14 NOISE AND VIBRATION

14.1 Introduction

14.1.1 This section of the ES describes the existing environment in relation to noise and vibration and assesses the potential impacts of the construction, operation and decommissioning phases of the proposed scheme. Where potentially significant impacts are identified, mitigation measures are detailed and residual impacts assessed.

14.2 Policy, guidance and consultation

Policy and guidance

National Policy Statement for Ports

14.2.1 The NPS for Ports (Department for Transport, 2012) provides relevant information with regard to the assessment of impacts to noise and vibration as a result of port infrastructure. The NPS Section 5.10.1 states that excessive noise can have wide-ranging impacts on the quality of human life and health, use and enjoyment of areas of value such as quiet places and areas with high landscape value. Noise resulting from a proposed scheme can also have adverse impacts on wildlife and biodiversity. Where noise impacts are likely to arise from a proposed scheme, the NPS states that the applicant should include the following points within a noise assessment:

- a description of the noise-generating aspects of the development proposals leading to noise impacts on the marine and terrestrial environment, including the identification of any distinctive tonal, impulsive or low-frequency characteristics of the noise;
- identification of noise sensitive premises and areas and noise-sensitive species that may be affected;
- the characteristics of the existing marine and terrestrial noise environment;
- a prediction of how the noise environment would change with the proposed scheme;
- as assessment of the effect of predicted changes in the noise environment on any noise sensitive receptors and noise sensitive species; and,
- mitigation measures to reduce the significance of noise impacts.

14.2.2 The NPS states that the noise impact of ancillary activities associated with the development (e.g. increased road traffic) should also be considered. Construction and operational noise with respect to human receptors should be assessed using the principles of the relevant British Standard. The seasonality of potentially affected species in nearby sites may also need to be taken into account.

The National Planning Policy Framework

14.2.3 The NPPF was introduced in March 2012 and replaced the former Planning Policy Guidance 24: Planning and Noise. Whilst it is not directly applicable to NSIP applications, it forms a material consideration in their determination. Paragraph 123 of the NPPF states that planning policies and decisions should aim to:

> *"- avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*

- mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;

- recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and

- identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason."

14.2.4 The NPPF also refers to the Noise Policy Statement for England (NPSE) (Defra, 2010). Section 1.7 sets out three policy aims:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life."*

14.2.5 The first two points require that significant adverse impacts should not occur and that, where a noise level falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect (Section 2.24):

"It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development. This does not mean that such adverse effects cannot occur."

14.2.6 Section 2.20 of the NPSE introduces key phrases including "significant adverse" and "adverse" and two established concepts being applied to noise impacts:

"NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected".

14.2.7 The NPSE extends the concepts described above and leads to a Significant Observed Adverse Effect Level – SOAEL, which is defined as the level above which significant effects on health and quality of life occur.

14.2.8 Section 2.15 of the NPSE states "it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations". Furthermore the document acknowledges that "further research is required to increase understanding of what may constitute a significant adverse effect on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available".

National Guidance

14.2.9 The National Planning Practice Guidance for Noise (NPPG Noise, March 2014), issued under the NPPF, Paragraph 001 states that noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. When preparing local or neighbourhood plans, or taking decisions about new development, there may also be opportunities to consider improvements to the acoustic environment.

14.2.10 Other relevant national guidance for noise and vibration assessment includes:

- British Standard (BS) 7445: Parts 1 and 2 - Description and measurement of environmental noise. The Standard provides details of the instrumentation and measurement techniques to be used when assessing environmental noise, and defines the basic noise quantity as the continuous A-weighted sound pressure level (L_{Aeq}). Part 2 of BS 7445 replicates ISO standard 1996-2.

- BS4142:1997 - Methods for rating industrial noise affecting mixed residential and industrial areas.

- The Standard provides a method for rating and assessing sound of an industrial and/or commercial nature. The methods described use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

- World Health Organisation (WHO) Guidelines for community noise.

These guidelines present health-based noise limits intended to protect the population from exposure to excess noise. Guideline limit values are set out at which the likelihood of particular effects, such as sleep disturbance or annoyance, may increase. The guideline values are 50 or 55dB L_{Aeq} during the day, related to annoyance, and 45dB L_{Aeq} or 60dB L_{Amax} at night, related to sleep disturbance.

- BS5228:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 1: Noise.

This document provides recommendations for basic methods of noise and vibration control relating to construction and open sites where work activities/operations generate significant noise and/or vibration levels. The legislative background to noise and vibration control is described and recommendations are given regarding procedures for the establishment of effective liaison between developers, site operators and local authorities. This British Standard provides guidance on methods of predicting and measuring noise and assessing its impact on those exposed to it.

- BS5228: 2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 2: Vibration.

Part 2 of this Standard gives recommendations for basic methods of vibration control relating to construction and open sites where work activities / operations generate significant vibration levels. The Standard includes tables of vibration levels measured during piling operations throughout the UK. It provides guidance concerning methods of mitigating vibration from construction, particularly with regard to percussive piling.

- Calculation of Road Traffic Noise (CRTN). This document provides a method for assessing noise from road traffic, in the UK. The calculation methods provided include correction factors to take account of variables affecting the creation and propagation of road traffic noise, accounting for the percentage of heavy goods vehicles, different road surfacing, inclination, screening by barriers and relative height of source and receiver.

- Design Manual for Roads and Bridges (DMRB).

Volume 11, Part 3, Section 7 provides guidance on the environmental assessment of noise impacts from road schemes. DMRB contains advice and information relating to transport-related noise and vibration, which has relevance with regard to the construction and operational traffic impacts affecting sensitive receptors adjacent to road networks. It also provides guideline significance criteria for assessing traffic related noise impacts.

- BS8233:2014 – Guidance on sound insulation and noise reduction for buildings – Code of Practice.

Provides a methodology to calculate the noise levels entering a building through facades and façade elements and provides details of appropriate measures for sound insulation between dwellings. Includes recommended internal noise levels which are provided for a variety of situations.

- British Standard 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Part 1 provides general guidance on human exposure to building vibration in the range of 1 Hz to 80 Hz and includes curves of equal annoyance for humans. It also outlines the measurement methodology to be employed. It introduces the concept of Vibration Dose Value (VDV) and estimated Vibration Dose Value (eVDV) for the basis of assessment of the severity of impulsive and intermittent vibration levels, such as those caused by a series of trains passing a given location.

- British Standard 6472-2:2008 Guide to evaluation of human exposure to vibration in buildings. Part 2 deals with blast induced vibration. Guidance is given on vibration measurement procedures. Guidance is provided on acceptable vibration levels for residential, office and workshop uses. The guidance is given on levels that are likely to give a low probability of adverse comment.

Local Planning Policy

14.2.11 Core Strategy Policy DP6 of the Redcar and Cleveland Local Development Framework (RCBC, 2007) states:

"Development that would give rise to increased levels of noise or vibration or which would add to air, land or water pollution, by itself or in accumulation with existing or other proposed uses, will only be permitted if it is acceptable in terms of:

- human health and safety;
- environment; and
- general amenity.

Where pollution is unavoidable, mitigation measures to reduce pollution levels will be required in order to meet acceptable limits."

14.2.12 Objective 7, Protection from Pollution 2.80 of the SBC Local Plan (SBC, 1997) states:

"To ensure that new development does not reverse the improvements to environmental quality already made, all proposals likely to cause noise, grit, dust, fumes, smoke or vibration will be referred to the relevant pollution control agency for advice. Any controls necessary will be secured through the use of planning conditions or legal agreements".

Consultation

14.2.13 A summary of the comments included in the PINS Scoping Opinion, along with responses received to consultation under Section 42 of the Planning Act 2008, with regard to noise and vibration is presented in **Table 14-1**.

14.2.14 In January 2014, contact was made with RCBC's Environmental Health Department to discuss the proposed noise assessment for the proposed scheme. Agreement on the proposed baseline noise assessment methodology and impact criteria, concerning potential noise and vibration from construction of the proposed scheme, as well as noise associated with the operational phase, was reached. Agreement was also reached on the proposed receptor monitoring locations for the noise and vibration assessment.

14.2.15 Consultation with a representative from the Wilton International Complex was also undertaken in March 2014. It was determined through this consultation that the recent economic downturn has resulted in a significant fall in the background noise levels around the Wilton Complex, which could be reversed in the event of an economic up-turn.

14.3 Assessment Methodology

Study area

14.3.1 The study area for noise and vibration assessment generally comprises the area immediately adjacent to the proposed scheme footprint, up to a distance of approximately 200m. However, the closest noise sensitive receptors in each geographical direction are taken into account, on the basis that receptors further from the site would experience lower noise effects from potential noise generating sources due to the increased separation distance. The study area also comprises the area immediately surrounding the road network significantly affected by the proposed development. The extent of the road network considered for this assessment has been dictated by the Transport Assessment (see **Section 12**).

Table 14-1 Summary of comments received in the PINS Scoping Opinion and in response to Section 42 consultation with regard noise and vibration

Consultation Comment	Response / Section of the ES in which the comment has been addressed
Scoping Opinion (January 2014)	
Secretary of State	
The Secretary of State recommends the choice of sensitive noise receptors to be included in the assessment is agreed with the Environmental Health Officer at RCBC.	**Section 14.2**
Consideration should also be given to discussing with Natural England the appropriate study area and methodology to assess potential noise and vibration impacts on marine and terrestrial ecology.	**Section 14.3**
Information on types of vehicles and plant and machinery to be used should be provided with appropriate cross reference to the Transport Assessment.	**Section 14.3**
The applicant should include a detailed assessment on the noise and vibration impacts from piling and dredging on both humans and ecological receptors.	**Sections 14.5** and **14.6**
Noise impacts on people should be specifically addressed and particularly any noise disturbance at night and other unsocial hours such as weekends and public holidays.	**Sections 14.5** and **14.6**
Consideration should be given to monitoring noise complaints during construction and operation.	**Section 14.5**
MMO	
The MMO considers that the EIA must assess the potential impacts from noise and vibration on marine receptors during both construction and operation. This should include the dredging operations.	An underwater noise assessment has been carried out to determine impacts to marine receptors; see **Section 9**
Natural England	
Given the proximity of the identified development site to designated sites, the piling element of both options under consideration should be fully assessed. A realistic worst case scenario should be identified and subsea acoustic modelling used to identify the potential impact zone. This should also include in-combination impact where appropriate.	**Section 14.3** **Section 14.5** Underwater noise modelling is also considered in **Sections 8** and **11**
Public Health England	
Significant impacts are unlikely to arise from installations which employ Best Available Techniques (BAT) and which meet regulatory requirements concerning emissions limits and design parameters.	Noted; see **Sections 14.5** and **14.6**

Consultation Comment	Response / Section of the ES in which the comment has been addressed
When considering a baseline and in the assessment of future monitoring of impacts, these should include: • Appropriate screening assessments and detailed dispersion modelling where this is screened as necessary; • Assessment of construction, operation and decommissioning; • Consideration of typical operational emissions from start-up, shut-down, abnormal operation and accidents when assessing potential impacts and include an assessment of worst case impacts; • Appropriate estimates of background levels; • Cumulative and incremental impacts; • Comparison of predicted environmental concentrations to applicable standard or guideline value; • Impacts on residential areas and sensitive receptors in the area which may be affected by emissions.	**Sections 14.3**, **14.4**, **14.5** and **14.6**
Section 42 Comments	
Natural England	
Further lighting assessment, noise assessment and sediment quality data are awaited with are essential for a proper understanding of impacts.	**Sections 14.5** and **14.6**. Lighting and sediment quality have been assessed separately (see Appendix 20.4 and **Section 7** respectively).
Natural England notes acoustic barriers are proposed. More detail on this mitigation measure will be required. Piling has only been considered for the port terminal with no information provided on the conveyor construction. Natural England would expect to see seasonal restrictions on construction scheduling to avoid impacts on wintering SPA birds.	**Section 14.5**
Parking, storage and lay down areas immediately adjacent to the lagoon will need to be properly screened to minimise disturbance during operation. During construction, the most disturbing activities should be scheduled outside the winter period (November to March inclusive).	**Section 14.5**
Redcar and Cleveland Borough Council	
The proposed methodology and scope of assessment has been agreed. A full noise mitigation scheme shall be provided with the formal EIA. Full methodologies and raw data shall be provided in the EIA.	**Section 14.4**

14.3.2 For the purpose of the noise and vibration impact assessment, four categories of noise sensitive receptors were defined to assess the potential direct and indirect impacts associated with noise impacts arising from the proposed scheme. These are:

- sensitive ecological receptors immediately surrounding the proposed harbour facility;
- sensitive residential receptors close to the proposed harbour facility;
- sensitive ecological receptors immediately adjacent to the proposed conveyor route; and,
- sensitive residential receptors close to the proposed conveyor route.
- The assessed noise sensitive receptors considered within this ES are provided in **Figure 14-1**.

Desk study

14.3.3 Consideration of the site and surrounding environment was conducted using satellite photography in order to determine the nearest noise sensitive receptors for use in the assessment. Receptor locations were also determined in consultation with RCBC.

Base mapping

14.3.4 A detailed noise model was developed using an OS Vectormap and an OS Landform Profile DTM ASCII XYZ file purchased from Ordnance Survey Ltd via Emapsite.

Traffic data

14.3.5 Information regarding the anticipated vehicle movements during the construction phase was generated as part of the EIA, and is presented in **Section 12**.

Construction data

14.3.6 Information regarding the anticipated plant to be used during the construction phase was supplied by Royal HaskoningDHV.

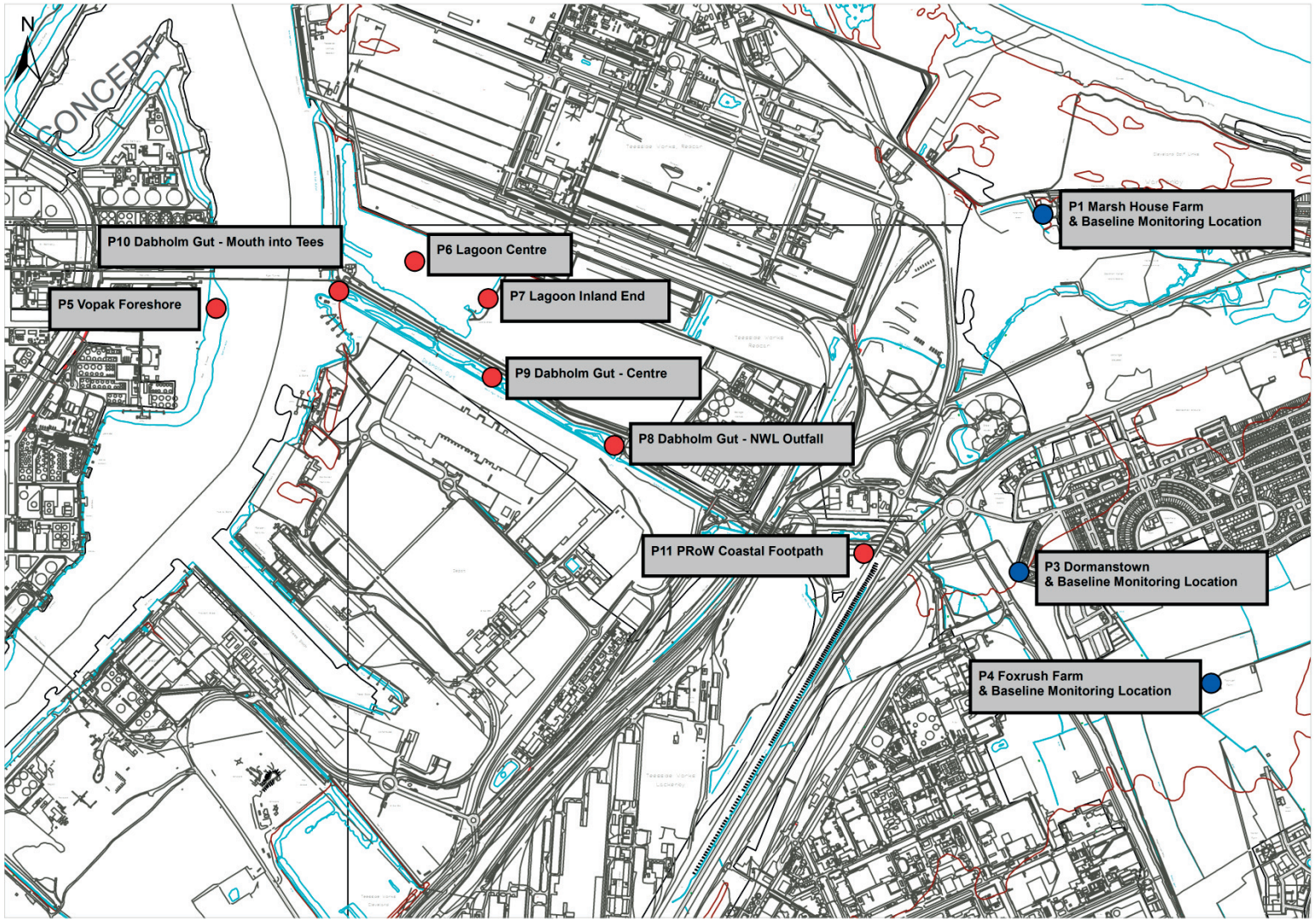
Baseline noise data

14.3.7 Baseline noise data were acquired during a noise survey conducted in March and June 2014.

Existing environment

14.3.8 In order to characterise the existing environment within the study area, a baseline noise survey was undertaken. Measurements of the ambient noise level were taken at locations that were representative of nearby noise sensitive receptors that have the potential to be affected by the construction and operational phases of the proposed scheme. The measurements included the following noise indices:

Figure 14-1 Assessed receptor locations and baseline monitoring locations



- L_{Aeq} – the equivalent continuous sound pressure level over the measurement period. This parameter was standardised as pertinent for land use within BS7445-2;
- L_{Amax} – the maximum sound pressure level occurring within the defined measurement period;
- L_{A90} – indicative of the background noise level, the sound pressure level exceeded for 90% of the measurement period; and
- L_{A10} – the sound pressure level exceeded for 10% of the measurement period. The L_{A10} index is used within the CRTN as an appropriate descriptor of traffic noise.

14.3.9 The equivalent continuous sound pressure level (L_{Aeq}) is the conventional descriptor of environmental noise and is defined below:

$$L_{eq,T} = 10 \times \log\left[\frac{1}{T}\int \frac{\rho^2(t)\partial t}{\rho_0^2}\right] dB$$

14.3.10 Noise measurements are normally taken with an A-weighting (denoted by a subscript 'A') to approximate the frequency response of the human ear.

14.3.11 Sensitive receptors, in the context of noise and vibration, are typically residential premises but can also include schools, places of worship and noise/vibration sensitive commercial premises.

14.3.12 The noise environment around the proposed harbour facility and conveyor route was largely governed by three main noise sources: the A1085, the SSI Steel Works and the Wilton Complex.

14.3.13 In order to establish a baseline dataset for receptors close to the Wilton Complex, it was deemed appropriate to use noise data collected by an existing monitor at Lazenby, on the southern boundary of the Wilton Industrial Complex. Noise data from this existing monitor was acquired for a 15 month period from January 2013 to March 2014; therefore the data acquired represents a long term measure of the existing noise environment, accounting for seasonal variations. Additional baseline noise surveys were conducted in the vicinity of Dormanstown, Foxrush Farm and Manor Farm.

Construction phase noise assessment

Residential receptors

14.3.14 Noise levels for the construction phase were calculated using the methods and guidance in BS 5228. This Standard provides methods for predicting receptor noise levels from construction works based on the number and type of construction plant and activities operating on site, with corrections to account for:

- the 'on-time' of the plant, as a percentage of the assessment period;
- distance from source to receptor;
- acoustic screening by barriers, buildings or topography; and,
- ground type.

14.3.15 Source noise levels for each piece of plant equipment operating were used as the basis for the calculation and were derived from Annex C of BS 5228.

14.3.16 An indicative list of construction equipment was developed (**Table 14-2**) and typical noise emissions, derived from BS5228 were used for the noise assessment. The results of the calculation have been presented as the dB $L_{Aeq,12h}$ noise levels, representing a conservative prediction of the noise level that might affect adjacent receptors during typical construction activity.

14.3.17 The following assumptions were made:

- certain construction activities, i.e. dredging, may take place over a 24 hour period;
- all ground was assumed to be acoustically hard and reflective, i.e. concrete/tarmac (absorption factor of 0); and
- the 'on-time' for all plant was assumed to be 50%, with the exception of power generation plant, dredging and compressors which were assumed to operate 100% of the time.

14.3.18 The list of the assumed plant used for the construction noise assessment is presented in **Table 14-2** and **Table 14-3** for the quay and conveyors respectively.

Table 14-2 List of assumed plant for quay construction noise assessment

Construction Stage	Plant / Activity	No.	Noise level *(dB L_{Aeq} at 10m)*	On-time *(%)*
Stage 1 Ground preparation / Earthworks	Dozer (clearing)	1	83	50
	Tracked excavator (clearing)	2	77	50
	Dump truck	2	83	50
	Dozer (towing roller)	1	86	50
Stage 2 Piling	Percussive piling rig (0.9m hammer drop - 3000kgm/blow)	1	108	50
	Compressor	2	75	50
	Concrete pump	1	78	50
	Tracked excavator (inserting cages)	1	74	50
Stage 3 Capital dredging of berthing pocket	Dredging Ship	1	77	100
Stage 4 General construction	Tracked excavator	3	77	50
	Concrete mixer truck & pump	1	73	50
	Poker vibrator	2	75	50
	Dump truck	2	79	50
	Tracked mobile crane	2	76	50
	Diesel Generator (site power)	2	66	100
	Crane (land and floating)	9	82	100

Table 14-3 List of assumed plant for conveyor construction noise assessment

Construction Stage	Plant / Activity	No.	Noise level *(dB L_{Aeq} at 10m)*	On-time *(%)*
Stage 1 Ground preparation / Earthworks	Dozer (clearing)	1	83	50
	Tracked excavator (clearing)	2	77	50
	Dump truck	2	83	50
	Dozer (towing roller)	1	86	50
	Compressor	2	79	50
	Concrete pump	1	78	50
	Tracked excavator (inserting cages)	1	74	50
Stage 2 Piling	Auger piling rig and generator	1	108	50
Stage 3 General construction	Concrete mixer truck & pump	1	73	50
	Poker vibrator	2	75	50
	Tracked excavator	3	77	50
	Dump truck	2	79	50
	Tracked mobile crane	2	76	50
	Diesel Generator (site power)	2	66	100

14.3.19 Noise sensitive receptors, at which predicted construction noise impacts were assessed, were selected from the closest residential receptors, or groups of residential receptors, to the proposed scheme footprint. The receptors are listed in **Table 14-4** and shown on **Figure 14-1**.

Table 14-4 Construction noise receptor locations

Identifier	Description	Approximate distance to the nearest point of the extent of works boundary (m)
P1	Residence at Marsh House Farm	3000
P2	Ecological receptors on South Gare and Coatham Sands SSSI	2800
P3	Residences at junction of Broadway West and Wilton Avenue (Dormanstown)	115
P4	Residence at Foxrush Farm	616
P5	Ecological: Vopak Foreshore	518
P6	Ecological: Lagoon Centre	188
P7	Ecological: Lagoon Inland End	214
P8	Ecological: Dabholm Gut – NWL Outfall	36
P9	Ecological: Dabholm Gut – Centre	65
P10	Ecological: Dabholm Gut – Mouth into Tees	85

P11	Public right of way (PRoW) Coastal Footpath Location	109

14.3.20 The predicted construction noise levels were assessed against noise limits derived from advice within Annex E of BS5228. The Standard details the "ABC method", which specifies a construction noise limit based on the existing ambient noise level. **Table 14-5**, reproduced from BS5228, demonstrates the criteria for selection of a noise limit for a specific receptor location.

Table 14-5 Construction noise threshold levels based on the ABC method (BS5228)

Assessment category and threshold value period (L_{Aeq})	Threshold value, in decibels (dB)		
	Category A	Category B	Category C [C]
Night time (23.00 to 07.00)	45	50	55
Evening and weekends [D]	55	60	65
Daytime (07.00 – 19.00) and Saturdays (07.00 - 13.00)	65	70	75
[A] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.			
[B] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.			
[C] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.			
[D] 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.			

14.3.21 The criteria for assessing the significance of predicted noise impacts in relation to the above construction noise thresholds, is detailed in **Table 14-6** (this approach differs from the assessment methodology set out in **Section 4**).

14.3.22 At each of the noise sensitive receptors, the ambient daytime noise levels (presented in **Tables 14-17** and **14-18**) (rounded to the nearest 5dB) are less than 65dB $L_{Aeq,T}$ and therefore fall into Category A of the 'ABC' assessment methodology (**Table 14-5**).

14.3.23 The magnitude effect criteria for construction noise are derived from the 'ABC method' described in BS 5228, which recommends three different construction noise thresholds depending on the existing ambient noise level. The subsequent thresholds for varying degrees of effect are defined for each category; A, B or C. The thresholds for change between the significance levels were determined on the basis that the smallest perceptible change in environmental noise is typically 3dB, and that a change of 10dB typically relates to a subjective doubling or halving of the apparent loudness of a noise source.

14.3.24 **Table 14-6** and **Table 14-7** summarise the noise limits beyond which a magnitude effect is considered to occur, for each of the identified residential receptors and for each period of the day.

Table 14-6 Daytime construction noise significance criteria (residential)

Construction noise level (dB)			Magnitude of effect
A) 65dB threshold	B) 70dB threshold	C) 75dB threshold	
< 65	< 70	< 75	No Impact
65 – 68	70 – 73	75 – 78	Very low
68 – 70	73 – 75	78 – 80	Low
70 – 75	75 – 80	80 – 85	Medium
> 75	> 80	> 85	High

Table 14-7 Evening/night time construction noise significance criteria (residential)

Construction noise level (dB)			Magnitude of effect
A) 45dB threshold	B) 50dB threshold	C) 55dB threshold	
< 45	< 50	< 55	No Impact
45 – 48	50 – 53	55 – 58	Very low
48 – 50	53 – 55	58 – 60	Low
50 – 55	55 – 60	60 – 65	Medium
> 55	> 60	> 65	High

Waterbird receptors

14.3.25 Wright *et al.* (2010) investigated the effects upon waterbirds to impulsive noise and have identified ranges in noise which caused behavioural responses (based on a measured L_{Aeq}). These can be generally outlined as:

- no observable behavioural response: 54.9 to 71.5dBA (with a high proportion of extreme outliers);
- non-flight behavioural response: 62.4 to 79.1dBA;
- flight with return: 62.4 to 73.9dBA; and,
- flight with all birds abandoning the site: 67.9 to 81.1dBA.

14.3.26 The above information highlights that below 55dBA, effects would not be significant, but when noise levels increase, particularly approaching 70dBA, there is a range of bird responses, which have the potential to experience significant effects.

14.3.27 Further information on noise levels affecting waterbirds is provided by Cutts *et al.* (2008). This provides a useful figure of waterbird response to construction disturbance, reproduced below within **Figure 14-2**. The effect of noise on waterbirds is assessed in further detail in **Section 9 Marine and Coastal Ornithology**.

14.3.28 Based on these studies, the noise levels of 70dBA for temporary construction noise and 55dBA for general operational noise are considered to be suitable thresholds to indicate a level of effect where disturbance due to noise may cause a behavioural response.

14.3.29 The criteria for assessing the significance of predicted noise impacts in relation to ecological receptors are detailed in **Table 14-8**.

Construction related traffic noise

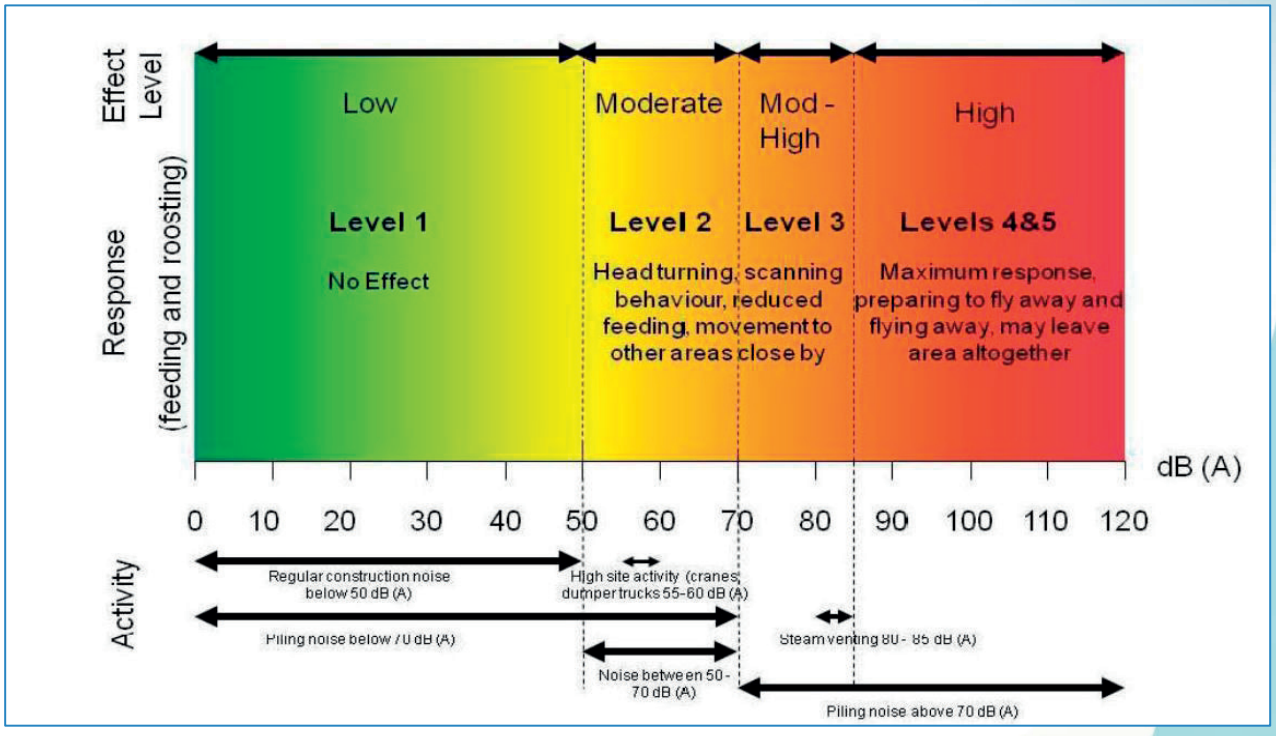
14.3.30 Noise level increases due to increases in traffic volume and composition on surrounding local roads were calculated in accordance with the methodology contained in Calculation of Road Traffic Noise (CRTN). The significance of any predicted change in noise level was then assessed in accordance with the criteria contained in the DMRB.

Table 14-8 Day, evening and night noise significance criteria (ecological)

Construction noise level (dB)	Impact magnitude
< 50	No impact / Very Low
50 – 70	Low
70 – 85	Medium
> 85	High

14.3.31 Following the methodology contained in DMRB, Volume 11, Section 3, Chapter 3 an initial screening assessment was undertaken to assess whether there would be any significant changes in traffic volumes as a result of the proposed scheme. Any road links with a predicted increase in traffic volume of 25%, or a decrease of 20%, were identified. Such changes in traffic volume would correspond to a 1dB(A) change in noise level at the relevant road link. A change in noise level of less than 1dB(A) is regarded as imperceptible and, therefore, of negligible significance. If there are no increases greater than 25% or a decrease of 20% or greater, then the guidance indicates that no further assessment needs to be conducted (Highways Agency, 2011).

Figure 14-2 Waterbird response to construction disturbance



Source: Cutts, N; Phelps, A; Burdon, D. (2008) Construction and Waterfowl: Defining Sensitivity, Response, Impacts and Guidance. Report to Humber INCA. Institute of Estuarine and Coastal Studies, University of Hull.

14.3.32 Where road links were predicted to have an increase of greater than 25% or a decrease of 20%, a noise level calculation was undertaken following the procedure outlined in CRTN.

14.3.33 **Table 14-9** presents the 18-hour Annual Average Weekday Traffic (AAWT) data for the roads which are proposed to be used during the construction phase; data was sourced from the TA (see **Section 12**).

Table 14-9 AAWT traffic data used for the construction traffic noise assessment

Link ID & Description	Baseline 2015 flows 18hr AAWT		2015 Baseline + Construction 18hr AAWT	
	Total Vehicles	Total HGVs	Total Vehicles	Total HGVs
2 A66	28,709	2,404	29,440	2,789
44 A1085	18,896	990	19,538	1,175

14.3.34 **Table 14-10** shows noise impact criteria for the assessment of changes in road traffic noise due to the addition of project related construction traffic. This table has been reproduced from **Table 3.1** of DMRB.

Table 14-10 Construction and operational noise impact magnitude criteria

Increase in traffic noise level (dB $L_{A10,18h}$)	Impact magnitude
≤0.0	No Impact
0.1 – 0.9	Very low
1.0 – 2.9	Low
3.0 – 4.9	Medium
≥ 5.0	High

14.3.35 The 24 hour baseline flow profiles identified a general trend that during the daytime, January weekday base flows are lower than those of annually averaged weekday base flows (albeit this is more pronounced at some hours than others). Variations in base flows were also identified between weekdays, Saturdays and Sundays. Accordingly, several sets of noise level predictions were undertaken to reflect different days of the week and times of the year. The following sets of predictions have been undertaken:

Annually averaged scenario

- Set 1 (weekdays)
  - **AA1a**: 2015 weekdays Base Flow
  - **AA1b**: 2015 weekdays Construction Flows (Base flows + Growth + Cumulative + Construction Development Flows)
- Set 2 (Saturdays)
  - **AA2a**: 2015 Saturday Base Flow
  - **AA2b**: 2015 Saturday Construction Flows (Base flows + Growth + Cumulative + Construction Development Flows)
- Set 3 (Sundays)
  - **AA3a**: 2015 Sundays Base Flow
  - **AA3b**: 2015 Sundays Construction Flows (Base flows + Growth + Cumulative + Construction Development Flows)

14.3.36 The year 2015 was selected as worst case, on the basis of having the lowest baseline data (i.e. at the start of proposed construction in absence of any subsequent background (non-project related) growth in the baseline conditions).

14.3.37 The year 2020 was selected for operational flow calculations, as assessed within the TA.

Construction vibration assessment criteria

14.3.38 Ground borne vibration can result from construction works and may lead to perceptible levels of vibration at nearby receptors, which at higher levels can cause annoyance to residents. In extreme

cases, cosmetic or structural building damage can occur, however vibration levels have to be very high for this effect to be manifested and such cases are rare.

14.3.39 High vibration levels generally arise from 'heavy' construction works such as piling, deep excavation, or dynamic ground compaction. The use of piling during the construction of the quay would be required; however, there is generally a large separation distance between all construction works and residential properties, with no residential properties within 3,000m of the proposed piling works for the quay. There are however, residential properties within very close proximity (less than 100m) of the conveyor system envelope.

14.3.40 Annex E of BS5228-2:2009+A1:2014 contains empirical formulae derived by Hiller and Crabb (2000) from field measurements relating to resultant peak particle velocity (PPV) with a number of other parameters for vibratory compaction, dynamic compaction, percussive and vibratory piling, the vibration of stone columns and tunnel boring operations. These prediction equations are based on the energy approach. Use of these empirical formulae enables resultant PPV to be predicted and for some activities (vibratory compaction, vibratory piling and vibrated stone columns) they can provide an indicator of the probability of these levels of PPV being exceeded.

14.3.41 The empirical equations for predicting construction-related vibrations provide estimates in terms of PPV and, therefore, the consequences of predicted levels in terms of human perception and disturbance can be established through direct comparison with the BS5228-2:2009+A1:2014 guidance vibration levels.

14.3.42 Using this approach to calculate the resultant vibration levels from a conservative percussive piling scenario at the identified sensitive receptors (**Figure 14-1**), it has been concluded that the separation distance, as outlined in **Table 14-4**, is large enough to protect receptors from construction related ground borne vibration. It is predicted that vibration would not adversely affect residential receptors and, hence, this has not been assessed in detail.

14.3.43 For construction vibration from sources other than blasting (which is not proposed for this project), the vibration level and effects presented in **Appendix 14.1** were adopted. These levels and effects are based on human perception of vibration in residential environments.

14.3.44 The effect magnitude was determined in accordance with **Table 14-11**.

Table 14-11 Effect magnitude - Construction vibration

Effect Magnitude	No impact / Very Low	Low	Medium	High
Construction Vibration Level	< 0.3 mm s^{-1}	0.3 – 0.9 mm s^{-1}	1.0 – 9.9 mm s^{-1}	> 10 mm s^{-1}

Operational phase assessment

14.3.45 SoundPLAN noise modelling software was used to predict the likely effects of noise from the operational aspects of the proposed scheme. The software implements accepted national and international acoustic calculation standards. The calculation algorithm described in International Standard (ISO) 9613 was used for determining noise levels at noise sensitive locations in close proximity to the proposed scheme. The method takes account of air absorption, distance attenuation, barriers and topography, and light downwind conditions from source to receptor. A three-dimensional model was created using topographical data of the local area and plans and elevations of the proposed development site. The model incorporated the proposed scheme, nearby residential dwellings, auxiliary buildings and the surrounding local road network.

14.3.46 Road traffic movements associated with the operational aspects of the proposed scheme were deemed to be negligible and, hence, have not been assessed in detail.

14.3.47 The following assumptions were made within the assessment:

- all ground was assumed to be acoustically hard and reflective, i.e. concrete/tarmac (absorption factor of 0); and,
- the 'on-time' for all cranes was assumed to be 50%, with the exception of vessels which were assumed to operate 100% of the time.

14.3.48 The following points were taken into account regarding the operational noise model set up:

- all noise emitting equipment located within buildings, i.e. conveyor drives and belts, was modelled as an area source;
- the surface of the proposed harbour facility and conveyor routes was assumed to be hard and an acoustically reflective surface, such as concrete;
- acoustic propagation effects were calculated using the ISO9613 method;
- free field noise levels were calculated at first floor height for each receptor, as the results were slightly higher than at ground floor level;
- a +5dB 'acoustic feature' penalty, as defined in BS4142, was added to the noise level calculated at each receptor. This is to account for the impulse and irregular nature of noise from the Harbour and Conveyor, and represents a conservative approach; and,
- the 'on-time' for all cranes was assumed to be 50%, with the exception of vessels which were assumed to operate 100% of the time.

14.3.49 Where a noise source is to be located internally, the structure was assumed to comprise of lightweight cladding materials. Typical cladding materials offer sound insulation performances of at least 17dB Rw.

14.3.50 Operational activities would take place according to the hours outlined in **Table 14-12**.

Table 14-12 Operational activity

Operational activity	Indicative working hours
Vessel at berth Ship loader operations at berth (including conveyors)	Continuous operation

14.3.51 The list of the assumed plant used for the operational noise assessment is presented in **Table 14-13**.

Table 14-13 List of assumed plant for operational noise assessment

Phase	Plant / Activity	No.	Noise level (dB L_{Aeq} at 10m)	On-time (%)
Operational Loading/Unloading/Docking	Vessel	2	77	100
	Ship Loader (including conveyors)	2	95	100
Operational conveyors	Conveyor Drives	2	76	100
	Conveyor belts	2	62	100

14.3.52 The difference between the noise rating level and the background noise is referred to as the assessment level. **Table 14-14** presents the BS4142 guidelines on assessing the likelihood of complaints.

Table 14-14 Harbour and conveyor operational noise effect magnitude criteria

Broadband operational noise level (Predicted dB $L_{Ar,5min}$ – Measured L_{A90})	Effect magnitude
≤ Measured L_{A90}	No impact / Very low
Measured L_{A90} + 1dB to 3dB	Low
Measured L_{A90} + 4dB to 9dB	Medium
> Measured L_{A90} + 10dB	High

14.3.53 The negligible threshold at residential receptors used in this assessment applies to noise levels outside of a property. BS8233 states that a partly open window will offer 15dBA attenuation against external noise; therefore on this basis the negligible threshold at residential receptors would produce an internal noise level lower than the 30dB $L_{Aeq,8hr}$ criteria defined in BS8233 inside bedrooms during the night time period.

14.3.54 **Table 14-15** presents definitions of terms relating to the sensitivity of the receptor.

Table 14-15 Definition of terms relating to sensitivity of receptors

Sensitivity	Definition
High	Hospitals (e.g. operating theatres or high dependency units), care homes at night
Medium	Residential accommodation, private gardens, hospital wards, care homes, schools, universities, research facilities, national parks, during the day; and temporary holiday accommodation at all times
Low	Offices, shops, outdoor amenity areas, long distance footpaths, doctors surgeries, sports facilities, places of worship and ecological receptors
Negligible	Warehouses, light industry, car parks, agricultural land

14.3.55 The assessment matrix presented in **Table 14-16** was used to determine the impact significance based on receptor sensitivity and the magnitude of effect for the assessment of noise.

Table 14-16 Overall impact resulting from each combination of receptor sensitivity and the magnitude of the effect upon it

Receptor sensitivity	Magnitude of effect				
	High	Medium	Low	Very Low	No Impact
High	Major	Major	Moderate	Minor	Negligible
Medium	Major	Moderate	Minor	Negligible	Negligible
Low	Moderate	Minor	Negligible	Negligible	Negligible

Limitations and assumptions

14.3.56 Construction details for the proposed scheme were provided by YPL The proposed elements of each indicative stage of the construction phase, including the construction equipment to be used, are fully detailed in **Section 3**.

14.3.57 Noise sources that are generally static (i.e. generators, cranes) were modelled as point sources. Noise equipment located in buildings was modelled as an area source.

14.3.58 Calculations were undertaken for the typical scenario for construction works during the relevant stage of the construction phase and assessment period (i.e. 07:00 to 19:00 and 19:00 to 07:00). This incorporated the percentage on-times assumed for typical operations over the course of the stage/shift. It was assumed that no manually operated item of plant would operate for 100% of an assessment period due to breaks/staff rotation.

14.4 Existing environment

14.4.1 As there was no existing noise monitoring data for the area around the proposed Harbour facilities, a baseline noise survey was therefore undertaken. The surrounding heavy industrial land uses (including the Norsea Oil Terminal at Seal Sands, North Tees Oil Refinery, Hartlepool nuclear power station, Seal Sands storage terminal) were considered likely to be the main contributors to the baseline noise levels. There are numerous other industrial and commercial activities in the surrounding area which operate for 24 hours a day. The adjacent rail and road network is also likely to contribute to the existing noise environment.

14.4.2 There are no significant sources of ground borne vibration in the local environment and vibration levels are expected to be negligible. The main noise sensitive receptors associated with the proposed scheme include:

- residential properties close to the proposed scheme;
- users of amenity areas around the mouth of the Tees and Coatham Sands;
- workers within the adjacent industrial areas; and
- marine life and bird populations.

Continuous unattended surveys

14.4.3 As set out in **Section 14.3**, the noise environment around the proposed scheme footprint is largely governed by three main noise sources: the A1085, the Steelworks and the Wilton Complex.

14.4.4 **Section 14.3** also states that it was deemed appropriate to use existing noise data collected for the Wilton site in order to establish a baseline dataset for receptors close to the Wilton International Complex. This data extends from January 2013 until March 2014 and represents typical night time conditions, which is considered to be the sensitive time for sleep disturbance.

14.4.5 A summary of these noise measurement results are detailed in **Table 14-17**.

Table 14-17 Summary of Wilton baseline noise levels (January 2013 to March 2014)

Date	Period	Measured L_{Aeq} (dB)	Measured L_{A90} (dB)
01/01/13 to 31/12/13	Night (23:00 – 05:00)	48.1	44.1
01/01/14 to 31/03/14	Night (23:00 – 05:00)	48.5	44.1

14.4.6 The agreed attended baseline noise monitoring locations are provided in **Figure 14-1**.

Attended survey

14.4.7 An attended baseline noise survey was undertaken by Royal HaskoningDHV between April and June 2014, representing typical night time and daytime conditions, to further characterise the existing noise climate in the vicinity of the site.

14.4.8 The noise measurement results are detailed in **Table 14-18** (representing daytime and night time periods respectively) with observations made regarding the character of noise and any specific noise sources audible during the surveys. The receptor locations are shown **Figure 14-1**.

14.5 Assessment of potential impacts during construction

14.5.1 A construction narrative is provided in **Section 3**. This informed the noise assessment presented below. The predicted noise impact from the multiple construction stages of the proposed scheme were assessed as individual components.

Table 14-18 Attended baseline noise levels

ID and Measurement Position	Period	Measurement Duration	$L_{AFmax,T}$	$L_{Aeq,T}$	$L_{A10,T}$	$L_{A90,T}$
P1 Marsh Farm House	Day	01:00:00	77	56	58	39
	Night	00:15:00	63	50	52	48
P2 South Gare and Coatham Sands SSSI	Day	01:00:00	72	58	61	43
	Night	00:15:00	57	51	53	50
P3 Dormanstown	Day	01:00:00	62	48	50	45
	Night	00:15:00	63	51	52	49
P4 Foxrush Farm	Day	01:00:00	77	48	51	38
	Night	00:15:00	66	54	58	45

NB – Night time noise levels were slightly elevated due to an increasing breeze (<3.5m/s^{-1})

14.5.2 The results of the construction noise calculations are presented as isopleth noise contour plots in **Figures 14-3** to **14-13**. **Tables 14-19** to **14-22** show the calculated day and evening/night time construction noise level and provide a comparison between the calculated level and the construction noise for each receptor, as described in **Tables 14-6** and **14-8**.

14.5.3 A baseline noise survey was not possible at receptors P5 to P11 inclusive, therefore background levels have been derived from a measured level at P2 South Gare/Coatham Sands SSSI for ecological receptors P5 to P10 inclusive and P3 Dormanstown for receptor P11.

14.5.4 To aid the prediction of noise levels from the construction phase a computer noise modelling study was undertaken using SoundPLAN.

14.5.5 Piling operations associated with the conveyor construction (routes north and south) have the potential to result in an impact of **moderate adverse** significance on an evening and night at receptor P3 (Dormanstown). This impact would be temporary and of short duration.

14.5.6 All other activities associated with construction are predicted to generate noise levels no more than the day or night time noise threshold level at any of the surrounding residential receptors and, therefore, satisfy the design guidance provided in BS 5228-1 and the PPG for the NPPF. The impact significance in this context is assessed as negligible.

Table 14-19 Predicted daytime noise impacts during quay construction

Construction Stage	Receptor Location	Daytime noise threshold dB	Calculated Construction Noise Level dB	Magnitude of effect	Impact significance
Stage 1 Site preparation/ Earthworks	P1	65 $L_{Aeq,12hr}$	8 $L_{Aeq,12hr}$	No impact	Negligible
	P2	50 $L_{Aeq,12hr}$	11 $L_{Aeq,12hr}$	No impact	Negligible
	P3	65 $L_{Aeq,12hr}$	12 $L_{Aeq,12hr}$	No impact	Negligible
	P4	65 $L_{Aeq,12hr}$	9 $L_{Aeq,12hr}$	No impact	Negligible
	P5	50 $L_{Aeq,12hr}$	31 $L_{Aeq,12hr}$	No impact	Negligible
	P6	50 $L_{Aeq,12hr}$	30 $L_{Aeq,12hr}$	No impact	Negligible
	P7	50 $L_{Aeq,12hr}$	25 $L_{Aeq,12hr}$	No impact	Negligible
	P8	50 $L_{Aeq,12hr}$	19 $L_{Aeq,12hr}$	No impact	Negligible
	P9	50 $L_{Aeq,12hr}$	23 $L_{Aeq,12hr}$	No impact	Negligible
	P10	50 $L_{Aeq,12hr}$	31 $L_{Aeq,12hr}$	No impact	Negligible
	P11	65 $L_{Aeq,12hr}$	11 $L_{Aeq,12hr}$	No impact	Negligible
Stage 2 Piling	P1	65 $L_{Aeq,5min}$	28 $L_{Aeq,5min}$	No impact	Negligible
	P2	50 $L_{Aeq,5min}$	27 $L_{Aeq,5min}$	No impact	Negligible
	P3	65 $L_{Aeq,5min}$	29 $L_{Aeq,5min}$	No impact	Negligible
	P4	65 $L_{Aeq,5min}$	28 $L_{Aeq,5min}$	No impact	Negligible
	P5	50 $L_{Aeq,5min}$	49 $L_{Aeq,5min}$	No impact	Negligible
	P6	50 $L_{Aeq,5min}$	49 $L_{Aeq,5min}$	No impact	Negligible
	P7	50 $L_{Aeq,5min}$	43 $L_{Aeq,5min}$	No impact	Negligible
	P8	50 $L_{Aeq,5min}$	34 $L_{Aeq,5min}$	No impact	Negligible
	P9	50 $L_{Aeq,5min}$	39 $L_{Aeq,5min}$	No impact	Negligible
	P10	50 $L_{Aeq,5min}$	54 $L_{Aeq,5min}$	Low	Negligible

Construction Stage	Receptor Location	Daytime noise threshold dB	Calculated Construction Noise Level dB	Magnitude of effect	Impact significance
	P11	65 $L_{Aeq,5min}$	30 $L_{Aeq,5min}$	No impact	Negligible
Stage 3 Capital dredging of berthing pocket and approach channel (Area 1)	P1	65 $L_{Aeq,12hr}$	14 $L_{Aeq,12hr}$	No impact	Negligible
	P2	50 $L_{Aeq,12hr}$	15 $L_{Aeq,12hr}$	No impact	Negligible
	P3	65 $L_{Aeq,12hr}$	16 $L_{Aeq,12hr}$	No impact	Negligible
	P4	65 $L_{Aeq,12hr}$	13 $L_{Aeq,12hr}$	No impact	Negligible
	P5	50 $L_{Aeq,12hr}$	36 $L_{Aeq,12hr}$	No impact	Negligible
	P6	50 $L_{Aeq,12hr}$	31 $L_{Aeq,12hr}$	No impact	Negligible
	P7	50 $L_{Aeq,12hr}$	28 $L_{Aeq,12hr}$	No impact	Negligible
	P8	50 $L_{Aeq,12hr}$	21 $L_{Aeq,12hr}$	No impact	Negligible
	P9	50 $L_{Aeq,12hr}$	25 $L_{Aeq,12hr}$	No impact	Negligible
	P10	50 $L_{Aeq,12hr}$	37 $L_{Aeq,12hr}$	No impact	Negligible
	P11	65 $L_{Aeq,12hr}$	15 $L_{Aeq,12hr}$	No impact	Negligible
Stage 3 Capital dredging of berthing pocket and approach channel (area 2)	P1	65 $L_{Aeq,12hr}$	16 $L_{Aeq,12hr}$	No impact	Negligible
	P2	50 $L_{Aeq,12hr}$	15 $L_{Aeq,12hr}$	No impact	Negligible
	P3	65 $L_{Aeq,12hr}$	15 $L_{Aeq,12hr}$	No impact	Negligible
	P4	65 $L_{Aeq,12hr}$	12 $L_{Aeq,12hr}$	No impact	Negligible
	P5	50 $L_{Aeq,12hr}$	41 $L_{Aeq,12hr}$	No impact	Negligible
	P6	50 $L_{Aeq,12hr}$	32 $L_{Aeq,12hr}$	No impact	Negligible
	P7	50 $L_{Aeq,12hr}$	28 $L_{Aeq,12hr}$	No impact	Negligible
	P8	50 $L_{Aeq,12hr}$	20 $L_{Aeq,12hr}$	No impact	Negligible
	P9	50 $L_{Aeq,12hr}$	26 $L_{Aeq,12hr}$	No impact	Negligible
	P10	50 $L_{Aeq,12hr}$	44 $L_{Aeq,12hr}$	No impact	Negligible

Construction Stage	Receptor Location	Daytime noise threshold dB	Calculated Construction Noise Level dB	Magnitude of effect	Impact significance
	P11	65 $L_{Aeq,12hr}$	14 $L_{Aeq,12hr}$	No impact	Negligible
Stage 4 General construction	P1	65 $L_{Aeq,12hr}$	22 $L_{Aeq,12hr}$	No impact	Negligible
	P2	50 $L_{Aeq,12hr}$	21 $L_{Aeq,12hr}$	No impact	Negligible
	P3	65 $L_{Aeq,12hr}$	22 $L_{Aeq,12hr}$	No impact	Negligible
	P4	65 $L_{Aeq,12hr}$	19 $L_{Aeq,12hr}$	No impact	Negligible
	P5	50 $L_{Aeq,12hr}$	40 $L_{Aeq,12hr}$	No impact	Negligible
	P6	50 $L_{Aeq,12hr}$	43 $L_{Aeq,12hr}$	No impact	Negligible
	P7	50 $L_{Aeq,12hr}$	37 $L_{Aeq,12hr}$	No impact	Negligible
	P8	50 $L_{Aeq,12hr}$	27 $L_{Aeq,12hr}$	No impact	Negligible
	P9	50 $L_{Aeq,12hr}$	33 $L_{Aeq,12hr}$	No impact	Negligible
	P10	50 $L_{Aeq,12hr}$	47 $L_{Aeq,12hr}$	No impact	Negligible
	P11	65 $L_{Aeq,12hr}$	21 $L_{Aeq,12hr}$	No impact	Negligible

Table 14-20 Calculated evening/night noise impacts during quay construction

ConstructionStage	Receptor Location	Evening / night noise threshold dB	Calculated Construction Noise Level dB	Effect magnitude	Impact significance
Stage 1 Site preparation/ Earthworks	P1	50 $L_{Aeq,12hr}$	12 $L_{Aeq,12hr}$	No impact	Negligible
	P2	50 $L_{Aeq,12hr}$	11 $L_{Aeq,12hr}$	No impact	Negligible
	P3	50 $L_{Aeq,12hr}$	12 $L_{Aeq,12hr}$	No impact	Negligible
	P4	50 $L_{Aeq,12hr}$	9 $L_{Aeq,12hr}$	No impact	Negligible
	P5	50 $L_{Aeq,12hr}$	31 $L_{Aeq,12hr}$	No impact	Negligible
	P6	50 $L_{Aeq,12hr}$	30 $L_{Aeq,12hr}$	No impact	Negligible
	P7	50 $L_{Aeq,12hr}$	25 $L_{Aeq,12hr}$	No impact	Negligible
	P8	50 $L_{Aeq,12hr}$	19 $L_{Aeq,12hr}$	No impact	Negligible
	P9	50 $L_{Aeq,12hr}$	23 $L_{Aeq,12hr}$	No impact	Negligible
	P10	50 $L_{Aeq,12hr}$	31 $L_{Aeq,12hr}$	No impact	Negligible
	P11	50 $L_{Aeq,12hr}$	11 $L_{Aeq,12hr}$	No impact	Negligible
Stage 2 Piling	P1	50 $L_{Aeq,5min}$	29 $L_{Aeq,5min}$	No impact	Negligible
	P2	50 $L_{Aeq,5min}$	27 $L_{Aeq,5min}$	No impact	Negligible
	P3	50 $L_{Aeq,5min}$	30 $L_{Aeq,5min}$	No impact	Negligible
	P4	50 $L_{Aeq,5min}$	29 $L_{Aeq,5min}$	No impact	Negligible
	P5	50 $L_{Aeq,5min}$	49 $L_{Aeq,5min}$	No impact	Negligible
	P6	50 $L_{Aeq,5min}$	49 $L_{Aeq,5min}$	No impact	Negligible
	P7	50 $L_{Aeq,5min}$	43 $L_{Aeq,5min}$	No impact	Negligible
	P8	50 $L_{Aeq,5min}$	34 $L_{Aeq,5min}$	No impact	Negligible
	P9	50 $L_{Aeq,5min}$	39 $L_{Aeq,5min}$	No impact	Negligible
	P10	50 $L_{Aeq,5min}$	54 $L_{Aeq,5min}$	Low	Negligible

ConstructionStage	Receptor Location	Evening / night noise threshold dB	Calculated Construction Noise Level dB	Effect magnitude	Impact significance
	P11	50 $L_{Aeq,5min}$	30 $L_{Aeq,5min}$	No impact	Negligible
Stage 3 Capital dredging of berthing pocket (area 1)	P1	50 $L_{Aeq,12hr}$	15 $L_{Aeq,12hr}$	No impact	Negligible
	P2	50 $L_{Aeq,12hr}$	15 $L_{Aeq,12hr}$	No impact	Negligible
	P3	50 $L_{Aeq,12hr}$	16 $L_{Aeq,12hr}$	No impact	Negligible
	P4	50 $L_{Aeq,12hr}$	13 $L_{Aeq,12hr}$	No impact	Negligible
	P5	50 $L_{Aeq,12hr}$	36 $L_{Aeq,12hr}$	No impact	Negligible
	P6	50 $L_{Aeq,12hr}$	31 $L_{Aeq,12hr}$	No impact	Negligible
	P7	50 $L_{Aeq,12hr}$	28 $L_{Aeq,12hr}$	No impact	Negligible
	P8	50 $L_{Aeq,12hr}$	21 $L_{Aeq,12hr}$	No impact	Negligible
	P9	50 $L_{Aeq,12hr}$	25 $L_{Aeq,12hr}$	No impact	Negligible
	P10	50 $L_{Aeq,12hr}$	37 $L_{Aeq,12hr}$	No impact	Negligible
	P11	50 $L_{Aeq,12hr}$	15 $L_{Aeq,12hr}$	No impact	Negligible
Stage 3 Capital dredging of berthing pocket and approach channel (area 2)	P1	50 $L_{Aeq,12hr}$	16 $L_{Aeq,12hr}$	No impact	Negligible
	P2	50 $L_{Aeq,12hr}$	15 $L_{Aeq,12hr}$	No impact	Negligible
	P3	50 $L_{Aeq,12hr}$	15 $L_{Aeq,12hr}$	No impact	Negligible
	P4	50 $L_{Aeq,12hr}$	12 $L_{Aeq,12hr}$	No impact	Negligible
	P5	50 $L_{Aeq,12hr}$	41 $L_{Aeq,12hr}$	No impact	Negligible
	P6	50 $L_{Aeq,12hr}$	32 $L_{Aeq,12hr}$	No impact	Negligible
	P7	50 $L_{Aeq,12hr}$	28 $L_{Aeq,12hr}$	No impact	Negligible
	P8	50 $L_{Aeq,12hr}$	20 $L_{Aeq,12hr}$	No impact	Negligible
	P9	50 $L_{Aeq,12hr}$	26 $L_{Aeq,12hr}$	No impact	Negligible
	P10	50 $L_{Aeq,12hr}$	44 $L_{Aeq,12hr}$	No impact	Negligible

ConstructionStage	Receptor Location	Evening / night noise threshold dB	Calculated Construction Noise Level dB	Effect magnitude	Impact significance
	P11	50 $L_{Aeq,12hr}$	14 $L_{Aeq,12hr}$	No impact	Negligible
Stage 4 General construction	P1	50 $L_{Aeq,12hr}$	23 $L_{Aeq,12hr}$	No impact	Negligible
	P2	50 $L_{Aeq,12hr}$	21 $L_{Aeq,12hr}$	No impact	Negligible
	P3	50 $L_{Aeq,12hr}$	22 $L_{Aeq,12hr}$	No impact	Negligible
	P4	50 $L_{Aeq,12hr}$	19 $L_{Aeq,12hr}$	No impact	Negligible
	P5	50 $L_{Aeq,12hr}$	40 $L_{Aeq,12hr}$	No impact	Negligible
	P6	50 $L_{Aeq,12hr}$	43 $L_{Aeq,12hr}$	No impact	Negligible
	P7	50 $L_{Aeq,12hr}$	37 $L_{Aeq,12hr}$	No impact	Negligible
	P8	50 $L_{Aeq,12hr}$	27 $L_{Aeq,12hr}$	No impact	Negligible
	P9	50 $L_{Aeq,12hr}$	33 $L_{Aeq,12hr}$	No impact	Negligible
	P10	50 $L_{Aeq,12hr}$	47 $L_{Aeq,12hr}$	No impact	Negligible
	P11	50 $L_{Aeq,12hr}$	21 $L_{Aeq,12hr}$	No impact	Negligible

Figure 14-3 Noise contour plot of quay construction – Stage 1

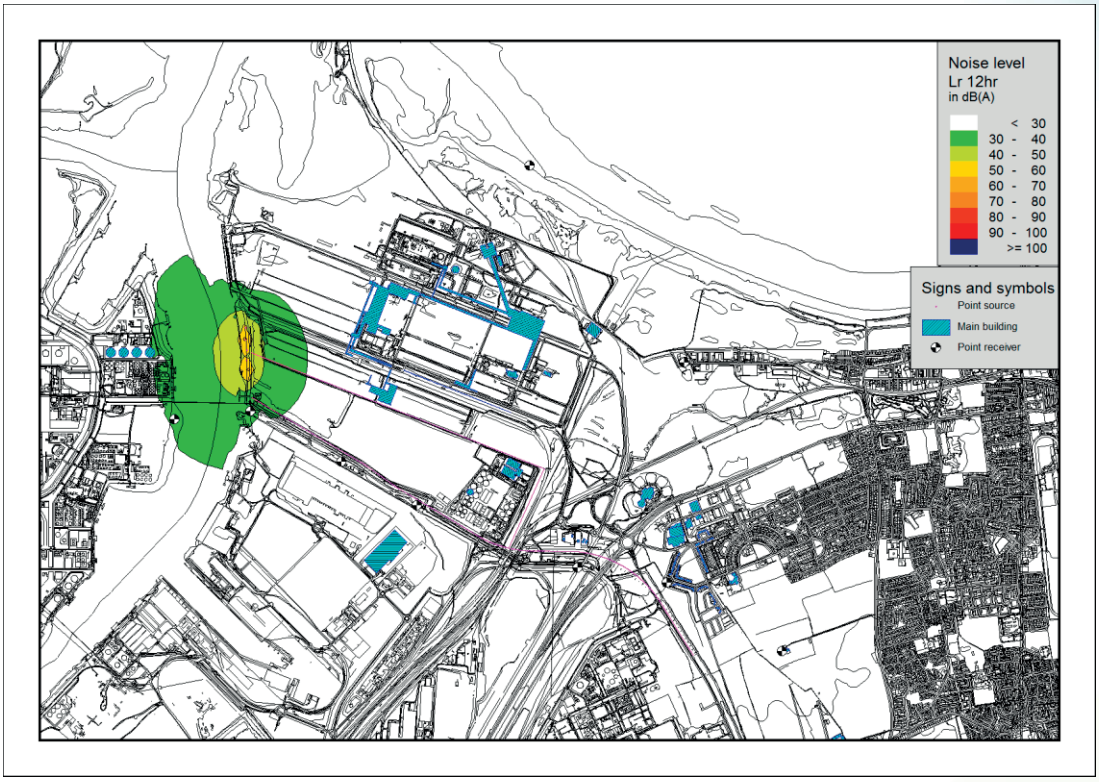


Figure 14-4 Noise contour plot of quay construction – Stage 2

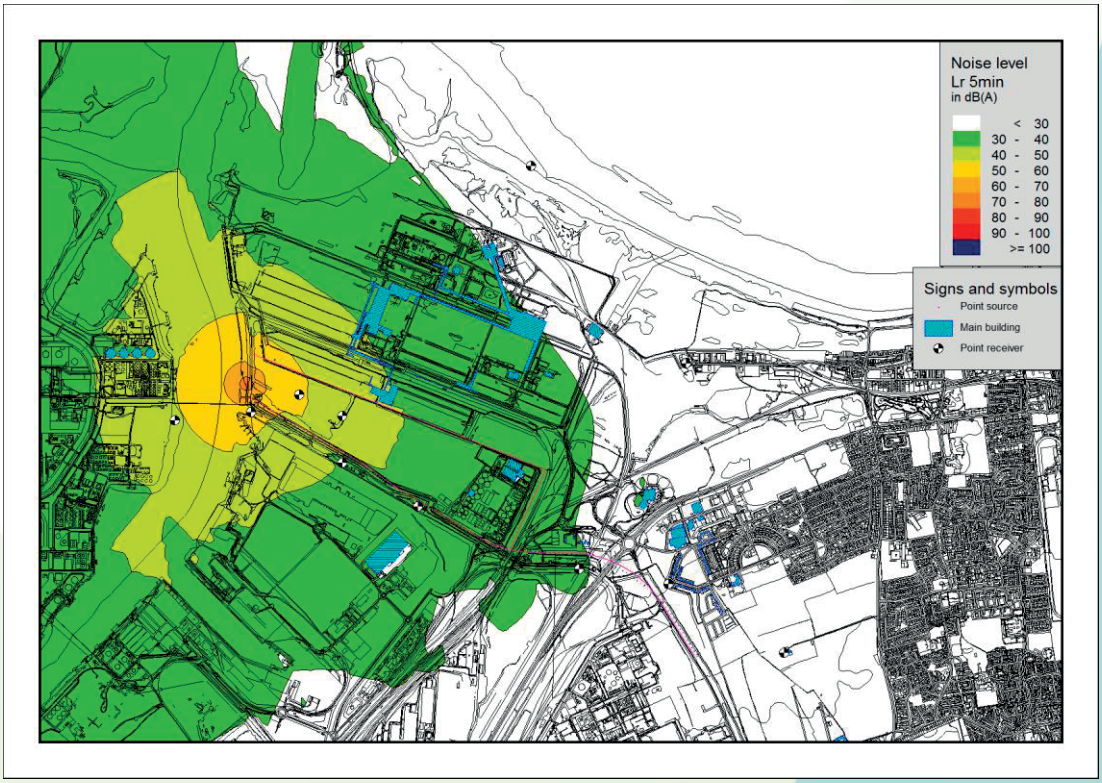


Figure 14-5 Noise contour plot of quay construction – Stage 3 (Dredge Area 1)

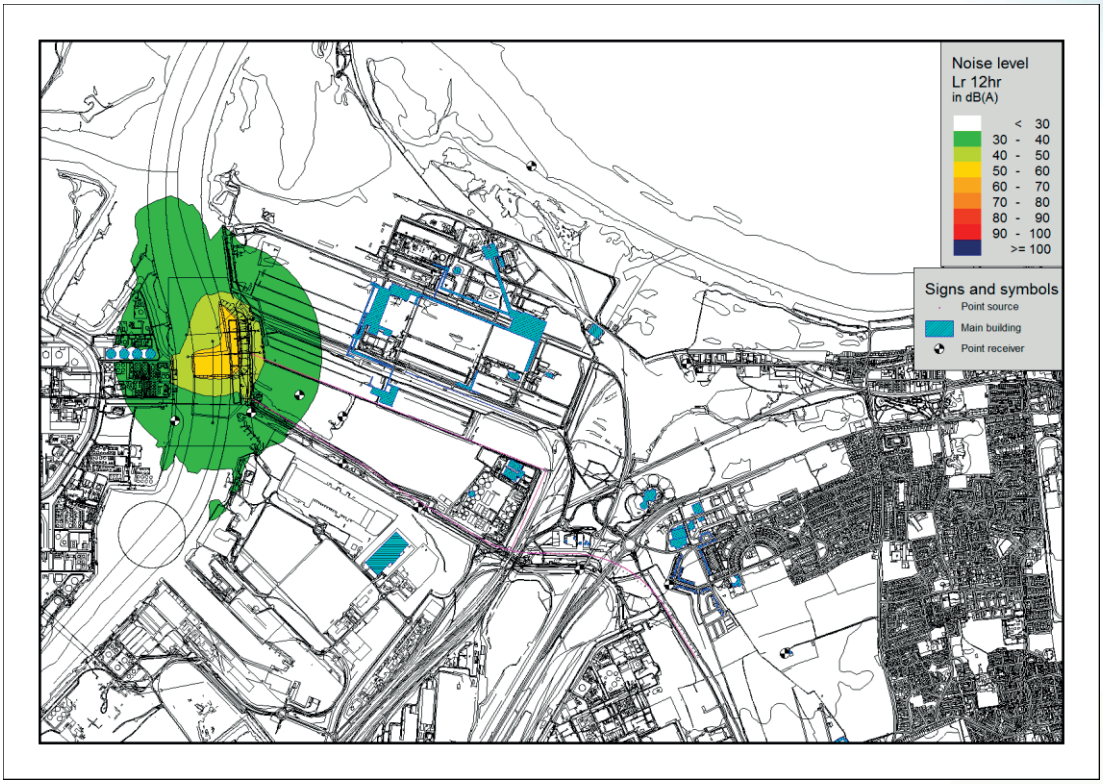


Figure 14-6 Noise contour plot of quay construction – Stage 3 (Dredge Area 2)

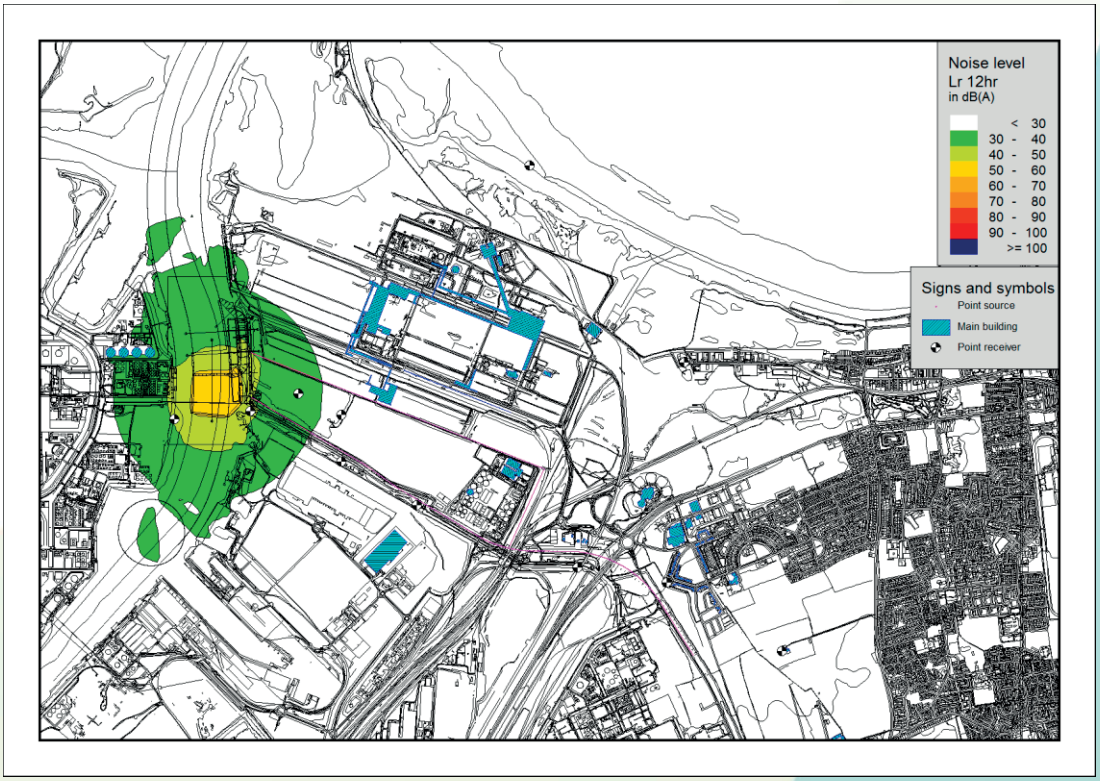


Figure 14-7 Noise contour plot of quay construction – Stage 4

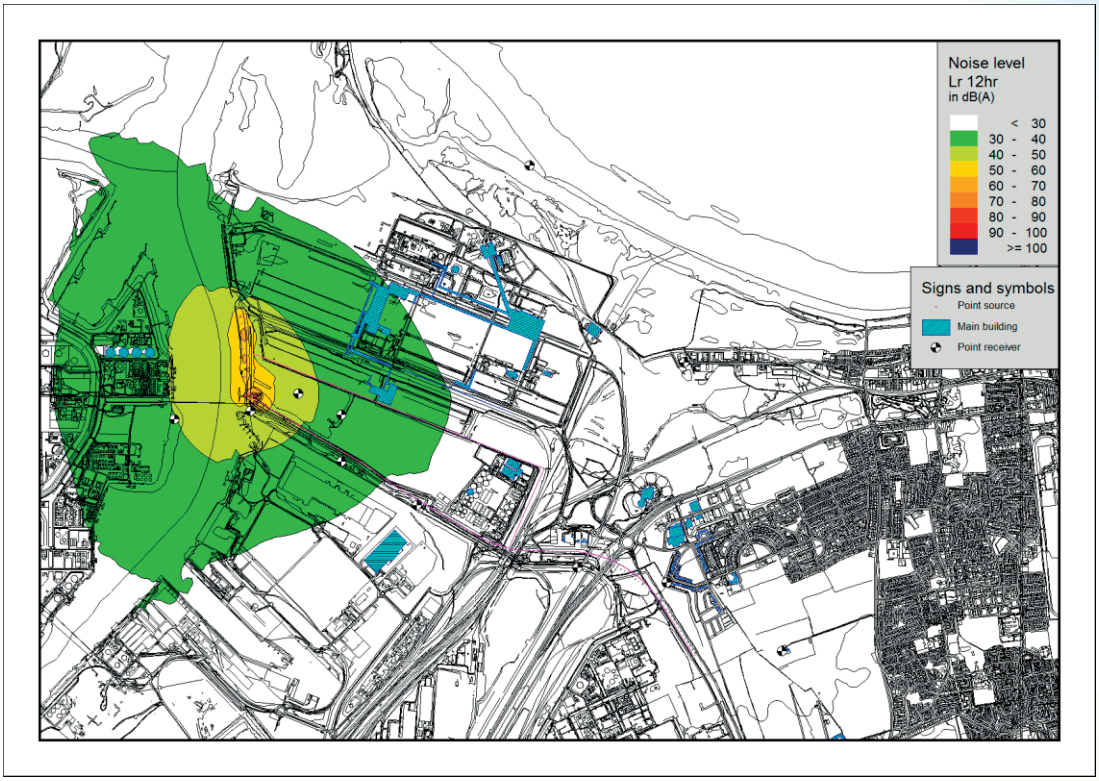


Figure 14-8 Noise contour plot of south conveyor construction – Stage 1

Table 14-21 Calculated day noise impacts during south conveyor option construction

Construction Stage	Receptor Location	Daytime noise threshold dB	Calculated Construction Noise Level dB	Effect magnitude	Impact significance
Stage 1 Site preparation/ Earthworks	P1	65 $L_{Aeq,12hr}$	19 $L_{Aeq,12hr}$	No impact	Negligible
	P2	50 $L_{Aeq,12hr}$	11 $L_{Aeq,12hr}$	No impact	Negligible
	P3	65 $L_{Aeq,12hr}$	42 $L_{Aeq,12hr}$	No impact	Negligible
	P4	65 $L_{Aeq,12hr}$	25 $L_{Aeq,12hr}$	No impact	Negligible
	P5	50 $L_{Aeq,12hr}$	19 $L_{Aeq,12hr}$	No impact	Negligible
	P6	50 $L_{Aeq,12hr}$	27 $L_{Aeq,12hr}$	No impact	Negligible
	P7	50 $L_{Aeq,12hr}$	23 $L_{Aeq,12hr}$	No impact	Negligible
	P8	50 $L_{Aeq,12hr}$	26 $L_{Aeq,12hr}$	No impact	Negligible
	P9	50 $L_{Aeq,12hr}$	25 $L_{Aeq,12hr}$	No impact	Negligible
	P10	50 $L_{Aeq,12hr}$	31 $L_{Aeq,12hr}$	No impact	Negligible
	P11	65 $L_{Aeq,12hr}$	27 $L_{Aeq,12hr}$	No impact	Negligible
Stage 2 Piling	P1	65 $L_{Aeq,5min}$	37 $L_{Aeq,5min}$	No impact	Negligible
	P2	50 $L_{Aeq,5min}$	29 $L_{Aeq,5min}$	No impact	Negligible
	P3	65 $L_{Aeq,5min}$	59 $L_{Aeq,5min}$	No impact	Negligible
	P4	65 $L_{Aeq,5min}$	43 $L_{Aeq,5min}$	No impact	Negligible
	P5	50 $L_{Aeq,5min}$	43 $L_{Aeq,5min}$	No impact	Negligible
	P6	50 $L_{Aeq,5min}$	49 $L_{Aeq,5min}$	No impact	Negligible
	P7	50 $L_{Aeq,5min}$	48 $L_{Aeq,5min}$	No impact	Negligible

Construction Stage	Receptor Location	Daytime noise threshold dB	Calculated Construction Noise Level dB	Effect magnitude	Impact significance
	P8	50 $L_{Aeq,5min}$	66 $L_{Aeq,5min}$	Low	Negligible
	P9	50 $L_{Aeq,5min}$	61 $L_{Aeq,5min}$	Low	Negligible
	P10	50 $L_{Aeq,5min}$	59 $L_{Aeq,5min}$	Low	Negligible
	P11	65 $L_{Aeq,5min}$	55 $L_{Aeq,5min}$	No impact	Negligible
Stage 3 General construction	P1	65 $L_{Aeq,12hr}$	18 $L_{Aeq,12hr}$	No impact	Negligible
	P2	50 $L_{Aeq,12hr}$	11 $L_{Aeq,12hr}$	No impact	Negligible
	P3	65 $L_{Aeq,12hr}$	42 $L_{Aeq,12hr}$	No impact	Negligible
	P4	65 $L_{Aeq,12hr}$	23 $L_{Aeq,12hr}$	No impact	Negligible
	P5	50 $L_{Aeq,12hr}$	17 $L_{Aeq,12hr}$	No impact	Negligible
	P6	50 $L_{Aeq,12hr}$	27 $L_{Aeq,12hr}$	No impact	Negligible
	P7	50 $L_{Aeq,12hr}$	29 $L_{Aeq,12hr}$	No impact	Negligible
	P8	50 $L_{Aeq,12hr}$	27 $L_{Aeq,12hr}$	No impact	Negligible
	P9	50 $L_{Aeq,12hr}$	30 $L_{Aeq,12hr}$	No impact	Negligible
	P10	50 $L_{Aeq,12hr}$	24 $L_{Aeq,12hr}$	No impact	Negligible
	P11	65 $L_{Aeq,12hr}$	27 $L_{Aeq,12hr}$	No impact	Negligible

Table 14-22 Calculated evening/night noise impacts during south conveyor option construction

Construction Stage	Receptor Location	Evening / night noise threshold dB	Calculated Construction Noise Level dB	Effect magnitude	Impact significance
Stage 1 Site preparation/ Earthworks	P1	50 $L_{Aeq,12hr}$	19 $L_{Aeq,12hr}$	No impact	Negligible
	P2	50 $L_{Aeq,12hr}$	11 $L_{Aeq,12hr}$	No impact	Negligible
	P3	50 $L_{Aeq,12hr}$	42 $L_{Aeq,12hr}$	No impact	Negligible
	P4	50 $L_{Aeq,12hr}$	25 $L_{Aeq,12hr}$	No impact	Negligible
	P5	50 $L_{Aeq,12hr}$	19 $L_{Aeq,12hr}$	No impact	Negligible
	P6	50 $L_{Aeq,12hr}$	27 $L_{Aeq,12hr}$	No impact	Negligible
	P7	50 $L_{Aeq,12hr}$	23 $L_{Aeq,12hr}$	No impact	Negligible
	P8	50 $L_{Aeq,12hr}$	26 $L_{Aeq,12hr}$	No impact	Negligible
	P9	50 $L_{Aeq,12hr}$	25 $L_{Aeq,12hr}$	No impact	Negligible
	P10	50 $L_{Aeq,12hr}$	31 $L_{Aeq,12hr}$	No impact	Negligible
	P11	50 $L_{Aeq,12hr}$	27 $L_{Aeq,12hr}$	No impact	Negligible
Stage 2 Piling	P1	50 $L_{Aeq,5min}$	38 $L_{Aeq,5min}$	No impact	Negligible
	P2	50 $L_{Aeq,5min}$	29 $L_{Aeq,5min}$	No impact	Negligible
	P3	50 $L_{Aeq,5min}$	59 $L_{Aeq,5min}$	Medium	Moderate
	P4	50 $L_{Aeq,5min}$	44 $L_{Aeq,5min}$	No impact	Negligible
	P5	50 $L_{Aeq,5min}$	43 $L_{Aeq,5min}$	No impact	Negligible
	P6	50 $L_{Aeq,5min}$	49 $L_{Aeq,5min}$	No impact	Negligible
	P7	50 $L_{Aeq,5min}$	48 $L_{Aeq,5min}$	No impact	Negligible

Construction Stage	Receptor Location	Evening / night noise threshold dB	Calculated Construction Noise Level dB	Effect magnitude	Impact significance
	P8	50 $L_{Aeq,5min}$	66 $L_{Aeq,5min}$	Low	Negligible
	P9	50 $L_{Aeq,5min}$	61 $L_{Aeq,5min}$	Low	Negligible
	P10	50 $L_{Aeq,5min}$	59 $L_{Aeq,5min}$	Low	Negligible
	P11	50 $L_{Aeq,5min}$	55 $L_{Aeq,5min}$	Low	Negligible
Stage 3 General construction	P1	50 $L_{Aeq,12hr}$	19 $L_{Aeq,12hr}$	No impact	Negligible
	P2	50 $L_{Aeq,12hr}$	11 $L_{Aeq,12hr}$	No impact	Negligible
	P3	50 $L_{Aeq,12hr}$	42 $L_{Aeq,12hr}$	No impact	Negligible
	P4	50 $L_{Aeq,12hr}$	23 $L_{Aeq,12hr}$	No impact	Negligible
	P5	50 $L_{Aeq,12hr}$	17 $L_{Aeq,12hr}$	No impact	Negligible
	P6	50 $L_{Aeq,12hr}$	27 $L_{Aeq,12hr}$	No impact	Negligible
	P7	50 $L_{Aeq,12hr}$	29 $L_{Aeq,12hr}$	No impact	Negligible
	P8	50 $L_{Aeq,12hr}$	27 $L_{Aeq,12hr}$	No impact	Negligible
	P9	50 $L_{Aeq,12hr}$	30 $L_{Aeq,12hr}$	No impact	Negligible
	P10	50 $L_{Aeq,12hr}$	24 $L_{Aeq,12hr}$	No impact	Negligible
	P11	50 $L_{Aeq,12hr}$	27 $L_{Aeq,12hr}$	No impact	Negligible

Figure 14-9 Noise contour plot of south conveyor construction – Stage 2

14.5.7 With the exception of receptor P3, all other predicted construction noise levels are significantly below the recommended levels in BS8233.

14.5.8 There is potential for the construction phase of the proposed scheme to result in noise disturbance to ecological receptors, including species utilising the nearby designated sites for nature conservation (as well as supporting habitat, including Bran Sands lagoon and Dabholm Gut) (see **Sections 8** and **9**).

14.5.9 A low magnitude of effect is predicted on a number of ecological receptors. This is due to their close proximity to the works and a direct line of sight across the river. The noise modelling exercise assumed that all construction equipment would be operating close to the site boundary, which would not necessarily occur at all times; therefore this represents a conservative assessment. In addition, baseline noise levels during the day and night periods are already in excess of the predicted construction noise limit level of 50dB $L_{Aeq,12hr}$during the daytime, due to the dominant heavy industrial activities, making disturbance from construction activities alone, unlikely. Hence construction noise levels are predicted to have an impact of **negligible** significance on all assessed ecological receptors.

Mitigation and residual impacts during construction

14.5.10 With the exception of receptor P3, the results of the noise calculations indicate all activities associated with the proposed scheme are predicted to be no more than the daytime noise threshold level at any of the surrounding residential receptors and, therefore, satisfy the design guidance provided in BS 5228-1 and the PPG for the NPPF.

Figure 14-10 Noise contour plot of south conveyor construction – Stage 3

Figure 14-11 Noise contour plot of north conveyor construction – Stage 1

Table 14-23 Predicted daytime noise impacts during north conveyor option construction

Construction Stage	Receptor Location	Daytime noise threshold dB	Calculated Construction Noise Level dB	Effect magnitude	Impact significance
Stage 1 Site preparation/ Earthworks	P1	65 $L_{Aeq,12hr}$	21 $L_{Aeq,12hr}$	No impact	Negligible
	P2	50 $L_{Aeq,12hr}$	15 $L_{Aeq,12hr}$	No impact	Negligible
	P3	65 $L_{Aeq,12hr}$	43 $L_{Aeq,12hr}$	No impact	Negligible
	P4	65 $L_{Aeq,12hr}$	26 $L_{Aeq,12hr}$	No impact	Negligible
	P5	50 $L_{Aeq,12hr}$	26 $L_{Aeq,12hr}$	No impact	Negligible
	P6	50 $L_{Aeq,12hr}$	32 $L_{Aeq,12hr}$	No impact	Negligible
	P7	50 $L_{Aeq,12hr}$	35 $L_{Aeq,12hr}$	No impact	Negligible
	P8	50 $L_{Aeq,12hr}$	24 $L_{Aeq,12hr}$	No impact	Negligible
	P9	50 $L_{Aeq,12hr}$	28 $L_{Aeq,12hr}$	No impact	Negligible
	P10	50 $L_{Aeq,12hr}$	27 $L_{Aeq,12hr}$	No impact	Negligible
	P11	65 $L_{Aeq,12hr}$	28 $L_{Aeq,12hr}$	No impact	Negligible
Stage 2 Piling	P1	65 $L_{Aeq,5min}$	38 $L_{Aeq,5min}$	No impact	Negligible
	P2	50 $L_{Aeq,5min}$	30 $L_{Aeq,5min}$	No impact	Negligible
	P3	65 $L_{Aeq,5min}$	59 $L_{Aeq,5min}$	No impact	Negligible
	P4	65 $L_{Aeq,5min}$	43 $L_{Aeq,5min}$	No impact	Negligible
	P5	50 $L_{Aeq,5min}$	42 $L_{Aeq,5min}$	No impact	Negligible
	P6	50 $L_{Aeq,5min}$	49 $L_{Aeq,5min}$	No impact	Negligible
	P7	50 $L_{Aeq,5min}$	48 $L_{Aeq,5min}$	No impact	Negligible

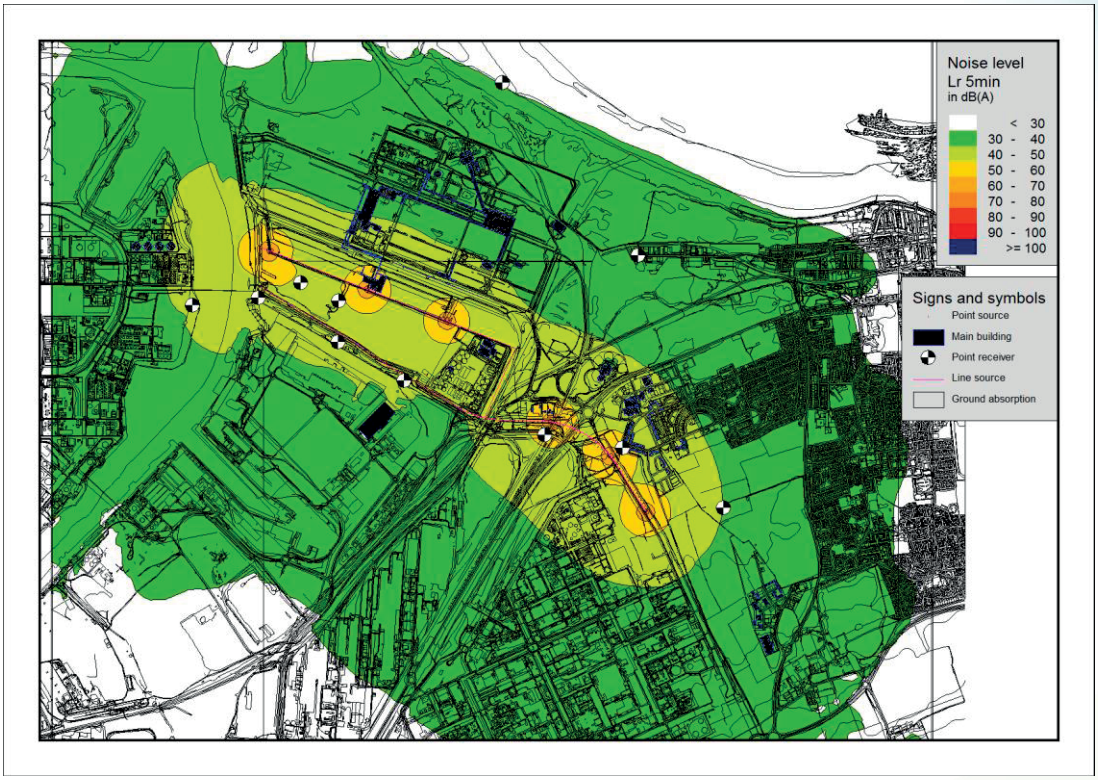
Construction Stage	Receptor Location	Daytime noise threshold dB	Calculated Construction Noise Level dB	Effect magnitude	Impact significance
	P8	50 $L_{Aeq,5min}$	40 $L_{Aeq,5min}$	No impact	Negligible
	P9	50 $L_{Aeq,5min}$	42 $L_{Aeq,5min}$	No impact	Negligible
	P10	50 $L_{Aeq,5min}$	44 $L_{Aeq,5min}$	No impact	Negligible
	P11	65 $L_{Aeq,5min}$	55 $L_{Aeq,5min}$	No impact	Negligible
Stage 3 General construction	P1	65 $L_{Aeq,12hr}$	19 $L_{Aeq,12hr}$	No impact	Negligible
	P2	50 $L_{Aeq,12hr}$	11 $L_{Aeq,12hr}$	No impact	Negligible
	P3	65 $L_{Aeq,12hr}$	42 $L_{Aeq,12hr}$	No impact	Negligible
	P4	65 $L_{Aeq,12hr}$	23 $L_{Aeq,12hr}$	No impact	Negligible
	P5	50 $L_{Aeq,12hr}$	19 $L_{Aeq,12hr}$	No impact	Negligible
	P6	50 $L_{Aeq,12hr}$	31 $L_{Aeq,12hr}$	No impact	Negligible
	P7	50 $L_{Aeq,12hr}$	30 $L_{Aeq,12hr}$	No impact	Negligible
	P8	50 $L_{Aeq,12hr}$	22 $L_{Aeq,12hr}$	No impact	Negligible
	P9	50 $L_{Aeq,12hr}$	21 $L_{Aeq,12hr}$	No impact	Negligible
	P10	50 $L_{Aeq,12hr}$	20 $L_{Aeq,12hr}$	No impact	Negligible
	P11	65 $L_{Aeq,12hr}$	28 $L_{Aeq,12hr}$	No impact	Negligible

Table 14-24 Predicted evening/night noise impacts during north conveyor option construction

Construction Stage	Receptor Location	Evening / night noise threshold dB	Calculated Construction Noise Level dB	Effect magnitude	Impact significance
Stage 1 Site preparation/ Earthworks	P1	50 $L_{Aeq,12hr}$	21 $L_{Aeq,12hr}$	No impact	Negligible
	P2	50 $L_{Aeq,12hr}$	15 $L_{Aeq,12hr}$	No impact	Negligible
	P3	50 $L_{Aeq,12hr}$	43 $L_{Aeq,12hr}$	No impact	Negligible
	P4	50 $L_{Aeq,12hr}$	26 $L_{Aeq,12hr}$	No impact	Negligible
	P5	50 $L_{Aeq,12hr}$	26 $L_{Aeq,12hr}$	No impact	Negligible
	P6	50 $L_{Aeq,12hr}$	32 $L_{Aeq,12hr}$	No impact	Negligible
	P7	50 $L_{Aeq,12hr}$	35 $L_{Aeq,12hr}$	No impact	Negligible
	P8	50 $L_{Aeq,12hr}$	24 $L_{Aeq,12hr}$	No impact	Negligible
	P9	50 $L_{Aeq,12hr}$	28 $L_{Aeq,12hr}$	No impact	Negligible
	P10	50 $L_{Aeq,12hr}$	27 $L_{Aeq,12hr}$	No impact	Negligible
	P11	50 $L_{Aeq,12hr}$	28 $L_{Aeq,12hr}$	No impact	Negligible
Stage 2 Piling	P1	50 $L_{Aeq,5min}$	39 $L_{Aeq,5min}$	No impact	Negligible
	P2	50 $L_{Aeq,5min}$	30 $L_{Aeq,5min}$	No impact	Negligible
	P3	50 $L_{Aeq,5min}$	59 $L_{Aeq,5min}$	Medium	Moderate
	P4	50 $L_{Aeq,5min}$	44 $L_{Aeq,5min}$	No impact	Negligible
	P5	50 $L_{Aeq,5min}$	42 $L_{Aeq,5min}$	No impact	Negligible
	P6	50 $L_{Aeq,5min}$	49 $L_{Aeq,5min}$	No impact	Negligible
	P7	50 $L_{Aeq,5min}$	48 $L_{Aeq,5min}$	No impact	Negligible

Construction Stage	Receptor Location	Evening / night noise threshold dB	Calculated Construction Noise Level dB	Effect magnitude	Impact significance
	P8	50 $L_{Aeq,5min}$	40 $L_{Aeq,5min}$	No impact	Negligible
	P9	50 $L_{Aeq,5min}$	42 $L_{Aeq,5min}$	No impact	Negligible
	P10	50 $L_{Aeq,5min}$	44 $L_{Aeq,5min}$	No impact	Negligible
	P11	50 $L_{Aeq,5min}$	55 $L_{Aeq,5min}$	Low	Negligible
Stage 3 General construction	P1	50 $L_{Aeq,12hr}$	19 $L_{Aeq,12hr}$	No impact	Negligible
	P2	50 $L_{Aeq,12hr}$	11 $L_{Aeq,12hr}$	No impact	Negligible
	P3	50 $L_{Aeq,12hr}$	42 $L_{Aeq,12hr}$	No impact	Negligible
	P4	50 $L_{Aeq,12hr}$	23 $L_{Aeq,12hr}$	No impact	Negligible
	P5	50 $L_{Aeq,12hr}$	19 $L_{Aeq,12hr}$	No impact	Negligible
	P6	50 $L_{Aeq,12hr}$	31 $L_{Aeq,12hr}$	No impact	Negligible
	P7	50 $L_{Aeq,12hr}$	30 $L_{Aeq,12hr}$	No impact	Negligible
	P8	50 $L_{Aeq,12hr}$	22 $L_{Aeq,12hr}$	No impact	Negligible
	P9	50 $L_{Aeq,12hr}$	21 $L_{Aeq,12hr}$	No impact	Negligible
	P10	50 $L_{Aeq,12hr}$	20 $L_{Aeq,12hr}$	No impact	Negligible
	P11	50 $L_{Aeq,12hr}$	28 $L_{Aeq,12hr}$	No impact	Negligible

Figure 14-12 Noise contour plot of north conveyor construction – Stage 2

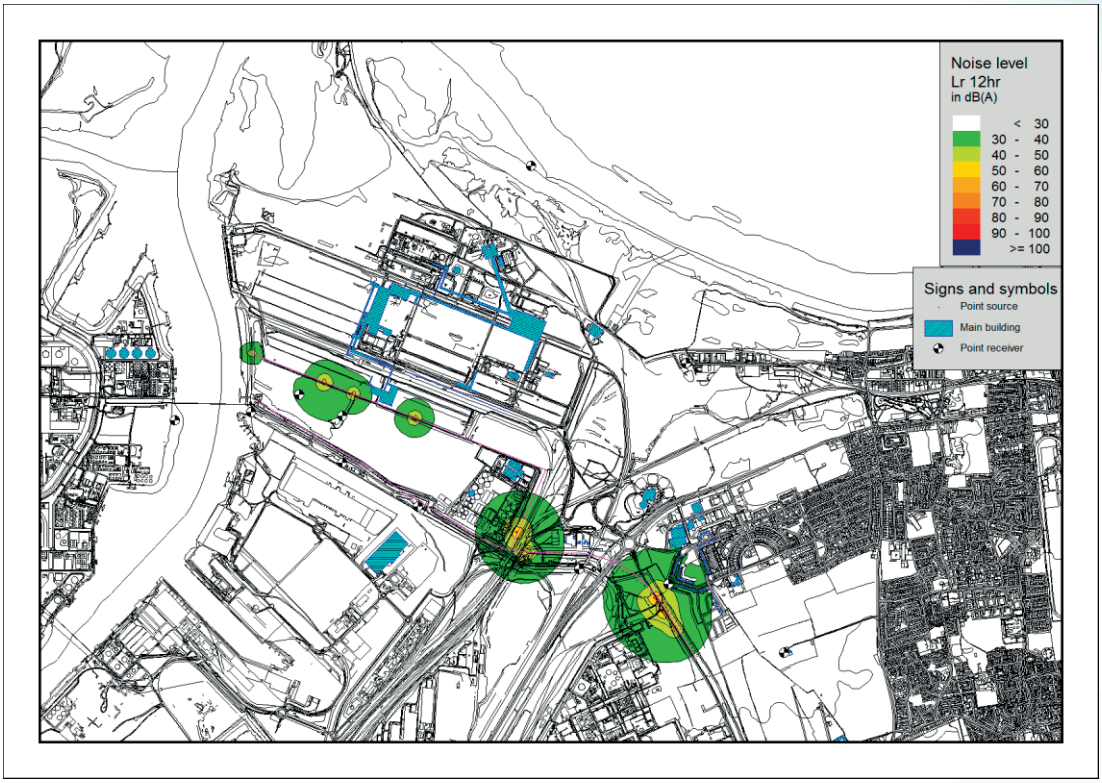


14.5.11 Due to the predicted impact at receptor P3, during conveyor piling operations, and at a number of ecological receptors, the adoption of general good practice construction noise management measures (typically referred to as Best Practical Means (BPM)) is recommended, and quantified below.

14.5.12 A conventional approach to good construction noise management is via the implementation of a CEMP; an initial version of which is provided in **Appendix 6.4**. Conventional mitigation measures implemented during construction can include:

- informing local residents about the construction works, including the timing and duration of any particularly noisy elements, and providing a contact telephone number to them;
- avoiding operating particularly noisy equipment at the beginning and end of the day;
- keeping potentially noisy deliveries, such as skips and concrete, to the middle or less sensitive times of the day where possible;
- locating noisy static plant, such as diesel generators, away from residential properties;
- appropriate use of site hoardings and barriers around site compounds;
- appropriate use of barriers around static construction equipment, i.e. generators, auger piling rigs etc.;
- the use of noise reduction curtain over the hammer piling rig during percussive operations, this can provide a minimum of 10dB attenuation (Hush Rig System, University of Hong Kong 1989);
- using the most modern equipment available and ensuring equipment is properly maintained; and
- where possible, using silencers/mufflers on equipment.

Figure 14-13 Noise contour plot of north conveyor construction – Stage 3



Training

14.5.13 The site induction programme and site rules would include good working practice instructions for site staff, managers, visitors and contractors to help minimise noise whilst working on the site.

14.5.14 Good working practice guidelines/instructions would include, but not be limited to, the following points:

- avoid un-necessary revving of engines;
- plant used intermittently should be shut-down between operational periods;
- avoid reversing wherever possible;
- drive carefully and within the site speed limit at all times;
- report any defective equipment/plant as soon as possible so that corrective maintenance can be undertaken; and,
- handle material in a manner that minimises noise.

Maintenance

14.5.15 Maintenance of plant would be carried out routinely and in accordance with the manufacturers' guidance. A regular inspection of all plant and equipment would be undertaken as a minimum to ensure that:

- all plant is in a good state of repair and fully functional;
- any plant found to be requiring interim maintenance has been identified and taken out of use;
- acoustic enclosures fitted to plant are in a good state of repair;

- doors and covers remain closed during operation; and,
- any repairs are being undertaken by a fully qualified maintenance engineer.
- Non-compliance with noise limits / receipt of complaint

14.5.16 If the predicted noise levels are exceeded as a result of construction works or a complaint is received from a local resident, an investigation would be instigated by the Site Manager within an agreed time period to identify the cause of the non-compliance/complaint.

14.5.17 Such an investigation may involve the identification and cessation of the activity or activities considered to be the cause of the non-compliance/complaint (where operationally safe to do so) and/or the investigation of mitigation measures to reduce the noise emission levels from the activity or activities, for example the replacement of noisy plant with quieter alternatives and/or the use of temporary screens.

14.5.18 Any deviation from agreed working practices would be identified immediately and conformance to the working practice reinstated. A further noise survey would be undertaken as soon as possible following the implementation of mitigation to re-assess the noise levels against the guideline noise levels.

14.5.19 A complaints response system would be maintained for the site enabling any complaints regarding noise to be reported and appropriate action taken.

Communication

14.5.20 Contact information should be displayed at the site entrance in order that complaints can be registered. A 24 hour emergency contact number would be set up and distributed accordingly to ensure enquiries can be registered at all times.

Residual impact

14.5.21 The results of the mitigated construction noise calculations for Stage 2 percussive piling on the quay and auger piling operations along the conveyor routes are presented below and as isopleth contour plots in **Figures 14-14** to **14-15**. **Tables 14-25** to **14-28** show the predicted mitigated day and evening/night time construction noise level and provide a comparison between the calculated level and the construction noise threshold for each receptor, as described in **Tables 14-6** and **14-8**.

Table 14-25 Mitigated day noise impacts during Stage 2 quay percussive piling and south conveyor route auger piling

Receptor Location	Daytime noise threshold dB	Mitigated Construction Noise Level dB	Effect magnitude	Impact significance
P1	65 $L_{Aeq,5min}$	33 $L_{Aeq,5min}$	No impact	Negligible
P2	50 $L_{Aeq,5min}$	26 $L_{Aeq,5min}$	No impact	Negligible
P3	65 $L_{Aeq,5min}$	45 $L_{Aeq,5min}$	No impact	Negligible
P4	65 $L_{Aeq,5min}$	39 $L_{Aeq,5min}$	No impact	Negligible

Receptor Location	Daytime noise threshold dB	Mitigated Construction Noise Level dB	Effect magnitude	Impact significance
P5	50 $L_{Aeq,5min}$	40 $L_{Aeq,5min}$	No impact	Negligible
P6	50 $L_{Aeq,5min}$	40 $L_{Aeq,5min}$	No impact	Negligible
P7	50 $L_{Aeq,5min}$	44 $L_{Aeq,5min}$	No impact	Negligible
P8	50 $L_{Aeq,5min}$	47 $L_{Aeq,5min}$	No impact	Negligible
P9	50 $L_{Aeq,5min}$	48 $L_{Aeq,5min}$	No impact	Negligible
P10	50 $L_{Aeq,5min}$	50 $L_{Aeq,5min}$	Low	Negligible
P11	65 $L_{Aeq,5min}$	45 $L_{Aeq,5min}$	No impact	Negligible

Table 14-26 Mitigated evening/night noise impacts during Stage 2 quay percussive piling and south conveyor route auger piling

Receptor Location	Evening / night noise threshold dB	Mitigated Construction Noise Level dB	Effect magnitude	Impact significance
P1	50 $L_{Aeq,5min}$	33 $L_{Aeq,5min}$	No impact	Negligible
P2	50 $L_{Aeq,5min}$	26 $L_{Aeq,5min}$	No impact	Negligible
P3	50 $L_{Aeq,5min}$	45 $L_{Aeq,5min}$	No impact	Negligible
P4	50 $L_{Aeq,5min}$	39 $L_{Aeq,5min}$	No impact	Negligible
P5	50 $L_{Aeq,5min}$	40 $L_{Aeq,5min}$	No impact	Negligible
P6	50 $L_{Aeq,5min}$	40 $L_{Aeq,5min}$	No impact	Negligible
P7	50 $L_{Aeq,5min}$	44 $L_{Aeq,5min}$	No impact	Negligible
P8	50 $L_{Aeq,5min}$	47 $L_{Aeq,5min}$	No impact	Negligible
P9	50 $L_{Aeq,5min}$	48 $L_{Aeq,5min}$	No impact	Negligible
P10	50 $L_{Aeq,5min}$	50 $L_{Aeq,5min}$	Low	Negligible
P11	50 $L_{Aeq,5min}$	45 $L_{Aeq,5min}$	No impact	Negligible

Table 14-27 Mitigated day noise impacts during Stage 2 quay percussive piling and north conveyor route auger piling

Receptor Location	Daytime noise threshold dB	Mitigated Construction Noise Level dB	Effect magnitude	Impact significance
P1	65 $L_{Aeq,5min}$	35 $L_{Aeq,5min}$	No impact	Negligible
P2	50 $L_{Aeq,5min}$	31 $L_{Aeq,5min}$	No impact	Negligible

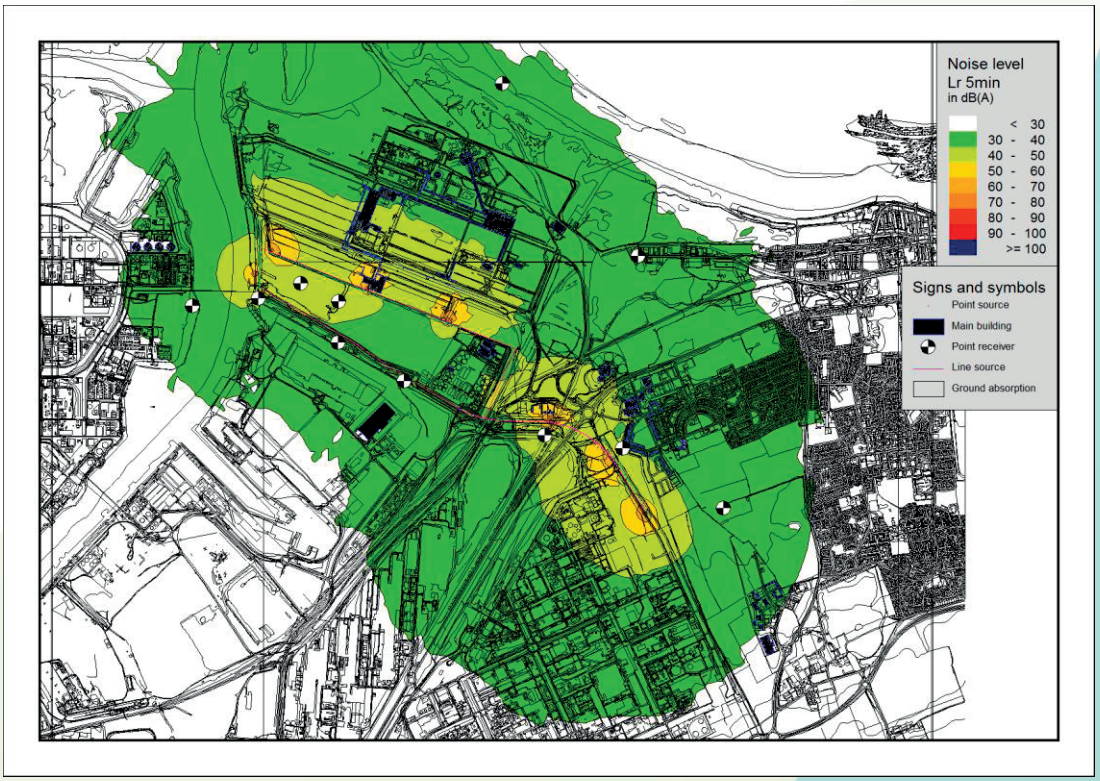
Receptor Location	Daytime noise threshold dB	Mitigated Construction Noise Level dB	Effect magnitude	Impact significance
P3	65 $L_{Aeq,5min}$	45 $L_{Aeq,5min}$	No impact	Negligible
P4	65 $L_{Aeq,5min}$	39 $L_{Aeq,5min}$	No impact	Negligible
P5	50 $L_{Aeq,5min}$	35 $L_{Aeq,5min}$	No impact	Negligible
P6	50 $L_{Aeq,5min}$	45 $L_{Aeq,5min}$	No impact	Negligible
P7	50 $L_{Aeq,5min}$	41 $L_{Aeq,5min}$	No impact	Negligible
P8	50 $L_{Aeq,5min}$	36 $L_{Aeq,5min}$	No impact	Negligible
P9	50 $L_{Aeq,5min}$	35 $L_{Aeq,5min}$	No impact	Negligible
P10	50 $L_{Aeq,5min}$	40 $L_{Aeq,5min}$	No impact	Negligible
P11	65 $L_{Aeq,5min}$	45 $L_{Aeq,5min}$	No impact	Negligible

Table 14-28 Mitigated evening/night noise impacts during Stage 2 quay percussive piling and north conveyor route auger piling

Receptor Location	Evening / night noise threshold dB	Mitigated Construction Noise Level dB	Effect magnitude	Impact significance
P1	50 $L_{Aeq,5min}$	36 $L_{Aeq,5min}$	No impact	Negligible
P2	50 $L_{Aeq,5min}$	31 $L_{Aeq,5min}$	No impact	Negligible
P3	50 $L_{Aeq,5min}$	45 $L_{Aeq,5min}$	No impact	Negligible
P4	50 $L_{Aeq,5min}$	39 $L_{Aeq,5min}$	No impact	Negligible
P5	50 $L_{Aeq,5min}$	35 $L_{Aeq,5min}$	No impact	Negligible
P6	50 $L_{Aeq,5min}$	45 $L_{Aeq,5min}$	No impact	Negligible
P7	50 $L_{Aeq,5min}$	41 $L_{Aeq,5min}$	No impact	Negligible
P8	50 $L_{Aeq,5min}$	36 $L_{Aeq,5min}$	No impact	Negligible
P9	50 $L_{Aeq,5min}$	35 $L_{Aeq,5min}$	No impact	Negligible
P10	50 $L_{Aeq,5min}$	40 $L_{Aeq,5min}$	No impact	Negligible
P11	50 $L_{Aeq,5min}$	45 $L_{Aeq,5min}$	No impact	Negligible

Figure 14-14 Noise contour plot of mitigated Stage 2 quay percussive piling and south conveyor construction

Figure 14-15 Noise contour plot of mitigated Stage 2 quay percussive piling and north conveyor construction



14.5.22 **Tables 14-25** to **14-28** indicate that, following the application of suitable mitigation, as outlined above (through the implementation of a CEMP) and the provision of a noise curtain over the quay percussive piling rig, temporary acoustic barriers around auger piling rigs and site boundary close-boarded fencing, the predicted noise levels at residential and ecological receptors have reduced by a maximum of 10dB. Therefore during quay percussive piling and conveyor auger piling activities associated with the north and south conveyor options the residual impact is predicted to be of **negligible** significance in all locations.

Construction vibration impact

14.5.23 Ground borne vibration assessments may be drawn from the empirical methods detailed in BS5228-2, in the Transport and Road Research Laboratory Research Report (TRRL) 246: Traffic induced vibrations in buildings and within the Transport Research Laboratory (TRL) Report 429 (2000): Ground borne vibration caused by mechanical construction works.

14.5.24 However, these calculation methods rely on detailed information, including the type and number of plant being used, their location and the length of time they are in operation. Given the mobile nature of much of the plant that has the potential to impart sufficient energy into the ground, and the varying ground conditions in the immediate vicinity of the construction works, it was considered that an accurate representation of vibration conditions using these predictive methods was not possible.

14.5.25 Consequently, a series of calculations, following the methodologies referred to above, was carried out based on typical construction activities that have the potential to impart sufficient energy into the ground, applying reasonable worst-case assumptions, in order to determine set-back distances at which critical vibration levels may occur.

14.5.26 **Table 14-29** lists the minimum set-back distances at which vibration levels of reportable significance were predicted to occur for typical construction activities that may occur on the site. Where applicable in the relevant calculation methods, a 66.6% certainty factor was included in order to provide a conservative approach.

Table 14-29 Predicted distances at which vibration levels may occur

Activity	Set-back Distance at which Vibration Level (PPV) occurs			
	0.3 mm/s	1.0 mm/s	10 mm/s	15 mm/s
Vibratory Compaction (Start-up)	*166m**	65m	9m	6m
Vibratory Compaction (Steady State)	102m	44m	8m	6m
Vibratory Piling (Start-up)	*154m**	56m	8m	6m
Vibratory Piling (Steady State)	75m	32m	6m	5m
Percussive Piling	48m	19m	3m	2m
Tunnelling	*137m**	54m	*9m**	*7m**
HGV Movement on uneven Haul Route	277m	60m	3m	2m

Note These predicted distances are outside the limitations of the calculations and are therefore provided for information only.*

14.5.27 The nearest identified sensitive receptor location is 120m to the north east of the proposed scheme footprint, as a minimum distance between the site boundary and the closest property in Dormanstown, indicating that the only potential source of perceptible vibration at a sensitive receptor would be HGV movements on uneven haul routes. The HGV activity within the site would rarely be just at the site boundary for any extended period, and given the expected haul route noise management controls, including consideration of road surfacing and restricted vehicle speeds, this activity would not be expected to generate significant vibration effects at this residential area.

14.5.28 Ground-borne vibration levels are, therefore, predicted to be significantly lower than 0.3mm/s at all nearby sensitive receptors (i.e. below levels which are considered to be just about perceptible in residential environments).

14.5.29 The magnitude of the effect is considered to be no effect / very low and the sensitivity of the receptor is assessed as medium; on this basis, the resulting impact is predicted to be of **negligible** significance.

Mitigation and residual impact

14.5.30 Best management practice for vibration should be implemented to minimise vibration impacts, including:

- choosing alternative, lower impact equipment or methods where possible;
- scheduling the use of vibration-causing equipment at the least sensitive time of day;
- routing, operating or locating high vibration sources as far away from sensitive areas as possible;
- sequencing operations so that vibration-causing activities do not occur simultaneously;
- isolating the equipment causing vibration on resilient mounts; and,
- keeping equipment well maintained.

14.5.31 The residual impact would remain of **negligible** significance.

Construction offsite road traffic noise

14.5.32 With regard to noise associated with vehicle movement, the screening assessment of construction road traffic impacts was undertaken by examining the percentage change in 18 hour AAWT traffic in the scheme initial construction year (2015) for each traffic scenario outlined in **Section 14.3**. The results of this screening exercise are presented below in **Tables 14-30** to **14-32**.

Table 14-30 Screening assessment of initial construction year traffic impacts – Weekday Average

Road link	18hr AAWT Traffic Flows (2015 Baseline)	18hr AAWT Traffic Flows (2015 Baseline + Construction)	% Increase
2 A66	28,709	29,440	2.5
44 A1085	18,896	19,538	3.3

Table 14-31 Screening assessment of initial construction year traffic impacts – Saturday Average

Road link	18hr AAWT Traffic Flows (2015 Baseline)	18hr AAWT Traffic Flows (2015 Baseline + Construction)	% Increase
2 A66	20,158	20,889	3.5
44 A1085	12,559	13,201	4.9

Table 14-32 Screening assessment of initial construction year traffic impacts – Sunday Average

Road link	18hr AAWT Traffic Flows (2015 Baseline)	18hr AAWT Traffic Flows (2015 Baseline + Construction)	% Increase
2 A66	15,112	15,496	2.5
44 A1085	11,935	12,410	3.8

14.5.33 **Tables 14-30** to **14-32** indicate that for the assessed traffic scenarios, potentially significant changes in total traffic flows of 25% or more were not predicted on any of the surrounding road links. In accordance with DMRB criteria, the magnitude of the effect at all receptors would, therefore, be very low and the associated impact would be of **negligible** significance.

14.6 Assessment of potential impacts during operation

Port and conveyor operation noise

14.6.1 The results of the SoundPLAN operational noise calculations are presented in **Tables 14-33** to **14-34**, and as isopleth (contour) plots in **Figures 14-16** and **14-17**. These tables show the calculated operational noise level, at each residential and ecological receptor. The tables also provide a comparison between the calculated level and the background noise level for the day and night time

period at each receptor, in accordance with BS4142. The background noise levels were rounded to the nearest whole number. A +5dB penalty was applied to the specific noise level to provide a 'Rating Level' (Lr), representing a conservative approach. The magnitude of the predicted effect was established using the criteria defined in **Table 14-14** for daytime and night-time periods at residential receptors and in **Table 14-8** for ecological receptors.

Table 14-33 Daytime operational noise assessment – quay and south conveyor route option

ID and Receptor Name	Measured Background L_{A90}	Predicted Daytime Operational Rating Level $L_{Ar\ (16hr)}$	Rating above Background dBA	Magnitude of effect	Significance of impact
P1	39	16	-23	No impact / Very low	Negligible
P2	43	21	-22	No impact / Very low	Negligible
P3	45	20	-25	No impact / Very low	Negligible
P4	38	16	-22	No impact / Very low	Negligible
P5	43	40	-3	No impact / Very low	Negligible
P6	43	43	0	No impact / Very low	Negligible
P7	43	34	-9	No impact / Very low	Negligible
P8	43	27	-16	No impact / Very low	Negligible
P9	43	33	-10	No impact / Very low	Negligible
P10	43	50	7	Low	Negligible
P11	45	20	-25	No impact / Very low	Negligible

Table 14-34 Night time operational noise assessment – quay and south conveyor route option

ID and Receptor Name	Measured Background L_{A90}	Predicted Night time Operational Rating Level $L_{Ar\ (8hr)}$	Rating above Background dBA	Magnitude of effect	Significance of impact
P1	48	19	-29	No impact / Very low	Negligible
P2	50	21	-29	No impact / Very low	Negligible
P3	49	20	-29	No impact / Very low	Negligible
P4	45	16	-29	No impact / Very low	Negligible
P5	50	40	-10	No impact / Very low	Negligible
P6	50	43	-7	No impact / Very low	Negligible
P7	50	34	-16	No impact / Very low	Negligible
P8	50	27	-23	No impact / Very low	Negligible
P9	50	33	-17	No impact / Very low	Negligible
P10	50	50	0	No impact / Very low	Negligible
P11	49	20	-29	No impact / Very low	Negligible

Figure 14-16 Noise contour plot of operational quay and south conveyor option

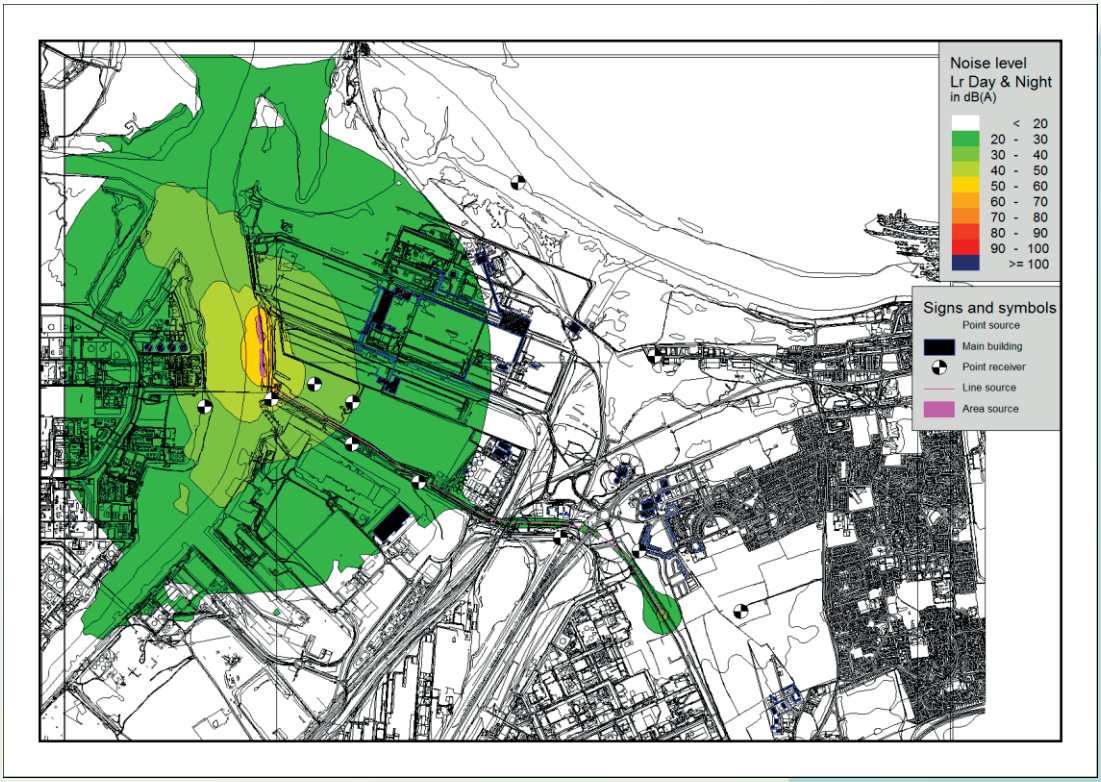


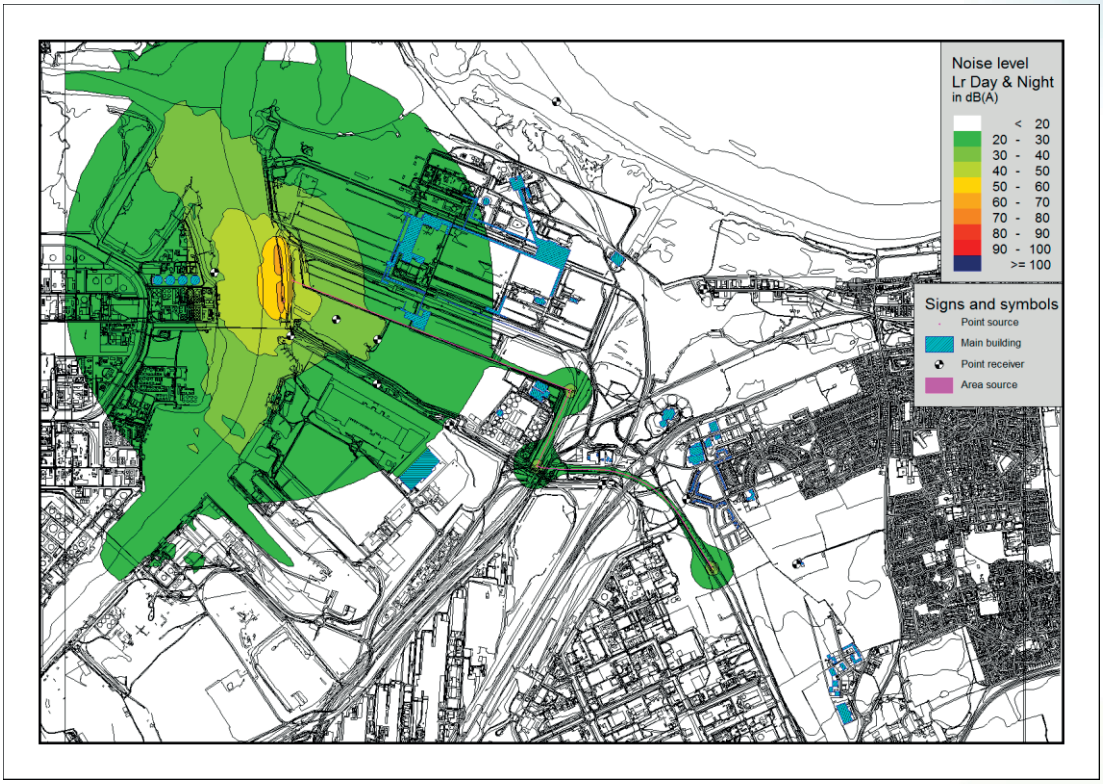
Table 14-35 Daytime operational noise assessment – quay and north conveyor route option

ID and Receptor Name	Measured Background L_{A90}	Predicted Daytime Operational Rating Level $L_{Ar\ (16hr)}$	Rating above Background dBA	Magnitude of effect	Significance of impact
P1	39	14	-25	No impact / Very low	Negligible
P2	43	19	-24	No impact / Very low	Negligible
P3	45	19	-26	No impact / Very low	Negligible
P4	38	15	-23	No impact / Very low	Negligible
P5	43	34	-9	No impact / Very low	Negligible
P6	43	42	-1	No impact / Very low	Negligible
P7	43	31	-12	No impact / Very low	Negligible
P8	43	23	-20	No impact / Very low	Negligible
P9	43	30	-13	No impact / Very low	Negligible
P10	43	46	3	No impact / Very low	Negligible
P11	45	19	-26	No impact / Very low	Negligible

Table 14-36 Night time operational noise assessment – quay and north conveyor route option

ID and Receptor Name	Measured Background L_{A90}	Predicted Night time Operational Rating Level $L_{Ar\ (8hr)}$	Rating above Background dBA	Magnitude of effect	Significance of impact
P1	48	18	-30	No impact / Very low	Negligible
P2	50	19	-31	No impact / Very low	Negligible
P3	49	20	-29	No impact / Very low	Negligible
P4	45	16	-29	No impact / Very low	Negligible
P5	50	34	-16	No impact / Very low	Negligible
P6	50	42	-8	No impact / Very low	Negligible
P7	50	31	-19	No impact / Very low	Negligible
P8	50	23	-27	No impact / Very low	Negligible
P9	50	30	-20	No impact / Very low	Negligible
P10	50	46	-4	No impact / Very low	Negligible
P11	49	19	-30	No impact / Very low	Negligible

Figure 14-17 Noise contour plot of operational quay and north conveyor option



14.6.2 **Tables 14-33** to **14-36** indicate that operational noise over a day and night time period from the proposed scheme has a predicted magnitude of effect that ranges from no impact to very low and low; hence an impact of **negligible** significance is predicted for all residential and ecological receptors.

Operational offsite road traffic noise

14.6.3 With regard to vehicle movement noise, the screening assessment of operational road traffic impacts was undertaken by examining the percentage change in 18 hour AAWT traffic in the scheme initial operational year (2020) for each traffic scenario outlined in **Section 14.3**. The results of this screening exercise are presented below in **Tables 14-37** to **14-39**.

Table 14-37 Screening assessment of initial operational year traffic impacts – Weekday Average

Road link	18hr AAWT Traffic Flows (2020 Baseline)	18hr AAWT Traffic Flows (2020 Baseline + Operational)	% Increase
2 A66	30,991	31,291	1.0
44 A1085	20,309	20,643	1.6

Table 14-38 Screening assessment of initial operational year traffic impacts – Saturday Average

Road link	18hr AAWT Traffic Flows (2020 Baseline)	18hr AAWT Traffic Flows (2020 Baseline + Operational)	% Increase
2 A66	21,953	22,253	1.3
44 A1085	13,613	13,947	2.4

Table 14-39 Screening assessment of initial operational year traffic impacts – Sunday Average

Road link	18hr AAWT Traffic Flows (2020 Baseline)	18hr AAWT Traffic Flows (2020 Baseline + Operational)	% Increase
2 A66	16,633	16,904	1.6
44 A1085	12,957	13,255	2.2

14.6.4 **Tables 14-37** to **14-39** indicate that for the assessed traffic scenarios, potentially significant changes in total traffic flows of 25% or more are not predicted on any of the surrounding road links. In accordance with DMRB criteria, the magnitude of effect at all receptors would be no impact / very low and the associated impact would be of **negligible** significance.

Assessment of impacts during decommissioning

14.6.5 The decommissioning of the proposed scheme would be managed through an overall Decommissioning Plan. Noise impacts associated with decommissioning activities would be similar (and most likely of lower significance) to those identified in the construction programmes, and appropriate controls and management approaches would be expected to be in place.

14.7 Summary

14.7.1 This section assessed the effect of the proposed scheme with regard to noise and vibration. Consideration was given to the potential impacts that could arise during the construction, operation and decommissioning phases at the most proximate receptors to the site and surrounding road network.

14.7.2 The assessment was undertaken following consultation and in accordance with approaches agreed with the Environmental Health Department of RCBC. It drew upon the results of a detailed baseline noise survey, to establish the prevailing noise environment in the vicinity of the proposed scheme.

14.7.3 The assessments accounted for relevant statutory and technical guidance on noise and vibration impacts of infrastructure development. Such guidance was used in the determination of the significance of each identified potential impact area.

14.7.4 Where appropriate, consideration was given to mitigation measures and residual impacts were determined. The assessed impacts are summarised below in **Table 14-40**.

Table 14-40 Summary of predicted impacts

Impact	Sensitivity of receptor	Magnitude of effect	Significance of impact	Mitigation	Residual impact
Construction Noise					
Port (capital dredging areas 1 and 2) and Conveyor (north and south options)	Medium	No impact to Medium	Negligible to Moderate	• The results of the noise calculations indicate that the majority of activities associated with the port facility and conveyor construction were predicted to be no more than the daytime noise threshold level at any of the surrounding residential and ecological receptors and therefore satisfy the design guidance provided in BS 5228-1 and the PPG for the NPPF. • A conventional approach to good construction noise management would be via the implementation of a CEMP, which can include measures such as: • Informing local residents about the construction works, including the timing and duration of any particularly noisy elements, and providing a contact telephone number to them; • Avoiding operating particularly noisy equipment at the beginning and end of the day; • Keeping potentially noisy deliveries, such as skips and concrete, to the middle or less sensitive times of the day where possible; • Locating noisy static plant, such as diesel generators, away from residential properties; • Appropriate use of close-boarded site hoardings and barriers around site compounds; • Appropriate use of barriers around static construction equipment, i.e. generators, auger piling rigs etc.; • Consideration into the use of noise reduction curtain over the percussive piling rig during operations; • Using the most modern equipment available and ensuring equipment is properly maintained; and • Where possible, using silencers/mufflers on equipment. • Following the application of suitable mitigation, as outlined above (through the implementation of a CEMP), and the provision of a noise curtain over the quay percussive piling rig, provision of temporary acoustic barriers around auger piling rigs and site boundary close-boarded fencing, the predicted noise level at residential and ecological receptors would be reduced by a maximum of 10dB.	Negligible

Impact	Sensitivity of receptor	Magnitude of effect	Significance of impact	Mitigation	Residual impact
Offsite construction road traffic	Medium	No impact	Negligible	None	Negligible
Construction Vibration					
Ground borne construction vibration at assessed residential and ecological receptors	Medium	No impact	Negligible	None	Negligible
Operation					
Port and Material Conveyor	Medium	No impact to Low	No impact / Very Low	Where a noise source is proposed to be located internally, the structure shall comprise of lightweight cladding materials. Typical cladding materials offer sound insulation performances of at least 17dB Rw.	Negligible
Offsite operational road traffic	Medium	No impact	Negligible	None	Negligible
Decommissioning					
Similar to those identified for construction					As for construction

BLANK PAGE