Kyleakin Fish Feed Factory

Marine Harvest

Environmental Impact Assessment - Volume 2 of 4: Main Report

Chapter 7: Noise

Final

May 2017

Contents

7. Noise

7.1 Introduction

This chapter provides an assessment of the likely noise and vibration effects arising from the construction and operation of the Kyleakin Fish Feed Plant on terrestrial noise sensitive receptors. An assessment of the likely noise and vibration effects arising from the construction and operation of the Kyleakin Fish Feed Plant on marine ecology and nature conservation is presented in **Chapter 19: Marine Ecology**. The Proposed Development site is located in Allt Anavig Quarry on the Isle of Skye approximately 570 metres (m) west of the Skye Bridge and 800m west of Kyleakin. The nearest dwellings to the Proposed Development are located beside the A87, approximately 350m east-south-east of the Proposed Development, along Old Kyle Farm Road approximately 470m east-south-east of the Proposed Development and at Kyle House approximately 560m east of the Proposed Development. The Development Area is shown in **Figure 1.1**.

The consultation undertaken as part of the noise assessment is provided in **Section 7.2**. The assessment methodology employed for the construction and operational noise assessment is set out in **Section 7.3**. A description of the baseline noise survey undertaken, and the results of this survey, are presented in **Section 7.4**. The construction and operational noise assessments are provided in **Section 7.5** and **Section 7.6**, respectively. Mitigation is considered in **Section 7.7**. Conclusions and references are provided in **Section 7.8** and **Section 7.9**, respectively.

To aid understanding of this chapter, definitions of frequently used acoustic terms are presented in **Appendix 7.1**. The calibration certificates for the sound level meters used during the baseline noise survey are presented in **Appendix 7.2**. Descriptions of the baseline survey locations and the detailed survey results are presented in **Appendix 7.3**. The construction and operational noise source data are presented in **Appendix 7.4**.

7.2 Consultation

7.2.1 Pre-Application Advice Pack

The Highland Council (THC) provided a Pre-Application Advice Pack (reference: 16/00734/PREAPP). In terms of noise, responses from THC Environmental Health Service were pending when the advice pack was provided. However, the advice pack did state "*…it is clear that a Noise Impact Assessment will be required as part of any application*".

Scottish Natural Heritage (SNH) were consulted as part of the production of the Pre-Application Advice Park, and, with regards to noise, stated:

"*An underwater noise assessment should be carried out and appropriate mitigation put forward based on relevant best practice guidance:*

- *Statutory nature conservation agency piling protocol (August 2010), http://jncc.defra.gov.uk/pdf/JNCC_Piling%20protocol_August_2010.pdf*
- *JNCC guidelines for minimising the risk of disturbance and injury to marine mammals whilst using explosives (August 2010), http://jncc.defra.gov.uk/pdf/JNCC_Guidelines_Explosives%20Guidelines_August%202010.pdf*".

With regards to noise, Scottish Environmental Protection Agency (SEPA) stated than they will "*regulate odour, dust and potentially noise during the operation of the site*" and "*Comments on noise and dust during construction should be sought from Environmental Health*".

7.2.2 Scoping

Scoping opinions were sought from THC and Marine Scotland. THC's scoping opinion (dated 04/07/2016) stated:

"*The applicant will be required to submit a noise assessment with regard to the operational phase of the development.*

A construction noise assessment should be submitted and it should be carried out in accordance with BS 5228-1: 2009 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise. It is expected that the developer/contractor will employ the best practicable means to reduce the impact of noise from construction activities. Details of any mitigation measures should be provided including proposed hours of operation".

Marine Scotland provided a Screening and Scoping Opinion report (dated 27/06/2016), which also included consultee responses from the Ministry of Defence (MOD), Transport Scotland, SEPA and SNH. With regards to noise, the Ministry of Defence (MOD), stated:

"*…construction works (particularly any pile driving activities) have the potential to compromise or otherwise cause significant noise interference to acoustic trials conducted at the MOD BUTEC* [(British Underwater Test and Evaluation Centre)] *ranges. Accordingly the MOD advises that the applicant should review the construction techniques that will be used and evaluate the associated noise emissions. In conjunction with this the applicant should prepare an appropriate noise impact mitigation strategy as part of a management plan to support any marine license application submitted to demonstrate what measures will be put in place to ensure pile driving type works are coordinated with the operation of the MOD BUTEC range and conducted at times when the range is not in operation. It is recommended that the applicant enters into further dialogue with the range operator to establish what type of mitigation measures will be appropriate*".

Transport Scotland stated: "*Based on the information supplied, we can confirm that we are satisfied that the type and scale of this project is unlikely to generate any significant environmental impacts on the trunk road network associated with increased traffic*."

SEPA and SNH scoping responses were similar to those provided for the Pre-Application Advice Pack (see **Section 7.2.1**).

7.2.3 Further Consultation

THC Environmental Health Service and SEPA were further consulted following receipt of scoping advice to discuss and agree the noise assessment methodology, particularly with regards to the baseline noise survey.

THC Environmental Health Service advised that baseline noise monitoring should be undertaken over as long a period as possible, weather permitting.

Three noise survey locations were initially proposed. Following consultation with SEPA, an additional noise survey location at Kyle House was agreed in addition to these. Concerns were also raised with regards to low frequency noise from ship engines or material transfer systems at the pier and it was recommended that the Environmental Impact Assessment (EIA) considered this and methods to prevent or minimise this noise were investigated.

7.3 Methodology

7.3.1 Construction

Control of Pollution Act 1974

Section 61 of the 'Control of Pollution Act 1974' (Ref. 7-1) sets out procedures for those undertaking works to obtain "Prior Consent" for construction works within agreed limits.

Applications for such consent are made to the local authority and contain a method statement of the works and the steps to be taken to minimise noise. Under Section 60 of the Act, the local authority has powers to attach conditions to, limit or qualify any consent to allow for changes and limit the duration of the consent. It is noted that although it is generally for those undertaking the works to decide whether or not to seek such consent, this

is also dependent on the custom and practice of the local authority. Some local authorities request demonstration of best practicable means rather than formal "Prior Consent" applications.

BS 5228-1: 2009+A1: 2014 - Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise

For control of noise on construction sites, British Standard - 'BS 5228-1: 2009+A1: 2014 - Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise' (Ref. 7-2), provides guidance for predicting construction noise and also provides advice on noise control techniques.

There is the potential for temporary noise and vibration effects to occur during the construction phase of the Proposed Development at residential properties located in proximity to the Development Area. The following requirements from the British Standard are relevant to the assessment of potential noise and vibration effects of the construction phase.

- BS 5228-1: 2009+A1: 2014 contains details of construction noise prediction methods and noise levels from different types and sizes of construction equipment. It contains a database on the noise emissions from individual items of equipment and activities to allow prediction of noise from demolition and construction activities. The standard also suggests practical ways to mitigate excessive noise.
- BS 5228-1: 2009+A1: 2014 provides two methodologies for the prediction of significance during typical construction works, based upon noise change and existing measured ambient noise levels. For Method 2 (The 5 decibel (dB) Change Method) (E.3.3, page 119): "*noise levels generated by site activities are deemed to be potentially significant if the total noise (pre-construction ambient plus site noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of* $L_{Aeq,T}$ *65 dB, 55 dB and 45 dB from site noise alone, for the daytime, evening and night-time periods respectively; and a duration of one month or more, unless works for a shorter duration are likely to result in a significant effect*".

The evaluation criteria are generally applicable for residential housing, hotels and hostels, buildings in religious use, schools and health or community facilities.

BS 5228-2: 2009+A1: 2014 - Code of Practice for noise and vibration control on construction and open sites, Part 2: Vibration

British Standard - 'BS 5228-2: 2009+A1: 2014 - Code of Practice for noise and vibration control on construction and open sites – Part 2: Vibration' (Ref. 7-3) contains guidance on vibration levels in structures from construction works. It provides a prediction methodology for mechanised construction works, such as compaction, tunnelling and piling works and presents guidance for the control of vibration from construction works.

BS 5228-2: 2009+A1: 2014 also provides guidance on the human response to vibration, reproduced from British Standard 'BS 6472-1: 2008 - Guide to evaluation of human exposure to vibration in buildings – Part 1 Vibration sources other than blasting' (Ref. 7-4).

7.3.2 Operational

BS 4142: 2014 Methods for rating and assessing industrial and commercial sound

British Standard - 'BS 4142: 2014 Methods for rating and assessing industrial and commercial sound' (Ref. 7-5) describe a method for rating and assessing sound from industrial and commercial developments.

BS 4142: 2014 defines a number of parameters that are used in the assessment of industrial and commercial sound, which include:

- specific sound level – sound levels at the assessment location due to only the sound source(s) being assessed;
- rating level – specific sound level plus any adjustment for the characteristic features of the sound, such as tonal features (hums, whines), impulsivity (sound switching on an off, such as on a vehicle reversing alarm)

and intermittency (an example is if you can notice the sound when it starts and stops and this occurs regularly);

- ambient sound – totally encompassing sound in a given situation at a given time, usually composed of sound from many sources, near and far, including the specific sound source;
- residual sound – ambient sound without the specific sound source, or where the specific sound level is so low that it does not affect the overall sound level; and
- background sound level – sound level that is exceeded by the residual sound level at the assessment location for 90 % of a given time interval.

Within the standard, a comparison is made between the noise attributable to the development, expressed as $L_{Aeq,T}$ (defined in BS 4142: 2014 as the 'specific sound'), adjusted to take account of any characteristics of the specific sound ('rating level' $L_{Ar,T}$), and the existing background sound level expressed as $L_{A90,T}$. The standard states (page 16):

"*Typically, the greater the difference, the greater the magnitude of impact.*

A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

The lower the rating level is relative to the measured background sound level, the less likely that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on context."

Given the context of the Proposed Development being in a rural location where background sound levels are likely to be low, the additional advice provided by BS 4142: 2014 on the assessment is also taken into consideration when determining the significance of noise effect. BS 4142: 2014 states (page 17): "*Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.*"

Therefore, as well as the change in noise levels, the predicted absolute noise levels from the Proposed Development have been compared with the World Health Organisation guideline noise limits, described in **Section 7.3.5** and **Section 7.3.6**, below, in determining whether operational noise effects are significant.

The World Health Organisation (WHO) Guidelines for Community Noise

WHO 'Guidelines for Community Noise' (Ref. 7-6) provides guideline noise limits for community noise, which includes:

- 30 dB $L_{Aeq,8h}$ and 45 dB L_{Amax} over the night-time period (23:00 to 07:00) inside bedrooms;
- 45 dB $L_{Aeq,8h}$ outside bedrooms with an open window over the night-time period;
- 35 dB $L_{Aeq,16h}$ inside living rooms over the daytime period (07:00 to 23:00);
- 50 dB to 55 dB $L_{Aeq,16h}$ in outdoor living areas over the daytime period; and
- 35 dB $L_{Aeq,T}$ inside school class room and pre-schools, during class time.

The guidance advises that the outdoor noise limits outside the façades of living spaces at night have been obtained by assuming that the noise reduction from outside to inside with the windows partially open is 15 dB (equivalent to a 12-13 dB reduction for free-field noise levels).

WHO Night Noise Guidelines for Europe

In WHO 'Night Noise Guidelines for Europe' (Ref. 7-7), a night noise guideline (NNG) of 40 dB $L_{night,outside}$ is recommended. This precautionary free field noise level is considered by the WHO to protect the public,

including most of the vulnerable groups (such as children, the chronically ill and elderly), from the adverse health effects of night noise.

In recognition of the precautionary nature of the 40 dB $L_{night,outside}$ target, the WHO also recommends an Interim Target (IT) of 55 dB $L_{night,outside}$ for situations where the achievement of NNG is not feasible in the short term. The guidance considers that this IT can be temporarily considered by policy-makers for exceptional local situations. No timescale is recommended to achieve these noise levels. Member States are encouraged to gradually reduce the proportion of the population exposed to levels over the IT within the context of meeting wider sustainable development objectives.

Scottish Government PAN 1/2011 'Planning and Noise' and TAN 2001 'Assessment of Noise'

Planning Advice Note (PAN) 1/2011 'Planning and Noise' (Ref. 7-8) is the current advice note for considering noise in the Scottish planning system. For technical information regarding noise assessment, PAN 1/2011 refers to the accompanying Technical Advice Note (TAN 2011), 'Assessment of Noise' (Ref. 7-9). TAN 2011 suggests the use of the method described in BS 4142 for new noise generating developments entering a noise sensitive area.

TAN 2011 states that:

"*The Scottish Government considers impacts are normally not significant when the difference between the rating and the background noise levels is less than 5 dB(A), and that usually the threshold of minor significant impacts is when the difference between the rating and background noise levels is at least 5 dB(A) and do not become sufficiently significant to warrant mitigation until the difference between the rating and background noise is more than 10 dB(A)*".

The level of significance of the noise effects from industrial development on noise sensitive receptors (NSRs) is determined from Table 3.5 in TAN 2011, which is reproduced in **Table 7.1**.

Table 7.1 : Significance of Effects

Magnitude of Effect (After – Before) $L_{Aeq,T}$ dB	Sensitivity of Receptor x = (Rating ($L_{Ar,Tr}$) – Background ($L_{A90,T}$)) dB		
	Low (x < 5)	Medium (5 ≤ x < 10)	High (x ≥ 10)
Major (≥ 5)	Slight/Moderate	Moderate/Large	Large/Very Large
Moderate (3 to 4.9)	Slight	Moderate	Moderate/Large
Minor (1 to 2.9)	Neutral/Slight	Slight	Slight/Moderate
Negligible (0.1 to 0.9)	Neutral/Slight	Neutral/Slight	Slight
No Change (0)	Neutral	Neutral	Neutral

The sensitivity of NSRs is based on the likelihood of complaint as determined by the difference between the rating level and the background noise level. The sensitivity of the NSR increases from 'Low' to 'High' as the difference between the rating level and background sound level increases. The magnitude of effect is based on the difference in $L_{Aeq,T}$ noise levels before and after the development at the NSR. In terms of a BS 4142 assessment, this is the difference between the residual and ambient noise levels. The level of significance depends on the sensitivity of the NSR and the magnitude of effect.

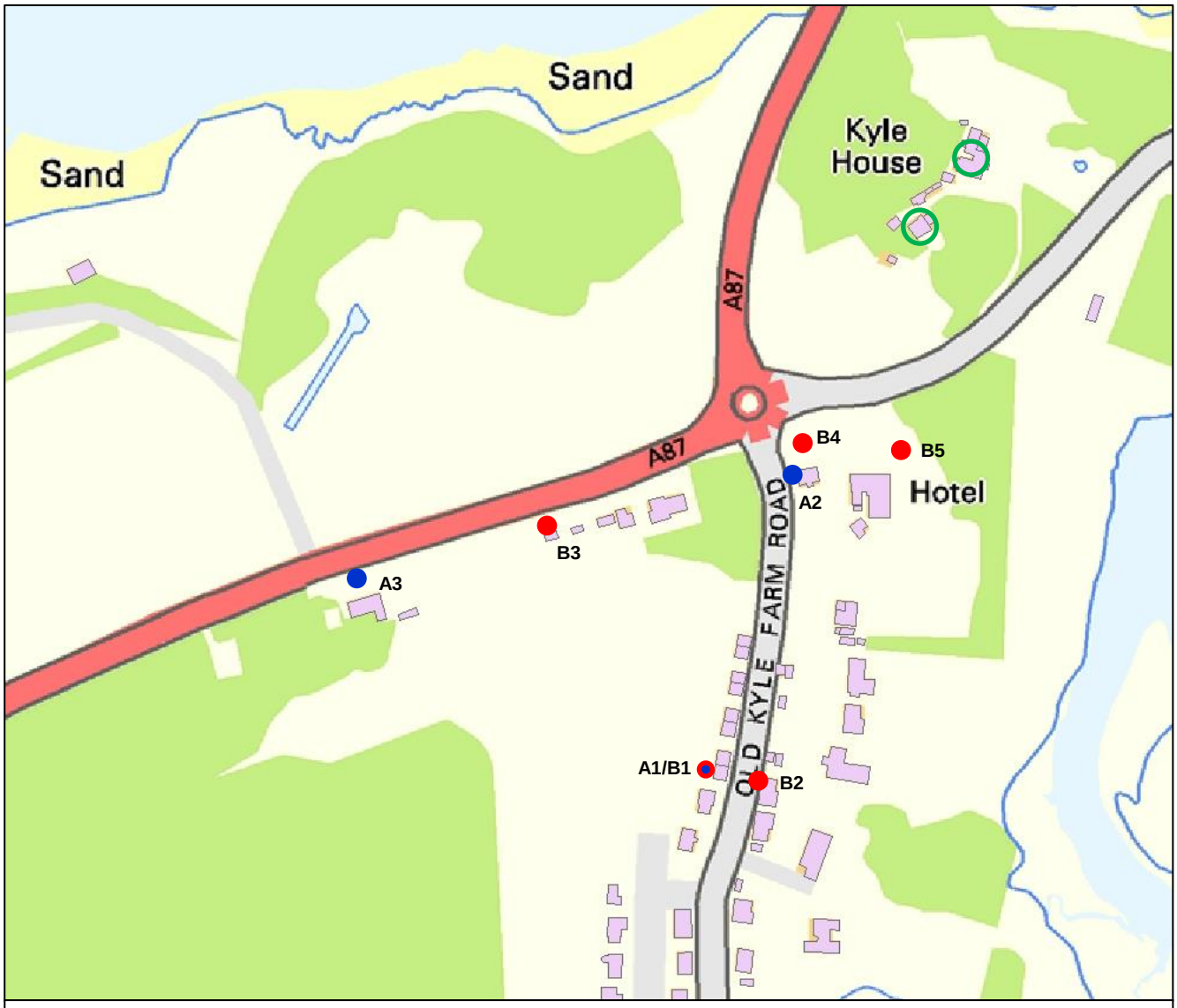
Given the low background and ambient noise levels expected, it is deemed appropriate to consider the absolute noise levels predicted against WHO guideline noise limits when determining whether noise effects are likely to be significant. TAN states that one of the issues which may be relevant when considering noise in relation to a development proposal includes: "*absolute level and possible dose-response relationships e.g. health effects, if robust data available*."

7.4 Baseline

7.4.1 Introduction

Baseline noise levels at locations near the development had been measured in 2009 by Vibrock for an ES for a different development. A noise survey has also been undertaken in August 2016 for the purposes of the noise assessment of the Kyleakin Fish Feed Plant. The locations of the measurements undertaken in both 2009 and 2016 are shown in **Figure 7.1**, as are the dwellings at Kyle House that are represented by measurement location B5.

Figure 7.1 : Baseline Noise Survey Locations



Key:

- 2009 Noise Survey
  - A1 – 8 Old Kyle Farm Road
  - A2 – Pinewood
  - A3 – Taste of India Restaurant
- 2016 Noise Survey
  - B1 – 8 Old Kyle Farm Road (unattended)
  - B1 – 8 Old Kyle Farm Road (attended)
  - B3 – Hirsel Caravan (attended)
  - B4 – Pinewood (attended)
  - B5 – MacKinnon House Hotel (attended)
- Dwellings at Kyle House

In the 2009 noise assessment by Vibrock, the measured noise levels were reported in terms of daytime (07:00 to 19:00), evening (19:00 to 23:00) and night-time (23:00 to 07:00) measurements. It is not clear in the 2009 ES to what extent the noise measurements were attended. The baseline noise levels are summarised in **Table 7.2**.

Table 7.2 : Baseline Noise Levels - 2009

Measurement Location	Period	Noise Level Indices (dB)		
		$L_{Aeq,T}$	$L_{A10,T}$	$L_{A90,T}$
8 Old Kyle Farm Road	Daytime	43	45	32
	Evening	43	40	28
	Night-time	40	34	26
Pinewood	Daytime	52	52	41
	Evening	47	50	36
	Night-time	47	43	31
Taste of India Restaurant	Daytime	56	60	36
	Evening	52	55	31
	Night-time	47	40	28

With regards to the noise climate at 8 Old Kyle Farm Road, the Vibrock report states: "*The noise recordings here were influenced by distant traffic on the A87 and by occasional local traffic. In addition, birdsong contributed to the measured levels*".

For Pinewood, the Vibrock report states: "*The noise levels at this location were influenced by road traffic on the A87 and on the nearby minor roads, as well as birdsong*".

With regards to the noise climate at Taste of India Restaurant, the Vibrock report states: "*The noise sources that, subjectively, influenced the noise climate at this location was road traffic, both travelling along the A87 and also vehicles moving around within the village, and birdsong*".

7.4.2 Baseline Survey Methodology

The locations chosen for the 2016 noise survey were selected to obtain baseline noise levels at the receptors nearest the Proposed Development that were most likely to be adversely affected by noise, and to allow comparison with the measured 2009 levels as a check that the levels measured were consistent. They were also selected following consultation with SEPA. As mentioned in Section 7.2.3, SEPA requested a baseline noise survey location at Kyle House. Unfortunately, no response was received to the requests for permission to access the garden at Kyle House for the purposes of the noise survey, so a measurement location in MacKinnon House Hotel was used as a proxy. This location was selected because most of the land around Kyle House is private so could not be accessed, and this location was a similar distance from the A87 as Kyle House, albeit closer to Caol Acain road, and has similar levels of surrounding vegetation.

A sound level meter and weather station was installed in the back garden of 8 Old Kyle Farm Road, and long term unattended measurements were undertaken between the evening of 25 August and the morning of 28 August 2016. Short term, attended satellite measurements were undertaken in front of 8 Old Kyle Farm Road, in front of Hirsel Caravan, near Pinewood and near MacKinnon House Hotel, rotating between locations and obtaining measurements during different periods of the day and night. These measurements were undertaken between the night of 25 August and the evening of 27 August 2016. As well as obtaining baseline noise levels for NSRs, attended measurements allow the subjective impressions of the measured levels to be reported, as required by BS 4142: 2014. The attended measurement location at 8 Old Kyle Farm Road was on the pavement across from the house rather than in the back garden where the long term sound level meter was located to avoid the noise levels being affected by a dog in the house that barked while the noise survey team were setting up in the back garden.

All measurements were undertaken using Class 1 precision grade instrumentation that has been laboratory calibrated within the last two years (see **Appendix 7.2**).

Measurements were undertaken with due regard to British Standard – 'BS 7445-1: 2003 'Description and measurement of environmental noise – Part 1: Guide to quantities and procedures' (Ref. 7-10) and BS 4142: 2014. The data collected included L_{Aeq}, L_{A90} and L_{A10} noise levels. The instruments were setup in free-field locations and the microphones were positioned at a height of approximately 1.5 m above ground level.

The sound level meter was calibrated using a field calibrator, which had itself been calibrated against a reference set traceable to national and international standards, prior to measurements being undertaken. Field calibration checks carried out during and at the end of the noise survey indicated that there was no variation in the calibration value greater than 0.5 dB.

7.4.3 Baseline Noise Survey Results

There were few periods of weather inappropriate for conducting the baseline noise measurements over the survey period. The weather data from the weather station was used to exclude noise levels measured during periods of rain from the unattended 8 Old Kyle Farm Road location. The wind speeds were suitable for baseline noise measurements throughout the survey period. Attended noise measurements were only undertaken in suitable weather. Unfortunately, due to the continuing rain when attended night-time measurements were being undertaken, attended night-time noise levels were not measured at 8 Old Kyle Farm Road.

During the attended measurements, it was noted that construction work was being undertaken on a house to the south-west of 8 Old Kyle Farm Road on the late morning to early afternoon of 26 August 2016. Attended measurements undertaken when construction noise was audible has not been included in the noise assessment, and the noise levels measured during this period for the unattended measurements have been excluded.

For the attended 8 Old Kyle Farm Road noise levels measured across the street from the house itself, the noise of vehicles passing was excluded, to give a give a better representation of the back garden area, which is not beside the road.

The measured baseline noise levels, including weather conditions and qualitative data, are presented in **Appendix 7.3**. The measured baseline noise levels are summarised in **Table 7.3** for the daytime (07:00 to 23:00) and night-time (23:00 to 07:00) periods, as required by BS4142: 2014. Typical representative sound levels were taken to be the arithmetic average of the $L_{Aeq,T}$, $L_{A10,T}$ and $L_{A90,T}$ levels measured for each receptor and period.

Table 7.3 : Baseline Noise Levels - 2016

Measurement Location	Period	Noise Level Indices (dB)		
		$L_{Aeq,T}$	$L_{A10,T}$	$L_{A90,T}$
8 Old Kyle Farm Road (unattended)	Daytime	37	39	29
	Night-time	27	28	21
8 Old Kyle Farm Road (attended)	Daytime	37	38	30
	Night-time	-	-	-
Hirsel Caravan (attended)	Daytime	62	67	38
	Night-time	28	29	22
Pinewood (attended)	Daytime	55	58	40
	Night-time	49	53	28

Measurement Location	Period	Noise Level Indices (dB)		
		$L_{Aeq,T}$	$L_{A10,T}$	$L_{A90,T}$
MacKinnon House Hotel (attended)	Daytime	47	51	38
	Night-time	37	40	22

When the long term unattended sound level meter was commissioned and decommissioned at 8 Old Kyle Farm Road, the main sources of noise observed were birdsong, general human activity in the area and vehicles travelling along Old Kyle Farm Road. For the attended measurements during the day, the main sources of noise observed were vehicles driving along Old Kyle Farm Road, general human activity in the area, such as children playing, pedestrian talking and music playing in the background, with noise from vehicles travelling on the A87 in the background. For the purposes of this noise assessment, the noise levels measured in the back garden have been used because this is based on longer term measurements. The back garden noise levels are lower than those measured at 8 Old Kyle Farm Road in 2009.

At Hirsel Caravan, the dominant source of noise during the day was vehicles travelling along the A87, resulting in noise levels higher than at any other location. At night-time, the noise levels drop significantly due to the reduction in vehicles on the A87 (the only night-time survey period was between 02:00 and 02:30 in the morning). The nearest measurement location from the 2009 noise survey was at the Taste of India Restaurant, where lower noise levels were measured during the day. This may have been because the Taste of India measurement location was further away from the A87 than the Hirsel Caravan, though it is difficult to be certain from the information provided in the 2009 ES. Hirsel Caravan is located closer to the A87 than the Taste of India Restaurant, so the use of the higher noise level measured near the caravan during the day is appropriate. The night-time noise levels measured at Hirsel Caravan are lower than those measured at Taste of India, which is likely to be because of the timing of the Hirsel Caravan night-time noise measurements as mentioned above. The lower night-time noise levels measured at Hirsel Caravan have been used.

Near Pinewood, during the day, the primary sources of noise observed were vehicles travelling around the nearby roundabout, birdsong and general human activity such as people talking and cars in the MacKinnon Hotel car park. At night-time, the noise levels dropped, but not as significantly as at other locations. At night-time, the primary sources of noise observed were cars passing by (though significantly lower in number than during the day) and birdsong. A similar pattern of noise levels was measured during the 2009 baseline noise survey. For the purposes of this noise assessment, the noise levels measured in 2016 have been used because these resulted in slightly lower $L_{A90,T}$ noise levels compared to the 2009 results, providing a more conservative assessment.

At MacKinnon House Hotel, the proxy location for Kyle House, the primary sources of noise observed during both the daytime and night-time were road traffic noise, birdsong, and occasional noise from guests at the hotel. The noise levels measured at night-time were significantly lower than those measured during the daytime, because of the reduced levels of nearby road traffic.

7.5 Construction Noise and Vibration Assessment

7.5.1 Noise

To determine whether there were likely to be significant noise effects during construction, the construction noise levels at the nearest NSRs during the construction phase with the greatest potential for adverse noise effect, pile driving, was calculated. These predictions have been undertaken using DataKustik's CadnaA noise modelling software, utilising the noise propagation algorithms within BS 5228-1: 2009+A1: 2014.

The construction noise model included the following items, settings and assumptions:

- Buildings footprints were extracted from OS MasterMap data. Buildings were assumed to be a height of 8 m, except for 'small buildings', defined as those with a building footprint area of less than 20 m^2 and an area divided by perimeter of less than 1.2 m, which were assumed to be 3 m high. Buildings were considered to be acoustically reflective (absorption coefficient, α=0).

- Receptor points were placed 1 m away from the façades of NSR buildings, on the site of the buildings nearest to the Proposed Development, at a height of 1.5 m.
- Façade noise levels have been predicted and reported.
- It is expected that two pile drivers will be in use. The pile driving plant was represented by point sources of 1.5 m height. These were located at the east end of the area where pile driving is to be undertaken, to calculate the highest noise level at the nearest NSRs for the pile driving.
- The Proposed Development topography was provided by Cain Tech. All other topography was from an OS digital terrain model (DTM) with 5 m spacing.

Noise data was available for the operation of the pile driver expected to be used during the pile driving, the Junttan PM20LC[1]. This provided the total A-weighted sound pressure levels at different distances in north, east, south and west directions, at a height of approximately 1.5 m. For the purposes of the construction noise assessment, the direction with the highest sound pressure levels has been assumed in all directions, as the orientation of the plant is not known at this stage. To obtain a realistic noise spectrum for the pile driver, the octave band spectrum for a hydraulic hammer rig, provided in BS 5228-1 (C.3.3, page 48), was normalised to the single value sound pressure level for the Junttan PM20LC. The resulting sound power level for the Junttan PM20LC pile driver is presented in **Table 7.4**.

Table 7.4 : Sound Power Level of Pile Driver

Plant	Octave Band Sound Power Level (dB), for Octave Band Centre Frequencies (Hz)								A-Weighted Sound Power Level (L_{WA})
	63	125	250	500	1000	2000	4000	8000	
Pile Driver (Junttan PM20LC)	113.5	119.5	111.5	113.5	109.5	106.5	101.5	98.5	115.0

It was assumed that the pile driver will be in continual operation during the day during the pile driving phase of construction.

Based on the lower cut-off noise levels provided in BS 5228-1 (Method 2 – The 5 dB Change Method), the following construction noise limits are considered appropriate:

- $L_{Aeq,T}$ 65 dB for daytime;
- $L_{Aeq,T}$ 55 dB for evening; and
- $L_{Aeq,T}$ 45 dB for night-time.

It is anticipated that standard daytime construction working hours (08:00 to 19:00 on Mondays to Saturdays) will be agreed with THC, with any working outside of these hours to be agreed in advance and subject to appropriate noise limits. As such, a construction noise assessment is only required for the daytime period.

Table 7.4 presents the predicted construction noise levels at the NSRs for pile driving, which includes a +3 dB façade correction, and the measured pre-construction ambient noise. The pre-construction ambient noise levels measured at MacKinnon House Hotel have been used as a proxy for Kyle House. **Table 7.4** also presents the resulting total construction noise level at the NSRs and compares these with the daytime construction noise limit of $L_{Aeq,T}$ 65 dB.

[1] Balfour Beatty Ground Engineering, Junttan Noise Assessment Footprint, Ref: BBGE-QR-0013 Issue 01, 09/03/10

Table 7.4 : Predicted Construction Noise Levels (Pile Driving) and Comparison with Daytime Noise Limit at NSRs

NSR	Pre-construction ambient noise ($L_{Aeq,T}$ dB)	Predicted Construction Noise Level ($L_{Aeq,T}$ dB)	Total Construction Noise Level ($L_{Aeq,T}$ dB)	Exceedance of $L_{Aeq,T}$ 65 dB Noise Limit (dB(A))
8 Old Kyle Farm Road	37	36	40	-25
Hirsel Caravan	62	42	62	-3
Pinewood	55	43	55	-10
Kyle House	47	45	49	-16

Table 7.4 demonstrates that there are not predicted to be any exceedances of the daytime construction noise limits at any noise sensitive receptor during the pile driving phase of construction, which is expected to have the greatest noise effect during construction of the Proposed Development. On this basis, it is expected that construction noise for all phases of construction will not exceed the daytime noise limit at any NSR and there will be no significant construction noise effects.

7.5.2 Vibration

The nearest vibration sensitive receptors to the site are located approximately 350 m away. Given this distance, construction vibration effects (in terms of both structural damage and annoyance to occupiers) are not expected to be significant.

7.6 Operational Noise and Vibration Assessment

7.6.1 Noise

Noise modelling has been undertaken to predict noise levels at nearby noise sensitive receptors as a result of the proposed operations at the Proposed Development. These noise predictions have been made using Datakustik's CadnaA noise modelling software, utilising the noise propagation algorithms within 'ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation' (Ref. 7-11).

The operational noise model included the following items, settings and assumptions:

- Buildings footprints were extracted from OS MasterMap data. Buildings were assumed to be a height of 8 m, except for 'small buildings', defined as those with a building footprint area of less than 20 m^2 and an area divided by perimeter of less than 1.2 m, which were assumed to be 3 m high. Buildings were considered to be acoustically reflective (absorption coefficient, α=0).
- Receptor points were placed 3.5 m away from the façades of NSR buildings, on the site of the buildings nearest to the Proposed Development, at a height of 1.5 m.
- Free-field noise levels have been predicted and reported, for ease of comparison against the measured baseline noise levels, which are free-field (as per BS 4142, page 4).
- Noise generating buildings have been modelled with vertical area sources for the walls and area sources for the roofs. Noise generating pipes and conveyor belts were modelled with line sources. Items of plant, such as fans and loaders, were represented with point sources.
- The Proposed Development topography was provided by Cain Tech. All other topography was from an OS digital terrain model (DTM) with 5 m spacing.
- All ground was conservatively assumed to have an absorption coefficient of α = 0 (equivalent to hard ground).

The Traffic and Transport assessment (Chapter 8) states that there are expected to be approximately 36 HGV movements per day and there will be 55 full time staff accessing the site throughout the day, resulting in a negligible change in road traffic. Given the very low level of operational traffic, these have not been included in the operational noise model.

The noise sources presented in **Table 7.5** below were included in the operational noise model. The noise data for all noise sources except the loader and unloader on the pier and cooling fans on the main building were obtained from the noise report[2] and accompanying CadnaA noise model produced for a similar development by COWI, which was based on measured noise levels. It was confirmed by MH that the activities in the buildings was similar to those measured in the COWI noise assessment.

The cooling building in the COWI noise model did not match the design of the cooling towers in the Proposed Development. Therefore, the noise data for the cooling system could not be used directly. However, total sound power levels were provided for the cooling fans and pumps in the development by GrainTec and the octave band sound power levels in the COWI noise model were normalised to these levels to provide a representative noise spectrum.

Total sound power levels for the loader and unloader were also provided by GrainTec. Measured octave band levels for a similar unloader were obtained from a WSP measurement report[3] and were normalised to the total unloader sound power level to provide a representative noise spectrum. Although the loader and unloader operate differently, in the absence of loader octave band levels, the measured unloader octave band noise levels were normalised to the loader total sound power level to provide a representative noise spectrum.

It has been confirmed by Marine Harvest that the ships moored for loading will be connected to onshore electrics and, as such, a ship idling noise source has been included for only the unloading section of the pier.

The octave band noise levels for the noise sources are presented in **Appendix 7.4**.

Table 7.5 : Summary of Operational Noise Data

Plant/Activity	Type of Noise Source	Sound Power Level (dB(A))
Activity in ship intake building and finished product bulk silo building	Internal	80.0
Activity in main process building	Internal	92.3
Activity in big bag building	Internal	78.1
Conveyors on pier	Line	60.3 (per m)
Conveyor from ship intake building to main process building	Line	78.7 (per m)
Transportation pipelines	Line	81.9 (per m)
Biobed north pipe	Line	85.0 (per m)
Biobed south pipe	Line	74.1 (per m)
Cargo to conveyors	Point	96.2
Biobed north fan	Point	113.4
Biobed south fan	Point	103.6

[2] COWI Marine Harvest Valsneset Fish Feed Factory, Ref: A070924, 22/09/15
[3] WSP Neuero Unloading Equipment for Biofuel, Ref: 10156850 R03, 05/12/11

Plant/Activity	Type of Noise Source	Sound Power Level (dB(A))
Ship idling	Point	96.3
Cooling fan	Point	70.0
Cooling pump	Point	73.0
Unloader	Point	93.0
Loader	Point	83.0

All plant were assumed to be operating continuously through both the daytime and night-time period. In both of the reports from which the noise data was obtained, noise sources were considered to have no impulse or tonal characteristics. For a worst-case scenario, a +3 dB(A) correction for 'other sound characteristics' has been added to all noise source sound power levels, representing that the Proposed Development specific sound at NSRs may be "*readily distinctive against the residual acoustic environment*" (BS 4142, page 14).

The sound reduction indices (SRI) presented in **Table 7.6** have been assumed for the façades and roof of noise generating buildings, as per the COWI noise model provided to Jacobs for a similar development. These SRI are considered to represent the façades and roofs that provide the least sound reduction out of the materials to be used in different sections of the Proposed Development, therefore providing a conservative assessment when assumed for all façades and roofs.

Table 7.6 : SRI of Building Elements

Building Element	Octave Band SRI (dB), for Octave Band Centre Frequencies (Hz)								R_W
	63	125	250	500	1000	2000	4000	8000	
Walls and roof	10	14	19	23	27	32	36	40	27

The measured background sound levels at each NSR are provided in **Table 7.7**, with the measured levels at MacKinnon Country House being used as a proxy for Kyle House.

Table 7.7 : Background Sound Levels at NSRs

NSR	Background Sound Level ($L_{A90,T}$ dB)	
	Daytime	Night-time
8 Old Kyle Farm Road	29	21
Hirsel Caravan	38	22
Pinewood	40	28
Kyle House	38	22

The predicted operational rating levels (free-field) at each NSR are presented in **Table 7.8**. As stated previously, all plant were assumed to be operating continuously through both the daytime and night-time period, so the predicted levels are the same for each period.

Table 7.8 : Predicted Operational Rating Levels at NSRs

NSR	Predicted Operational Rating Level ($L_{Ar,Tr}$ dB)	
	Daytime	Night-time
8 Old Kyle Farm Road	31	31
Hirsel Caravan	37	37
Pinewood	35	35
Kyle House	35	35

A comparison of the background sound and rating levels, and the corresponding NSR sensitivity as defined by TAN 2011, is provided in **Table 7.9**.

Table 7.9 : Comparison of Background Sound and Rating Levels at NSRs

NSR	Difference Between Rating Level and Background Sound Level (dB(A))		Corresponding TAN 2011 Sensitivity	
	Daytime	Night-time	Daytime	Night-time
8 Old Kyle Farm Road	2	10	Low	High
Hirsel Caravan	-1	15	Low	High
Pinewood	-5	7	Low	Medium
Kyle House	-3	13	Low	High

Table 7.10 presents the measured residual sound levels, the predicted specific sound levels and the resulting predicted ambient sound levels at each NSR. The predicted specific sound levels do not include the +3 dB(A) sound character correction because the character of the sound will not affect the absolute value of the ambient sound levels. The sound levels are rounded to one decimal place because the magnitude of effect categories in TAN 2011 are defined by noise levels rounded to one decimal place (see **Table 7.1**).

Table 7.10 : Measured Residual and Predicted Specific and Ambient Sound Levels at NSRs

NSR	Residual Sound Level ($L_{Aeq,T}$ dB)		Specific Sound Level ($L_{Aeq,T}$ dB)		Ambient Sound Level ($L_{Aeq,T}$ dB)	
	Daytime	Night-time	Daytime	Night-time	Daytime	Night-time
8 Old Kyle Farm Road	37.1	26.7	27.8	27.8	37.6	30.3
Hirsel Caravan	62.3	27.5	34.3	34.3	62.3	35.1
Pinewood	54.5	49.0	32.0	32.0	54.5	49.1
Kyle House	46.5	37.0	32.1	32.1	46.7	38.2

The difference between the ambient and residual sound levels, and the corresponding magnitude of effect, as defined by TAN 2011 (see **Table 7.1**), at NSRs is presented in **Table 7.11**.

Table 7.11 : Comparison of Residual and Ambient Sound Levels at NSRs

NSR	Difference Between Ambient and Residual Sound Level (dB(A))		Corresponding TAN 2011 Magnitude of Effect	
	Daytime	Night-time	Daytime	Night-time
8 Old Kyle Farm Road	0.5	3.6	Negligible	Moderate
Hirsel Caravan	0.0	7.6	No Change	Major
Pinewood	0.0	0.1	No Change	Negligible
Kyle House	0.2	1..2	Negligible	Minor

The significance of effect, as defined by TAN 2011 (see **Table 7.1**), can be determined by comparing the NSR sensitivity in **Table 7.9** with the magnitudes of effect in **Table 7.11**. The significance of effects at NSRs is presented in **Table 7.12**.

Table 7.12 : Significance of Effect at NSRs

Address	Daytime			Night-time		
	Sensitivity	Magnitude	Significance	Sensitivity	Magnitude	Significance
8 Old Kyle Farm Road	Low	Negligible	Neutral/Slight	High	Moderate	Moderate/Large
Hirsel Caravan	Low	No Change	Neutral	High	Major	Large/Very Large
Pinewood	Low	No Change	Neutral	Medium	Negligible	Neutral/Slight
Kyle House	Low	Negligible	Neutral/Slight	High	Minor	Slight/Moderate

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Table 7.9 shows that, for the daytime period, the rating level at 8 Old Kyle Farm Road is predicted to be 2 dB(A) above the background sound level. According to BS 4142: 2014, a difference of 5 dB(A) is "*likely to be an indication of an adverse impact, depending on the context*". BS 4142: 2014 also states that "*Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context*", suggesting that although potentially adverse, a difference of 2 dB(A) will not be significant. In the context of a predicted absolute sound level of $L_{Aeq,16h}$ 28 dB (without the 3 dB(A) character correction), which is 22 dB(A) below the WHO guideline noise lower limit of $L_{Aeq,16h}$ 50 dB for outdoor living area over the daytime period, it is deemed that the operational noise effects at 8 Old Kyle Farm Road will not be significant during the day.

For the daytime period, the rating levels at Hirsel Caravan, Pinewood and Kyle House are predicted to be below the background noise level. BS 4142: 2014 states that "*Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context*". Therefore, it is deemed that the operational noise effects at Hirsel Caravan, Pinewood and Kyle House will not be significant during the day.

For the night-time period, the rating levels at 8 Old Kyle Farm Road, Hirsel Caravan, Pinewood and Kyle House are predicted to be between 7 dB(A) and 15 dB(A) above the background sound level. BS 4142: 2014 states that "*A difference of around 10 dB or more is likely to be an indication of a significant adverse impact, depending on the context*", which could suggest significant effects will occur at night-time. However, in the

context of the night-time assessment, when people are generally indoors between the hours of 23:00 and 07:00, the internal noise levels should also be considered. Assuming a conservative 10 dB(A) reduction for noise through a partially open window, the predicted absolute internal sound levels (without the 3 dB(A) character correction) are between $L_{Aeq,8h}$ 18 dB and 24 dB, which are 6 dB(A) to 12 dB(A) below the WHO guideline night-time noise limit of $L_{Aeq,8h}$ 30 dB inside bedrooms. In this context, it is deemed that the adverse effects predicted will not be significant at 8 Old Kyle Farm Road, Hirsel Caravan, Pinewood and Kyle House during the night.

BS 4142: 2014 requires the uncertainty of the assessment results to be considered and reported. The baseline measurements were undertaken over a few days, and the baseline levels at the NSRs may vary over the year depending on seasonal effects (such as changes in weather, road traffic levels, etc.), which will not be taken into account in the measurements. The baseline sound measurements included measurements undertaken over a Saturday (and part of Sunday for the unattended 8 Old Kyle Farm Road), which is likely to be one of the quietest periods of the week and is therefore conservative. In addition, the noise levels measured for the purposes of this noise assessment were compared with noise levels measured in 2009 to check that the noise levels used in the assessment were representative.

Uncertainty is also introduced through the use of proxy baseline data for Kyle House. However, during the daytime the rating level is predicted to be 3 dB(A) below the background sound level, allowing an approximately 10 dB(A) margin for error before significant adverse effects are predicted. At night-time, the internal absolute noise level (without the 3 dB(A) character correction) is predicted to be approximately $L_{Aeq,8h}$ 22 dB, which is 8 dB(A) below the WHO guideline noise limit of $L_{Aeq,8h}$ 30 dB, which again allows a reasonable margin of error before adverse effects are deemed to be significant.

Another source of uncertainty is any difference between the assumptions used in the noise model, and what occurs in reality. By assuming that all plant and activities are operating continuously throughout both the day and night, and with a 3 dB(A) character correction added to the sound power levels of all noise sources in the noise model, the calculated operating noise levels should be conservative and represent a worst case scenario.

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Table 7.12 shows that, for the daytime period, operational noise effects of Neutral or Neutral/Slight significance are predicted at all NSRs, which are not considered to be significant.

For the night-time period, operational noise effects of Neutral/Slight significance are predicted at Pinewood, Slight/Moderate significance at Kyle House, Moderate/Large significance at 8 Old Kyle Farm Road and Large/Very Large significance at Hirsel Caravan; the latter two could be significant when considered only in terms of change in noise levels. However, as per the BS 4142: 2014 operational noise assessment, given the low absolute noise levels predicted, it is deemed appropriate to consider the WHO guideline night-time noise limit of $L_{Aeq,8h}$ 30 dB inside bedrooms. At Hirsel Caravan, the external ambient noise level is predicted to be $L_{Aeq,8h}$ 35.1 dB at night-time, resulting in an internal noise level of approximately $L_{Aeq,8h}$ 25.1 dB which is 4.9 dB(A) below the WHO guideline night-time noise limit of $L_{Aeq,8h}$ 30 dB inside bedrooms. Therefore, it is deemed that operational noise effects at night-time will not be significant.

7.6.2 Vibration

The nearest sensitive receptors to the development are approximately 350 m away. Given this distance and the type of activities to be carried out at the Proposed Development, vibration is not considered to be a significant issue for operation of the Proposed Development, in terms of structural damage or annoyance at nearby receptors.

7.7 Mitigation

7.7.1 Construction Noise Mitigation

Whilst no construction noise significant effects are predicted, in order to minimise noise emissions, all construction work will be undertaken following best practice practicable means, including the guidance within

BS 5228-1: 2009+A1: 2014. Best practicable means to be employed will be developed through the Construction Environmental Management Plan and could include the following measures:

- starting up plant and equipment sequentially rather than all together;
- where viable, the use of temporary noise screens around particularly noisy activities (or stationary plant such as generators);
- use of audible reversing warning systems on mobile plant and vehicles should be of a type that, whilst ensuring that they give proper warning, have a minimal noise effect on nearby sensitive receptors (an example is the use of white noise reversing alarms);
- use of plant with efficient exhaust sound reduction equipment to earth moving plant where possible;
- use of quietest suitable plant/equipment where available;
- fitting efficient sound reduction equipment to compressors and generators;
- pneumatic tools to be fitted with suitably designed muffler or sound reduction equipment to reduce noise without impairing efficiency;
- ensuring that air lines to pneumatic equipment do not leak;
- ensuring equipment is well maintained;
- locate static plant away from nearest noise and vibration sensitive receptors, where possible;
- optimising haul road routes, and keeping them well maintained, to minimise noise emissions to noise sensitive receptors;
- setting a speed limit for vehicles on site;
- implement an efficient complaints procedure;
- restricting “noisy activities” to certain times;
- monitor noise levels before and during construction; and
- switching off plant and equipment when not in use and safe to do so.

7.7.2 Operational Noise Mitigation

As no significant operational noise effects are predicted, no specific mitigation is recommended. For information only, as the restriction of operating times of plant/activities would hamper the operation of the site, the following methods would be most effective at reducing noise levels:

- the use of quieter plant or changing work methods to reduce the noise at source; and
- decrease the noise breakout from buildings, particularly the main process building, by increasing internal noise absorption and/or increase sound reduction provided by walls and roofs.

It is proposed that after 3 months of operation a noise monitoring survey, the details of which will be agreed with the local authority prior to measurements commencing, will be undertaken to determine whether site operations are compliant with the assessment criteria presented in Section 7.3.2, above. Should the noise survey indicate that noise exceedances are occurring then noise mitigation measures based on Best Available Techniques (BAT) shall be provided.

The layout of the Proposed Development, topography and location of NSRs suggest that noise barriers around the site perimeter would not be an effective method to reduce operational noise from the site.

7.8 Conclusions

A construction noise assessment has been undertaken for pile driving, which is expected to be the construction activity with the greatest potential for adverse noise effect. This assessment has shown that, for this worst case construction activity, it is predicted that construction noise levels will not exceed the proposed daytime noise limits, which were derived from the guidance in BS 5228-1: 2009 + A1: 2014.

It is anticipated that standard daytime construction working hours will be agreed with THC, with any construction work outside of these hours to be agreed in advance and subject to appropriate noise limit values.

An operational noise assessment has been undertaken based on the guidance in BS 4142: 2014 and TAN, assuming the worst case scenario of all plant/activities occurring simultaneously and continuously, and with a 3 dB(A) character correction added to all noise sources. No significant noise effects are predicted during the operation of the Proposed Development during the daytime period. Although operational rating levels are predicted to be greater than the existing background sound levels during the night-time period, it has been shown that the internal noise levels will be comfortably below the WHO guideline night-time noise limit of $L_{Aeq,8h}$ 30 dB inside bedrooms at all NSRs. Therefore, it is deemed that the adverse night-time noise effects predicted will not be significant.

Given the distance to the nearest sensitive receptors, vibration during construction and operation of the Proposed Development is not expected to result in significant vibration effects.

7.9 References

Ref. 7-1: Control of Pollution Act 1974. HMSO (1974)

Ref. 7-2: BS 5228-1: 2009 + A1: 2014 Code of Practice for noise and vibration control on construction and open sites – Part 1 Noise. British Standards Institution (2014)

Ref. 7-3: BS 5228-2: 2009 + A1: 2014 Code of Practice for noise and vibration control on construction and open sites – Part 2 Vibration. British Standards Institution (2014)

Ref. 7-4: BS 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings – Part 1 Vibration sources other than blasting. British Standards Institution (2008)

Ref. 7-5: BS 4142: 2014 Methods for rating and assessing industrial and commercial sound. British Standards Institution (2014)

Ref. 7-6: Guidelines for Community Noise. World Health Organisation (1999)

Ref. 7-7: Night Noise Guidelines for Europe. World Health Organisation (2009)

Ref. 7-8: Planning Advice Note PAN 1/2011 – Planning and Noise. The Scottish Government (2011)

Ref. 7-9: Technical Advice Note – Assessment of Noise. The Scottish Government (2011)

Ref. 7-10: BS 7445-1: 2003 Description and Measurement of Environmental Noise – Part 1: Guide to quantities and procedures. British Standards Institution (2003)

Ref. 7-11: ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation (1996)