

8 Noise and Vibration

8.1 Introduction

- 8.1.1 This chapter provides a summary of the noise and vibration assessment undertaken for the proposed 3Rs Facility proposed at the site located at Langhurstwood Road, Horsham, West Sussex.

Scope of Study

- 8.1.2 This chapter sets out the approach to the assessment; provides a description of the baseline noise environment; identifies those aspects of the proposed development that may result in significant noise and/or vibration effects; provides predictions of noise and/or vibration immissions at the nearest noise and vibration sensitive receptors (NVSRs); and provides an assessment of the significance of noise and/or vibration effects. Mitigation measures are identified where necessary. Cumulative noise and/or vibration effects with other proposed developments that may also affect the same NVSRs as the project are also considered, as are the limitations of the assessment.
- 8.1.3 Significant noise exposure can cause annoyance and sleep disturbance, both of which can impact on the quality of life. Significant groundborne vibration can reduce the quality of life and working efficiency of building occupants and, for very high levels, has the potential to cause cosmetic or structural damage to buildings and structures.
- 8.1.4 This assessment considers noise and vibration effects during the construction phase, together with noise arising from operation of the proposed facility. Noise effects from construction and operational traffic are assessed. The plant and equipment associated with the facility would not produce high levels of vibration. In addition, vibration levels drop off rapidly with distance and the closest receptors are over 200 metres away. Therefore, vibration effects from operation of the proposed facility have been scoped out of the assessment.

Study Area

- 8.1.5 The study area for this assessment includes the nearest existing and proposed noise sensitive receptors (NVSRs) to each boundary of the site that lie within 500 metres. The following are the sensitive receptors/areas which have been identified and considered within this assessment:
- Langhurst Moat Cottage and Wealden, Langhurstwood Road, located approximately 210 metres south east of the site;
 - Grayland's Lodge, on Langhurstwood Road, located approximately 330 metres to the north east of the site;
 - Several residential properties on Langhurstwood Road, located approximately 370 metres south east of the site;
 - Residential properties on Station Road, located approximately 330 metres south of site;
 - Cox Farm, located approximately 420 metres north west of site; and
 - The proposed residential development Land North of Horsham (subject to a resolution to grant outline consent) located approximately 450 metres south east of the site.
- 8.1.6 A plan indicating the locations of the above NVSRs is provided in Figure 8.1.

8.2 Legislation and Policy Context

8.2.1 This section summarises relevant legislation and policies that are directly relevant to noise and vibration issues.

Legislation

Control of Pollution Act, 1974

8.2.2 Part III of the Control of Pollution Act 1974 (CoPA) is specifically concerned with pollution. With regards to noise it covers construction sites; noise in the street; noise abatement zones; codes of practice and best practicable means (BPM).

8.2.3 Section 60, Part III of the CoPA refers to the control of noise on construction sites. It provides legislation by which local authorities can control noise from construction sites to prevent noise disturbance occurring. The Control of Noise (Code of Practice for Construction and Open Sites) (England) Order 2015 approved British Standard (BS) 5228 Part 1 (BSI, 2014a) and Part 2 (BSI, 2014b) for the purpose of giving guidance on appropriate methods for minimising noise from construction and open sites in exercise of the powers conferred on the Secretary of State by sections 71(1)(b), (2) and (3) of the CoPA.

8.2.4 The CoPA enables the local authority, in whose area work is going to be undertaken, or is being undertaken, the power to serve a notice imposing requirements as to the way in which construction works are to be carried out. This notice can specify the plant or machinery that is or is not to be used, the hours during which the construction work can be carried out, the level of noise and vibration that can be emitted from the premises in question or at any specified point on these premises or that can be emitted during specified hours, or for any change of circumstances.

8.2.5 Section 61, Part III of the CoPA refers to prior consent for work on construction sites. It provides a method by which a contractor can apply for consent to undertake construction works in advance. If consent is given, and the stated method and hours of work are complied with, then the local authority cannot take action under Section 60.

8.2.6 Section 71, Part III of the CoPA refers to the preparation and approval of codes of practice for minimising noise.

8.2.7 Section 72, Part III of the CoPA refers to Best Practicable Means, which is defined as:

“reasonably practicable, having regards among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications”. Whilst ‘Means’ includes ‘the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and acoustic structures”.

8.2.8 If Best Practicable Means is applied, it can provide a defence in the event of legal action by a complainant.

National Policy and Guidance

National Planning Policy Framework (2012)

8.2.9 The National Planning Policy Framework (NPPF) (DCLG, 2012), published in March 2012, sets out the government’s planning policies for England.

8.2.10 The document does not contain any specific noise policy or noise limits, but it provides a framework for local people and local authorities to produce their own local and neighbourhood plans, which reflect the needs and priorities of their communities.

- 8.2.11 In Section 11, 'Conserving and enhancing the natural environment', paragraph 123 relates to noise and states that:

'123. Planning policies and decisions should aim to:

- avoid noise from giving rise to significant adverse impacts²⁷ on health and quality of life as a result of new development;
- mitigate and reduce to a minimum other adverse impact²⁸ on health and quality of life arising from noise from new development, including through the use of conditions;
- recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established;²⁸ and
- identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.'

27 See Explanatory Note to the Noise Policy Statement for England (Department for the Environment, Food and Rural Affairs).

28 Subject to the provisions of the Environmental Protection Act 1990 and other relevant law.'

National Planning Policy for Waste (2014)

- 8.2.12 Appendix B of the National Planning Policy for Waste (DCLG, 2014a) provides a list of factors that are to be considered in determining planning applications including:

"j. noise, light and vibration Considerations will include the proximity of sensitive receptors. The operation of large waste management facilities in particular can produce noise affecting both the inside and outside of buildings, including noise and vibration from goods vehicle traffic movements to and from a site. Intermittent and sustained operating noise may be a problem if not properly managed particularly if night-time working is involved. Potential light pollution aspects will also need to be considered."

Noise Policy Statement for England (2010)

- 8.2.13 The Noise Policy Statement for England (NPSE) (Defra, 2010) aims to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion.

- 8.2.14 Paragraph 1.6 of the NPSE sets out the long-term vision and aims of government noise policy:

"Noise Policy Vision

Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."

"Noise Policy Aims

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

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

- 8.2.15 The aims require that all reasonable steps should be taken to avoid, mitigate and minimise adverse effects on health and quality of life whilst also taking into account the guiding principles of sustainable development, which include social, economic, environmental and health considerations.

- 8.2.16 With regard to the terms 'significant adverse' and 'adverse' included in the 'Noise Policy Aims', these are explained further in the 'Explanatory Note' as relating to established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation which are:

'NOEL – No Observed Effect Level'

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

'LOAEL – Lowest Observed Adverse Effect Level'

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

- 8.2.17 Defra has then extended these concepts for the purpose of the NPSE to introduce the concept of:

'SOAEL – Significant Observed Adverse Effect Level'

- 8.2.18 This is the level above which significant adverse effects on health and quality of life occur. The accompanying explanation states that:

'It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.'

- 8.2.19 With regard to 'further evidence', Defra has commissioned research to try and identify the levels at which the above effects occur but this is not yet in the public domain. However, early indications are that this research has been largely inconclusive. On this basis, and until further guidance becomes available, and given that there is no specific guidance in the NPPF on noise, there is no justification to vary assessment methods and criteria from those previously adopted from British Standards and good practice guidance.

Planning Practice Guidance

- 8.2.20 In addition to the NPPF and the Noise Policy Statement for England (NPSE) described below, the Department for Communities and Local Government released National Planning Practice Guidance (NPPG) (DCLG, 2014b) on noise in March 2014. The NPPG provides guidance on determining the significance of noise effects to support the requirements of the NPPF.
- 8.2.21 The guidance provides advice on how to deliver its policies. The NPPG reiterates general guidance on noise policy and assessment methods provided in the NPPF, NPSE and British Standards and contains examples of acoustic environments commensurate with various effect levels (paragraph Reference ID: 30-001-20140306).
- 8.2.22 The NPPG describes noise that is not noticeable to be at levels below the NOEL. It describes a range of noise exposure that is noticeable but not to the extent there is a perceived change in quality of life. Noise exposures in this range are below the LOAEL and need no mitigation. On this basis, the audibility of noise from a development is not, in itself, a criterion to judge noise effects that is commensurate with national planning policy.
- 8.2.23 The NPPG suggests that noise exposures above the LOAEL cause small changes in behaviour. An example of noise exposures above the LOAEL provided in the PPG is having to turn up the volume on the television; needing to speak more loudly to be heard; or, where there is no alternative ventilation, closing windows for some of the time because of the noise. In line with the NPPF and NPSE, the NPPG states that consideration

needs to be given to mitigating and minimising effects above the LOAEL but taking account of the economic and social benefits being derived from the activity causing the noise.

- 8.2.24 The NPPG suggests that noise exposures above the SOAEL cause material changes in behaviour. An example of noise exposures above the SOAEL provided in the NPPG are, where there is no alternative ventilation, keeping windows closed for most of the time or avoiding certain activities during periods when the noise is present. In line with the NPPF and NPSE, the NPPG states that effects above the SOAEL should be avoided and that whilst the economic and social benefits being derived from the activity causing the noise must be taken into account, such exposures are undesirable.

Development Plan Policy

West Sussex Waste Local Plan (2014)

- 8.2.25 The following policies of the West Sussex Waste Local Plan (West Sussex County Council and South Downs National Park Authority, 2010) are relevant to noise and vibration.

- 8.2.26 Policy W18: Transport

“Proposals for waste development will be permitted provided that:

- (b) ...transport links are adequate to serve the development or can be improved to an appropriate standard without an unacceptable impact on amenity, character, or the environment;”*

- 8.2.27 Policy W19: Public Health and Amenity

“Proposals for waste development will be permitted provided that:

- (a) lighting, noise, dust, odours and other emissions, including those arising from traffic, are controlled to the extent that there will not be an unacceptable impact on public health and amenity;”*

Horsham District Planning Framework

- 8.2.28 Strategic Policy 24, Environmental Protection, of the Horsham District Local Plan (Horsham District Council, 2015) is relevant to noise and vibration. The policy seeks to protect the high quality of the District's environment, requiring new development to minimise emission of pollutants including noise, odour, air and light pollution.

8.3 Assessment Methodology

Relevant Guidance

- 8.3.1 The assessment methodology has been informed by guidance contained within the following documents:
- BS 5228-1:2009+A1:2014. Code of practice for noise and vibration control on construction and open sites - Part 1: Noise (BSI, 2014a);
 - BS 5228-1:2009+A1:2014. Code of practice for noise and vibration control on construction and open sites - Part 2: Vibration (BSI, 2014b);
 - BS 4142:2014. Methods for rating and assessing industrial and commercial sound (BSI, 2014c);
 - BS 8233:2014 Guidance on sound insulation and noise reduction for buildings (BSI, 2014d);
 - ISO 9613-2:1996. Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation (International Organization for Standardization, 1996);
 - Department of Transport (1988) Calculation of Road Traffic Noise; and

- Highways Agency *et al.* (2011) Design Manual for Roads and Bridges. Volume 11. Section 3 - Part 7: Noise and Vibration.

Consultation

8.3.2 In carrying out the noise and vibration assessment, consultation has included:

- A formal scoping request;
- Informal scoping, including consultation with an Environmental Health Officer at Horsham District Council regarding the methodology for the operational noise assessment and baseline noise monitoring locations; and
- Comments received in relation to the previous application at the site (issued by WSCC in relation to application 062/16/NH.)

8.3.3 The issues raised through the consultation outlined above that are relevant to noise and vibration are summarised in Table 8.1 below.

8.3.4 A full copy of the Scoping Opinion is contained in Appendix 4.2.

Table 8.1: Consultation Relevant to Noise and Vibration

Date/Source	Consultee and Issues Raised	How/ Where Addressed
October 2015/ Scoping Opinion	Jane Mosely, Case Officer – Main Report Agreed to approach set out in Scoping Report. Stated that the cumulative impact of vehicle noise/vibration with the North Horsham allocation should be taken into account.	The North Horsham traffic has been included in the cumulative assessment provided in Section 8.10 of this ES chapter.
October 2015/ Scoping Opinion	Gerry Benham – Clerk to Warnham Parish Council Quantitative assessment of the changes in noise levels on the highways due to road traffic should be included. Cumulative traffic noise effects with the North of Horsham development to be included. Effects on the North of Horsham development should be assessed. The basis for the statement that significant operational vibrations are unlikely should be explained.	The North Horsham traffic has been included in the cumulative assessment provided in Section 8.10 of this ES chapter. Effects on residents of the new development are included within the assessment. The plant and equipment associated with the facility will not produce high levels of vibration. In addition, vibration levels drop off rapidly with distance and the closest receptors are over 200 m away. Therefore, vibration effects from operation of the development have been scoped out.
July 2016/ Informal Consultation	Adam Dracott – Environmental Health Officer at Horsham District Council Agreed to methodology set out in Scoping Request and responses as above. Agreed baseline noise monitoring locations.	Baseline noise monitoring locations are provided in Figure 8.3.
January 2018 Regulation 22 Request	West Sussex County Council Provide further evidence to demonstrate how noise impacts from plant, machinery and activities at the site will be minimised.	Mitigation for the operational aspects of the site is provided in Section 8.6 of this ES chapter.

Date/Source	Consultee and Issues Raised	How/ Where Addressed
January 2018 Regulation 22 Request	West Sussex County Council Provide further justification to demonstrate that no correction for tonality or impulsivity is appropriate in the assessment, with reference to the conclusions in the previous ES and the issues raised by the Environmental Health Officer.	Paragraph 8.8.3 of this ES chapter. The applicant is also prepared to accept a planning condition to control the rating level of the plant with respect to BS 4142:2014, and hence take into consideration any tonality and impulsivity. This would be agreed with West Sussex County Council prior to the commencement of the operation. See Section 8.6.
January 2018 Regulation 22 Request	West Sussex County Council Clarify what mitigation measures would be provided to off-set the night-time noise impacts at three receptor locations (two of them significant).	Section 8.6 of this ES chapter. The applicant is also prepared to accept a planning condition that requires mitigation to be applied to reduce the significance of effects. See Section 8.13.

Baseline Surveys

- 8.3.5 Three long term baseline sound level surveys were carried out at nearby residential dwellings between 14:30 hours on Wednesday 27th July 2016 until 10:15 hours on Thursday 4th August 2016. The surveys were carried out to determine the existing levels of environmental sound affecting the nearest noise sensitive receptors. A plan showing the approximate location of the measurement positions and site boundary is provided in Figure 8.3.
- 8.3.6 The first long term survey (LT1) was located at 11 Station Road to the south of the site. The microphone was mounted on a pole secured to the garden fence at a height of approximately 2.5 metres above local ground level and placed approximately 20 metres north of the rear façade of the property. The microphone was secured to a height of 2.5 metres to ensure that it was under free field conditions (at least 3.5 metres from any reflecting surfaces, excluding the ground). During the time spent on site setting up the long term survey, the following sound sources were noted affecting the site: road traffic on the A24, passing trains, industrial noise (whirring and reversing alarms), geese and aircraft passing overhead.
- 8.3.7 The second long term survey (LT2) was located at Cox Farm to the north west of the site. The microphone was mounted on a pole 1.2 metres above ground level, approximately 10 metres west of the rear façade of the house and under free-field conditions. During the time spent on site setting up the long term survey, the following sound sources were noted affecting the site: aircraft passing overhead, distant road traffic and wind through trees.
- 8.3.8 The third long term survey (LT3) was set-up in the rear garden of Haybarn Cottage to the south east of the site. The microphone was mounted on a pole 1.2 metres above ground level, approximately 3.5 metres east of the rear façade of the house and under free-field conditions. During the time spent on site setting up the long term survey, the following sound sources were noted affecting the site: distant road traffic from the A264, HGVs and other vehicles on Langhurstwood Road, birdsong and wind rustling through trees.
- 8.3.9 All sound level measurements were made using 'Class 1' Rion NL-52 sound level meters (SLMs) in accordance with BS 7445-2:1991 (BSI, 1991). Both SLMs were calibrated before and checked after use with a Rion NC-74 calibrator with no significant drift occurring.
- 8.3.10 Meteorological data have been taken from the Met Office Weather Observations Website for the Horsham site. During the survey, period wind speeds were low, not exceeding 2.8 m/s. Rainfall accumulation (over 15 minutes) was generally low with the exception of 2nd August 2016 when up to 12 mm was measured. Analysis of the data has not indicated that noise levels were affected by wind or rainfall and, therefore, no data have been excluded due to meteorological conditions.

Assessment Criteria and Assignment of Significance

Sensitivity of Receptors

- 8.3.11 Table 8.2 below provides the thresholds used within this assessment for determining the sensitivity of noise and vibration receptors.

Table 8.2: Definitions of Sensitivity

Sensitivity	Descriptors
Very High	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	High or medium importance and rarity, regional scale, limited potential for substitution.
Low	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

- 8.3.12 The NVSRs considered within this assessment are all residential receptors including private gardens and, therefore, considering the descriptors above, are considered to be of medium sensitivity.

Assessment of Construction Effects

On-Site Construction Works

- 8.3.13 A qualitative assessment of noise and vibration effects has been undertaken based on the typical construction equipment and plant that would be required for this type of development. It is anticipated that the activity likely to generate the greatest levels of noise and vibration would be piling for foundations if required. The significance of effects have been determined on the basis of professional judgement, baseline sound levels determined from surveys and the semantic scale described in Table 8.3, which refers to guidance contained within the NPPG. Table 8.3 provides the corresponding impact levels in the terminology of the NPPG.

Table 8.3: Methodology for Determining Magnitude of Impact for Construction (and Industrial) Noise and Vibration at Residential NVSRs

Magnitude of Impact	Threshold Effect Level for Residential NVSRs (NPPG)	Examples of Outcomes
High	UAEL ¹	The noise/vibration causes a material change in behaviour and/or attitude. 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.
Medium	SOAEL	Noise/vibration can be heard/felt and causes small changes in behaviour and/or attitude. Affects the acoustic character of the area such that there is a perceived change in the quality of life.
Low	LOAEL	A minor shift away from baseline conditions. Noise/vibration can be heard/felt, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.
Negligible	NOEL	Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation.

Note 1: The NPPG indicates that an unacceptable adverse effect (level) occurs above SOAEL; the term UAEL (Upper Adverse Effect Level) has therefore been used to describe effects at this level although it is not a term referred to in the NPSE or elsewhere in the NPPG except in the table of effects.

Construction Traffic

- 8.3.14 The assessment of changes in road traffic noise levels on local roads as a result of the construction of the proposed development is based on the methods contained within Calculation of Road Traffic Noise (CRTN) and the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7: Noise and Vibration (HD 213/11), which is a method designed for the assessment of new construction, improvements and maintenance of trunk roads. Therefore, the method described in the DMRB is considered as informative but not definitive for the assessment of the traffic noise effects arising from traffic generation associated with the proposed development.
- 8.3.15 Further details of the traffic noise assessment are provided within the methodology set out below for assessment of operational off-site road traffic noise, with thresholds of impact magnitude provided in Table 8.4. For a temporary change, such as may arise from construction traffic servicing a construction site, as the noise change is not permanent, and in order to allow the project to proceed at a reasonable rate without undue constraint, it is considered justifiable, following accepted precedent, that the threshold can be raised to a level that is higher than for permanent operational traffic. Therefore, for the purposes of this assessment, the impact thresholds for noise change for each stated operational noise level have been doubled from that of the operational noise assessment.

Assessment of Operational Effects

Operation of the Proposed Facility

- 8.3.16 Noise effects due to the operation of the proposed facility have been assessed according to the guidance and methodology contained in BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' and the NPPG as presented in Table 8.3 above. The foreword to BS 4142:2014 provides the following introduction for the assessment of human response to sound:

"Response to sound can be subjective and is affected by many factors, both acoustic and non-acoustic. The significance of its impact, for example, can depend on such factors as the margin by which a sound exceeds the background sound level, its absolute level, time of day and change in the acoustic environment, as well as local attitudes to the source of the sound and the character of the neighbourhood."

- 8.3.17 BS 4142:2014 primarily provides a numerical method by which to determine the significance of sound of an industrial nature (i.e. the 'specific sound' from the proposed development) at residential NVSRs. The specific sound level may then be corrected for the character of the sound (e.g. perceptibility of tones and/or impulses), if appropriate, and it is then termed the 'rating level', whether or not a rating penalty is applied. The 'residual sound' is defined as the ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.
- 8.3.18 The specific sound levels have been determined separately in terms of the $L_{Aeq,T}$ index over a period of $T = 1$ -hour during the daytime and $T = 15$ -minutes during the night-time. For the purposes of the Standard, daytime is typically considered to be the period between 07:00 and 23:00 hours and night-time is typically between 23:00 and 07:00 hours. It is also common practice to separate the daytime period into two periods comprising day 07:00 to 19:00 hours and the evening from 19:00 to 23:00 hours, as described in ISO 1996-2:2015 (ISO, 1966). This approach has been adopted for this assessment.
- 8.3.19 The majority of the plant on site would operate continuously over 24 hours/7 days. However, deliveries and exports would only take place during the standard working hours of 07:00 to 18:00 Monday to Saturday, and waste sorting activities would normally also only take place within these hours. For the purposes of this assessment in accordance with BS 4142:2014, it has been assumed that full site operations including HGVs and other external mobile plant would take place during the daytime assessment period, i.e. between 07:00 and 19:00 hrs, and that all operations excluding HGV movements and other external mobile plant would be fully operational during the evening and night-time assessment periods, i.e. between 19:00 and 07:00 hours.

- 8.3.20 Specific sound immissions from the site have been predicted at the NVSRs defined in the study area using SoundPLAN Version 7.2 sound modelling software utilising the propagation method contained in ISO 9613-2:1996 (ISO, 1996). Indicative source data for the plant have been supplied by the technology providers for the site and from measurements undertaken by RPS of similar operations on other sites. Specifications for the sound insulation of the facades of the turbine hall have been provided by one of the potential technology suppliers for the site. All other buildings have been modelled as clad using a standard Kingspan panel. Details of the source data used for the assessment are provided in Appendix 8.1 and a plan indicating the location of the plant is provided in Figure 8.2.
- 8.3.21 For the sound model, standard meteorological conditions have been used with a ground factor of 0 (hard ground) for the site and other industrial premises, and 1 (soft ground) for agricultural land. For each group of NVSRs, a single location has been modelled, which is representative of the closest NVSRs to the site within that group. Predictions have been made at ground floor level for the daytime and evening periods (07:00 to 23:00 hrs) and first floor level for the night-time period (23:00 to 07:00 hrs).
- 8.3.22 At each NVSR, the rating level has been determined from the predicted specific sound level. Where RPS has considered it to be appropriate, a rating penalty has been applied for tonality, impulsivity and/or intermittency of sound as described in the commentary to paragraph 9.2 of BS 4142:2014. This has been applied with consideration of the main sound sources from site that contribute to the level of specific sound at the NVSR location, i.e. in accordance with BS 4142:2014, the character of the sound is only of concern and hence requires consideration at the NVSRs, not at source.
- 8.3.23 Background sound levels have been determined for the daytime, 07:00 to 19:00 hours; evening, 19:00 hours to 23:00 hours and night-time, 23:00 to 07:00 hours periods. BS 4142:2014 requires that the background sound levels adopted for the assessment be representative for the period being assessed. The Standard recommends that the background sound level should be derived from continuous measurements of normally not less than 15-minute intervals, which can be contiguous or disaggregated. However, the Standard states that there is no 'single' background sound level that can be derived from such measurements. It is particularly difficult to determine what is 'representative' of the night-time period is because it can be subject to a wide variation in background sound level between the shoulder night periods. The accompanying note to paragraph 8.1.4 states that:
- "A representative level ought to account for the range of background sounds levels and ought not automatically to be assumed to be either the minimum or modal value."*
- 8.3.24 The approach that has been adopted for this project has been to determine the background sound levels for each full daytime, evening and night-time and provide a linear average of the levels calculated for each period. Further information regarding the determination of background sound levels is provided within Section 8.4 'Baseline Conditions'.
- 8.3.25 An initial estimate of the impact of the specific sound has been obtained by subtracting the measured background sound level from the rating level of the specific sound. In the context of the Standard, adverse impacts include, but are not limited to, annoyance and sleep disturbance. Typically, the greater this difference, the greater is the magnitude of the impact defined in the Standard as follows:
- A difference of around +10 dB or more is likely to be an indication of a material 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 it is that the specific sound source will have an adverse impact or a material 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 the context.

- 8.3.26 Whilst there is a relationship between the level of impacts determined by the method contained within BS 4142:2014 and the impacts described in the NPPG, there is not a direct link. It is not appropriate to ascribe numerical rating / background level differences to LOAEL and SOAEL because this fails to consider the context of the sound, which is a key requirement of the Standard.
- 8.3.27 The magnitude of impact of the noise in question (i.e. whether above or below SOAEL and LOAEL) has been determined on the basis of the initial estimate from the BS 4142:2014 assessment with reference to the examples of outcomes described within the NPPG and after having considered the context of the sound. It is necessary to consider all pertinent factors, including:
- The absolute level of the sound;
 - The character and level of the residual sound compared to the character and level of the specific sound; and
 - The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.
- 8.3.28 In addition to the above, the number of affected NVSRs is considered within the overall significance of effects due to the proposed development.

Off-Site Road Traffic Noise

- 8.3.29 The assessment of changes in road traffic noise levels on local roads as a result of the operation of the proposed development has been based on the methods contained within Calculation of Road Traffic Noise (CRTN) and the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7: Noise and Vibration, which is a method designed for the assessment of new construction, improvements and maintenance of trunk roads. Therefore, the method described in DMRB is considered as informative but not definitive for the assessment of the traffic effects of the proposed development.
- 8.3.30 The calculations are based on traffic flow data contained with Chapter 6: Traffic and Transport, and consider the difference in flows, comparing 'with' and 'without' the proposed development. Both scenarios 'with' and 'without' the proposals include measured 2013 baseline traffic flows and anticipated traffic growth to 2018. In order to assess cumulative effects, a comparison has also been made between the scenario 'with and without other committed developments for the following links:
- Link 1 - Langhurstwood Road – Between Mercer Road and A264;
 - Link 2 - Langhurstwood Road – Between Site Access and Mercer Road;
 - Link 3 – A264 East; and
 - Link 4 – A264 West.
- 8.3.31 Paragraph 3.5 of DMRB HD 213/11 states that:

"The threshold criteria used for traffic noise assessment during the day is a permanent change in magnitude of 1 dB $L_{A10,18h}$ in the short term (i.e. on opening) or a 3 dB $L_{A10,18h}$ change in the long term (typically 15 years after project opening). For night time noise impacts, the threshold criterion of a 3 dB $L_{night,outside}$ noise change in the long term should also apply but only where the $L_{night,outside}$ is predicted to be greater than 55 dB for any scenario."

- 8.3.32 Furthermore, (paragraph 3.37):

"A change in road traffic noise of 1 dB $L_{A10,18h}$ in the short term (e.g. when a project is opened) is the smallest that is considered perceptible. In the long term (typically 15 years after project opening), a 3 dB $L_{A10,18h}$ change is considered perceptible."

- 8.3.33 On the basis of the above, changes in road traffic sound emissions will only have the potential to cause or contribute to some harmful or otherwise unwanted effect, like annoyance or sleep disturbance, (i.e. for the change to be an impact) if they are 1 dB $L_{A10,18h}$ or more. Changes in road traffic sound emissions that are less than 1 dB $L_{A10,18h}$ do not give rise to an impact. Consequently, no adverse effect, significant or otherwise, can occur from such changes.
- 8.3.34 The magnitude of impact is also dependent upon the absolute level of the sound. If the levels are low such they do not have the potential to cause or contribute to some harmful or otherwise unwanted effect, like annoyance or sleep disturbance, then the impact would be low regardless of the increase in level. Consequently, where an impact is predicted to occur, the absolute levels of road traffic sound immission are considered in terms of guidance contained within BS 8233:2014, Noise Insulation Regulations and DMRB HD 213/11.
- 8.3.35 BS 8233:2014 provides guideline values for desirable internal ambient noise levels in rooms used for resting, dining and sleeping when they are unoccupied. Impacts are increasingly likely to give rise to adverse effects the greater the road traffic noise immission exceeds the guideline levels contained within BS 8233:2014.
- 8.3.36 On this basis, the guideline internal noise levels contained within BS 8233:2014 have been converted to equivalent external noise levels on the basis that windows are sufficiently open (partially) to provide background ventilation. An external to internal sound level difference of 15 dB has been adopted based on the guidance contained within the report 'Open/Closed Window Research – Sound Insulation through Ventilated Domestic Open Windows' (Building Performance Centre, 2007). The Noise Insulation Regulations provide $L_{A10,18h}$ levels above which insulation would be offered, assuming other factors are satisfied. The magnitude of impact is increased if the road traffic noise immission exceeds the threshold levels contained within Noise Insulation Regulations.
- 8.3.37 The methodology described above has been summarised in Table 8.4 below. However, the table has not been used prescriptively; the ultimate determination has been based on professional judgment with consideration for the context of the site and NVSRs being assessed albeit informed by quantitative assessment.

Table 8.4: Magnitude of Impact for Road Traffic Noise

Magnitude of Impact	Absolute Level of Traffic Noise (baseline + proposed) $L_{A10,18hr}$ dB	Change in Traffic Noise Level $L_{A10,18hr}$ dB
High	≥ 68	≥ 5.0
	≥ 52	≥ 10.0
Medium	≥ 68	3.0 to 4.9
	$\geq 52 \text{ \& } < 68$	5.0 to 9.9
	< 52	≥ 10.0
Low	≥ 68	1.0 to 2.9
	$\geq 52 \text{ \& } < 68$	3.0 to 4.9
	< 52	5.0 to 9.9
Negligible	$\geq 52 \text{ \& } < 68$	1.0 to 2.9
	< 52	1.0 to 4.9
	Any	0.1 to 0.9
No Change	Any	< 0.1

Assignment of Significance

- 8.3.38 The assessment of significance for each aspect of the development has been determined from the NVSR sensitivity and magnitude of impact based on the following matrix.

Table 8.5: Assessment Matrix for the Determination of the Significance of Effect

Sensitivity of Receptor	Magnitude of Impact				
	No Change	Negligible	Low	Medium	High
Negligible	None	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	None	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	None	Negligible or Minor	Minor	Moderate	Moderate or Major
High	None	Minor	Minor or Moderate	Moderate or Major	Major or Substantial
Very high	None	Minor	Moderate or Major	Major or Substantial	Substantial

8.3.39 Where the matrix offers more than one significance option, professional judgement has been used to decide which option is most appropriate.

8.3.40 The broad definitions of the terms above are as follows:

- **Substantial:** These effects represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
- **Major:** These effects are considered to be very important considerations and are likely to be material in the decision-making process.
- **Moderate:** These effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse effect on a particular resource or receptor.
- **Minor:** These effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.
- **Negligible:** No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

8.3.41 In general, only effects that are moderate and above are considered to be significant in terms of the EIA Regulations in this assessment.

8.4 Limitations of the Assessment

8.4.1 In all assessments, it is good practice to consider uncertainty, which can arise from a number of different aspects of an assessment. There is a degree of uncertainty associated with: the instrumentation itself; the use of instrumentation, i.e. the measurements; the source terms used; the sound propagation model; and the subjective response of residents to the sound sources.

8.4.2 With regard to subjective response, the acoustics standards and guidance adopted for the assessments within this chapter are based on the subjective response of the majority of the population. This is considered to be the best that can be achieved in a population of varying subjective responses, which are dependent upon a wide range of factors.

- 8.4.3 On the basis of the above, whilst the magnitude of uncertainty has not been quantitatively defined, measures have been taken to minimise this aspect in accordance with best practice.

Baseline Characterisation

- 8.4.4 Uncertainty due to instrumentation error has been significantly reduced with the introduction of modern instrumentation and is reduced further by ensuring that all instrumentation is calibrated before and after each measurement period and is within accepted calibration intervals.
- 8.4.5 Uncertainty in the baseline data has been reduced significantly by carrying out baseline sound monitoring over a period of seven days in some locations, allowing analysis of how representative the baseline data are given the naturally varying sound level at NVSRs within the vicinity of the site.

Operation of the Proposed Facility

- 8.4.6 Operational sound emissions have been determined from sound power data provided by the technology providers and from data within the RPS Source Term Library of similar plant and facilities. Therefore, these data are estimates of realistically achievable sound levels although the final plant servicing the facility may vary from that which has been modelled. However, any plant included in the facility would need to comply with the Environmental Permitting Regulations (EPR), and therefore demonstrate that the techniques used represent Best Available Techniques (BAT), which would include minimising noise immissions at NVSRs, among other requirements.
- 8.4.7 Sound immissions at NVSRs have been calculated using the prediction methodology in ISO 9613-2:1996 (ISO, 1996). For source heights up to 30 metres and prediction distances between 100 and 1000 metres, ISO 9613-2:1996 claims accuracy of +/-3 dB. ISO 9613-2 is widely used for the prediction of industrial noise and is recommended in paragraph 1.5.3.2 of the Horizontal Guidance - H3 Part 2 Noise Assessment and Control (Environment Agency *et al*, 2004) and referred to in BS 4142:2014 (BSI, 2014c).
- 8.4.8 On the basis of the above, it is considered that limitations to the assessment have been minimised and that the results provide a robust estimate of the likely noise effects of the development.

Road Traffic Noise Assessment

- 8.4.9 The assessment of noise from road traffic is limited to the traffic data provided. Further details of the assumptions used in deriving the traffic data are provided in Chapter 6: Traffic and Transport.
- 8.4.10 The CRTN prediction method is based on free-flowing traffic on main roads and typical noise levels from cars and HGVs. Vehicles have changed since the time that the guidance was drafted and typically it is expected that HGVs in particular will be quieter. Therefore, the predictions of absolute noise levels produced by road traffic are potentially higher than road traffic noise levels will be in practice. Predictions of changes in noise levels are likely to be robust.

8.5 Baseline Conditions

Existing Baseline Conditions

- 8.5.1 The results of the baseline sound level surveys are presented in Table 8.6 below. The ambient and background noise levels are given for each monitoring location during the daytime, evening and night-time periods. Further details are provided in Appendix 8.2.

Table 8.6: Baseline Sound Level Survey Results

Period	Parameter	11 Station Road	Cox Farm	Langhurst Moat Cottage
Daytime (07:00 - 19:00)	Baseline ambient noise level, dB L _{Aeq}	49	47	44
	Background noise level, dB L _{A90}	43	40	43
Evening (19:00 - 23:00)	Baseline ambient noise level, dB L _{Aeq}	50	45	43
	Background noise level, dB L _{A90}	42	39	42
Night-time (23:00-07:00)	Baseline ambient noise level, dB L _{Aeq}	55	49	48
	Background noise level, dB L _{A90}	36	34	35

Future Baseline Conditions

- 8.5.2 Since the time of the previous application for the proposed development, the Land North of Horsham development has been subject to a resolution to grant outline planning consent for residential development. This development has the potential to increase the level of noise from road traffic at receptors that are in close proximity to Langhurst Wood Road, including Langhurst Moat Cottage and Grayland's Lodge, in addition to properties within the Land North of Horsham development itself. As the scheme is residential, these increases are mainly expected to occur during the daytime i.e. between 07:00 and 23:00 hrs.
- 8.5.3 The assessment of noise from the site is primarily based on the background sound levels L_{A90,T} dB, which are the baseline levels that are exceeded for 90% of the relevant period, in accordance with the BS 4142:2014 methodology. Reference is also made to the residual sound levels, which are based on the average energy within the baseline sound. It is unlikely that any increase to the baseline traffic would cause a notable increase in the background sound levels, particularly at night, which is the most sensitive period. Although residual sound levels may increase as a result of the Land North of Horsham development, this again is unlikely to affect night-time levels. Therefore, future baseline conditions are not likely to significantly alter the sound climate during the most sensitive period. If there is any change, the noise levels would likely increase and, therefore, the assessment based on existing sound levels has been considered as a worst-case.
- 8.5.4 In order to ensure that effects from the 3Rs Facility on the future residents of the land North of Horsham scheme are considered, these future residential properties have been included as sensitive receptors within this assessment.
- 8.5.5 Cumulative noise effects due to road going traffic have been considered with the Land North of Horsham development within Section 8.10 on Cumulative Effects.

8.6 Incorporated Enhancement and Mitigation

- 8.6.1 The mitigation measures proposed as part of the 3Rs Facility design in relation to noise and vibration include the following.

Construction Phase

- 8.6.2 Construction works would follow Best Practicable Means (BPM) outlined in Section 72 of the Control of Pollution Act 1974 (as amended) to minimise noise and vibration effects. Such details will be required by the Construction Environmental Management Plan (CEMP) to be submitted to and agreed in writing with West Sussex County Council prior to commencement of construction activities and following the appointment of a

contractor. The following mitigation measures for noise and vibration will be provided within the CEMP. These are based upon the guidance contained in BS 5228:2009 (BSI, 2014a, 2014b):

- **Communication:** The existing Local Liaison Committee arrangements or the site would be continued for the new development, and occupiers of residential and business properties that are likely to be affected by the works would be notified in advance of the works. A named individual would be appointed to take primary responsibility for the day-to-day implementation of the CEMP during the construction phase and to act as the first point of contact on environmental matters for with West Sussex County Council, other external bodies and the general public. Information regarding the nature and duration of the works, and named contact details for key members of staff would be displayed on a noticeboard near to the site.
- **Standard construction hours:** Core working hours would be 07:30 to 19:00 hours Monday to Friday, 08:00 to 16:00 hours on Saturday and at no time on Sundays or on public or bank holidays, with some non-intrusive and internal activities such as fit out and commissioning to be undertaken outside these hours. In the event that noise generating works are required outside of core working hours, this would be agreed with West Sussex County Council prior to commencement of the activity. In such instances the contractor would apply to with West Sussex County Council for written consent prior to work commencing by submitting either a Section 61 consent application or an agreed method statement in line with the Control of Pollution Act.
- **Access routes:** The sole access point to the site would be from the A264 and then directly north on Langhurstwood Road. Construction traffic routes on the public highway would be controlled through a Construction Traffic Management Plan.
- **Equipment:** Quieter alternative methods, plant and equipment would be used, where reasonably practicable, as required by the CEMP.
- **Worksite:** Plant, equipment, site offices, storage areas and worksites would be positioned away from existing NVSRs, where reasonably practicable.
- **Screening:** Portable acoustic enclosures/screens would be used, as required.
- **Maintenance:** All vehicles, plant and equipment would be maintained and operated in an appropriate manner, to ensure that extraneous noise from mechanical vibration, creaking and squeaking is kept to a minimum.

Operational Phase

- 8.6.3 In order to comply with Environmental Permitting Regulations (EPR), the plant would be designed to present Best Available Techniques (BAT), which will include limiting noise generation by the plant where practicable. Of the plant within the facility, the air cooled condensers are likely to result in the most significant effects at NVSRs as they are located externally and require 24/7 operation. The air cooled condensers would be selected such that they would not exceed a sound power level of 97 dB(A), which is the lowest practical level identified by the technology suppliers for the plant. Furthermore, acoustic screening would be installed around the perimeter of the air cooled condensers. Other significant items of plant would be located within buildings or enclosures which would be designed to reduce noise levels, as required. Specifically, the turbine hall, which contains the highest noise generating plant would be designed with a high specification façade and roof to reduce the noise levels emitted from these buildings. Furthermore, the plant would be designed such that it would not be tonal in character at the nearest NVSRs.
- 8.6.4 The proposed development would not result in any increase in vehicles coming to the site above those already permitted. There would, therefore, be no requirement for any additional waste related HGV movements to transport waste to the site over and above the sites extant consent. HGVs would follow the approved access routes to and from site.

8.7 Assessment of Construction Effects

On-Site Construction Works

- 8.7.1 Noise emissions are likely to be highest at the early stages of works i.e. during site preparation and civils works, and would decrease during the plant erection and fit-out stages. Noise emissions during the fit-out as buildings are completed would be very low, as work would be undertaken mostly with hand-tools within the completed structures.
- 8.7.2 For the majority of the construction period, plant on-site would comprise various diesel mechanised construction plant including excavators (with various tool attachments depending upon the task being undertaken), dump trucks, fork-lift trucks, concrete wagons and pumps, mobile cranes and delivery lorries.
- 8.7.3 It is anticipated that the most noise generating activity on site would be piling of foundations. Building foundation loadings are only likely to be high for the main building. Therefore, the need for driven piling is expected to be limited and alternative methods would be employed where possible, i.e. bored.
- 8.7.4 As construction works are likely to be short to medium term, only existing NVSRs need to be considered within the construction assessment. As identified in Section 8.1 of this ES, there are two residential properties (Langford Moat Cottage and Wealden) on Langhurstwood Road approximately 210 metres south east of the site, and several residential properties on Langhurstwood Road, approximately 370 metres south east of the site; residential properties on Station Road, approximately 330 metres south of site; and Cox Farm, approximate 420 metres north-west of site. From the baseline surveys existing ambient sound levels in the area are around 48 to 55 dB $L_{Aeq,12hr}$ during the daytime between 07:00 and 19:00 hours when construction works would take place. On this basis noise from construction activities is likely to be noticeable and may exceed existing ambient sound levels at the closest NVSRs at times, but is unlikely to cause a perceived change in the quality of life.
- 8.7.5 Depending upon the method used, piling has the potential to cause vibration that would be noticeable on-site. However, the propagation of groundborne vibration is subject to significant losses due to the distances between the site and NVSRs and the varying densities of the subsurface geology. Therefore, vibration effects are unlikely to be noticeable at the closest NVSRs, which are more than 200 metres from the site construction activity.
- 8.7.6 In summary, it is unlikely that construction works would generate noise levels at NVSRs that are disturbing or that would affect activities commonly occurring in residential areas. Noise levels may be noticeable for limited and short durations when significant works such as piling are being undertaken during site establishment and foundation construction. Vibration is likely to be imperceptible at the closest NVSRs to the site. Construction activities would take place according to a predetermined schedule following the BPM measures stated within Section 8.6 above. There would be very little change to the evening, night-time and weekend baseline noise conditions as most construction activities would be outside of these more sensitive periods.
- 8.7.7 With reference to Table 8.3, the magnitude of noise impacts would be low and the sensitivity of the receptors is medium. Therefore, there is likely to be a direct, temporary, medium term noise effect on NVSRs of minor adverse significance prior to the implementation of mitigation measures. There would be no change due to vibration and the significance of effects in terms of vibration would therefore be negligible. With reference to the NPPG, construction noise effects are likely to be above the LOAEL but below the SOAEL and vibration effects would be below the NOEL.

Construction Traffic

- 8.7.8 The magnitude of impacts during the daytime is determined from the absolute traffic noise levels and predicted change in road traffic noise levels at NVSRs comparing the flows for the year 2018 'with' and 'without' construction traffic for the development using the methodology described in Section 8.3 of this

chapter. The predicted road traffic noise levels and magnitude of impacts are summarised in Table 8.7 below. Full traffic calculations are provided in Appendix 8.3.

Table 8.7: Magnitude of Road Traffic Noise Impacts in the Construction Phase

NVSR	Road Traffic Noise Level L _{A10,18h} (dB)		Change in Road Traffic Noise Level L _{A10,18h} (dB)	Magnitude of Impact
	Baseline 2018	2018 With Development		
Link 1: Langhurstwood Rd between A264 and Mercer Rd	66.2	66.5	0.3	Negligible
Link 2: Langhurstwood Rd between Site Access and Mercer Rd	65.2	65.6	0.3	Negligible
Link 3: A264 East	79.4	79.4	0.0	Negligible
Link 4: A264 West	79.4	79.4	0.0	Negligible

8.7.9 From Table 8.7, the magnitude of impact from construction traffic noise would be negligible. The sensitivity of the receptors is medium. Therefore, the significance of effects from construction traffic noise is negligible.

8.8 Assessment of Operational Effects

Operation of the Proposed Facility

- 8.8.1 The predicted specific sound levels from the facility and the results of the BS 4142:2014 assessment are provided in Table 8.8. Noise contour plots for the daytime, evening and night-time periods are provided in Figures 8.4, 8.5 and 8.6. The change in the ambient sound levels at NVSRs has also been determined by adding the level of residual and specific sound levels.
- 8.8.2 BS 4142:2014 states that acoustic features including tonality, impulsivity, intermittency and features that are otherwise readily distinctive can increase the level of impact over that expected from a basic comparison between the specific sound level and the background sound level. For planning purposes, a subjective assessment of the prominence of the character of a specific sound at the noise sensitive locations should be applied based on the expected characteristics of a similar source.
- 8.8.3 In the experience of RPS, noise emissions from modern well designed plant used in industrial facilities are generally broadband and not dissimilar in character to the sound from a domestic central heating system. Therefore, noise emissions from the proposed facility would generally not be tonal or impulsive by design. It is widely acknowledged that tonal and/or impulsive acoustic features can increase the likelihood of complaint. It is considered commensurate with BAT that these features would therefore be controlled. Although there are some exceptions to this, where processes are difficult to control and may, at times, produce sound that contains impulsive or other specific features, the predictions indicate that the main sound sources are the air cooled condensers; and emissions from the buildings; both of which are unlikely to contain discrete tones or impulsive noise. Therefore, on the basis of the subjective analysis above no character correction has been applied to derive the rating level at any of the NVSRs considered within this assessment. Notwithstanding the consideration that no character corrections are necessary, this aspect can be controlled by condition based upon the acceptable rating level from the facility.

Table 8.8: BS 4142 and Noise Change Assessment of Noise Immissions from the Operation of the Proposed Facility

Location	Background Sound level, dB L _{A90}	Residual Sound Level dB L _{Aeq,T}	Specific Sound Level, dB L _{Aeq,T}	Rating Level, dB L _{Ar,Tr}	Rating Level minus Background Sound Level	Total Ambient Sound Level (Specific plus Residual) dB L _{Aeq,T}	Change in Ambient Sound Level dB
<i>Day (07:00 to 19:00)</i>							
11 Station Road	43	49	37	37	-6	49	+0
Cox Farm	40	50	32	32	-8	50	+0
Graylands Lodge	43	55	38	38	-5	55	+0
Haybam Cottage	43	55	39	39	-5	55	+0
Langhurst Moat Cottage	43	55	45	45	+2	56 ¹	+0
North Horsham Scheme	43	55	36	36	-7	55	+0
<i>Evening (19:00 to 23:00)</i>							
11 Station Road	42	47	35	35	-8	47	+0
Cox Farm	39	45	31	31	-7	46 ¹	+0
Graylands Lodge	42	49	38	38	-4	49	+0
Haybam Cottage	42	49	34	34	-8	49	+0
Langhurst Moat Cottage	42	49	37	37	-5	49	+0
North Horsham Scheme	42	49	31	31	-11	49	+0
<i>Night (23:00 to 07:00)</i>							
11 Station Road	36	44	37	37	0	45	+1
Cox Farm	34	43	32	32	-2	43	+0
Graylands Lodge	35	48	39	39	+4	49 ¹	+0
Haybam Cottage	35	48	35	35	0	48	+0
Langhurst Moat Cottage	35	48	38	38	+3	49 ¹	+0
North Horsham Scheme	35	48	32	32	-3	48	+0
1) Noise change is less than 0.5 dB although rounded noise levels vary.							

8.8.4 From Table 8.8, during the daytime period, the difference between the rating and the background sound level would range between -8 dB and +2 dB, with the highest level difference occurring at Langhurst Moat Cottage. During the evening period, the difference between the rating and the background sound level ranges between -11 dB and -4 dB, with the highest level difference occurring at Graylands Lodge. During the night-time period, the difference between the rating and background sound level ranges between -3 dB and +4 dB, with the highest level difference occurring at Graylands Lodge. In the majority of locations for the

majority of the time, the rating level is predicted to be below the background sound level which is an indication of a low impact depending on the context. From BS 4142:2014, a difference of around 5 dB is likely to be an indication of an adverse impact, depending on the context. The rating level would only exceed the background sound level at Graylands Lodge (+ 4 dB), and Langhurst Moat Cottage (+3 dB) (i.e. a total of two residential receptors) during the night-time.

- 8.8.5 Section 8.3 of this chapter states the factors that BS 4142:2014 requires to be taken into consideration when assessing the context of the sound, including the absolute level of sound, including any potential for sleep disturbance, the character and level of the residual sound, and any mitigation that is incorporated into the NVSRs. The absolute levels of specific sound are predicted to be between 32 and 45 dB $L_{Aeq,T}$ during the daytime, 31 and 37 dB $L_{Aeq,T}$ during the evening and between 32 and 39 dB $L_{Aeq,T}$ during the night-time.
- 8.8.6 Table 4 of BS 8233:2014 (BSI, 2014d) contains guidance values for indoor ambient noise levels within dwellings for resting during the daytime and sleeping during the night-time. The guidance levels are 35 dB $L_{Aeq,16hr}$ for daytime (07:00 to 23:00 hrs) resting and 30 dB $L_{Aeq,8hr}$ for night-time (23:00 to 07:00 hrs) sleeping. BS 8233:2014 also recommends that '*for traditional areas that are used for amenity space, such as gardens and patios, it is desirable that the daytime external noise level does not exceed 50 dB $L_{Aeq,16hr}$ with an upper guideline value of 55 dB $L_{Aeq,1hr}$ which would be acceptable in noisier environments*'.
- 8.8.7 Based on the guidance contained within the Report NANR 116 (Building performance Centre, 2007), a standard residential partially open window will provide a sound attenuation of around 15 dB. Based on this guidance, the specific sound from the site, not accounting for other existing sources of sound, would be within the guidance of BS 8233:2014 for indoor ambient noise levels. The specific sound levels are also within the guidance levels for quiet enjoyment of gardens during the daytime and evening.
- 8.8.8 The specific sound levels are predicted to be at least 8 dB below existing residual levels during the daytime, evening and night-time periods at all locations. The noise change assessment indicates that there would be no increase to the ambient sound level at the majority of locations for the majority of times, with the only exception being and at 11 Station Road where it is estimated that there would be an increase in the ambient sound level of 1 dB during the night-time from 44 dB $L_{Aeq,8hr}$ to 45 dB $L_{Aeq,8hr}$, and, therefore, assuming a sound attenuation of 15 dB for a partially open window, the internal level would still just lie within the guideline level of 30 dB $L_{Aeq,8hr}$ within BS 8233:2014 for internal noise levels within bedrooms. Although the character of the sound may be different from that of road traffic, and therefore may be audible, it is likely to be a broadband sound that is neither tonal nor impulsive and therefore would not be a prominent noise source at any of the NVSR locations.
- 8.8.9 The above assessment indicates that, with the development, at the closest NVSRs, there would be a small change to baseline conditions during the daytime and night-time period and no or a negligible change during the evening period. In the event that noise from the site is audible, it is unlikely to cause any changes in behaviour or attitude or a perceived change in quality of life. Therefore, with respect to national planning guidance in the NPPF, NPSE and NPPG (Table 8.3), noise from operations on site would be at or below the LOAEL.
- 8.8.10 Therefore, with consideration for the context, the impact of noise from activities on site is expected to be low. The sensitivity of receptors is medium so there would be a direct, permanent minor adverse effect due to noise from the operation of the facility.

Off-Site Road Traffic Noise

- 8.8.11 The magnitude of impacts during the daytime is determined from the absolute traffic noise levels and predicted change in road traffic noise levels at NVSRs comparing the flows for the year 2018 'with' and 'without' the development using the methodology described in Section 8.3 of this chapter. The predicted road traffic noise levels and magnitude of impacts are summarised in Table 8.9 below. Full operational traffic calculations are provided in Appendix 8.4.

Table 8.9: Magnitude of Road Traffic Noise Impacts During the Operational Phase

NVSR	Road Traffic Sound Level, L _{A10,18h} (dB)		Road Traffic Sound Level, L _{A10,18h} (dB)	Magnitude of Impact
	2018Baseline	2018 with Development		
Link 1: Langhurstwood Rd between A264 and Mercer Rd	66.2	67.5	1.3	Negligible
Link 2: Langhurstwood Rd between Site Access and Mercer Rd	65.2	66.8	1.6	Negligible
Link 3: A264 East	79.4	79.5	0.1	Negligible
Link 4: A264 West	79.4	79.4	0.0	Negligible

8.8.12 From Table 8.9, the magnitude of impact from road traffic noise would be negligible. The sensitivity of the receptors is medium. Therefore, the significance of effects from road traffic noise would be negligible. It should also be noted that although an assessment of noise from operational traffic has been provided, the traffic numbers are within those agreed within the existing planning permission.

8.9 Assessment of Decommissioning Effects

8.9.1 The activities associated with the future decommissioning of the facility would be similar to those for construction. It is therefore unlikely that this activity would lead to any greater disruption, and it is possible that noise and vibration levels at NVSRs from decommissioning would be quieter than for the construction phase due to improvements in plant technology in future years.

8.10 Assessment of Cumulative Effects

8.10.1 A review of proposed projects that may have a cumulative impact with the 3Rs Facility has been undertaken and used to inform this Environmental Statement. The proposed developments considered identified are summarised in Appendix 4.4.

8.10.2 In relation to noise and vibration impacts, the following developments have been identified as having the potential to impact cumulatively with the proposed 3Rs Facility and have therefore been examined as part of the assessment:

- Brookhurst Wood landfill site (development of a materials recycling facility, anaerobic digestion plant and extension to existing landfill site);
- Land south of Brookhurst Wood landfill site (mechanical biological treatment);
- Land west of Brookhurst Wood landfill site (proposed facility for compaction and baling of Refuse Derived Fuel);
- Green's Accident Repair Centre, Horsham (parking and storage of vehicles, plant and equipment); and
- Land north of Horsham (proposed mixed use strategic development, including up to 2,750 dwellings, business park, retail, community centre, leisure facilities, education facilities and public open space).

Construction Phase

- 8.10.3 During the construction phase, significant cumulative effects are only likely to occur in the area where the developments have common NVSRs within close proximity (circa 300 metres) of both developments. Cumulative effects would then only be experienced if construction works on both developments were to take place simultaneously. The Land North of Horsham development is such a development. Effective implementation of relevant mitigation measures at both sites should ensure the risk of cumulative noise and vibration effects is minimal. Construction effects from the 3Rs Facility would be controlled through the CEMP. Therefore, cumulative impacts are anticipated to be negligible or low during the construction phase. The sensitivity of residential NVSRs is medium. Therefore, there is likely to be a direct, temporary, medium-term noise effect on NVSRs of negligible or minor adverse significance during the construction phase.

Operational Phase

Operation of the Proposed Facility

- 8.10.4 The Brookhurst Wood Landfill Site and Green's Accident Repair Centre both include industrial processes and therefore have potential to result in cumulative noise effects at existing NVSRs. There are several applications for the Brookhurst Wood Landfill site some of which relate to activities that are currently being carried out on the site. The only notable change with respect to noise is the construction of a new Refuse Derived Fuel (RDF) facility. As these sites are currently operational, it can be assumed that any noise from these sites would contribute to existing baseline ambient sound levels, although the contribution from each site at each NVSR location and has therefore been considered within the primary assessment.
- 8.10.5 It is also noted that for the Brookhurst RDF facility and Green's Accident Repair Centre noise assessments were not submitted as part of the respective planning applications, which is an indication that significant noise effects were not anticipated from these sites.
- 8.10.6 The operational noise assessment indicated that adverse noise effects are only likely to occur from the proposed development during the night-time period at NVSRs to the north east and south east of the site on Langhurstwood Road. Therefore the contribution of the proposed 3Rs Facility to any cumulative noise effects during the daytime would be negligible. Green's Accident Repair Centre is unlikely to operate during the night-time period, and night-time works at the Brookhurst RDF Plant are likely to be minimal. It is therefore anticipated that any cumulative noise effects would be of no greater significance than predicted operational noise effects. Therefore, the cumulative noise impacted is expected to be negligible or low. The sensitivity of receptors is medium so there would be a direct, permanent negligible to minor adverse effect due to cumulative noise from the site and other NVSRs.

Road Traffic Noise

- 8.10.7 The Brookhurst Wood Landfill Site and MBT facility and Green's Accident Repair Centre are currently operational. The Brookhurst RDF plant is likely to contribute a very minor increase in the overall quantity of vehicles accessing the sites. Therefore, the only site that has potential to produce cumulative traffic noise effects is the Land North of Horsham development.
- 8.10.8 Traffic data were provided for the baseline scenario and with development scenario in 2031 for the Land North of Horsham development. Therefore, the 2031 traffic has been used as a baseline for the cumulative traffic noise assessment. Of the links assessed in the Land North of Horsham ES, the only common road links at which cumulative noise effects with the development may occur are:
- Link 1 - Langhurstwood Road – Between Mercer Road and A264
 - Link 2 - Langhurstwood Road – Between Site Access and Mercer Road
- 8.10.9 A cumulative road traffic noise assessment has been carried out for the above road links following the same methodology as used for the operational traffic noise assessment. The magnitude of the road traffic noise impacts is provided in Table 8.10. Full cumulative traffic calculations are provided in Appendix 8.5.

Table 8.10: Magnitude of Cumulative Road Traffic Noise Impacts

NVSR	Road Traffic Sound Level, LA10,18h (dB)		Change in Road Traffic Sound Level LA10,18h (dB)	Magnitude of Impact
	2031 Baseline	2031 with Development + Cumulative Development		
Link 1: Langhurstwood Rd between A264 and Mercer Rd	67.4	69.3	1.9	Low
Link 2: Langhurstwood Rd between Site Access and Mercer Rd	67.4	68.4	1.0	Negligible

8.10.10 From Table 8.10, the magnitude of impact from road traffic noise is predicted to be low. The sensitivity of the receptors is medium. Therefore, there would be a direct, permanent cumulative noise effect of minor adverse significance.

8.11 Inter-relationships

8.11.1 Inter-relationships with road traffic have been considered as part of this assessment. Traffic effects are considered in more detail in Chapter 6 of this ES. There are no other inter-relationships with noise and vibration from other aspects that are likely to occur.

8.12 Further Mitigation Measures

Construction Phase

8.12.1 Reasonable mitigation for noise and vibration from construction activities has been provided by applying BPM as outlined within Section 8.6 of this chapter 'Incorporated Mitigation and Enhancement'. With this mitigation in place, construction noise and vibration effects are expected to be minor adverse at worst, and of a temporary nature. On this basis, it is not expected that there will be a need for further mitigation measures to be employed.

Operational Phase

8.12.2 Reasonable mitigation for noise from the operation of the facility has been provided as outlined within Section 8.6 of this chapter 'Incorporated Mitigation and Enhancement'. With this mitigation in place, noise effects from the operation of the facility are expected to be minor adverse at worst. However, as there is potential for change to the final selection of plant, the following condition is proposed to control operational noise immissions:

"The plant will be designed such that the rating level $L_{Ar,Tr}$ of the noise emitted from it shall not exceed the existing representative background sound levels $L_{A90,T}$ (as provided in the Environmental Statement), by more than 3 dB during the appropriate time period at the nearest noise sensitive receptors. The assessment shall be carried out in accordance with BS4142:2014 'Methods for rating and assessing industrial and commercial sound'. Noise monitoring will be carried out post completion to ensure that the operational plant complies with the design requirement presented in this condition. The monitoring procedure will be discussed and agreed with the case officer at WSCC (and/or their consultee on noise) in advance."

8.12.3 Compliance with the above condition will be included in the plant specification.

8.13 Monitoring and Management Strategies

Construction

- 8.13.1 A CEMP would be in place to ensure that environmental effects, including noise and vibration from the site, are adequately controlled. This will include any requirements for monitoring and management. The CEMP will be agreed in writing with West Sussex County Council prior to the commencement of construction works.

Operation

- 8.13.2 Noise monitoring would be carried out to demonstrate compliance as identified in the planning condition proposed above. It is also noted that that monitoring would be required as part of the Environmental Permit which would set out details of the type of monitoring and the frequency of data collection and reporting. Any monitoring requirements for planning are likely to be similar to those for permitting, so it may be possible to co-ordinate these.

8.14 Residual Effects

- 8.14.1 Table 8.11 summarises the significance of effects for the construction and the operational phase for the project taking into account the mitigation measures incorporated into the development proposals.

Table 8.11: Summary of Likely Environmental Effects on Noise and Vibration

Parameter (e.g. Receptor No 1)	Sensitivity of receptor	Likely impact	Duration	Magnitude of impact	Significance of effect	Mitigation	Magnitude of Residual Impact	Significance of Residual Effect	Significant
Construction Phase									
Residential NVSRs on Langhurstwood Road, Station Road and Cox Farm	Medium	Noise from construction works	Short to medium term	Low	Minor Adverse	Noise Measures to be included in the CEMP ref Section 8.6	Low	Minor adverse	Not significant
Residential NVSRs on Langhurstwood Road, Station Road and Cox Farm	Medium	Vibration from construction works	Short to medium term	Negligible	Negligible	No mitigation required	Negligible	Negligible	Not significant
Residential NVSRs on Langhurstwood Road	Medium	Noise from construction traffic	Short to medium term	Negligible	Negligible	No mitigation required	Negligible	Negligible	Not significant
Operational Phase									
Residential NVSRs on Langhurstwood Road, Station Road and Cox Farm	Medium	Noise from operational plant on site	Long term	Low	Minor Adverse	Site will need to comply Best Available Techniques as part of the Environmental Permitting Regulations.	Low	Minor adverse	Not significant
Residential NVSRs on Langhurstwood Road	Medium	Noise from operational traffic	Long term	Negligible	Negligible	No mitigation required	Negligible	Negligible	Not significant

8.15 Summary and Conclusions

- 8.15.1 A detailed noise and vibration assessment considering the potential effects of emissions generated during the construction and operation of the facility has been undertaken.
- 8.15.2 Mitigation for noise and vibration from construction activities would be provided within the Construction Environmental Management Plan (CEMP) for the site based upon the guidance in 5228:2009 (BSI, 2014a, 2014b). Construction works would follow Best Practicable Means (BPM) outlined in Section 72 of the Control of Pollution Act 1974 (as amended) to minimise noise and vibration effects.
- 8.15.3 A qualitative assessment of construction noise and vibration effects has been carried out with reference to National Planning Practice Guidance for noise (NPPG). The assessment indicates that, with suitable mitigation measures, there is likely to be a direct, temporary, medium term noise effect on noise sensitive receptors (NVSRs) of minor adverse significance. Vibration impacts would be negligible and the significance of effects would therefore be negligible. With reference to the NPPG, construction noise effects might be above the Lowest Observed Adverse Effect Level (LOAEL) but would be below the Significant Observed Adverse Effect Level (SOAEL) and vibration effects would be below the No Observed Effect Level (NOEL).
- 8.15.4 The effects of change in noise levels due to road traffic on the local road network during the construction period have also been considered with reference to the guidance in the DMRB. The assessment indicates that the significance of effects due to operational road traffic noise would be negligible.
- 8.15.5 In order to comply with the Environmental Permitting Regulations, the development would incorporate Best Available Techniques to minimise noise emissions. The air cooled condensers would be selected such that they would not exceed a sound power level of 90 dB(A) as identified within this assessment. HGVs would follow the approved access routes to and from site. Other external plant would be located within buildings or enclosures which would be designed to reduce noise levels, if required.
- 8.15.6 An assessment of the operational noise effects, with the above measures in place has been carried out in accordance with the NPPG and BS 4142:2014. The assessment indicates that at the majority of locations the rating level would not exceed the background sound level, though the background sound level would be exceeded by up to 6 dB during the night-time period at three locations. With consideration for the context, it is possible that noise from site activities would be noticeable on occasions at the closest NVSRs to the site but it would not cause any changes in behaviour or attitude or a perceived change in quality of life. Therefore, with respect to national planning guidance in the NPPG, the level of noise would be at or below the LOAEL. The impact of noise from activities on site is expected to be low. The sensitivity of receptors is medium so there would be a direct, minor adverse effect due to noise from the operation of the facility.
- 8.15.7 The effects of change in noise levels due to road traffic on the local road network during the operational phase have also been considered with reference to the guidance in the DMRB. The assessment indicates that the significance of effects due to operational road traffic noise would be negligible. The traffic numbers associated with the development are also within those agreed within the existing planning permission.
- 8.15.8 Cumulative operational noise effects with other consented developments that have the potential to generate cumulative operational noise effects at receptors within the vicinity of the site have been considered. Although there is potential for cumulative effects to occur, these are likely to be negligible to minor. On this basis, the significance of cumulative effects would be, in the worst case, of minor adverse significance.
- 8.15.9 Cumulative effects of change in noise levels due to road traffic on the local road network have also been considered with reference to the guidance on noise contained in the DMRB. The assessment indicates that the cumulative impact due to operational road traffic noise from this development and other developments would be minor adverse, and the significance of effects would also therefore be minor adverse.

- 8.15.10 In conclusion, there is the potential for effects of up to minor adverse significance to occur due to noise during the construction of the development and during the operation of the development, and cumulatively with road traffic from other developments. Construction noise would be controlled using best practicable means and operational noise would be controlled using best available technology. The effects due to construction vibration are predicted to be negligible. None of the identified effects would be significant.

8.16 References

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British Standards Institution (2014c) British Standard 4142:2014. Methods for rating and assessing industrial and commercial sound.

British Standards Institution (2014d) British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings.

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