

SP MANWEB

Reinforcement to the North Shropshire Electricity Distribution Network



Document Reference: 6.4.1
Environmental Statement Appendix 4.1
Noise and Air Quality Technical Note

PINS Reference: EN020021
Regulation Reference: 5(2)(a)
November 2018

SP MANWEB

Reinforcement to the North Shropshire Electricity Distribution Network

APPENDIX 4.1

NOISE AND AIR QUALITY TECHNICAL NOTE

Environmental Statement

DCO Document 6.4 1

November 2018

PINS Reference EN020021

This page is intentionally blank

APPENDIX 4.1: NOISE AND AIR QUALITY TECHNICAL NOTE

1.1 INTRODUCTION

- 1.1.1 This appendix outlines the reasons for not considering further the effects of construction on noise and air quality within the Environment Statement (ES) (**DCO Documents 6.1 – 6.16**).
- 1.1.2 As per the e-mails attached as Annex A4.1.1 to this appendix, agreement was received to scope both potential noise and air quality effects out of the ES. Following this agreement, however, the extent of the Proposed Development was amended to include the works at Oswestry and Wem Substations, the lower voltage diversions and the 132kV underground cable.
- 1.1.3 It is considered that potential noise effects from construction work at the substations and for the 132kV underground cable and the lower voltage diversions will be short term and transient in nature, similar to those for the overhead line, and will be negligible. As the proposals now include a 132kV to 33kV transformer at Wem Substation a noise assessment for operation of the new transformer at Wem Substation has been undertaken and provided as Annex 4.1.2 to this document.

1.2 NOISE DURING CONSTRUCTION

- 1.2.1 Following receipt of the Scoping Opinion¹ and noting the Secretary of State (SoS) comments in respect to the potential effects of noise during construction, further consultation was undertaken with the Environmental Protection Team at Shropshire Council. Shropshire Council confirmed (see emails in Annex A4.1.1) they were content for noise during construction to be 'scoped out' of the Environment Impact Assessment (EIA) based on those discussions.

¹ <https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN020021/EN020021-000012-Scoping%20Opinion.pdf>

1.2.2 Table A4.1 details anticipated plant noise levels for typical construction plant:

Table A4.1 – Typical Plant Noise Levels for Constructing Overhead Lines		
Plant	BS5228 Ref	LAeq at 10m, dB
360 Excavator	C2 14-25	74
Dumper	D3 98 73	73
Tipper Lorries	C8 20	79
Concrete mixer lorry	C4 18-23	73

1.2.3 In discussions between SP Manweb and Shropshire Council's Environmental Health Officer² it was noted that in general there is a 6dBA reduction in noise level for a doubling of distance. Therefore based on the highest noise impact from Table A4.1 (Tipper Lorries: 79dBA at 10m), this reduces as follows: 20m = 72dBA, 40m = 66dBA, 80m = 60dBA, and 160m = 54dBA. The closest properties to any proposed wood pole location are the small grouping at Rednal Mill, between approximately 67m and 71m from the nearest wood pole and Avondale (near Wem sub-station), approximately 69m from the nearest wood pole. In addition there are only three further properties within 150m of a proposed location for a wood pole. Therefore all residential properties are at such a distance that any noise effects would be well below 65dBA noise threshold noted below.

² Meeting held on 30th May 2017

- 1.2.4 In the same meeting it was also agreed by Shropshire Council that potential noise effects on other receptors close to the Proposed Development, namely Public Rights of Way (PRoW), would not be considered significant due to their short-term transient nature.
- 1.2.5 The Category A³ noise level limit of 65dB LAeq is unlikely to be exceeded given the nature of the works to be undertaken, and therefore significant effects are not anticipated. Notwithstanding this there is the potential for further noise management as outlined below.
- 1.2.6 To ensure noise does not become an issue during construction activities the following principles are included within the Draft Construction Environmental Management Plan (CEMP (**DCO Document 6.3.2**)) and will be applied when relevant:
- generally limiting site work to daylight hours;
 - appropriate choice of plant and equipment such as low noise generators and quieter plant and equipment as far as reasonably practicable;
 - regular plant maintenance to keep plant in good working condition;
 - reducing noise from all vehicles, plant and equipment using effective exhaust silencers;
 - careful phasing of the proposed operations; and
 - in locations where there is the potential for noise disturbance, the provision of temporary barriers around static plant (pumps, generators) and equipment liable to create noise whilst in operation as suggested in Section 8 of British Standard 5228-1:2009 *Code of Practice for noise*

³ BS5228 contains example methods of determining the significance of construction noise. Method 1 'The ABC Method' examines absolute levels based on various threshold categories. Category A: threshold values are used when ambient noise levels are less than 65 dB LAeq,T for Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)

and vibration.

- 1.2.7 Should any unforeseen ground conditions be encountered then specific noise management measures would be implemented to reduce noise effects, for example temporary noise barriers (which typically reduce noise levels by 5-10dB). These would be set out within activity/location specific method statements following consultation with Shropshire Council.
- 1.2.8 SP Manweb understands that good stakeholder relations are often the most effective way to manage potential noise impacts on site. Therefore, local residents and other receptors would be informed of the progress of the works, including when and where the noisiest activities would be taking place and how long they would be expected to last. Any noise complaints would be effectively recorded, investigated and addressed. In addition, the measures to reduce noise effects are included within the draft CEMP (**DCO Document Ref 6.3.2**) which is secured by a Requirement to the draft DCO (**DCO Document 3.1**).
- 1.2.9 The potential effects of noise during the construction have not therefore been considered further.

1.3 NOISE DURING OPERATION AND MAINTENANCE

- 1.3.1 It was noted in the Scoping Opinion⁴ (para 3.25) that:

‘Due to the nature of the Proposed Development and its location, the SoS agrees that the following matters may be scoped out:noise during operation’.

- 1.3.2 As the Proposed Development now includes a new 132kV to 33kV transformer within an extension to the existing Wem Substation a noise assessment identifying relevant guidance, the background noise levels and closest noise sensitive receptors (NSRs) has been undertaken (see Annex

⁴ <https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN020021/EN020021-000012-Scoping%20Opinion.pdf>

4.1.2).

1.3.3 The ‘Assessment Methodology’ (see Section 4 of Annex 4.1.2) identified that relevant guidance is provided within British Standards BS4142: 2014 ‘Methods for Rating and Assessing Industrial and Commercial Sound’ and BS 8233: 2014 ‘Guidance on Sound insulation and Noise Reduction for Buildings’.

1.3.4 A baseline noise monitoring exercise was carried out in October 2018. The baseline noise levels at the NSRs in the area were determined primarily by distant road traffic. A summary of the measured noise levels (free-field levels) is provided in Table A4.1 below

Table A4.1

Parameter	LA90 (15 minutes) dB	
	Range	Modal
Daytime (07:00-23:00)	24 – 50	36
Night-time (23:00-07:00)	22 – 36	23

1.3.5 As the background sound levels are very low the assessment concluded that, in accordance with Section 11 of BS4142:2014, ‘Methods for Rating and Assessing Industrial and Commercial Sound’ it was appropriate to consider absolute noise levels as they affect the NSRs. The assessment then identifies a level of 40 dB LAr(T) (free-field) at the facades of the nearby residential properties which should not be exceeded.

1.3.6 SP Manweb intends to procure, from its specialist suppliers, a design of transformer, incorporating active control systems. It is intended that a rating noise limit of 40 dB LAr15min will be applied, and therefore the levels of noise would fall within the requirements of BS 4142:214 when absolute levels are

considered. The impact is therefore considered to be low.

- 1.3.7 Based on the above it is considered that operational noise can be scoped out of the EIA.

1.4 AIR QUALITY DURING CONSTRUCTION

- 1.4.1 Following receipt of the Scoping Opinion and noting the Secretary of State's comments in respect of the potential effects on air quality during construction, further consultation was undertaken with the Environmental Protection Team at Shropshire Council. They confirmed (see emails attached as Annex 4.1.1) that they were content for effects on air quality during construction to be 'scoped out' of the EIA based on the discussions and the following information.
- 1.4.2 The area in which the Proposed Development is located is rural in character. Levels of nitrogen oxide (NO²) and sulphur dioxide (PM₁₀) and other air pollutants associated with industrial and vehicle pollution are relatively low. Away from the roads, the current air environment comprises mainly natural sources.
- 1.4.3 Baseline conditions have been identified through a desk based review. This review was based on analysis of air quality monitoring data published on the UK Air Information Resource website⁵ and the Shropshire Council website.
- 1.4.4 The DEFRA website provides estimated background air pollution data for NO₂ and PM₁₀ for each 1km by 1km OS grid square across the UK6. This shows that baseline background levels of NO₂ and PM₁₀ are below the air quality objective level of 40 µg/m³ set by DEFRA's 2007 Air Quality Strategy for England, Scotland, Wales and Northern Ireland⁷.

⁵ <http://uk-air.defra.gov.uk/>

⁶ Baseline data is provided on the website for 2013

⁷ DEFRA (2007), The Air Quality Strategy for England, Scotland, Wales and Northern Ireland

1.4.5 In all instances the main source of NO₂ is road traffic.

1.4.6 Shropshire Council have four Air Quality Management Areas (AQMA):

- Bridgnorth Pound Street;
- Shrewsbury Town Centre;
- Bayston Hill; and
- Heathgates roundabout.

1.4.7 The closest of these AQMA to the Proposed Development is Heathgates roundabout, which is over 14km distant and therefore none of the AQMA will be affected by the Proposed Development.

1.4.8 The area in which the Proposed Development is located is sparsely populated with most of the population living in scattered farms, hamlets or villages. The main centres of population within approximately 2km of the Proposed Development are listed below:

- Oswestry, Whittington, Babbinswood, Cockshutt, Loppington and Wem are the larger areas of settlement within 2km of the Proposed Development at its closest point; and
- Middleton, Rednal, Hordley, Lower Hordley, Bagley, Burlton, English Frankton, Noneley and Commonwood, Ruewood, Tilley, Horton are the smaller areas of settlement within 2km of the Proposed Development at its closest point.

1.4.9 Sensitive ecological sites are those which have designated features that are sensitive to air pollutants, either directly or indirectly, and could be adversely affected by the effect of air pollution. There is one ecologically designated site close to the route. Ruewood SSSI is located approximately 250m south of the Order Limits for the overhead line at its closest point. The poles would be located in arable land/field edges where the soil quality means that air pollution (e.g. dust) from placing the wood poles would not be an issue.

- 1.4.10 Air quality impacts that may arise during construction activities include:
- Dust deposition, from pole excavation;
 - Elevated PM¹⁰ concentrations, as a result of dust generating activities on site; and
 - An increase in concentrations of airborne particles and NO² due to exhaust emissions from diesel powered vehicles and equipment⁸ used on site and on the road network.
- 1.4.11 An indicative construction programme is provided in Chapter 3 'The Proposed Development (**DCO Document 6.3**). For a Trident wood pole line an allowance of 1.5km per week is made for construction. However each wood pole structure is likely to be constructed in a single operation within one to two days. For the underground cable the duration of works is expected to be two months. Works at Oswestry and Wem Substation are expected to take approximately two months and six months respectively.
- 1.4.12 Site clearance and reinstatement works would be phased throughout the construction programme, thereby minimising the length of exposure of areas of bare ground and potential for dust generation.
- 1.4.13 SP Manweb's experience of assessing the exhaust emissions from on-site plant and site traffic suggests that they are unlikely to make a significant impact on local air quality, and do not therefore need to be quantitatively assessed. As requested by Shropshire Council construction traffic will avoid the centre of Wem, thereby not creating a potential air pollution problem in Wem.
- 1.4.14 The emissions of pollutants and creation of dust from on-site vehicles, plant and construction activities will be minimised as far as is practicable by measures incorporated within the draft CEMP (**DCO Document 6.3.2**), which

⁸ In the UK the maximum permitted sulphur content of fuels used in road and off-road applications is 10ppm, and therefore sulphur dioxide is not long a significant pollutant from these sources.

is secured by a Requirement to the draft DCO (**DCO Document 3.1**). These measures include:

- Ensuring all vehicle movements are kept to the absolute minimum;
- Rigorously enforcing appropriate speed limits for all construction vehicles on site to minimise dust generation through the use of signage and tool box talks;
- The (Environmental / Ecological Clerk of Works) ECoW will carry out check of the Contractors vehicles to ensure low emission vehicles and plant fitted with catalyts, diesel particulate filters or similar devices are utilised where practicable;
- The ECoW will carry out checks to ensure plant is well maintained, with routine servicing of plant and vehicles to be carried out in accordance with manufacturer's recommendations by the Contractor;
- Requiring that all construction vehicles hold current MOT certificates;
- Requiring all vehicles to switch off engines when not in use;
- Minimising the use of diesel or petrol powered generators and using mains electricity or battery powered equipment where practicable;
- No burning of waste materials to be permitted on site;
- Vehicle loads to be sheeted during the transportation of loose or potentially dusty material or spoil; and
- Regular cleaning of site work areas and wheel washing facilities if necessary.

1.4.15 Based on the above, there is no potential for significant air quality effects associated with the construction of the Proposed Development.

1.4.16 The potential effects on air quality during the construction, of the Proposed Development have not therefore been considered further.

1.5 AIR QUALITY DURING OPERATION AND MAINTENANCE

1.5.1 It was noted in the Scoping Opinion⁹ (para 3.25) that:

‘Due to the nature of the Proposed Development and its location, the SoS agrees that the following matters may be scoped out:air quality during operation’.

1.5.2 The potential effects on air quality during the operation and maintenance of the Proposed Development have not therefore been considered further.

⁹ <https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN020021/EN020021-000012-Scoping%20Opinion.pdf>

1.6 ANNEX A4.1.1

From: [Matthew Clark](#)
To: [Zac Ford](#)
Subject: RE: North Shropshire Reinforcement - Stakeholder Meeting 6
Date: 04 September 2017 10:33:50
Attachments: [image006.jpg](#)
[image007.png](#)
[image008.png](#)
[image009.png](#)
[image010.gif](#)
[image011.png](#)
[image012.gif](#)

Morning Zac,

I have had a look through the information provided and can confirm that no further detail is required in relation to noise and air quality however it will be important that the document provided is submitted with any future application etc. in order that it can be noted that these elements have been addressed. In relation to noise a statement to say that times of any works will be restricted to 07:30 – 18:00 Monday to Friday, 08:00 – 13:00 Saturday with no Sundays or bank holidays should be provided to ensure that Shropshire Council guidelines are followed on this front.

Kind Regards,

Matthew Clark - Professional Officer
Regulatory Services - Environmental Protection Team
Public Health
Shropshire Council

Tel: 01743 251708

Email: matthew.clark@shropshire.gov.uk



[Public Protection on facebook](#)

From: Zac Ford [mailto:Zac.Ford@gillespies.co.uk]
Sent: 01 September 2017 10:34
To: Matthew Clark <matthew.clark@shropshire.gov.uk>
Subject: [CAUTION] FW: North Shropshire Reinforcement - Stakeholder Meeting 6

** CAUTION
** It has not been possible to verify the sender of this e-mail as the sender's
** e-mail domain does not have an SPF record. This means the sender's
** e-mail address may be spoofed and used for SPAM or Malware distribution.
** Treat the e-mail with caution, and if in doubt contact the sender.
** If you need further help please email its_helpdesk@shropshire.gov.uk

Hello Matthew

You may remember that we met on 30 May 2017 at Shropshire Council in a meeting on the proposed North Shropshire Reinforcement Project.

The assessment process is continuing and it is intended for the statutory consultation process to begin in November 2017. As part of this process we will submit a Preliminary Environmental Impact Report providing details of the proposals and any potentially significant environmental impacts.

I would be grateful if you could confirm that Shropshire Council are content for Air Quality and Noise to be scoped out of the ES assessment, during both construction and operational phases, based upon the relevant

meeting notes within point 5 of the attached minutes (which were previously issued to Shropshire Council on 7 June 2017).

Within the PEIR we would confirm the points discussed during our meeting – please see the attached Statutory Nuisance wording which provides draft wording based on our discussions. For your ease of reference I have highlighted the areas which relate to the meeting notes.

I look forward to your response.

Regards

Zac

Zachary Ford
Landscape Architect
GILLESPIES LLP

Westgate House
44 Hale Road, Hale
Cheshire, WA14 2EX
T: +44 (0)161 928 7715
www.gillespies.co.uk

2016 Landscape Institute Awards Highly Commended: Crossrail Place Roof Garden
2016 MIPIM Awards Winners: Queen Elizabeth University Hospital & Crossrail Place Roof Garden
2015 Landscape Institute Awards Winner: [National Park Landscape Sensitivity and Capacity Study](#)
2015 Landscape Institute Awards Highly Commended: [Wind Turbines and Pylons: Guidance on Separation Distances](#)
2015 Landscape Institute Awards Highly Commended: [National Grid Protected Landscapes Study](#)



From: Edwards, Steven [<mailto:Steven.Edwards@spenergynetworks.co.uk>]
Sent: 07 June 2017 16:39
To: Edward West (edward.west@shropshire.gov.uk) <edward.west@shropshire.gov.uk>
Cc: Zac Ford <Zac.Ford@gillespies.co.uk>; SPENNS@camargue.uk
Subject: North Shropshire Reinforcement - Stakeholder Meeting 6 [Filed 07 Jun 2017 16:40]

Eddie,

Thanks for your and your colleagues' time to meet last week. I enclose a copy of our meeting notes for your records and ask you to please note actions.

Regards

Steve Edwards

cid:image001.gif@01CA4CB9.702F4FD0



Land & Planning
Senior Environmental Planner

Tel: 0141 614 5656 / 07793980975

PA_17_shortlist



=====

Please consider the environment before printing this email.

If you have received this message in error, please notify the sender and immediately delete this message and any attachment hereto and/or copy hereof, as such message

contains confidential information intended solely for the individual or entity to whom it is addressed. The use or disclosure of such information to third parties is prohibited by law and may give rise to civil or criminal liability.

The views presented in this message are solely those of the author(s) and do not necessarily represent the opinion of Scottish Power Energy Networks Holdings Ltd. or any company of its group. Neither Scottish Power Energy Networks Holdings Ltd. nor any company of its group guarantees the integrity, security or proper receipt of this message. Likewise, neither Scottish Power Energy Networks Holdings Ltd. nor any company of its group accepts any liability whatsoever for any possible damages arising from, or in connection with, data interception, software viruses or manipulation by third parties.

=====

Registered office: Westgate House, 44 Hale Road, Hale, Cheshire, WA14 2EX T: +44 (0)161 928 7715 Partnership Number: OC303988 VAT Number: 260 037 887

This message is intended only for the individual(s) named. If you are not a named addressee you should delete the email from your system and you should not disseminate it. Email cannot be guaranteed as secure or error-free. Gillespies LLP does not accept liability for any errors or omissions in email and these contents do not give rise to any binding legal obligation upon Gillespies LLP unless confirmed on business notepaper. The company email is swept for viruses but Gillespies LLP cannot accept responsibility for any loss or damage arising from the use of this email or attachments.



Please consider the environment before printing this email

***** If you are not the intended recipient of this email please do not send it on to others, open any attachments or file the email locally. Please inform the sender of the error and then delete the original email. *****

1.7 ANNEX A4.1.2



ACOUSTIC CONSULTANTS LTD

Proposed Substation Extension
Wem, Shropshire

Noise Assessment

Reference: 7405/BL
November 2018



Proposed Substation Extension
Wem, Shropshire

Noise Assessment

Client:

Scottish Power Energy Networks
3 Prenton Way
Prenton
Merseyside
CH43 3ET

Noise and Acoustic Consultant:

Acoustic Consultants Limited
Raleigh House
Wellsway
Keynsham
Bristol
BS31 1HS

Prepared by:

Blake Lucas BEng (Hons) MIOA

Checked by:

Daniel Oldaker BSc. (Hons), MIOA

Issue Number:

Revision B

Date:

5th November 2018



Table of Contents

1.	Introduction	4
2.	The Site	5
3.	Planning and Noise	6
4.	Assessment Methodology	9
5.	Baseline Noise Monitoring	13
6.	Proposed Noise Limits	17
7.	Summary and Conclusions	19
8.	Glossary of Acoustic Terminology	20
9.	Limitations	22



1. Introduction

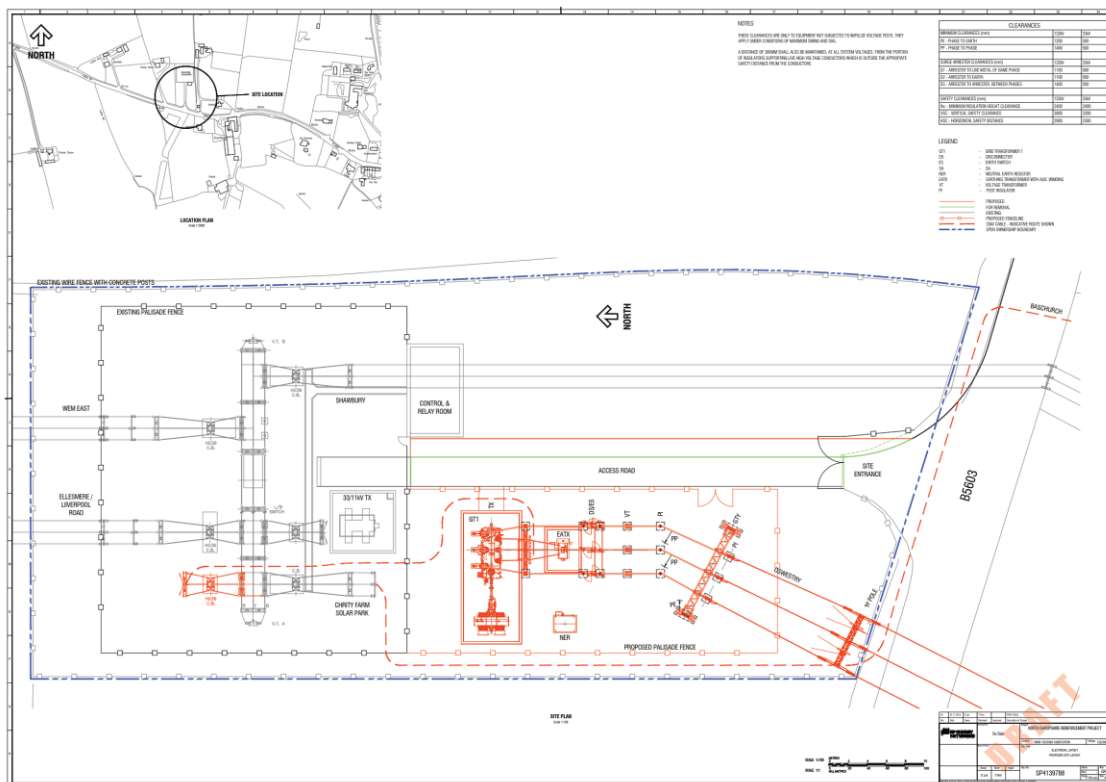
SP Energy Networks appointed Acoustic Consultants Limited to carry out a site noise monitoring survey to determine appropriate noise limits for proposed substation extension (including a 132kV transformer) in Wem, Shropshire in support of an application for an Order granting Development Consent.

The report identifies relevant planning and noise policies and guidance, establishes environmental noise levels and provides noise limiting criteria.

The noise limits have been determined in accordance with the guidance in the National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE), National Planning Practice Guidance (NPPG) and British Standard 4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound' (BS4142).

The proposed substation extension layout is as follow:

Figure 1: Proposed Substation Extension Layout



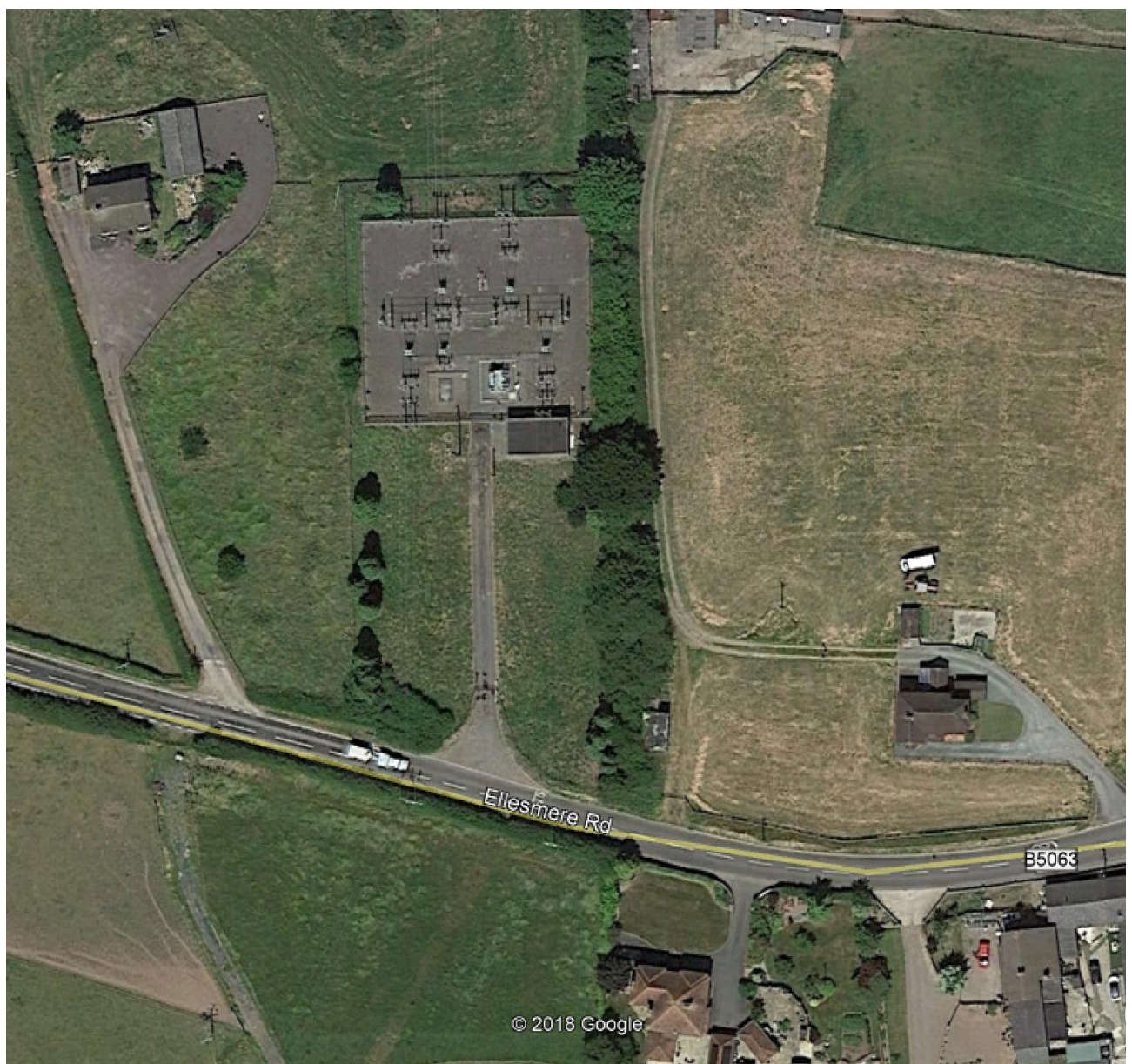


2. The Site

The proposed substation extension is on land within the existing substation boundary, to the south of the existing substation equipment, off Ellesmere Road, Wem, Shropshire. To the north of the site are existing transformers, to the south is Ellesmere Road. There are existing residential properties on all boundaries of the site with the closest being within 30m of the southern boundary.

The substation location is as follows:

Figure 2: Existing Substation Location





3. Planning and Noise

3.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was published in March 2012 and revised in July 2018. Section 15 entitled 'Conserving and enhancing the natural environment' addresses noise as a requirement of planning. Paragraph 170 states:

"170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

Paragraph 180 states:

"180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life¹*
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
- c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation. "*

The document does not prescribe any assessment methodology or criteria to assess the adverse effect of noise.

¹ See Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food & Rural Affairs, 2010)



3.2. Noise Policy Statement for England

The NPPF refers to the Noise Policy Statement for England (NPSE). This was published in March 2010 by DEFRA and 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. It applies to all forms of noise including environmental noise, neighbour noise and neighbourhood noise. The NPSE introduces the **concept of “Significant Adverse” and “Adverse” impacts of noise. These are applied as follows:**

NOEL – No Observed Effect Level

This is the level of noise exposure below which no effect at all on health or quality of life can be detected.

LOAEL – Lowest Observed Adverse Effect Level

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

SOAEL – Significant Observed Adverse Effect Level

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

The NPSE does not provide any assessment criteria for the noted effect levels.

3.3. National Planning Practice Guidance, Noise

The National Planning Practice Guidance (NPPG) on noise referred to here is based on the current version (January 2015) as provided on the Planning Guidance Website. It states that ***“Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment.”***

It provides generic guidance on how to determine the noise impact and what factors could be a concern. It includes the option types to mitigate any adverse effects of noise stating that there are four broad types of mitigation.



These are engineering, layout, using planning conditions or obligations and noise insulation. Paragraph 5 of the NPPG provides a table identifying the effect level and examples of effect relating to the impact effect levels provided in the NPSE. The table is duplicated below:

Table 1: NPPG Noise – Perception of Effect Levels

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	
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	
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

The table does not provide any objective assessment which equates to the noted effect levels however the NPPG identifies that where noise is audible it is not necessarily intrusive. The effect and impact on people is based primarily on the level of noise.



4. Assessment Methodology

The following section identifies guidance which is considered to provide noise criteria equivalent to or below the LOAEL described in NPPG and NPSE, i.e.

“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.”

4.1. British Standard 4142:2014

For substation noise the most relevant guidance is provided within British Standard 4142:2014. The British Standard 4142:2014 entitled ‘Method for rating and assessing industrial and commercial sound’ was published on the 31st October 2014.

The methods described in the British Standard use outdoor sound levels to assess the likely effects of sound upon people who might be inside or outside a dwelling or other premises used for residential purposes. The principle is that of establishing the ‘difference’ between the ‘rating level’ and the ‘background sound level’.

The ‘rating level’ is the ‘specific sound level’ of the source over a period of one hour during the day (07:00 to 23:00 hours) and over a period of 15 minutes during the night (23:00 to 07:00 hours). Section 9 entitled ‘Rating Level’ states:

“Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level.”

An acoustic character correction should be added to the ‘specific sound level’ if it exhibits any tonality, impulsivity, other specific characteristics and/or intermittency at the assessment location. The value of the character correction varies, dependent on the prominence of the character of the sound source at the assessment location.

In Section 11 of the Standard, entitled ‘Assessment of the Impacts’, it states:

“Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9), and consider the following.



- *Typically, the greater this difference, the greater 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.*
- *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."*

Based on the initial assessment outcomes as set out in British Standard 4142, and the context for the proposed extension to the substation, it is our opinion the NOEL, LOAEL and SOAEL levels stated in the Noise Policy Statement for England would generally fall within the following categories when considered in conjunction with the effect levels of the NPPG Noise.

- NOEL – The No Observed Effect Level is considered to apply where the rating level does not exceed the background sound level (less than or equal to 0dB) would fall within the No Effect level or No Observed Adverse Effect level of the NPPG Noise.
- LOAEL – The Lowest Observed Adverse Effect Level is considered to fall between a difference of 0dB (where according to British Standard 4142:2014 the impact is low) and 5dB (where according to British Standard 4142:2014 there is a likely indication of adverse impact).
- SOAEL – The Significant Observed Adverse Effect Level is considered to fall between a difference of 5dB (where according to British Standard 4142:2014 there is a likely indication of adverse impact) and 10dB (where according to British Standard 4142:2014 there is a likely indication of significant adverse impact). A difference in excess of 10dB is expected to result in an unacceptable adverse effect and therefore exceeds the significant observed adverse effect level.

In all instances, the context needs to be considered when determining the overall impact and Observed Effect Level. In terms of context British Standard 4142:2014 states:

"Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.



- 1) *Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night. Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.*
- 2) *The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.*

NOTE 3 Consideration ought to be given to evidence on human response to sound and, in particular, industrial and/or commercial sound where it is available. A number of studies are listed in the “Effects on humans of industrial and commercial sound” portion of the “Further reading” list in the Bibliography.

- 3) *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:*
 - i) *façade insulation treatment;*
 - ii) *ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*
 - iii) ***acoustic screening.”***



4.2. British Standard 8233

With regard to “absolute levels” as stated in section 11 of BS4142:2014, the most relevant guidance is British Standard 8233:2014 entitled “Guidance on Sound insulation and Noise Reduction for Buildings. Section 7.7.2 Table 4 of the British Standard provides internal ambient noise levels for dwellings from noise sources ‘without a specific character’ and are based on existing guidelines issued by the World Health Organisation 1999.

The British Standard guideline states that noise levels should not exceed those as noted in Table 4 of the British Standard and this is summarised below:

Table 2: British Standard 8233:2014 Internal Ambient Noise Level Criteria

Activity	Location	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Resting	Living Room	35 dB $L_{Aeq,16\text{ hour}}$	-
Dining	Dining Room/area	40 dB $L_{Aeq,16\text{ hour}}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16\text{ hour}}$	30 dB $L_{Aeq,8\text{ hour}}$

For industrial noise with a specific character it may be more appropriate to consider the above noise criteria in terms of the Rating Level as defined in BS4142:2014. This would include any appropriate corrections for the character of the sound.



5. Baseline Noise Monitoring

A noise monitoring exercise was undertaken at the monitoring location on Figure 3 below commencing at 15:30 hours on the 5th October 2018 and finishing at 14:15 hours on the 8th October 2018. The survey was completed in accordance with BS4142:2014.

5.1. Monitoring Equipment

Sound Pressure Levels were measured using a sound level analyser with half-inch condenser **microphone, using the ‘fast’** setting. The equipment is checked regularly using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2017 **entitled “General requirements for the competence of testing and calibration laboratories”**; in accordance with British Standard EN 10012:2003 **“Measurement management systems. Requirements for measurement processes and measuring equipment”**; and traceable to the National Standards. This equipment was checked and calibrated as noted below.

Table 3: Monitoring Equipment

Equipment Description / Manufacturer / Type	Serial number	Date of calibration	Calibration Certification Number
SLM, Cirrus Research, CR:171C	G071684	27/03/2018	258512
Cirrus Research, Microphone, MK224	606369B	27/03/2018	117727
Calibrator, Cirrus Research, CR:515	73217	27/03/2018	117728

The measuring system was checked for calibration before and after the tests and no significant drift was detected.

5.2. Weather Conditions

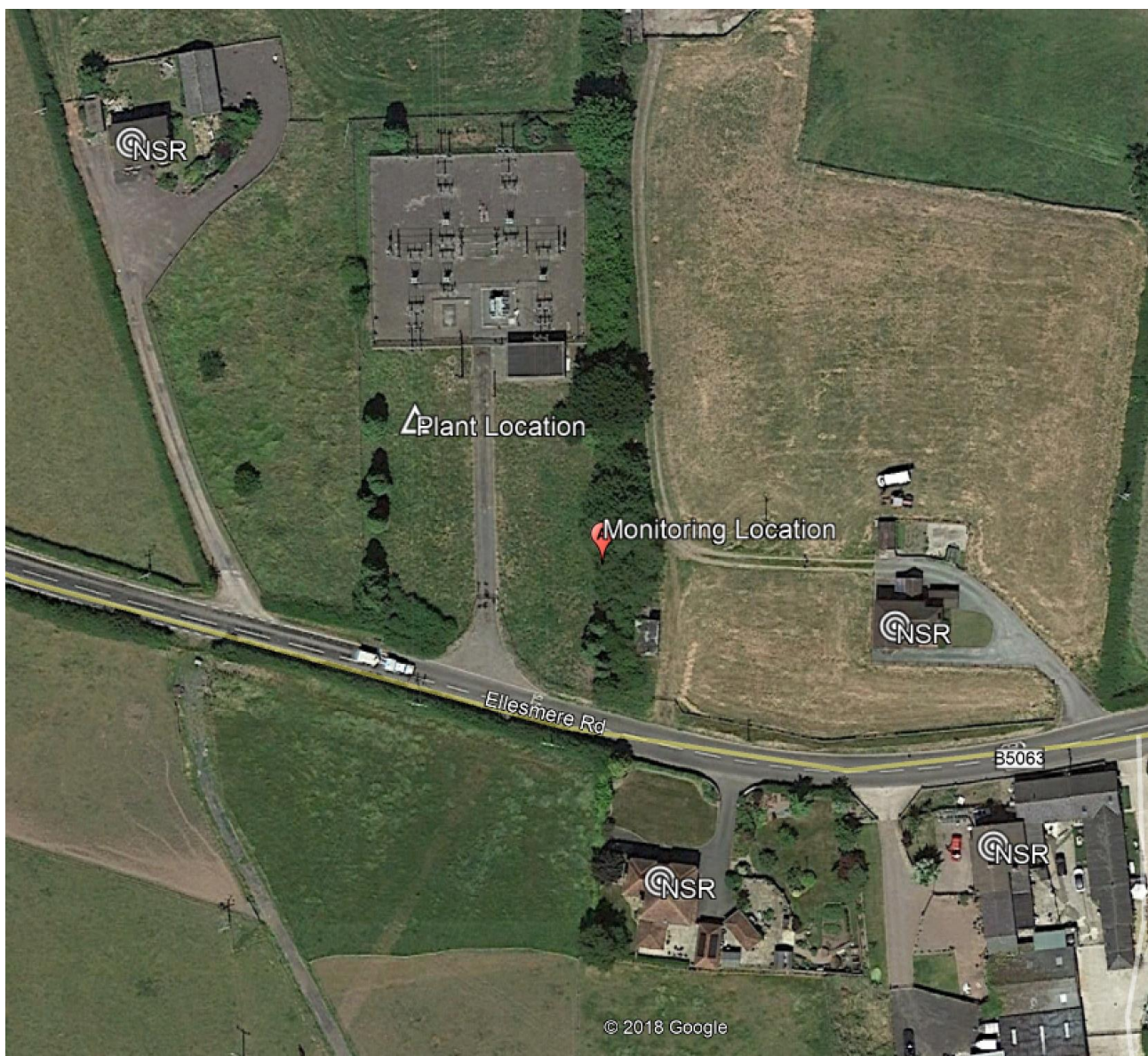
The conditions were generally dry, with an average air temperature of 18 degrees Celsius throughout measurement, with a westerly wind which was generally less than 5 metres per second. These conditions **are** not expected to have had a significant effect on the measured levels and are within the requirements of Section 6 of BS4142:2014.

5.3. Monitoring Procedure

The monitoring location 'A' was located within the existing site adjacent to the boundary with the noise sensitive receptors (NSRs) to the east. The microphone was situated on a tripod at a height of 1.5 metres above the ground, in a free-field position. The monitoring position is considered representative of the NSRs in the area.

The baseline noise levels at the NSRs in the area were determined primarily by distant road traffic. Figure 3 below provides the monitoring location and nearest NSRs.

Figure 3: Monitoring Location and NSRs

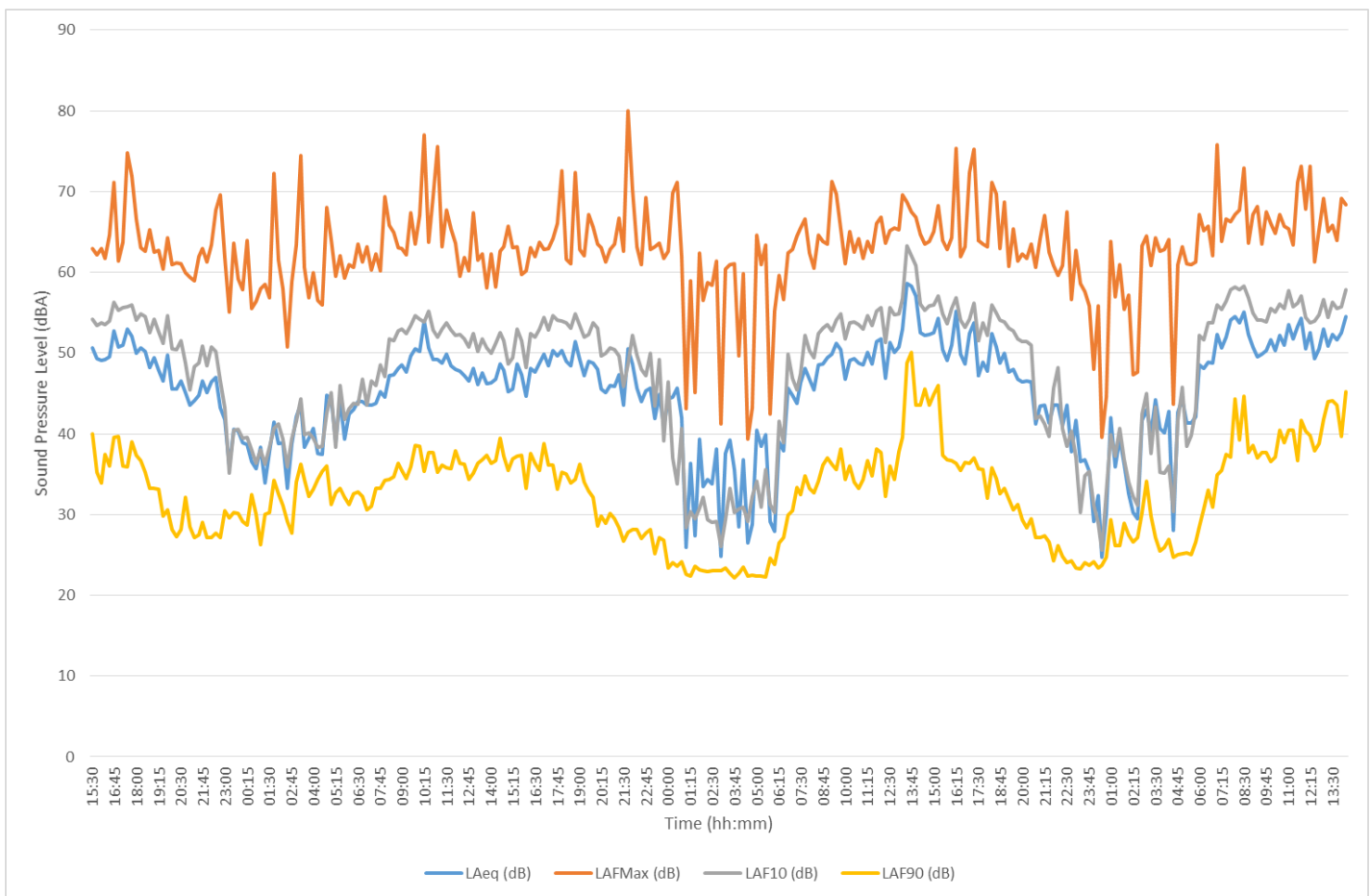




5.4. Measured Baseline Noise Levels

The noise monitoring location is considered representative of the NSRs in the vicinity of the proposed substation extension in the vicinity in terms of British Standard 4142:2014. The variation in A-weighted baseline background sound levels ($L_{A9015min}$) and equivalent noise levels ($L_{Aeq15min}$) are provided below in chart format, the chart also includes the maximum noise level (L_{AFmax}) and 10th percentile level ($L_{A1015min}$). Tabular data is available upon request.

Chart 1: Measured baseline noise levels (free-field levels)



From the measured data we have determined the following typical background sound level over the monitoring period. The levels are free-field levels.

Table 4: Summary of Measured Noise Levels (free-field levels)

Parameter	L_{A90} (15 minutes) dB	
	Range	Modal
Daytime (07:00-23:00)	24-50	36
Night-time (23:00-07:00)	22-36	23



The following charts also provide the modal analysis of the background sound level over the measurement period.

Chart 2: Daytime Modal Analysis of $L_{A90}(15\text{minutes})$

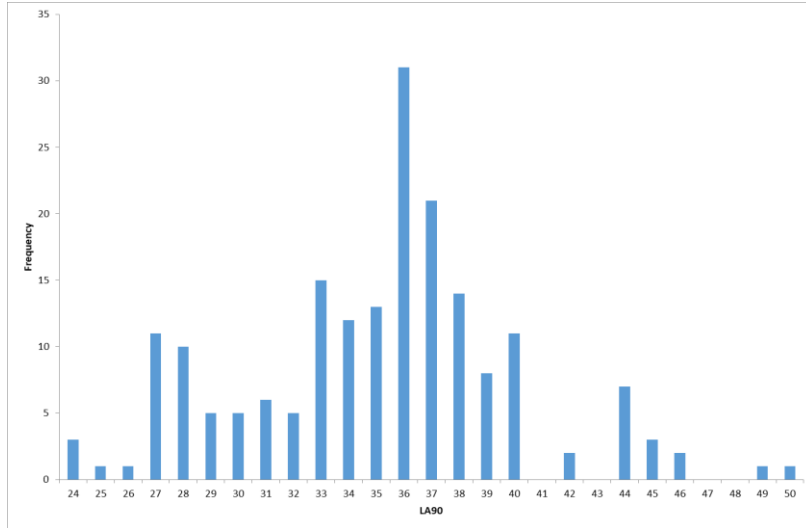
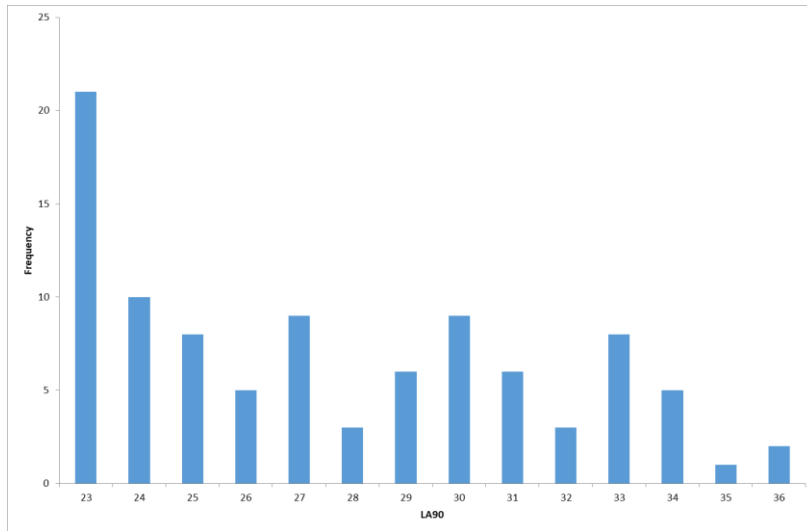


Chart 3: Night-time Modal Analysis of $L_{A90}(15\text{minutes})$



We would consider the above modal background sound level and equivalent noise level to be typical for the NSRs.



6. Proposed Noise Limits

The proposed substation equipment (including the 132kV to 33kV transformer) will be procured from selected manufacturers. **It is intended that the procurement will include a noise limit based on the survey results (see below).**

6.1. Noise Limits based on Noise Climate

The noise limits provided in Table 5 are based on achieving a BS4142:2014 assessment 'difference' of 0 decibels. **According to the British Standard a difference of 0 decibels is an indication of the specific sound source having a low impact, depending on the context.**

The noise limits are the cumulative noise levels from the development when assessed at the locations of the nearby NSRs. The free-field noise limits are as follows:

Table 5: Free-Field Noise Limits for Substation Equipment

Time Period	Noise Limits
Daytime(07:00-23:00 hours)	36 dB L _{Ar} (15 minutes)
Night-time (23:00-07:00 hours)	23 dB L _{Ar} (15 minutes)

The noise limits are Rating levels which include corrections for the character of the noise.

Where noise from the substation equipment is observed to have character (such as tonal, impulse, intermittent or has other characteristics) at the NSRs which is likely to attract attention a correction for the character should be applied when determining the rating level as per the method of BS4142:2014.

6.2. Noise Limits based on Absolute Noise Levels

As the background sound levels are very low, in accordance with Section 11 of BS4142:2014, it is considered more appropriate to propose absolute noise levels as they affect the NSRs.

As stated in Section 4.2 of this report the most appropriate absolute noise criteria is provided within British Standard 8233:2014. This document advises an internal noise limit of 30 dB L_{Aeq}(8 hour) within bedrooms at night.



We would advise that for specific industrial noise sources this criteria is based on a rating level taking into consideration the character of the sound and is assessed over the duration of continuous operation rather than a night time average.

Based on the above the proposed noise limit for the substation equipment should not exceed a rating level of 40 dB $L_{A(T)}$ (free-field) at the facades of the nearby residential properties. This is on the basis a partially open window achieves a sound level difference of 10 dB (as defined in BS8233/WHO1999).



7. Summary and Conclusions

SP Energy Networks appointed Acoustic Consultants Limited to carry out a site noise monitoring survey to determine appropriate noise limits for proposed substation extension (including a 132kV transformer) in Wem, Shropshire in support of an application for an Order granting Development Consent.

The report identifies relevant planning and noise guidance, establishes environmental noise levels and provides noise limiting criteria.

The noise limits have been determined in accordance with the guidance in the National Planning Policy Framework (NPPF), Noise Policy Statement for England (NPSE), National Planning Practice Guidance (NPPG) and British Standard 4142:2014 (BS4142).

A noise monitoring exercise was undertaken in October 2018. The purpose of which was to determine the background sound levels for the area representative of the NSRs in the vicinity of the existing Wem Substation.

Noise limits have been **provided based on achieving a BS4142:2014 assessment 'difference' of 0 decibels**. According to the British Standard a difference of 0 decibels is an indication of the specific sound source having a low impact, depending on the context.

The background sound levels are 36 dB $L_{A90(1hour)}$ during the day and 23 dB $L_{A90(15minutes)}$ at night.

The background sound levels are very low. In accordance with Section 11 of BS4142:2014 it is considered more appropriate to consider absolute noise levels as they affect the NSRs. Alternative noise limits of a rating level of 40 dB $L_{Ar(T)}$ (free-field) at the facades of the nearby residential properties have therefore been set out on this basis.



8. Glossary of Acoustic Terminology

A-weighted sound pressure p_A – value of overall sound pressure, measured in pascals (Pa), after the electrical signal derived from a microphone has been passed through an A-weighting network

A-weighted sound pressure level, L_{pA} - quantity of A-weighted sound pressure given by the following formula in decibels (dBA)

$$L_{pA} = 10 \log_{10} (p_A/p_0)^2$$

where:

p_A is the A-weighted sound pressure in pascals (Pa);

p₀ is the reference sound pressure (20 μPa)

Background sound level, L_{A90,T} – A-weighted sound pressure level that is exceeded by the residual sound assessment location for 90% of a given time interval, T, measured using weighting F and quoted to the nearest whole number of decibels

Decibel (dB) – The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithms are taken to base 10. Hence an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

Equivalent continuous A-weighted sound pressure level, L_{Aeq,T} – value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, T = t₂ – t₁, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:



$$L_{AeqT} = 10 \lg_{10} \left\{ (1/T) \int_{t_1}^{t_2} [p_A(t)^2 / p_0^2] dt \right\} \quad (1)$$

where:

p_0 is the reference sound pressure (20 μ Pa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure (Pa) at time t

NOTE The equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.

Free-field level – sound pressure level away from reflecting surfaces. Measurements made 1.2 m to 1.5 m above the ground and at least 3.5 m away from other reflecting surfaces are usually regarded as free-field. To minimize the effect of reflections the measuring position has to be at least 3.5 m to the side of the reflecting surface (i.e. not 3.5 m from the reflecting surface in the direction of the source).

Octave and Third Octave Bands – The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz and is generally more sensitive to medium and high frequencies than to low frequencies within the range. There are many methods of describing the frequency content of a noise. The most common methods split the frequency range into defined bands, in which the mid-frequency is used as the band descriptor and in the case of octave bands is double that of the band lower. For example, two adjacent octave bands are 250 Hz and 500 Hz. Third octave bands provide a fine resolution by dividing each octave band into three bands. For example third octave bands would be 160 Hz, 250 Hz, 315 Hz for the same 250 Hz octave band.

Sound pressure level – Sound pressure level is stated on many of the charts. It is the amplitude of the acoustic pressure fluctuations in a sound wave, fundamentally measured in Pascals (Pa), typically from 20 micro-Pascals to 100 Pascals, but commonly simplified onto the decibel scale.

Specific sound level, $L_s = L_{Aeq,Tr}$ – equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r .

Rating level, $L_{Ar,Tr}$ – Specific sound level plus any adjustment for the characteristic features of the sound.

Weighted sound reduction index, R_w – Single-number quantity which characterizes the airborne sound insulating properties of a material or building element over a range of frequencies. The weighted sound reduction index is used to characterize the insulation of a material or product that has been measured in a laboratory (see BS EN ISO 717-1).



9. Limitations

The report limits itself to addressing solely on the noise aspects as included in this report. We provide advice only in relation to noise and acoustics. It is recommended that appropriate expert advice is sought on all the ramifications (e.g., CDM, structural, condensation, fire, legal, etc.) associated with any proposals in this report or as advised and concerning the appointment.

The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above.

The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

It should be noted that noise predictions are based on the current information as we understand it and on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.



ACOUSTIC CONSULTANTS LTD

Raleigh House, Wellsway, Keynsham, Bristol BS31 1HS

T: 0117 986 2956 E: mail@acoustic-ltd.co.uk www.acoustic-ltd.co.uk

Incorporated in the UK as Acoustic Consultants Limited. Registered Office: Raleigh House, Wellsway, Keynsham, Bristol BS31 1HS. Registered No: 8544901.