REPORT

Boston Alternative Energy Facility

Without Prejudice Habitats Regulations Assessment
Derogation Case: Assessment of Alternative Solutions

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1 Introduction

1.1 Purpose and Scope

1.1.1 This report sets out an 'assessment of alternative solutions' for the Boston Alternative Energy Facility (herein 'the Facility') on behalf of Alternative Use Boston Projects Limited ('the Applicant'). This assessment of alternative solutions represents Stage 3 of the without prejudice Shadow Habitat Regulations Assessment (HRA) process for the Facility and considers the feasibility of 'alternative solutions' to the Facility's proposals and whether any of these solutions would have a lesser effect on the integrity on The Wash Special Protection Area (SPA) and Ramsar site and The Wash and North Norfolk Coast Special Area of Conservation (SAC). This assessment is in the context of The Conservation of Habitats and Species Regulations 2017 (as amended by The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019) (the Habitat Regulations).

1.1.2 The stages of the HRA process are detailed in section A17.2 of Appendix 17.1 Habitats Regulations Assessment (document reference 6.4.18, APP-111) and are summarised in **Section 2** of this report. The documents which comprise the Applicant's Shadow HRA process are as follows:

- Stage 1: Screening/Likely Significant Effect (LSE) assessment is provided within Appendix 17.1 Habitats Regulations Assessment (document reference 6.4.18, APP-111);
- Stage 2: Appropriate Assessment is provided in Appendix 17.1 Habitats Regulations Assessment (document reference 6.4.18, APP-111);
- Stage 3: Without Prejudice Habitats Regulations Assessment Derogation Case: Assessment of Alternative Solutions (this document);
- Stage 4: Without Prejudice Habitats Regulations Assessment Derogation Case: Imperative Reasons of Overriding Public Interest (IROPI) Case (document reference 9.29)
- Stage 5: Without Prejudice Habitats Regulations Assessment Derogation Case: Compensation Measures (document reference 9.30).

1.1.3 Appendix 17.1: Habitats Regulations Assessment (document reference 6.4.18, APP-111) has concluded no adverse effect on integrity (AEOI) on The Wash SPA and Ramsar site and The Wash and North Norfolk Coast SAC as a result of either project alone or in combination effects. Consequently, based on that conclusion, no further assessment under the Habitats Regulations (i.e. Stages 3 and 4) were undertaken.

1.1.4 However, Natural England (NE) (and other Interested Parties, including the Royal Society for the Protection of Birds (RSPB) and Lincolnshire Wildlife Trust (LWT)) have advised the Examining Authority (ExA) that (in their view) AEOI cannot be excluded, beyond all reasonable scientific doubt for The Wash SPA and Ramsar and The Wash and North Norfolk Coast SAC. The reasons for NE's position (as per their Relevant and Written Representation (RR-021) submitted on 18 June 2021, prior to HRA addendums (document references 9.13, REP1-026; 9.14, REP1-027 and 9.15, REP1-028) submitted at Deadline 1, are summarised as follows:

- The Wash SPA - redshank: NE consider that the proposed Facility location would potentially result in AEoI on Annex I redshank, which are a qualifying species of The Wash SPA, and would be impacted by the following risk pathways:
    - Loss of foraging habitat on site through modification
    - Loss of roost on site through modification or disturbance
    - Loss of foraging habitat along The Haven which may be degraded through boat wash along the channel.
- The Wash SPA – Assemblage: There are significant concerns regarding the feeding/ roosting area at the mouth of The Haven which is within The Wash SPA. Significant numbers of the SPA/ Ramsar bird assemblage are using this area at low tide including up to 28% of the black-tailed godwit. NE advise that there are the following risk pathways:
    - Repeated boat movements are likely to result in changes to bird use behaviours of this important area of The Wash.
    - NE also have further concerns regarding the usage of this area at High tide.
- NE note 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, NE consider this to be an important area of supporting habitat of The Wash SPA. NE advise that an AEOI can't be excluded beyond all reasonable scientific doubt.
- NE are concerned with potential impacts of additional vessel movements and anchorage on The Wash and North Norfolk Coast SAC harbour seal population. NE advise that there is a Likely Significant Effect from the proposals and if further options to avoid, reduce and mitigate the impacts to acceptable levels can't be found/adopted then an AEOI cannot be excluded beyond all reasonable scientific at this time.

1.1.5 The reason for RSPB's position (as per their Relevant Representation (RR-024) submitted on 18 June 2021 and Written Representation submitted on 19 October 2021 (REP1-060)), prior to HRA addendums (document references 9.13, REP1-026; 9.14, REP1-027 and 9.15, REP1-028) submitted at Deadline 1, was that insufficient information was presented to demonstrate beyond reasonable scientific doubt that there will be no AEOI on the interest features of The Wash SPA and Ramsar and The Wash and North Norfolk Coast SAC. RSPB's concerns are summarised as follows:

- Loss of habitat, direct and indirect impacts, on foraging SPA linked birds at the application site;
- Loss of SPA linked redshank roost and impact on foraging birds adjacent the application site (during construction and operation); and
- Impact on birds roosting and foraging at the mouth of The Haven; and
- Impacts on birds at the anchorage area in The Wash SPA.

1.1.6 The reason for LWT's position (as per their Relevant Representation (RR-011) submitted on 8 June 2021 and Written Representation submitted on 19 October 2021 (REP1-055), prior to HRA addendums (document references 9.13, REP1-026; 9.14, REP1-027 and 9.15, REP1-028) submitted at Deadline 1, was that insufficient information was presented to demonstrate beyond reasonable scientific doubt that there will be no AEOI on the interest features of The Wash SPA and Wash and North Norfolk Coast SAC. LWT's concerns are summarised as follows:

- Impacts of increased vessel movements during the operational phase at the Facility and at the mouth of The Haven on feeding and roosting redshank;
- Loss of intertidal mudflat and saltmarsh; and
- Impact to harbour seal due to piling and vessel movements.

1.1.7 The Applicant has engaged with Interested Parties and has considered comments raised in their Relevant Representations (see document reference 9.11, REP1-024) and Written Representations (see document reference 9.22, submitted at Deadline 2 of the Examination) but does not consider that any of the issues raised alter the position stated at the time of the application.

1.1.8 Notwithstanding the Applicant's position that there will be no AEOI of any designated site, this document presents the assessment of alternative solutions as part of the case for derogation under the Habitats Directive on a without prejudice basis to allow for full consideration of all aspects during the Examination.

1.2 Structure of Report

1.2.1 This report is structured as follows:

- Section 1 introduces the purpose and scope of this report and provides an outline description of the proposed Facility.
- Section 2 sets out the overview of the outcome of the Shadow HRA process and introduces Stage 3 and 4, alternatives, IROPI and compensation.
- Section 3 establishes the legislation and guidance relevant to the Shadow HRA.
- Section 4 sets out the methodology adopted by the Applicant for the assessment of alternative solutions.
- Section 5 provides details of Step 1 of the process and identifies the project need and objectives.
- Section 6 describes Step 2, which sets out the position of NE and other Interested Parties that, in their view, AEOI cannot be excluded for The Wash SPA and Ramsar and The Wash and North Norfolk Coast SAC.
- Section 7 presents Step 3 of the process, presenting a long list of potential alternative solutions to address the potential harm (in the view of NE and other Interested Parties). The long list is screened to define a short list of options that would fulfil the project need (in line with national policy and guidance) and objectives.
- Section 8 presents Step 4, considering whether any short-listed potential alternative solutions are feasible.
- Section 9 reports Step 5 of the process, drawing conclusions as to whether any feasible alternative solutions would have a lesser effect on the integrity of The Wash SPA.
- Section 10 summarises the conclusions of the Stage 3 Assessment of Alternative Solutions.
- Section 11 provides details of the references used.

1.2.2 In addition, **Appendix 1** presents an assessment of the alternative options of road and rail transportation during construction and operation phases, this Appendix is relevant to **Section 7** (Step 3).

1.3 The Proposed Facility

1.3.1 The Facility is proposed to be located at Riverside Industrial Estate, Boston, Lincolnshire. The Riverside Industrial Estate is adjacent to the tidal River Witham (known as The Haven) and down-river from the Port of Boston. The DCO Application Site for the Facility (herein the 'Application Site') is denoted by the solid red line on **Figure 1.1** of the ES (document reference 6.3.1, APP-067). The Application Site covers 26.8 hectares (ha) and comprises two components:

- the Principal Application Site (NGR TF33950 42241), which covers 25.3 ha and will contain all of the operational infrastructure; and
- the Habitat Mitigation Area, which covers 1.5 ha and is located approximately 170 m to the south east of the Principal Application Site, encompassing an area of saltmarsh and small creeks at the margins of The Haven that will be enhanced.

1.3.2 The proposed Facility would deliver approximately 80 megawatts electric (MWe) of renewable energy to the National Grid using Refuse Derived Fuel (RDF) as a feedstock into a thermal treatment facility generating power via steam turbine generators. This technology provides significant environmental benefits compared to landfilling residual waste and contributes to Government sustainable energy targets to achieve a net zero reduction in carbon emissions by 2050. A detailed description of the Facility is provided within **Chapter 5 Project Description** of the Environment Statement (document reference 6.2.5, APP-043). The layout of the proposed Facility is presented in Figure 5.1 (document reference 6.3.2, APP-068).

1.3.3 The Facility would comprise the following main elements:

- a wharf and associated infrastructure (including re-baling facility, workshop, transformer pen and welfare facilities);
- a RDF bale contingency storage area, including sealed drainage, with automated crane system for transferring bales;
- conveyor system running in parallel to the wharf between the RDF storage area and the RDF bale shredding plant. Part of the conveyor system is open and part of which is under cover (including thermal cameras);
- bale shredding plant;
- RDF bunker building;
- thermal treatment plant comprising three nominal 34 MWe combustion lines (circa 120 megawatts thermal (MWth)) and associated ductwork and piping, transformer pens, diesel generators, three stacks, ash silos and ash transfer network; and air pollution control residues (APCr) silo and transfer network;
- turbine plant comprising three steam turbine generators, make-up water facility and associated piping and ductwork;
- air-cooled condenser structure, transformer pen and associated piping and ductwork;
- Lightweight Aggregate (LWA) manufacturing plant comprising four kiln lines, two filter banks with stacks, storage silos for incoming ash, APCr, and binder material (clay and silt), a dedicated berthing point at the wharf, silt storage and drainage facility, clay storage and drainage facility, LWA workshop, interceptor tank, LWA control room, aggregate storage facility and plant for loading aggregate / offloading clay or silt;

- electrical export infrastructure;
- two carbon dioxide (CO_2) recovery plants and associated infrastructure, including chiller units;
- associated site infrastructure, including site roads, pedestrian routes, car parking, site workshop and storage, security gate, control room with visitor centre and site weighbridge; and
- habitat mitigation works for redshank and other bird species comprising of improvements to the existing habitat through the creation of small features such as pools/scrapes and introduction of small boulders (Habitat Mitigation Works) within the Habitat Mitigation Area.

1.3.4 The construction period for the whole development, including pre-construction enabling works and commissioning, is anticipated to be up to 55 months, as per the Indicative Construction Programme (document reference 9.18, REP1-031). Construction activities would take place six days a week (Monday to Saturday) between 8am and 8pm (with an option of commencing work at 7am but, in order to restrict construction to a 12 hours working period each day, work would cease at 7pm under this option), with no bank holiday or public holiday working. There may be short periods of 24 hour working when concrete is being poured.

1.3.5 The Facility would be designed to operate for an expected period of at least 25 years, after which ongoing operation will be reviewed and if it is not appropriate to continue operation the plant will be decommissioned. The wharf structure would form the primary flood defence bank, adding to the existing flood defence bank, and without impacting on the integrity of the bank. The flood defence would form a permanent structure that is not anticipated to be decommissioned, however the wharf deck would be decommissioned.

1.3.6 The construction and operation of the wharf and associated vessel movements are noted by NE (and other Interested Parties, including the RSPB and LWT) to be the principal reasons that AEOI cannot be excluded, beyond all reasonable scientific doubt for The Wash SPA and The Wash and North Norfolk Coast SAC. Therefore, the description of the development below focusses on the import and export of materials via vessel and the wharf construction and operation, rather than details of the full development. For a detailed description of the full development see **Chapter 5 Project Description** of the ES (document reference 6.2.5, APP-043). Further details on wharf construction are also included in the Wharf Construction Outline Methodology (document reference 9.17, REP1-030), submitted at Deadline 1 of the Examination.

Construction

Delivery of Raw Materials

1.3.7 Delivery of raw materials to the Principal Application Site would be via both vessel and road. The first section of the wharf construction would be undertaken to allow a proportion of the raw materials to be delivered by vessel rather than transportation by local roads. It is estimated that it would take approximately six months to construct the first section of the wharf to allow raw materials to be received by vessel. The subsequent section of the wharf would take a further 12 months (approximately) to complete.

1.3.8 A concrete batching plant will be installed to reduce transport movements associated with concrete production. Aggregate brought in via vessel would be transferred from the wharf via an overland temporary conveyor to the concrete batching plant. The concrete batching plant would take approximately four days to install. The temporary aggregate conveyor would take around five months to install. This would be decommissioned when the need for aggregate supply by vessel has come to an end.

1.3.9 The bulk of cement would come from Ketton Cement works in the County of Rutland, with potential alternative sources from Purfleet or Tyneside. It is not considered practical to deliver cement via vessel due to the vessel size required and the logistical requirements associated with timetabling of deliveries.

1.3.10 Other bulk loads including reinforcement materials such as steel and fibre would also be brought in via vessel, with on-site vehicle transport to lay-down areas within the Principal Application Site.

1.3.11 It is anticipated that there would be approximately 89 shipments of raw materials during the construction period.

Wharf Construction

1.3.12 The wharf will be constructed as a suspended deck structure. The wharf would be built in a phased manner as described in **paragraph 1.3.7**, replacing sections of the current flood defence bank, and would comprise the flood defence wall, the main area of the wharf and an area behind the wharf for associated infrastructure, such as the re-baling facility, workshop, transformer pen and welfare facilities.

1.3.13 The wharf facility would include a berthing pocket to allow vessels to safely dock without restricting the navigable channel within The Haven. The berthing pocket would be constructed by dredging and excavation of the mudflats and land to the edge of the proposed wharf. Most of these construction works would be carried

out by land-based equipment, although some floating plant may be required to complete the excavation of the berthing pocket towards the edge of the main channel, due to the distance from the proposed location of the flood defence wall.

1.3.14 There would be two phases of dredging for the construction of the wharf and the berthing pocket. The first phase of dredging of the slope would be required to construct the revetment (which would be located beneath the wharf once built) and this would comprise approximately 75,000 m^3 of dredged sediment. This activity would be completed using land-based equipment with long-arm hydraulic excavators (and/or suitable cranes equipped with a grab) located on top of the flood defence to excavate the slope. A second phase of capital dredging would be required for the berthing areas in front of the flood defence wall, with approximately 150,000 m^3 of sediment requiring excavation to create sufficient water depth in the berthing areas in front of the flood defence wall. The final depth of the berthing pocket would be -3.5 m Ordnance Datum (OD).

1.3.15 The deck structure of the wharf would be constructed by first driving the piles and then constructing the deck. The deck would be constructed of concrete precast beams and deck slabs, tied together with *in-situ* concrete.

1.3.16 Protection required to prevent scour of the dredged slope beneath the wharf would need to be completed prior to placing the concrete deck. This slope protection would be placed after the piles have been driven and before the deck is formed, as this allows easy access to the area using cranes, and or excavators to place the scour protection mattress. Scour protection would be required at either end of the wharf, as shown on **Figure 5.1**.

1.3.17 The area behind the wharf would be consolidated with a suitable specification of fill material. If necessary, it would be surcharged to reduce post-construction settlements. Prefabricated vertical drains (PVDs), if required, would be installed in the first stage.

1.3.18 The estimated quantities associated with construction of the wharf are provided in **Table 1-1.**

Table 1-1 Indicative Quantities of Dredging and Material Requirements for the Wharf Construction

Item	Indicative Quantity
Excavation of the revetment slope	75,000 m^3
Dredging of channel (berthing area)	150,000 m^3
Fill required	7,000 m^3
Piles for suspended deck	300 no.
Concrete for suspended deck	7,000 m^3
Slope (scour) protection	10,000 m^2

Operation

Refuse Derived Fuel Supply

1.3.19 The Facility would receive approximately 1,200,000 tonnes of RDF per year.

1.3.20 The RDF feedstock would be delivered by vessel to the Facility sealed in plastic-wrapped bales. The bales would be wrapped by the supplier who would pre-screen the feedstock prior to baling to ensure that no unacceptable material (for example hazardous waste or gas cannisters) is baled.

1.3.21 The RDF would be sourced from UK suppliers and comprise of Materials Recycling Facility (MRF) residues. This waste would be residual household waste and similar municipal-type waste that has been through the MRF and had all potential recyclate and contaminants (for example hazardous wastes) removed. The Facility would not divert any source-segregated or co-mingled recyclate from being recycled.

1.3.22 The material would be dispatched to the Facility from UK ports. The specific departure locations would be dictated by market conditions at the time of supply. All of the RDF that is transported to the Facility would be sourced from UK ports. A list of potential ports has been identified as follows:

- Glasgow King George V;
- Montrose;
- Grangemouth;
- Fleetwood;
- Hartlepool;
- Hull;
- Great Yarmouth;
- Ridham;
- Sheerness;

- Southampton;
- Port Talbot; and
- Belfast.

1.3.23 There would be up to ten (9.2) RDF deliveries by vessel per week, 480 vessels per year, assuming each vessel has a 2,500 tonne payload. The vessels are anticipated to have typical dimensions as detailed in **Table 1-2**, however, this would be directed by the market forces and the shipping fleet operator.

Table 1-2 Anticipated Vessel Size and Capacity

Minimum Draught (m)	3.5
Maximum Draught (m)	4
Minimum Length (m)	90
Maximum Length (m)	100
Minimum Beam (m)	13
Maximum Beam (m)	15
Capacity of RDF bales (tonnes)	2,500

Wharf Operation

1.3.24 The proposed wharf would provide accessibility between the Facility and incoming and outgoing vessels via The Haven and The Wash, enabling delivery of RDF feedstock, sediment and clay (both of which can be used as binder material in the manufacture of lightweight aggregate); and the dispatch of lightweight aggregate. Using vessels to transport materials would significantly reduce the operational impact of the Facility on the local road network.

1.3.25 The proposed wharf would comprise a 400 m long berthing facility, loading and offloading equipment and access / egress ramp. The wharf would have two berths for receiving RDF feedstock, and one berth for loading aggregate and receiving clay and sediment, which are required by the LWA plant (clay is likely to be sourced from south-east England) and sediment (maintenance dredged material from the river).

1.3.26 Arriving vessels must navigate up The Haven to the proposed berth over high tide and leave over the next available high tide. It is anticipated that vessels would be turned at the Port of Boston, either at the ‘Knuckle’ point turning circle outside of the Wet Dock, or within the Wet Dock. .

1.3.27 The berths at the proposed wharf would be designed to allow vessels to sit on the bed of the river at low tide whilst waiting for the next high tide because there is insufficient water depth at low tide to float (i.e. NAABSA, 'Not Always Afloat But Safe Aground', berths). The berthing pocket would have a bed at elevation of approximately -3.5 m OD and a width of approximately 20 m with a gravel/chalk bed (or similar) forming a surface for the vessels to remain level when resting on the bed at low tide.

1.3.28 The berthing points for the proposed wharf would be set parallel to the waterway but set back in the berthing pocket to maintain a safe distance from passing vessels.

1.3.29 Bales would be removed from the vessels by hydraulic cranes equipped with clamps, with two cranes per berth. The bales would be unloaded by crane directly onto the conveyor and then transferred to the bale shredder building to allow RDF to be tipped into the RDF bunker building.

1.3.30 If a bale is observed to be damaged when it is offloaded, it would be immediately sent to the re-baling facility. This is to prevent litter from a damaged bale potentially falling or being blown into the river during unloading.

1.3.31 The outbound quantity of aggregate is dependent upon the composition of the RDF (in particular the ash content), which dictates the quantity of bottom ash and Air Pollution Control (APC) residues produced, and the amount of binder material required to produce the aggregate. For a design reference point, it is anticipated that just over 200,000 tonnes (design point = 201,890 tonnes) of LWA would be produced from bottom ash residues, and just less than 100,000 tonnes (design point = 97,531 tonnes) from APC residues. Therefore, 100 vessels per year bearing approximately 3,000 tonnes of aggregate per load would be required to export this material from the Facility. This is equivalent to approximately two vessels per week, on average.

1.3.32 In total approximately 580 vessels per year, or up to 12 per week, would be required by the fully operational Facility.

2 Overview of the Process

2.1.1 The Shadow HRA process follows a four-stage approach, as detailed in the PINS Advice Note 10:

- Stage 1: Screening for Likely Significant Effects (LSE).
- Stage 2: Appropriate Assessment.
- Stage 3: Assessment of Alternative Solutions.
- Stage 4: Demonstration of IROPI and the provision of compensatory measures.

2.1.2 This section summarises the outcome of the Facility's Shadow HRA Stages 1 and 2 and introduces Stages 3 and 4.

2.2 Stage 1 LSE

2.2.1 The Appendix 17.1 Habitats Regulations Assessment (Section A17.4) (document reference 6.4.18, APP-111) concluded that LSE could arise due to the Facility on The Wash SPA and Ramsar site and The Wash and North Norfolk Coast SAC. Therefore, the information to undertake a Stage 2 Appropriate Assessment was collated.

2.3 Stage 2 Appropriate Assessment

2.3.1 The Applicant's Appendix 17.1: Habitats Regulations Assessment (document reference 6.4.18, APP-111) has concluded no AEOI on The Wash SPA and Ramsar site and The Wash and North Norfolk Coast SAC. Consequently, based on that conclusion, no further assessment under the Habitats Regulations (i.e. Stages 3 and 4) was undertaken.

2.3.2 However, NE (and other Interested Parties, including RSPB and LWT) have advised the ExA that (in their view) AEOI cannot be excluded, beyond all reasonable scientific doubt for The Wash SPA and Ramsar and The Wash and North Norfolk Coast SAC. The reasoning for this view is summarised in **Section 6**.

2.3.3 The Applicant has engaged with Interested Parties and has considered comments raised in their Relevant Representations (see NE (RR-021); RSPB (RR-024); and LWT (RR-011)) and Written Representations (see NE (RR-021); RSPB (REP1-060) and LWT (REP1-055)) but does not consider that any of the issues raised alter the Applicant's position stated (i.e. no AEOI) at the time of the application.

2.3.4 Notwithstanding the Applicant's position that there will be no AEOI of any designated site, this document presents the case for derogation under the Habitats Directive on a 'without prejudice' basis to allow for full consideration of all aspects during the Examination.

2.3.5 Where an adverse effect on site integrity cannot be excluded, a plan or project can only be approved or granted consent if:

- it is demonstrated that there are no alternative solutions which would have no or a lesser effect on the integrity of the designated site(s) included in the national site network (and on Ramsar sites), collectively known as 'protected sites' (Stage 3); and,
- IROPI can be shown and necessary compensation measures can be secured (Stage 4).

2.4 Stage 3 Assessment of Alternative Solutions

2.4.1 The Stage 3 Assessment of Alternative Solutions (this document) considers the feasibility of 'alternative solutions' to the Facility's proposals and whether any of these solutions would have a lesser effect on the integrity on The Wash SPA and Ramsar site and The Wash and North Norfolk Coast SAC. Methodology associated with this assessment is provided within **Section 4**.

2.5 Stage 4 IROPI and compensation

2.5.1 Defra (2021) states "*If there are no feasible alternative solutions, you must next be able to show that there are imperative reasons of overriding public interest why the proposal must go ahead. These must justify the proposal, despite the damage it will or could cause to the European site.".* The assessment of IROPI is included within document reference 9.28.

2.5.2 Once IROPI has been established – the HRA process requires that sufficient and appropriate compensatory measures must be provided by the Applicant and *"the appropriate authority must secure that any necessary compensatory measures are taken to ensure that the overall coherence of Natura 2000 is protected"* (HM Government, 2017). It is noted in Defra, (2021) that *"If there are no feasible alternative solutions and you have shown that there are imperative reasons of overriding public interest, you need to make sure that compensatory measures will be taken. These measures will need to fully offset the damage which will or could be caused to the site.".* Compensatory measures are outlined in document reference 9.30.

3 Relevant Legislation and Guidance

3.1 The Habitats Regulations

3.1.1 The Habitats Regulations implement Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) in England and Wales. The Habitats Directive requires Member States to schedule important wildlife sites throughout the European Community as SACs and to give protection to habitats and species listed in the Directive as being threatened or of Community Interest.

3.1.2 The EU meets its obligations for birds through Council Directive 2009/147/EC on the conservation of wild birds (the Birds Directive). This provides a framework for the conservation and management of wild birds in Europe through the classification of SPAs. The Habitats Regulations incorporate all SPAs into the definition of European sites and, consequently, the protections afforded to European sites under the Habitats Directive apply to SPAs designated under the Birds Directive.

3.1.3 The HRA process helps meet the requirements of Article 6(3) of the Habitats Directive (replicated in Regulation 63(1) of the Habitats Regulations) which states that any plan or project, which is not directly connected with or necessary to the management of an European site, but would be likely to have a significant effect on such a site, either on its own or in-combination with other plans or projects, will be subject to an 'appropriate assessment' of its implications for the European site in view of the site's 'conservation objectives'.

3.1.4 In accordance with Regulation 64 of the Habitats Regulations, if the competent authority is satisfied that, there being no alternative solutions, the plan or project must be carried out for imperative reasons of overriding public interest, it may agree to the plan or project notwithstanding a negative assessment of the implications for the European site.

3.1.5 In such circumstances, in accordance with Regulation 68 of the Habitats Regulations, necessary compensatory measures must be secured to ensure that the overall coherence of the *Natura 2000* network is protected.

3.1.6 On the 1st January 2021 the UK left the European Union and the management of Habitats Directive legislation transferred from the European Commission to UK Government ministers. The amended regulations are termed Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.

4 Methodology

4.1 Introduction

4.1.1 The methodology adopted to assess alternative solutions has been developed based on guidance from a range of sources, including:

- The European Commission's (EC) Assessment of plans and projects significantly affecting Natura 2000 sites, methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive (2000)[1] EC, 2000).
- EC's Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (1992) ('Habitats Directive').
- EC Guidance Document on Article 6(4) of the 'Habitats Directive' 92/43/EEC (2012) (EC Guidance, 2012).
- EC Guidance Document on Managing Natura 2000 sites, The provisions of Article 6 of the 'Habitats Directive' (2018) (EC Guidance, 2018).
- Department for Environment, Food and Rural Affairs (Defra) Guidance, Habitats regulations assessments: protecting a European site (2021) (Defra, 2021).
- The Planning Inspectorate's (PINS) Advice Note Ten: Habitat Regulations Assessment relevant to Nationally Significant Infrastructure Projects (2017) ('PINS Advice Note 10', version 8).

4.1.2 The definition of an alternative solution is based on paragraph 4 of page 9 in Methodological Guidance for the Habitats Regulations: *"Alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of the Natura 2000 site".*

4.1.3 The methodology for the assessment of alternative solutions consists of five steps, as follows:

- Identify the need for the Facility and define its objectives.
- Identify the potential harm on the integrity of designated site(s) included in the national site network (and on Ramsar sites), collectively known as 'protected sites' within this report.
- Produce a long list of potential alternative solutions to address the potential harm and screen these to produce a short list.
- Consider whether any short-listed potential alternative solutions are 'feasible' alternative solutions.
- Consider whether any feasible alternative solutions would have a lesser effect on the integrity of any protected site.

[1] *The guidance has been supplemented by the EC's Managing Natura 2000 sites: the provisions of Article 6 of the Habitats Directive 92/43/EEC (2018, "Provisions of Article 6")*

4.1.4 Defra (2021) is the most recent guidance relevant to this assessment and states that:

"An alternative solution is acceptable if it:

- *achieves the same overall objective as the original proposal*
- *is financially, legally and technically feasible*
- *is less damaging to the European site and does not have an adverse effect on the integrity of this or any other European site".*

4.1.5 The above guidance is reflected in the description of the various steps adopted in this assessment, presented in the following sub-sections.

4.2 Step 1 – Need and Objectives

4.2.1 The need for the Facility is set out in **Section 5**. This is based on key relevant policy such as the National Policy Statements (NPSs) for Energy (DECC, 2011a; 2011b).

4.2.2 The objectives of the Facility, set out in **Section 5**, have been set out having regard to the following guidance:

- Defra (2021) which states *"Alternatives need to meet the original objectives of the proposal"*.
- EC (2000) (Stage Three: Assessment of Alternative Solutions) also sets out that alternative solutions should be assessed by *"identifying and characterising the key objectives of the project or plan"*.

4.3 Step 2 – Potential for Harm

4.3.1 The outcome of the Appendix 17.1 Habitats Regulations Assessment (document reference 6.4.18) has concluded no AEOI on The Wash SPA. However, in light of the current position of NE and other Interested Parties, this report summarises the pathways by which these parties consider that AEOI cannot be excluded on The Wash SPA and Ramsar site and The Wash and North Norfolk Coast SAC.

4.4 Step 3 – Long List of Potential Alternative Solutions

4.4.1 In accordance with guidance including, EC (2000), EC (2012) Planning Inspectorate (2017) and Defra (2021), the first step is to identify a list of potential alternative solutions. The various guidance suggests these should include:

- alternative locations or routes (EC, 2000; EC, 2012 and Defra, 2021);
- change its scale, size, design, method or timing (Defra, 2021); and

- an option of a ‘do nothing’ approach (Planning Inspectorate, 2017; EC, 2012 and EC, 2000).

4.4.2 It is noted in Defra (2021) that alternatives *“need to meet the original objectives of the proposal”*. For example, an alternative would not include an alternative form of energy generation, as this would not meet the original objectives of the proposal.

4.4.3 Following identification of the long list of potential alternative solutions, these are screened against the project need and objectives. This short list of alternative solutions is then assessed further under Step 4.

4.5 Step 4 – Assessment of Feasible Alternative Solutions

4.5.1 As noted above, Defra (2021) states that the alterative solution should also be *“financially, legally and technically feasible”* . These elements are defined below.

Financial feasibility

4.5.2 A potential alternative would not be financially feasible where its cost is disproportionately high in the context of the scale of the reduction in the environmental effect that the alternative would achieve. Alternative solutions need not be equivalent in cost, but additional costs should not be such that the alternative becomes undeliverable or unviable.

4.5.3 There are direct and indirect costs associated with potential alternative solutions.

4.5.4 Direct costs include the cost of using more expensive equipment or the additional costs of construction the alternative solution.

4.5.5 Indirect costs would arise from the consequences of (for example) extending the construction schedule due to the adoption of an alternative methodology.

Legal feasibility

4.5.6 An alternative solution is considered to be not legally feasible where there is a legal impediment or where, from a legal or consenting perspective, it would be unreasonably difficult to deliver an alternative because it would have ‘unacceptable’ impacts.

Technical feasibility

4.5.7 A potential alternative would not be technically feasible where it is impractical, incapable of being implemented, technically unsound and/or would not meet safety and regulatory requirements (including health and safety).

4.5.8 The consideration of alternatives is therefore not a speculative and hypothetical exercise. It must be grounded in the real world, with reference to proven options. The feasibility of each of the potential alternative solutions need to be assessed against the components of feasibility noted above.

4.6 Step 5 – Feasible Alternative Solutions which have a Lesser Effect on the Integrity of any Protected Site

4.6.1 As noted in Defra (2021), an alternative solution is acceptable if it "is less damaging to the European site and does not have an adverse effect on the integrity of this or any other European site". Therefore, Step 5 considers whether any of the feasible alternative solutions have a lesser effect on The Wash SPA and Ramsar site and The Wash and North Norfolk Coast SAC. Step 5 is within **Section 9**.

5 Step 1 – Need and Objectives

5.1 Introduction

5.1.1 This chapter sets out the need for the Facility and the key objectives that the proposed Facility is intending to meet. Chapter 2 Project Need of the ES (document reference 6.2.2, APP-040) provides a full description of the need for the project; key points from this are summarised below, along with additional information that is relevant to the scope of this assessment.

5.2 The Need for the Facility

5.2.1 The 'need' that exists for new power generating infrastructure, such as the proposed Facility, is confirmed in the NPSs for energy infrastructure. The NPSs of most direct relevance to the Facility are EN-1 (Overarching NPS for Energy) and EN-3 (NPS for Renewable Energy) (DECC, 2011a; 2011b).

5.2.2 NPSs EN-1 and EN-3 establish an urgent and substantial need for new energy generation infrastructure, with the desire for it to be renewable or low carbon, to achieve climate change targets established and made legally-binding under the Climate Change Act 2008. In addition, the UK is committed to reduce carbon emissions to net zero by 2050 (HM Government, 2021).

5.2.3 With respect to security of energy supplies, EN-1 states “It is critical that the UK continues to have secure and reliable supplies of electricity as we make the transition to a low carbon economy. To manage the risks to achieving security of supply we need: sufficient electricity capacity (including a greater proportion of low carbon generation) to meet demand at all times.”

5.2.4 Section 2.5.2 of EN-3 (DECC, 2011b) states that “The recovery of energy from the combustion of waste, where in accordance with the waste hierarchy, will play an increasingly important role in meeting the UK’s energy needs. Where the waste burned is deemed renewable, this can also contribute to meeting the UK’s renewable energy targets. Further, the recovery of energy from the combustion of waste forms an important element of waste management strategies in both England and Wales.”

5.2.5 In addition, the Government’s Waste Strategy for England 2007 (Defra, 2007) introduced stringent targets for increasing recycling and reducing landfill. This was reinforced by the National Waste Management Plan for England in July 2013 (Defra, 2013). The key aim of the Waste Management Plan for England was to set a direction towards a ‘zero-waste economy’ as part of the transition to a sustainable economy.

5.2.6 The 'Proximity Principle' as established in the revised Waste Framework Directive (rWFD) (2008/98/EC; European Parliament, 2008), requires waste to be disposed of, or recovered in one of the nearest appropriate installations, by means of the most appropriate methods and technologies to ensure a high level of protection for the environment and public health. The rWFD also requires Member States to move towards the aim of self-sufficiency in waste disposal and recovery of waste. This is within the context of the requirement on Member States to establish an integrated and adequate network of waste disposal facilities for recovery of mixed municipal waste collected from private households. The requirement included where such collection also covers waste from other producers.

5.2.7 Approximately 2.8 million tonnes of waste-derived fuel (RDF and Solid Recovered Fuel (SRF)) was exported to international destinations in 2019 (Environment Agency, 2021). Therefore, in line with the proximity principle, the proposed Facility seeks to move the recovery of energy to closer to the point of production and ensure that the UK is more self-sufficient in managing its own waste.

5.2.8 RDF would be sourced for the proposed Facility from the residual waste element (non-recyclable) from materials recycling facilities (MRFs). This represents a 15 million tonne (Mt) waste market, of which approximately 2.45 Mt of RDF is exported from the UK and the majority of the remainder is landfilled. The Facility would therefore contribute to the reduction in the export of waste from the UK and associated emissions; and divert material from landfill. There are nine counties which already have no landfill capacity and five English regions are set to run out within the next 10 years (Biffa, 2017). Furthermore, recovery of energy from residual waste is a preferential option on the waste hierarchy compared to landfill; and managing the UK waste within the UK, rather than exporting it, promotes the proximity principle at a national scale.

5.2.9 Overall, there is an urgent need for energy from waste facilities in the UK from both an energy need and waste management need perspective.

5.3 The Facility's Objectives

5.3.1 The Facility's objectives are presented in **Table 5-1**, alongside detail on how each of the objectives reflect – and are supported by – national and local planning policies.

5.4 Purpose of Need and Objectives within this assessment

5.4.1 The need for the Facility and the objectives have been used to screen the long list of potential alternative solutions identified in Step 3 (section 7) of this assessment in order to derive a short list (see section 7.3).

Table 5-1 Overview of the Proposed Development's Objectives

ID	Theme / topic	Objective	Basis of the Objective(s) (Emphasis Added)
1	Sustainable and renewable energy	To provide a sustainable and renewable form of energy recovery, to contribute towards meeting renewable targets and carbon emissions and is in line with the requirements of NPS EN-1 and EN-3 (DECC, 2011a; 2011b).	NPSs EN-1 and EN3 establish an urgent and substantial need for new energy generation infrastructure, with the desire for it to be renewable or low carbon, to achieve climate change targets established and made legally-binding under the Climate Change Act 2008. Section 2.5.2 of EN-3 (DECC, 2011b) states that *"The recovery of energy from the combustion of waste, where in accordance with the waste hierarchy, will play an increasingly important role in meeting the UK's energy needs. Where the waste burned is deemed renewable, this can also contribute to meeting the UK's renewable energy targets. Further, the recovery of energy from the combustion of waste forms an important element of waste management strategies in both England and Wales."* In addition, the UK is committed to reduce carbon emissions to net zero by 2050 (HM Government, 2021).
2	Waste management	To reduce the quantity of waste disposed to landfill.	The UK's Circular Economy Package (CEP) was published on 30 July 2020 by the UK, Welsh, Scottish and Northern Ireland governments and is predominantly the same as the European CEP. The CEP proposes a binding landfill target to reduce landfill to maximum of 10% of municipal waste by 2035. The CEP will also provide concrete measures to promote re-use and stimulate industrial symbiosis where one industry's by-product is reused as another industry's raw material. The proposed Facility will contribute to the CEP target to reduce landfill, promote reuse and stimulate industrial symbiosis.
3		To reduce the quantity of waste exported abroad.	The 'Proximity Principle' as established in the revised Waste Framework Directive (rWFD) (2008/98/EC; European Parliament, 2008), requires waste to be disposed of, or recovered in one of the nearest appropriate installations, by means of the most appropriate methods and technologies to ensure a high level of protection for the environment and public health.
4	Local employment and skills	To nurture and develop skills within Lincolnshire.	NPS EN-1 provides a list of relevant socio-economic impacts, which may include: • The creation of jobs and training opportunities; • The provision of additional local services and improvements to local infrastructure; • Effects on tourism; the impact of an influx of workers during the different construction, operation and decommissioning phases of the energy infrastructure; and • Cumulative impacts.
5		To create employment opportunities within Lincolnshire.	

ID	Theme / topic	Objective	Basis of the Objective(s) (Emphasis Added)
			Boston is located within the Greater Lincolnshire Local Enterprise Partnership (GLLEP). The GLLEP published their Strategic Economic Plan (SEP) in 2014 before refreshing it in Spring 2016 (GLLEP, 2016). The refreshed SEP outlines the ambition to secure new investment to accelerate the delivery of: • 13,000 new jobs; • Support up to 22,000 businesses; • Up to 100,000 new homes; and • An increase in the value of the Greater Lincolnshire economy by £3.2 billion. The SEP identifies that the low carbon economy is worth £1.2 billion per annum to the Greater Lincolnshire economy, employing over 12,000 people, and with significant potential to secure up to £60 billion of private investment over the next 15 years. Linked to this potential investment, the SEP identifies energy from waste, in addition to other low carbon or environmental goods and services such as biomass and biofuels, as a major opportunity for growth. One of the priorities for the low carbon sector includes the development of a Greater Lincolnshire-wide energy efficiency/waste management programme. The adopted local plan for Boston is the South-East Lincolnshire Local Plan 2011-2036 (South-East Lincolnshire Joint Strategic Planning Committee, 2019). This was adopted on 8 March 2019. Policy 7 (Improving South-East Lincolnshire's Employment Land Portfolio) states that: *"the South-East Lincolnshire authorities will, in principle, support proposals which assist in the delivery of economic prosperity and some 17,600 jobs in the area".*
6	Transport infrastructure.	To minimise adverse impacts on the function and efficiency of strategic transport infrastructure	NPS EN-1 recognises that a new energy NSIP may give rise to substantial impacts on the surrounding transport infrastructure and the decision maker should therefore ensure that the applicant has sought to mitigate these impacts, including during the construction phase of the development. Detrimental impacts on the surrounding transport infrastructure should be managed and mitigated during all stages of the development. Demand management measures must be considered, including other modes of transport such as water-borne or rail transport. Controls must be put in place for heavy goods vehicle (HGV)

ID	Theme / topic	Objective	Basis of the Objective(s) (Emphasis Added)
			movements, ensuring arrangements are in place for any abnormal disruption. The applicant is required to provide a Transport Assessment and Travel Plan that includes measures to manage demand, in the interests of mitigating transport impacts. Measures to improve access by public transport, walking and cycling are an essential component of Travel Plans.
7		To minimise carbon emissions associated with transportation	NPS EN-1 notes in Section 5.13 *"The consideration and mitigation of transport impacts is an essential part of Government's wider policy objectives for sustainable development as set out in Section 2.2 of this NPS.".* In addition, NPS EN-1 notes in Section 5.13: *"Water-borne or rail transport is preferred over road transport at all stages of the project, where cost-effective."* NPS EN-3 notes in Section 2.5.25: *"Government policy encourages multi-modal transport and the IPC (PINS) should expect materials (fuel and residues) to be transported by water or rail routes where possible. (See Section 5.13 of EN-1 on transport impacts). Applicants should locate new biomass or waste combustion generating stations in the vicinity of existing transport routes wherever possible."*
8	Location	To develop the Facility at a location that aligns with local planning policy.	The Lincolnshire Mineral and Waste Local Plan (LMWLP) and the South-East Lincolnshire Local Plan (SELLP) include spatial strategies and land allocation for specific developments. The adopted LMWLP Site Allocations document, adopted in December 2017, identifies the Principal Application Site as predominantly falling within 119 ha of land allocated as WA22-BO: Riverside Industrial Estate Waste Area (Lincolnshire County Council, 2017). The accompanying Sustainability Appraisal undertaken for the 'Site Locations' report confirms that the site is suitable for potential waste uses including, Energy from Waste (EfW) projects. The South-East Lincolnshire Local Plan (SELLP) (March 2019) identifies 89.7 ha of land as BO006 within the Riverside Industrial Estate, allocated for the purposes of Business (B1), General industrial (B2) and Storage or distribution (B8). Part of the Principal Application Site falls within this Local Plan allocation, with the remainder designated as countryside. However, it is noted that whilst the SELLP deals with all land use and development issues affecting South-East Lincolnshire, issues associated with minerals and waste are covered in the LMWLP.

ID	Theme / topic	Objective	Basis of the Objective(s) (Emphasis Added)
9	Waste	To minimise waste and apply the principles of waste hierarchy.	A number of priorities for sustainable waste management are set out at Section 5.14 of NPS EN-1, specifically: • prevention; • preparing for reuse; • recycling; • other recovery, including energy recovery; and • disposal.

6 Step 2 – Potential for Harm

6.1 Introduction

6.1.1 This chapter implements step 2 by:

- Describing the potential for harm. Specifically, the activities related to the project which key stakeholders believe may cause an adverse effect on the integrity of a protected site (or AEOI cannot be ruled out, beyond reasonable scientific doubt).
- Summarising specific aspects of the Facility which relate to the key stakeholders' envisaged potential for harm.
- Outlining the proposed mitigation for the potential harm as described in Appendix 17.1 HRA and HRA addendums.
- Identifying any residual potential for harm which requires assessment to determine if there are alternative solutions available.

6.2 What is the potential for harm?

6.2.1 As discussed in **paragraph 2.3.2** NE (and other Interested Parties, including the RSPB and LWT) have advised the ExA that (in their view) AEOI cannot be excluded for The Wash SPA and Ramsar and The Wash and North Norfolk Coast SAC. NE, RSPB and LWT have raised the concern that there is insufficient information to determine if the proposed wharf location could potentially result in AEOI on redshank, which are a qualifying species of The Wash SPA and a qualifying feature of The Wash Ramsar site. NE, RSPB and LWT have also raised concerns regarding insufficient information to determine whether increased vessel movements could potentially result in AEOI to the SPA bird populations using the feeding/roosting area at the mouth of The Haven which is within The Wash SPA. NE and LWT are also concerned with potential effects of additional vessel movements and anchorage on The Wash and North Norfolk Coast SAC harbour seal population. Note, these views were prior to HRA addendums (document references 9.13, REP1-026; 9.14, REP1-027 and 9.15, REP1-028) submitted at Deadline 1) For the purpose of this assessment of alternative solutions the Applicant has adopted, but not accepted, NE, RSPB and LWT's position.

6.3 Aspects of the Facility with the potential for harm

Construction and Presence of the Wharf

6.3.1 The construction and presence of the wharf will result in the loss of 1.5 hectares (ha) of mudflats and 1 ha of saltmarsh, which is not within The Wash protected site boundary.

6.3.2 NE and RSPB note the loss of foraging and roosting habitat for Annex I redshank through modification and disturbance. Annex I redshank are a qualifying species of The Wash SPA (noted by NE and RSPB) and a feature of The Wash Ramsar (noted by RSPB) and NE note that the saltmarsh is a priority habitat, functionally linked to The Wash SPA habitat. RSPB note the site as a high tide roost for redshank.

6.3.3 LWT mention the impacts of piling at the wharf site on The Wash and North Norfolk Coast SAC harbour seals.

Vessel Transit through The Haven

6.3.4 NE and RSPB also note that ship wash may result in erosion of the mudflats and saltmarsh along The Haven between the Application Site and the mouth of The Haven. NE and RSPB note this may result in a loss of foraging habitat for redshank.

6.3.5 NE and RSPB note effects due to disturbance caused by repeated additional vessel movements at the mouth of The Haven on feeding and roosting of SPA and Ramsar birds. NE note impacts particularly at high tide on the mouth of The Haven. RSPB notes disturbance from vessels includes visual, presence and noise disturbance.

6.3.6 NE notes particular concerns regarding redshank, black-tailed godwit, golden plover and lapwing. Redshank and black-tailed godwit are qualifying species of The Wash SPA and golden plover and lapwing are part of the waterbird assemblage as part of The Wash SPA. RSPB note concerns over redshank, dark-bellied brent goose, shelduck, oystercatcher, black-tailed godwit, curlew, common tern and turnstone which are qualifying species of The Wash SPA. In addition, RSPB note concerns over lapwing, golden plover (discussed above).

Vessel presence in The Wash Anchorage Site

6.3.7 NE and LWT note potential impacts associated with additional vessel movements and anchorage on The Wash and North Norfolk Coast SAC harbour seal

population. NE's concerns relate to harbour seals being injured and/or killed through entanglement with anchor chains or being dragged into unguarded propellors. LWT note the impact of disturbance from vessels (including noise and presence) on harbour seals.

6.3.8 RSPB note the impacts on foraging birds in the vessel anchorage area. RSPB notes ducks such as common scoter and goldeneye (qualifying species of The Wash SPA) will be more likely to be present where there are areas of open water.

6.4 What are the proposed mitigation measures?

Construction and Presence of the Wharf

6.4.1 As included within Appendix 17.1 (document reference 6.4.18, APP-111), in order to mitigate the loss of the roosting and foraging habitats outside of the SPA for waders, but in particular, for redshank, works will be carried out to enhance the habitat within a Habitat Mitigation Area (see Figure 17.9 (document reference 6.3.25, APP-091)), which is located at least 250 m away from the closest edge of the wharf, within Area B (see Figure 17.8 (document reference 6.3.25, APP-091)), to improve the existing roosting and foraging habitat. This will involve the creation of shallow pools (10-15cm deep) in the existing marshy habitat, re-profiling the edges of existing pools and low profile banks and, increasing the volume of 'roosting' rocks in the upper intertidal area. Further information on the Habitat Mitigation Area is provided within the Outline Landscape and Ecological Mitigation Strategy (OLEMS) (document reference 7.4, APP-123).

6.4.2 Some of the disturbance will be mitigated by ensuring that the noisiest activities (such as the piling works) are undertaken during periods which are not so sensitive for birds feeding on the mudflats or roosting on the saltmarsh. This would include undertaking the piling works during May to September.

6.4.3 The outline mitigation measures, as provided in paragraph 17.8.127 of Chapter 17 of the ES (document reference 6.2.17, APP-055), have been used to inform the Outline Marine Mammal Mitigation Protocol (MMMP) (document reference 9.12). These mitigation and management measures will be in place to reduce the potential impact to marine mammals, (e.g. harbour seal), they include:

- Mitigation for piling:
    - Pre-piling watch for marine mammals, when piling activities are undertaken within three hours of high water, following the standard JNCC 'Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise' (JNCC

Protocol)[2] (JNCC, 2010) for minimising the risk of injury to marine mammals from piling noise; and

- Soft-start and ramp-up procedures, for piling activities undertaken within three hours of high water.

Vessel Transit through The Haven

6.4.4 The outline mitigation measures, as provided in paragraph 17.8.127 of Chapter 17 of the ES (document reference 6.2.17, APP-055), have been used to inform the Outline Marine Mammal Mitigation Protocol (MMMP) (document reference 9.12, REP1-025). These mitigation and management measures will be in place to reduce the potential impact to marine mammals, (e.g. harbour seal), they include:

- Best practice measures for all vessels:
  - Observers on board each vessel, monitoring for marine mammals as the vessel makes its way through The Wash (including the anchorage area) and up The Haven.
  - Safety, weather and tidal conditions permitting, vessel speed limits of 6 knots for all vessels travelling within The Haven and The Wash, will reduce the potential for fatal collisions with marine mammals, including harbour seal.
  - Safety permitting, vessels will maintain the same course (if possible) and speed to give, if required, any seal time to avoid the vessel.

6.4.5 With regard to vessel movements causing disturbance to birds there is no mitigation proposed.

Vessel presence in The Wash Anchorage Site

6.4.6 Based on comments from NE and LWT within their Relevant Representations (RR-021 and RR-011 respectively) a further assessment of risks of injury and / or fatality of harbour seals within the vessel anchorage area was undertaken within the Marine Mammals addendum to the ES and HRA (document reference 9.14, REP1-027). This concluded no potential for adverse effect to harbour seals within The Wash and North Norfolk Coast SAC due to the presence of stationary vessels within the anchorage area, either during construction or operation. Therefore, no additional mitigation measures were included within the Outline Marine Mammal Mitigation Protocol with regards to the anchorage areas.

[2] https://data.jncc.gov.uk/data/31662b6a-19ed-4918-9fab-8fbcff752046/JNCC-CNCB-Piling-protocol-August2010-Web.pdf

6.5 What is the residual potential for harm?

6.5.1 NE (and other Interested Parties, including the RSPB and LWT) have advised the ExA that (in their view) AEOI cannot be excluded for The Wash SPA and Ramsar site and The Wash and North Norfolk Coast SAC, prior to HRA addendums (document references 9.13, REP1-026; 9.14, REP1-027 and 9.15, REP1-028) submitted at Deadline 1) (as discussed in **Section 6.3**). If the Secretary of State reaches the same conclusion as NE, then the DCO can only be granted if the requirements of HRA Stages 3 and 4 can be demonstrated and the necessary compensation measures can be secured.

6.5.2 Therefore, taking into account the above, the residual potential for harm to be examined in the Stage 3 HRA process is that there is potential for AEOI on SPA bird populations associated with habitat loss due to the construction and presence of the wharf and SPA bird populations and SAC harbour seal due to vessel movements within The Wash and The Haven.

7 Step 3 – Long List of Potential Alternative Solutions

7.1 Introduction

7.1.1 This chapter implements Step 3 of the methodology by:

- Identifying a long list of potential alternative solutions for the potential harm.
- Screening the long list of potential alternative solutions against the project need and objectives to produce a short list.

7.2 Long list of potential alternative solutions

7.2.1 For the purpose of this assessment, the Applicant has adopted, but not accepted, NE, RSPB and LWT's position that an adverse effect on the integrity of the Wash SPA and Ramsar site and The Wash and North Norfolk Coast SAC could result from the effect of the habitat loss at the Facility and the vessel movements at the mouth of The Haven and the anchorage site in The Wash. **Table 7-1** presents a long list of potential alternative solutions focussed on the effect of the wharf on habitat loss and disturbance due to increased vessel movements associated with the Facility according to the methodology described in **Section 1.3**.

Table 7-1 Long list of potential alternative solutions

Project Phase	Potential Alternative	Approach Included Within the DCO Application	Potential Alternative Solution	Further Details	Effect on the Potential for Harm on the SPA, Ramsar Site, SAC.
All	Do nothing	Construct an Energy from Waste Facility at Boston.	Not progressing the Facility.	Do not construct the Facility. This will remove the associated wharf and vessel movements.	Removes the loss of habitat and disturbance from additional vessel movements.
All	Alternative locations	Construct an Energy from Waste Facility at Boston.	Construct an Energy from Waste Facility at an alternative location.	Do not construct the Facility with the associated wharf and vessel movements.	Removes the loss of habitat and disturbance from additional vessel movements in The Haven.
Construction	Seasonal restrictions on vessel movements	Construction vessel movements not seasonally restricted.	Vessel movements for construction materials to avoid overwintering periods.	Vessel movements limited to May to September.	Removes the disturbance at a sensitive period (but would cause the construction programme to be extended).
Construction	Alternative methods – road movements instead of vessel movements	Mixed vessel and road movements.	All road movements.	Bring in all construction materials via road rather than vessel.	Removes construction period vessel movements at the mouth of The Haven.
Construction	Alternative methods – rail movements instead of vessel movements	Mixed vessel and road movements.	All rail movements.	Bring in all construction materials via rail rather than vessel.	Removes construction period vessel movements at the mouth of The Haven.
Operation	Alternative methods – RDF, lightweight	RDF, LWA and clay transported via vessel.	All road movements of RDF, LWA and clay.	N/A	Removes the requirement for vessel movements during

Project Phase	Potential Alternative	Approach Included Within the DCO Application	Potential Alternative Solution	Further Details	Effect on the Potential for Harm on the SPA, Ramsar Site, SAC.
	aggregate (LWA) and clay transported via road.				operation at the mouth of The Haven. Removes the need for the wharf.
Operation	Alternative methods – RDF, LWA and clay transported via rail.	RDF, LWA and clay transported via vessel.	All rail movements of RDF, LWA and clay.	Rail movements with either a rail head or HGVs to transport materials from an existing rail head.	Removes the requirement for vessel movements during operation at the mouth of The Haven. Removes the need for the wharf.
Operation	Capacity – could the amount of RDF required be reduced?	1,200,000 tonnes of RDF required for 103MW gross and 80MW net energy generation.	A reduction in the tonnage of RDF.	A reduction in the tonnage of RDF with a higher calorific value for the same energy generation.	Reduces the number of vessels during operation at the mouth of The Haven.
Operation	Alternative methods – larger vessels for transporting RDF	Vessels with a 2,500 tonne capacity for RDF. Resulting in 1.3 RDF vessels per day (therefore could be up to 2).	Vessels with a larger capacity for RDF therefore fewer vessels required.	Vessels with a minimum 3,300 tonne capacity, resulting in 1 RDF vessel per day.	Reduces the number of vessels during operation at the mouth of The Haven.
Operation	Timing – vessels to move along The Haven at the same time (where there is >1 vessel per day).	No restriction on when vessels travel up The Haven.	Vessels to wait at anchor point in The Wash until there are two vessels together.	N/A	Reduces the number of disturbance events at the mouth of The Haven during operation.
Operation	Timing – vessels leave the wharf just before the next ones arrive at The Haven.	No restriction on when vessels travel up The Haven.	Vessels leave the wharf just before the next ones arrive at The Haven.	N/A	Reduces the number of disturbance events at the mouth of The Haven during operation.

Project Phase	Potential Alternative	Approach Included Within the DCO Application	Potential Alternative Solution	Further Details	Effect on the Potential for Harm on the SPA, Ramsar Site, SAC.
Operation	Timing – vessels to only arrive during the night	No restriction on when vessels travel up The Haven.	Vessels to only use the night time high tides to travel along The Haven.	N/A	The large vessels would be less obvious to birds and therefore a reduction in disturbance events would be expected.

7.3 Screening the long list of potential alternative solutions

7.3.1 This section assesses whether the potential alternative solutions set out in **Table 7-1** could meet or deliver the need for the proposed Facility as defined in **Section 5** of this report, and the objectives as detailed in **Table 7-2**.

7.3.2 **Table 7-2** presents the findings of the screening exercise.

Table 7-2 Screening the long list of potential solutions

Potential Alternative Solutions	Does the Option Meet/Deliver the Project Need?	Does the Option Meet/Deliver the Project objectives?	Why and How?	Take to Step 4? (i.e. Passes Step 3?)
Do nothing	No	No	NPSs EN-1 and EN3 establish an urgent and substantial need for new energy generation infrastructure, with the desire for it to be renewable or low carbon, to achieve climate change targets established and made legally-binding under the Climate Change Act 2008.	No
Alternative locations	Yes	No	This option would be contrary to the local objective of providing employment and skills benefits within Lincolnshire and Boston. In addition, this option would reduce the potential of meeting the following objectives together: • the objective to develop the Facility at a location which aligns with local planning policy; and • to minimise adverse impacts and carbon emissions associated with transportation – which aligns with NPS EN-1 and EN-3.	No
Seasonal restrictions on vessel movements during construction	No	No	NPSs EN-1 and EN3 establish an urgent and substantial need for new energy generation infrastructure, with the desire for it to be renewable or low carbon, to achieve climate change targets established and made legally-binding under the Climate Change Act 2008. Seasonal restrictions on vessel movements during construction could lead to an extension in the construction programme which would have wider implications on disturbance. The main import during construction is for raw materials such as for the production of concrete at the concrete batching plant. The availability of concrete is vital for multiple key pieces of infrastructure, therefore if there were seasonal restrictions this could result in infrastructure being delayed for several months. In addition, a delay in the	No

Potential Alternative Solutions	Does the Option Meet/Deliver the Project Need?	Does the Option Meet/Deliver the Project objectives?	Why and How?	Take to Step 4? (i.e. Passes Step 3?)
			construction programme would be contrary to the urgent need detailed above.	
Alternative methods – road movements instead of vessel movements during construction	Yes	No	A detailed analysis of the option for road transfer during construction is provided in **Appendix 1**. This assessment notes that the peak daily demand would be 278 daily HGV movements and it is likely that the peak assessed in Chapter 19 (Traffic and Transport) of the ES would occur more frequently throughout the 5-year construction duration and for a longer periods, with potential associated increases in residual impact significance. This is therefore contrary to objectives 6, 7 and NPS EN-1 which notes *"water-borne or rail transport is preferred over road transport at all stages of the project, where cost-effective".*	No
Alternative methods – rail movements instead of vessel movements during construction	Yes	No	A detailed analysis of the option for rail transfer during construction is provided in **Appendix 1**. It has been calculated that there would be a weekly peak requirement for 16 trains movements or up to three trains per day. Transfer of construction materials by rail would need to be shuttled to the Facility by road, resulting in at least 278 two-way HGV movements. Due to the associated road movements and potential associated increases in impact significance this option would be contrary to objective 6.	No
Alternative methods – RDF, lightweight aggregate (LWA) and clay transported via road during operation	Yes	No	A detailed analysis of the option for road transfer during operation is provided in **Appendix 1**. This assessment calculates that the transfer from water transport to road transport could generate a total of 332 additional two-way HGV movements per day (Monday to Saturday) associated with the import of RDF and clay and the export of LWA. The continuous duration of increased road movements would	No

Potential Alternative Solutions	Does the Option Meet/Deliver the Project Need?	Does the Option Meet/Deliver the Project objectives?	Why and How?	Take to Step 4? (i.e. Passes Step 3?)
			increase the significance of the impacts on local sensitive receptors noting additional movements along the A16, would result in potential delays at junctions, as well as associated noise and air quality impacts. This is therefore contrary to objectives 6, 7 and NPS EN-1 which notes *"water-borne or rail transport is preferred over road transport at all stages of the project, where cost-effective".*	
Alternative methods – RDF, LWA and clay transported via rail during operation	Yes	No	A detailed analysis of the option for rail transfer during operation is provided in **Appendix 1**. The transfer to rail transport for RDF would result in at least six freight trains per day into and out of the Port of Boston. In addition, there would be a requirement for 24 hour working to facilitate a highly optimised rail delivery scenario which would necessitate numerous closures of the A16 and opening of the swing bridge, which would result in potentially significant delays and severance for road users, and disruption to river traffic. In addition, 24-hour working could potentially induce significant noise impacts on local sensitive receptors. It is also concluded that it is unlikely that there is sufficient rail capacity to accommodate the import of clay or export of LWA and therefore and a further 66 daily HGV two-way movements would be required to import/export these materials. Due to the associated road closures, severance, disruption to river traffic and likely noise impacts this option would be contrary to objective 6.	No
Capacity – could the amount of RDF required be reduced?	Yes	Yes (but to a lesser extent)	This option does meet the project need and objectives because it would still be delivered in broadly the same way as currently proposed. However, it would result in a lower quantity of waste being diverted from landfill and/or from export abroad (objectives 2 and 3).	Yes

Potential Alternative Solutions	Does the Option Meet/Deliver the Project Need?	Does the Option Meet/Deliver the Project objectives?	Why and How?	Take to Step 4? (i.e. Passes Step 3?)
Alternative methods – larger vessels for transporting RDF during operation	Yes	Yes	This option would meet the project need and objectives because it would still be delivered in broadly the same way as currently proposed.	Yes
Timing – vessels to move along The Haven at the same time (where there is >1 vessel per day) during operation	Yes	Yes	This option would meet the project need and objectives because it would still be delivered in broadly the same way as currently proposed.	Yes
Timing – vessels leave the wharf just before the next ones arrive at The Haven during operation	Yes	Yes	This option would meet the project need and objectives because it would still be delivered in broadly the same way as currently proposed.	Yes
Timing – vessels to only arrive during the night during operation	Yes	Yes	This option would meet the project need and objectives because it would still be delivered in broadly the same way as currently proposed.	Yes

7.4 Short list of alternative options

7.4.1 The screening exercise set out in **Table 7-2** reveals that the following potential alternative solutions need to be assessed in Step 4, to determine if they are 'feasible' alternative solutions:

- Capacity – could the amount of RDF required be reduced;
- Alternative methods – larger vessels for transporting RDF during operation;
- Timing – vessels to move along The Haven at the same time (where there is >1 vessel per day) during operation;
- Timing – vessels leave the wharf just before the next ones arrive at The Haven during operation; and
- Timing – vessels to only arrive during the night during operation.

8 Step 4 – Assessment of Feasible Alternative Solutions

8.1.1 This section implements Step 4 of the methodology by assessing the feasibility of each short-listed potential alternative solution, as detailed above.

8.1.2 Each of the short-listed alternatives are assessed in **Table 8-1**, in accordance with the methodology detailed in **Section 4** of this report.

Table 8-1 Step 4: assessing the feasibility of short-listed options

Potential alternative solution	Legally feasible?	Technically feasible?	Financially feasible?	Take to Step 5?
Capacity – could the amount of RDF required be reduced?	✓	A higher calorific value (CV) would result in a lower feedstock requirement to achieve the same capacity to the National Grid. However, the design case for the Facility is a calorific value (CV) of 10.1 MJ/kg, which is based on a mid-range value based on a range of calorific values (8-14 MJ/kg). It is not guaranteed that this value could be increased particularly as waste CV values could vary over the operational phase of the Facility. Therefore, it is not technically feasible to assume a higher CV would be available and could be utilised over the entire operational phase of the Facility.	As this option has been ruled out for technical reasons, its financial feasibility has not been considered.	No
Alternative methods – larger vessels for transporting RDF during operation	✓	The design of the Facility is based on the maximum vessel allowance (particularly the beam of 13.6m) within the Port of Boston wet dock and in-river turning circle. However, the wet dock entrance and in-river turning circle are to be widened (as part of the Boston Barrier project) to increase the maximum size of vessels that can be accommodated. This will increase the beam allowance to 16.5m. Therefore, the vessel size could be increased to circa 3,500 tonnes.	✓	Yes
Timing – vessels to move along The Haven at the same time (where there is >1 vessel per day) during operation	✓	Vessels within The Haven can currently move in convoy following the Port of Boston pilots meeting the vessels at the Anchor Point in The Wash. However, this process will be managed by the Port of Boston pilots and will not be in the control of the Facility. The management	As this option has been ruled out for technical reasons, its financial feasibility has not been considered.	No

Potential alternative solution	Legally feasible?	Technically feasible?	Financially feasible?	Take to Step 5?
		of vessels by the Port will be dependent on multiple external factors for example other vessels, seasons, tidal conditions and weather conditions. Therefore, it cannot be guaranteed that this is a technically feasible option, although it may occur in practice on occasion.		
Timing – vessels leave the wharf just before the next ones arrive at The Haven during operation	✓	This is technically feasible but unlikely to occur due to the number of vessels required to leave the berth to make space for incoming vessels. In addition, the vessels will be restricted in their ability to pass each other on The Haven, as this will only be possible at the Facility wharf, within the downstream section of The Haven between Tab's Head and Hobhole, and for approximately half a mile upstream of Hobhole. Therefore, moving the vessels at the same time cannot be guaranteed.	As this option has been ruled out for technical reasons, its financial feasibility has not been considered.	No
Timing – vessels to only arrive during the night during operation	✓	Due to the number of vessels required for the Facility all available high tides must be used. In addition, depending on the time of year there will not always be a high tide in the hours of darkness. Therefore, in order to maintain operation, this option would not be feasible.	As this option has been ruled out for technical reasons, its financial feasibility has not been considered.	No

9 Step 5 – Feasible Alternative Solutions which have a Lesser Effect on the Integrity of any Protected Site

9.1.1 This section implements the final step of the Stage 3 alternatives solutions assessment, whereby alternative solutions determined to be feasible are assessed in accordance with Stage 2 of the HRA process.

9.1.2 The only option which was considered feasible was for larger vessels for transporting RDF during operation. If the vessels had the capacity of at least 3,300 tonnes, this option would reduce the vessels movements for RDF to one per day. However, on 100 days of the year there would still be an additional vessel per day associated with the LWA and clay vessel movements. Overall, there would be up to nine vessel movements per week (as opposed to up to 12 as noted in Chapter 5 Project Description (document reference 6.2.5, APP-043)).

9.1.3 Although this option would result in a reduced number of vessel movements there would continue to be repeated vessel movements on a daily basis (including the existing level of vessel movements entering and leaving the Port of Boston) at the mouth of The Haven which is one of the key reasons NE, RSPB and LWT have stated that an AEOI cannot be excluded. The vessels would still require anchorage in The Wash, which NE and LWT have noted concerns over effects to harbour seals associated with The Wash and North Norfolk Coast SAC. In addition, this option would not affect the presence of the wharf and the associated loss of foraging and roosting habitat for Annex I redshank. NE also note that the saltmarsh is a priority habitat, functionally linked to The Wash SPA habitat. Therefore, overall, this alternative solution is unlikely to change the view taken by NE, RSPB and LWT that AEOI cannot be excluded for the Wash SPA and Ramsar site and The Wash and North Norfolk Coast SAC.

10 Conclusions

10.1.1 NE (and other Interested Parties, including the RSPB and LWT) have advised the ExA that (in their view) there is insufficient information to exclude AEOI for The Wash SPA and Ramsar and The Wash and North Norfolk Coast SAC. Therefore, the Applicant has adopted, not accepted, this position for an assessment of alternative solutions.

10.1.2 This assessment of alternative solutions has considered a long list of potential alternative solutions to assess whether any of these solutions would have a lesser effect on the integrity on The Wash SPA and Ramsar and The Wash and North Norfolk Coast SAC. This long list was screened against the project need and project objectives to produce a short list as follows:

- Size – could the amount of RDF required be reduced;
- Alternative methods – larger vessels for transporting RDF during operation;
- Timing – vessels to move along The Haven at the same time (where there is >1 vessel per day) during operation;
- Timing – vessels leave the wharf just before the next ones arrive at The Haven during operation; and
- Timing – vessels to only arrive during the night during operation.

10.1.3 The feasibility of each short-listed potential alternative solution was assessed, and all options apart from one were considered not to be feasible due to technical feasibility. This assessment demonstrates that there is one feasible alternative solution: using larger operational vessels for RDF with a minimum 3,300 tonne capacity.

10.1.4 However, the assessment has concluded that this solution is unlikely to change the view taken by NE, RSPB and LWT that AEOI cannot be excluded for the Wash SPA and Ramsar site and The Wash and North Norfolk Coast SAC. There would continue to be daily vessel movements at the mouth of The Haven, which NE, RSPB and LWT have particular concerns with regards to disturbance to SPA birds including redshank. The vessels would still require anchorage in The Wash, which NE and LWT have noted concerns over effects to harbour seals associated with The Wash and North Norfolk Coast SAC. In addition, this option does not affect the requirement for a wharf at the Facility which NE and RSPB have noted is a priority habitat, functionally linked to The Wash SPA habitat and a foraging and roosting habitat for redshank.

11 References

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Appendix 1

Transport Alternative Options Assessment

Note / Memo

HaskoningDHV UK Ltd.
Mobility & Infrastructure

To:	National Infrastructure Planning
From:	Alternative Use Boston Projects Limited
Date:	11 November 2021
Our reference:	PB6934-ZZ-XX-NT-Z-4046
Document reference:	9.28
Planning Inspectorate Reference:	EN010095
Classification:	Project related
Checked by:	Andrew Ross and Matt Simpson
Approved by:	Paul Salmon

Subject: **Boston Alternative Energy Facility - Transport Options Note**

1.1 Introduction

This note considers the potential impacts of transporting Refuse Derived Fuel (RDF), Lightweight Aggregate (LWA) and construction materials to and from the proposed Boston Alternative Energy Facility (the 'Facility') by alternative modes other than water.

The purpose of this note is to evaluate land-based alternatives for transporting RDF, LWA and construction materials, by comparing the potential residual environmental impacts with those assessed in the Development Consent Order (DCO) application, Chapter 19 (Traffic and Transport) of the ES (document reference 6.2.19, APP-057).

Specifically, the note considers the potential effects of transferring operation and construction freight deliveries from water to road or rail.

1.2 Background

A DCO application for the Facility was submitted by Alternative Use Boston Projects Ltd. in March 2021. The following section provides an overview of the pertinent Facility background data; full details are provided within Chapter 5 (Project Description) of the Environmental Statement (ES) (document reference 6.2.5, APP-043).

The Facility is proposed to be located at Riverside Industrial Estate, Boston, Lincolnshire. The Riverside Industrial Estate is adjacent to the tidal River Witham (known as 'The Haven') and down-river from the Port of Boston (PoB).

Operation Phase

The proposed Facility would deliver approximately 80 megawatts electric (MWe) of renewable energy to the National Grid using RDF as a feedstock into a thermal treatment facility generating power via steam turbine generators. It is proposed that the RDF would be transported by vessel along The Haven before being offloaded at a new wharf and transported by conveyor to the Facility. Up to 1,200,000 tonnes of processed RDF would be supplied into the thermal treatment plant each year.

The thermal treatment of the RDF and the associated Air Pollution Control (APC) will generate ash as a by-product. Rather than export this material to a tip, it is proposed that the Facility will include a LWA plant that will combine the ash with imported sediment or clay binder to form LWA. It is proposed that the clay/sediment would be imported by vessel along The Haven before being offloaded at the new wharf and transported to the LWA facility. The vessels utilised to import clay/sediment would also be used to export the processed LWA. It is forecast that the LWA plant could produce approximately 300,000 tonnes of LWA per annum.

Construction Phase

Chapter 19 (Traffic and Transport) of the ES (document reference 6.2.19, APP-057) outlines that the delivery of raw materials for the construction phase will be via both water and road facilitated by a newly constructed wharf. The first phase of the wharf construction will be programmed early to allow a proportion of the raw materials to be delivered by vessel rather than by local roads. It is estimated that it will take approximately six months to construct the first section of the wharf to allow initial deliveries of raw materials to be received by water.

1.3 Existing Situation

This section presents a review of the existing road and rail network in the vicinity of the Facility.

1.3.1 Road

Chapter 19 (Traffic and Transport) of the ES outlines that the Facility would be accessed by road via the Riverside Industrial Estate's existing road network from Marsh Lane via Nursery Road and Bittern Way.

A traffic and transport study area has been defined which comprises of 12 links (discrete lengths of road with similar highway/spatial character and traffic flows) and provides a comprehensive review of the baseline characteristics for each link.

The background traffic annual average daily traffic (AADT) flows in 2021 and 2025 (earliest operational year) and assessed sensitivity for all 12 links are summarised in **Table 1**.

Table 1: Summary of existing link sensitivity and traffic flows

Link	Description	Link Sensitivity	Background 2021 Flows (24hr AADT)		Background 2025 Flows (24hr AADT)	
			All vehicles	HGVs	All vehicles	HGVs
1	Marsh Lane (Wyberton Low Rd to Lealand Way)	Low	6,921	451	7,404	482
2	Marsh Lane (Wyberton Low Rd to A16)	Medium	9,532	467	10,198	499
3	A16 (south of Marsh Ln)	Low	19,911	979	21,303	1,047
4	A16 (north of Marsh Ln to London Rd)	Low	25,519	988	27,303	1,057
5	A16 (Spalding Road)	Low	28,420	1,125	30,406	1,204
6	A52 (Liquorpond Street)	High	31,003	709	33,170	758

Link	Description	Link Sensitivity	Background 2021 Flows (24hr AADT)		Background 2025 Flows (24hr AADT)	
			All vehicles	HGVs	All vehicles	HGVs
7	A16 (John Adams Way)	Medium	41,573	1,481	44,479	1,584
8	B1397 (London Road)	High	12,809	244	13,704	261
9	Wyberton Low Road	High	3,042	10	3,254	11
10	Nursery Road / Lealand Way	Low	1,664	104	1,780	111
11	Marsh Lane (south of Lealand Way)	Low	3,328	208	3,561	223
12	Bittern Way	Low	1,092	52	1,168	56

1.4 Rail

There are no existing rail lines adjacent to the proposed Facility. Consequently, any movement by rail would require the loads to be 'shuttled' by road from an existing or new rail head to the Facility.

Figure 1 shows that Boston is located towards the eastern end of a rail route from Nottingham via Grantham, Sleaford and Boston to Skegness and is known as the 'Poacher Line'. The route from Nottingham is approximately 80 miles long and is largely double track but there are single track sections between Sleaford and Heckington (7.7 miles), Hubberts Bridge and Sleaford Junction to the west of Boston (6.0 miles), and the north end of Boston Station and former Sibsey Junction (7.6 miles).

The route is currently served by passenger trains between Nottingham and Skegness at regular hourly intervals in each direction throughout the day. Currently the railway at Boston is operational between circa 06:00 and 22:30.

In addition to the passenger services, the Poacher Line also accommodates existing freight services. Sidings are located adjacent to the A16 Spalding Road within the Boston area (understood to be currently used for the movement of aggregates), and a rail connected terminal is located within the PoB (operated by the Port Authority).

The PoB has advised that the port currently accommodates freight services associated with the export of steel coil and averages approximately four services a week.

The route between Nottingham and Boston has a rating of Route Availability (RA) of 8 which permits axle loads of up to 22.5 tonnes and a permitted loading gauge of W8 which permits the use of all conventional freight wagons and standard height container wagons conveying up to 8' 6" high maritime containers. The maximum permitted line speed is 60mph for passenger trains and 35mph for freight trains.

Figure 2 provides detail of the rail facilities within the Boston area. Rail access to and from both PoB from the Poacher Line is from the down track only via a single slip crossover, this route also provides a route to the 'Sleaford Sidings' (west of the A16). The Sleaford Sidings comprise two tracks forming an effective loop length of 250m. The route to the PoB requires trains to cross the A16 Spalding Road and London Road by level crossing and River Witham by a swing bridge.

Within the PoB there are two rail connected transit sheds (currently used for steel deliveries) and a pair of external sidings. Measuring from aerial imagery, it is noted that these two sidings provide an approximate length of 125m for loading/unloading rail wagons (250m in total).

1.5 Operational Road and Rail Transfer Evaluation

1.5.1 Operational Parameters

Chapter 5 (Project Description) of the ES (document reference 6.2.5, APP-043) outlines that up to 1,200,000 tonnes of processed RDF would be supplied into the thermal treatment plant each year and 300,000 tonnes of LWA would be exported.

The RDF would be supplied to the Facility in 'bales', the approximate dimensions of these bales are outlined in **Table 2**.

Table 2: RDF bales dimensions

Dimensions	Values
Length of RDF bales (m)	1.4
Width of RDF bales (m)	1.2
Height of RDF bales (m)	1.1
Volume of RDF bales (m^3)	1.848
Min weight of RDF bales (tonnes)	1.3
Max. weight of RDF bales (tonnes)	1.5
Density of RDF bales (tonnes / m^3)	0.7 – 0.8

1.5.2 Road Transfer

When transported by road, RDF is typically delivered on curtain sided HGVs. A curtain sided trailer can typically carry up to 29 tonnes, or a maximum volume of 91m^3.

It is noted from **Table 2** that RDF has a density of 0.7 – 0.8 tonnes/m^3. A curtain sided trailer has a volume of 91m^3 which equates to approximately 73 tonnes of RDF; it can therefore be noted that weight rather than volume is the limiting factor for HGV deliveries.

Assuming a conservative 312 working days per year (Monday to Saturday) and a maximum HGV payload of 29 tonnes it can be calculated that there could be a minimum of 133 laden arrivals and 133 unladen departures of RDF (266 two-way HGV movements) per day associated with delivery of RDF.

In addition to the import of RDF, there would also be a requirement for clay to be imported and LWA to be exported. It would be reasonable to assume that the same HGVs that import clay or RDF could also be used to export LWA. This process is known as 'back hauling' and reduces the number of unladen trips.

Assuming back hauling, 312 working days per year, and a maximum HGV payload of 29 tonnes, it can be calculated that the production of 300,000 tonnes of LWA could generate 66 two-way HGV movements per day.

It is therefore calculated that the transfer from water transport to road transport could generate a total of **332** additional two-way HGV movements per day (Monday to Saturday) associated with the import of RDF and clay and the export of LWA.

HGV Distribution

Road access to the Facility would be via Marsh Lane (links 1, 2 and 11) and Bittern Way (link 12) towards the A16. Drivers would then either head north on the A16 (link 4) or south on the A16 (link 3). Drivers travelling south on the A16 would likely travel towards destinations to the south and east of the UK, whilst drivers travelling north on the A16 would travel towards destinations to the north of the UK.

As a result of the feedback received from Preliminary Environmental Information consultation, Chapter 19 (Traffic and Transport) determines that no HGV construction traffic would route through the A52 Liquorpond Street. This commitment would also equally need to be applied to the operational phase and therefore it is assumed that deliveries of RDF from the east would approach on the A16 (south) rather than using the more direct A52 route.

The supply chain for RDF and clay and the destination of LWA is not established at this stage and could be subject to amendment as contracts and suppliers change. Therefore, in order to consider a worst case, it has been assumed that 100% of HGV traffic would assign both to the A16 north and south.

The forecast additional 332 two-way daily HGV movements have been added to the proposed operational miscellaneous HGV movements (30 two-way daily HGV movements) set out in Chapter 19 (Traffic and Transport) of the ES to give a resultant HGV demand of 362 two-way daily HGV movements. The distribution of these movements is summarised in **Table 3**. The table also provides a comparison of the peak daily operational flows with the forecast background daily traffic flows for 2025 for all links where there would be a change in HGV traffic as a result of transferring materials to road.

Table 3: Link screening

Link	Description	Link Sensitivity	Background 2025 Flows (24hr AADT)		Operational Vehicle Movements		Percentage Increase	
			All vehicles	HGVs	All vehicles	HGVs	All vehicles	HGVs
1	Marsh Lane (Wyberton Low Rd to Lealand Way)	Low	7,404	482	535	362	7.2%	75.1%
2	Marsh Lane (Wyberton Low Rd to A16)	Medium	10,198	499	535	362	5.2%	72.5%
3	A16 (south of Marsh Ln)	Low	21,303	1,047	388	362	1.8%	34.6%
4	A16 (north of Marsh Ln to London Rd)	Low	27,303	1,057	509	362	1.9%	34.2%

Link	Description	Link Sensitivity	Background 2025 Flows (24hr AADT)		Operational Vehicle Movements		Percentage Increase	
			All vehicles	HGVs	All vehicles	HGVs	All vehicles	HGVs
5	A16 (Spalding Road)	Low	30,406	1,204	483	362	1.6%	30.1%
7	A16 (John Adams Way)	Medium	44,479	1,584	422	362	0.9%	22.9%
10	Nursery Road / Lealand Way	Low	1,780	111	354	181	19.9%	163.1%
11	Marsh Lane (south of Lealand Way)	Low	3,561	223	188	181	5.1%	81.2%
12	Bittern Way	Low	1,168	56	181	181	15.5%	323.2%

Road Evaluation

With the exception of Bittern Way, the percentage increase (magnitude of effect) of HGVs per link is of a similar quantum to the effects assessed and mitigated for peak construction in Chapter 19 (Traffic and Transport) of the ES. Bittern Way would be potentially subject to major adverse impacts and would require infrastructure mitigation to accommodate the volume of HGV demand.

However, it should be noted that the assessed peak construction HGV demand would be very short in duration (see **Table 4** below). By contrast, road based operational impact would be for the asset life of the Facility, 312 working days per year. This continuous duration would increase the significance of the impacts on local sensitive receptors, noting additional movements along the A16 would result in potential delays at junctions, as well as associated noise and air quality impacts. Of particular note, traffic heading north on the A16 would travel through the existing Havenside Bridge and Bargate Bridge Air Quality Management Areas (AQMAs).

Table 4: Yearly Construction HGV Movements

Year	Average Daily HGV Movements	Peak Daily HGV Movements	Peak Duration
Year 1 (Oct 2021 - Mar 2022)	56	293	1 week
Year 2 (Mar 2022 - Mar 2023)	66	220	1 week
Year 3 (Mar 2023 - Mar 2024)	70	136	2 weeks
Year 4 (Mar 2024 - Mar 2025)	31	54	3 weeks
Year 5 (Mar 2025 – Dec 2025)	9	11	n/a

Source: Chapter 19 (Traffic and Transport) Table 19-17 of the Environmental Statement (document reference 6.2.19, APP-057)

1.5.3 Rail Transfer

A desktop evaluation of rail demand and distribution has been undertaken in context of the baseline situation. The assessment has assumed that current signalling functionality and methods of working would not preclude the postulated train paths and method of working other than extending the hours for which the railway was open operational.

Train paths

In order to understand if the existing Poacher Line to the PoB could accommodate additional freight train movements, a train graph of the weekday timetable is presented in **Figure 3**. It can be seen from **Figure 3**, that eastbound services tend to 'cross' westbound services just to the east of Heckington (the location of Heckington is shown on **Figure 1**) and the end of the first single line section. This means that with the current Poacher Line timetable in place, additional eastbound freight trains would need to wait at Sleaford until the westbound service had cleared the single track section (at circa 12 to 14 minutes past the hour) and then cover the 16.5 miles between Sleaford and the end of the second single track section at Boston before the next westbound Poacher Line service was due to leave Boston (at circa 47 to 50 minutes past the hour). This gives a window of 35 minutes to cover the single line section.

Passenger trains between Sleaford and Boston are timetabled to take 24 minutes with one stop, whilst freight trains are understood to be limited to 35mph so would take a minimum of 27 minutes. The freight train would also then need to reverse into Sleaford Sidings at Boston either in advance of the westbound train or after the departure of the westbound train and before the arrival of the next eastbound passenger train (which currently varies between 3 and 20 minutes past the hour).

With the current layout at Boston, westbound freight trains would need to move out from the sidings onto the down main line after an eastbound train had gone through (at 16 to 20 minutes past the hour) and then change direction and clear the single track section at Sleaford before the next eastbound passenger train was due to leave Sleaford (at 53 to 56 minutes past the hour). This would only be feasible if the formed train were to reverse out of the sidings and then swiftly begin its westbound journey.

Based upon the baseline evaluation, it is assumed that as a best case, freight train paths could be available at two hourly intervals in each direction throughout the day between Sleaford and Boston.

Train Configuration

Section 1.3 outlines that the maximum train length that can be accommodated at the PoB Sidings would be 125m. However, this could potentially be increased to 250m by combining two sets of wagons within the existing (250m long) Sleaford Sidings. It would not be feasible to form longer sets as this would impact upon the main Poacher Line through Boston.

Two existing types of wagon (Van) and open (Box) wagon types are considered to be potentially suitable for the transport of RDF. Considering the limitations on axle loads (see section **1.3**) and train length (max. 250m) an assessment of the potential number of trains that would be required to transport 1,200,000 tonnes of RDF per annum has been undertaken. The derivation is presented in **Appendix A** and outlines a best case in terms of the fewest number of trains that would be required per day.

It can be identified from **Appendix A** that utilising either a Van or Box type wagon the minimum required number of trains would likely to be at least six per day, with a payload of circa 730 - 820 tonnes of RDF

per train (equivalent of up to 690 bales per train). The likely gross trainload trailing weight of approximately 1,200 to 1,500 tonnes would be within the capability of the most common UK freight locomotive[1].

Train Distribution

Currently, the Poacher Line is operational between circa 06:00 and 22:30 (16.5 hours a day), therefore, to accommodate the proposed six RDF trains per day and maintain capacity for at least one steel train per day (as per existing operations at the PoB), there would be a maximum cycle time of 165 minutes (16.5 hours divided by six).

It is conservatively estimated that it would take 30 minutes for each of the two portions of the train to move between the PoB and Sleaford Sidings and then back again (60 minutes in total). The sequence of movements being generally as follows:

1. The 250m long train pulls into the Sleaford Sidings loaded with RDF;
2. The mainline Class 66 locomotive is uncoupled and a shunter locomotive from the PoB collects the first 125m of wagons to transfer to the sidings in the PoB (crossing the A16 and Swing Bridge);
3. The wagons are unloaded, and the shunting locomotive pulls the first set of empty wagons out of the PoB to Sleaford Sidings (crossing the Swing Bridge and A16);
4. The shunting locomotive is decoupled from the first 125m of wagons and then coupled to the second 125m of wagons before shunting them to the sidings in the PoB (crossing the A16 and Swing Bridge);
5. The wagons are unloaded, and the shunting locomotive pulls the second set of empty wagons out of the PoB to Sleaford Sidings (crossing the Swing Bridge and A16);
6. The two sets of wagons are coupled, and the shunting locomotive is decoupled; and
7. The mainline Class 66 locomotive is recoupled, and the train departs from Sleaford Sidings towards the main Poacher Line.

The total process of shunting between the Sleaford Sidings and PoB outlined above is conservatively estimated to take at least 60 minutes, providing approximately 52 minutes per 125m of wagons to unload the RDF. Each train would carry up to 690 bales, therefore for each half of the train there would be a requirement to unload 345 bales in 40 minutes. At just nine seconds per bale this time allowance would not be sufficient.

It is therefore determined that to allow the movement of six RDF trains per day and the continued use of the PoB for steel deliveries, there would need to be an extension of the operational working times of the railway from 16.5 hours a day to 24 hours per day.

With 24 hour working, the maximum cycle time would extended to 240 minutes (24 divided by six), allowing up to 90 minutes for unloading (per 125m of wagons) of the RDF. This revised scenario would provide approximately 16 seconds to unload each bale. Recognising this highly optimised rail delivery scenario, it is considered unlikely that additional capacity could be found for the import of clay or export of LWA, necessitating transfer to road haulage.

It is also noteworthy that the optimised rail delivery scenario would leave no capacity for PoB expansion or aggregate delivery via the Sleaford Sidings.

It is further noted that the RDF shunting between Sleaford Sidings and the PoB would result in at least 24 closures of the A16 and opening of the swing bridge per day (above those currently occurring) which would

[1] Class 66

result in potentially significant delays and severance for road users and disruption to river traffic. Potentially 12 additional closures could occur if the shunting locomotive were to return to the PoB between loads.

Rail Evaluation

The transfer to rail transport would result in at least six freight trains per day into and out of the PoB. In addition, there would be a requirement for 24hour working to facilitate a highly optimised rail delivery scenario which would necessitate numerous closures of the A16 and opening of the swing bridge, which would result in potentially significant delays and severance for road users, and disruption to river traffic. Furthermore, 24-hour working could potentially induce significant noise impacts on local sensitive receptors.

The highly optimised RDF rail delivery scenario would constrain PoB rail expansion and deliveries of aggregates by rail via the Sleaford Sidings.

If construction of the wharf was to be avoided completely, the RDF bales would need to be shuttled by road from the PoB to the Facility, inducing a total of 332 additional two-way HGV movements per day (Monday to Saturday) on the local highway network with further potential for driver delay, noise and air quality impacts on local receptors. It is unlikely that there is sufficient rail capacity to accommodate the import of clay or export of LWA and therefore and a further 66 daily HGV two-way movements would be required to import/export these materials (see section 1.5.2 for HGV demand derivation).

1.6 Construction Road and Rail Transfer Evaluation

1.6.1 Background

Chapter 19 (Traffic and Transport) of the ES includes an assessment of the worst case period for material deliveries of 293 two-way HGV movements, in year 1, i.e. prior to the completion of the wharf (**Table 4** refers).

Following completion of the wharf, it is proposed that a quantity of materials (including aggregates and steel) would be imported by vessel for the remainder of the construction phase. Overall, it is anticipated that there could be up to 89 vessel movements over four years, each of which would carry approximately 2,500 tonnes. This strategy would save approximately 22,250 two-way HGV movements (assuming a typical 20 tonne HGV payload), or an average of 18 two-way HGV movements per day[2].

1.6.2 Road Transfer

Appendix 19.3 (APP-115) of the ES includes derivation of the traffic movements throughout the five year construction phase, **Table 4** of this note summarises the yearly HGV demand.

During the peak construction periods it is anticipated that there could be a requirement for five vessels per week (12,500 tonnes per week). If the 12,500 tonnes of water delivered materials were to be transferred to road, there would need to be an additional 208 two-way HGV movements per day reassigned[3]. To evaluate the impact of this transferred demand it is necessary to apply the additional HGV movements to the HGV movements assessed in Chapter 19 (Traffic and Transport) of the ES (APP-057).

[2] Assuming a four year construction phase and 312 working days per year.
[3] Assuming a typical 20 tonne HGV payload and deliveries are spread evenly over six days

Year 1 and Year 2 peak HGV demand is related to the accelerated construction of the quay to accommodate water-based freight deliveries and, is by definition unlikely to coincide with peak vessel movements. Therefore, the transferred 208 daily two-way HGV movements have been applied to the year 3 worst case daily average HGV movements of 70 to derive a peak of 278 two-way daily HGV movements. This quantum is similar to the peak construction demand of 293 two-way daily HGV movements determined in Chapter 19 (Traffic and Transport) of the ES and assessed to have no significant residual environmental impacts.

Road Evaluation

The transfer from water deliveries would lead to a peak daily demand of 278 daily HGV movements. This magnitude is within the worst case construction demand of 293 two-way HGV movements and the resultant impacts assessed and mitigated in Chapter 19 (Traffic and Transport) of the ES.

However, from **Table 4** it is noted that the peak year 1 and year 2 HGV construction demand was only estimated to occur for a 1 week duration. Water transferred HGV demand would change the assessed HGV profile and it is likely that the peak would occur more frequently throughout the 5 year construction duration and for a longer periods, with potential associated increases in impact significance.

1.6.3 Rail Transfer

It is identified in section 1.6.2 that transfer from vessel would need to accommodate a weekly peak demand of 12,500 tonnes of water delivered materials.

Section 1.5.3 identifies that during the operational phase, trains could carry circa 730 - 820 tonnes of materials per train. Adopting these same parameters, it can be calculated that would be a weekly peak requirement for 16 trains movements[4] or up to three trains per day.

Section 1.3 outlines that existing sidings are located adjacent to the A16 Spalding Road within the Boston area (and currently understood to be used for the movement of aggregates). Transfer of construction materials by rail would therefore need to be shuttled to the Facility by road, resulting in at least 278 two-way HGV movements (as outlined in section 1.6.2).

Rail Evaluation

Based on the train path evaluation undertaken in section 1.5.3, it is considered that the maximum construction transfer of three trains per day could be accommodated within the rail network and timetable.

However, if construction of the wharf was to be avoided completely the rail transfer scenario would rely on the shuttling of the materials by road from the A16 Spalding Road to the Facility inducing a peak demand of potentially 278 daily HGV movements. HGV demand would change the assessed HGV demand profile and it is likely that the peak would occur more frequently throughout the 5 year construction duration and for a longer periods, and be concentrated on local receptors with potential associated increases in impact significance.

[4] 12,500 tonnes of construction material, divided by 820 tonnes per train

1.7 Summary

This note evaluates land-based alternatives for transporting RDF, LWA and construction materials, by comparing the potential residual environmental effects with those assessed in the Chapter 19 (Traffic and Transport) of the ES (APP-057).

Specifically, the note considers the potential effects of transferring operation and construction freight deliveries from water to road or rail.

Operation Phase

It is calculated that a transfer from water transport during the operational phase to road transport could result in an additional 332 two-way HGV movements per day for the lifetime of the Facility. The increase of HGVs is of a similar quantum to the effects assessed and mitigated for peak construction in Chapter 19 (Traffic and Transport) of the ES.

However, the road based operational impact would be for the asset life of the Facility, 312 working days per year. This continuous duration would increase the assessed environmental impacts on local sensitive receptors.

The transfer to rail from water transport would result in at least six freight trains per day into and out of the PoB. To accommodate the movement of six freight trains per day, there would be a requirement for an increase in the working hours of the existing rail line from 16 to 24 hours a day. The increase in freight trains, operating times and closures of the A16 and opening of the River Witham swing bridge would have potentially significant environmental impacts and would constrain future rail expansion of the PoB and aggregate deliveries by rail to the Sleaford Sidings.

Construction Phase

The transfer from water deliveries would lead to a peak daily demand of 278 daily HGV movements. This magnitude is within the worst case construction demand of 293 two-way HGV movements and the resultant impacts assessed and mitigated in Chapter 19 (Traffic and Transport) of the ES.

However, vessel transferred HGV demand would change the assessed HGV profile and it is likely that the peak assessed in Chapter 19 (Traffic and Transport) of the ES would occur more frequently throughout the 5-year construction duration and for a longer periods, with potential associated increases in residual impact significance.

It is calculated that there would be a weekly peak requirement for 16 train movements or up to three trains per day to accommodate the transfer from water deliveries. It is considered that the maximum construction transfer of three trains per day could be accommodated within the rail network and timetable.

However, the rail transfer scenario relies on the shuttling of the materials by road from the A16 Spalding Road to the Facility inducing a peak demand of potentially 278 daily HGV movements. HGV demand would change the assessed HGV demand profile and it is likely that the peak would occur more frequently throughout the 5 year construction duration and for a longer periods, and be concentrated on local receptors with potential associated increases in impact significance.

1.7.1 Conclusion

Based on the review of the existing road and rail network in the vicinity of the Facility and an evaluation of the transfer of peak demand from water deliveries to land based modes, it is concluded that rail and road

concentrated delivery scenarios have to potential to induce significant environmental impacts to those assessed in the DCO application and are therefore not considered viable alternatives to the preferred water augmented delivery strategy.

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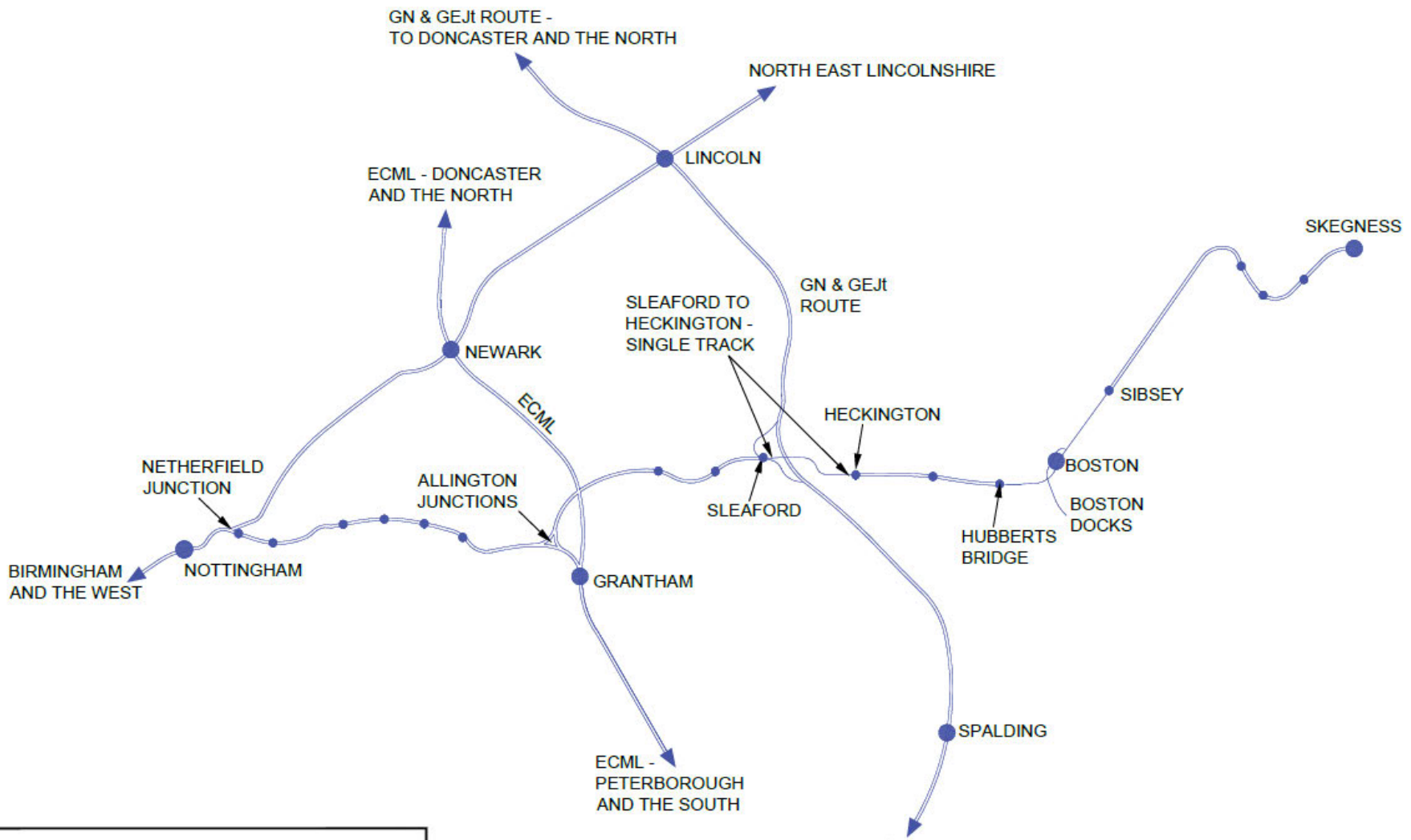
FIGURES AND APPENDICES

DO NOT SCALE



KEY

ECML (EAST COAST MAIN LINE)

GN & GEJt (GREAT NORTHERN AND GREAT EASTERN JOINT ROUTE)

TITLE: FIGURE 1 EXISTING RAIL ROUTES	PROJECT: BOSTON ALTERNATIVE ENERGY FACILITY	Royal HaskoningDHV Enhancing Society Together	JOB No. PB6934	DATE SEPT 2021	SCALE NTS
			DRAWN SKT	CHECKED BA	PASSED ADR
			AUTOCAD REF.	DRG No. Figure 1	REV D01

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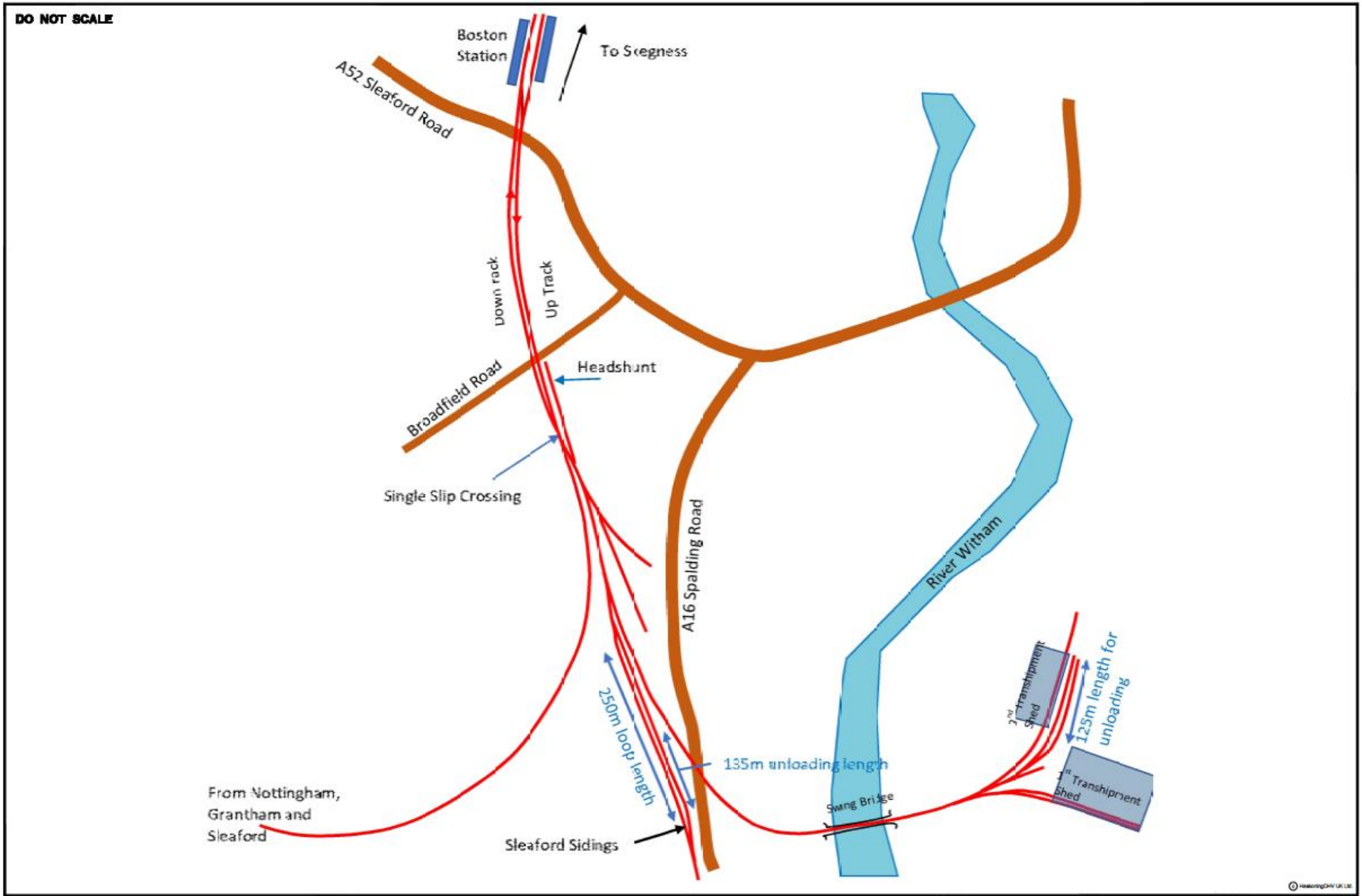
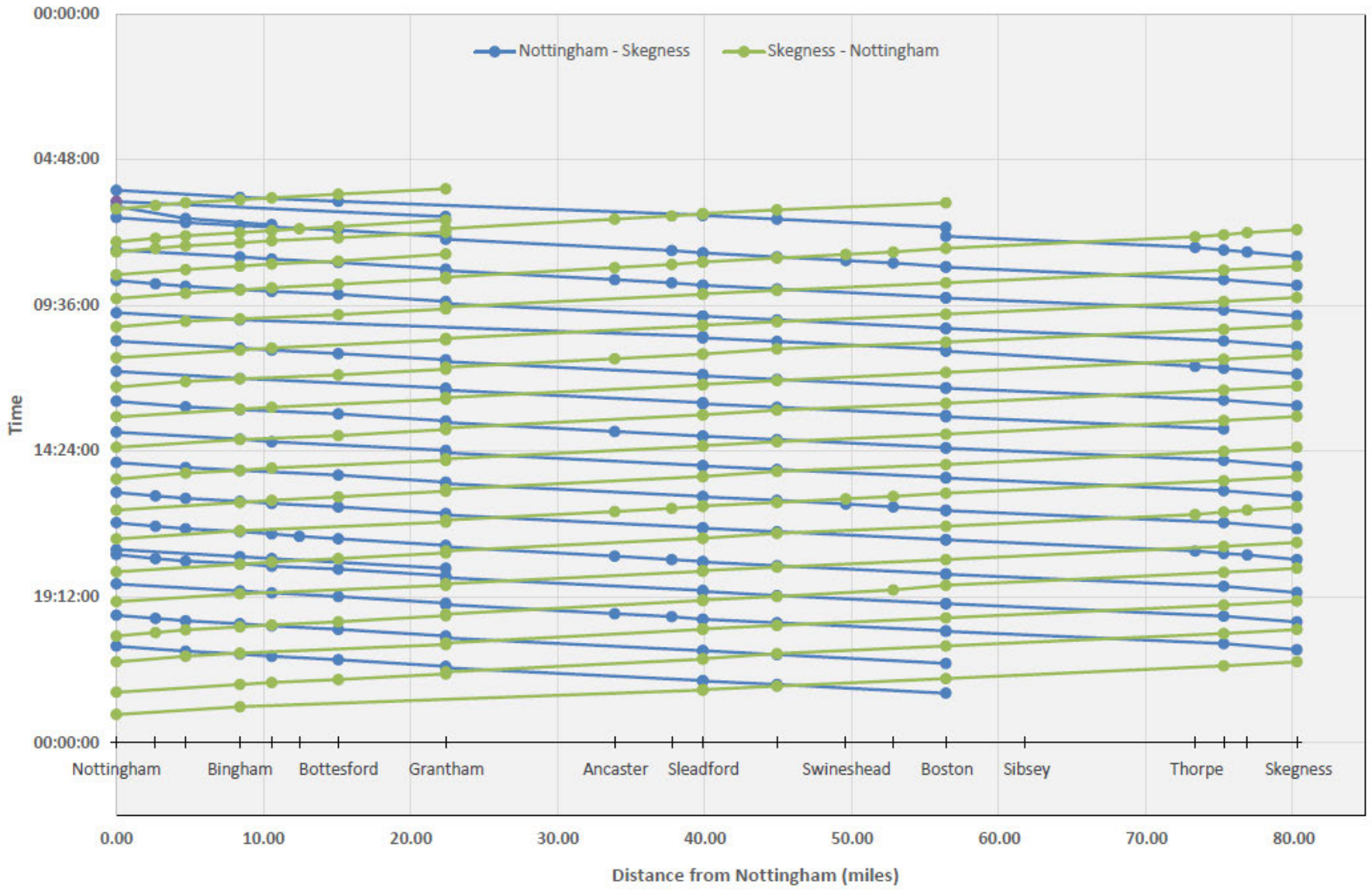


TITLE: FIGURE 2 RAIL INFRASTRUCTURE AT BOSTON	PROJECT: BOSTON ALTERNATIVE ENERGY FACILITY	Royal HaskoningDHV Enhancing Society Together	JOB No. PB6934	DATE SEPT 2021	SCALE NTS
			DRAWN SKT	CHECKED BA	PASSED ADR
			AUTOCAD REF.	DRG No. Figure 2	REV D01

Figure 3 - Train Graph of Weekday 'Poacher' Line Passenger Services (valid from June 21st 2021)



Appendix A Table 1: Capacity with Van Type Wagons

	Parameters	Units	VAN Wagons			PALVAN Wagons		
Wagon	Length Over Couplings	m	14.33			15.24		
	Tare	tonnes	24			26		
	Gross Vehicle Weight	tonnes	52			74		
	Max Design Axle load	tonnes	26			18.5		
	Permitted Axle load on Route	tonnes	22.5			22.5		
	Governing Axle load	tonnes	22.5			18.5		
	Potential Payload	tonnes	21			48		
	Loadable Length	m	12.2	11.2	11.2	14		
	Loadable Width	m	2.5			2.6		
	Loadable Height	m	2.2			2.1		
RDF bales	RDF blae length	m	1.4	1.4	1.2	1.4	1.4	1.2
	width	m	1.2			1.2		
	height	m	1.1			1.1		
	max weight	Tonnes	1.5	1.5	1.286	1.5	1.5	1.286
	Min weight	Tonnes	1.3	1.3	1.114	1.3	1.3	1.114
	Assumed Weight	Tonnes	1.4	1.4	1.2	1.4	1.4	1.2
	Volume	m^3	1.848	1.848	1.584	1.848	1.848	1.584
	Density	Tonne/m^3	0.758			0.758		
Potential loading arrangements	Orientation of RDF bales	n/a	Length -ways	On end vertically	Cross ways short bales	Length- ways	On end vertically	Cross ways short bales
	1st layer – No. lengthways	No	8	9	9	10	10	11
	1st layer – No. widthways	No	2			2		
	2nd layer – No. lengthways	No	8	0	8	10	0	8
	2nd layer – No. widthways	No	1	0	2	1	0	2
	Total No	No	24	18	34	30	22	38
	Weight	Tonnes	33.6	25.2	40.8	42	30.8	45.6

	Parameters	Units	VAN Wagons			PALVAN Wagons		
	Utilisation of permitted payload	n/a	1.6	1.2	1.9	0.875	0.642	0.950
Trains	Train length	m	250			250		
	No of wagons per train	No	17			16		
	Payload per Train	Tonnes	571	428	694	672	493	730
	Gross Trainload		979	836	1,102	1,088	909	1,146
	Annual Quantity	Tonnes	1,200,000			1,200,000		
	Trains per Year	No	2,101	2,802	1,723	1,786	2,436	1,645
	Days per year (assume 50 weeks and 5.5 days per week)	No	275			275		
	Trains per Day	**No**	**7.64**	**10.19**	**6.29**	**6.49**	**8.86**	**5.98**

Appendix A Table 2: Capacity with Box Type Wagons

	Parameters	Units	BOX JUA/JTA			BOX CAIB		
Wagons	TOPS Code		JUA/JTA	JUA/JTA	JUA/JTA	CAIB	CAIB	CAIB
	Length Over Couplings	m	12.497			16.192		
	Tare	tonnes	24.6			24.6		
	Gross Vehicle Weight	tonnes	101.9			101.9		
	Max Design Axle load	tonnes	25.475			25.475		
	Permitted Axle load on Route	tonnes	22.5			22.5		
	Governing Axle load	tonnes	22.5			22.5		
	Potential Payload	tonnes	65.4			65.4		
	Loadable Length	m	11.2			14.81		
	Loadable Width	m	2.5			2.5		
	Loadable Height	m	2.2			2.2		
RDF Bales	Length	m	1.4	1.4	1.2	1.4	1.4	1.2
	Width	m	1.2			1.2		
	Height	m	1.1			1.1		
	Max. weight	Tonnes	1.5	1.5	1.286	1.5	1.5	1.286

	Parameters	Units	BOX JUA/JTA			BOX CAIB		
	Min. weight	Tonnes	1.3	1.3	1.114	1.3	1.3	1.114
	Assumed Weight	Tonnes	1.4	1.4	1.2	1.4	1.4	1.2
	Volume	m^3	1.848	1.848	1.584	1.848	1.848	1.584
	Density	Tonne/m^3	0.758			0.758		
Potential loading arrangement	Orientation	n/a	Length- ways	On end vertically	Cross ways short bales	Length- ways	On end vertically	Cross ways short bales
	1st layer – No. lengthways	No	8	9	9	10	12	12
	1st layer – No. widthways	No	2			2		
	2nd layer – No. lengthways	No	8	0	8	10	0	11
	2nd layer – No. widthways	No	1	0	2	1	0	2
	Total No	No	24	18	34	30	24	46
	Weight	Tonnes	33.6	25.2	40.8	42	33.6	55.2
	Utilisation of permitted payload		0.514	0.385	0.624	0.642	0.514	0.844
Trains	Train length	m	250			250		
	No of wagons per train	No	20			15		
	Payload per Train	Tonnes	672	504	816	630	504	828
	Gross Trainload		1,164	996	1,308	999	873	1,197
	Annual Quantity	Tonnes	1,200,000			1,200,000		
	Trains per Year	No	1,786	2,381	1,471	1,905	2,381	1,451
	Days per year (assume 50 weeks and 5.5 days per week)	No	275			275		
	Trains per Day	**No**	**6.49**	**8.66**	**5.35**	**6.93**	**8.66**	**5.27**