

SHARPS REDMORE

ACOUSTIC CONSULTANTS ▪ Established 1990



Report

BP Service Station, Former Tollgate Hotel, Gravesend

Environmental Noise Report

Prepared by

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Project No 2221003

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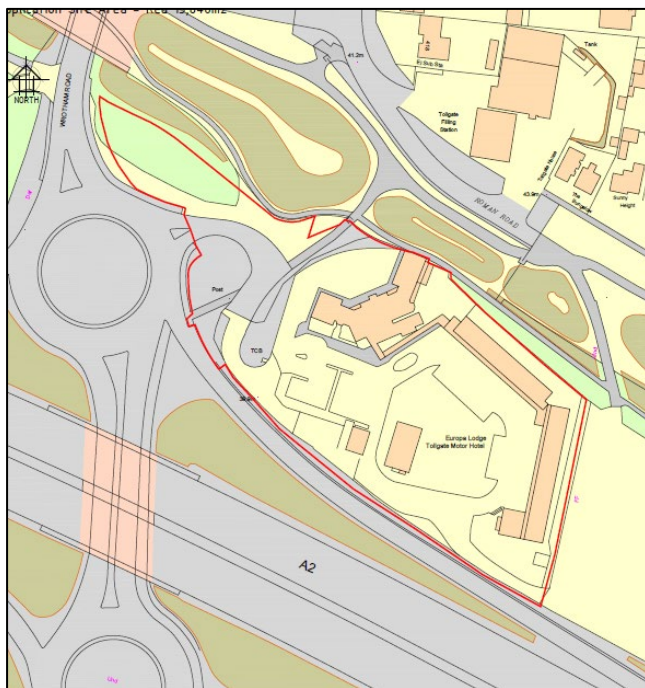
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1.0 Introduction

- 1.1 Sharps Redmore (SR) has been instructed by BP to carry out a noise assessment for a service station on land to the north of A2, on the southern edge of Gravesend. The site location is shown in Figure 1 below:

FIGURE 1: Site Location



- 1.2 The site is known as the Tollgate Hotel site and currently comprises of former hotel buildings which have been unoccupied for some time. Planning permission has previously been sought for redevelopment of the site as a petrol filling station, forecourts and sales building however this was withdrawn before the application was determined. Planning permission is now being sought by BP to create a new service station, including EV charging station, sales building, and petrol filling station. The site layout is shown in Appendix A to this report.
- 1.3 The site lies at the southern edge of Gravesend within the administrative area of Gravesham Borough Council and is adjacent to the slip road to the A2 truck road which runs to the north of the site. The nearest noise sensitive properties to the site are the residential properties in Old Watling Street to the north of the site adjacent to the existing Shell service station.
- 1.4 The purpose of the report is to consider the impact of noise on the proposed residential properties to the north of the site. The report has regard to national and local policy aims and relevant noise guidance, these are discussed in detail in section 2.0 of this report.
- 1.5 Section 3.0 of this report sets out the findings of an acoustic survey, undertaken at noise sensitive areas around the site.
- 1.6 The impact of the operation of the site is considered in section 4.0 with the report conclusions contained within section 5.0 of the report.
- 1.7 A guide to the acoustic terminology used within the report included in Appendix C.

2.0 Assessment methodology and criteria

National Policy

- 2.1 The National Planning Policy Framework (NPPF), December 2023 sets out the Government's planning policies for England and "these policies articulate the Government's vision of sustainable development." In respect of noise, Paragraph 191 of the NPPF states the following:

"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 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; and*
- c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation".*

- 2.2 Guidance on the interpretation of the policy aims contained within the NPPF is contained within National Planning Policy Guidance (NPPG). The NPPG introduces the concept of a noise exposure hierarchy based on likely average response. The guidance contained in the NPPG is summarised in the table below:

TABLE 1: Noise Exposure Hierarchy

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	

Perception	Examples of Outcomes	Increasing Effect Level	Action
		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

- 2.3 The NPPF and NPPG reinforce the March 2010 DEFRA publication, “Noise Policy Statement for England” (NPSE), which states three policy aims, as follows:

“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.”*

- 2.4 Together, the first two aims require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

“... all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur.”

Local Policy

- 2.5 In terms of local policy regard is had to Gravesham Local Plan Core Strategy 2014 Policy CS19 ‘Development and Design Principles’ which in terms of noise states:

*“New development will be located, designed and constructed to avoid adverse environmental impacts from pollution, including **noise** (SR emphasis), air, odour and light pollution and land contamination.”*

- 2.6 Taking an overview of strategic national and local policy it is clear that when considering the impact of noise, one must consider the significance of any impact. The presence of an adverse impact in itself is not sufficient to refuse permission.

Design Guidance

2.7 It is possible to apply objective standards to the assessment of noise and the effect produced by the introduction of a certain noise source may be determined by several methods, as follows:

- i) The effect may be determined by reference to guideline noise values. British Standard (BS) 8233:2014 and World Health Organisation “Guidelines for Community Noise” contain such guidelines.
- ii) Alternatively, the impact may be determined by considering the change in noise level that would result from the proposal, in an appropriate noise index for the characteristic of the noise in question. There are various criteria linking change in noise level to effect. This is the method that is suited to, for example, the assessment of noise from road traffic because it is capable of displaying impact to all properties adjacent to a road link irrespective of their distance from the road.
- iii) Another method is to compare the resultant noise level against the background noise level (L_{A90}) of the area. This is the method employed by BS 4142:2014 to determine the impact of noise of an industrial or industrial type nature. It is best suited to the assessment of steady or pseudo-steady noise.

Guideline noise values

2.8 There are a number of guidance documents that contain recommended guideline noise values of these the WHO advice is the most useful, comprehensive, and pertinent advice in this case, because it is not specific to the circumstances of the assessment. Instead, it provides guidance on acceptable limits in, for example, schools, dwellings and offices.

2.10 The WHO guideline values are appropriate to what are termed “critical health effects”. This means that the limits are at the lowest noise level that would result in any psychological, physiological or sociological effect. They are, as defined by NPSE, set at the Lowest Observed Adverse Effect Level (LOAEL), but do not define the level above which effects may be considered significant (SOAEL). Compliance with the LOAEL should, therefore, be seen as a robust aim.

2.11 The WHO LOAEL guideline values are summarised in the following table.

TABLE 2: WHO Guidelines

Document	Level	Guidance
World Health Organisation “Community Noise 2000”	$L_{AeqT} = 55 \text{ dB}$	Serious annoyance, daytime and evening. (Continuous noise, outdoor living areas)
	$L_{AeqT} = 50 \text{ dB}$	Moderate annoyance, daytime and evening. (Continuous noise, outdoor living areas).
	$L_{AeqT} = 35 \text{ dB}$	Moderate annoyance, daytime and evening. (Continuous noise, dwellings, indoors)
	$L_{AeqT} = 30 \text{ dB}$	Sleep disturbance, night-time (indoors)
	$L_{AMAX} = 60 \text{ dB}$	Sleep disturbance, windows open at night. (Noise peaks outside bedrooms, external level).
	$L_{AMAX} = 45 \text{ dB}$	Sleep disturbance at night (Noise peaks inside bedrooms, internal level)

- 2.12 For L_{AeqT} criteria the time base (T) given in the document is 16 hours for daytime limits and 8 hours for night time limits. When assessing impact, this has the tendency to smooth out the hourly variations in noise level. As such, our calculations are carried out to a 1-hour time base, which is more stringent assessment than is given in the guidance but is reflective of the actual duration of the delivery process.
- 2.13 In 2018 the WHO published the “Environmental Noise Guidelines for the European Region” (ENGER). The new WHO Environmental Noise Guidelines (page 28) explain that “*The current environmental noise guidelines for the European Region supersede the CNG from 1999. Nevertheless, the GDG (Guideline Development Group) recommends that all CNG indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid*”. Hence the CNG remain relevant to this assessment.
- 2.14 The WHO ENGER brings together the latest research on the effects of specific types of noise on health in relation to transportation noise sources (road, rail and aircraft noise exposure), wind turbines and leisure noise. Hence in direct relation to the specific proposal that this noise assessment considers, the new WHO ENGER are not of material consideration.

Changes in noise level

- 2.15 Changes in noise levels of less than 3 dBA are not perceptible under normal conditions and changes of 10 dB are equivalent to a doubling of loudness. This guidance has been accepted by Inspectors, at Inquiry, to encompass changes in noise levels in the index $L_{Aeq,T}$ in relation to road traffic noise and therefore if of limited use in this case.
- 2.16 The following table shows the response to changes in noise level (known as the Semantic Scale).

TABLE 3: Change in noise level

Change in noise level L_{AeqT} dB	Response	Impact
<3	Imperceptible	None
3 - 5	Perceptible	Slight
6 - 10	Up to a doubling	Significant
11 – 15	More than a doubling	Substantial
> 15	-	Severe

BS 4142:2014+A1:2019

- 2.17 This British Standard describes a method for rating and assessing sound of industrial and/or commercial nature according to the following summary process:
- Carry out a numerical assessment of the noise, taking into the character and areas of uncertainty, by comparing the noise against the existing background noise level. The greater the difference between the two, the greater the impact.
 - By considering the noise impact against the context in which it is placed. There are many contextual points to consider when considering an assessment of sound impact including the following:

- The absolute level of sound.
- The character and level of the specific sound compared to the existing noise climate.
- The sensitivity of the receptors.
- The time and duration that the specific sound occurs. The conclusions of assessments undertaken using alternative assessment methods, for example WHO guideline noise values or change in noise level.
- The ability to mitigate the specific sound through various methods, for example by screening, the selection of quiet plant equipment, the use of attenuators, through the imposition of noise management plans and good practice, façade design and layout/orientation.
- The form and scale and scale of a development. For example, does not the proposed development involve a new industrial/commercial premise or is the proposal the installation of new plant or an extension to an existing premises?

2.18 It is therefore entirely possible that whilst the numerical outcome of a BS 4142 assessment is indicative of adverse or even significant adverse impact, when the proposal is considered in context the significance of the impact is reduced to an acceptable level.

3.0 Survey Details

- 3.1 To determine existing noise levels on the site a noise survey was undertaken between the 13 and 14 June 2022. Measurements were carried out at three locations as shown in Figure 2 below. The monitoring locations were chosen to represent the residential properties to the north of the site, these being the nearest noise sensitive properties to the proposed service station

FIGURE 2: Monitoring Location



TABLE 4: Measurement Details

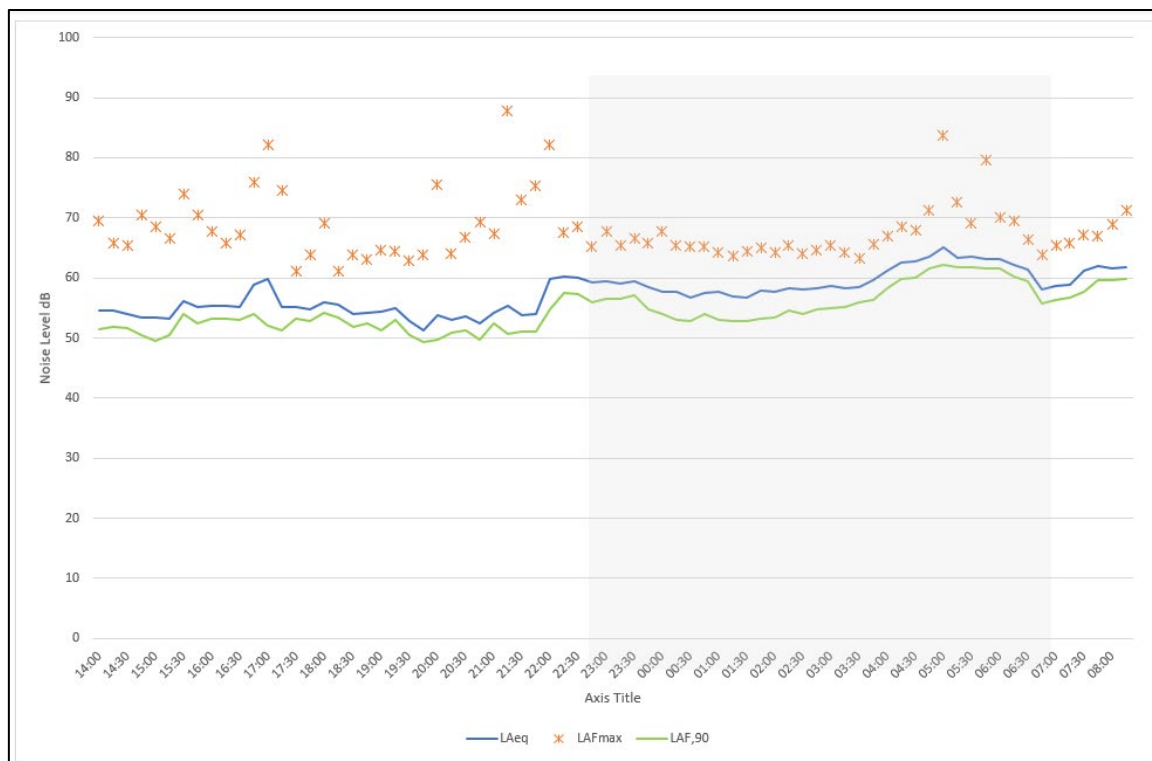
Ref:	Details
NL1	Attended measurements carried out during daytime, evening and night time periods. Measurements carried out using a Norsonic type 1 sound level meter with the microphone in free-field conditions.
NL2	Attended measurements carried out during daytime, evening and night time periods. Measurements carried out using a Norsonic type 1 sound level meter with the microphone in free-field conditions.
NL3	Unattended measurements carried out between 1400 hrs on 13 June and 0800 hours on 14 June 2022. Measurements carried out at 15-min intervals using a Norsonic type 1 sound level meter with the micro-phone fitted on a mast approximately 2 metres above ground level. All measurements in free-field conditions

- 3.2 Each sound level meter was calibrated before and after the survey with no drift in accuracy found. Weather conditions during the survey were determined from site observations and were dry, warm with light north westerly breeze. Weather conditions were suitable for taking sound level measurements and did not influence survey results. The survey results are shown in the following tables and Figure 3 below:

TABLE 5: Survey Results NL1 and NL2

	Period	Noise Levels dB		
		L _{Aeq1hr}	L _{A90,1hr}	L _{Amax}
NL1	1300 - 1315 hrs	59	56	76
	1410 - 1425 hrs	59	56	71
	1500 – 1515 hrs	59	53	79
	2030 - 2045 hrs	55	51	75
	2100 – 2115 hrs	53	51	72
	0115 – 0130 hrs	53	50	69
NL2	1317 – 1402 hrs	61	57	69
	1430 – 1445 hrs	60	58	70
	1520 – 1535 hrs	60	55	68
	2050 – 2105 hrs	54	52	65
	2120 – 2135 hrs	56	54	62
	0135 – 0150 hrs	55	52	62

FIGURE 3: Summary of survey results – NL3



- 3.3 Based on site observations it was noted that existing noise levels are dominated by road traffic including the A2. At location NL1 noise levels from the adjacent Shell Service Station was noted. SR understands that the service station currently trades 24-hours a day. Background noise levels were dominated by road traffic on the A2 and were 51 dB during the day (based on measurements carried out during the evening) and 50 dB during the night time period.

4.0 Noise Assessment

4.1 SR has carried out a noise assessment for many similar developments and based on experience of these sites the main impacts have identified as follows:

- Forecourt activity;
- Delivery activity;
- Mechanical services; and
- EV Charging Stations;

Forecourt Activity

- 4.2 Noise levels at numerous petrol filling stations (PFS) across the country have been measured. Typical noise levels for PFS were found to be 47 dB L_{Aeq1hr} when measured at 10 metres from the centre of the forecourt. Maximum, L_{Amax} , noise levels from door slams/engine noise were 66 dB at 10 metres.
- 4.3 The nearest noise sensitive properties to the site are the residential properties to the north. The nearest properties are approximately 90 metres from the centre of the forecourt area. Taking into the distance attenuation predicted noise levels from forecourt activity at the residential properties will be 28 dB with maximum levels L_{Amax} in the region of 47 dB.
- 4.4 Predicted noise levels will be below the daytime and night time WHO Guidelines and also below the existing ambient noise levels measured, day and night.

Delivery activity

Deliveries to retail kiosk

- 4.5 Deliveries of groceries will be received to the site on a daily basis, with vehicles entering the site via the access road and driving through the forecourt to the loading bay located on the southern side of the retail kiosk. In terms of noise this is the optimum position as it is at the furthest point from the residential properties to the north and screened by the retail kiosk building. Based on experience of similar developments goods will then be unloaded via a tail gate and taken into the building via the 'goods in' area on the southern side of the building.
- 4.6 Delivery event activity has been measured at a large number of similar BP Service Station; the following maximum noise level and event duration has been recorded:

TABLE 6: Delivery event noise levels

Event Noise Level (at 10 metres)						Overall L_{Amax} dB Arrival&departure/unloading
Arrival		Unloading		Departure		
Duration (mins)	L _{Aeq T} (dB)	Duration (mins)	L _{Aeq T} (dB)	Duration (mins)	L _{Aeq T} (dB)	
0.5	69	30	63	0.5	67	

- 4.7 The noise levels in the table above encompass all typical delivery activity noise sources; vehicle engine noise, hydraulic tailgate lift noise, the removal of secure straps, noise associated with the lowering of tailgate flaps and the movement of roll cages.
- 4.8 Using the above baseline data the noise levels of service activity have been calculated at the residential properties to the north of the site. Full details of the calculation are shown in Appendix B and summarised in Table 7 below:

TABLE 7: Delivery Calculations

L _{Aeq1hr} dB	L _{Aeq15min} dB	L _{Amax} dB (arrival/unloading)
33 dB	38 dB	59/46 dB

- 4.9 Noise from unloading activity only is 33 dB L_{Aeq1hr} during the day and 38 dB L_{Aeq15min} during the night time period. Taking into account the location of the loading bay and the existing background noise levels which are around 51 dB during the day and 50 dB at night it is not considered unloading activity will be noticeable at the nearest residential properties. Therefore, in terms of noise from delivery activity the main consideration is noise from vehicles arriving.
- 4.10 Predicted maximum noise levels L_{Afmax} are significantly below the existing noise levels during both the day and night time period and also below the recommended WHO guidelines for sleep disturbance of 60 dB L_{Afmax}. The character of the noise will be not be distinguishable from existing traffic noise and therefore based on both character and level of the noise the impact from delivery activity is considered low and there is no technical reason to restrict deliveries to the retail kiosk.

Fuel deliveries

- 4.11 The actual unloading of the fuel is a relatively quiet operation and the dominant noise source during fuel tanker deliveries is found to be that from the engine noise during the arrival and departure of deliveries. At night of primary concern will be maximum noise levels for the application of the air brakes as the tanker manoeuvres on the site. Typical maximum noise levels from a tanker be 75 dB L_{Amax} when measured at a distance of 10m. Taking into account the distance attenuation maximum noise levels from tanker arriving will be no greater than 60 dB, which as defined in section 2.0 of this report can be considered when the onset of sleep disturbance will occur. Noise from tanker arrivals will therefore be below the lowest observed adverse effect level.
- 4.12 Noise from deliveries, will therefore not cause adverse impact to local residents and as concluded above there is no technical reasons why deliveries could not be received at any time.

Mechanical Services Plant

- 4.13 The precise details of the mechanical services plant and refrigeration equipment (type and noise signature) are not known at this stage. However, the fixed plant may consist of refrigeration and condenser units, air handling units, extract fans and boilers. All of the equipment is expected to operate during the daytime, with only the refrigeration units remaining operational during the night. It is assumed that the plant will be located in the

compound on the southern side of the building. This area is screened from the residential properties to the north of the site.

- 4.14 With regard to the assessment of industrial noise sources in commercial premises (i.e. fixed mechanical plant) BS 4142 enables the resultant noise from new equipment to be compared to the existing background noise level (L_{A90}) of an area to assess the significance of impact.
- 4.14 Based on the survey results that the representative background sound levels are considered to be 51 dB during the day time period and 50 dB during the evening period.
- 4.15 In terms of seeking to set appropriate plant rating sound limits, the advice in BS 4142:2014 is that *“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 of having a low impact, depending on the context”* (clause 11, note ‘d’).
- 4.16 Hence in relation to the guidance above from BS 4142 there is a technical case to seek to set plant sound limits that match the current background sound climate. This approach would lead to plant rating sound level of 51 dB daytime and 50 dB at night. The suggested criteria can be secured by a suitably worded planning condition.

EV Charging Stations

- 4.17 Twenty four EV charging bays will be provided around the kiosk, which will be served by an Alpitronic HYC 300 hypercharger units as shown in Figure 4 below. Each charging point will serve two bays and can operate simultaneously. In addition, there are four Low Voltage power cabinets and two sub-stations on the northern boundary of the site. From measurements carried out at similar sites noise from sub-station was negligible.

FIGURE 4: EV Charging Point



4.18 Based on manufacturer's noise data the following noise levels have been assumed

- Power Cabinet (x2): 67 dB(A) at 1 metre
- Charge Post (x12) 69 dB(A) at 1 metre

4.19 The levels are similar to those measured by Sharps Redmore at similar sites.

4.20 The predicted noise level from operation of the EV charging posts has been determined using SR own noise modelling software 'Noys Plot'. This software enables coordinates to be entered for the relative positions of the noise sources, receivers, barriers to calculate the resultant noise levels at a given receptor. The software carries out detailed 'text book' calculations with regard to distance and screening attenuation by referencing relative source and receiver positions.

4.21 For the purposes of the assessment it has been assumed that all EV Charging posts will be used simultaneously. The predicted noise levels at the nearest noise sensitive properties are shown in Table below:

TABLE 8: Predicted Noise levels – EV Charging Stations

Receptor	Predicted noise level dB [day and night]
	L_{AeqT}
The Bungalow	41
Sunny Height	39
Ridgeway	38

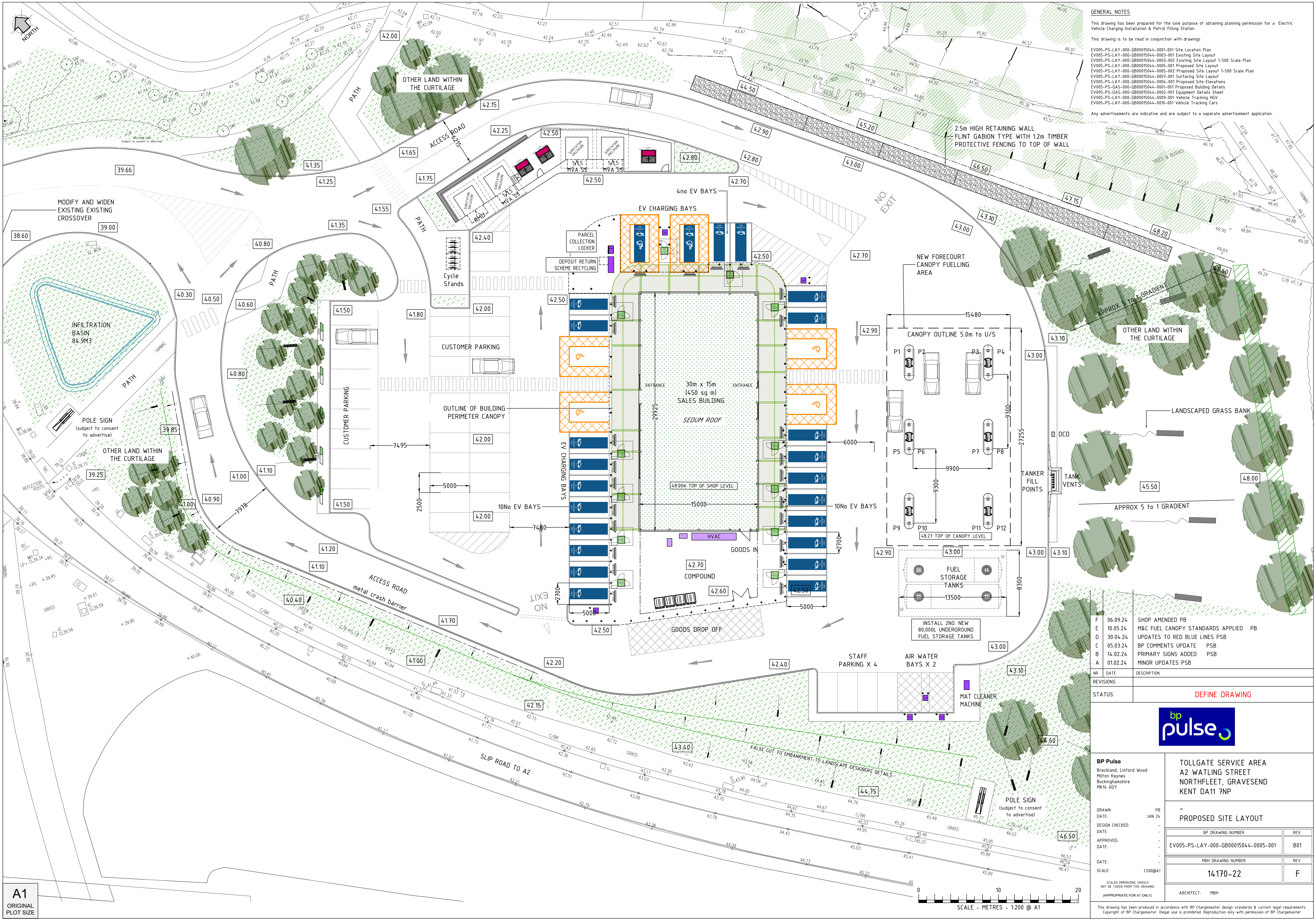
4.22 Predicted noise levels are at least 10 dB below the existing background noise levels and therefore the impact can be considered negligible.

5.0 Summary and Conclusions

- 5.1 Sharps Redmore have carried out an assessment of the predicted noise impact from a new BP Service Station at Lower Watling Street, Gravesend.
- 5.2 Noise from site activity has been assessed against national guideline and the existing noise climate and the following concluded:
- Noise from forecourt and customer activity will be significantly below the daytime and night time guideline values and existing noise levels;
 - Noise from delivery activity, fuel and groceries, will be below existing background noise levels. Maximum levels, L_{Amax} associated with delivery activity will be below the WHO night time guidelines for the onset of sleep disturbance;
 - Noise from plant can be conditioned to ensure that noise does not exceed existing background levels; and
 - A detailed assessment of use of the EV Charging stations has been carried out and assuming a worst case scenario of all stations being used simultaneously noise levels will be at least 10dB below background levels.
- 5.3 Having assessed the noise against national guidelines it is concluded that the PFS could trade and receive deliveries at any time, including the night time period, without causing impact to neighbour amenity.

APPENDIX A

SITE LAYOUT



GENERAL NOTES

This drawing has been prepared for the sole purpose of obtaining planning permission for a Electric Vehicle Charging Installation & Petrol Filling Station

This drawing is to be read in conjunction with drawings

EV005-PS-LAY-000-GB00015044-0001-001 Site Location Plan
EV005-PS-LAY-000-GB00015044-0003-001 Existing Site Layout
EV005-PS-LAY-000-GB00015044-0003-002 Existing Site Layout 1:500 Scale Plan
EV005-PS-LAY-000-GB00015044-0005-001 Proposed Site Layout
EV005-PS-LAY-000-GB00015044-0005-002 Proposed Site Layout 1:500 Scale Plan
EV005-PS-LAY-000-GB00015044-0007-001 Surfacing Site Layout
EV005-PS-LAY-000-GB00015044-0004-001 Proposed Site Elevations
EV005-PS-GAS-000-GB00015044-0001-001 Proposed Building Details
EV005-PS-GAS-000-GB00015044-0002-001 Equipment Details Sheet
EV005-PS-LAY-000-GB00015044-0009-001 Vehicle Tracking HGV
EV005-PS-LAY-000-GB00015044-0010-001 Vehicle Tracking Cars

Any advertisements are indicative and are subject to a separate advertisement application.

F	06.09.24	SHOP AMENDED PB	
E	10.05.24	M&C FUEL CANOPY STANDARDS APPLIED	PB
D	30.04.24	UPDATES TO RED BLUE LINES PSB	
C	05.03.24	BP COMMENTS UPDATE	PSB
B	14.02.24	PRIMARY SIGNS ADDED	PSB
A	01.02.24	MINOR UPDATES PSB	

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**TOLLGATE SERVICE AREA
A2 WATLING STREET
NORTHFLEET, GRAVESEND
KENT DA11 7NP**

PROPOSED SITE LAYOUT

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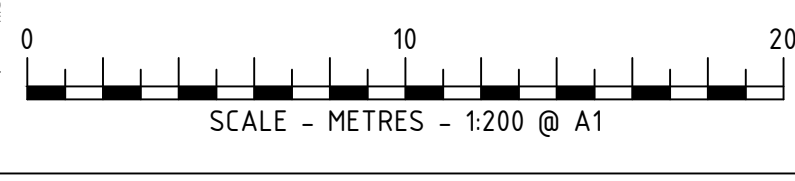
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A1
ORIGINAL
PLOT SIZE



APPENDIX B

DELIVERY CALCULATIONS

Appendix B: Delivery Calculations

Assessment project: BP Gravesend	Delivery component		
	Arrival	Unloading	Departure
Delivery noise activity - predicted ambient noise levels (L_{AeqT}) *			
Closest residential property address:	The Bungalow		
Source noise level at 10 metres L_{AeqT}	69	65	65
Time - minutes	0.5	30	0.5
Distance between noise source and residential property in metres	70	115	115
Screening attenuation dB	0	13	0
Convert to 1 hour - dB	-20.8	-3.0	-20.8
Convert to 15 mins - dB	-14.8	-0.3	-
Distance attenuation correction - dB	-16.9	-21.2	-21.2
Activity $L_{Aeq\ 1\ hr}$	31.3 dB	27.8 dB	23.0 dB
Activity $L_{Aeq\ 15\ mins}$	37.3 dB	30.5 dB	-
Rating level correction	0 dB	0 dB	0 dB
Resultant daytime rating level $L_{Ar, Tr}$	31.3 dB	27.8 dB	23.0 dB
Resultant nighttime rating level $L_{Ar, Tr}$	37.3 dB	30.5 dB	-
Overall delivery activity noise (arrival, unloading, departure) $L_{Aeq\ 1\ hr}$	33 dB		
Overall delivery activity noise (arrival + unloading) $L_{Aeq\ 15\ mins}$	38 dB		
Rating level dB $L_{Aeq\ 1\ hr}$	33 dB		
Rating level dB $L_{Aeq\ 15\ mins}$	38 dB		
Delivery noise activity - predicted peak noise levels (L_{Amax})			
Source noise level at 10 metres L_{amax}	76	80	76
Distance between noise source and residential property in metres	70	115	115
Screening attenuation dB	0	13	0
Distance attenuation correction - dB	-16.9	-21.2	-21.2
Peak noise level L_{Amax}	59 dB	46 dB	55 dB

APPENDIX C

ACOUSTIC TERMINOLOGY

Acoustic Terminology

- C1 Noise, defined as unwanted sound, is measured in units of decibels, dB. The range of audible sounds is from 0 dB to 140 dB. Two equal sources of sound, if added together will result in an increase in level of 3 dB, i.e. 50 dB + 50 dB = 53 dB. Increases in continuous sound are perceived in the following manner:
- 1 dB increase - barely perceptible.
 - 3 dB increase - just noticeable.
 - 10 dB increase - perceived as twice as loud.
- C2 Frequency (or pitch) of sound is measured in units of Hertz. 1 Hertz (Hz) = 1 cycle/second. The range of frequencies audible to the human ear is around 20Hz to 18000Hz (or 18kHz). The capability of a person to hear higher frequencies will reduce with age. The ear is more sensitive to medium frequency than high or low frequencies.
- C3 To take account of the varying sensitivity of people to different frequencies a weighting scale has been universally adopted called "A-weighting". The measuring equipment has the ability automatically to weight (or filter) a sound to this A scale so that the sound level it measures best correlates to the subjective response of a person. The unit of measurement thus becomes dBA (decibel, A-weighted).
- C4 The second important characteristic of sound is amplitude or level. Two units are used to express level, a) sound power level - L_w and b) sound pressure level - L_p . Sound power level is an inherent property of a source whilst sound pressure level is dependent on surroundings/distance/directivity, etc. The sound level that is measured on a meter is the sound pressure level, L_p .
- C5 External sound levels are rarely steady but rise or fall in response to the activity in the area - cars, voices, planes, birdsong, etc. A person's subjective response to different noises has been found to vary dependent on the type and temporal distribution of a particular type of noise. A set of statistical indices have been developed for the subjective response to these different noise sources.
- C6 The main noise indices in use in the UK are:
- LA90: The sound level (in dBA) exceeded for 90% of the time. This level gives an indication of the sound level during the quieter periods of time in any given sample. It is used to describe the "background sound level" of an area.
 - LAeq: The equivalent continuous sound level in dBA. This unit may be described as "the notional steady noise level that would provide, over a period, the same energy as the intermittent noise". In other words, the energy average level. This unit is now used to measure a wide variety of different types of noise of an industrial or commercial nature, as well as aircraft and trains.

LA10: The sound level (in dBA) exceeded for 10% of the time. This level gives an indication of the sound level during the noisier periods of time in any given sample. It has been used over many years to measure and assess road traffic noise.

LAMAX The maximum level of sound measured in any given period. This unit is used to measure and assess transient noises, i.e. gun shots, individual vehicles, etc.

C7 The sound energy of a transient event may be described by a term SEL - Sound Exposure Level. This is the LAeq level normalised to one second. That is the constant level in dBA which lasting for one second has the same amount of acoustic energy as a given A weighted noise event lasting for a period of time. The use of this unit allows the prediction of the LAeq level over any period and for any number of events using the equation;

$$L_{AeqT} = SEL + 10 \log n - 10 \log T \text{ dB.}$$

Where

n = Number of events in time period T.

T = Total sample period in seconds.

C8 In the open, known as free field, sound attenuates at a rate of 6 dB per each doubling of distance. This is known as geometric spreading or sometimes referred to as the Inverse Square Law. As noise is measured on a Logarithmic scale, this attenuation in distance = 20 Log (ratio of distances), e.g. for a noise level of 60 dB at ten metres, the corresponding level at 160 metres is:

$$60 - 20 \log \frac{160}{10} = 60 - 24 = 36 \text{ dB}$$