Report VA4245.220809.NIA1.2

Shell Welwyn Garden City
Stanborough Road

Noise Impact Assessment

09 August 2022

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Contents

Attachments

1. Introduction

As part of the works being undertaken at Shell Welwyn Garden City, Stanborough Road, it is intended to install four new EV charging stations as well as new cooling plant to service the building.

Venta Acoustics has been commissioned by JMS Planning & Design to undertake an assessment of the potential noise impact of the new plant on nearby noise sensitive receivers, as required by Welwyn Hatfield Council.

An environmental noise survey was undertaken to determine the background noise levels at the site as well as the sound levels generated by the surrounding premises. These levels were then used to undertake an assessment of the likely impact with reference to the methodology in BS4142:2014 *Methods for rating and assessing industrial and commercial sound*, BS8233: 2014 *Guidance on sound insulation and noise reduction for buildings.*

All staff at Venta Acoustics are fully qualified and members of the Institute of Acoustics, the recognised UK professional body for acoustics, noise and vibration professionals and are fully competent to undertake BS4142 assessments.

2. Site Description

As illustrated on attached site plan VA4245/SP1, the site is located to the north of Stanborough Road, with residential dwellings located immediately to the north, west and south-east.

The most affected noise sensitive receivers are expected to be the rear of the houses to the north on Rooks Hill due to the car charging equipment, and Stanborough Close from the cooling plant.

3. Design Criterion and Assessment Methodology

3.1 Welwyn Hatfield Council Requirements

Condition 11 of the consent issued by Welwyn Hatfield Council (ref. 6/2021/2260/FULL) states:

> *11. Prior to above ground works, the applicant shall submit to, for approval in writing by the Local Planning Authority, details relating to a scheme to mitigate the noise from new plant and equipment. The impact of new plant and equipment should be assessed in accordance with BS4142:2014. When noise sources show signs of tonality we require noise levels to be 10dB below background noise level at the nearest receptor location. In instances where the noise source presents no tonality we require the noise level to be 5dB below the background noise level at the nearest receptor location.*
>
> *REASON: To protect the occupants adjoining the new development from noise disturbance in accordance with Policy R19 and D1 of the District Plan 2005 and the National Planning Policy Framework.*

Policies R19 and D1 are replicated below:

Policy R19 - Noise and Vibration Pollution

Proposals will be refused if the development is likely:

(i) To generate unacceptable noise or vibration for other land uses; or

(ii) To be affected by unacceptable noise or vibration from other land uses.

Planning permission will be granted where appropriate conditions may be imposed to ensure either:

(iii) An adequate level of protection against noise or vibration; or

(iv) That the level of noise emitted can be controlled.

Proposals should be in accordance with the Supplementary Design Guidance.

Policy D1: Quality of Design

The Council will require the standard of design in all new development to be of a high quality. The design of new development should incorporate the design principles and policies in the Plan and the guidance contained in the Supplementary Design Guidance.

3.2 BS4142:2014+A1:2019

British Standard BS4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound* describes a method for rating and assessing sound of an industrial and/or commercial nature, which includes:

- Sound from industrial and manufacturing processes;
- Sound from fixed installations which comprise mechanical and electrical plant and equipment;
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises, and;
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes.

The Standard is therefore suited to this assessment.

The assessment methodology considers the Specific Sound Level, as measured or calculated at a potential noise sensitive receptor, due to the source under investigation in terms of a L_{Aeq} value over a one-hour period during daytime operation (07:00-23:00 hours) and a fifteen-minute period during night-time operation (23:00-07:00 hours).

A correction factor is added to this level to account for the acoustic character of the sound. This is determined as follows when using the subjective assessment methodology:

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 allocated as a 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 +9dB 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 allocated as a penalty of 3 dB for impulsivity which is just perceptible at the receiver, 6 dB where it is clearly perceptible and 9 dB where it is highly perceptible.

Other sound characteristics - Where the specific sound contains characteristics that are neither tonal nor impulsive, but are otherwise startling, disturbing or incongruous with the residual acoustic environment, a penalty of +3 dB can be applied.

Intermittency - When the specific sound has identifiable on/off conditions, if the intermittency is readily distinctive against the residual acoustic environment, a penalty of +3 dB can be applied.

An initial estimate of the impact of the source is then obtained by subtracting the typical background noise level, in terms of a LA90 value over the relevant period of operation, from the corrected Specific Sound Level.

- 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 could 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 there will be an adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound having a low impact, depending on the context.

The initial estimate of the impact may then be modified by taking consideration of the context in which the sound occurs.

3.3 The National Planning Policy Framework (2021)

The revised *National Planning Policy Framework* (NPPF), published in July 2021, sets out the Government's planning polices for England, superseding all previous planning policy statements and guidance.

In respect of noise, the NPPF states that the planning system should contribute to and enhance the natural and local environment by preventing both new and existing developments from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of noise pollution.

Hence, Paragraph 185 states that *planning policies and decisions should also ensure 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 life
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

In regards to the term adverse impact, reference is made to the Noise Policy for England:

3.4 Noise Policy Statement for England (2010)

The Noise Policy Statement for England (NPSE) sets out the long term vision of Government noise policy: to promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development.

This vision is supported by the following aims:

- *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.*

The terms “significant adverse” and “adverse” are related to the following concepts:

No Observed Effect Level (NOEL) - *the level below which no effect on health and quality of life can be detected*.

Lowest Observed Adverse Effect Level (LOAEL) - *the level above which adverse effects on health and quality of life can be detected*.

Significant Observed Adverse Effect Level (SOAEL) - *the level above which significant adverse effects on health and quality of life occur*.

The guidance acknowledges that it is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations, but will be different for different noise sources, receptors and times.

In order to enable assessment of impacts in line with these requirements, reference should be made to other currently available guidance.

4. Environmental Noise Survey

4.1 Survey Procedure & Equipment

In order to establish the existing background noise levels at the site, a noise survey was carried out between Friday 1st and Monday 4th July 2022 at the location shown in site plan VA4245/SP1. This location was chosen to be representative of the background noise level at the most affected noise sensitive receivers.

Continuous 5-minute samples of the L_{Aeq}, L_{Amax}, L_{A10} and L_{A90} sound pressure levels were undertaken at the measurement location.

The weather during the survey period was generally dry with light winds. The background noise data is not considered to have been compromised by these conditions.

Measurements were made generally in accordance with ISO 1996 2:2017 *Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of sound pressure levels*.

The following equipment was used in the course of the survey:

Manufacturer	Model Type	Serial No	Calibration	
			Certificate No.	Date
NTi Class 1 Integrating SLM	XL2	A2A-15892-E0	UCRT21/1389	22/3/21
Larson Davis calibrator	CAL200	19816	44622-19816-CAL200	2/3/22

Table 4.1 – Equipment used for the survey

The calibration of the sound level meter was verified before and after use with no significant calibration drift observed.

5. Results

The measured sound levels are shown as time-history plots on the attached charts VA4245/TH1-4.

The prevailing background sound climate at the measurement position is determined by traffic on the surrounding road network, particularly passing vehicles on Stanborough Road, with the night-time period being the quietest against which the assessment will be carried out.

The typical background noise levels measured were:

Monitoring Period	Typical[1] $L_{A90,5min}$
07:00 – 23:00 hours	45 dB
23:00 – 07:00 hours	40 dB

Table 5.1 – Typical background noise levels **[dB ref. 20 µPa]**

[1] The typical L_{A90} value is taken as the 10th percentile of all L_{A90} values measured during the relevant period.

6. BS4142 Noise Impact Assessment

Four Tritium electric car chargers will be installed in the north-east of the site, with the associated inverter units located to the north of the charger units. The GRP unit is understood to generate negligible amounts of noise, with the inverters being the main source of noise, and a lower contribution from the charger units themselves.

To the rear of the store, new cooling plant is to be installed to provide cooling to the store and also the cold cabinets in the shop.

Noise Source	Measurement Distance	L_{Aeq}	Notes
Car Charging Plant			
Tritium Inverter	1m	71 dB	Advised by Tritium. 2 units (1 unit per 2 chargers)
Tritium Charger	1m	55 dB	From measurement of equivalent units at other sites
Substation	Sound Power	57 dB	Typical substation manufacturer noise data from similar sites. Tonal at 63/125Hz
Cooling Plant			
Mitsubishi PUHZ-P100YKA	L_p@1m	51 dB	No of units: 2
Mitsubishi MUZ-AP25 VG	L_p@1m	47 dB	No of units: 1
Danfoss OP-MPPM035VVLP01E	L_p@1m	66 dB	No of units: 2
Hubbard HZS11-3A3	L_p@1m	58 dB	No of units: 1

Table 6.1 – Noise sources used for assessment

It is understood that the loudest cooling plant (Danfoss and Hubbard units) will be located to the eastern end of the rear of the shop building, with the quieter Mitsubishi units located to the western end of the rear plant area.

6.1 Acoustic Character Correction

The subjective method of allocating corrections to the sound source has been used following the methodology provided in BS4142:2014 and as summarised in section 3.2.

Noise Source	Subjective Description	Allocated Corrections
Power Inverter	Slight tonal content	Tonality: +2dB Impulsivity: 0dB Intermittency: 0dB
Car Charger	Intermittent operation of charger	Tonality: 0dB Impulsivity: 0dB Intermittency: +3dB
Substation	Constant operation with a potential faint low frequency tone. Housed in a GRP enclosure.	Tonality: +2dB Impulsivity: 0dB Intermittency: 0dB
Cooling Plant	Faintly tonal, operating intermittently.	Tonality: +2dB Impulsivity: 0dB Intermittency: +3dB

Table 6.2 – Acoustic character corrections

These penalties are applied to the Specific Sound Level to obtain the Rating Level.

6.2 Rating Level and Assessment

The rating levels at the assessment locations are compared against the relevant background noise levels to assess the notional significance of the noise impact as follows. Operations are adjusted to the appropriate on times.

Due to the complexity of the building interaction in this locale and the likelihood of noise both reflecting off and being screened by the surrounding building and screens, 3D noise mapping was implemented to ensure the most accurate prediction of plant noise levels at the nearest noise sensitive receivers, with 3 reflections modelled for all surfaces.

This process uses several different calculation protocols to derive accurate noise analysis predictions. Noise propagation and barrier attenuation are calculated in accordance with ISO 9613-1:1993 *Acoustics - Attenuation of sound during propagation outdoors - Part 1: Calculation of the absorption of sound by the atmosphere* and ISO 9613-2:1996 *Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation*.

It is recommended that a barrier be introduced between the charger plant installation and the noise sensitive receivers, at the location shown on the attached site plan, ref VA4245/SP1.

The screen should be at least 0.3m higher than the top of the inverter, i.e., nominally 2.7m high, and formed from a continuous and imperforate material with a minimum mass per unit area of 14kg/m^2.

With these mitigation measures in place, the following specific sound levels and assessments are derived at the residential dwellings.

Results		Relevant Clause	Commentary
Specific Sound Level	L_{Aeq} 35 dB		Car charger plant (2 inverters, 4 chargers and 1 substation) – shown in VA4245/NM1
Assume 100% on time	0 dB	7.2	
Acoustic feature correction	+2 dB	9.2	+2 dB for tonality
Rating level	L_{Ar} 37 dB	9.2	
Background sound level	L_{A90} 40 dB	8	Night-time background
Excess of rating over background sound level	- 3 dB	11	
Positive indication of a low impact		11	Depending on context

Table 6.3 – BS4142 Assessment – Car Charging Plant Noise

Table 6.4 shows the assessment for the cooling plant. A barrier will be required between the cooling plant and the neighbouring property, at the location shown on the attached site plan, ref VA4245/SP1.

The screen should be at least 1m higher than the top of the tallest item of plan, i.e., nominally 2m high, and formed from a continuous and imperforate material with a minimum mass per unit area of 14kg/m^2.

Results		Relevant Clause	Commentary
Specific Sound Level	L_{Aeq} 32 dB		All cooling plant, calculated in VA4245/NM2
Assume 100% on time	0 dB	7.2	
Acoustic feature correction	+5 dB	9.2	+2 dB for tonality, +3dB for intermittency
Rating level	L_{Ar} 37 dB	9.2	
Background sound level	L_{A90} 40 dB	8	Night-time background
Excess of rating over background sound level	-3 dB	11	
Indication of a low impact		11	Depending on context

Table 6.4 – BS4142 Assessment – Cooling Plant Noise

Table 6.4 shows the cumulative assessment for all the proposed plant.

Results		Relevant Clause	Commentary
Specific Sound Level	L_{Aeq} 36 dB		All plant, calculated in VA4245/NM3
Assume 100% on time	0 dB	7.2	
Acoustic feature correction	+5 dB	9.2	+2 dB for tonality, +3dB for intermittency
Rating level	L_{Ar} 41 dB	9.2	
Background sound level	L_{A90} 40 dB	8	Night-time background
Excess of rating over background sound level	+1 dB	11	
Indication of a low impact		11	Depending on context

Table 6.5 – BS4142 Assessment – Cumulative Plant Noise

The above assessments show a low/marginal impact at the nearest receivers. However, it should be noted that this is based upon the assumption that all equipment would be operating at full duty (including 4 cars charging) during the middle of the night, and so is highly pessimistic. Realistically, it is likely that during the night-time impact would be considerably lower than this robustly assumed assessment.

6.3 Context

The site is located on a busy main road, with the fuel station currently operating 24 hours a day. The reconfiguration of the site and installation of the chargers will result in the removal of an existing automated car-wash, which will significantly reduce existing noise levels at nearby receivers when this is in use.

Within this context, the estimated impact of the sound sources is expected to remain valid or be slightly reduced.

6.4 Uncertainty

This section considers the variable in the assessment that may cause variations within the final results and describes how these have been addressed.

- Use of a Class 1 sound level meter is considered to reduce instrument error to insignificant levels as compared with environmental variations. The calibration of the instrumentation was confirmed before and after the noise surveys.
- The background measurements were undertaken under suitable weather conditions over a period designed to include reasonable temporal variations in background noise levels, including a weekend period. The monitoring location was selected to be representative of the background noise levels expected to be experienced by the nearby dwellings without being unduly influenced by extraneous noise sources.
- Where library data has been used, propagation calculations have been used to correct noise levels to the relevant distance at the receiver.

Overall, the uncertainty is considered to have been minimised to a suitable range so as not to risk significant variations in the impact assessment of typical operations.

7. Conclusion

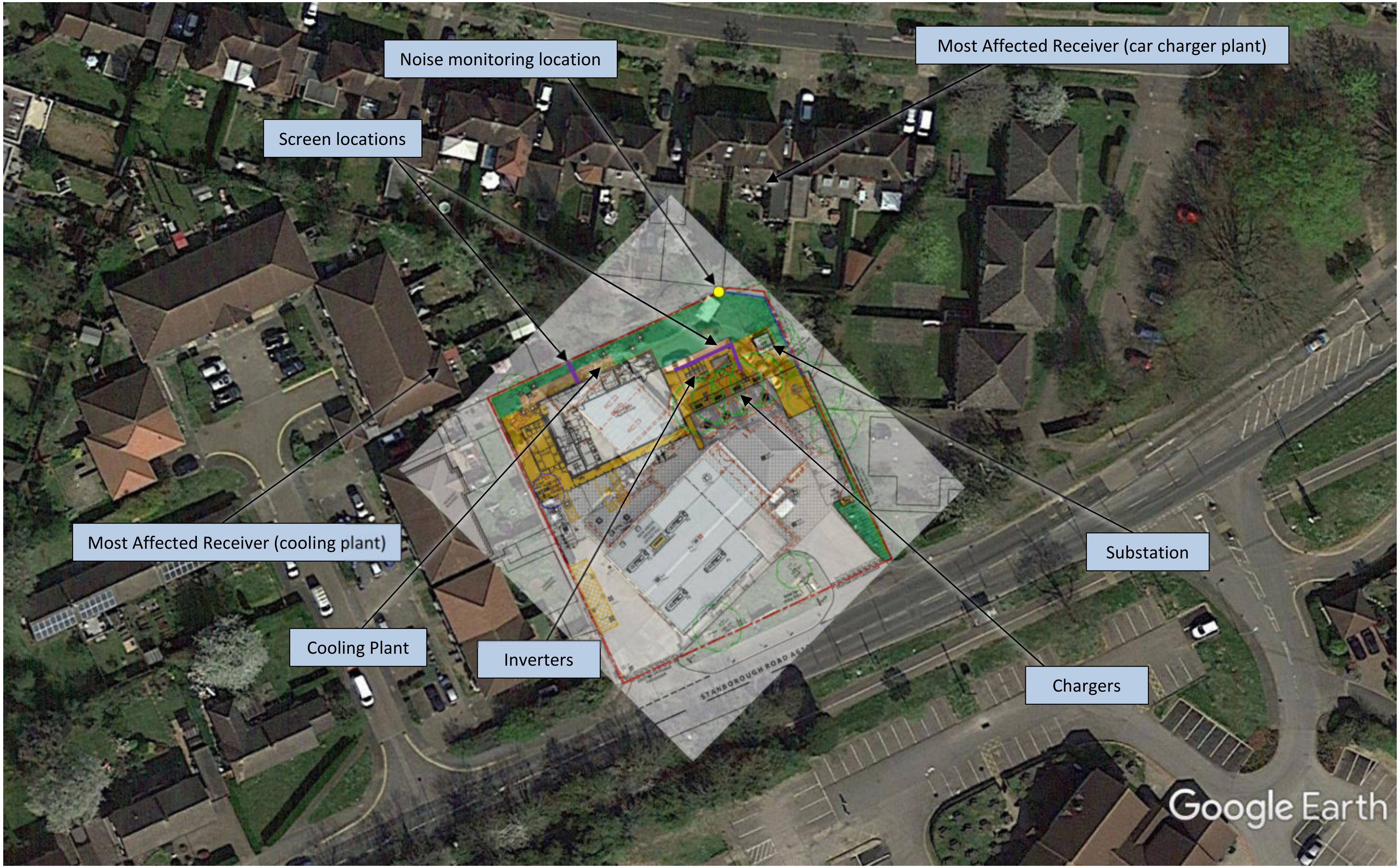
A baseline noise survey has been undertaken by Venta Acoustics to establish the background noise climate in the locality of Shell Welwyn Garden City, Stanborough Road.

The measured noise levels have been assessed against BS4142:2014 *Methods for rating and assessing industrial and commercial sound* to assess potential noise impacts of the new electric charger plant and shop cooling plant on the nearby noise sensitive properties.

When assessed using BS4142, noise from the new equipment on site have been shown to have a low/marginal impact, where an acoustic fence meeting the specifications detailed in this report is installed to screen the plant from the nearby houses.

The assessment has been based upon the assumption that all equipment would be operating on full duty in the middle of the night, which is considered highly unlikely, and so in real terms, the actual impact from all equipment is expected to be low.

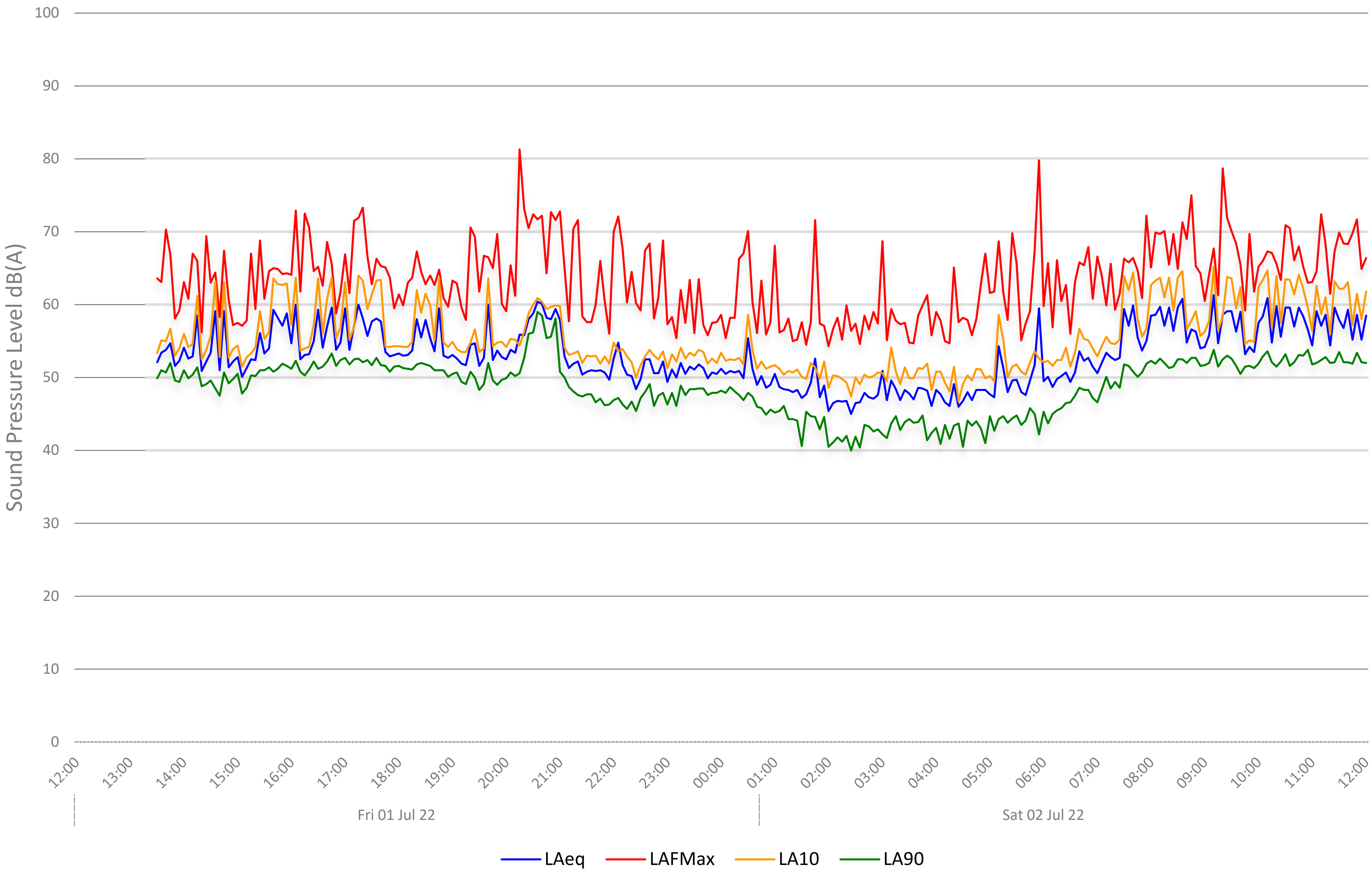
Jamie Duncan MIOA


Noise monitoring location
Most Affected Receiver (car charger plant)
Screen locations
Most Affected Receiver (cooling plant)
Substation
Cooling Plant
Inverters
Chargers
STANBOROUGH ROAD
Google Earth

Shell Welwyn Garden City, Stanborough Road

Environmental Noise Time History: 1

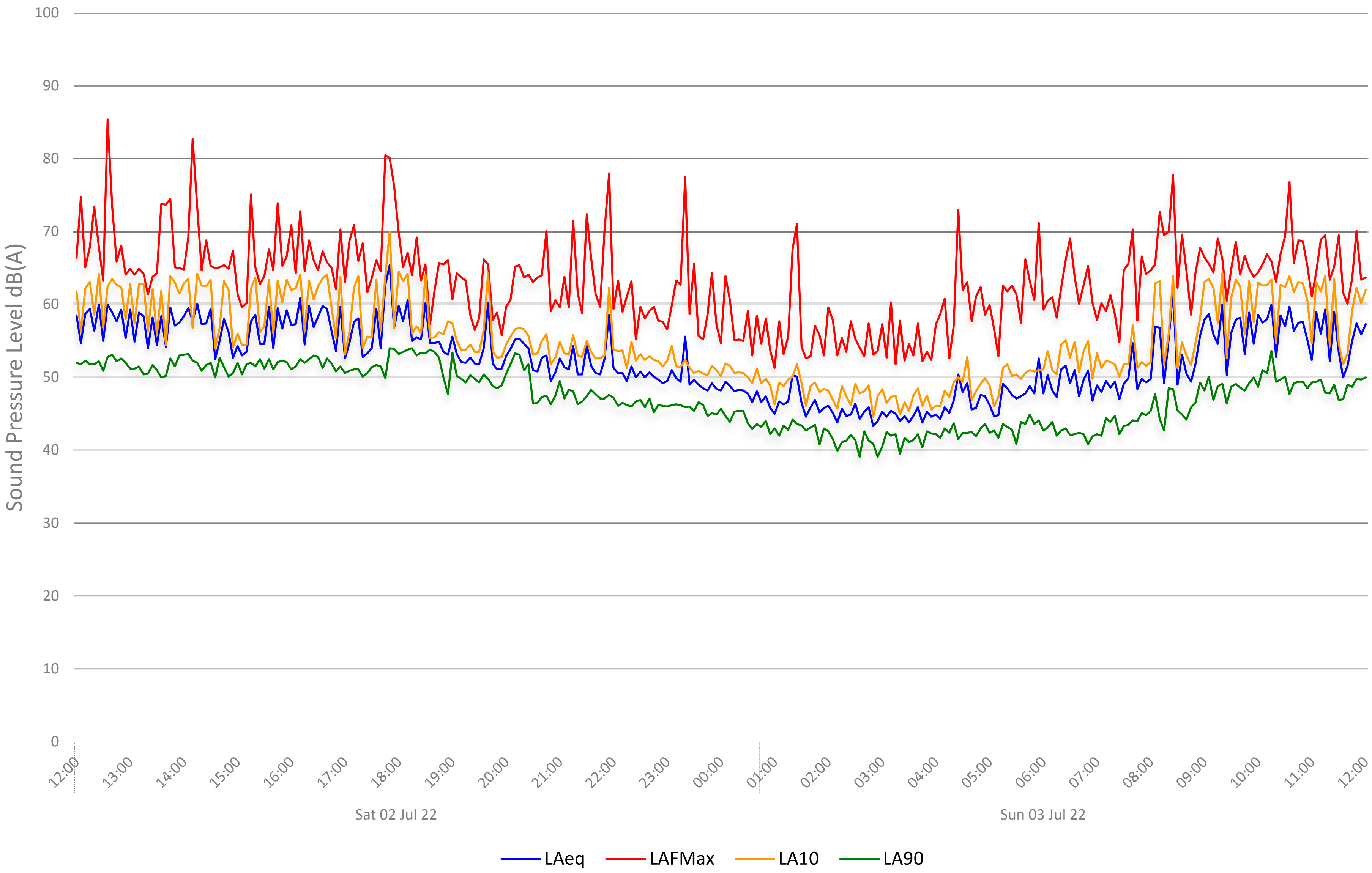
Figure VA4245/TH1



Shell Welwyn Garden City, Stanborough Road

Environmental Noise Time History: 2

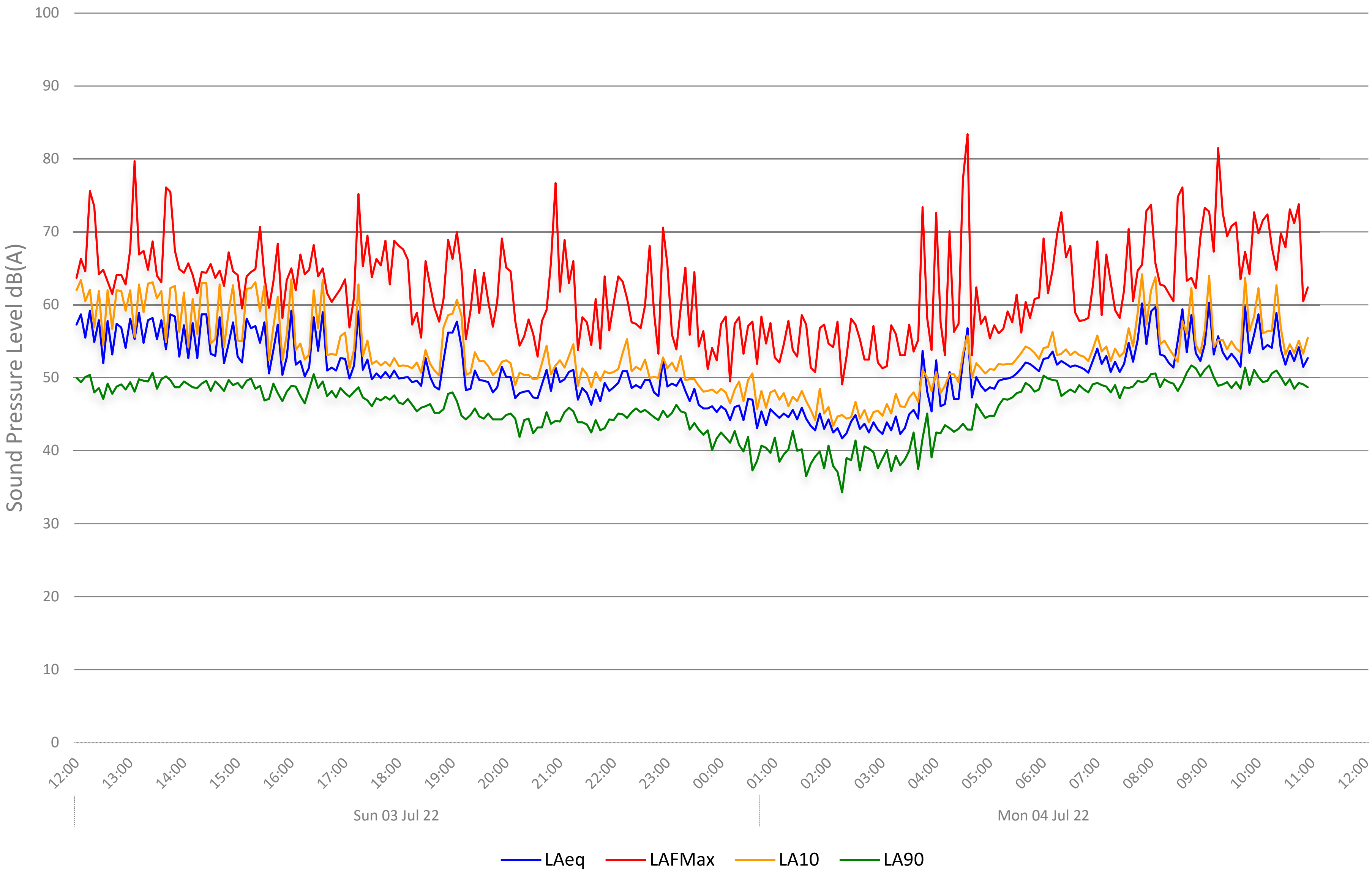
Figure VA4245/TH2

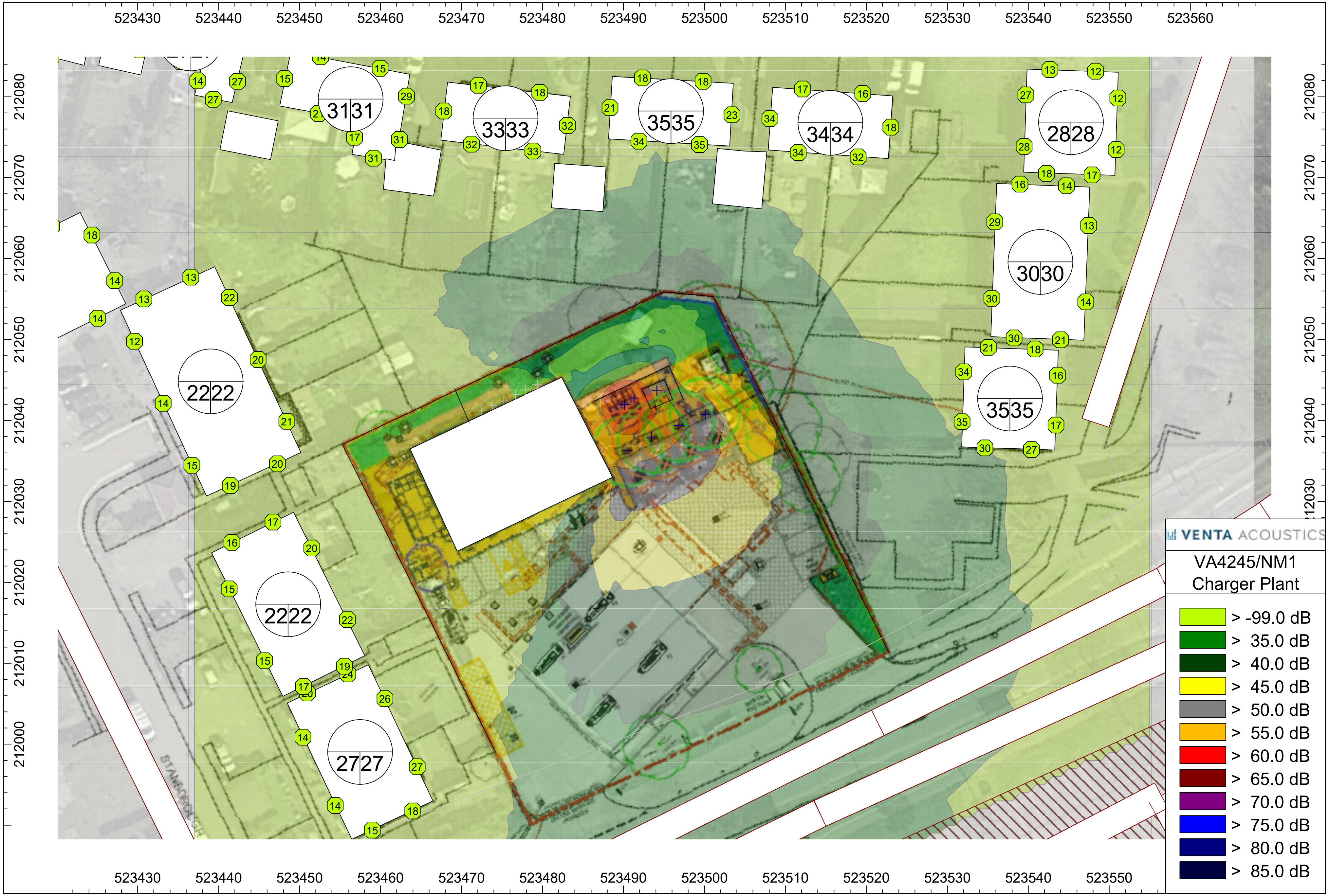


Shell Welwyn Garden City, Stanborough Road

Environmental Noise Time History: 3

Figure VA4245/TH3




VENTA ACOUSTICS
VA4245/NM1
Charger Plant
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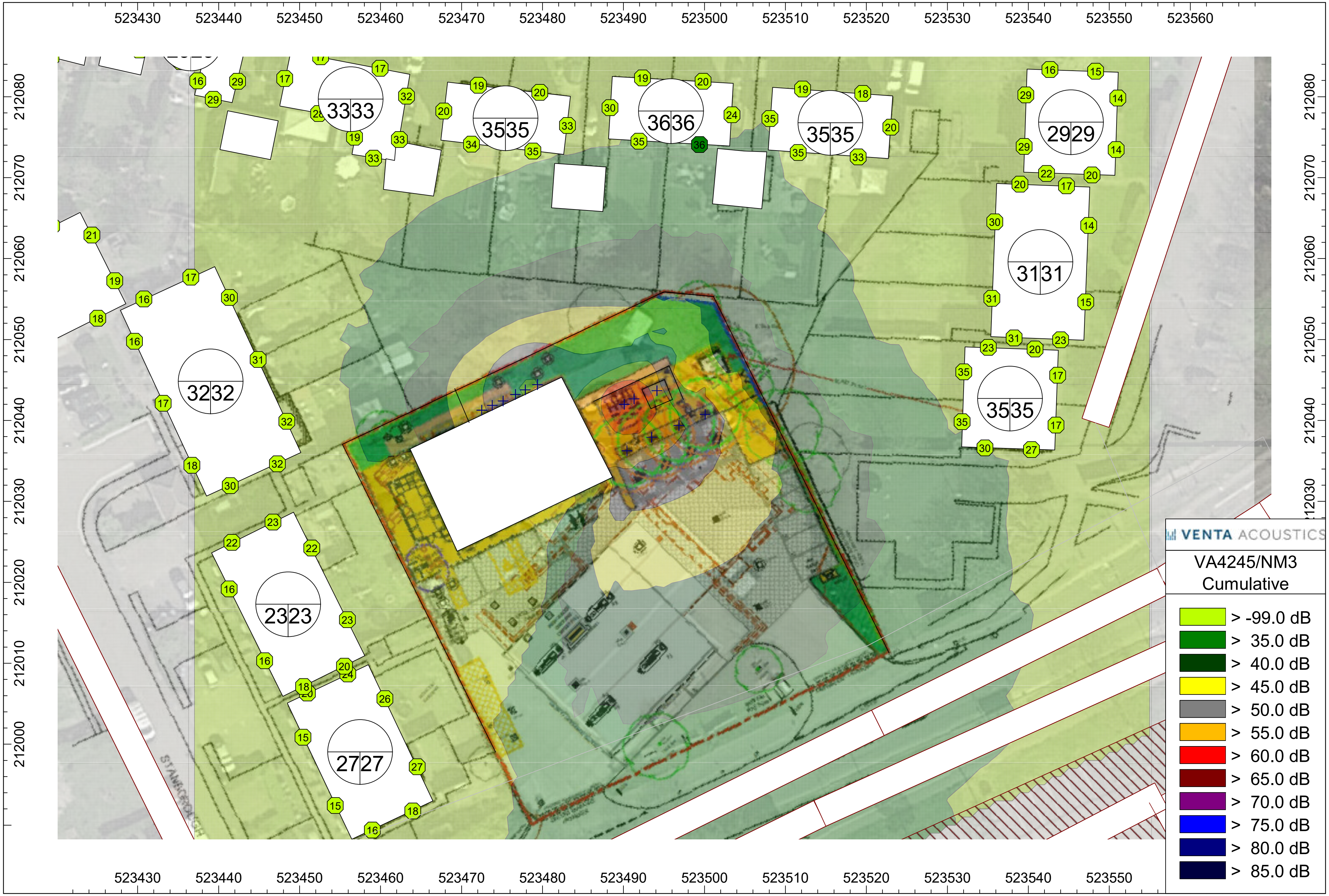
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APPENDIX A

Acoustic Terminology & Human Response to Broadband Sound

1.1 Acoustic Terminology

The human impact of sounds is dependent upon many complex interrelated factors such as ‘loudness’, its frequency (or pitch) and variation in level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

Sound	Vibrations propagating through a medium (air, water, etc.) that are detectable by the auditory system.
Noise	Sound that is unwanted by or disturbing to the perceiver.
Frequency	The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of ‘pitch’, with low frequencies producing low ‘notes’ and higher frequencies producing high ‘notes’.
dB(A):	Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the ‘A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated ‘A' weighted sound level is designated as dB(A) or L_A.
L_{eq} :	A notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc). The concept of L_{eq} (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction. Because L_{eq} is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.
L_{10} & L_{90} :	Statistical L_n indices are used to describe the level and the degree of fluctuation of non-steady sound. The term refers to the level exceeded for n% of the time. Hence, L_{10} is the level exceeded for 10% of the time and as such can be regarded as a typical maximum level. Similarly, L_{90} is the typical minimum level and is often used to describe background noise. It is common practice to use the L_{10} index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow.
L_{max} :	The maximum sound pressure level recorded over a given period. L_{max} is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged L_{eq} value.

1.2 Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band. In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

Octave Band Centre Frequency Hz	63	125	250	500	1000	2000	4000	8000

1.3 Human Perception of Broadband Noise

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial