REPORT

Boston Alternative Energy Facility

Noise Modelling and Mapping Relating to Bird Disturbance at the Principal Application Site

Client:	Alternative Use Boston Projects Ltd
Planning Inspectorate Reference:	EN010095
Document Reference:	9.50
Pursuant to:	APFP Regulation: N/A
Reference:	PB6934-RHD-ZZ-XX-NT-Z-4074
Status:	Final/0.0
Date:	13 December 2021

baef
Boston Alternative Energy Facility

Royal HaskoningDHV
Enhancing Society Together

Note / Memo

HaskoningDHV UK Ltd.
Industry & Buildings

To:	National Infrastructure Planning
From:	Alternative Use Boston Projects Limited
Date:	13 December 2021
Reference:	PB6934-RHD-ZZ-XX-NT-Z-4074
Document reference:	9.50
Planning Inspectorate Reference:	EN010095
Classification:	Project related
Checked by:	Dean Curtis
Approved by:	Paul Salmon

Subject: **Boston Alternative Energy Facility: Deadline 4 - Noise modelling and mapping relating to bird disturbance at the Principal Application Site**

1 Background information

This technical note has been produced in further response to Natural England's Relevant Representation 4 within Appendix B (Offshore Ornithology) of their Risks & Issues Log at Deadline 2 (document reference REP2-048): "Natural England awaits a demonstration that the proposed 250m buffer zone is fit for purpose for ruff and redshank. The Applicant has informed NE that "buffer zones work to avoid and minimise disturbance, Cutts *et al* (2008) provides peer reviewed data on disturbance for waders. NE responded (on 13th Sept) to state that while, "Cutts *et al*. may be appropriate for identifying generic distances where no better data exists, disturbance and habituation are often subject to site specific variation. As...some data had been collected as part of the bird surveys, it would be appropriate to review behavioural response information to see how distances compare at this site and whether following Cutts *et al* is appropriate; precautionary; or not precautionary enough...This matter remains under discussion."

Following the oral case made by the Applicant in response to the Examiner's question on this subject to both Natural England and the Applicant during Issue Specific Hearing 2 into Environmental Matters on 24 November 2021, the aim of this technical note is to provide further quantitative information on A) the noise levels associated with different phases (Construction, Operation) and scenarios of the Applicant Project, B) the areas over which the threshold and higher noise levels associated with bird disturbance (according to relevant published sources) occur, and C) the effective distances from Applicant Project activities within which waterbirds may be disturbed or excluded (compared to the planned 250 m Monitoring Zone).

1.1 Planned project activities and noise

1.1.1 Construction

Construction activity for the proposed Facility is set out in the Indicative Construction Programme (document reference 9.18, REP1-031) and is scheduled to take place over an approximately 55 month period. Construction at the wharf is indicatively programmed for between 18 and 22 months, as set out in paragraph 3.1.1 of the Wharf Construction Outline Methodology (document reference 9.17, REP1-030). Therefore the construction phase will take in all months of the annual cycle for birds and other animal species at least once.

In general, construction activities would take place six days a week (Monday to Saturday) between 8am and 8pm (with an option of 7am to 7pm), with no bank holiday or public holiday working. Some activities, for example slip-forming may require 24 hour working, any additional activities other than those specified in the DCO would require prior approval of the relevant planning authority. The concrete batching plant will only operate 24 hours/day when there are long concrete pours (e.g. the EfW turbine hall floor and the fuel storage chamber) so night time batching will be an unusual and planned occurrence over a very limited time period. In winter it is therefore expected that work will take place in one or more hours of darkness. This work considers all construction noise during the wharf construction as it is the activity most likely to affect non-breeding waterbirds, several species of which are designated features of The Wash SPA (Special Protection Area)/Ramsar/SSSI (Site of Special Scientific Interest), the boundary of which is situated approximately 3 km from the Principal Application Site.

As detailed in the Updated Piling Noise Assessment (document reference 9.16, REP1-029), piling for construction of a new wharf at the Principal Application Site will be confined to June, July, August and September. The scheduling of the wharf piling has been largely driven to limit the potential for occurrence of noise impacts to non-breeding waterbirds on The Haven[1] in the winter season (disturbance to foraging, loafing, bathing or roosting).

Following Environment Agency (EA) reporting and recommendations from monitoring bird numbers in proximity to geotechnical investigation (GI) works in The Haven as part of the design preparation for a localised crest raising scheme to improve the current Standard of Protection along the Boston Haven (Environment Agency 2019), a 250 m Monitoring Zone for birds around construction noise/visual sources of disturbance is proposed for the construction period (Environmental Statement (ES) Appendix 17.1, document reference APP-111 paragraph A17.6.6 to A17.6.12). If numbers of birds of a waterbird species present within the 250 m zone (e.g. at the start of the working day) exceed 1% of the species' Wash SPA population (as documented in the most recent five years of the British Trust for Ornithology (BTO) Wetland Birds Surveys (WeBS)), behaviour and responses to works will be monitored. If considered to be currently or potentially about to cause disturbance that would disrupt their roosting activity (as an example minimum response; untucking and raising heads for a minimum period, to be agreed), works will be reduced, paused or postponed in that location until the behavioural change is reduced (and does not occur again if the noise levels increase) or until numbers present recede e.g. due to birds moving off to use habitat that becomes available as the tide changes. Disturbance to non-breeding waterbirds from construction noise will therefore be reduced in terms of rate of occurrence and numbers of birds impacted.

1.1.2 Operation

Operation of the Principal Application Site will be on a 24 hours per day basis and will include running of machinery within the alternative energy plant, unloading of Refuse Derived Fuel (RDF) from vessels to fuel the Energy from Waste plant, and loading of the lightweight aggregate by-product onto vessels. Berthing and loading of vessels at the aggregate wharf, closest to a regular redshank *Tringa totanus* high tide roost in bird survey area B (see 1.3), is planned to take place only two times per week. Pouring of by-product into vessels at this wharf is a higher noise-level activity and is to be limited to daytime hours (Table 10.17 of ES Chapter 10 Noise and Vibration (document reference 6.2.10, APP-048) details the proposed operational hours for the Lightweight Aggregate loading crane as 0800 to 1800 taken from the Project Design Statement). Otherwise, no time or tide constraints or limitations are placed on operational activities.

[1] Considered among some Interested Parties to be functionally linked to The Wash Special Protection Area (SPA)/Ramsar/Site of Special Scientific Interest (SSSI).

1.2 Waterbirds and noise

Non-breeding waterbirds use The Haven beside the Principal Application Site for foraging and roosting primarily in the autumn and winter months, when non-breeding waterbird numbers in the wider region of The Wash are at their highest. Baseline surveys of birds have recorded from survey section or area A (a 700 m section of The Haven shipping channel alongside the Principal Application Site and including the site of the proposed wharf construction) and survey section or area B (the immediate downstream 670 m section of the Haven including the planned Habitat Mitigation Area) as shown in ES Figure 17.8 (document reference 6.3.25, APP-091 and in Figure 1-1 below). As detailed in ES Appendix 17.1 Habitats Regulations Assessment (document reference 6.4.18, APP-111), and ES Chapter 17 and Appendix 17.1 – Ornithology Addendum (document reference 9.13, REP1-026), the species occurring in the highest numbers at the Principal Application Site relative to their reported British Trust for Ornithology (BTO) Wetland Birds Survey (WeBS) populations in The Wash, are redshank (a named designated feature of The Wash SPA/Ramsar/SSSI 3 km away) and named non-breeding waterbird assemblage species of The Wash SPA/Ramsar/SSSI ruff *Philomachus pugnax*, and on few occasions the named assemblage species ringed plover *Charadrius hiaticula*, cormorant *Phalacrocorax carbo*, little grebe *Tachybaptus ruficollis*, lesser black-backed gull *Larus fuscus*, mallard *Anas platyrhynchos* and white-fronted goose *Anser albifrons*. The SPA/Ramsar/SSSI is considered by the RSPB (supported by Natural England) to be functionally linked to the Principal Application Site by daily or tidal movements of individuals of at least one of these waterbird species between the sites (RSPB Written Representation document ref. REP01-060, Paragraph 3.3). The Applicant has considered the connectivity between the designated sites and the Principal Application Area (as discussed in the ES Chapter 17 and Appendix 17.1 – Ornithology Addendum (document reference 9.13, REP1-026)) and although there is some doubt over the connectivity due to the distance from the SPA boundary, on a precautionary basis, connectivity is not ruled out for all of the individuals present in Areas A and B. This will be discussed further within an ornithology technical note to be submitted for Deadline 5.

The noise mapping relating to the present project (discussed further in Section 1.3 below), and information from Cutts *et al.* (2013) are used here to make modelling-based conclusions of effects of noise during different phases of the project on waterbirds on The Haven. Of the species discussed above, redshank, ringed plover and mallard have received coverage of noise levels associated with disturbance levels from field observations, in the construction mitigation toolkit produced by Cutts *et al.* (2013).

Figure 1-1 Environmental Statement Figure 17.8, Bird survey area A (blue dashed boundary), area B (black dashed boundary), order limit of Principal Application Site (red line) including Habitat Mitigation Area (smaller red-line boundary within area B).

1.3 Noise mapping and modelling approach

Noise levels were modelled following the methodology outlined in the ES Chapter 10 – Noise and Vibration (document reference 6.2.10, APP-048). Modelling was carried out for the following scenarios utilising the relevant day or night time baseline noise as set out in Table 10.30 Chapter 10 of the ES (document reference 6.2.10, APP-048):

- Construction
  - Construction with no piling in daytime (daytime here defined as 0700-1900/2000)
  - Construction with piling in daytime (daytime here defined as 0700-1900/2000)
  - Construction period night-time (night-time here defined as 1900/2000-0700)
- Operation
  - Operation of the project site in daytime (daytime here defined as 0700-2300, based on BS4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound)
  - Operation of the project site in night-time (night-time here defined as 2300-0700 based on BS4142)

Chapter 10 Noise and Vibration of the ES (document reference 6.2.10, APP-048) refers to BS5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise. In the Foreword section of the document it states:
"*This British Standard refers to the need for the protection against noise and vibration of persons living and working in the vicinity of, and those working on, construction and open sites*".

Therefore the 'BS5228 Category' and subsequent 'Suggested significant effect threshold value $L_{Aeq,T}$' detailed in Chapter 10 Noise and Vibration of the ES ((document reference 6.2.10, APP-048) refers to

human receptors and is only included for the provision of measured baseline noise levels for each reference period.

Table 1-1 Summary of measured baseline levels and recommended threshold limits for construction phase (from Table 10-30 of ES Chapter 10 Noise and Vibration (document reference 6.2.10, APP-048)).

Assessment category and threshold period	Location ID	Measured level ($L_{Aeq,T}$) (1)	BS5228 Category	Suggested significant effect threshold value ($L_{Aeq,T}$) (5)
Daytime and Saturdays (2)	ST R1	50.0	A	65
	ST R2	49.6	A	65
	ST R3	51.6	A	65
	ST R4	57.5	A	65
	ST R5	61.4	A	65
	ST R6	52.7	A	65
Evenings and weekends (3)	ST R1	41.1	A	55
	ST R2	43.7	A	55
	ST R3	44.8	A	55
	ST R4	51.6	A	55
	ST R 5	53.9	B	60
	ST R6	62.4	C	65
Night-time (4)	ST R1	39.4	A	45
	ST R2	37.3	A	45
	ST R3	42.1	A	45
	ST R4	52.7	C	55
	ST R5	55.6	C	55
	ST R6	46.5	B	50

(1) Based on data measured in 2018
(2) 07:00 – 19:00 weekdays and 07:00 – 13:00 Saturdays
(3) 19:00 – 23:00 weekdays, 13:00-23:00 Saturdays and 07:00 – 23:00 Sundays
(4) Every day 23:00 – 07:00
(5) Thresholds are for effects on human activity/community

The assumed plant present during the construction phase, for simulating and modelling noise levels in construction scenarios, is outlined in **Table *1-2***.

Table 1-2 Assumed plant present during construction phase for modelling construction scenarios (from Table 5 of Deadline 1 Submission – 9.16: Boston Alternative Energy Facility Examination Technical Note: Updated Piling Noise Assessment (document reference 9.16, REP1-029)).

Location / Activity	Equipment	No.	L_{WAeq} (dB)	On-time (%)
Power export island	Concrete pump	1	103	40
	JCB	1	99	55
	20T Tipper lorry	1	116	15
Pre-construction enabling works	25T Backhoe	1	108	55
	Dumper	1	111	50
	20T Tipper lorry	1	116	15
Control room and office	Crane 100T	1	110	55
	Telehandler	1	99	40
	Angle grinder	1	108	15
	JCB	1	99	55
	Dumper	1	111	50
	20T Tipper lorry	1	116	15
Fuel + RDF conveyors	20T Tipper lorry	1	116	15
	Vibrating roller	1	110	40
	Concrete pump	1	103	40
Turbine house	Telehandler	1	99	40
	Dumper	1	111	50
	20T Tipper lorry	1	116	15
	Angle grinder	1	108	15
Wharf	Dumper	1	111	50
	20T Tipper lorry	2	116	15
	Vibrating roller	1	110	40

Location / Activity	Equipment	No.	L_{WAeq} (dB)	On-time (%)
	Concrete pump	1	103	40
	Tubular piling rig	2	115	35
	Sheet piling rig	2	116	35
	Crane 100T	1	110	55
EfW bases + main hall slab	Pre-cast concrete piling rig	1	117	35
	Crane 40T	1	89	55
	Concrete pump	1	103	40
	20T Tipper lorry	1	116	15
LWA facility	25T Backhoe	1	108	55
	20T Tipper lorry	1	116	15
	Auger piling rig	1	111	35
Air cooled condensers	Auger piling rig	1	111	35
	Crane 40T	1	89	55
	Concrete pump	1	103	40
	20T Tipper lorry	1	116	15
	Dumper	1	111	50
Concrete batching plant	Concrete pump	1	103	40
	JCB	1	99	55
	20T Tipper lorry	2	116	15

Noise modelling was based on three-dimensional transmission of sound and contours were mapped for a height of 0.5 m above ground, to estimate noise levels within the band height from the ground occupied by waterbirds during roosting and foraging. All topographical (height) data for the modelled area was based on LiDAR data (2020, 2m LiDAR Composite DTM available from DEFRA Open Government Licence).

Redshank roosting at high tide routinely gather at a favoured site (in terms of both numbers of birds and frequency with which this location is used) at global co-ordinates 52.959376, -0.001310 (lying within what is referred to in project-specific waterbird surveys as Section (or Area) B, and within the planned Habitat Mitigation Area) (**Figure 1-1**). Noise levels were modelled for this 'ecological receptor' under all the scenarios set out above in order to demonstrate that noise levels during construction and operation of the Applicant Project would be below key levels during winter periods when redshank would be roosting in peak numbers. This receptor's location is **shown in all noise maps as the black and white circle furthest east on the maps**, on the south side of The Haven.

2 Noise mapping and modelling

2.1 Construction phase

As stated in Section 1.1.1 in general, construction activities would avoid the night time period. However, some activities may require 24 hour working and these would require prior approval of the relevant planning authority. The concrete batching plant will only operate 24 hours/day when there are long concrete pours (e.g. the EfW turbine hall floor and the fuel storage chamber) so night time batching will be an unusual and planned occurrence over a very limited time period.

The construction noise results set out below are therefore provided for transparency and completeness and do not reflect the majority of the construction period where no over-night construction activities will be taking place.

The daytime noise contour map for the Principal Application Site during the construction phase, during the period where piling is not in progress (i.e. the vast majority of the construction programme), is shown in Figure 21. Contour mapping for daytime construction noise levels during the four-month summer period where piling is planned to take place, is shown in **Figure 2-2**. The night-time noise contour map for the construction period is shown in **Figure 2-3**.

Cutts et al. (2013) outline noise level thresholds for disturbance in redshank, ringed plover and mallard, and lower levels at which 'caution' should be employed, e.g. limiting activity if numbers of waterbirds within a set radius are above a set number (**Table 2-1**). Piling is, additionally, an impulsive noise source in contrast to the more continuous construction noises likely on a day to day basis, and birds will be less able to acclimatise to any extent to this activity. Wright et al. (2010) specifically considering impulsive sources of noise such as piling, suggested 60dB (at bird) could cause flight responses with return to original location in more sensitive species e.g. lapwing *Vanellus vanellus* (increasing to 70dB for more resilient species). 75dB was the lowest noise level (at bird) observed to cause flight response wherein birds left the area entirely.

Table 2-1 Noise levels associated with disturbance responses from Cutts et al. (2013) for three waterbird species, which are also recorded on The Haven close to the Principal Application Site in winter months.

Species	Noise level (at bird) - disturbance likely:	Noise level (at bird) – suggest caution:	Noise level (at source) given typical distance of birds – disturbance likely	Noise level (at source) given typical distance of birds – suggest caution	Responses to piling	Other responses
Redshank	>70dB	>55dB (60 in high disturbance areas)	>100-105dB	>87-92dB	None given	'Heads-up' at 72dB and flushed at 88dB from overflying aircraft
Ringed plover	>75dB	>60dB (65 in high disturbance areas)	>107-112dB	>93-98dB	None given	No response to noise up to 88dB from overflying aircraft
Mallard	>72dB	>55dB (60 in high disturbance areas)	>105-110dB	>87-92dB	'Heads up' response to piling 69dB and 71dB	No response to continuous noise over 80dB in similar environment to The Haven
Note that the Haven in this area is considered in this analysis to be a 'high disturbance area' as referred to in this table.						

2.1.1 Construction with no piling in daytime

During the non-piling periods of construction, noise in the daytime is only modelled to exceed 60dB (red to violet colours, **Figure *2-1***) over terrestrial parts of the modelled area, with noise levels of 50-56dB over most of the adjacent length of The Haven including close to the identified redshank roost site in bird survey area B. At the highlighted redshank roost site in this location (the point receiver within Area B (as shown on Figure 11) in Figure 21 below), the predicted receptor noise level is 49.7dB. **Noise levels on The Haven in the daytime during the non-piling construction activities are therefore not modelled to exceed the at-bird noise levels associated with 'caution'** (60dB) recommended for the three species by Cutts et al. (2013) (**Table *2-1***). Using the 54-56dB contour as a guide 'caution' noise level for redshank, the approximate distance around the construction works advised by Cutts et al. (2013) to carry a minimum potential disturbance effect on redshank is approximately 200 m (**Figure *2-1***). However, the study area is considered to be a high-noise area due to existing industrial and intermittent vessel noise, therefore the 58-60dB (**Table *2-1***) may be a more suitable guide contour, which results in a smaller radius around construction noise sources of approximately 75 m within which redshank are likely to be disturbed and/or excluded. Both of these distances are captured within the 250m Monitoring Zone planned for the construction phase.

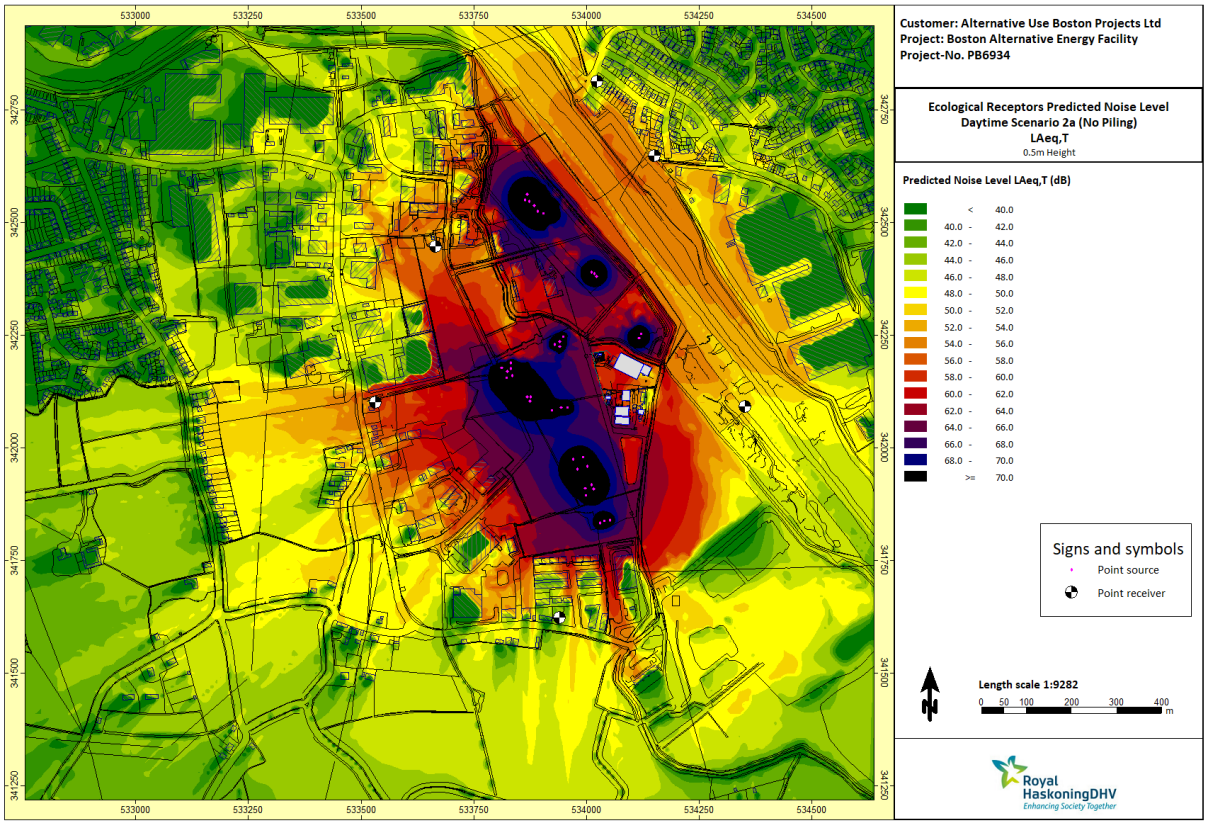

Figure 2-1 Noise contours for construction without piling in daytime

2.1.2 Construction with piling in daytime

During the piling period of the construction phase (**Figure 2-2**), daytime noise will exceed 54-56dB along the entire 1400 m length of The Haven which was surveyed for wintering waterbirds (i.e. areas A and B in **Figure *1-1***). Along an approximately 400m section of The Haven in bird survey area A (in line with the

constructions on Principal Application Site), noise levels are modelled to range from 66-68dB on the opposite bank of The Haven to 74-76dB on the near side of The Haven (**Figure 2-2**, **Figure *2-3***).
In survey area B, noise contours indicate predicted noise levels of 54-60dB. At the highlighted redshank roost site in this location (the point receiver within Area B (as shown on Figure 11) in Figure 21 below), the predicted receptor noise level is 58.5dB. Using the 54-56dB contour as a guide, there is an approximate 450 m radius around piling-period construction sources within which redshank would experience 'caution' levels of at-bird noise level or higher (from Cutts et al. 2013). Using the 58-60dB contour this radius is reduced to approximately 300 m (Fig. 2-2).

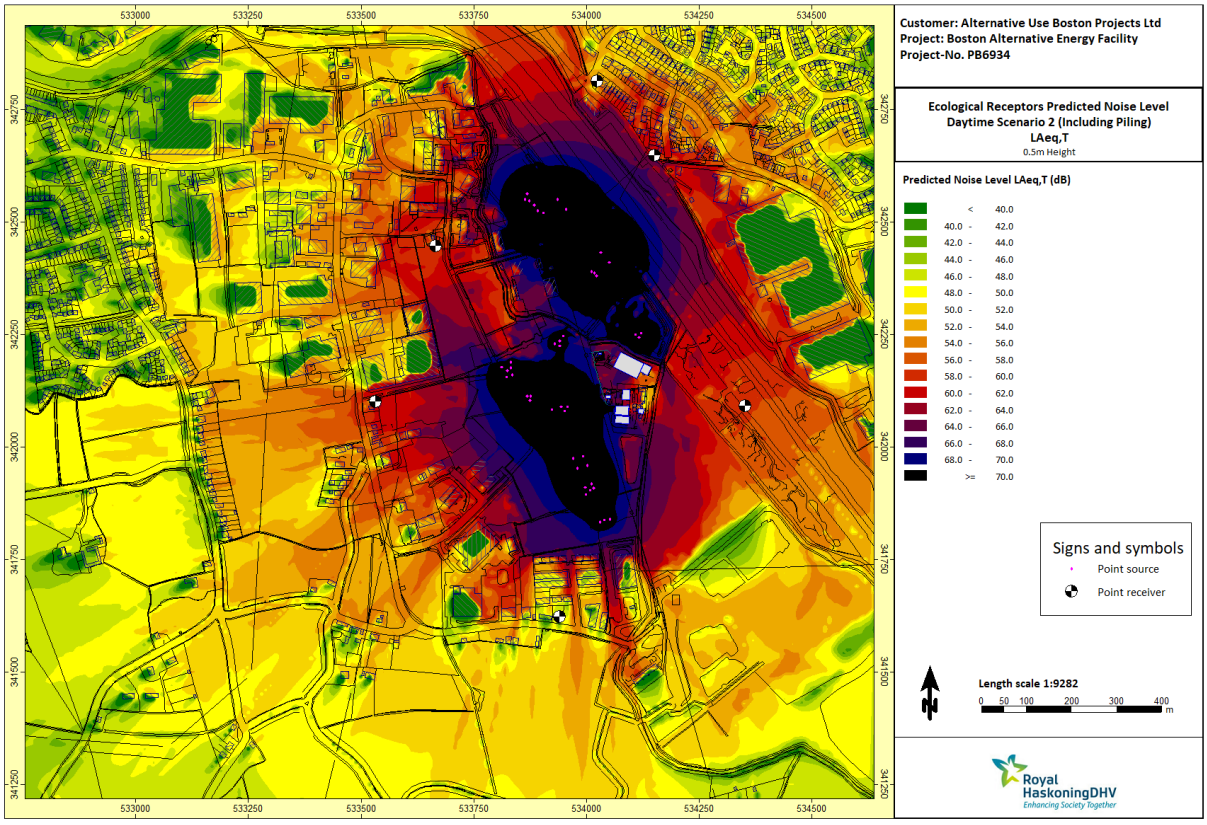

Figure 2-2 Noise Contours for Construction with piling in daytime noise environment of local area

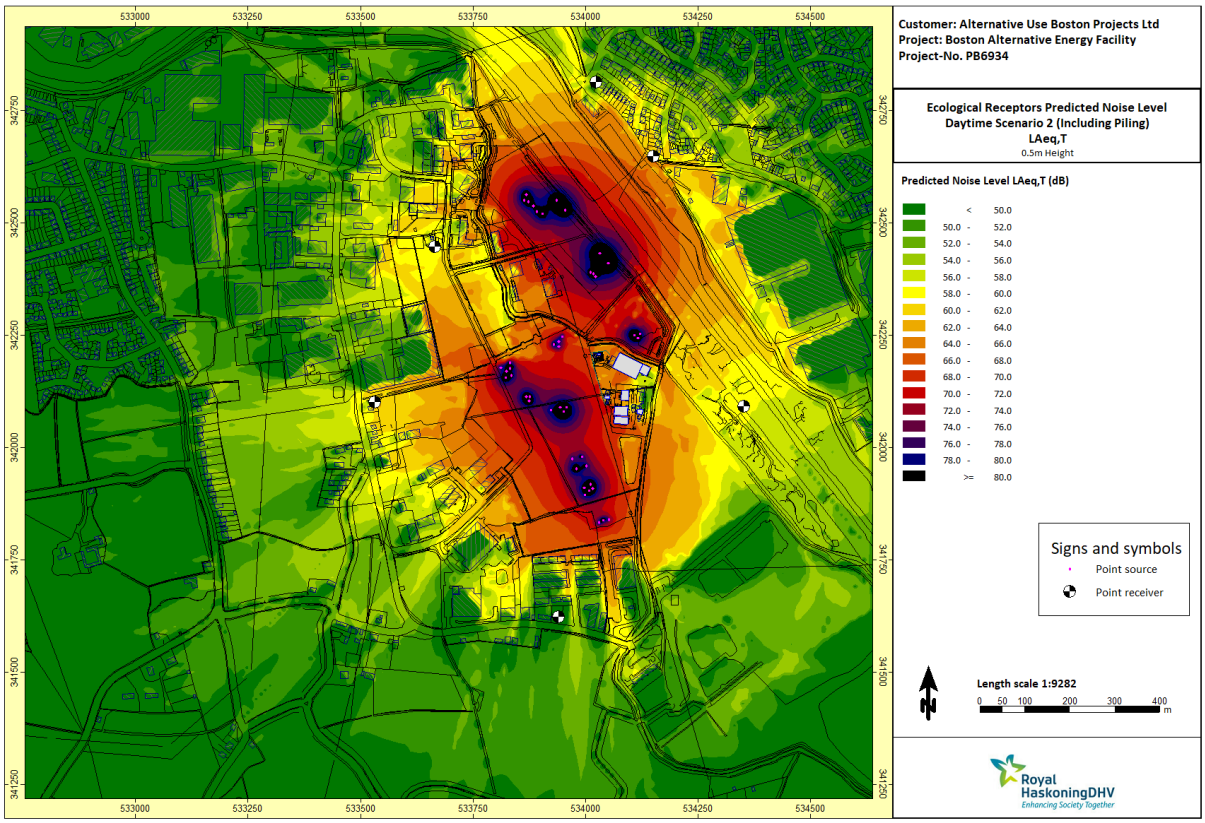

Figure 2-3 Re-draw of Figure 22 with shifted top and bottom contour range to illustrate more contours for highest noise values.

Noise levels during piling are in summary indicated to exceed the 'caution' level for waterbird disturbance over much of the local area of the Haven, and in line with the Principal Application Site noise levels are **generally modelled to exceed the at-bird threshold noise level** for disturbance (70dB, **Table *2-1***) including levels associated with vacating the site entirely (Wright et al. 2010). However, **the months to which piling is to be limited (June to September inclusive) mean that considerably fewer waterbirds (in terms of species and individuals, but in particular, redshank) are expected to be present to be potentially affected**.

2.1.3 Construction without piling in night-time

As detailed in Section 1.1.1, concrete batching plant will only operate 24 hours/day when there are long concrete pours, so night time batching will be an unusual and planned occurrence over a very limited time period. The night time construction contours are shown for transparency and completeness but show a situation that will be unusual in the context of the whole construction programme.

Noise levels for the modelled area at night during the construction phase are predicted to be lower (**Figure *2-3***), with noise levels reaching 44-48dB on The Haven in line with the Principal Application Site when construction sources of noise at the Site are active. At the highlighted redshank roost site in area B (the point receiver within Area B (as shown on Figure 11) in Figure 21 below), the predicted receptor noise level is 37.6dB. **Noise levels are in summary not predicted to exceed threshold 'caution' values at night during the construction period**. **It should also be noted that as set out previously, night-time**

construction will not be a regular occurrence and would be constrained temporally to specific events such a long concrete pours. Such working would need prior agreement with the local planning authority before night time construction work was permitted.

In this lower-noise ambient environment, one consideration is that noise thresholds for 'caution' should be taken as the lower value from Cutts et al. (2013) e.g. 55dB for redshank (**Table *2-1***). One-off or impulsive sources of noise in this environment can be expected to cause greater disturbance than the same noise during periods of high background noise. Using the 54-56dB contour as a guide, there is radius of approximately 100 m around night-time construction noise sources within which redshank experience 'caution' noise levels or higher (Cutts et al. 2013). Much of this radius is occupied by habitat less suitable or unsuitable for redshank (**Figure *2-3***).

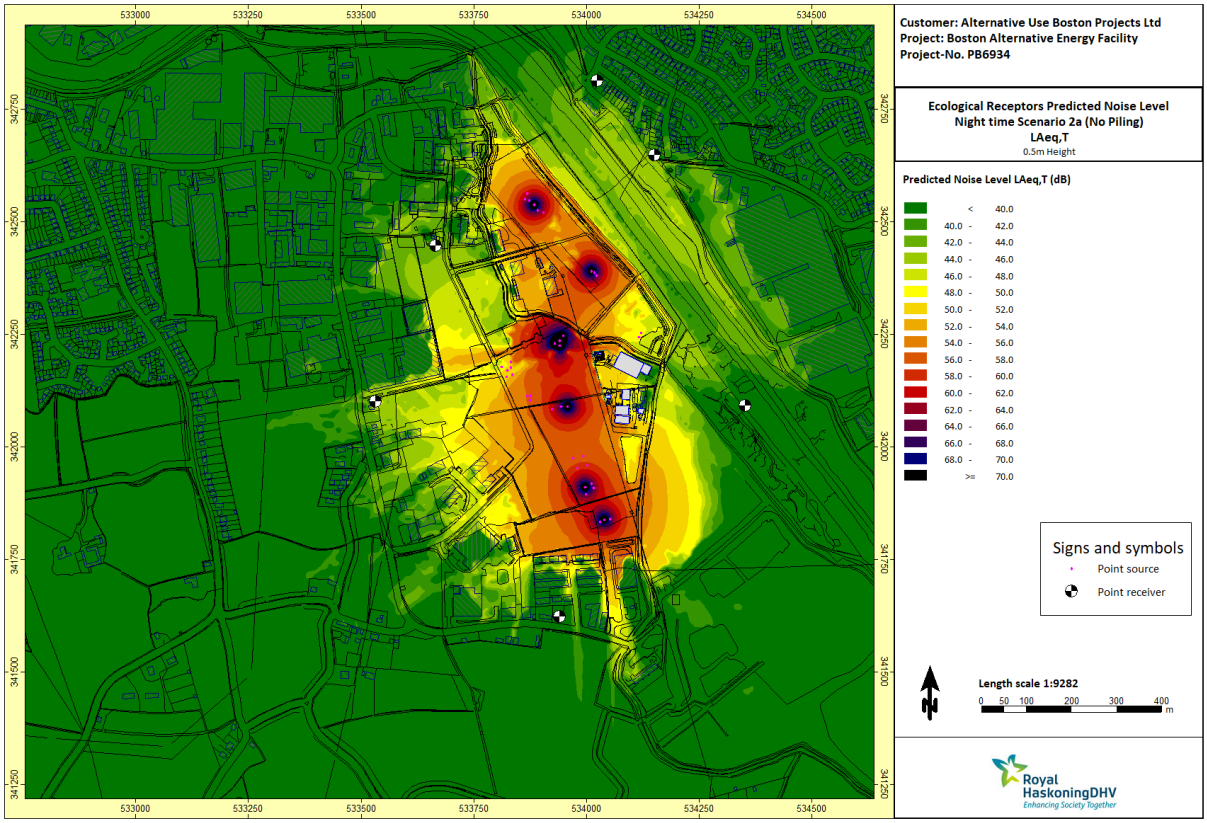

Figure 2-4 Noise contours for construction without piling in night-time

2.2 Operation phase

The noise contour maps for the Principal Application Site during the operational phase, during the day and night are shown in **Figure *2-4*** and **Figure *2-5***.

2.2.1 Operation of the site in daytime and night-time

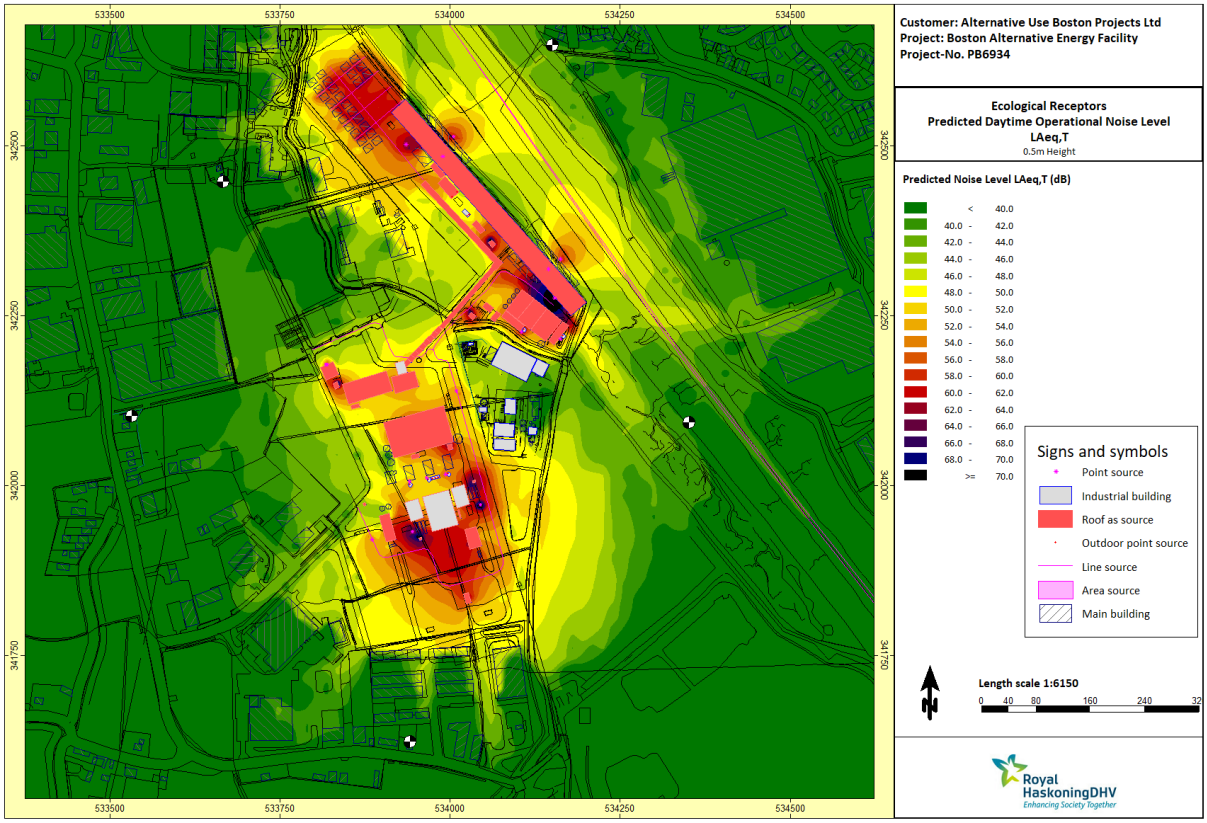

Figure 2-5 Noise contours for operating the project site in daytime

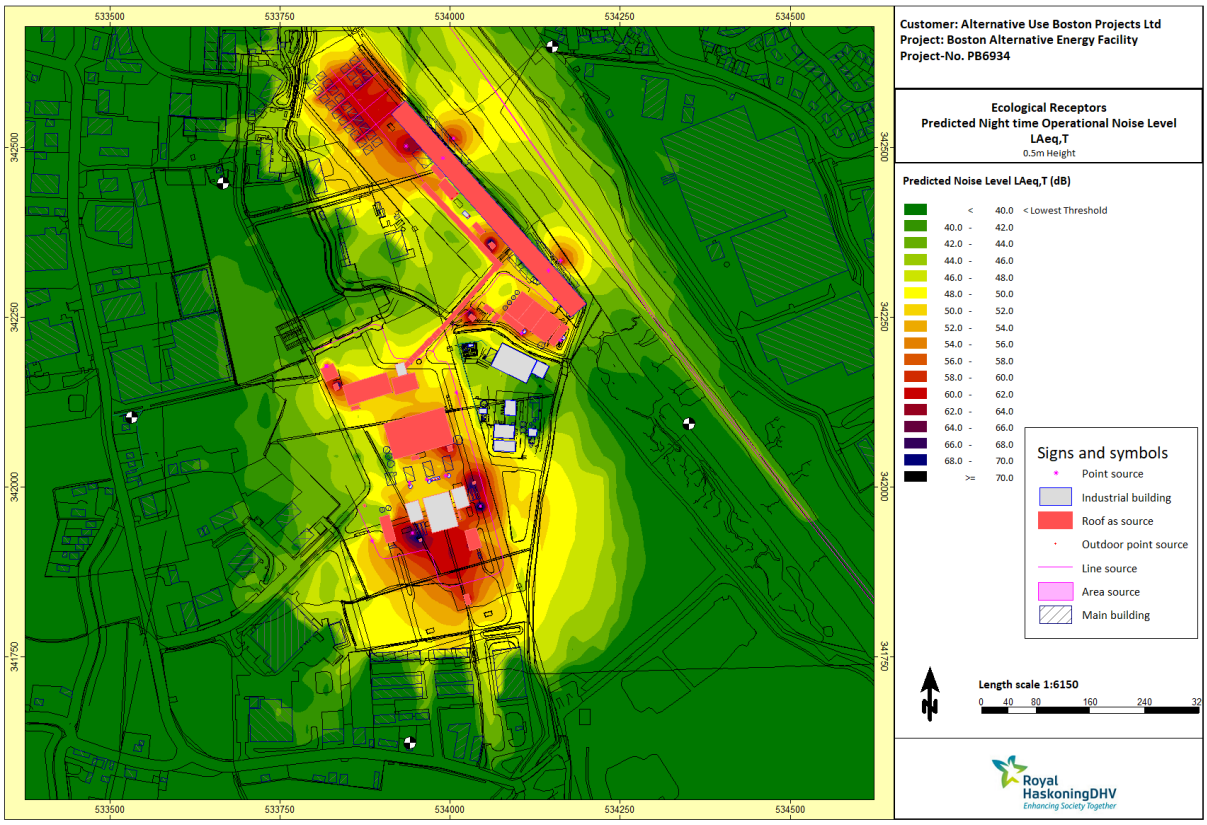

Figure 2-6 Noise contours for operating the project site in night-time

Noise levels in the day and night during the operation phase are predicted to exceed 50-52dB in two zones (orange to red contours, approximately 0.8 to 1 hectare each) within bird survey area A corresponding to the planned locations of vessel mooring and loading/unloading, reaching 54-56dB in two small areas (a radius of around 30 m and 40 m around the two respective points) within these zones (**-Figure 26**). Redshank are therefore predicted to experience 'caution' noise levels within this small radius of the vessel mooring sites but not on the remainder of The Haven. As with the non-piling construction noise, the distance from source and works within which redshank (as an example waterbird) are likely to experience 'caution' noise levels is well within the larger monitoring radius or Zone of 250 m planned for the construction period. However, this is also the location where habitat change will take place following construction of the wharf, therefore suitability of the site may have decreased here. More widely on The Haven noise levels will generally not exceed 'caution' levels from **Table *2-1*** and are predicted to range from 40dB or even lower (e.g. across much of bird survey area B, where noise is modelled to be 42dB only in the centre of the river in line with the vessel navigation route) to 50dB over a large proportion of survey area A. At the highlighted redshank roost site in area B, the predicted receptor noise level is 38.8dB during the day and 37.6dB at night. **Overall, noise levels during the operational phase will be below 'caution' levels for waterbird disturbance over the vast majority of The Haven** within the modelled area, and in particular survey area B (where the primary Habitat Mitigation Area is to be located) will experience low noise levels.

2.3 Conclusions and further recommendations

The distribution of 'caution' noise levels on the Haven, and the distances they extend from noise sources, in all scenarios with the exception of that involving piling are less than the 250 m radius planned for the Monitoring Zone maintained during the construction phase of the Facility, and the redshank roost within the Habitat Mitigation Zone is modelled to experience noise levels below 'caution' levels recommended in

Cutts et al. (2013). The exception is during the piling period during construction which is seasonally restricted to the four months of June, July, August and September when **temperatures are higher, daylight foraging opportunity for waterbirds is greater, energy budgets are therefore less constrained, and several non-breeding waterbirds associated with the nearby SPA are recorded as absent or infrequent near the Principal Application Site** (Report on Autumn Bird Surveys technical note (document reference 9.43)). In the piling period, 'caution' noise levels are predicted to occur over at least 300 m from the Principal Application Site, including the location of the redshank roost in the Habitat Mitigation Area (during months where few redshank will be using it).

Enforcement of the 250 m Monitoring Zone for waterbirds will entail pre-commencement checks pre-dawn in winter months during the construction phase when hours of light are most limited. This may be achieved by use of a thermal viewer, or less preferably red-filtered torchlight by a suitably qualified/experienced field ornithologist. In the wider construction period, the ornithologist will monitor bird numbers, behaviour and responses within the Monitoring Zone in winter months (October-March). Data provided from autumn counts of non-breeding waterbirds at The Haven adjacent to the Principal Application Site show that some birds are present in the final week of September in similarly significant numbers (by virtue of exceeding 1% of their BTO WeBS populations for The Wash) to main winter months, including ruff (a named non-breeding waterbird assemblage species of The Wash SPA/Ramsar/SSSI). It is therefore recommended that ornithologists monitor the zone in autumn months (August to September). The updated OLEMS (7.4(1) Outline Landscape and Ecological Mitigation Strategy (Document Reference REP3-007)) is a flexible document to take account of developments in the monitoring methodologies and will be updated during the DCO Examination to take account of the monitoring requirements following the results of the autumn bird counts. Breeding Bird Surveys and vessel disturbance surveys at the Principal Application Site have shown that waterbird numbers on The Haven are considerably lower in April to July (Ornithology Addendum document reference REP01-026).

3 References

British Standards Institution (2019) BS4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound. London, BSI.

British Standards Institution (2014) BS5228-1:2009+A1:2014 "Code of practice for noise and vibration control on construction and open sites – Part 1: Noise". London, BSI.

Cutts, N., Phelps, A., Spencer, J., & Hemmingway, K. (2013). Waterbird disturbance mitigation toolkit. *Tide toolbox, Interreg IVB North Sea Region Programme*.

Environment Agency (2019). *Boston Haven Ground Investigations - Bird Disturbance Monitoring 2019* | 12 June 2019

Royal HaskoningDHV (2021). REP1-029. Deadline 1 Submission – 9.16: *Boston Alternative Energy Facility Examination Technical Note: Updated Piling Noise Assessment* 19 October 2021

Wright, M. D., Goodman, P., & Cameron, T. C. (2013). Exploring behavioural responses of shorebirds to impulsive noise. *Wildfowl*, *60*(60), 150-167.