7 Noise & Vibration

7.1 Purpose of this Chapter

7.1.1 This chapter assesses the likely significant noise and vibration effects resulting from the Proposed Development.

7.1.2 The potential noise impacts considered in association with the project include the following:

During construction / decommissioning:

- Noise generated by construction plant located at the Site;
- Vibration generated by construction plant, located at the Site; and
- Noise arising from off-site traffic generated by the project during construction, operation, maintenance and decommissioning;

During operation:

- Noise arising from off-site traffic generated by the project during operation;
- Noise arising from operations at the Site, including noise from fixed and mobile plant and from HGV movements around the Site; and
- Vibration generated by operational plant at the Site.

7.2 Regulatory and Policy Framework

Planning Policies and Guidance

Overarching National Policy Statement for Energy (EN-1), Section 5.11:

7.2.1 The overarching National Policy Statement (NPS) for Energy (EN-1) [Ref 7.1] is part of a suite of NPSs issued by the Secretary of State for Energy and Climate Change. It sets out the Government's policy for delivery of major energy infrastructure.

7.2.2 EN-1 refers to noise and vibration assessment; para 5.11.1 explains that the Government's policy on noise is set out in the Noise Policy Statement for England (NPSE). With regard to an 'Applicant's Assessment', paragraph 5.11.4 states that:

"Where noise impacts are likely to arise from the proposed development, the applicant should include the following in the noise assessment:

- *a description of the noise generating aspects of the development proposal leading to noise impacts, including the identification of any distinctive tonal, impulsive or low frequency characteristics of the noise;*
- *identification of noise sensitive premises and noise sensitive areas that may be affected;*
- *the characteristics of the existing noise environment;*
- *a prediction of how the noise environment will change with the proposed development;*
- *in the shorter term such as during the construction period;*
- *in the longer term during the operating life of the infrastructure;*
- *at particular times of the day, evening and night as appropriate;*
- *an assessment of the effect of predicted changes in the noise environment on any noise sensitive premises and noise sensitive areas; and*
- *measures to be employed in mitigating noise.*

The nature and extent of the noise assessment should be proportionate to the likely noise impact."

7.2.3 Paragraph 5.11.5 states that:

"The noise impact of ancillary activities associated with the development, such as increased road and rail traffic movements, or other forms of transportation, should also be considered."

7.2.4 Operational noise, with respect to human receptors, should be assessed using the principles of the relevant British Standards and other guidance.

National Policy Statement for Fossil Fuel Electricity Generating Infrastructure (EN-2, Section 2.7 Noise and vibration:

7.2.5 The NPS for Fossil Fuel Electricity Generating Infrastructure [Ref 7.2] builds on the detail provided in EN-1. In addition to the requirements of EN-1, EN-2 directing consideration of:

- *"the gas and steam turbines that operate continuously during normal operation; and*
- *external noise sources such as externally-sited air-cooled condensers that operate continuously during normal operation."*

7.2.6 EN-2 also provides specific mitigation guidance:

"2.7.5 As described in EN-1, the primary mitigation for noise from fossil fuel generating stations is through good design, including enclosure of plant and machinery in noise-reducing buildings wherever possible and to minimise the potential for operations to create noise. Noise from gas turbines should be mitigated by attenuation of exhausts to reduce any risk of low-frequency noise transmission.

2.7.6 Noise and vibration from features including crushing and milling machinery during operation of coal-fired generating stations is unavoidable. Similarly, noise from apparatus external to the main plant may be unavoidable. This can be mitigated through careful plant selection."

National Planning Policy Framework (NPPF)

7.2.7 The National Planning Policy Framework (NPPF) [Ref 7.3], published in March 2012, sets out the Governments planning policies for England. 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.

7.2.8 Section 11, 'Conserving and enhancing the natural environment', paragraph 123 relates to noise and states:

"123. Planning policies and decisions should aim to:

- *avoid noise from giving rise to significant adverse impacts[27] on health and quality of life as a result of new development;*
- *mitigate and reduce to a minimum other adverse impacts[27] 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."

7.2.9 The first bullet point refers to 'significant adverse impacts' which relates to the 'significant observed adverse effect level' (SOAEL) in the Noise Policy Statement for England (NPSE) [Ref 7.4], though the term 'effect' is used instead of the term 'impact' although these have been deemed to be interchangeable in this context. Therefore, given the aims above in the NPSE with regard to assessment methods and criteria, the current content of the NPPF does not require any change in previously adopted approaches.

Noise Policy Statement for England

7.2.10 The Noise Policy Statement for England (NPSE) [Ref 7.4], published in March 2010 by Defra, 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.

7.2.11 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."*

7.2.12 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.

7.2.13 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."*

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

"SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur."

7.2.15 The accompanying explanation states:

"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. 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."

7.2.16 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 adopted from British Standards etc (see paragraphs 7.2.27 – 7.2.42 below).

Planning Practice Guidance - Noise (PPGN)

7.2.17 The Government has published Planning Practice Guidance on a range of subjects including noise [Ref 7.5].The guidance provides advice on how to deliver the policies of the NPPF. The PPGN reiterates general guidance on noise policy and assessment methods provided in the NPPF, NPSE and British Standards (BSs) and contains examples of acoustic environments commensurate with various effect levels. Paragraph 006 of the PPGN explains that:

"The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation."

7.2.18 According to the PPGN (Paragraph: 006 Reference ID: 30-006-20141224), factors that can influence whether noise could be of concern include:

- the source and absolute level of the noise together with the time of day it occurs;
- for non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise;
- the spectral content and the general character of the noise;
- the local topology and topography along with the existing and, where appropriate, the planned character of the area.

- where applicable, the cumulative impacts of more than one source should be taken into account along with the extent to which the source of noise is intermittent and of limited duration;

- whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time;

- in cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur;

- where relevant, Noise Action Plans, and, in particular the Important Areas identified through the process associated with the Environmental Noise Directive and corresponding regulations;

- the effect of noise on wildlife;

- if external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces; and

- the potential effect of a new residential development being located close to an existing business that gives rise to noise should be carefully considered. This is because existing noise levels from the business even if intermittent (for example, a live music venue) may be regarded as unacceptable by the new residents and subject to enforcement action. To help avoid such instances, appropriate mitigation should be considered, including optimising the sound insulation provided by the new development's building envelope. In the case of an established business, the policy set out in the third bullet of paragraph 123 of the NPPF should be followed.

7.2.19 The PPGN provides a relationship between various perceptions of noise, effect level and required action in accordance with the NPPF (Paragraph: 005 Reference ID: 30-005-20140306). This is reproduced in Table 7.1, below.

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, 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.	No Observed Adverse Effect	No specific measures required
Lowest Observed Adverse Effect Level (LOAEL)			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, 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 perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level (SOAEL)			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, 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.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

Table 7.1: Noise Exposure Hierarchy Based on the Likely Average Response

7.2.20 The PPGN describes sound that is not noticeable to be at levels below the NOEL. It describes exposures that are noticeable, but not to the extent that there is a perceived change in quality of life, as below the LOAEL; and these exposures need no mitigation. With reference to the definition of noise in the NPSE, such immissions are 'sound' and not 'noise'. On this basis, the audibility of sound from a development is not, in itself, a criterion to judge noise effects that is commensurate with national planning policy.

7.2.21 The PPGN suggests that noise exposures above the LOAEL but below the SOAEL cause small changes in behaviour. Examples of noise exposures above the LOAEL provided in the PPGN is: *having to turn up the volume on the television; needing to speak more loudly to be heard; where there is no alternative ventilation, closing windows for some of the time because of the noise; or, a potential for some reported sleep disturbance.* In line with the NPPF and NPSE, the PPGN 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.

7.2.22 The PPGN suggests that noise exposures above the SOAEL cause material changes in behaviour. Examples of noise exposures above the SOAEL provided in the PPGN 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; and/or there is a potential for sleep disturbance resulting in difficulty in getting to sleep, premature

awakening and difficulty in getting back to sleep. In line with the NPPF and NPSE, the PPGN 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.

7.2.23 The PPGN suggests that a noise impact may be partially offset if the residents of affected dwellings have access to a relatively quiet part of their dwelling, private external amenity area and/or external public or private amenity space nearby.

7.2.24 The principles of the PPGN can also be applied to non-residential noise sensitive receptors. For example from professional judgement, for users of a public right of way, a noise which was audible but did not result in any change of behaviour would be below the LOAEL; if the noise were intrusive and resulted in some behaviour change (such as not stopping as one passes through the noisy area), then the impact would be judged to be below the SOAEL; If the noise resulted potential users to avoid the area or risk psychological stress or physiological effect, impacts would be above the SOAEL.

Swale Borough Council's Development Plan

7.2.25 The Swale Borough Council (SBC) Development Plan, "Bearing Fruits 2031" [Ref 7.6], adopted 2017, commits to "Conserving and enhancing the natural environment". In its policy relating to pollution, land contamination and unstable land, it instructs that, in context of the NPPF:

> *"Noise and vibration*
>
> *7.7.4 Assessing developments for noise and vibration - both from noise generated from new developments affecting existing development and new development close to existing noise sources - can be complex. The relevant British Standards and guidance, including BS4142, BS8233 and BS7445 need to be considered. The Council's Environmental Protection Team has published a guidance document, Noise and Vibration: Planning Guidance Document, 2013. Developers should refer to this guidance, as well as the latest revised British Standards, in their planning applications."*

7.2.26 The SBC Noise and Vibration: Planning Guidance Document, 2013 [Ref 7.7] identified above directs developers to the former issue of BS 4142:1997. Where appropriate, the current version of the standard, BS 4142:2014 will be used.

British Standard 5228 'Code of practice for noise and vibration control on construction and open sites', Parts 1 and 2, 2009

7.2.27 British Standard (BS) 5228 is a two part standard which comprises:

- BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' [Ref 7.8]; and
- BS 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration' [Ref 7.9];

7.2.28 The Standard provides guidance, information and procedures on the control of noise and vibration from demolition and construction sites. The Control of Noise (Code of Practice for Construction and Open Sites) (England) Order 2015 [Ref 7.10] approved BS 5228-

1:2009+A1:2014 and BS 5228-2:2009+A1:2014 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 Control of Pollution Act 1974 [Ref 7.11].

7.2.29 There are no set standards for the definition of the significance of construction noise effects, however, for noise, example criteria are provided in BS 5228-1:2009+A1:2014 Annex E and for vibration, example criteria are provided in BS 5228-2:2009+A1:2014 Annex B. The assessment of whether changes in noise levels due to construction activity constitute significant effects will be dependent on the absolute levels of ambient and construction noise, as well as the magnitude, duration, time of occurrence and frequency of the noise change.

7.2.30 BS 5228-1:2009+A1:2014 provides basic information and recommendations for methods of noise control relating to construction and open sites where work activities/operations generate significant noise levels. It includes sections on: community relations; noise and persons on site, neighbourhood nuisance; project supervision; and control of noise. However, annexes include: information on legislative background; noise sources, remedies and their effectiveness (mitigation options); current and historic sound level data on site equipment and site activities; significance of noise effects; calculation procedures estimating sound emissions from sites and sound level monitoring; types of piling; and air overpressure.

7.2.31 BS 5228-2:2009+A1:2014 covers basic information and recommendations for basic methods of vibration control relating to construction and open sites where work activities/operations generate significant vibration levels. It includes sections on: community relations; vibration and persons on site; neighbourhood nuisance; project supervision; control of vibration and measurement.

British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound'

7.2.32 The foreword to BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' [Ref 7.12] 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."*

7.2.33 The note to paragraph 8.5 of BS 4142:2014 is relevant to the assessment of the proposed development, and states:

"Where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognized that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation."

7.2.34 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 NSRs. 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.

7.2.35 The specific sound levels should be determined separately in terms of the LAeq,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 between 07:00 and 23:00 hours and night-time is typically between 23:00 and 07:00 hours.

7.2.36 BS 4142:2014 states that measurement locations should be outdoors, where the microphone is at least 3.5 m from any reflecting surfaces other than the ground and, unless there is a specific reason to use an alternative height, at a height of between 1.2 m and 1.5 m above ground level. However, where it is necessary to make measurements above ground floor level, the measurement position, height and distance from reflecting surfaces should be reported, and ideally measurements should be made at a position 1 m from the façade of the relevant floor if it is not practical to make the measurements at least 3.5 m from the facade.

7.2.37 With regards to the rating correction, paragraph 9.2 of BS 4142:2014 states:

"Consider the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention."

The commentary to paragraph 9.2 of BS 4142:2014 suggests the following subjective methods for the determination of the rating penalty for tonal, impulsive and/or intermittent specific sounds:

"Tonality

For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a rating penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

Impulsivity

A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity

which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.

Other sound characteristics

Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

Intermittency

When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. … If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."

7.2.38 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."

7.2.39 An initial estimate of the impact of the specific sound is 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:

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

7.2.40 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 significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

7.2.41 Whilst there is a relationship between the significance of impacts determined by the method contained within BS 4142:2014 and the significance of effects described in the PPGN, 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.

7.2.42 The significance of the effect of the noise in question (i.e. whether above or below SOAEL and LOAEL) should be determined on the basis of the initial estimate of impact significance from the BS 4142:2014 assessment with reference to the examples of outcomes described within the PPGN 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, such as:
- facade insulation treatment;
- ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
- acoustic screening.

7.3 Methodology

Scoping and Consultation

7.3.1 The formal scoping exercise is summarised in Chapter 3. A scoping opinion was provided in September 2017 by The Planning Inspectorate.

7.3.2 The formal scoping exercise is set out in chapter 3 with a summary of consultation responses set out in Appendix 3.1.

7.3.3 Consultation was also made with Kevin Tucker, Environmental Health Officer at Swale Borough Council (SBC) on Wednesday 17th January 2018. Stephen Scott, Senior Acoustic Consultant with RPS, contacted SBC to discuss the assessment methodology. It was confirmed by telephone that the assessment: for operational noise, should follow the assessment methodology contained within BS 4142:2014 with a rating difference appropriate to the situation; and for construction noise, the assessment could follow the examples within BS 5228, with appropriate adjustment if required. The noise surveys along the residential fringe towards the Paper Mill were discussed, with their locations considered broadly appropriate.

Establishing Baseline Conditions

7.3.4 Baseline noise conditions have been determined by survey with due regard to Chapter 10 of *IEMA's Guidelines for Environmental Noise Impact Assessment* [Ref 7.13] and British Standard 7445 'Description and measurement of environmental noise' - Parts 1 to 3, 2003

[Ref 7.14], 1991 [Ref 7.15] and 1991 [Ref 7.16]. Survey details and results are provided in Appendix 7.1.

Study Area

7.3.5 Following good practice, a study area of approximately 1 km from the red line boundary has been considered for the assessment for noise and vibration sensitive receptors (NSRs). Representative receptors within that area have been assessed for potential effect. Beyond this distance, noise predictions become unreliable; any adverse effects will have been identified within the 1 km area.

Significance Criteria

7.3.6 This section provides and describes how the magnitudes of impact relating to noise and vibration have been identified with regards to the construction and operation of the proposed K4.

Construction Noise

7.3.7 The magnitude of construction noise impacts has been determined in accordance with Annex E of BS 5228-1:2009+A1:2014 [Ref 7.8]. The significance criteria for assessing noise impact from construction works have been based on Example Method 2 contained within Annex E.3.3 of BS 5228-1:2009+A1:2014, as referred to above, this indicates that:

> *"Noise levels generated by site activities are deemed to be potentially significant if the total noise (pre-construction ambient plus site noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB L_{Aeq} period, from site noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in significant effect."*

7.3.8 For the majority of NSRs, pre-construction ambient sound levels are relatively low, not consistently exceeding 62 dB $L_{Aeq,day}$; 52 dB $L_{Aeq,evening}$ and 42 dB $L_{Aeq,night}$, resulting in the criteria set within the lower cut-off levels given in Table 7.2 below applying, the most stringent limits. As such, the lower cut-off levels are used throughout the construction assessment. Assessment determination is also subject to duration criteria and where ambient sound levels are low.

Assessment category and threshold value period (L_{Aeq})	Threshold value[1], in decibels (dB)			
	No/Negligible	Minor	Moderate	Major
Night-time (23.00 to 07.00 hours)	<40	40 - 45	45 – 55	>55
Evenings (19.00 to 23.00 hours weekdays). Weekends (13.00 to 23.00 hours Saturdays and 07.00 to 23.00 hours Sundays)	<50	50 - 55	55 – 65	>65

Assessment	Threshold value[1], in decibels (dB)			
Daytime (07.00 to 19.00 hours) weekdays and Saturdays (07.00 to 13.00 hours)	<60	60 - 65	65 - 75	>75

Table 7.2: Construction Noise Threshold Criteria

Construction traffic

7.3.9 For noise change associated with non-permanent sources and construction road traffic, a change of 3 dB is the minimum perceptible under normal conditions, and a change of 10 dB corresponds roughly to halving or doubling of a sound.

7.3.10 It is generally accepted that an increase of 3 dB(A) or more is the threshold at which a permanent noise effect becomes significant (Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 7 HD 213/11 para 3.37 [Ref 7.17]). However, 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 of significance can be raised to a 6 dB(A) change. Noise change criteria are applied equally to the day and night periods.

7.3.11 It is also standard practice to categorise the degree of effect according to the extent of the predicted noise change. This is frequently implemented by the use of semantic descriptors associated with noise change bands. The approach has been used in the UK over the last 10 years in the assessment of road traffic schemes, expanding upon the criteria within DMRB and reflecting the likely duration of construction for this particular project. The criteria are based on the premise that subjective response to noise from a new source is proportional to the change in overall noise level. Hence, the semantic scale provided in Table 7.3 has been adopted to describe noise change (given that only increases are likely, there are no decrease bands).

Predicted Change In $L_{Aeq,T}$ or $L_{A10,T}$	Significant Yes/No?	Semantic Scale Rating / Magnitude of Impact
Increase of less than 1 dB	No	No significant change
Increase of 1 - 3 dB	No	Negligible Increase
Increase of 3 - 6 dB	No	Minor Increase
Increase of 6 -10 dB	Yes	Moderate Increase
Increase of 10 - 20 dB	Yes	Major Increase
Increase of more than 20 dB	Yes	Substantial Increase

Table 7.3: Construction Traffic Noise Criteria Levels.

Construction Vibration

7.3.12 Criteria for assessing the significance of construction vibration are provided in BS 5228-2:2009+A1:2014 [Ref 7.9]. Table 7.4 below details potential vibration levels measured in terms of Peak Particle Velocity (PPV) based on the guidance in BS 5228-2:2009+A1:2014 and provides a semantic scale for construction vibration effects on human receptors . Criteria are applied equally to day and night-time periods.

Peak Particle Velocity	Description	Magnitude of Impact
>0.14 mm/s	Vibration might just be perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.	Negligible
>0.3 mm/s	Vibration might just be perceptible in residential environments.	Minor
>1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents.	Moderate
>10 mm/s	Vibration is likely to be intolerable for any more than a brief exposure to this level.	Major

Table 7.4: Guidance on Effects of Vibration Levels.

Operational Noise

7.3.13 The significance of the noise effects associated with the operation of the Proposed Development has been determined based upon the methodology contained within BS 4142:2014 *Methods for rating and assessing industrial and commercial sound* [Ref 7.8]. This requires the following:

- Determination and characterisation of the baseline sound environment to derive a representative background sound level for the periods of interest;
- Development of a noise model that includes the significant sound generating items of plant and activities; this model predicts noise levels at the NSRs included within the model – this provides the specific noise level at each NSR (a SoundPLAN noise model will be developed which utilises prediction methodology contained within International Standard (ISO) 9613-2:1996 'Acoustics: Attenuation of sound during propagation outdoors. Part 2: General method of calculation' [Ref 7.18);
- Specification of any character corrections as required and described in Section 9 of BS 4142:2014 including those for tonality, impulsivity, other sound characteristics and intermittency – when any corrections are made to the Specific Noise Level, this then becomes the Rating Level, $L_{Ar,Tr}$ (if no corrections are made, the level is still termed the Rating Level); and then
- Determination of the difference at each NSR between the $L_{Ar,Tr}$ and the background sound level. The difference determines the impact which can be described in accordance with Section 11 of BS 4142:2014 but this also requires consideration of the context.

7.3.14 From the above and following the guidance in BS 4142:2014, Table 7.5 can be used to define the magnitude of impact.

7.3.15 In general, criteria are applied equally to day and night-time periods. However, the night-time background sound levels are generally lower than for the daytime, resulting in more

stringent criteria at night. BS 4142 instructs that the context of any potential impact should also be considered in determining impact. It may be appropriate to vary the impact criteria for individual cases by giving weight to the absolute noise levels and resulting internal noise environment at surrounding noise sensitive receptors (for example within residences) using the levels within BS 8233: *Guidance on sound insulation and noise reduction for buildings* [Ref 7.19]. The frequency and time of occurrence may also be considered.

Difference between Rating Level and Background Sound Level	BS 4142 Semantic Description	Magnitude of Impact
> 10 dB	A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.	Major
5 to 10 dB	A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.	Moderate
0 to 5 dB	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.	Minor
-10 to 0 dB		Negligible
< -10 dB	-	No change

Table 7.5: Operational Noise - Determination of Magnitude of Impact

7.3.16 Predictions are made for nine residential NSRs within a 1 km buffer of the Proposed Development, considered representative of the wider area and noise contours have also been calculated. NSRs are shown in Figure 7.2. Baseline sound levels for these properties are taken, for the purpose of assessment, to be the lower of the two measured locations. This provides a worst-case assessment.

Operational Vibration

7.3.17 Vibration from operational plant will be assessed qualitatively using professional judgement.

Assessment of Effects

7.3.18 The assessment of the effect with regards to noise and vibration is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The particular method employed, with regard to IEMA's Guidelines, is presented in Table 7.6. Where a range of significance of effect is presented, the final assessment for each effect is based upon expert judgement. Specific NSRs have been identified and included within the assessment and are shown on Figure 7.1.

7.3.19 For the purposes of this assessment, any effects with a significance level of moderate adverse magnitude or greater are considered as significant adverse effects. Adverse effects of slight magnitude or below are noteworthy but not significant in terms of the EIA Regulations.

Magnitude of impact						
Sensitivity of receptor		No change	Negligible	Minor/Small	Moderate/Medium	Major/Large
	Negligible	Negligible	Negligible	Negligible or slight	Negligible or slight	Slight
	Low	Negligible	Negligible or slight	Negligible or slight	Slight	Slight or moderate
	Medium	Negligible	Negligible or slight	Slight	Moderate	Moderate or substantial
	High	Negligible	Slight	Slight or moderate	Moderate or substantial	Substantial or very substantial

Table 7.6: Determination of Magnitude of Effect with regards to Impact and Sensitivity of Receptor

Limitations and Assumptions

7.3.20 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.

7.3.21 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.

7.3.22 Every effort has been made to reduce the uncertainty of the baseline sound level measurements. Uncertainty in the baseline data has been reduced significantly by carrying out the baseline sound level survey over a period of seven days, allowing analysis of how representative the baseline data is given the naturally varying noise level at the site.

7.3.23 A quantitative assessment has been undertaken based on likely source levels provided by the measurement taken on site and relevant British Standards. This approach minimises uncertainty associated with the source term inputs to the sound propagation model.

7.3.24 With regard to subjective response, the acoustics standards and guidance adopted for the assessment 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.

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

7.3.26 It is noted the event K4 does not get consent, K1 may be modified and continue to operate. For the basis of this assessment it is therefore assumed that noise levels will remain comparable with existing levels.

7.4 Baseline Conditions

7.4.1 The proposed development is located at Kemsley Paper Mill, Sittingbourne, Kent. The site is bounded to the west by the paper mill, to the east by The Swale and to the north and south by Kemsley Marshes. The nearest residential receptors approximately 600 m to the west. This is the residential area called Kemsley. There are potential noise sensitive ecological receptors bordering the north, east and south of the proposal site. Saxon Shore Way public footpath which follows the bank of the Swale, passes the eastern extent of the site.

7.4.2 The A249 is located approximately 2 km to the north and west of the site and is accessed via Swale Way. The A249 connects with both the A2 west of Sittingbourne and the M2 at Junction 5 approximately 8 km south of the site. To the north, the A249 provides access to the Isle of Sheppey.

Sensitive Receptors

7.4.3 The sensitive receptors listed in Table 7.7 below have the potential to be affected by the Proposed Development. The assessment in this Chapter has considered the effects upon the identified sensitive receptors. Receptors are shown on Figure 7.1. Sensitivities are derived from professional judgement such as to match the impact criteria with the determination of magnitude of effect, such as to ensure that an exceedance of any mandated limit results in a significant effect.

7.4.4 Residential receptors are considered to be of medium sensitivity. This allows for other receptors of particular sensitivity to be allocated high sensitivity where appropriate.

7.4.5 One school, Kemsley Primary School, has been identified within the 1 km study area, approximately 850 m from the Site. The school is considered to be of medium sensitivity. No high-sensitivity receptors (e.g. such as hospitals, recording studios etc.) have been identified within the study area.

7.4.6 Public rights of way and parkland are considered of low sensitivity. The Saxon Shore Way footpath follows both sides of the Swale, passing within approximately 100 m of the Site. Approximately half of The Church Marshes Country Park falls between 500 m and 1 km from the K4 red line, the remaining half beyond 1 km distance.

7.4.7 The assessment of ecological receptors is considered within Ecology Chapter 10.

Receptor	Importance/ Sensitivity/ Vulnerability to Change
Residential dwellings	Medium
School, Kemsley Primary	Medium
Public Rights of Way	Low
Other noise sensitive receptors	n/a - None identified

Table 7.7: Potentially affected sensitive receptors

7.4.8 Ecological receptors are identified within Chapter 10 Ecology.

7.5 Existing Noise Environment

7.5.1 Baseline noise survey data gathered in 2016 is used to determine a representative baseline sound level across the Site and wider area. The local noise environment within the residential areas is determined by noise arising from traffic movements. From Chapter 4 Traffic and Transport, traffic growth of around 3.5% is anticipated between 2016 and 2019. This would equate to a noise increase of approximately 0.1 dB, indicating that the 2016 data remains valid without modification for assessment in 2019 and beyond.

7.5.2 Baseline sound measurements were carried out between Tuesday 7th June and Tuesday 14th June 2016 at 41 Reams Way and 97 Walsby Drive. It is considered that these locations are representative of the neighbouring residential areas. These locations are shown in Figure 7.2.

7.5.3 Table 7.8 below provides a summary of the representative baseline levels determined by survey. The representative level has been determined by consideration of the survey data to provide a level indicative of the quieter times during the survey period. This is considered a robust approach.

NSR	Survey Location	Period	Representative Background Sound Level $L_{A90,T}$ (dB)	Range of Background Sound Levels $L_{A90,T}$ (dB)	Range of Residual Sound Level $L_{Aeq,T}$ (dB)
Reams Way	LT1	07:00 - 23:00	49	40 – 62	60 - 64
		23:00 - 07:00	43	38 – 56	54 - 59
Walsby Drive	LT2	07:00 - 23:00	39	32 – 49	47 - 51
		23:00 - 07:00	35	30 – 48	45 - 51

Table 7.8: Representative Baseline Sound Levels

7.5.4 Within this assessment, the minimum representative day and night-time levels are used; ie. 39 dB $L_{A90,day}$ and 35 dB $L_{A90,night}$. These are considered to provide the basis for a robust assessment and reflect the context of the proposal within the wider area.

7.5.5 No significant vibration is transmitted beyond the footprint of the neighbouring industrial buildings, so existing vibration levels across the site and wider area are considered to be negligible. Assessment of vibration effects are compared against absolute levels, rather than vibration level change. Therefore no measurement of baseline vibration is required.

Future baseline

7.5.6 The likely future baseline conditions of the application site in the absence of the Proposed Development have been considered.

7.5.7 Based on the traffic flow data provided for the existing baseline (2017) and future baseline (2019) scenarios, predictions indicate that baseline sound levels are likely to increase by approximately 0.1 dB due to the natural increase in traffic flows on the local

road network. For 2021, as K4 becomes operational, no traffic assessment has been undertaken as there will be minimal if not no movements associated with K4.

7.5.8 In the event K4 does not get consent, K1 may be modified and continue to operate. For the basis of this assessment it is assumed that noise levels will remain comparable with existing levels and no assessment of a modified K1 in the absence of K4 has been assessed.

7.5.9 As the K3 generating station, IBA recycling facility and access track have planning permission from Kent County Council, the consented future baseline of the site comprises the built and operational development of both buildings in accordance with their permissions in addition to the future baseline conditions described above.

7.6 Predicted Effects

7.6.1 Effects of the development of K4 may arise during its construction, operation, and eventual decommissioning. The effects of noise are generally limited to the area immediately surrounding the development site, and so receptors representative of the immediate surrounding areas within the study area have been assessed.

Construction Effects

7.6.2 The impacts of the construction of K4 have been considered with regards to noise and vibration. No significant demolition will be required for the construction of K4.

7.6.3 For the purposes of this Environmental Statement chapter, construction effects are temporary and relatively short-term (less than 5 years). Construction noise and vibration will be intermittent, depending on the nature of the construction phase and day-to-day programme, but with more intense activity at the start and consequentially higher noise levels during site clearance and foundation construction. Once construction works cease, construction noise and vibration will also immediately cease.

7.6.4 Although the majority of the works will be undertaken during the daytime, in exceptional circumstances, it may be necessary for evening or night works to occur. The Project will be undertaken within prescribed working hours except by prior written agreement of Swale Borough Council.

Construction Noise

7.6.5 The nearest residential properties are over 500 m from the main construction area of K4. Given the separation between the K4 site and the nearest residential receptors, construction activities are unlikely to result in significant adverse effect due to noise.

7.6.6 At this stage of assessment, detailed construction programme and methodology is not available. Three of the more noisy phases of construction works have been considered: piling works; general excavation; and concrete works. Other construction activities, such as installing plant, would be expected to result in noise levels below that for those identified above.

7.6.7 For piling, it has been assumed that the significant plant with regards to noise comprise: two piling rigs, one excavator and one truck mixer. For general excavation, plant

assumed are: one Excavator and three trucks. For concrete works, plant assumed are: one concrete pump and three mixers. A 150 kva generator would operate throughout. Typical noise source levels have been taken from BS 5228-1:2009+A1:2014 or provided by Costain's engineers, and are summarised in Table 7.9 below.

Plant	Source	dB SPL @ 10m
Excavator - 20T	BS5228 C2.3	78
Generator - 150kva	BS5228 C6.39	65
Concrete pump - 40m	BS5228 C4.25	82
CFA piling rig - 65T	Costain	85
Impact Pile Driver	BS5228 C3.1	89
8 wheel muckaway truck / truck mixer	BS5228 C4.21	76

Table 7.9: Typical Construction Plant Noise Levels

7.6.8 Specific sound levels at the NSRs identified have been calculated using 3D sound modelling software 'SoundPlan v7.4', with input acoustic data based that provided by Costain and taken from BS 5228. Calculation of the above indicates that overall noise emissions from concreting works will be approximately 4 dB below that for CFA piling; and noise emissions from general excavation around 6 dB below that from CFA piling activity. Other construction activities would also result in noise levels below that for CFA piling.

7.6.9 A qualitative assessment of the overall likely effects is therefore considered for the works as a whole, based on the likely most-noisy activity.

7.6.10 The most noisy construction activity on site would likely be associated with site clearance and piling, in particular if impact piling is required. As a worst case assessment, and to inform the ecological assessment, a prediction of impact piling noise has been made. Noise contours showing maximum noise levels during piling are provided in Figure 7.3.

7.6.11 During piling, noise levels from the piling are predicted to be a maximum of 40 dB L_{Aeq} at any surrounding residential area, as determined by the noise model. For daytime and evening works, this would be of negligible magnitude under the criteria adopted from BS 5228. For night-time works, a level of 40 dB L_{Aeq} just reaches the minor adverse impact criteria. Construction noise levels during general excavation and concreting would be lower than for piling.

7.6.12 For the residential NSRs identified, this would equate to a slight adverse effect (not significant). From the maximum predicted levels above, during construction, effects on Kemsley Primary School would be negligible; effects on the PRoW would be negligible.

7.6.13 Construction of the facility will also necessitate a significant number of construction vehicles accessing the Site, a high proportion of which will be HGVs. Construction traffic will consist of mix of light and heavy commercial vehicles to transport materials and equipment to and within the site. Given that the site is accessed by well maintained and appropriate roads, already serving the adjacent industrial areas, any increase in vehicle movements is unlikely to result in anything but a negligible increase in road traffic noise.

7.6.14 From the Traffic and Transport chapter 4, construction works will result in up to a maximum of around 250 vehicle two-way movements per day, including 80 HGVs. With these vehicles use the existing road network, there is the potential to increase the existing road traffic noise experienced by the residents of surrounding properties. Road links are described in Traffic and Transport chapter 4.

7.6.15 A summary of the traffic flows from chapter 4 are provided in Tables 7.10 to 7.12 below, for weekdays, Saturday & Sunday. The increase in noise arising from each link as a result of the additional construction traffic is provided in the last column, calculated using the formula within the Calculation of Road Traffic Noise (CRTN) [Ref 7.20]

Road Link	Time basis	5 Day Average				
		2019 Future Baseline		Construction Traffic		dB Increase
		Total	HGVs	Total	HGVs	
Link 1 Swale Way East of B2005 Grovehurst Roundabout	12 hr	16876	2143	80	80	**0.1**
	24 hr	22240	3050	249	80	**0.1**
Link 2 Barge Way North of Swale Roundabout	12 hr	5188	1706	80	80	**0.2**
	24 hr	8099	2367	80	80	**0.1**
Link 3 Barge Way West of Fleet End Roundabout	12 hr	2871	1252	80	80	**0.2**
	24 hr	4186	1661	80	80	**0.2**
Link 4 A249 South of Swale Way Junction	12 hr	31164	14572	80	80	**0.0**
	24 hr	41564	20231	242	80	**0.0**
Link 5 Swale Way north of Reams Way Junction	12 hr	11605	581	0	0	**0.0**
	24 hr	14382	828	170	0	**0.0**
Link 6 Swale Way south of Reams Way Junction	12 hr	11641	623	0	0	**0.0**
	24 hr	14401	870	170	0	**0.0**
Link 7 Swale Way south of Reams Way Junction	12 hr	10706	492	0	0	**0.0**
	24 hr	13043	653	1	0	**0.0**

Table 7.10: Construction Vehicle Noise – 5 Day Average

Road Link	Time basis	Saturday				
		2019 Future Baseline		Construction Traffic		dB Increase
		Total	HGVs	Total	HGVs	
Link 1 Swale Way East of B2005 Grovehurst Roundabout	12 hr	9361	1121	84	60	**0.1**
	24 hr	13043	1782	169	60	**0.1**
Link 2 Barge Way North of Swale Roundabout	12 hr	2687	1068	0	60	**0.2**
	24 hr	4588	1620	0	60	**0.1**
Link 3 Barge Way West of Fleet End Roundabout	12 hr	1195	673	0	60	**0.3**
	24 hr	1914	971	0	60	**0.2**
Link 4 A249 South of Swale Way Junction	12 hr	26602	13684	81	60	**0.0**
	24 hr	35215	18261	162	60	**0.0**

Link 5 Swale Way north of Reams Way Junction	12 hr	7058	188	85	0	**0.0**
	24 hr	8881	306	170	0	**0.1**
Link 6 Swale Way south of Reams Way Junction	12 hr	6899	201	85	0	**0.0**
	24 hr	8795	300	170	0	**0.1**
Link 7 Swale Way south of Reams Way Junction	12 hr	6767	86	0	0	**0.0**
	24 hr	8376	163	1	0	**0.0**

Table 7.11: Construction Vehicle Noise – Saturday

Road Link	Time basis	Sunday				
		2019 Future Baseline		Construction Traffic		dB Increase
		Total	HGVs	Total	HGVs	
Link 1 Swale Way East of B2005 Grovehurst Roundabout	12 hr	4682	34	144	60	**0.6**
	24 hr	7110	86	229	60	**0.4**
Link 2 Barge Way North of Swale Roundabout	12 hr	983	268	60	60	**0.7**
	24 hr	1914	429	60	60	**0.4**
Link 3 Barge Way West of Fleet End Roundabout	12 hr	158*	11	60	60	**5.5***
	24 hr	289*	35	60	60	**3.1***
Link 4 A249 South of Swale Way Junction	12 hr	21646	11373	141	60	**0.0**
	24 hr	28456	14950	222	60	**0.0**
Link 5 Swale Way north of Reams Way Junction	12 hr	5220	136	85	0	**0.1**
	24 hr	6601	217	170	0	**0.1**
Link 6 Swale Way south of Reams Way Junction	12 hr	4829	146	85	0	**0.1**
	24 hr	6145	215	170	0	**0.1**
Link 7 Swale Way south of Reams Way Junction	12 hr	5055	86	0	0	**0.0**
	24 hr	6276	123	1	0	**0.0**

* Very low base flows

Table 7.12: Construction Vehicle Noise – Sunday

7.6.16 From the tables above, it can be seen that for most links, on all days, any noise change arising from change in traffic flows due to additional construction vehicles would result in a noise increase of less than 1 dB.

7.6.17 The exception to this is for Link 3 Barge Way West of Fleet End Roundabout, where an increase of 5 dB during Sunday daytime, or 3 dB over a 24-hour Sunday period is indicated. This link, however, has a very low baseline flow (less than 1000 vehicles per 24-hour), resulting in the noise change indicated for this link being significantly over-reported, being masked by any existing ambient noise. Furthermore, this link is well separated from any residential NSRs. Consequently, it is considered that all construction traffic noise will be of negligible adverse impact or below.

7.6.18 For residential NSRs, PRoW and the identified school, this would equate to a negligible adverse effect.

7.6.19 It is considered, therefore, that construction works on site would not result in any significant impact within the surrounding residential area. Notwithstanding this, best practicable means to reduce construction noise impact (including minimising night-time works where practicable) should be implemented to minimise any potential for disturbance to the surrounding area.

Construction Vibration

7.6.20 Surface plant such as cranes, compressors and generators are not recognised as sources of high levels of environmental vibration. Even at a closest distance of 10 m, PPVs significantly less than 5 mm/s are generated by such plant. For example, from BS 5228-2:2009+A1:2014, a tracked excavator may generate a PPV of approximately 0.6 mm/s and a heavy lorry on poor road surface a PPV of less than 0.1 mm/s at 10 m distance. These values are well below limits at which even cosmetic building damage becomes likely. Similarly, whilst vibration from impact piling might result in higher vibration levels at source, vibration level would be insignificant beyond the immediate development area.

7.6.21 The nearest residential properties are over 500 m from the main construction area of K4. From BS 5228-2, vibration levels decrease rapidly with increasing distance and is also attenuated by energy absorption in the soil and by obstacles and discontinuities. Given the separation between the K4 site and the nearest residential receptors, vibration from construction activities will be significantly below the minor significance criteria. As such, vibration is considered to have no or negligible impact magnitude, and will have no significant adverse effect. Notwithstanding this, vibration impacts will be minimised to ensure any sensitive activities and machinery associated with the existing Mill are not adversely affected by the works.

7.6.22 Any impacts and effects on other non-residential NSRs would also be negligible. The school identified is beyond the nearest residential properties and of similar sensitivity to them. The PRoW is not considered sensitive to vibration.

7.6.23 Similarly to that for construction traffic noise; vibration levels arising from HGVs off-site, peak or cumulative vibration levels would not be significantly any greater than that arise from existing traffic. As such construction traffic vibration would be of negligible impact and consequently negligible effect on NSRs.

Operational Effects

Operational Noise

7.6.24 Noise during operation will arise from mobile and fixed plant. Plant items within buildings will contribute to an internal reverberant noise level which will be attenuated by the building structure before radiating into the environment. External plant items will radiate noise straight into the environment, as will the heat recovery steam generator (HRSG) stack, exhaust stacks and air intakes. The locations of these plant items are shown in **Figures 2.4a&b** in Chapter 2. A summary of the noise sources modelled are provided in Table 7.13.

Item No.	Drawing Reference		dB L_{pA} at 1m	dB L_{wA}
(a)	Local Equipment Room (including battery enclosure)	Not noisy	-	-
(b)	Generator	Internal reverberant levels, attenuated by building structure standard thermal insulation.	89	-
(c)	Gas Turbine	Internal reverberant levels, attenuated by building structure standard thermal insulation.	89	-
(d)	Heat Recovery Steam Generator	HRSG - Air Intake	-	89
		HRSG - Exhaust Air	-	89
		GT Filter House	-	93
(e)	H.R.S.G. Stack	-	-	98
(f)	Turbine Hall (including steam turbine)	Turbine Hall	85*	-
		Machine Hall Blow Down Vessel	-	92
		Safety Valves Systems	-	130
(g)	CHP pipe bridge	Not noisy	-	-
(h)	Dump Condenser	Fans 1-32	-	98
(i)	Fin Fan Cooler	-	-	93
(j)	Package Boiler Stack	-	-	92
(k-w)	Start Transformer	-	-	90
(k-w)	Fire Extinguishing Cabinet	Not noisy	-	-
(k-w)	Switchgear	Not noisy	-	-
(k-w)	Block Transformer	-	-	90
(k-w)	EB Transformer	-	-	90
(k-w)	Package Boiler	Internal reverberant levels, attenuated by building structure standard thermal insulation.	80	-
(k-w)	Fuel Gas Skid	Gas Reduction Station	-	92
		GT Gas Filters	-	95
		Gas Heaters	-	95
(k-w)	Condensate Pumps	-	-	93
(k-w)	Chemical Dosing	Not noisy	-	-
(k-w)	Effluent Sump	Not noisy	-	-
(k-w)	Condensate Tank	Not noisy	-	-
(k-w)	Boiler Water Feed Pumps	-	-	93

Table 7.13 Operational Noise Source Levels

7.6.25 The operation of K4 will result in no significant additional vehicle or HGV movements, as discussed in Chapter 4 Traffic and transport.

7.6.26 Operational noise from the K4 facility has been predicted for three operating scenarios:

- Scenario 1: During normal CHP operation, heat in the form of steam is provided to the Paper Mill, which provides the necessary cooling to sustain the electrical generation process.
- Scenario 2: Should the Paper Mill not require heat when the CHP is in operation (due to sudden change in Paper Mill operation), then the CHP will bring into action the Dump Condenser array, which is a significant additional source of noise.
- Scenario 3: In exceptional (emergency) circumstance, such as the sudden non-operation of the turbine, it is necessary to vent all steam to atmosphere. This is done through steam safety valve systems.

7.6.27 With regard to Scenario 3, the use of the steam releases are likely to be less than that for the existing K1 facility; an oversized dump condenser is proposed for K4 (plant that doesn't exist for K1) such that the need to operate the steam pressure immediate release valve will be greatly reduced.

7.6.28 For context, the frequency of operation of the steam release valves for the existing K1 CHP facility is reported as "The main HP safety valves (2 x WHRB S/htr safety v/v's) have either lifted on approximately 3 to 4 times a year for a duration of approximately 60 to 90 seconds on each occasion."

7.6.29 Predictions of operational noise have been made using the noise source data in Table 7.13 and SoundPLAN 7.4 noise modelling software. SoundPLAN implements the prediction methodology set in BS EN ISO 9613-2.

7.6.30 During normal operation, noise from the CHP Plant is assumed to be neither tonal nor impulsive when considered from the surrounding NSRs (an assumption considered reasonable for appropriately specified and well-maintained plant). Any plant noise specification will either require this, or require that a more stringent overall noise level is achieved. A zero dB rating correction (as determined using the BS 4142 methodology) is applied within the calculations and assessment for normal and Dump Condenser operation.

7.6.31 The steam release valve, when in use, will generate noise which may be tonal and is likely to be readily distinctive against the residual acoustic environment. As such, a +3 dB rating correction under BS4142 is applied.

7.6.32 Details of the predicted noise levels, and the assessment against representative background sound levels and anticipated noise change is given in Tables 7.14 to 7.16 for the three scenarios. Noise contours showing predicted noise levels for normal operations with and without the dump condenser are provided in Figure 7.4 and Figure 7.5.

NSR	Period	Representative Background Sound Level $L_{A90,T}$ dB	Specific Sound Level $L_{Aeq,Tr}$ dB	Rating Penalty dB	Rating Level, $L_{Ar,Tr}$ dB	Rating / Background Level Difference dB	Representative Residual Sound Level $L_{Aeq,T}$ dB	Noise Change L_{Aeq} dB
Marsh Rise	Day	39	33	0	33	-6	47	0.2
	Night	35	33	0	33	-2	45	0.3
Off Reams Way	Day	39	34	0	34	-5	47	0.2
	Night	35	34	0	34	-1	45	0.3
Reams Way	Day	39	32	0	32	-7	47	0.1
	Night	35	32	0	32	-3	45	0.2
Reams Way N	Day	39	33	0	33	-6	47	0.2
	Night	35	33	0	33	-2	45	0.3
Reams Way S	Day	39	33	0	33	-6	47	0.2
	Night	35	33	0	33	-2	45	0.3
Recreation Way N	Day	39	33	0	33	-6	47	0.2
	Night	35	33	0	33	-2	45	0.3
Recreation Way S	Day	39	32	0	32	-7	47	0.1
	Night	35	32	0	32	-3	45	0.2
Walsby Drive N	Day	39	32	0	32	-7	47	0.1
	Night	35	32	0	32	-3	45	0.2
Walsby Drive S	Day	39	33	0	33	-6	47	0.2
	Night	35	33	0	33	-2	45	0.3

Table 7.14: Operational Assessment Summary (Normal Operation – Scenario 1)

NSR	Period	Representative Background Sound Level $L_{A90,T}$ dB	Specific Sound Level $L_{Aeq,Tr}$ dB	Rating Penalty dB	Rating Level, $L_{Ar,Tr}$ dB	Rating / Background Level Difference dB	Representative Residual Sound Level $L_{Aeq,T}$ dB	Noise Change L_{Aeq} dB
Marsh Rise	Day	39	38	0	38	-1	47	0.5
	Night	35	38	0	38	3	45	0.8
Off Reams Way	Day	39	36	0	36	-3	47	0.3
	Night	35	36	0	36	1	45	0.5
Reams Way	Day	39	34	0	34	-5	47	0.2
	Night	35	34	0	34	-1	45	0.3
Reams Way N	Day	39	35	0	35	-4	47	0.3
	Night	35	35	0	35	0	45	0.4
Reams Way S	Day	39	36	0	36	-3	47	0.3
	Night	35	36	0	36	1	45	0.5
Recreation Way N	Day	39	38	0	38	-1	47	0.5
	Night	35	38	0	38	3	45	0.8
Recreation Way	Day	39	35	0	35	-4	47	0.3

S	Night	35	35	0	35	0	45	0.4
Walsby Drive N	Day	39	37	0	37	-2	47	0.4
	Night	35	37	0	37	2	45	0.7
Walsby Drive S	Day	39	39	0	39	0	47	0.7
	Night	35	39	0	39	4	45	1.0

Table 7.15: Operational Assessment Summary (Normal Operation with Dump Condenser – Scenario 2)

NSR	Period	Representative Background Sound Level $L_{A90,T}$ dB	Specific Sound Level $L_{Aeq,Tr}$ dB	Rating Penalty dB	Rating Level, $L_{Ar,Tr}$ dB	Rating / Background Level Difference dB	Representative Residual Sound Level $L_{Aeq,T}$ dB	Noise Change L_{Aeq} dB
Marsh Rise	Day	39	59	3	62	23	47	12.5
	Night	35	59	3	62	27	45	14.5
Off Reams Way	Day	39	60	3	63	24	47	12.7
	Night	35	60	3	63	28	45	14.7
Reams Way	Day	39	58	3	61	22	47	11.7
	Night	35	58	3	61	26	45	13.6
Reams Way N	Day	39	59	3	62	23	47	12.3
	Night	35	59	3	62	27	45	14.2
Reams Way S	Day	39	59	3	62	23	47	12.5
	Night	35	59	3	62	27	45	14.5
Recreation Way N	Day	39	60	3	63	24	47	12.8
	Night	35	60	3	63	28	45	14.7
Recreation Way S	Day	39	60	3	63	24	47	13.0
	Night	35	60	3	63	28	45	14.9
Walsby Drive N	Day	39	58	3	61	22	47	11.7
	Night	35	58	3	61	26	45	13.6
Walsby Drive S	Day	39	59	3	62	23	47	11.9
	Night	35	59	3	62	27	45	13.8

Table 7.16: Operational Assessment Summary (Normal Operation and Steam Release Valves – Scenario 3)

7.6.33 The receptors above are identified as residential. The sensitivity of the receptor is therefore, considered to be medium.

7.6.34 During normal operation, without the dump condenser operating, a maximum rating difference between specific rating level and representative background level of -1 dB is predicted. This would be of negligible adverse impact following the criteria adopted. The addition of noise from K4 would result in a noise increase of no more than 0.3 dB; also considered a negligible impact.

7.6.35 The effect of these negligible impacts on residential properties is considered to be of negligible or slight adverse effect, and not significant.

7.6.36 During normal operation with the dump condenser operating, a maximum rating difference between specific rating level and representative background level of +4 dB is predicted. This would be of minor adverse impact following the criteria adopted. The addition of noise from K4 would result in a noise increase of no more than 1 dB, also a minor impact.

7.6.37 The effect of these minor impacts on residential properties is considered to be of slight adverse effect, and not significant.

7.6.38 During extraordinary or emergency operation, with the dump condenser and steam release valve operating, a maximum rating difference between specific rating level and representative background level of +28 dB is predicted. This would be of major adverse impact for the duration of occurrence, following the criteria adopted. The addition of noise from K4 would result in a noise increase of no more than 15 dB.

7.6.39 Absolute noise levels approaching 60 dB L_{Aeq} are predicted at neighbouring residences during use of the safety valve system. Whilst such a level is not immediately prejudicial to health, off-site, it may result in sleep disturbance and general annoyance to local residents. For information, the distance within which the lower action level of The Control of Noise at Work Regulations 2005 [Ref 7. 22] would be exceeded is approximately 125 m from the source, with the upper action level exceed at around 70 m distance.

7.6.40 However, the anticipated infrequency of steam release for K4 will be less than for K1, which is historically approximately 3 to 4 times a year for a duration of approximately 60 to 90 seconds on each occasion, due to the of provision of a steam condenser (not an existing feature of K1). In the consideration of the context required by BS 4142:2014, it is considered that this infrequency of occurrence would not constitute a moderate or major significant impact. Consequently, the steam release occurrence is considered no more than a slight adverse effect.

7.6.41 Whilst the results above relate to assessment based on **Figures 2.4a&b** in Chapter 2, minor changes to the site layout would be unlikely to result in any significant changes to the levels predicted or the impact or effect outcomes.

Operational Vibration

7.6.42 The plant will be designed and installed as to minimise vibration transmission from any plant items which might generate vibration. This control of vibration at source is necessary to maximise life of the plant, minimise maintenance and prevent interference with other processes within the K4 and wider site. Typically, the use of vibration isolation mounts into concrete pads will ensure that groundborne vibration is not perceptible beyond the immediate area of the plant.

7.6.43 The nearest residential properties are over 500 m from the main construction area of K4. As discussed in BS 5228-2, vibration levels decrease rapidly with separation. Given the separation between the K4 site and the nearest residential receptors, vibration from operational activities will be significantly below the negligible significance criteria.

7.6.44 No non-residential NSRs have been identified as being sensitive to vibration; for example, the PRoW is not considered vibration-sensitive. Notwithstanding this, groundborne

operational vibration is not likely to be perceptible beyond the immediate area of the plant.

7.6.45 As such, vibration is considered to have no or negligible impact magnitude, and will have no significant adverse effect.

Operational Traffic

7.6.46 The facility will generate no significant operational traffic; within Chapter 4 Traffic and Transport it is stated that the number of vehicle movements associated with K4 when it is operational would be minimal and would be unlikely to create any discernible transport impacts.

7.6.47 The noise and vibration impacts of operational traffic are therefore considered to be none or negligible. For surrounding NSRs, this would result in negligible adverse effects due to noise or vibration arising from operational traffic.

Decommissioning

7.6.48 The exact operational life of K4 is currently unknown however at the point that it reaches the end of its operational life it will be decommissioned. The effects in relation to noise and vibration will be no worse than, but are likely to be similar to or less than, those that occurred during the construction phase.

7.6.49 As identified within Traffic and Transport Chapter 4, the traffic flows associated with decommissioning are lower than those during its construction. Consequently any traffic impacts will also be no greater than those experienced during construction.

7.6.50 The decommissioning of K1, excluding any demolition works, will not require significantly noisy works. Consequently no adverse impact or effects due to the decommissioning of K1 will occur.

7.7 Mitigation

7.7.1 Specific measures necessary to mitigate adverse noise or vibration effects are identified in this section.

7.7.2 In addition to these required mitigation measures, best practicable means should be adopted to minimise noise emissions as far as is reasonably practicable.

Mitigation of Construction Effects

7.7.3 No specific mitigation is identified as being required to reduce construction noise or vibration adverse effects.

7.7.4 Notwithstanding this, best practicable means should be adopted to minimise noise emissions as far as is reasonably practicable. This should include minimising noisy night-time and weekend working, and adherence to a Construction Environmental Management Plan (CEMP) or similar which will demonstrate how the construction works will meet best practicable means. Examples of appropriate construction mitigation are provided in BS 5228-1:2009+A1:2014.

7.7.5 The Project will be constructed during prescribed working hours except by prior written agreement of SBC.

Mitigation of Operational Effects

7.7.6 No specific mitigation is identified as being required to reduce noise or vibration arising from normal operation of the K4 facility, including use of the Dump Condenser array.

7.7.7 Any plant noise specification (other than for steam release valves) will either require that noise emissions as experienced within neighbouring residential areas are free from distinct tone or impulsive character, or specified to a lower acoustic emission such that the BS 4142 rating level remains as stated in Table 7.13.

7.7.8 Notwithstanding this, best practicable means should be adopted to minimise noise emissions as far as is reasonably practicable.

7.7.9 It is noted that the operation of the steam release valves would generally occur only during emergency operation and not for an extended period. Where the valves are used in non-emergency operation (such as during commissioning or testing) this should be scheduled during the daytime period, and the duration of their use minimised.

7.8 Residual Effects

7.8.1 Residual effects are those that are predicted to remain after implementation of the any mitigation (as necessary). No significant adverse residual effects are predicted to result from the construction, operation or decommissioning of the Proposed Development.

7.9 Cumulative Effects

7.9.1 An assessment of the potential effects of the Proposed Development with other schemes that are operational, constructed, consented or for which planning permissions are currently being sought has been considered.

7.9.2 Twenty-one other external schemes have been identified, as shown in Figure 3.2 in Chapter 3. The cumulative schemes *'d fall wholly or partly within 1 km of this project's red line:

1*) 16/501484/COUNTY - The construction and operation of a gypsum recycling building

2*) 16/501228/FULL - Construction of new baling plant building

3*) 16/507687 - The construction and operation of an Incinerator Bottom Ash (IBA) recycling facility

4*) SW/10/444 - Development of a sustainable energy plant

5*) END10085 - DCD scoping opinion for power upgrade project

6) 15/510/589/OUT - Construction of Business Park

7*) SW/11/1291 - Anaerobic digester and associated ground profiling and landscaping

8*) 14/500327/OUT - Up to 8000 m^2 of class B1 and B2 floor space and country park

9*) SW/12/0816 - Relocation of Nicholls Transport depot from Lydbrook Close

10*) 16/506935/COUNTY - Application for steam pipeline connecting the Ridham Dock Biomass Facility to the DS Smith Paper Mill

11) SW/14/0224 - Application for solar farm

12) 14/502737/EIA - Scoping opinion for combined heat and power plant

13) SW/12/1211 - Construction of materials recycling facilities and waste transfer station

14*) 15/500348/COUNTY - Install advance thermal conversion and energy facility at Kemsley Fields Business Park

15) 17/503713/ENVSCR - EIA Screening Opinion for large residential development

16) 16/506193/ENVSCR - EIA Screening Opinion – Outline application for proposed residential development of 275 dwellings

17) 16/506014 - EIA Scoping Opinion - A sustainable urban extension comprising up to 1,100 new dwellings

18*) 17/505073/FULL - Erection of a tile factory including service yard, storage yard and parking area

19) 18/500393/FULL - Erection of a natural gas fuelled reserve power plant with a maximum export capacity of up to 12MW

20*) Forthcoming application by D S. Smith for a new southern boundary road for Kemsley Paper Mill

21) 18/500257 - Proposed Development of 153 Dwellings

7.9.3 It is considered that none of these projects introduce new or potential residential NSRs to the scoped study area of 1 km radius. Whilst four external schemes would introduce housing to the wider area, none are within the study area of this assessment, and would be separated by the development by existing NSRs, for which assessment has already been undertaken. No new residential NSRs would experience any adverse effect, beyond those already identified for existing NSRs.

7.9.4 A country park forms part of application 8) 14/500327/OUT, within 1 km of the K4 development. This potential receptor is considered to be of low sensitivity under the adopted assessment criteria.

Cumulative Construction Noise

7.9.5 The timescale for construction of these projects is set out in Chapter 4 of the ESs. Due to the variable nature of construction noise, the cumulative effects of construction are generally no greater than arise for individual projects. Most commonly, one of construction projects dominates the other in terms of noise immissions at any NSR; the

cumulative effect is then very similar to that for the more noisy project alone. Hypothetically, where two projects are approximately equal in noise immissions, the cumulative increase in construction noise is limited to a maximum of 3 dB. Whilst this could affect a determination of impact, 3 dB is of the order of other uncertainties associated with construction noise prediction.

7.9.6 This results in the combined effects of construction works for different projects tending not to be greater than the effects associated with each project individually unless they are very close and similar in activity, i.e. it is most unlikely that any additional NSRs will be subject to a significant adverse effect due to the cumulative works, above those NSRs already identified for an adverse effect due to each work individually. Nor would NSRs predicted to experience an impact from the development alone be likely to experience an increased impact due to the cumulative developments.

7.9.7 The duration for which construction noise occurs may be extended if different projects are constructed non-concurrently. However if each development follows the guidance contained within BS 5228 and given the localised nature of noise impacts associated with the construction of each development it is unlikely that cumulative impacts will occur.

7.9.8 Consequently, the cumulative effects due to construction works overlapping with other projects would be unlikely to be greater than for the project alone.

7.9.9 With regards to the DS Smith proposal for the construction of a "southern boundary road" within their land; this would be completed prior to the works considered within this assessment but might bring forward the breaking out of concrete from the K4 site area and make use of this spoil as a substrate for the road. It is considered that the early breaking out of concrete would not result in additional noise; it would just occur sooner. The appropriate reuse of the spoil on site would also have the potential to reduce associated construction spoil haulage both for the road scheme and the K4 scheme. As such, no significant adverse cumulative effect is anticipated with regards to noise.

Cumulative Construction Vibration

7.9.10 Due to the short distances over which any vibration levels attenuate to baseline, there would be no cumulative vibration effects from construction or demolition.

Cumulative Construction Traffic

7.9.11 From Chapter 4 Traffic and Transport, the operational traffic associated with each of the committed developments is included within the committed traffic flows assessed. The cumulative effects of committed operational traffic with the proposed construction traffic associated with K4 are therefore considered within the traffic noise assessment above, summarised in Tables 7.10 to 7.12.

Cumulative Operational Noise

7.9.12 Given the spatial separation of these projects, it is considered that the cumulation of operational effects (either direct or arising from vehicle movements) would not result in any significant increase in cumulative effect for any of the cumulative schemes considered. The schemes considered in the cumulative assessment would also have to comply with similar operational noise requirements; and as such, there would be no

increase in cumulative noise impact above that which may have been identified for individual schemes.

7.9.13 A country park forms part of application 8: 14/500327/OUT, within 1 km of the K4 development. The noise environment across this area would be expected to be comparable to that at present during normal operation of K4. The operational noise contours in Figure 7.4 indicates that specific noise levels (from K4) across the application 8 site vary between 35 – 45 dB L_{Aeq}. From the surveys in Table 7.8, the existing residual noise levels exceed 45 dB L_{Aeq}. Consequently the cumulative effect of introducing this NSR to within 1 km of the scheme is considered no greater than introducing that NSR to the area without the scheme.

Cumulative Operational Vibration

7.9.14 Due to the short distances over which any vibration levels attenuate to baseline, there would be no cumulative vibration effects from operation of the facility.

7.10 Summary

7.10.1 The area immediately surrounding the proposed K4 facility is industrial in nature, with residential properties well-separated from the development area. The immediate existing noise environment is characterised by industrial noise, meaning that additional industrial noise, provided it is not too great in magnitude, will not materially change the immediate existing noise environment.

7.10.2 The assessment of noise and vibration on ecological receptors is considered within the ecology chapter.

7.10.3 Noise or vibration from construction and the normal operation of the K4 facility will have no significant adverse impact on the surrounding NSRs.

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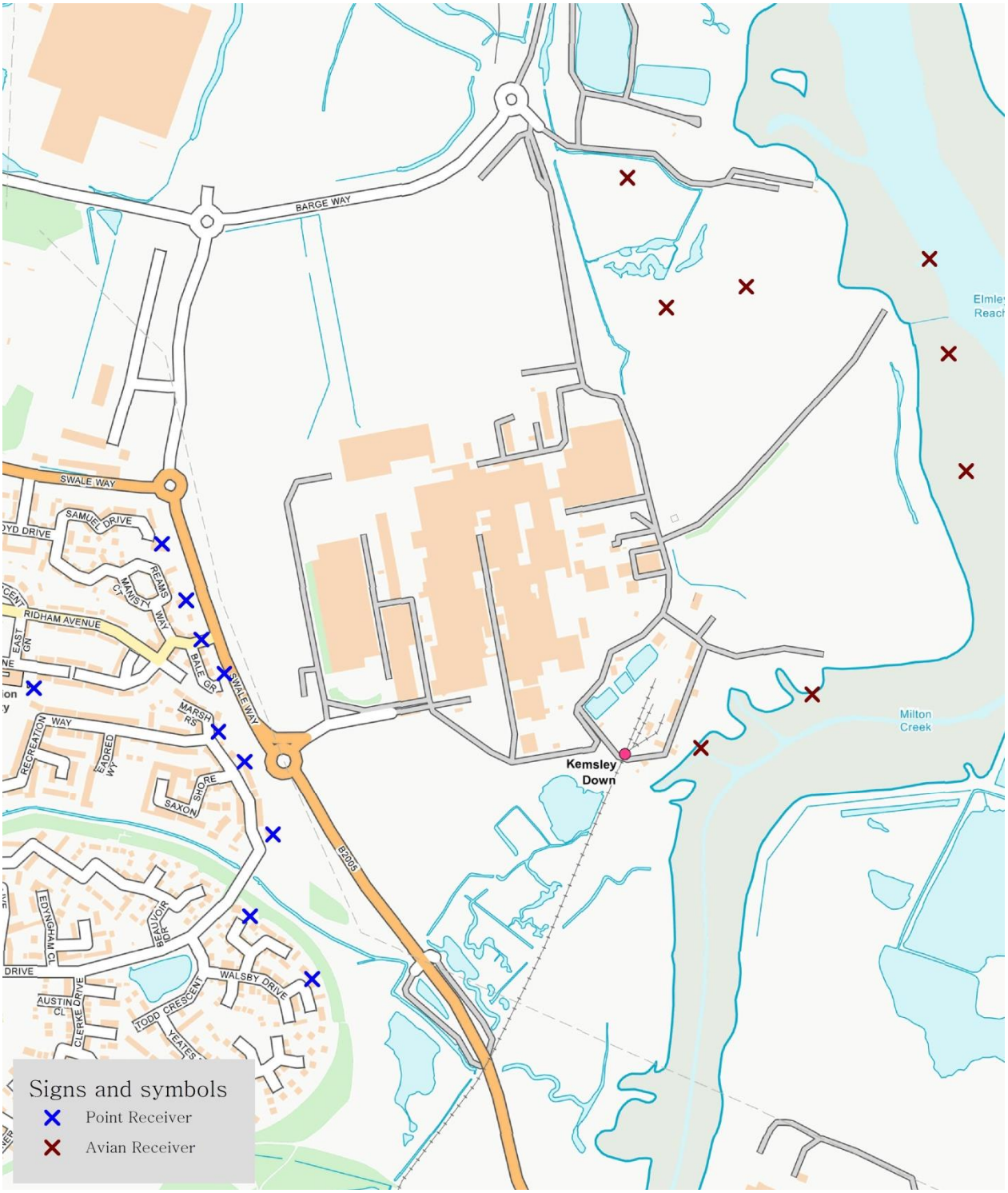

Figure 7.1: Noise Prediction Locations

Project Number	**JAE9664**	**Project Title**	**Kemsley Paper Mill (K4) CHP Plant**		
Client:	**D S Smith Paper Ltd**	**Rev :**	**2**	**Drawn By:**	**CB**
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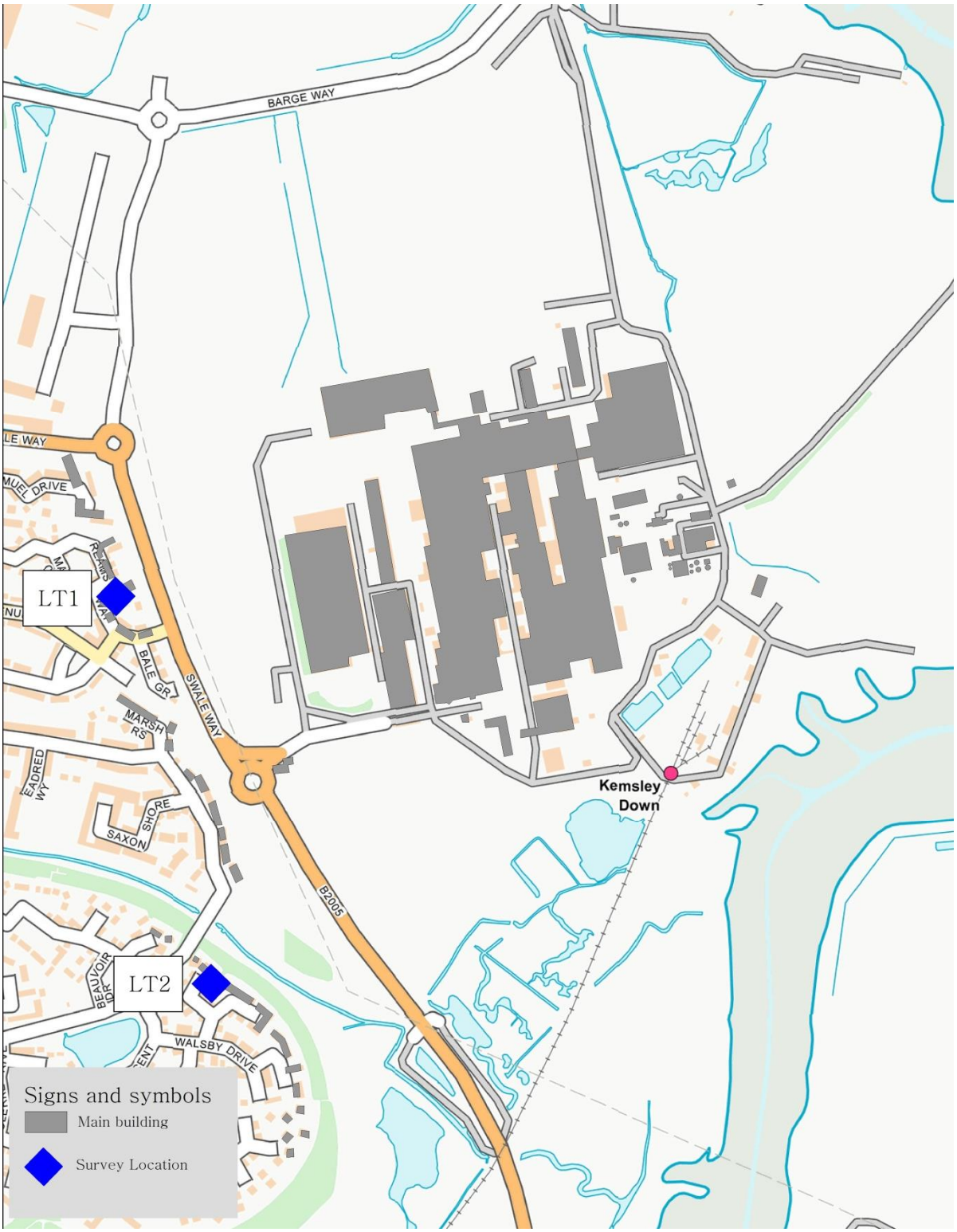

Figure 7.2: Noise Survey Locations

Project Number	**JAE9664**	**Project Title**	**Kemsley Paper Mill (K4) CHP Plant**		
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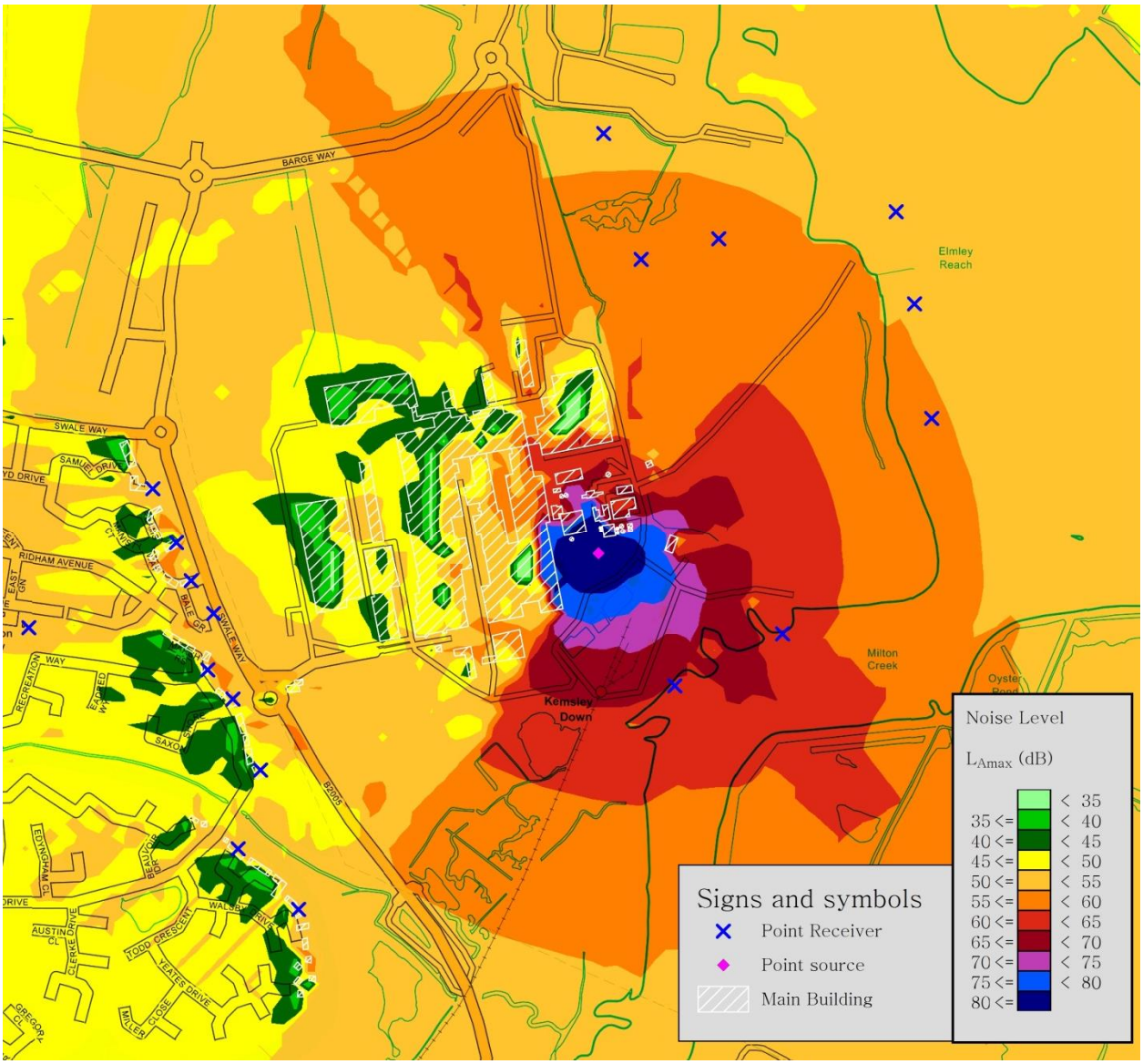

Figure 7.3: Construction Noise Contour

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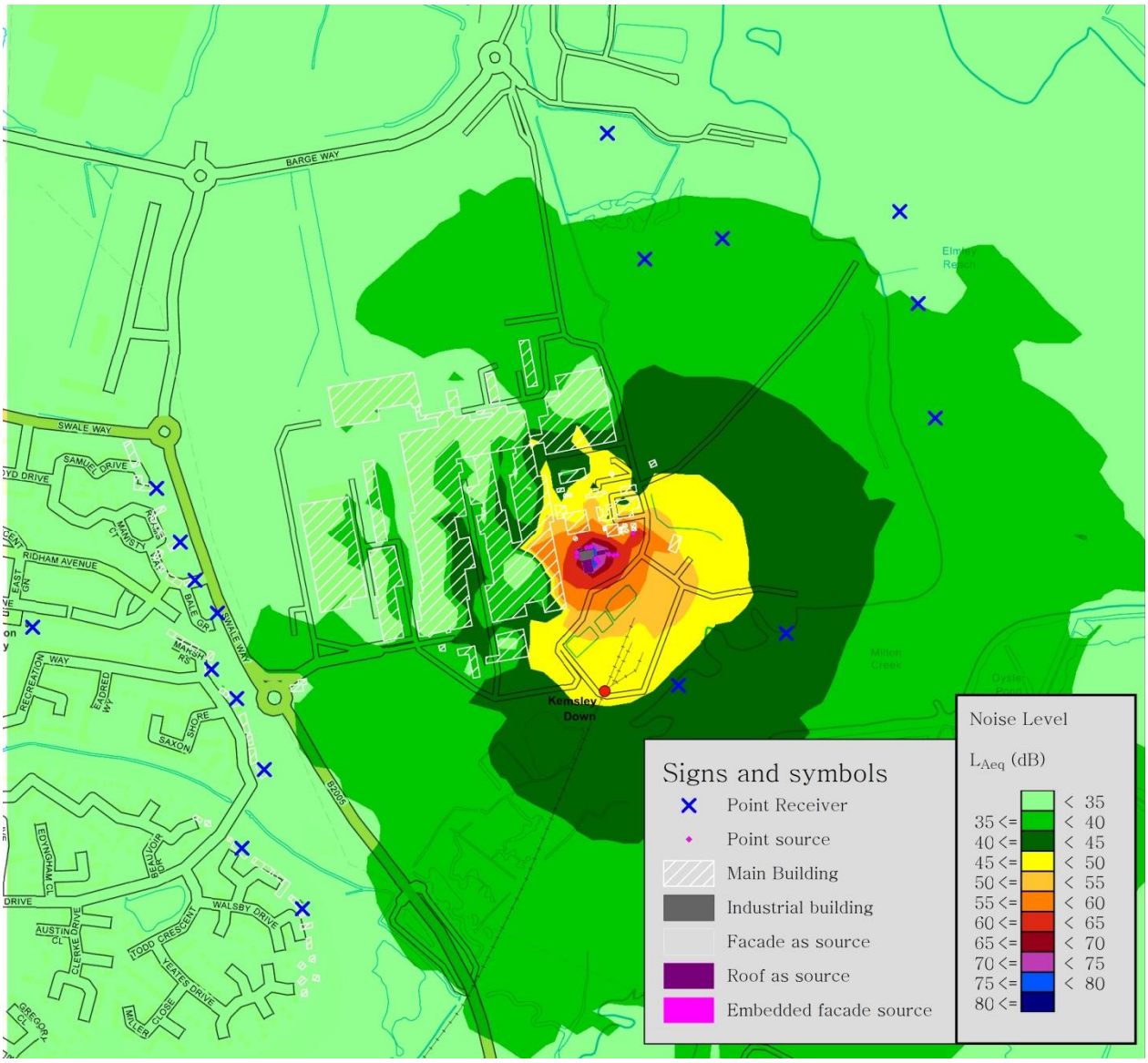

Figure 7.4: Operational Noise Contour – Normal Operation

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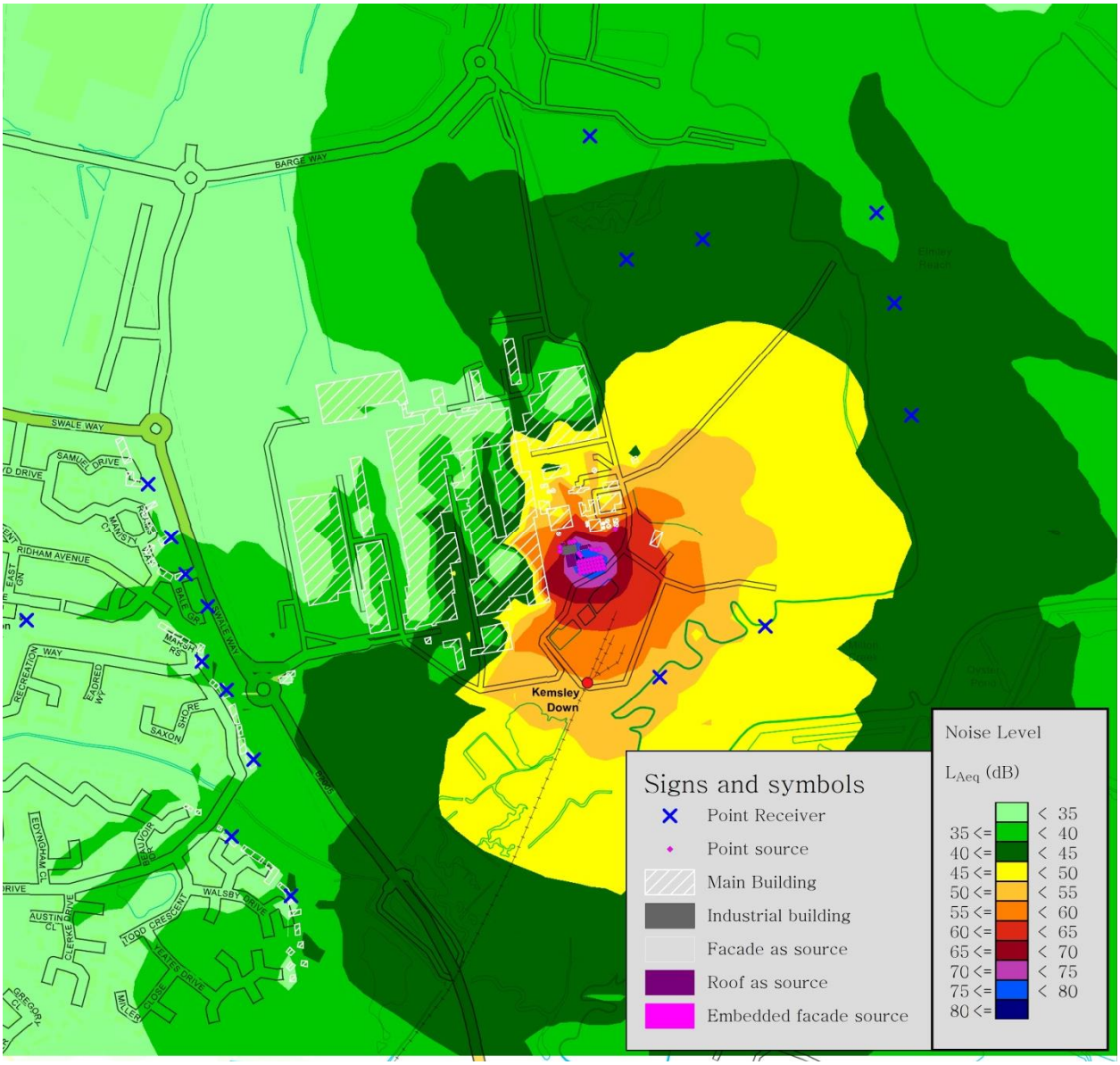

Figure 7.5: Operational Noise Contour – Normal Operation and Dump Condensers

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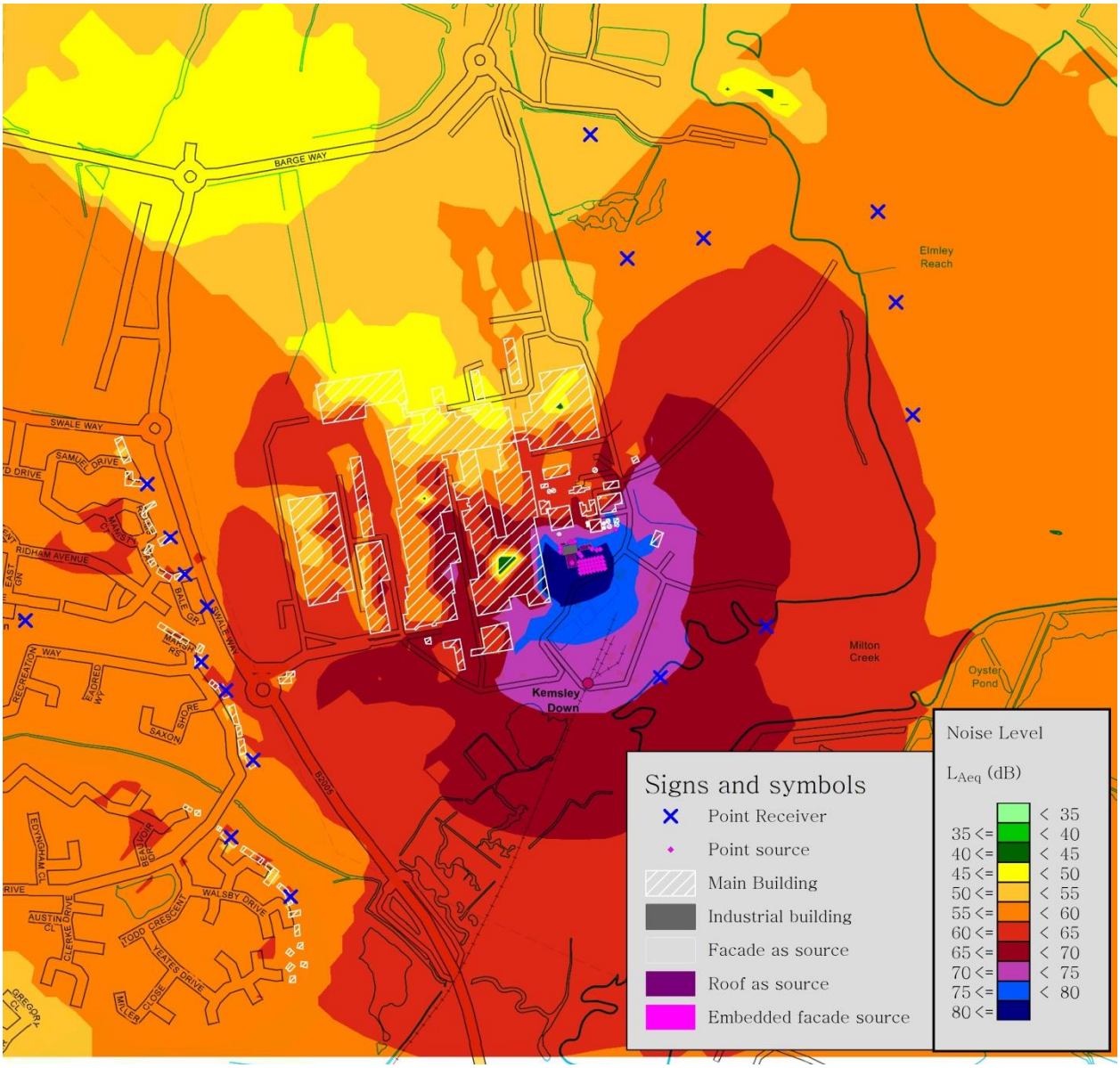

Figure 7.6: Operational Noise Contour – Normal Operation and Steam Release Valves

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