



The Sizewell C Project

6.5 Volume 4 Southern Park and Ride Chapter 4 Noise and Vibration

Revision: 1.0
Applicable Regulation: Regulation 5(2)(a)
PINS Reference Number: EN010012

May 2020

Planning Act 2008
Infrastructure Planning (Applications: Prescribed
Forms and Procedure) Regulations 2009



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4. Noise and Vibration

4.1 Introduction

4.1.1 This chapter of **Volume 4** of the **Environmental Statement (ES)** presents an assessment of the potential effects on noise and vibration arising from the construction, operation and removal and reinstatement of the southern park and ride at Wickham Market (referred to throughout this volume as the 'proposed development'). This includes an assessment of potential impacts, the significance of effects, the requirements for mitigation and the residual effects.

4.1.2 Detailed descriptions of the southern park and ride site (referred to throughout this volume as the 'site'), the proposed development, and the different phases of development are provided in **Chapters 1** and **2** of this volume of the **ES**. A glossary of terms and list of abbreviations used in this chapter is provided in **Volume 1, Appendix 1A** of the **ES**.

4.1.3 The assessment considers noise and vibration impacts from construction, operation and removal and reinstatement of the proposed development on sensitive receptors around the site. Changes in noise levels on the wider road network are considered within **Volume 2, Chapter 11** of the **ES**.

4.1.4 This assessment has been informed by data presented in **Appendix 4A** of this chapter: Construction and operational noise assessment.

4.2 Legislation, policy and guidance

4.2.1 **Volume 1, Appendix 6G** of the **ES** identifies and describes legislation, policy and guidance of relevance to the assessment of the potential noise and vibration impacts associated with the Sizewell C Project across all **ES** volumes.

4.2.2 This section provides an overview of the specific legislation, policy and guidance of relevance to the assessment of the proposed development.

a) International

4.2.3 There is no international legislation and policy that is relevant to the noise and vibration assessment of the proposed development.

b) National

4.2.4 The Overarching National Policy Statement for Energy (NPS EN-1) (Ref. 4.1), and the National Policy Statement for Nuclear Power Generation (NPS EN-6) (Ref. 4.2) include requirements that are relevant to the noise and

vibration assessment. A summary of the relevant NPS EN-1 and NPS EN-6 requirements, together with consideration of how these requirements have been taken into account are discussed in detail in **Volume 1, Appendix 6G** of the **ES**.

4.2.5 Part III of the Control of Pollution Act 1974 (Ref. 4.3) gives local authorities powers to control noise from construction sites, and enable developers to apply for prior consent for construction works. Section 72 defines what is meant by “best practicable means”, and requires that regard be had to relevant codes of practice, one of which is British Standard BS 5228 (parts 1 and 2) (Ref. 4.4 and 4.5).

4.2.6 Other relevant policy, as described in **Volume 1, Appendix 6G** of the **ES**, comprise:

- National Planning Policy Framework 2019 (Ref. 4.6).
- Planning Practice Guidance (PPG) 2019 (Ref. 4.7).
- Noise Policy Statement for England (NPSE) 2010 (Ref. 4.8).
- Government’s 25 Year Environment Plan 2019 (Ref. 4.9).

c) **Regional**

4.2.7 No regional policy is deemed relevant to the noise and vibration assessment for the proposed development.

d) **Local**

4.2.8 Local policy relating to noise and vibration assessment is found in:

- Suffolk Coastal District Council (SCDC) Local Plan Core Strategy and Development Management Policies (2013) (Ref. 4.10); and
- SCDC Final Draft Local Plan (2013) (Ref 4.11).

4.2.9 The requirements of these, as relevant to the noise and vibration assessment, are set out in **Volume 1, Appendix 6G** of the **ES**.

e) **Guidance**

4.2.10 In addition to these policy requirements, this assessment has been undertaken in accordance with the following guidance documents:

- World Health Organisation Regional Office for Europe Environmental Noise Guidelines for the European Region 2018 (Ref. 4.12).
- Guidance in the Design Manual for Roads and Bridges LA111 (Ref. 4.13).
- Calculation of Road Traffic Noise (CRTN) (Ref. 4.14)
- British Standard BS 8233:2014 – Guidance on sound insulation and noise reduction for buildings (Ref. 4.15).
- British Standard BS 5228-1 Noise: 2009+A1: 2014 – Code of Practice for noise and vibration control at open construction sites – Noise (Ref. 4.4).
- British Standard BS 5228-2 Vibration: 2009+A1: 2014 – Code of Practice for noise and vibration control at open construction sites – Vibration (Ref. 4.5).
- British Standard BS 4142: 2014+A1: 2019 – Methods for rating and assessing industrial and commercial sound, BSI Standards Publication (Ref. 4.16).

4.2.11 Further details on this guidance, as relevant to the noise and vibration assessment for the proposed development is contained in **Volume 1, Appendix 6G**.

4.3 Methodology

a) Scope of the assessment

4.3.1 The generic Environmental Impact Assessment (EIA) methodology is detailed in **Volume 1, Chapter 6**.

4.3.2 The full method of assessment for noise and vibration that has been applied for the Sizewell C Project is included in **Volume 1, Chapter 6G**.

4.3.3 The scope of this assessment has been established through a formal EIA scoping process undertaken with the Planning Inspectorate (PINS). A request for an EIA Scoping Opinion was initially issued to the PINS in 2014, with an updated request issued in 2019 provided in **Volume 1, Appendix 6A**.

4.3.4 Comments raised in the EIA Scoping Opinion received in 2014 and 2019 have been taken into account in the development of the assessment methodology. These are detailed in **Appendices 6A to 6C of Volume 1**.

b) Consultation

4.3.5 The scope of the assessment has also been informed by ongoing consultation and engagement with statutory consultees throughout the design and assessment process. Details of the consultation process have been provided in **Volume 1, Appendix 6G**.

4.3.6 The following matters have been developed in consultation with the local authorities:

- assessment criteria;
- noise source data; and
- assessment approach (both noise and vibration).

c) Study area

4.3.7 The geographical extent of the study area for noise and vibration impacts includes noise sensitive receptors surrounding the site, which have any potential to be exposed to noise or vibration levels which might result in a low adverse effect (or greater).

4.3.8 Potentially sensitive receptors such as residents within buildings in the vicinity of the site which may be disturbed by adverse noise and vibration levels, and structures that are sensitive to vibration have been taken into consideration. The receptors selected in this assessment are those considered to be representative of the nearest receptors to the site, for example, the receptors that would likely experience the highest levels of noise and vibration.

4.3.9 Further details on the study area and the location of representative receptors are provided in **Figure 4.1** and **section 4.4** of this chapter.

d) Assessment scenarios

4.3.10 The assessment scenarios for the proposed development comprise the construction phase, operational phase, and the subsequent removal and reinstatement phase. The assessment scenarios are as follows:

- Construction: it is expected that the construction phase for the proposed development would take place over a period of approximately 12-18 months, in various stages as outlined in **Chapter 2** of this volume.
- Operation: the operational phase includes the use of the park and ride facility by the construction workforce travelling to the Sizewell C main

development site, and would operate seven days per week. Peak use of the park and ride facility is anticipated to be in 2028 when the construction workforce at the main development site would also reach its peak.

- Removal and reinstatement: this phase is when the need for the park and ride facility has ceased once all of the construction activities associated with the main development site are complete, and Sizewell C power station is operational. This scenario includes the removal and reinstatement of the site to agricultural use.

e) **Assessment criteria**

4.3.11 As described in **Volume 1, Chapter 6** the EIA methodology considers whether impacts of the proposed development would have an effect on any resources or receptors. Assessments broadly consider the magnitude of impacts and value/sensitivity of resources/receptors that could be affected in order to classify effects.

4.3.12 A detailed description of the assessment methodology used to assess the potential noise and vibration effects arising from the proposed development is provided in **Volume 1, Appendix 6G**.

4.3.13 The effect of noise and vibration on a receptor or community is dependent on the magnitude of the impact, the sensitivity of the receptor, and may also depend on other factors such as the existing acoustic environment. A summary of the assessment criteria used in this assessment is presented in the following sub-sections.

i. **Sensitivity**

4.3.14 The criteria used in the noise and vibration assessment for determining the sensitivity of receptors are set out in **Table 4.1**.

Table 4.1: Assessment of the value or sensitivity of receptors for noise and vibration

Sensitivity	Description
High	Receptors that are highly sensitive to noise or vibration such as theatres, auditoria, recording studios, concert halls and highly vibration sensitive structures or uses such as certain laboratories medical facilities or industrial processes.
Medium	Noise and vibration sensitive receptors such as permanent residential buildings, hospitals and other buildings in health/community use, buildings in educational use, hotels and hostels.
Low	Receptors with limited sensitivity to noise and vibration such as offices, libraries buildings in religious use, and other workplaces with a degree of sensitivity due to the need to concentrate.

Sensitivity	Description
Very Low.	Receptors of very low sensitivity to noise and vibration such as industrial or commercial buildings and transient or mobile receptors.

4.3.15 No high sensitivity receptors have been identified within the study area. The receptors assessed in this chapter are considered to be of medium sensitivity, or less.

ii. Magnitude

Construction noise and vibration

4.3.16 The approach taken to evaluate noise effects for all construction work associated with the Sizewell C Project on occupiers of dwellings and other permanent residential accommodation is that outlined in Part 1 of BS 5228. This recommends that, for dwellings, significant effects may occur when the site noise level, rounded to the nearest decibel, exceeds the value listed in **Table 4.2**. The table is used as follows: for the appropriate period (daytime, evening, night-time, weekends), the pre-construction ambient noise level is determined and rounded to the nearest 5 dB. This rounded value is compared to the Category A criteria in **Table 4.2** and depending on whether the rounded values are below, equal to, or above the Category A values, the Category A, B or C criteria will apply to the construction works as an indicator of significant effects. Further detail is provided in **Volume 1 Appendix 6G**.

Table 4.2: Thresholds of potential significant construction effects at dwellings, from Part 1 of BS 5228

Period	Assessment Category		
	A	B	C
Day: Weekdays, 0700-1900, Saturday, 0700-1300	65 dB L _{Aeq,T}	70 dB L _{Aeq,T}	75 dB L _{Aeq,T}
Evenings and weekends: Weekdays 1900-2300,	55 dB L _{Aeq,T}	60 dB L _{Aeq,T}	65 dB L _{Aeq,T}

Period	Assessment Category		
	A	B	C
Saturdays 1300-2300 Sundays 0700 - 2300			
Every day 2300 - 0700	45 dB $L_{Aeq,T}$	50 dB $L_{Aeq,T}$	55 dB $L_{Aeq,T}$

Notes:

Assessment Category A: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are less than these values;

Assessment Category B: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are the same as category A values; and

Assessment Category C: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are higher than category A values.

If the ambient sound level exceeds the Assessment Category C threshold values given in the table (i.e. the ambient sound level is higher than the above values), then an impact is deemed to occur if the total $L_{Aeq,T}$ sound level for the period increases by more than 3 dB due to construction activity.

4.3.17 A significant effect is deemed to occur where the relevant criteria is exceeded for the following periods of time:

- 10 or more days or nights in any 15 consecutive days or nights; or
- a total number of days or nights exceeding 40 in any 6 consecutive months.

4.3.18 Where an assessment conclusion identifies a significant effect, it is on the basis that the effect is assumed to meet both the noise level criteria and the duration criteria, unless otherwise stated. Where there is uncertainty as to whether the duration criteria will be met, a precautionary approach has been adopted and it is assumed that the works will continue for a sufficient period to meet the duration criteria.

4.3.19 The values to be used to assess the magnitude of impact for construction work are as shown in **Table 4.3**.

Table 4.3: Values to be used to assess the magnitude of impact for construction noise

Sensitivity of Receptor	Period	Magnitude of Impact				Parameter
		Very Low	Low	Medium	High	
High	Any	Bespoke assessment method to be used				
Medium and low	Day	Below baseline values	Baseline noise levels	ABC ⁽¹⁾⁽²⁾	ABC ⁽¹⁾⁽²⁾ + 10	L _{Aeq, 12h} , dB
	Evening					L _{Aeq, 4h} , dB
	Night					L _{Aeq, 8h} , dB
Very low	Any	Bespoke assessment method to be used				

Notes:

(1) ABC indicates the significance threshold from **Table 4.2** above, based on the “ABC method” from BS 5228-1.

(2) Where levels are predicted as free field values, the ABC criteria are reduced by 3dB, to account for the difference between free field and façade levels.

4.3.20 For the assessment of magnitude of construction vibration, **Table 4.4** will be used.

Table 4.4: Values to assess the magnitude of vibration impact from all construction sources (day or night)

Sensitivity of Receptor	Magnitude of Impact				Parameter
	Very Low	Low	Medium	High	
High	Bespoke assessment method to be used				
Medium and low	<0.3	0.3	1	>10	PPV mm/s
Very low	No assessment normally required				

4.3.21 Construction vibration will be considered significant if the effect is moderate or major adverse and occurs for a duration exceeding:

- 10 or more days or nights in any 15 consecutive days or nights; or
- a total number of days or nights exceeding 40 in any 6 consecutive months.

4.3.22 As with the assessment of construction noise, where an assessment conclusion identifies a significant effect, it is on the basis that the effect is assumed to meet both the vibration level criteria and the duration criteria, unless otherwise stated. Where there is uncertainty as to whether the duration criteria will be met, a precautionary approach has been adopted and

it is assumed that the works will continue for a sufficient period to meet the duration criteria.

iii. Operational Noise

4.3.23 The assessment of mechanical services noise from the operational park and ride site would be considered using the assessment approach from BS 4142. The initial magnitude of impact is defined by the difference between the rating and background sound levels as shown in **Table 4.5**, prior to any consideration of context. “BG” in this table is shorthand for background sound level, L_{A90} , dB, assessed in accordance with the procedures in BS 4142. Day is taken to be 07:00 to 23:00 hours and night is 23:00 to 07:00 hours.

Table 4.5: Values to be used to assess the magnitude of impact for mechanical services (all values are free field)

Sensitivity of Receptor	Period	Magnitude of Impact				Parameter
		Very Low	Low	Medium	High	
High	Any	Bespoke assessment method to be used				
Medium or Low	Day	<BG+0*	BG+0*	BG+5*	BG+10*	L_{Ar} 1 hour, dB
	Night					L_{Ar} 15 mins, dB
Very low	Any	No assessment normally required				

Note: * All assessments of significance must be considered in the context in which the sound occurs, in accordance with the guidance in BS 4142: 2014+A1: 2019.

4.3.24 Where background noise levels are at or below 30dB, L_{A90} , an adverse effect would not occur below an absolute threshold of 40 dB, L_{night} .

4.3.25 **Table 4.6** shows the magnitudes of impact for receptors of different sensitivity for car parks, security areas (other than those at the main development site), park and ride operations, and campus activities.

Table 4.6: Magnitudes of impact for receptors of different sensitivity receptors for the operational park and ride (all values are free field)

Sensitivity of Receptor	Period	Magnitude of Impact				Parameter
		Very Low	Low	Medium	High	
High	Any	Bespoke assessment method to be used				
Medium	Day	<50	50	55	60	L_{Aeq} , 16h, dB
	Night	<40	40	45	55	L_{Aeq} , 8h, dB
		<60	60	65	70	L_{Amax} , dB
Low	Day or night	<55	55	60	65	L_{Aeq} , 8h, dB

Sensitivity of Receptor	Period	Magnitude of Impact				Parameter
		Very Low	Low	Medium	High	
Very low	Any	No assessment normally required				

iv. Classification of effects

4.3.26 Following the classification of the magnitude of the impact and the value/sensitivity of the receptor/feature, the effect is classified as shown in **Table 4.7** below. Definitions of each of the different levels of effect, which can be adverse, beneficial or neutral are shown in **Table 4.8**.

Table 4.7: Classification of effects

		Value/Sensitivity of Receptor			
		Very Low	Low	Medium	High
Magnitude	Very Low	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Minor	Minor	Moderate
	Medium	Minor	Minor	Moderate	Major
	High	Minor	Moderate	Major	Major

Table 4.8: Effect definitions

Effect	Description
Major	The noise causes a material change in behaviour attitude or other physiological response. Adverse change may result in the potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished or improved due to change in acoustic character of the area.
Moderate	Effects that may result in moderate changes in behaviour, attitude or other physiological response. Adverse effects may result in some reported sleep disturbance. Changes to the acoustic character of the area are such that there is a perceived change in the quality of life.
Minor	Effects that may result in small changes in behaviour attitude or other physiological response. Adverse effects may result in some minor reported sleep disturbance. Small changes to the acoustic character of the area are such that there is a low perceived change in the quality of life.
Negligible	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.

4.3.27 Following the classification of an effect as detailed in **Tables 4.7** and **4.8**, a clear statement is made as to whether the effect is ‘significant’ or ‘not significant’. As a general rule, major and moderate effects are considered to be significant and minor and negligible effects are considered to be not significant. However, professional judgement is also applied where

appropriate. In addition to considering these tables, other project-specific factors, such as the number of receptors affected and the duration and character of the impact need to be considered where these have a potential bearing on significance.

v. Use of LOAEL and SOAEL values in the assessment

4.3.28 The NPSE, the NPSs and the PPG require the assessment of noise and vibration against the lowest observed adverse effect levels (LOAEL) and the significant observed adverse effect level (SOAEL). These will differ dependent on variables such as the level and character of the noise or vibration source, timings of when it would occur, its duration, existing sounds present and the frequency of the occurrence of the source.

4.3.29 Each different source type requires its own specific value for LOAEL and SOAEL, which depends on these factors. The methodology for assigning significance differs from the general methodology set out in **Volume 1 Chapter 6** of the **ES**, as it does not allow for these variables to be properly considered. Each source has therefore been considered separately and values for LOAEL and SOAEL defined for different sensitivities.

4.3.30 In line with the NPSE, the concept of LOAEL and SOAEL has been established for the assessment of noise and vibration generating activities associated with the proposed main development site, and proposed associated developments. **Table 4.9** below sets out descriptions for and actions recommended in relation to these categories.

Table 4.9: Generic effect descriptions and actions recommended

Effect	Description	Action
Below LOAEL.	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No specific measures required.
Between LOAEL and SOAEL.	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a small actual or perceived change in the quality of life.	Mitigate and reduce to a minimum.
Above SOAEL.	The noise causes a material change in behaviour, attitude or other physiological response, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Avoid

- 4.3.31 Actual values for the noise and vibration sources assessed vary, dependent on the source of noise, as recommended in the various noise assessment standards and sources of guidance.
- 4.3.32 The descriptions and actions recommended in **Table 4.9** are based on the guidance in the NPSE and associated guidance in the PPG. This approach was discussed in meetings with the local authorities between 2015 and 2019.
- 4.3.33 For construction noise, the LOAEL is considered to be equal to the existing baseline ambient level. SOAEL values are as shown in **Table 4.10** below.

Table 4.10: SOAEL values for noise from all construction work associated with the development (all values are façade levels)

Day	Time (Hours)	Averaging Period T	Significant Observed Adverse Effect Level L _{Aeq,T} (dB)
Mondays to Fridays	0700 – 0800	1 hour	70
	0800 – 1800	10 hours	75
	1800 – 1900	1 hour	70
	1900 – 2300	4 hours	65
Saturdays	0700 – 0800	1 hour	70
	0800 – 1300	5 hours	75
	1300 – 1400	1 hour	70
	1400 - 2300	1 hour	65
Sundays & Public Holiday	0700 – 2300	1 hour	65
Any night	2300 – 0700	1 hour	55

Note: (1) Duration of exceedance must occur for 10 or more days or nights in any 15 consecutive days or nights; or for a total number of days exceeding 40 days or nights in any 6 consecutive months.

- 4.3.34 **Table 4.11** sets out the LOAEL and SOAEL values adopted for construction vibration and the derivation of these values are detailed in **Volume 1 Appendix 6G** and **Annex 6G.1** of the **ES**.

Table 4.11: LOAEL and SOAEL values for construction vibration

LOAEL	SOAEL	Parameter
0.3	10.0	PPV mm/s

4.3.35 **Table 4.12** sets out the LOAEL and SOAEL values for mechanical services and the derivation of these values are detailed in **Volume 1 Appendix 6G** and **Annex 6G.1** of the **ES**.

Table 4.12: LOAEL and SOAEL values for mechanical services (all values are free field values)

Period	Sensitivity of Receptor	LOAEL	SOAEL
Day	Medium	BG+0dB, L _{Ar} , dB	BG+10, L _{Ar} or Above 60dB, L _{Aeq, 16h} , whichever is the higher
	Low		65dB, L _{Aeq, 16h}
Night	Medium	BG+0dB, L _{Ar} , dB or 40dB L _{night} , whichever is the higher ¹	BG+10, L _{Ar} or Above 55dB, L _{night} , dB, whichever is the higher
	Low (if occupied at night)		65dB, L _{Aeq, 8h}

Note: (1) The 40dB L_{night} threshold is stated as a lower cut-off for the LOAEL at night as there is unlikely to be an adverse effect below this level. This is part of the contextual consideration required by BS 4142, embedded in the definition of the night-time LOAEL.

4.3.36 **Table 4.13** sets out the LOAEL and SOAEL values for the park and ride activities and the derivation of these values are detailed in **Volume 1 Appendix 6G** and **Annex 6G.1** of the **ES**.

Table 4.13: LOAEL and SOAEL values for the operational park and ride.

Time Period	LOAEL	SOAEL
Day (07:00-23:00)	50dB L _{Aeq, 16h} , free field level	60dB L _{Aeq, 16h} , free field level
Night (23:00-07:00)	40dB L _{night} , outside (free-field)	55dB L _{Aeq, 8h} , free field level
	60dB, L _{Amax} , free field	70dB, L _{Amax} , free field

f) **Assessment Methodology**

i. **Baseline surveys**

4.3.37 Baseline monitoring was undertaken at a number of locations around the site as shown in **Figure 4.2** in 2014 to characterise the existing noise environment. These locations were chosen to be representative of levels at nearby noise sensitive receptors.

4.3.38 At each location, a survey was carried out to characterise sound levels over a 24-hour period. Summaries of each monitoring location, along with plans identifying the locations; photo of the site and a summary graph of the measurement results are provided in **Volume 2, Appendix 11A**.

ii. Construction assessment

4.3.39 Various construction activities have been considered for the construction and removal and reinstatement phase, and the noise impacts then assessed at each of the noise sensitive receptors. The construction phases have been identified and described as follows:

- enabling works; excavations and earthworks (including construction of landscape bunds);
- construction of parking and circulation routes;
- utilities and building construction;
- final surfacing of parking and circulation routes; and
- removal of infrastructure on-site and reinstatement of the land back to agricultural use.

4.3.40 Calculations have been carried out to predict noise levels for each phase of work at each receptor, based on the methodology set out in **Volume 1 Appendix 6G**.

iii. Operational assessment

4.3.41 The proposed development would operate during daytime, evening, and night-time assessment periods, with varying occupation levels in the parking areas and bus frequencies adapting to demand. Noise from movements of vehicles on-site would be the dominant source, therefore predictions have been made of levels during the busiest periods. Noise from mechanical services in use at the welfare building, and security buildings on-site are also assessed.

4.3.42 $L_{Aeq,T}$ noise contour plots have been produced for daytime and night-time periods ($L_{Aeq,16hour}$ 07:00 – 23:00, and $L_{Aeq,8hour}$ 23:00 – 07:00 respectively) for the operation of the proposed development. These plots capture the overall sound level from typical site operation predicted to a height of 1.5 metres (m) above ground level at noise sensitive receptors for daytime, and to a height of 4.5m (first floor bedroom equivalent) for the night-time assessment period. At noise sensitive receptors, predicted values account for the effect of façade reflection by adding 3 dB.

4.3.43 To assess the impact of sudden, higher sound level events (e.g. vehicle door closing), the L_{Amax} sound parameter has also been predicted for all relevant

noise sensitive receptors for comparison with the criterion. Façade reflection has again been accounted for in the same way.

4.3.44 Background and ambient sound levels can be expected to be lower at night at noise sensitive receptors, and this assessment period is considered to be more sensitive. The L_{Amax} contour plot therefore shows predicted noise levels at a height of 4.5m above ground, the equivalent of first floor bedrooms at the noise sensitive receptors.

g) Assumptions and limitations

4.3.45 Construction noise predictions have been undertaken using the activities and plant described in **Chapter 2** of this volume, with further detail provided in **Appendix 4A** of this chapter. Construction work would take place during Monday to Saturday 07:00 to 19:00 hours, with no working on Sundays or bank holidays. No evening or night-time works during construction are proposed. However, if night-time working were to be required, for example for longer concrete pouring or unplanned dewatering, East Suffolk Council (ESC) would be notified in advance and noise control measures agreed, as necessary.

4.3.46 The operational noise assessment has been undertaken based on the description of development set out in **Chapter 2** of this volume, and includes the following key features:

- a park and ride facility, including up to 1,250 car parking spaces (of which 40 would be accessible spaces and 12 would be pick-up only spaces);
- up to ten spaces for minibuses/vans/buses, up to 80 motorcycle parking spaces and secure cycle parking for approximately 20 bicycles; and
- bus terminus area and parking, including shelters, an amenity and welfare building, a postal consolidation building, a Traffic Incident Management Area, security buildings and an administration office.

4.3.47 The following limitations have been identified:

- The construction noise has been predicted, based on the assumptions provided in **Chapter 2** of this volume, including the construction methodology, phasing and source data for each different source type. The details would be developed as part of the detailed design, however the assumptions provided are considered sufficient to enable robust assessment of a realistic 'worst-case' scenario of likely significant effects.

- The standards used in the assessment of permanent or new effects do not always provide guidance for the consideration of short-term impacts (such as any impact occurring over a period of less than a whole day or a whole night) or for a change in an existing situation. In such circumstances, the use of these standards may need to be adapted based on professional judgement, as required.

4.4 Baseline environment

4.4.1 This section presents a description of the baseline environmental characteristics within the site and in the study area.

a) Current baseline

4.4.2 Baseline monitoring was undertaken at a number of locations around the site, as shown in **Figure 4.2** in 2014 to characterise the existing noise environment.

4.4.3 A summary of measured levels at each location is shown in **Table 4.14**. Further detail is provided in **Volume 2, Appendix 11A** of the **ES**. The principal noise source in the study area is from road traffic using the A12.

Table 4.14: Summary of baseline survey data (free field values)

Receptor Reference	Receptor Name	Typical Sound Level DAY		Typical Sound Level NIGHT	
		L _{Aeq,T} (dB).	L _{A90,T} (dB).	L _{Aeq,T} (dB).	L _{A90,T} (dB).
Hacheston	PRS1	68	38	50	25
The Lodge, Lower Hacheston.	PRS2	55	42	40	28
Ash View, Lower Hacheston.	PRS3	68	55	52	35
Marlesford	RT14	77	63	-	-

4.4.4 As road traffic noise is the dominant source, noise levels have been modelled (based on flows – 14,000 vehicles per hour during the day and 1,712 per hour at night on the A12) to estimate levels at facades and in the vicinity of noise sensitive premises around the site. **Figures 4.3** and **4.4** contain noise contour plots for daytime and night-time respectively showing predicted noise levels from existing road traffic.

4.4.5 The noise and vibration sensitive receptors close to the proposed development are predominantly residential of ‘medium’ sensitivity. The locations of these noise sensitive receptors A, B, C and D are illustrated in the Site Location and Receptors Plan in **Figure 4.1**.

4.4.6 Existing daytime and night-time values are shown in **Table 4.15** for each receptor.

Table 4.15: Existing day-time and night-time noise levels at each identified receptor (free field values)

Receptor	Existing level, L_{Aeq} , dB.	
	Day	Night
A – Bottle and Glass Cottages (medium sensitivity).	52	43
B – Closest dwelling in Wickham Market (medium sensitivity).	56	50
C – Closest dwelling in Marlesford (medium sensitivity).	64	57
D – Closest dwelling in Hacheston (medium sensitivity).	47	37

i. **Future baseline**

4.4.7 It is not predicted that there would be any change in the future noise and vibration baseline. There are no new schemes in the area that would introduce noise sources that would alter the existing environment and no new committed developments which would result in receptors any closer than those considered as existing receptors.

4.5 **Environmental design and mitigation**

4.5.1 As detailed in **Volume 1, Chapter 6**, a number of primary mitigation measures have been identified through the iterative EIA process, and have been incorporated into the design and construction planning of the proposed development. Tertiary mitigation measures are legal requirements, or are standard practices that will be implemented as part of the proposed development.

4.5.2 The assessment of likely significant effects of the proposed development assumes that primary and tertiary mitigation measures are in place. For noise and vibration, these measures are identified in this section, with a summary provided on how the measures contribute to the mitigation, and management of potentially significant environmental effects.

a) **Primary mitigation**

4.5.3 Primary mitigation is often referred to as ‘embedded mitigation’ and includes modifications to the location or design to mitigate impacts, these measures become an inherent part of the proposed development.

4.5.4 The site layout would incorporate landscape bunds as shown in **Figure 2.1** of this volume. This would provide limited sound level reduction for the receptors once constructed.

4.5.5 The mechanical services plant (such as air conditioning condenser units and air handling units) would be selected to ensure that limit values would be met.

b) Tertiary mitigation

4.5.6 Tertiary mitigation will be required regardless of any EIA assessment, as it is imposed, for example, as a result of legislative requirements and/or standard sectoral practices.

4.5.7 The standard of good practice outlined in BS 5228-1 would be followed, as set out in the **Code of Construction Practice (CoCP)** (Doc Ref. 8.11). Tertiary mitigation for the control of noise and vibration would include:

- selection of quiet plant and techniques in accordance with good practice in BS 5228 for all construction, demolition and earthwork activities;
- switching off equipment when not required;
- use of reversing alarms that ensure proper warning whilst minimising noise impacts off-site; and
- provision of training and instruction to construction site staff on methods and techniques of working to minimise off-site noise and vibration impacts.

4.5.8 BS 5228-2 gives detailed advice on standard good practice for minimising impacts from construction vibration. The key requirements of BS 5228-2 are set out in the **CoCP** (Doc Ref. 8.11).

4.5.9 During construction, a **Construction Traffic Management Plan** (Doc Ref. 8.7) and a **Construction Workforce Travel Plan** (Doc Ref. 8.8) will be implemented to help reduce and manage the effects of traffic generated by the Sizewell C Project - see **Volume 2, Chapter 10** of the **ES** for more detail.

c) Other Mitigation

4.5.10 A Noise Mitigation Scheme, provided in **Volume 2 Appendix 11H** of the **ES** is proposed as part of the DCO Section 106 obligations, so that noise insulation or temporary rehousing may be provided where specified noise criteria are exceeded.

4.5.11 NPS EN-1 indicates that noise insulation is a valid form of mitigation, as part of a package of noise mitigation measures, stating at paragraph 5.11.13 (Ref. 4.2):

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"In certain situations, and only when all other forms of noise mitigation have been exhausted, it may be appropriate for the IPC to consider requiring noise mitigation through improved sound insulation to dwellings."

4.5.12 Similarly, paragraph 010 of the PPG for noise refers to the use of insulation when seeking to address noise impacts:

"In general, for developments that are likely to generate noise, there are 4 broad types of mitigation:

- *engineering: reducing the noise generated at source and/or containing the noise generated;*
- *layout: where possible, optimising the distance between the source and noise-sensitive receptors and/or incorporating good design to minimise noise transmission through the use of screening by natural or purpose built barriers, or other buildings;*
- *using planning conditions/obligations to restrict activities allowed on the site at certain times and/or specifying permissible noise levels differentiating as appropriate between different times of day, such as evenings and late at night, and;*
- *mitigating the impact on areas likely to be affected by noise including through noise insulation when the impact is on a building.* (emphasis added)

4.5.13 Offering temporary rehousing where short-term construction noise is forecast to exceed specified levels is also commonly regarded as best practice for projects involving significant construction activity.

d) **Monitoring**

4.5.14 Routine monitoring would be carried out during construction in accordance with the **CoCP** (Doc Ref. 8.11) and SZC Co. would have a system for the receipt and recording of any noise or vibration complaints from occupiers of noise sensitive receptors, and procedures for investigating and acting appropriately as necessary upon those complaints.

4.6 Assessment

a) Introduction

4.6.1 This section presents the findings of the noise and vibration assessment for the construction, operation and removal and reinstatement phases of the proposed development.

4.6.2 This section identifies any potentially significant effects that are predicted to occur and **section 4.7** of this chapter identifies any secondary mitigation and monitoring measures that are required to minimise any adverse effects.

4.6.3 The site would be accessed during both construction and operational purposes from a slip-road that carries traffic onto the A12 (heading northbound) to the south of the site. Four representative dwellings or groups of dwellings have been identified as noise sensitive receptors for the purposes of assessment positions for the assessment phases described in this chapter. The noise sensitive receptors A, B, C and D are illustrated in the Site Location and Receptors Plan in **Figure 4.1**.

b) Construction

i. Noise

4.6.4 A description of the construction methods is provided in **Chapter 2** of this volume. Associated environmental control measures are detailed in the **CoCP** (Doc Ref. 8.11), and are summarised in **section 4.5** of this chapter. The hours of working during the construction phases have been discussed during consultation meetings with the Suffolk County Council and ESC. For the purposes of this assessment, construction site overall working hours are therefore considered as follows:

- Monday to Saturday 07:00 to 19:00 hours.

4.6.5 The working hours fall entirely within the daytime assessment period of 07:00 to 19:00 hours, and therefore, for work taking place during a weekday working and work between 07:00 and 13:00 hours on Saturday, only the daytime criteria in **Table 4.2** apply to this part of the assessment. For work taking place between 13:00 and 19:00 hours on a Saturday, the evenings and weekends criteria in **Table 4.2** would apply.

4.6.6 Various construction activities have been considered for the construction and removal and reinstatement phases, and the noise and vibration effects then assessed at each of the noise and vibration sensitive receptors A-D. The construction phases have been identified and described as follows:

- enabling works;
- excavations and earthworks (including construction of landscape bunds);
- construction of parking and circulation routes;
- utilities and building construction;
- final surfacing of parking and circulation routes; and
- removal and reinstatement (including removal of buildings, breaking of concrete and earthworks).

4.6.7 Calculations have been carried out to predict noise levels during each phase of construction work at each of the closest noise sensitive receptors. Details of these calculations, the assumptions which support them and the analysis of results are in **Appendix 4A** of this chapter. **Table 4.16** shows a summary of the predicted levels.

Table 4.16: Summary of predicted construction noise levels at the nearest noise sensitive receptor locations around the site (free field values).

Receptor Reference	Predicted Sound Level $L_{Aeq,day}$ dB				
	Enabling Works, Earthworks and Excavation	Parking and Circulation Routes	Utilities and Building Construction	Final Surfacing	Removal and Reinstatement
A	51	53	47	48	53
B	47	49	42	43	49
C	45	48	43	45	49
D	45	46	41	43	48

4.6.8 The significance of effects of these noise levels during weekdays and Saturdays 07:00 to 13:00 hours are shown in **Table 4.17**, based on each receptor being of medium sensitivity.

Table 4.17: Summary of predicted construction noise effects at the nearest noise sensitive receptor locations around the site on weekdays and Saturdays 0700 to 13:00.

Receptor Reference	Predicted Effect				
	Enabling Works, Earthworks and Excavation	Parking and Circulation Routes	Utilities and Building Construction	Final Surfacing	Removal and Reinstatement
A	Negligible, not significant	Minor adverse, not significant	Negligible, not significant	Negligible, not significant	Minor adverse, not significant
B	Negligible, not significant	Negligible, not significant	Negligible, not significant	Negligible, not significant	Negligible, not significant
C	Negligible, not significant	Negligible, not significant	Negligible, not significant	Negligible, not significant	Negligible, not significant
D	Negligible, not significant	Negligible, not significant	Negligible, not significant	Negligible, not significant	Minor adverse, not significant

4.6.9 The assessment of effects from construction noise at noise sensitive receptors is considered to represent a typical day during each period.

4.6.10 Between Monday and Friday, 07:00 and 19:00 hours and Saturday 07:00 and 13:00 hours, for all phases of construction work, there are predicted to be no worse than minor adverse effects. Effects at all receptor locations are considered to be **not significant**.

4.6.11 Between 13:00 and 19:00 hours on Saturday, the impacts (from the same activities) would be assessed against different criteria, as defined in **Table 4.3**. The effects of these noise levels in this period are shown in **Table 4.18**, based on each receptor being of medium sensitivity.

Table 4.18: Summary of predicted construction noise effects at the nearest noise sensitive receptor locations around the site on Saturdays 13:00 to 19:00

Receptor Reference	Predicted Effects				
	Enabling Works, Earthworks and Excavation	Parking and Circulation Routes	Utilities and Building Construction	Final Surfacing	Removal and Restoration
A	Negligible, not significant	Moderate adverse, significant	Negligible, not significant	Negligible, not significant	Moderate adverse, significant

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Receptor Reference	Predicted Effects				
	Enabling Works, Earthworks and Excavation	Parking and Circulation Routes	Utilities and Building Construction	Final Surfacing	Removal and Restoration
B	Negligible, not significant	Negligible, not significant	Negligible, not significant	Negligible, not significant	Negligible, not significant
C	Negligible, not significant	Negligible, not significant	Negligible, not significant	Negligible, not significant	Negligible, not significant
D	Negligible, not significant	Negligible, not significant	Negligible, not significant	Negligible, not significant	Minor adverse, not significant

4.6.12 With the exception of at receptor A, there would be no difference in effect of construction activities which would occur between 13:00 and 19:00 hours on a Saturday, and those which occur between Monday to Friday 07:00 to 19:00 hours and Saturday 07:00 to 13:00 hours. The worst effects are predicted to be minor adverse, which are considered to be **not significant**.

4.6.13 At receptor A, predicted levels on a Saturday between 13:00 and 19:00 would result in a moderate adverse effect during the construction of parking and circulation routes and the removal and restoration phases.

4.6.14 Setting aside the removal and reinstatement phase, which is considered later in this chapter, it can be seen from **Table 4.16** that the construction SOAEL of 75dB for the weekday daytime period of 0800 to 1800 hours will not be exceeded at any of the assessed receptors, even when the free-field values are adjusted by +3dB to obtain façade levels. The lower SOAELs that are adopted for the periods outside of the main weekday daytime works are also predicted to be not exceeded at any receptor, even when the free-field values are adjusted by +3dB to obtain façade levels.

4.6.15 The LOAEL, which for construction noise is taken to be equal to the existing baseline sound levels, is likely to be exceeded at all of the receptor locations for at least some of the time during the construction works. This will be mitigated and minimised through the measures described in the Environmental Design and Mitigation section in this chapter and through the implementation of the **CoCP** (Doc Ref. 8.11).

4.6.16 It is inevitable that construction noise will vary over the course of any given day, and the predicted levels in **Table 4.16** are considered to be a reasonable representation of the likely construction noise levels for time periods other than the 12 hour period used in the calculations.

4.6.17 The potential for combined noise effects with the increased traffic on the A12 is assessed and presented in the project-wide effects assessment in **Volume 10 Chapter 3**. In summary, no additional significant effects are predicted to arise at receptors as a result of the in-combination effects.

ii. Vibration

4.6.18 The approach taken for predicting vibration levels is described in **Volume 1, Chapter 6, Appendix 6G, Annex 6G**. Using Figures 1 and 2 from this it can be seen that for earthmoving, including bulldozers, breakers, crushers and small twin drum vibratory rollers, there would be a negligible vibration effect beyond a distance of 40m from the activity. For plant which produces higher vibration levels (such as piling and large single drum compactors), there would be a negligible vibration effect beyond a distance of 90m from the activity.

4.6.19 The distances between the receptors and the main working areas during the construction phases are all greater than 90m, so vibration levels from construction would be less than 0.3mm/s. This is expected to be below a low magnitude of impact, and would therefore result in no more than minor adverse effects. This is considered to be **not significant**.

4.6.20 There are predicted to be no exceedances of the SOAEL of 10mm/s nor of the LOAEL of 0.3mm/s as a result of these works.

iii. Inter-relationship effects

4.6.21 Inter-relationship effects with noise and vibration for amenity and recreation, ecological receptors and heritage receptors are considered within **Chapters 7, 8 and 9** of this volume respectively. Inter-relationship effects on human health receptors are considered further in **Volume 2, Chapter 28** of this volume, and in **Volume 10, Chapter 2**.

c) Operation

4.6.22 Once operational, the proposed development is expected to operate seven days per week providing a park and ride service for workers accessing the Sizewell C main development site. Construction of Sizewell C main development site would take place up to 24 hours a day, and therefore the proposed development would operate during daytime, evening, and night-time assessment periods, with varying occupation levels in the parking areas and bus frequencies adapting to demand. On the basis of the shift patterns, the proposed development is not assumed to be operational between the hours of 01:00 and 05:00 hours, i.e. no vehicle movements in and out.

4.6.23 There would also be some noise from mechanical services in use at the amenity and welfare building, postal consolidation building, administration office and security buildings on-site as detailed below.

i. **Operational noise from car parking and vehicle movements on-site**

4.6.24 The noise sensitive receptor locations A, B, C and D used for the construction phase assessment have also been used for reporting the operational phase noise assessment.

4.6.25 The potential activities associated with the operational park and ride facility that could give rise to a noise impact at receptor locations are as follows:

- vehicle movements within the development site including cars and motorbikes parking, door closing, engine start-ups;
- park and ride buses entering and leaving site; and
- park and ride users, security and visitors using the facility.

4.6.26 Buses would operate to and from the proposed development to accommodate the Sizewell C main development site construction shift patterns. Between Monday and Friday shifts are expected to consist of the shift start and finish times as set out in **Table 4.19**. Whilst the proposed development would operate seven days a week, the use would vary throughout the construction and typically, there would be fewer shifts on Fridays and weekends.

Table 4.19: Main development site construction shift times

Shift	Start Time.	Finish Time.
Shift 1.	From 06:00 to 07:30.	From 14:00 to 16:00 or after 17:30.
Shift 2.	From 13:30 to 15:00.	From 22:00 to 24:00.
Night Shift.	From 20:30 to 22:00.	From 06:00 to 08:00.
Single Shift.	From 07:00 to 08:30.	From 16:30 to 18:30.
Office Shift.	From 07:30 to 09:00.	From 17:30 to 19:00.

4.6.27 The criteria for assessing the potential noise effects from the operation of the proposed development does not distinguish the day of the week but considers the daytime and night time assessment periods set out in **Table 4.6**. Traffic data for movements of vehicles associated with these shift patterns have therefore been categorised into movements in each day or night time period.

- 4.6.28 During the day there are predicted to be 1,784 vehicle movements on-site, of which 154 would be by vehicles over 3.5 tonnes (including buses). At night there are predicted to be 896 vehicle movements on-site, of which 44 would be by vehicles over 3.5 tonnes (including buses).
- 4.6.29 Noise levels have been predicted using computer modelling and details of the modelling carried out and assumptions made are shown in **Appendix 4B** of this chapter. **Figures 4.5, 4.6** and **4.7** show predicted noise contours for daytime L_{Aeq} levels, night-time L_{Aeq} levels and night-time L_{Amax} noise levels, respectively.
- 4.6.30 **Table 4.20** shows a summary of predicted noise levels at each receptor and the noise effects predicted for each period, based on the predicted levels and each receptor being of medium sensitivity.

Table 4.20: Predicted noise levels and noise effects from operation of the proposed development

Receptor Reference	Parameter	Predicted Level	Classification of Effect
A	$L_{Aeq,16hour}$ (day).	29	Negligible, not significant
	$L_{Aeq,8hour}$ (night).	30	Negligible, not significant
	L_{Amax} (night).	38	Negligible, not significant
B	$L_{Aeq,16hour}$ (day).	29	Negligible, not significant
	$L_{Aeq,8hour}$ (night).	29	Negligible, not significant
	L_{Amax} (night).	39	Negligible, not significant
C	$L_{Aeq,16hour}$ (day).	23	Negligible, not significant
	$L_{Aeq,8hour}$ (night).	24	Negligible, not significant
	L_{Amax} (night).	31	Negligible, not significant
D	$L_{Aeq,16hour}$ (day).	23	Negligible, not significant
	$L_{Aeq,8hour}$ (night).	22	Negligible, not significant
	L_{Amax} (night).	31	Negligible, not significant

- 4.6.31 **Table 4.20** shows that there would be negligible effects at all receptors considered. These are considered to be **not significant**.
- 4.6.32 It can also be seen from **Table 4.20** that the predicted noise levels will not exceed the SOAEL or LOAEL at any of the assessed receptors.
 - ii. **Mechanical services noise**
- 4.6.33 The proposed development would have a number of buildings on-site shown on **Figure 2.1** of this volume. The detailed design of these buildings is not available at this time however, the purpose is to provide facilities for the

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security staff that would be on-site 24 hours per day, office accommodation and WC facilities for all users of the site.

- 4.6.34 Typically, such buildings can be expected to include extract fans serving the WC areas, and any kitchen area provided for staff. It is also likely that these buildings would be served by heating and cooling systems. The buildings may be occupied by staff, and the facilities available for park and ride users at any time in a 24-hour period. The mechanical services plant can also therefore be expected to operate day and night.
- 4.6.35 Specific details of the proposed mechanical services to be installed are not known at this stage, and therefore it is appropriate that design target noise levels are set for the mechanical services systems in order that plant is selected, designed, and installed in such a manner that the design target noise levels are achieved.
- 4.6.36 It should be the aim to ensure that the combined mechanical services plant when all operating would be either equal to background or no higher than 35dB, L_{Ar} , where the existing background is low at all noise sensitive receptors. (35dB, L_{Ar} is considered to represent a “very low” rating level for reasons explained in **Volume 1, Appendix 6G, Annex 6G.**)
- 4.6.37 The design target noise levels must be set relative to the typical background sound levels ($L_{A90,T}$). The nearest noise sensitive receptors to the proposed buildings are at a distance of approximately 500m.
- 4.6.38 The typical background sound levels ($L_{A90,T}$) are lowest through the night-time period of 23:00 to 07:00 hours. Typical background sound levels at night at a position representative of the nearest noise sensitive receptor was found to be $L_{A90,15\text{minute}}$ of 23dB. This means that the design target for mechanical services is 35dB, L_{Ar} .
- 4.6.39 For plant noise not to exceed the design target, the $L_{Ar,15\text{minute}}$ of the combined mechanical services plant would need to be no greater than 35dB, L_{Ar} at any nearby receptor. Given the likely type of plant to be installed, the separation distances, and the scope for selection of quiet mechanical services (if required), plus the ability to locate, and orient the plant in such a way as to take advantage of screening from buildings, and directionality of the sound source, this level would be readily achievable without the need for additional screening or enclosure.
- 4.6.40 By designing the plant to achieve a free-field level of 35 dB $L_{Ar,15\text{minute}}$ outside the nearest residential receptor, the adopted SOAEL and LOAEL will not be exceeded.

iii. Inter-relationship effects

4.6.41 Inter-relationship effects with noise and vibration for amenity and recreation, ecological receptors and heritage receptors are considered within **Chapters 7, 8 and 9** of this volume respectively. Inter-relationship effects on human health receptors are considered further in **Volume 2, Chapter 28** of this volume, and in **Volume 10, Chapter 2** of the **ES**.

d) Removal and Reinstatement

4.6.42 The assessment of the removal and reinstatement phase is presented in **section 4.6** of this chapter as part of the construction assessment. Once the removal works are complete and the site reinstated to agricultural use, noise levels would be similar to those presented for the baseline.

4.6.43 As shown in **Tables 4.17 and 4.18**, the predicted noise levels will lead to effects that are no worse than minor adverse, **not significant** except at receptor A, when this work is carried out on a Saturday between 13:00 and 19:00.

4.6.44 It can be seen from **Table 4.16** that the construction SOAEL of 75dB for the weekday daytime period of 0800 to 1800 hours will not be exceeded at any of the assessed receptors, even when the free-field values are adjusted by +3dB to obtain façade levels. The lower SOAELs that are adopted for the periods outside of the main weekday daytime works are also predicted to be not exceeded at any receptor, even when the free-field values are adjusted by +3dB to obtain façade levels.

4.6.45 The LOAEL, which for construction noise is taken to be equal to the existing baseline sound levels, is likely to be exceeded at all of the receptor locations for at least some of the time during the construction works. This will be mitigated and minimised through the measures described in the Environmental Design and Mitigation section in this chapter and through the implementation of the **CoCP** (Doc Ref. 8.11).

4.6.46 It is inevitable that construction noise will vary over the course of any given day, and the predicted levels in **Table 4.16** are considered to be a reasonable representation of the likely construction noise levels for time periods other than the 12 hour period used in the calculations.

i. Inter-relationship effects

4.6.47 Inter-relationship effects with noise and vibration for amenity and recreation, ecological receptors and heritage receptors are considered within **Chapters 7, 8 and 9** of this volume respectively. Inter-relationship effects on human health receptors are considered further in **Volume 2, Chapter 28** of this volume, and in **Volume 10, Chapter 2**.

4.7 Mitigation and monitoring

a) Introduction

4.7.1 Primary and tertiary mitigation measures which have been accounted for as part of the assessment are summarised in **section 4.5** of this chapter. Where other mitigation is required to avoid a significant adverse effect, or mitigate and minimise adverse effects, this is referred to as secondary mitigation as described below.

b) Mitigation

4.7.2 No significant effects have been identified for any of the activities during construction, operation or removal and re-instatement of the proposed development for any work occurring between 13:00 and 19:00 hours. However, between 13:00 and 19:00, since levels would be significant if they were to occur on a Saturday between 13:00 and 19:00 at receptor A during construction of parking and circulation routes and the removal and restoration phases. It would therefore be necessary to reduce noisier activities during these construction works in this period.

4.7.3 Additional mitigation to further reduce construction noise levels could include:

- the detailed construction programme and equipment specifications which would not be available until contractors have been appointed;
- on-site constraints (space, topography or other ecological or geographical feature which may prevent or limit screening);
- consideration of any other impacts which the construction of further acoustic screening may have, such as landscape and visual impacts; and
- the amount of time over which the reduction would be required.

4.7.4 No secondary or additional mitigation is considered to be necessary for operational noise.

4.8 Residual effects

4.8.1 The following tables (**Tables 4.21, 4.22, 4.23, 4.24, 4.25** and **4.26**) present a summary of the noise and vibration assessment.

4.8.2 **Tables 4.21, 4.23** and **4.25** relate to the construction, operational and reinstatement phases respectively, identifying the receptors likely to be impacted, the level of effect and, where the effect is deemed to be significant,

the tables include the mitigation proposed and the resulting residual effect. Any receptor coding included in **Tables 4.21, 4.23 and 4.25** are as per **Table 4.15**.

4.8.3 Tables 4.22, 4.24 and 4.26 also relate to the construction, operational and reinstatement phases respectively, identifying the assessment outcomes against LOAEL and SOAEL.

Table 4.21: Summary of effects for the construction phase

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
A	Noise during construction of parking and circulation routes occurring on Saturday between 13:00 and 19:00 hours.	Landscape bunds and the CoCP , including monitoring (Doc Ref. 8.11).	Moderate adverse	Reduce noisy activities on Saturday between 13:00 and 19:00 hours during this phase of construction.	Minor adverse or negligible (not significant)
A	Noise during construction works at all other times and during other construction phases		Minor adverse or negligible	None.	Minor adverse or negligible (not significant)
All other receptors	Construction noise – all phases and periods of work.		Minor adverse or negligible		Minor adverse or negligible (not significant)
All	Construction vibration.	CoCP (Doc Ref. 8.11).	Negligible	None.	Negligible (not significant)

Table 4.22: Summary of assessment against LOAEL / SOAEL for construction

Phase of Works or Activity	Assessment Against SOAEL/LOAEL	Comment
Noise from construction works.	No exceedances of the SOAEL expected. LOAEL likely to be exceeded at some points during construction works at all receptors.	No action required to avoid significant adverse effects on health and quality of life. Exceedances of the LOAEL will be mitigated and minimised through the adoption of the measures detailed in section 4.5 on Environmental Design and Mitigation, and through the implementation of the CoCP (Doc Ref. 8.11).
Vibration from construction works.	No exceedances of SOAEL or LOAEL.	No action required to avoid significant adverse effects on health and quality of life.

Phase of Works or Activity	Assessment Against SOAEL/LOAEL	Comment
		No requirement for further mitigation to mitigate and minimise adverse effects on health and quality of life.

Table 4.23: Summary of effects for the operational phase

Receptor	Impact	Primary Tertiary Mitigation	or	Assessment of Effects	Additional Mitigation	Residual Effects
All	Noise and vibration from operation of the proposed development.	Landscape bunds and the CoCP (Doc Ref. 8.11), including routine monitoring.		Negligible	None.	Negligible (not significant)

Table 4.24: Summary of assessment against LOAEL / SOAEL for operation

Phase of Works or Activity	Assessment Against SOAEL/LOAEL	Comment
Noise and vibration from operation of the proposed development.	No exceedances of the SOAEL or LOAEL expected.	No action required to avoid significant adverse effects on health and quality of life. No requirement for further mitigation to mitigate and minimise adverse effects on health and quality of life.
Operation of fixed mechanical plant.	No exceedances of SOAEL or LOAEL expected.	No action required to avoid significant adverse effects on health and quality of life. No requirement for further mitigation to mitigate and minimise adverse effects on health and quality of life.

Table 4.25: Summary of effects for the removal and reinstatement phase

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
A	Noise during removal and restoration work occurring on Saturday between	Landscape bunds and the CoCP (Doc Ref. 8.11), including routine monitoring.	Moderate adverse	Reduce noisy activities on Saturday between 13:00 and 19:00 hours during this phase of construction.	Minor adverse or negligible (not significant)

NOT PROTECTIVELY MARKED

Receptor	Impact	Primary or Tertiary Mitigation	Assessment of Effects	Additional Mitigation	Residual Effects
	13:00 and 19:00 hours.				
A	Noise during removal and resoration work at all other times and during other construction phases		Minor adverse or negligible	None.	Minor adverse or negligible (not significant)
All other receptors	Noise levels during removal and reinstatement works – all phases and periods of work.		Minor adverse or negligible	None.	Minor adverse or negligible (not significant)
All	Vibration from removal and reinstatement activities.	CoCP.	Negligible	None.	Negligible (not significant)

Table 4.26: Summary of assessment against LOAEL / SOAEL for removal and reinstatement phase

Phase of Works or Activity	Assessment Against SOAEL/LOAEL	Comment
Noise from removal / reinstatement works.	No exceedances of the SOAEL expected. LOAEL likely to be exceeded at some points during construction works at all receptors.	No action required to avoid significant adverse effects on health and quality of life. Exceedances of the LOAEL will be mitigated and minimised through the adoption of the measures detailed in SECTION 4.5 on Environmental Design and Mitigation, and through the

Phase of Works or Activity	Assessment Against SOAEL/LOAEL	Comment
		implementation of the CoCP (Doc Ref. 8.11).
Vibration from construction removal / reinstatement works.	No exceedances of SOAEL or LOAEL.	No action required to avoid significant adverse effects on health and quality of life. No requirement for further mitigation to mitigate and minimise adverse effects on health and quality of life.

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