2021
Tide visit: low	**Low**	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
Sector A	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
Redshank	18	26	14	27	26	17	24	18	15
Sanderling									
Shelduck									
Turnstone				1		2			
Wigeon									
Ruff *Philomachus pugnax*				1				3	
Lapwing *Vanellus vanellus*	1	2	3		1			15	
Ringed plover *Charadrius hiaticula*								7	
Black-headed gull *Chroicocephalus ridibundus*	21	47	3	43	72	34	14	5	11
Canada goose *Branta canadensis*	2	9		5		6	2		20
Common gull *Larus canus*		3		3	7	6	2		
Cormorant *Phalacrocorax carbo*	3	4		2	1	1	1	3	
Great black-backed gull *Larus marinus*	2	3			3	2			
Grey heron *Ardea cinerea*			1				1		
Herring gull *Larus argentatus*		4		2	11	27			2

Date	30/10/2019	13/11/2019	12/12/2019	10/01/2020	12/02/2020	07/03/2020	31/01/2021	13/02/2021	14/03/2021
Tide visit: low	Low	L	L	L	L	L	L	L	L
Sector A	A	A	A	A	A	A	A	A	A
Jack snipe *Lymnocryptes minimus*			1						
Kingfisher *Alcedo atthis*	1								
Lesser black-backed gull *Larus fuscus*						7			2
Little egret *Egretta garzetta*	2		1	2	1				1
Mallard *Anas platyrhynchos*	4	6	6	2		3	4	2	
White-fronted goose *Anser albifrons*									
Greylag goose *Anser anser*									1
Little grebe *Tachybaptus ruficollis*									
Snipe *Gallinago gallinago*								2	
Greenshank *Tringa nebularia*									
Green sandpiper *Tringa ochropus*									

Date	23/10/2019	21/11/2019	18/12/2019	15/01/2020	14/02/2020	07/03/2020	23/01/2021	19/02/2021	21/03/2021
Tide visit	H	H	H	H	H	H	H	H	H
Sector	A	A	A	A	A	A	A	A	A
Bar-tailed Godwit									1

Date	23/10/2019	21/11/2019	18/12/2019	15/01/2020	14/02/2020	07/03/2020	23/01/2021	19/02/2021	21/03/2021
Tide visit	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**
Sector	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
Black-tailed Godwit									
Common Scoter									
Curlew	1	1			2		1	1	2
Dark-bellied Brent Goose									
Dunlin									
Gadwall									
Goldeneye									
Grey plover		3	1					2	
Knot									
Oystercatcher	4			2	3	2		2	2
Pink-footed goose									
Pintail									
Redshank	20	19	27	162	29	13	44	18	26
Sanderling									
Shelduck					2				2
Turnstone						2	1		
Wigeon									
Ruff Philomachus pugnax	1								1
Lapwing Vanellus vanellus	1	2	1				1		

Date	23/10/2019	21/11/2019	18/12/2019	15/01/2020	14/02/2020	07/03/2020	23/01/2021	19/02/2021	21/03/2021
Tide visit	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**
Sector	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
Ringed plover Charadrius hiaticula			2						
Black-headed gull Chroicocephalus ridibundus	13	13	23	28	11		12	15	3
Canada goose Branta canadensis	49	12	10	9	6		1		1
Common gull Larus canus	5	3	4	3					1
Cormorant Phalacrocorax carbo	3	1		3	1		1	2	6
Great black-backed gull Larus marinus								1	
Grey heron Ardea cinerea							1	3	
Herring gull Larus argentatus	1		1		3				
Jack snipe *Lymnocryptes minimus*									
Kingfisher *Alcedo atthis*									
Lesser black-backed gull *Larus fuscus*									

Date	23/10/2019	21/11/2019	18/12/2019	15/01/2020	14/02/2020	07/03/2020	23/01/2021	19/02/2021	21/03/2021
Tide visit	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**
Sector	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
Little egret *Egretta garzetta*								1	
Mallard *Anas platyrhynchos*	6	19	8	5	8	2	6	3	
White-fronted goose *Anser albifrons*				1					
Greylag goose *Anser anser*							1		
Little grebe *Tachybaptus ruficollis*									
Snipe *Gallinago gallinago*									
Greenshank *Tringa nebularia*									
Green sandpiper *Tringa ochropus*								1	

Date	30/10/2019	13/11/2019	12/12/2019	10/01/2020	12/02/2020	07/03/2020	31/01/2021	13/02/2021
Tide visit	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**L**
Sector	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**
Bar-tailed Godwit								1
Black-tailed Godwit	1				2	2		
Common Scoter								
Curlew	3	4	2		7	3	8	5
Dark-bellied Brent Goose								
Dunlin								25

Date	30/10/2019	13/11/2019	12/12/2019	10/01/2020	12/02/2020	07/03/2020	31/01/2021	13/02/2021
Tide visit	L	L	L	L	L	L	L	L
Sector	B	B	B	B	B	B	B	B
Gadwall								
Goldeneye								
Grey plover	6	6	13	6	4	1	1	17
Knot								
Oystercatcher	1					2		
Pink-footed goose								
Pintail								
Redshank	25	61	19	36	21	31	34	16
Sanderling								
Shelduck								
Turnstone								
Wigeon								
Ruff *Philomachus pugnax*	6			1		3		
Lapwing *Vanellus vanellus*	6	6	8	5	4		9	19
Ringed plover *Charadrius hiaticula*	2	1			11			22
Black-headed gull *Chroicocephalus ridibundus*			1				10	
Canada goose *Branta canadensis*		7			8	17		14
Common gull *Larus canus*								
Cormorant *Phalacrocorax carbo*	3	4	2	2	2		4	2
Great black-backed gull *Larus marinus*								

Date	30/10/2019	13/11/2019	12/12/2019	10/01/2020	12/02/2020	07/03/2020	31/01/2021	13/02/2021
Tide visit	L	L	L	L	L	L	L	L
Sector	B	B	B	B	B	B	B	B
Grey heron *Ardea cinerea*	2	1					1	2
Herring gull *Larus argentatus*								
Jack snipe *Lymnocryptes minimus*			2					1
Kingfisher *Alcedo atthis*								
Lesser black-backed gull *Larus fuscus*						2		
Little egret *Egretta garzetta*	2				1			
Mallard *Anas platyrhynchos*	21	23	20		6	1	14	6
White-fronted goose *Anser albifrons*								
Greylag goose *Anser anser*					1	3		1
Little grebe *Tachybaptus ruficollis*					1			
Snipe *Gallinago gallinago*	1		4			1		4
Greenshank *Tringa nebularia*								
Green sandpiper *Tringa ochropus*								

Date	23/10/2019	21/11/2019	18/12/2019	15/01/2020	14/02/2020	07/03/2020	23/01/2021	19/02/2021	21/03/2021
Tide visit	H	H	H	H	H	H	H	H	H
Sector	B	B	B	B	B	B	B	B	B
Bar-tailed Godwit	1	1					10	1	
Black-tailed Godwit	1	1							
Common Scoter									
Curlew	8	1	1		1	1	6		1
Dark-bellied Brent Goose									
Dunlin							8	1	
Gadwall									
Goldeneye									
Grey plover		3	2	2	2	1	4	2	
Knot									
Oystercatcher		3						1	2
Pink-footed goose									
Pintail									
Redshank	78	38	33	3	93	73	43	21	73
Sanderling									
Shelduck					1			3	

Date	23/10/2019	21/11/2019	18/12/2019	15/01/2020	14/02/2020	07/03/2020	23/01/2021	19/02/2021	21/03/2021
Tide visit	H	H	H	H	H	H	H	H	H
Sector	B	B	B	B	B	B	B	B	B
Turnstone							1		1
Wigeon									
Ruff *Philomachus pugnax*	4				1	3			6
Lapwing *Vanellus vanellus*	4	4	6	2	3		6	1	
Ringed plover *Charadrius hiaticula*	1						15		
Black-headed gull *Chroicocephalus ridibundus*			1	1	1		2	1	2
Canada goose *Branta canadensis*				27	15	16		4	
Common gull *Larus canus*									
Cormorant *Phalacrocorax carbo*	3	1		1	1	1			1
Great black-backed gull *Larus marinus*									

Date	23/10/2019	21/11/2019	18/12/2019	15/01/2020	14/02/2020	07/03/2020	23/01/2021	19/02/2021	21/03/2021
Tide visit	H	H	H	H	H	H	H	H	H
Sector	B	B	B	B	B	B	B	B	B
Grey heron *Ardea cinerea*							1	2	
Herring gull *Larus argentatus*									1
Jack snipe *Lymnocryptes minimus*				1					
Kingfisher *Alcedo atthis*									
Lesser black-backed gull *Larus fuscus*									1
Little egret *Egretta garzetta*	1							2	3
Mallard *Anas platyrhynchos*	11		13	2	8	5	12	7	5
White-fronted goose *Anser albifrons*									
Greylag goose *Anser anser*				3	3	3			
Little grebe *Tachybaptus ruficollis*									
Snipe *Gallinago gallinago*	2			4			1	1	

Date	23/10/2019	21/11/2019	18/12/2019	15/01/2020	14/02/2020	07/03/2020	23/01/2021	19/02/2021	21/03/2021
Tide visit	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**
Sector	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**B**
Greenshank *Tringa nebularia*				1					
Green sandpiper *Tringa ochropus*									

A3 Changes in Behaviour survey data

A3.1 Proposed development site Changes in Waterbird Behaviour observations

VESSEL EVENT								BIRD RESPONSE								
Date	Time	Site	Vessel type	Vessel size	Photo	Vessel direction	Event no. of session	Species	Count	Original Behaviour	Response	Apparent cause	Distance moved (m)	New location type	Time (s)	Notes
31/05/2021	09:36	WHARF	Fishing	small	25	Out	1	Cormorant	2	RL	Flew/Moved	Proximity	50	ROOST		
31/05/2021	09:36	WHARF	Fishing	small	25	Out	1	Black-headed gull	6	RW	Flew/Returned	Proximity	0	ROOST	45	
31/05/2021	10:11	WHARF	Fishing	medium	26	In	2	Cormorant	3	RL	Flew/Moved	Proximity	600	ROOST		Individuals moved 100, 200 and 600 m approx.
31/05/2021	10:11	WHARF	Fishing	medium	26	In	2	Shelduck	1	RL	Flew/Returned	Proximity	0	ROOST	45	
31/05/2021	10:11	WHARF	Fishing	medium	26	In	2	Shelduck	2	RL	Flew/Moved	Proximity	800	ROOST		
31/05/2021	10:11	WHARF	Fishing	medium	26	In	2	Black-headed gull	7	RL	Flew/Returned	Proximity	0	ROOST	60	
31/05/2021	11:00	WHARF	Fishing	small	27	Out	3	Cormorant	1	RL	Flew/Moved	Proximity	100	ROOST		
30/06/2021	09:40	WHARF	Pilot	small	31	In	1	Black-headed gull	14	RL	Flew/Returned	Proximity	0	ROOST	60	
30/06/2021	09:40	WHARF	Pilot	small	31	In	1	Mallard	3	Feed	Flew/Moved	Proximity	400	Feed		
30/06/2021	09:40	WHARF	Pilot	small	31	In	1	Herring gull	2	Bathe	Flew/Moved	Proximity	400	Bathe		
30/06/2021	09:40	WHARF	Pilot	small	31	In	1	Cormorant	1	Feed	Flew/Moved	Proximity	700	ROOST		
30/06/2021	09:40	WHARF	Pilot	small	31	In	1	Little egret	1	Feed	Flew/Moved	Proximity	300	Feed		
30/06/2021	09:53	WHARF	Cargo	Large	32	In	2	Black-headed gull	12	RL	Flew/Returned	Proximity	0	ROOST	80	100% of birds present
30/06/2021	09:53	WHARF	Cargo	Large	32	In	2	Cormorant	2	RL	Flew/Moved	Proximity	600	ROOST		100% of birds present
30/06/2021	09:53	WHARF	Cargo	Large	32	In	2	Little egret	1	Feed	Flew/Moved	Proximity	40	Feed		100% of birds present, walked back to original feeding location
30/06/2021	09:54	WHARF	Cargo	Large	32	In	3	Cormorant	1	RL	Flew/Moved	Proximity	600	ROOST		
30/06/2021	10:09	WHARF	Cargo	Large	33	In	4	Little egret	2	Feed	Flew/Moved	Proximity	1000	Out of sight		
30/06/2021	10:09	WHARF	Cargo	Large	33	In	4	Little egret	1	Feed	Flew/Moved	Proximity	150	Feed		
30/06/2021	10:09	WHARF	Cargo	Large	33	In	4	Black-headed gull	12	RL	Flew/Returned	Proximity	0	Roost	60	
17/07/2021	09:16	WHARF	Fishing	small	41	Out	1	Redshank	1	Feed	Flew/Moved	Proximity	400	Feed		

VESSEL EVENT								BIRD RESPONSE								
Date	Time	Site	Vessel type	Vessel size	Photo	Vessel direction	Event no. of session	Species	Count	Original Behaviour	Response	Apparent cause	Distance moved (m)	New location type	Time (s)	Notes
17/07/2021	09:31	WHARF	Tour	medium	42	Out	2	Lesser black-backed gull	2	Bathe	Flew/Moved	Proximity	40	Roost		
17/07/2021	09:43	WHARF	Private	small	43	Out	3	Black-headed gull	2	Feed	Flew/Moved	Proximity	50	Feed		
17/07/2021	09:44	WHARF	Private	small	44	Out	4	All			None					Uncertainty what if any other birds present at roost
17/07/2021	09:49	WHARF	Private	small	45	Out	5	All			None					Uncertainty what if any other birds present at roost
17/07/2021	10:58	WHARF	Private	small	46	Out	6	Lesser black-backed gull	32	Bathe	Flew/Moved	Proximity	150	ROOST		
17/07/2021	10:58	WHARF	Private	small	46	Out	6	Herring gull	10	Bathe	Flew/Moved	Proximity	150	ROOST		
17/07/2021	10:58	WHARF	Private	small	46	Out	6	Black-headed gull	1	Bathe	Flew/Moved	Proximity	150	ROOST		
17/07/2021	10:58	WHARF	Private	small	46	Out	6	Cormorant	1	RL	Flew/Moved	Proximity	400	ROOST		
19/07/2021	13:04	WHARF	Private	small	47	Out	1	All			None					Uncertainty what if any other birds present at roost
19/07/2021	13:22	WHARF	Cargo	Large	48	Out	2	Lesser black-backed gull	7	RW	Flew/Moved	Proximity	100	ROOST		
19/07/2021	13:22	WHARF	Cargo	Large	48	Out	2	Lesser black-backed gull	7	RW	Flew/Moved	Proximity	200	ROOST		Same birds again
19/07/2021	13:22	WHARF	Cargo	Large	48	Out	2	Lesser black-backed gull	52	RW	Flew/Returned	Proximity	0	ROOST		Includes same 7 birds again
19/07/2021	13:22	WHARF	Cargo	Large	48	Out	2	Herring gull	12	RW	Flew/Returned	Proximity	0	ROOST		
19/07/2021	13:22	WHARF	Cargo	Large	48	Out	2	Oystercatcher	1	RL	Flew/Moved	Proximity	1000	Out of sight		
19/07/2021	13:22	WHARF	Cargo	Large	48	Out	2	Black-headed gull	15	RW	Flew/Returned	Wave wash	0	ROOST	80	
19/07/2021	13:25	WHARF	Cargo	Large	49	Out	3	Lesser black-backed gull	44	RW	Flew/Returned	Proximity	0	ROOST	90	
19/07/2021	13:25	WHARF	Cargo	Large	49	Out	3	Herring gull	12	RW	Flew/Returned	Proximity	0	ROOST	90	
19/07/2021	13:25	WHARF	Cargo	Large	49	Out	3	Black-headed gull	12	RW	Flew/Returned	Wave wash	0	ROOST	60	
19/07/2021	13:30	WHARF	Pilot	small	50	Out	4	Lesser black-backed gull	43	RW	Flew/Returned	Proximity	0	ROOST	45	

VESSEL EVENT								BIRD RESPONSE								
Date	Time	Site	Vessel type	Vessel size	Photo	Vessel direction	Event no. of session	Species	Count	Original Behaviour	Response	Apparent cause	Distance moved (m)	New location type	Time (s)	Notes
19/07/2021	13:30	WHARF	Pilot	small	50	Out	4	Herring gull	6	RW	Flew/Returned	Proximity	0	ROOST	45	
19/07/2021	13:30	WHARF	Pilot	small	50	Out	4	Black-headed gull	8	RW	Flew/Returned	Proximity	0	ROOST	45	
19/07/2021	14:05	WHARF	Private	Small	51	In	5	Lesser black-backed gull	46	RW	Flew/Returned	Proximity	0	ROOST	35	
19/07/2021	14:05	WHARF	Private	Small	51	In	5	Herring gull	4	RW	Flew/Returned	Proximity	0	ROOST	35	
19/07/2021	14:05	WHARF	Private	Small	51	In	5	Black-headed gull	5	RW	Flew/Returned	Proximity	0	ROOST	35	
19/07/2021	14:33	WHARF	Pilot	Small	52	In	6	Lesser black-backed gull	8	RW	Flew/Returned	Proximity	0	ROOST	60	
19/07/2021	14:33	WHARF	Pilot	Small	52	In	6	Lesser black-backed gull	36	RW	Flew/Returned	Proximity	0	ROOST	155	
19/07/2021	14:33	WHARF	Pilot	Small	52	In	6	Herring gull	2	RW	Flew/Returned	Proximity	0	ROOST	155	
19/02/2021		WHARF (casual)	Fishing	small	17	In	1	Redshank	3	Feed	Flew/Moved	Proximity	100	Feed		Site A, flew downstream
19/02/2021		WHARF (casual)	Fishing	small	17	In	1	Redshank	15	Feed	None					Site A
20/03/2021	09:07	WHARF (casual)	Cargo	Large	18	In	1	Redshank	5	RL	Flew/Moved	Proximity	350	ROOST		Site A to B
20/03/2021	09:07	WHARF (casual)	Cargo	Large	18	In	1	Redshank	8	RL	Flew/Moved	Proximity	150	ROOST		Site A to B
20/03/2021	09:07	WHARF (casual)	Cargo	Large	18	In	1	Redshank	2	RL	Flew/Returned	Proximity	0	ROOST	45	Site A
20/03/2021	09:07	WHARF (casual)	Cargo	Large	18	In	1	Oystercatcher	3	RL	Flew/Moved	Proximity	150	ROOST		
20/03/2021	09:07	WHARF (casual)	Cargo	Large	18	In	1	Bar-tailed godwit	1	RL	Flew/Moved	Proximity	300	ROOST		Site A to B
20/03/2021	09:07	WHARF (casual)	Cargo	Large	18	In	1	Black-headed gull	1	RL	Flew/Moved	Proximity	50	ROOST		80-90% of all birds of all species
20/03/2021	09:07	WHARF (casual)	Cargo	Large	18	In	1	Cormorant	1	Feed	Flew/Moved	Proximity	200	FEED		
20/03/2021	09:07	WHARF (casual)	Cargo	Large	18	In	1	Carrion crow	2	Feed	Flew/Moved	Proximity	50	FEED		
21/03/2021	10:32	WHARF (casual)	Cargo	Large	19	Out	1	Ruff	1	RL	Flew/Moved	Proximity	300	ROOST		Site A to B
21/03/2021	10:32	WHARF (casual)	Cargo	Large	19	Out	1	Bar-tailed godwit	1	RL	Flew/Moved	Proximity	300	ROOST		Site A to B
21/03/2021	10:32	WHARF (casual)	Cargo	Large	19	Out	1	Redshank	23	RL	Flew/Moved	Proximity	300	ROOST		Site A to B, all RK present changed behav

VESSEL EVENT								BIRD RESPONSE								
Date	Time	Site	Vessel type	Vessel size	Photo	Vessel direction	Event no. of session	Species	Count	Original Behaviour	Response	Apparent cause	Distance moved (m)	New location type	Time (s)	Notes
21/03/2021	10:32	WHARF (casual)	Cargo	Large	19	Out	1	Redshank	5	RL	Flew/Returned	Proximity	0	ROOST	60	Site A, all RK present changed behaviour
21/03/2021	10:32	WHARF (casual)	Cargo	Large	19	Out	1	Oystercatcher	2	RL	Flew/Moved	Proximity	150	ROOST		Within Site A
21/03/2021	10:32	WHARF (casual)	Cargo	Large	19	Out	1	Shelduck	2	RL	Flew/Moved	Proximity	400	ROOST		Site A to B
21/03/2021	10:32	WHARF (casual)	Cargo	Large	19	Out	1	Curlew	2	RL	Flew/Moved	Proximity	250	ROOST		Site A upstream
21/03/2021	10:32	WHARF (casual)	Cargo	Large	19	Out	1	Cormorant	4	Feed	Flew/Moved	Proximity	600	FEED		
21/03/2021	10:32	WHARF (casual)	Cargo	Large	19	Out	1	Cormorant	4	Feed	Flew/Moved	Proximity	800	Out of sight		Same 4 birds again
21/03/2021	10:32	WHARF (casual)	Cargo	Large	19	Out	1	All	6	R & F	None					
21/03/2021	10:38	WHARF (casual)	Cargo	Large	19	Out	2	Redshank	72	RL	Flew/Returned	Proximity	0	ROOST	60	Site B. RK that changed behaviour equalled 93% of RK present
21/03/2021	10:38	WHARF (casual)	Cargo	Large	19	Out	2	Ruff	6	RL	Flew/Returned	Proximity	0	ROOST	60	
21/03/2021	10:38	WHARF (casual)	Cargo	Large	19	Out	2	Mallard	3	RL	Flew/Returned	Proximity	0	ROOST	60	
21/03/2021	10:38	WHARF (casual)	Cargo	Large	19	Out	2	Black-headed gull	2	RL	Flew/Returned	Proximity	0	ROOST	60	
21/03/2021	10:38	WHARF (casual)	Cargo	Large	19	Out	2	Bar-tailed godwit	1	RL	Flew/Returned	Proximity	0	ROOST	60	
21/03/2021	10:38	WHARF (casual)	Cargo	Large	19	Out	2	Redshank	17	RL	Flew/Moved	Proximity	300	ROOST		Site B to A. RK that changed behaviour equalled 93% of RK present
21/03/2021	10:38	WHARF (casual)	Cargo	Large	19	Out	2	Redshank	7	RL	None					
21/03/2021	10:38	WHARF (casual)	Cargo	Large	19	Out	2	Shelduck	2	RL	Flew/Moved	Proximity	500	Out of sight		
21/03/2021	10:38	WHARF (casual)	Cargo	Large	19	Out	2	Little egret	3	RL	Flew/Moved	Proximity	500	Out of sight		
21/03/2021	10:38	WHARF (casual)	Cargo	Large	19	Out	2	All	18	RL	None					

VESSEL EVENT								BIRD RESPONSE								
Date	Time	Site	Vessel type	Vessel size	Photo	Vessel direction	Event no. of session	Species	Count	Original Behaviour	Response	Apparent cause	Distance moved (m)	New location type	Time (s)	Notes
21/03/2021	10:40	WHARF (casual)	Pilot	small		Out	3	Redshank	3	RL	Flew/Returned	Proximity	0	ROOST	45	Site A. Most birds had vacated site by this point
21/03/2021	10:40	WHARF (casual)	Pilot	small		Out	3	Redshank	19	RL	None					Site A. Most birds had vacated site by this point
21/03/2021	10:42	WHARF (casual)	Pilot	small	20	Out	4	All	131	None	already disturbed					Already disturbed by preceding cargo ship
21/03/2021		HAVEN	Further disturbance to waders and gulls noted to occur downstream from the cargo ship (perceived as cause), escorted by pilot.													

A3.2 Mouth of The Haven Changes in Waterbird Behaviour observations

VESSEL EVENT								BIRD RESPONSE								
Date	Time	Site	Vessel type	Vessel size	Photo	Vessel direction	Event no. of session	Species	Count	Original Behaviour	Response	Apparent cause	Distance moved (m)	New location type	Time (s)	Notes
22/11/2019	14:06	Mouth	Cargo	large	1	In	1	Ringed plover	40	RL	Flew/Returned	Proximity	0	roost	45	
22/11/2019	14:06	Mouth	Cargo	large	1	In	1	Dunlin	20	RL	Flew/Returned	Proximity	0	roost	45	
22/11/2019	14:26	Mouth	Cargo	large	2	Out	2	Lapwing	200	RL	Flew/Moved	Proximity	300	roost	?	
22/11/2019	14:26	Mouth	Cargo	large	2	Out	2	Redshank	4	RL	Flew/Moved	Proximity	300	roost	?	
22/11/2019	14:26	Mouth	Cargo	large	2	Out	2	Dunlin	150	RL	Flew/Returned	Proximity	0	roost	60	
22/11/2019	14:26	Mouth	Cargo	large	2	Out	2	Turnstone	15	RL	Flew/Returned	Proximity	0	roost	60	
22/11/2019	14:26	Mouth	Cargo	large	2	Out	2	Ringed plover	3	RL	Flew/Returned	Proximity	0	roost	60	
22/11/2019	14:26	Mouth	Cargo	large	2	Out	2	Eider	2	OW	Flew/Moved	Proximity	500	sea	?	
22/11/2019	14:26	Mouth	Cargo	large	2	Out	2	Turnstone	3	FL	Flew/Moved	Wave wash	300	roost	?	
22/11/2019	14:26	Mouth	Cargo	large	2	Out	2	Redshank	2	FL	Flew/Moved	Wave wash	300	roost	?	
22/11/2019	14:40	Mouth	Fishing	small	3	In	3	ALL	?	R & F	None	N/A	N/A	N/A	N/A	
22/11/2019	14:52	Mouth	Pilot	small	4	In	4	ALL	?	R & F	None	N/A	N/A	N/A	N/A	
19/12/2019	09:38	Mouth	Pilot	small	5	Out	1	Golden plover	750	RL	Flew/Returned	Proximity	0	roost	90	
19/12/2019	09:38	Mouth	Pilot	small	5	Out	1	Lapwing	500	RL	Flew/Returned	Proximity	0	roost	90	
19/12/2019	09:38	Mouth	Pilot	small	5	Out	1	Lapwing	150	RL	Flew/Returned	Wave wash	0	roost	90	

VESSEL EVENT								BIRD RESPONSE								
Date	Time	Site	Vessel type	Vessel size	Photo	Vessel direction	Event no. of session	Species	Count	Original Behaviour	Response	Apparent cause	Distance moved (m)	New location type	Time (s)	Notes
19/12/2019	10:05	Wash	Cargo	large	6	In	2	Cormorant	2	OW	Flew/Moved	Proximity	500	sea	?	MOVED TO AVOID COLLISION
19/12/2019	10:05	Wash	Cargo	large	6	In	2	Great northern diver	1	OW	Flew/Moved	Proximity	750	sea	?	MOVED TO AVOID COLLISION
19/12/2019	10:09	Mouth	Cargo	large	6	In	2	Oystercatcher	50	RL	Flew/Moved	Proximity	300	roost	?	"There is a large roost of Oystercatcher on the banks of The Welland river mouth. If the birds are roosting on the rocks as opposed to the banks, they are more likely to be disturbed by river traffic."
19/12/2019	10:09	Mouth	Cargo	large	6	In	2	Lapwing	1100	RL	Flew/Returned	Proximity	0	roost	90	
19/12/2019	10:09	Mouth	Cargo	large	6	In	2	Black-tailed godwit	2000	RL	Flew/Moved	Proximity	800	roost	?	
19/12/2019	10:09	Mouth	Cargo	large	6	In	2	Golden plover	2500	RL	Flew/Returned	Proximity	0	roost	90	
19/12/2019	10:09	Mouth	Cargo	large	6	In	2	Redshank	220	RL	Flew/Moved	Proximity	800	roost	?	
19/12/2019	10:09	Mouth	Cargo	large	6	In	2	Knot	500	RL	Flew/Moved	Proximity	800	roost	?	
19/12/2019	10:09	Mouth	Cargo	large	6	In	2	Dunlin	100	RL	Flew/Moved	Proximity	800	roost	?	
19/12/2019	10:09	Mouth	Cargo	large	6	In	2	Cormorant	10	RW	Flew/Moved	Proximity	200	sea	?	
19/12/2019	10:45	Mouth (R Welland))	Pilot (?)	small	7	Out	3	Lapwing	500	RL	Flew/Returned	Proximity	0	roost	120	
19/12/2019	10:45	Mouth (R Welland))	Pilot (?)	small	7	Out	3	Wigeon	100	RW	Flew/Moved	Proximity	400	sea	?	
19/12/2019	10:45	Mouth (R Welland))	Pilot (?)	small	7	Out	3	Cormorant	3	RW	Flew/Moved	Proximity	400	sea	?	
19/12/2019	11:07	Mouth	Cargo	large	8	Out	4	Lapwing	1000	RL	Flew/Moved	Proximity	800	roost	?	
19/12/2019	11:07	Mouth	Cargo	large	8	Out	4	Golden plover	500	RL	Flew/Moved	Proximity	800	roost	?	
19/12/2019	11:07	Mouth	Cargo	large	8	Out	4	Wigeon	30	RW	Flew/Moved	Proximity	100	sea	?	
19/12/2019	11:07	Mouth	Cargo	large	8	Out	4	Mallard	55	RW	Flew/Moved	Proximity	100	sea	?	
19/12/2019	11:07	Mouth	Cargo	large	8	Out	4	Cormorant	3	RW	Flew/Moved	Proximity	150	sea	?	
19/12/2019	11:15	Mouth (R Welland))	Pilot (?)	small	9	In	5	Mallard	50	RW	Flew/Moved	Proximity	150	sea	?	
19/12/2019	11:15	Mouth (R Welland))	Pilot (?)	small	9	In	5	Wigeon	10	FL	Flew/Moved	Proximity	50	SALTMARSH	?	
19/12/2019	11:36	Mouth	Pilot	small	10	In	6	ALL	?	RL	None					Few birds present, already been disturbed and displaced
17/01/2020	09:12	Mouth	Fish & Pilot	small x2	11& 12	Out	1	ALL		RL	See pilot boat	Proximity			?	Passed roost at same time as faster pilot boat

VESSEL EVENT								BIRD RESPONSE								
Date	Time	Site	Vessel type	Vessel size	Photo	Vessel direction	Event no. of session	Species	Count	Original Behaviour	Response	Apparent cause	Distance moved (m)	New location type	Time (s)	Notes
17/01/2020	09:12	Mouth	Fish & Pilot	small x2	11& 12	Out	1	Turnstone	22	FL	Flew/Moved	Proximity	100	Feed	?	Passed roost at same time as slower fishing boat
17/01/2020	09:12	Mouth	Fish & Pilot	small x2	11& 12	Out	1	Redshank	36	FL	Flew/Moved	Proximity	100	Feed	?	Passed roost at same time as slower fishing boat
17/01/2020	09:12	Mouth	Fish & Pilot	small x2	11& 12	Out	1	Oystercatcher	700	RL	Flew/Moved	Proximity	250	roost	?	Passed roost at same time as slower fishing boat
17/01/2020	09:12	Mouth	Fish & Pilot	small x2	11& 12	Out	1	Dunlin	50	RL	Flew/Moved	Proximity	250	roost	?	Passed roost at same time as slower fishing boat
17/01/2020	09:12	Mouth	Fish & Pilot	small x2	11& 12	Out	1	Lapwing	600	RL	Flew/Moved	Proximity	250	roost	?	Passed roost at same time as slower fishing boat
17/01/2020	09:12	Mouth	Fish & Pilot	small x2	11& 12	Out	1	Dark-bellied brent goose	250	RL	Flew/Moved	Proximity	300	FEED SALTMARSH	?	Passed roost at same time as slower fishing boat
17/01/2020	09:12	Mouth	Fish & Pilot	small x2	11& 12	Out	1	Teal	25	RL	Flew/Moved	Proximity	150	SEA	?	Passed roost at same time as slower fishing boat
17/01/2020	09:12	Mouth	Fish & Pilot	small x2	11& 12	Out	1	Wigeon	12	RL	Flew/Moved	Proximity	150	SEA	?	Passed roost at same time as slower fishing boat
17/01/2020	09:12	Mouth	Fish & Pilot	small x2	11& 12	Out	1	Cormorant	3	RL	Flew/Moved	Proximity	50	roost	?	Passed roost at same time as slower fishing boat
17/01/2020	09:12	Mouth	Fish & Pilot	small x2	11& 12	Out	1	Shelduck	2	RL	Flew/Moved	Proximity	100	SEA	?	
17/01/2020	09:12	Mouth	Fish & Pilot	small x2	11& 12	Out	1	Red-breasted merganser	1	rw	Flew/Moved	Proximity	400	SEA	?	
17/01/2020	09:12	Mouth	Fish & Pilot	small x2	11& 12	Out	1	Black-headed gull	10	RL	Flew/Moved	Proximity	250	roost	?	
17/01/2020	09:36	Wash	Pilot	small	13	In	2	Great crested grebe	1	OW	Flew/Moved	Proximity	500	SEA	?	
17/01/2020	09:36	Wash	Pilot	small	13	In	2	Herring gull	2	OW	Flew/Moved	Proximity	50	SEA	?	
17/01/2020	09:37	Mouth	Pilot	small	13	In	2	Mallard	2	OW	Flew/Moved	Proximity	200	SEA	?	
17/01/2020	09:37	Mouth	Pilot	small	13	In	2	Eider	1	OW	Flew/Moved	Proximity	200	SEA	?	
17/01/2020	09:37	Mouth	Pilot	small	13	In	2	Oystercatcher	32	RL	Flew/Moved	Proximity	150	ROOST	?	
17/01/2020	09:37	Mouth	Pilot	small	13	In	2	Black-tailed godwit	5	RL	Flew/Moved	Proximity	150	ROOST	?	
17/01/2020	09:37	Mouth	Pilot	small	13	In	2	Cormorant	2	OW	Flew/Moved	Proximity	200	SEA	?	

VESSEL EVENT								BIRD RESPONSE								
Date	Time	Site	Vessel type	Vessel size	Photo	Vessel direction	Event no. of session	Species	Count	Original Behaviour	Response	Apparent cause	Distance moved (m)	New location type	Time (s)	Notes
17/01/2020	09:42	Wash	Cargo	Large	14	In	3	Great crested grebe	1	OW	Flew/Moved	Proximity	500	SEA	?	
17/01/2020	09:43	Mouth	Cargo	Large	14	In	3	Lapwing	800	RL	Flew/Returned	Proximity	0	ROOST	90	
17/01/2020	09:43	Mouth	Cargo	Large	14	In	3	Black-tailed godwit	200	RL	Flew/Returned	Proximity	0	ROOST	90	
17/01/2020	09:43	Mouth	Cargo	Large	14	In	3	Redshank	6	RL	Flew/Moved	Proximity	300	ROOST	?	
17/01/2020	09:43	Mouth	Cargo	Large	14	In	3	Curlew	2	RL	Flew/Moved	Proximity	300	ROOST	?	
17/01/2020	09:43	Mouth	Cargo	Large	14	In	3	Dunlin	5	RL	Flew/Moved	Proximity	300	ROOST	?	
17/01/2020	09:43	Mouth	Cargo	Large	14	In	3	Teal	27	RL	Flew/Moved	Proximity	500	ROOST	?	
17/01/2020	09:43	Mouth	Cargo	Large	14	In	3	Wigeon	8	RL	Flew/Moved	Proximity	500	ROOST	?	
17/01/2020	09:43	Mouth	Cargo	Large	14	In	3	Cormorant	3	RL	Flew/Moved	Proximity	100	Sea	?	
17/01/2020	11:02	Mouth	Fishing	SMALL	15	In	4	ALL			NONE					NO INFO ON WHAT BIRDS PRESENT ON ROOST AT TIME
17/02/2020	12:23	Mouth	Cargo	Large	16	In	1	Shelduck	36	RL	Flew/Moved	Proximity	800	ROOST	?	
17/02/2020	12:23	Mouth	Cargo	Large	16	In	1	Teal	54	RL	Flew/Moved	Proximity	800	ROOST	?	
17/02/2020	12:23	Mouth	Cargo	Large	16	In	1	Grey plover	5	RL	Flew/Moved	Proximity	800	ROOST	?	
17/02/2020	12:23	Mouth	Cargo	Large	16	In	1	Redshank	35	RL	Flew/Moved	Proximity	800	ROOST	?	
17/02/2020	12:23	Mouth	Cargo	Large	16	In	1	Curlew	16	RL	Flew/Moved	Proximity	800	ROOST	?	
17/02/2020	12:23	Mouth	Cargo	Large	16	In	1	Oystercatcher	10	RL	Flew/Moved	Proximity	800	ROOST	?	
17/02/2020	12:23	Mouth	Cargo	Large	16	In	1	Herring gull	2	RL	Flew/Moved	Proximity	200	SEA	?	
17/02/2020	12:23	Mouth	Cargo	Large	16	In	1	Great black-backed gull	1	RL	Flew/Moved	Proximity	200	SEA	?	
17/02/2020	12:23	Mouth	Cargo	Large	16	In	1	Cormorant	2	RL	Flew/Moved	Proximity	100	SEA	?	
17/02/2020	12:27	Mouth	Cargo	Large	17	Out	2	Shelduck	3	OW	Flew/Moved	Proximity	150	SEA	?	MOVED TO AVOID COLLISION
17/02/2020	12:27	Mouth	Cargo	Large	17	Out	2	Redshank	5	RL	Flew/Moved	Proximity	800	ROOST	?	
17/02/2020	12:27	Mouth	Cargo	Large	17	Out	2	Oystercatcher	6	RL	Flew/Moved	Proximity	800	ROOST	?	
17/02/2020	12:27	Mouth	Cargo	Large	17	Out	2	Black-headed gull	1	RL	Flew/Returned	Proximity	0	ROOST	80	
17/02/2020	12:51	Mouth	Cargo	Large	18	Out	3	Black-headed gull	1	RL	Flew/Moved	Proximity	500	ROOST (BUOY)	?	NO OTHER BIRDS AT ROOST SITE
17/02/2020	12:51	Mouth	Cargo	Large	18	Out	3	Cormorant	1	RL	Flew/Moved	Proximity	100	SEA	?	NO OTHER BIRDS AT ROOST SITE
12/03/2020	12:51	Mouth	Cargo	Large	19	In	1	Oystercatcher	300	RL	Flew/Moved	Proximity	800	ROOST	?	

VESSEL EVENT								BIRD RESPONSE								
Date	Time	Site	Vessel type	Vessel size	Photo	Vessel direction	Event no. of session	Species	Count	Original Behaviour	Response	Apparent cause	Distance moved (m)	New location type	Time (s)	Notes
12/03/2020	12:51	Mouth	Cargo	Large	19	In	1	Turnstone	15	RL	Flew/Moved	Proximity	800	ROOST	?	
12/03/2020	12:51	Mouth	Cargo	Large	19	In	1	Redshank	10	RL	Flew/Moved	Proximity	800	ROOST	?	
12/03/2020	12:51	Mouth	Cargo	Large	19	In	1	Dunlin	50	RL	Flew/Moved	Proximity	800	ROOST	?	
25/01/2021	14:11	MOUTH	Pilot	small	1	Out	1	Dark-bellied brent goose	1150	RL	Flew/Moved	Proximity	500	grassland		not at roost site?
25/01/2021	14:41	MOUTH	Pilot	small	2	In	2	Black-headed gull	34	RL	Flew/Moved	Proximity	500	ROOST		waders disturbed by Marsh Harrier
25/01/2021	14:50	MOUTH	Cargo	Large	3	In	3	ALL	?	predator	already disturbed					waders disturbed by 2 Marsh Harriers
25/01/2021	16:26	MOUTH	Cargo	Large	4	Out	4	Wigeon	43	FL	Flew/Moved	Proximity	50	FEED		
25/01/2021	16:26	MOUTH	Cargo	Large	4	Out	4	Curlew	55	RL	Flew/Moved	Proximity	300	ROOST		
25/01/2021	16:28	MOUTH	Pilot	small	5	Out	5	ALL			NONE					NO INFORMATION IF ANY BIRDS PRESENT, PROBABLY NOT
25/01/2021	16:39	MOUTH	Cargo	Large	6	Out	6	Black-headed gull	26	RW	Flew/Moved	Proximity	400	sea		
25/01/2021	17:03	MOUTH	Pilot	small	7	In	7	Redshank	1	FL	Flew/Moved	Wave wash	5	FEED	45	NO INFORMATION IF ANY OTHER BIRDS PRESENT, PROBABLY NOT
22/02/2021	12:10	MOUTH	Pilot	small	8	Out	1	Cormorant	4	OW	Flew/Moved	Proximity	600	SEA		
22/02/2021	12:10	MOUTH	Pilot	small	8	Out	1	Lapwing	424	RL	Flew/Returned	Proximity	0	ROOST	125	
22/02/2021	12:45	MOUTH	Fishing	small	9	In	2	All	c320	RL/feed	None					NO INFORMATION IF ANY BIRDS PRESENT, PROBABLY Yes
22/02/2021	12:49	MOUTH	Cargo	Large	10	In	3	Shelduck	8	Feed	Flew/Moved	Proximity	250	FEED		
22/02/2021	12:49	MOUTH	Cargo	Large	10	In	3	Wigeon	2	Feed	Flew/Moved	Proximity	250	FEED		
22/02/2021	12:49	MOUTH	Cargo	Large	10	In	3	Avocet	1	Feed	Flew/Moved	Proximity	300	ROOST		
22/02/2021	12:49	MOUTH	Cargo	Large	10	In	3	Bar-tailed godwit	10	RL	Flew/Moved	Proximity	300	ROOST		
22/02/2021	12:49	MOUTH	Cargo	Large	10	In	3	Redshank	8	RL	Flew/Moved	Proximity	300	ROOST		
22/02/2021	12:49	MOUTH	Cargo	Large	10	In	3	Lapwing	120	RL	Flew/Moved	Proximity	400	ROOST		
22/02/2021	12:49	MOUTH	Cargo	Large	10	In	3	Dunlin	180	RL	Flew/Moved	Proximity	400	ROOST		
22/02/2021	12:49	MOUTH	Cargo	Large	10	In	3	Curlew	6	RL	Flew/Moved	Proximity	400	ROOST		
22/02/2021	12:50	MOUTH	Pilot	small	none	In	4	All			None (already disturbed)					just behind, then overtook cargo vessel

VESSEL EVENT								BIRD RESPONSE								
Date	Time	Site	Vessel type	Vessel size	Photo	Vessel direction	Event no. of session	Species	Count	Original Behaviour	Response	Apparent cause	Distance moved (m)	New location type	Time (s)	Notes
22/02/2021	12:59	Wash	Cargo	Large	11	In	5	Great crested grebe	1	OW	Flew/Moved	Proximity	50	SEA		to avoid collision
22/02/2021	12:59	MOUTH	Cargo	Large	11	In	5	Oystercatcher	250	RL	Flew/Moved	Proximity	150	ROOST		Uncertainty what if any other birds present at roost
22/02/2021	13:05	MOUTH/WELLAND	Private	Small	12	In	6	All			None (already disturbed?)					Uncertainty what if any other birds present at roost
20/03/2021	07:46	MOUTH	Fishing	small	13	In	1	All			None					Uncertainty what if any other birds present at roost
20/03/2021	07:48	MOUTH	Pilot	small	14	Out	2	Common gull	3	RL	Flew/Moved	Proximity	50	ROOST		
20/03/2021	07:48	MOUTH	Pilot	small	14	Out	2	Oystercatcher	2	RL	Flew/Moved	Proximity	150	ROOST		
20/03/2021	08:11	MOUTH	Pilot	small	15	In	3	Mallard	1	RL	Flew/Moved	Proximity	200	ROOST		
20/03/2021	08:11	MOUTH	Pilot	small	15	In	3	Curlew	1	FEED	Flew/Moved	Proximity	100	FEED		
20/03/2021	08:24	MOUTH	Cargo	Large	16	In	4	Oystercatcher	1	RL	Flew/Moved	Proximity	10	FEED		
20/03/2021	08:24	MOUTH	Cargo	Large	16	In	4	Redshank	1	FL	Flew/Moved	Proximity	10	FEED		
20/03/2021	08:24	MOUTH	Cargo	Large	16	In	4	Mallard	2	RL	Flew/Moved	Proximity	30	ROOST		
20/03/2021	08:24	MOUTH	Cargo	Large	16	In	4	Curlew	2	RL	Flew/Moved	Proximity	60	FEED		
01/05/2021	07:16	MOUTH	Pilot	small	21	Out	1	Oystercatcher	2	RL	Flew/Moved	Proximity	250	ROOST		
01/05/2021	07:16	MOUTH	Pilot	small	21	Out	1	Redshank	1	RL	Flew/Moved	Proximity	250	ROOST		
01/05/2021	07:16	MOUTH	Pilot	small	21	Out	1	Cormorant	1	OW	Flew/Moved	Proximity	400	SEA		
01/05/2021	07:16	MOUTH	Pilot	small	21	Out	1	Dark-bellied brent goose	4	RL	Flew/Moved	Proximity	650	ROOST		
01/05/2021	07:47	MOUTH	Pilot	small	22	In	2	Common sandpiper	3	RL	Flew/Returned	Wave wash	0	ROOST	45	
01/05/2021	07:54	MOUTH	Cargo	Large	23	In	3	Common sandpiper	3	RL	Flew/Moved	Proximity	400	ROOST		
01/05/2021	07:54	MOUTH	Cargo	Large	23	In	3	Redshank	3	RL	Flew/Moved	Proximity	400	ROOST		
01/05/2021	07:54	MOUTH	Cargo	Large	23	In	3	Oystercatcher	175	RL	Flew/Moved	Proximity	3300	ROOST		Moved to saline lagoon at RSPB Freiston Shore reserve
01/05/2021	08:06	MOUTH	Fishing	small	24	Out	4	All			None					Uncertainty what if any other birds present at roost
25/06/2021	18:15	MOUTH	Cargo	Large	28	In	1	Oystercatcher	700	RL	Flew/Returned	Proximity	0	ROOST	90	

VESSEL EVENT								BIRD RESPONSE								
Date	Time	Site	Vessel type	Vessel size	Photo	Vessel direction	Event no. of session	Species	Count	Original Behaviour	Response	Apparent cause	Distance moved (m)	New location type	Time (s)	Notes
25/06/2021	18:15	MOUTH	Cargo	Large	28	In	1	Oystercatcher	125	RL	Flew/Moved	Proximity	3300	ROOST		Moved to saline lagoon at RSPB Freiston Shore reserve
25/06/2021	18:15	MOUTH	Cargo	Large	28	In	1	Common tern	10	RL	Flew/Returned	Proximity	0	ROOST	60	
25/06/2021	19:55	MOUTH	Cargo	Large	29	Out	2	All			None					Uncertainty what birds present at roost
25/06/2021	20:00	MOUTH	Pilot	small	30	Out	3	All			None					Uncertainty what birds present at roost
25/06/2021	20:14	MOUTH	Pilot	small	30	In	4	All			None					Uncertainty what birds present at roost
14/07/2021	19:30	MOUTH	Fishing	small		In	1 to 22	All			None					
14/07/2021	19:40	MOUTH	Fishing	small	34	In	1 to 22	Whimbrel	1	Feed	Flew/Moved	Proximity	25	Feed		
14/07/2021	unknown	MOUTH	Fishing	small		In	1 to 22	All			None					
14/07/2021	20:14	MOUTH	Fishing	small	36	In	1 to 22	Common sandpiper	1	RL	Flew/Moved	Proximity	100	ROOST		
14/07/2021	20:34	MOUTH	Fishing	small		In	1 to 22	All			None					
14/07/2021	20:33	MOUTH	Pilot	small	37	Out	23	All			None					
14/07/2021	20:57	MOUTH	Pilot	small	38	In	24	All			None					
14/07/2021	21:03	MOUTH	Cargo	Large	39	In	25	Herring gull	3	RL	Flew/Moved	Proximity	50	ROOST		
14/07/2021	21:03	MOUTH	Cargo	Large	39	In	25	Black-headed gull	2	RL	Flew/Moved	Proximity	50	ROOST		
14/07/2021	21:03	MOUTH	Cargo	Large	39	In	25	Oystercatcher	43	RL	Flew/Moved	Proximity	500	ROOST		
14/07/2021	21:06	MOUTH	Cargo	Large	40	In	26	Oystercatcher	51	RL	Flew/Moved	Proximity	500	ROOST		

Appendix

Appendix Title

Subtitle

Royal HaskoningDHV