Noise Impact Assessment

SPAR Store Post Office and Petrol Filling Station, Frizington

Reference: 50-500-R1-2

Date: April 2022

NOISE IMPACT ASSESSMENT

SPAR Store Post Office and
Petrol Filling Station, Frizington

Prepared for:

M&L Richardson & Sons Ltd

Report Ref: 50-500-R1-2
Date Issued: 12th April 2022

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EXECUTIVE SUMMARY

BACKGROUND

Site Address	Main Street, Frizington CA26 3SA
National Grid Reference	E 303361 N 517196
Proposed Development	Construction of Convenience Store, Post Office and Petrol Filling Station along with infrastructure.
Report Objectives	The objectives of this report are to: • Identify, measure and assess the potential impact of any proposed sound sources associated with the development upon existing and proposed receptors in the immediate vicinity of the Site. The report follows current and relevant British Standards in order to provide a robust assessment.

ASSESSMENT

Surveys Completed	An unattended background and ambient sound survey has been undertaken out of a 1st floor window of the existing building in the south western area of the Site, The Griffin, in a position representative of surrounding residential receptors.
Assessments	A 3D noise model has been constructed to assess potential commercial sound impact. The model has been used to predict the Rating Level at the receptors which has been compared with the typical background sound level, accounting for any acoustic characteristics associated with the sound in accordance with BS 4142:2014. A worst-case assessment has been undertaken assuming worst-case plant and maximum deliveries in any given, applicable time period.
Mitigation Requirements	The assessment determined that the predicted rating level during the daytime and night-time periods, at existing receptors, would exceed at certain dwellings. As such, close boarded fencing in addition to that proposed is recommended around part of the car park area at a height of 2 m.

CONCLUSIONS

This assessment has shown that no adverse impact is predicted day or night at the receptors due to commercial/industrial sound.

As such, noise need not be a material consideration in the granting of planning permission if the recommendations of this report are followed and included within the design stage.

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1. INTRODUCTION

1.1. BACKGROUND

E3P were commissioned by M&L Richardson & Sons Ltd to undertake a Noise Impact Assessment for a proposed SPAR Store, Post Office and Petrol Filling Station (PFS) at an existing site off Main Street in Frizington, to be referred to hereafter as '*the Site*'.

This assessment looks to determine the key noise sources associated with the proposed development and to assess their impact, if any, upon existing residential receptors and to specify mitigation measures, where required.

1.2. PROPOSED DEVELOPMENT

The client intends to demolish the existing buildings and construct a SPAR store with Post Office and PFS along with associated infrastructure including external plant, refuse stores, fuel pumps, etc.

The key sources of sound associated with the development will be heavy goods vehicle (HGV) deliveries, fuel deliveries and external plant including condensers and air conditioning units.

This assessment has been undertaken in accordance with the following supplied drawings:

- Site Plan and Street Elevations (Drawing Number 453 16 Rev P2) dated January 2022.

The Site Plan is shown in Figure 1 of Appendix II.

1.3. LIMITATIONS

Where a noise or vibration survey is required to inform an assessment, E3P will endeavour to ensure that all noise and vibration measurements taken are robust, representative and reliable in order to inform an accurate assessment at the time.

E3P will endeavour to capture all existing and proposed sources of sound and vibration at the time of the surveys and/or assessments. However, should new sources of sound be introduced, existing sources modified/changed, or characteristics of the sound be altered following completion of such, E3P cannot be held accountable for this.

Where mitigation measures are specified in this report, it should be noted that these measures are relative to a specific sound or vibration source, both in terms of the measured sound pressure and vibration level and the character of the sound source. Where either the sound pressure level or the character of the sound varies following completion of the sound survey, E3P cannot be held responsible for any subsequent variations in the proposed mitigation performance, for either absolute levels or frequency content.

2. ASSESSMENT METHODOLOGY

2.1. NATIONAL PLANNING POLICY FRAMEWORK

To prevent unacceptable risks from pollution, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be considered.

The national planning policy framework states that planning policies and decisions should aim to:

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

2.2. NATIONAL PLANNING PRACTICE GUIDANCE

Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. When preparing local or neighbourhood plans, or taking decisions about new development, there may also be opportunities to consider improvements to the acoustic environment.

Local planning authorities' plan-making and decision-making should take account of the acoustic environment and in doing so consider:

- Whether or not a significant adverse effect is occurring or is likely to occur.
- Whether or not an adverse effect is occurring or is likely to occur.
- Whether or not a good standard of amenity can be achieved.

In line with the explanatory note of the NPSE, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase, where applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.

The "observed effect levels" are as follows:

- **Significant observed adverse effect level:** This is the level of noise exposure above which significant adverse effects on health and quality of life occur.
- **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.
- **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.

Table 2.1 summarises the noise exposure hierarchy, based on the likely average response.

TABLE 2.1 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, or having to close windows for some of the time because of the noise where there is no alternative ventilation. 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, having to keep windows closed most of the time because of the noise where there is no alternative ventilation. 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 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 (auditory and non-auditory).	Unacceptable adverse effect	Prevent

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

These factors include the following:

- The source and absolute level of the noise together with the time of day it occurs. Some types and level of noise will cause a greater adverse effect at night than if they occurred during the day. The adverse effect can also be greater simply because there is less background noise at night.
- For non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise can be important.
- The spectral content of the noise and the general character of the noise. The local topology and topography should also be considered along with the existing and, where appropriate, the planned character of the area.

More specific factors to consider when relevant:

- Where applicable, the cumulative impacts of more than one source should be considered along with the extent to which the source of noise is intermittent and of limited duration.
- Consideration should also be given to whether adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time. In both cases, a suitable alternative means of ventilation is likely to be necessary.
- If external amenity spaces are an intrinsic part of the overall design, then the acoustic environment of those spaces should be considered so that they can be enjoyed as intended.

2.3. BS 4142: 2014+A1:2019 'METHODS FOR RATING AND ASSESSING INDUSTRIAL AND COMMERCIAL SOUND'

This standard describes methods for rating and assessing sound of an industrial 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 processes or premises, such as that from forklift trucks, or that from train or ship movements on or around an industrial or commercial Site.

The procedure detailed in the standard compares the measured or predicted specific noise level from any of the above with the background sound level at a residential dwelling. The measured background sound level at a receptor should be reliable and should not necessarily ascertain a lowest measured background sound level, but rather to quantify what is typical.

The specific noise level also acknowledges the reference time intervals depending upon whether the noise source operates during daytime (1-hour) or night-time (15-minute) periods.

There are several 'penalties' which can be attributed to the specific sound level depending upon the 'acoustic features' of the sound level under investigation as follows:

Tonality

- +2 dB: where the tonality is just perceptible.
- +4 dB: where the tonality is clearly perceptible; and
- +6 dB: where the tonality is highly perceptible.

Impulsivity

- +3 dB: where the impulsivity is just perceptible.
- +6 dB: where the impulsivity is clearly perceptible; and
- +9 dB: where the impulsivity is highly perceptible.

Intermittency

- +3 dB: where the intermittency is readily distinctive against the acoustic environment.

In addition to the above, there is a penalty for 'other sound characteristics' of +3 dB where a sound exhibits characteristics that are neither tonal nor impulsive, though are readily distinctive against the acoustic environment. BS 4142 goes on to state that the rating level is equal to the specific sound level if there are no such features present or expected to be present.

Assessment of the rating level relative to the background sound level can yield the following commentary:

- Typically, the greater this difference (between the rating level and the background sound level), the greater the magnitude of 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; and
- 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. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact.

It is common that a Local Planning Authority (LPA) will specify their own criterion and, where this is the case, this criterion will usually take precedence over a simple comparison of the rating level against the background sound level.

3. SURVEY RESULTS

The measurement positions are detailed in Figure 1 of Appendix III.

Following the initial submission to the LPA, E3P have since undertaken attended measurements of deliveries to update historical data.

3.1. SOURCE NOISE LEVELS – DELIVERIES

To inform assessments of this and similar sites, E3P have undertaken dedicated source noise measurements of all applicable deliveries that can take place at the proposed store, as well as supplemented by previously measured data. The following Table details the measured levels for fresh and main deliveries. E3P have relied upon previously measured data for fuel deliveries.

The measured levels have been analysed in detail and corrected for façade conditions and residual noise levels, where applicable. Only measurement distances of 0.5 and 0.7 m were possible due to the restricted space at the test site. However, this distance relates to the worst case measured levels, i.e. next to the tailgate where all rattling, motor noise and banging was noted. Operations further from this position only consisted of movements of trolleys across smooth concrete floors with little to no rattling.

TABLE 3.1 DELIVERY NOISE SOURCE LEVELS

DELIVERY	SOURCE	AVERAGE MEASURED SOUND LEVEL, $L_{Aeq,T}$ (dB)	MEASURED ON-TIME (seconds)	MEASURED DISTANCE (m)	HOURLY NOISE LEVEL, $L_{Aeq,1hr}$ (dB)	15 MINUTE NOISE LEVEL, $L_{Aeq,15mins}$ (dB)
Fresh Delivery with Refrigeration unit running	Reversing	64.5	17	2	41.3	47.3
	Tailgate Operation	68.4	99	0.7	52.8	58.8
	Unloading Operations	73.3	535	0.7	65.0	71.0
	Tailgate up	72.6	43	0.7	53.4	59.4
	Leaving	62.9	48	2	44.2	50.2
Main Delivery with engine off	Reversing	64.5	16	1	36.5	42.5
	Tailgate Operation	70.4	295	0.5	57.7	63.7
	Unloading Operations	74.6	1400	0.5	69.8	75.9

For the main delivery, the tailgate being retracted and the HGV leaving were included in the unloading/loading operations as it was at a relatively low level and of very short duration. The refrigeration unit was running for the fresh delivery but the noise from the unloading includes this and was the main noise source.

Respective sound power levels to be used in the assessment are given in Section 4.0.

3.2. UNATTENDED BACKGROUND AND AMBIENT SOUND SURVEY

E3P has conducted a full weekday and weekend Background and Ambient Sound Survey in order to quantify the existing levels of background and ambient sound at existing, and proposed, receptors in the immediate vicinity of the Site. The survey was carried out over the following time period:

- 10:00 Friday 7th January to 10:00 Monday 10th January 2022.

The following noise measurement position was chosen for the Background and Ambient Sound Survey:

- Noise Measurement Position 1 (NMP1): Located out of a first floor window of the former The Griffin Public House overlooking Mill Street. Dominant sources of noise included road traffic along the local road network.

Table 3.2 details the range and median measured background sound levels. The daytime levels correspond to the $L_{A90,1hr}$ and the night-time levels to the $L_{A90,15mins}$. Appendix II details the full hourly and 15-minute data.

TABLE 3.2 MODAL AND RANGE OF MEASURED BACKGROUND SOUND PRESSURE LEVELS

DATE	TIME PERIOD	RANGE OF MEASURED BACKGROUND SOUND PRESSURE LEVELS, $L_{A90,T}$ (dB)	MEDIAN MEASURED BACKGROUND SOUND PRESSURE LEVELS, $L_{A90,T}$ (dB)
Friday 7th January 2022	10:00–23:00	32.1-56.4	49
	23:00–07:00	27.8-56.8	28
Saturday 8th January 2022	07:00–23:00	33.4-57.9	56
	23:00–07:00	29.3-38.2	33
Sunday 9th January 2022	07:00–23:00	27.3-52.9	**48**
	23:00–07:00	25.7-44.8	**27**

During the survey, conditions mostly remained dry and wind speeds rarely exceeded 5 m/s.

The equipment outlined in Table 3.3 was used for the noise survey.

TABLE 3.3 NOISE MEASUREMENT EQUIPMENT AND CALIBRATION DATES

MEASUREMENT POSITION	EQUIPMENT DESCRIPTION	MANUFACTURER & TYPE NUMBER	SERIAL NUMBER	CALIBRATION DUE DATE
NMP1	Sound Level Meter	Cirrus CR:171B	G301925	27th November 2022
	Pre-amplifier	Cirrus MV:200F	10730F	
	Microphone	Cirrus MK:224	213437D	
	Calibrator	Cirrus CR:515	93700	

The sound level meter was field calibrated on site using the above-mentioned calibrator prior to and after noise measurements were taken. No significant drift was witnessed as noted above. Calibration certificates are available upon request.

4. NOISE IMPACT ASSESSMENT

For the purposes of this assessment, E3P has used noise modelling software, CadnaA 2021 MR1, to determine the impact of noise from the proposed sound sources associated with the development.

The following inputs have been included in the model:

- Proposed Site Plan Rev P2.
- Proposed 2 m high close boarded fences are included in the noise model for all scenarios and are shown on the proposed site plan.
- Ground elevations have been taken as existing by way of a 2 m grid Digital Terrain Model (DTM) which contains public sector information licensed under the Open Government License v3.0.
- Existing buildings have been included in the model and assumed to have a structured façade.
- With regards commercial/industrial sound, corrections have been applied to the inputted sound power levels to account for acoustic characteristics, as per BS 4142:2014. As such, the model output is the Rating Level, $L_{A,r}$.
- A reflection order of 2 has been used in all calculations.
- Noise levels generated using ISO 9613-1 and ISO 9613-2 "*Acoustics – Attenuation of sound during propagation outdoors*" as incorporated into CadnaA software.

E3P has used library source data and data for a similar development site to inform the noise model. The data used can be seen below:

TABLE 4.1 SOURCE DATA FOR INCLUSION IN NOISE MODEL

SOURCE	OPERATIONAL PERIODS	DAYTIME 1 HOUR SOUND POWER LEVEL, L_W (dB)	NIGHT-TIME 15 MINUTE SOUND POWER LEVEL, L_W (dB)
Heat Pump	24/7	61	61
Pumpstation	24/7	48	48
Dry cooler	24/7	50	50
Main convenience store delivery	Daytime and Night-time	78	78
Fuel delivery	Daytime and Night-time	72	75

With regards to fixed plant, no locations are noted on the plan and so the above items are modelled in the centre of the external fenced area to inform a worst-case assessment.

In order to inform a worst-case assessment, it is assumed that both deliveries can take place during the daytime and at night, 05:00-07:00.

This informs a worst-case assessment and thus worst-case mitigation requirements. The resultant sound pressure level is likely to be lower once operational and so any mitigation proposed may likely overcompensate or could be reviewed at the detailed design stage.

For the BS 4142:2014 assessments, penalties are applied to the specific sound level in order to provide the rating level. These penalties relate to the acoustic features of the sound source. Accordingly, the following objective and subjective features have been accounted for in the assessment, in accordance with the subjective method detailed in BS 4142:2014, for the Site as a whole operation.

TABLE 4.2 ACOUSTIC FEATURES

ACOUSTIC FEATURE	APPLICABLE?	ATTRIBUTABLE PENALTY	COMMENT
Tonality	Yes	2 dB	It is assumed that the external plant will result in a just perceptible tonality at the closest receptors.
Impulsivity	No	-	It is assumed that no impulsive sounds will exist.
Intermittency	Yes	3 dB	Intermittent operations at the site will be audible and noticeable to the receptors.
Other Sound Characteristics	No	-	Other penalties applied

Figures 2 and 3 determine the rating levels across the Site during the daytime and night-time periods, respectively, due to commercial/industrial sound.

4.1. DAYTIME ASSESSMENT

Figure 2 should be used to view the daytime rating level, $L_{A,r}$, at the existing receptors. In order to inform a worst-case assessment, the lowest modal value between 07:00 and 23:00 has been used, specifically 48 dB.

As can be seen, the highest predicted rating level at existing receptors is 49 dB for garden areas to the immediate north and less than 48 dB at all other receptors.

The level of exceedance at the garden to the north is up to 1 dB which could result in adverse impact. As such, mitigation measures are recommended to address this exceedance.

4.2. NIGHT-TIME ASSESSMENT

Figure 3 should be used to view the night-time rating level, $L_{A,r}$, at the receptors. In order to inform the assessment, the lowest measured modal 15-minute background sound level across all night-time periods between 23:00 and 07:00 has been used, specifically 27 dB. However, this level of background sound level is considered low and, considering the sources of sound, a BS 4142 assessment is not considered appropriate for the night-time periods. As such, consideration is given to internal noise levels in bedrooms to avoid sleep disturbance.

As can be seen, the highest predicted façade rating level at existing receptors is 43 dB. When considering a reduction of 13 dB by an open window, internal noise levels will equal the allowable internal criterion of 30 dB.

As such, no additional mitigation measures are required.

4.2.1. MAXIMUM NOISE LEVEL ASSESSMENT AT NIGHT

When considering instantaneous maximum noise levels, E3P has considered the impact of car park usage, specifically a car door slam, at a space closest to the respective receptors at night. As such, E3P has used library source data to inform the Table below for door slams. The closest space to each respective receptor is used. A criterion level of 60 dB $L_{Amax,fast}$ is used externally to the façade as detailed in WHO Guidelines.

TABLE 4.3 MAXIMUM NOISE LEVEL ASSESSMENT – CAR PARK USAGE

RECEPTOR	SOURCE	MEASURED MAXIMUM NOISE LEVEL, $L_{Amax,fast}$ (dB)	DISTANCE TO RECEPTOR (m)	CALCULATED EXTERNAL MAXIMUM NOISE LEVEL, $L_{Amax,fast}$ (dB)	WHO GUIDELINES EXTERNAL NOISE LEVEL CRITERION, $L_{Amax,fast}$ (dB)	DIFFERENCE, +/- (dB)
Mill Lane - North	Door slam	75 dB at 2 m	12	59	60	-1
Mill Lane – West	Door slam	75 dB at 2 m	17	56	60	-4
Main Street - East	Door Slam	75 dB at 2 m	14	58	60	-2

As shown in the Table, the predicted maximum noise levels at receptors fall below the criterion.

5. MITIGATION

The assessment determined compliance with night-time criteria at existing receptors but noted a slight exceedance at gardens to the north. As such, the following mitigation measures are proposed and are remodelled and shown in Figure 4:

- 2 m high close boarded timber fencing along northern edge of car park.

As shown, rating levels are now below 45 dB in this garden area.

The close boarded timber fencing must be sealed at the base, be free from holes and have a minimum mass of 10 kg/m^2. A typical close boarded fence would achieve this requirement.

6. CONCLUSION AND RECOMMENDATIONS

E3P were commissioned by M&L Richardson & Sons Ltd in order to undertake a Noise Impact Assessment for a proposed SPAR Store, Post Office and PFS at a site in Frizington.

An unattended background and ambient sound survey has been undertaken within the Site to quantify the existing levels of background sound at receptors surrounding the Site over a full weekday and weekend period.

A 3D noise model has been constructed to assess commercial sound impact. The model has been used to predict the rating level at the receptors which has been compared with the typical background sound level, accounting for any acoustic characteristics associated with the sound in accordance with BS 4142:2014.

The assessment determined that the predicted rating level during the daytime and night-time periods, at most existing receptors, would achieve or fall below the existing background sound level with the proposed close boarded timber fencing installed. However, a slight exceedance was noted at gardens to the north and, as such, an additional 2 m high fence is recommended along the car park edge.

As such, noise need not be a material consideration in the granting of planning permission if the recommendations of this report are followed and included within the design stage.

END OF REPORT

APPENDIX I
GLOSSARY OF ACOUSTIC TERMINOLOGY

NOISE

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source. The most widely used weighting mechanism that best corresponds to the response of the human ear is the "A"-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc., according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective but, as a general guide, a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions. An indication of the range of sound levels commonly found in the environment is given in the following table.

TABLE A1 TYPICAL SOUND PRESSURE LEVELS

SOUND PRESSURE LEVEL	LOCATION/EXAMPLE
0	Threshold of hearing
20–30	Quiet bedroom at night
30–40	Living room during the day
40–50	Typical office
50–60	Inside a car
60–70	Typical high street
70–90	Inside a factory
100–110	Burglar alarm at 1 m away
110–130	Jet aircraft on take off
140	Threshold of pain

ACOUSTIC TERMINOLOGY

TABLE A2 TERMINOLOGY

DESCRIPTOR	EXPLANATION
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2E-05 Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. "A" weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$L_{Aeq, T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the "fast" sound level meter response.
L_{10} and L_{90}	If a non-steady noise is to be described, it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and 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 the "average maximum level". Similarly, L_{90} is the "average minimum level" and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally, as measured outside and away from buildings.
Fast	A time weighting used in the root-mean-square section of a sound level meter with a 125-millisecond time constant.
Slow	A time weighting used in the root-mean-square section of a sound level meter with a 1000-millisecond time constant.

APPENDIX II
MEASURED SOUND PRESSURE LEVELS

TABLE A.1 HOURLY MEASURED AMBIENT AND BACKGROUND SOUND LEVELS

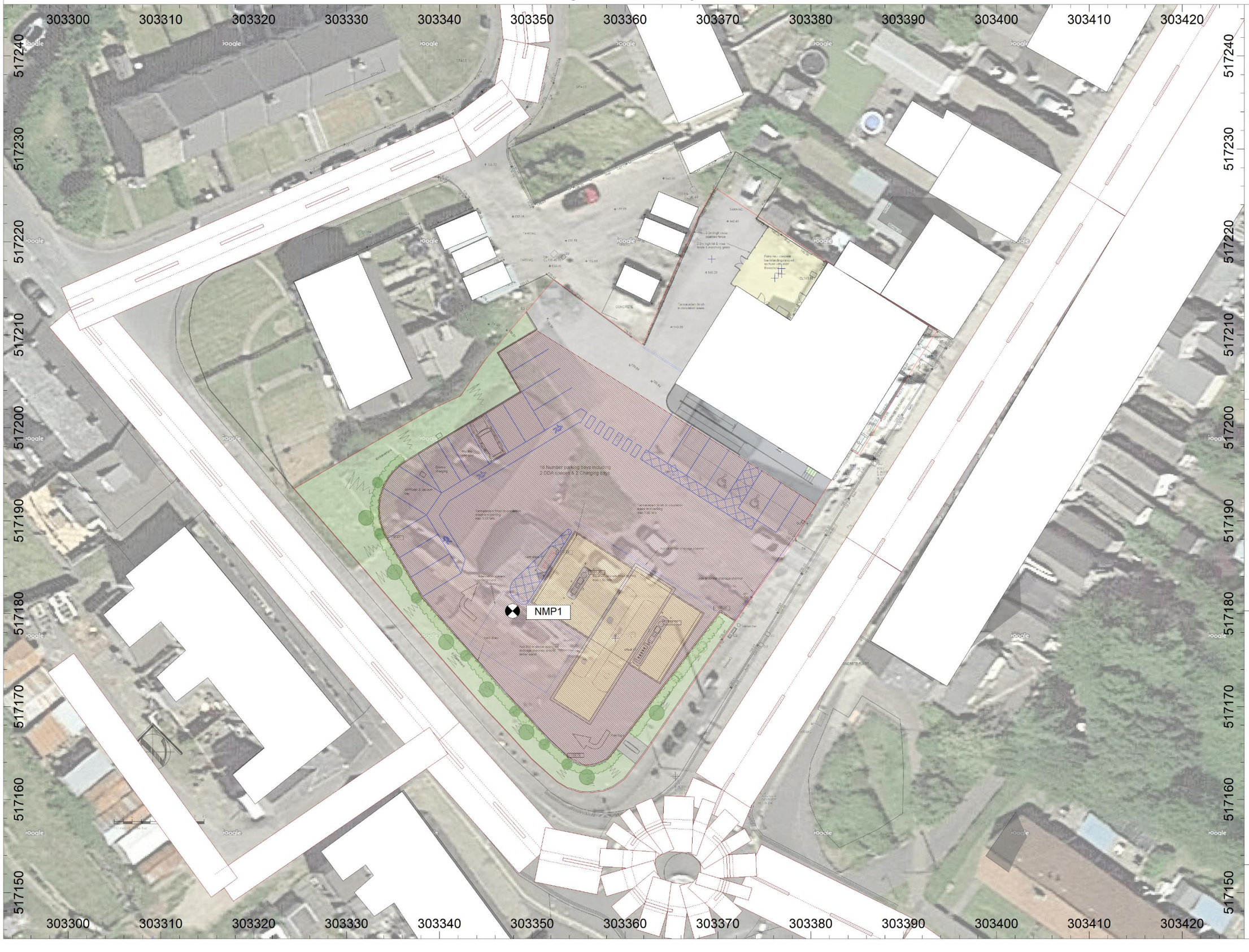
PERIOD START	MEASURED AMBIENT SOUND PRESSURE LEVEL, $L_{Aeq,1HR}$ (dB)	MEASURED BACKGROUND SOUND LEVEL, $L_{A90,1HR}$ (dB)
07/01/2022 10:00	60.5	48.6
07/01/2022 11:00	60.2	48.8
07/01/2022 12:00	61.7	50.9
07/01/2022 13:00	60.9	48.0
07/01/2022 14:00	61.9	50.1
07/01/2022 15:00	63.3	55.4
07/01/2022 16:00	62.3	52.6
07/01/2022 17:00	62.0	51.3
07/01/2022 18:00	60.7	46.5
07/01/2022 19:00	58.6	40.0
07/01/2022 20:00	56.4	36.8
07/01/2022 21:00	57.2	35.1
07/01/2022 22:00	54.9	32.9
07/01/2022 23:00	52.6	28.7
08/01/2022 00:00	51.1	29.8
08/01/2022 01:00	49.6	28.3
08/01/2022 02:00	57.8	40.8
08/01/2022 03:00	57.8	51.5
08/01/2022 04:00	59.8	52.3
08/01/2022 05:00	60.5	53.3
08/01/2022 06:00	62.4	55.5
08/01/2022 07:00	62.1	56.1
08/01/2022 08:00	60.1	48.9
08/01/2022 09:00	60.7	47.6
08/01/2022 10:00	62.9	54.3
08/01/2022 11:00	63.0	52.9
08/01/2022 12:00	62.5	51.4
08/01/2022 13:00	61.5	50.0
08/01/2022 14:00	60.6	49.1
08/01/2022 15:00	60.9	46.7
08/01/2022 16:00	62.2	46.3
08/01/2022 17:00	59.0	44.0
08/01/2022 18:00	58.2	43.6

PERIOD START	MEASURED AMBIENT SOUND PRESSURE LEVEL, $L_{Aeq,1HR}$ (dB)	MEASURED BACKGROUND SOUND LEVEL, $L_{A90,1HR}$ (dB)
08/01/2022 19:00	56.6	40.7
08/01/2022 20:00	55.7	40.0
08/01/2022 21:00	54.7	36.5
08/01/2022 22:00	54.1	36.1
08/01/2022 23:00	51.7	37.0
09/01/2022 00:00	49.0	36.1
09/01/2022 01:00	49.8	31.5
09/01/2022 02:00	46.8	31.4
09/01/2022 03:00	48.0	32.1
09/01/2022 04:00	50.9	31.9
09/01/2022 05:00	51.1	30.2
09/01/2022 06:00	51.4	33.3
09/01/2022 07:00	53.2	34.9
09/01/2022 08:00	58.0	43.8
09/01/2022 09:00	60.9	45.2
09/01/2022 10:00	60.8	47.8
09/01/2022 11:00	60.5	48.5
09/01/2022 12:00	61.5	50.1
09/01/2022 13:00	61.6	49.0
09/01/2022 14:00	61.8	49.9
09/01/2022 15:00	60.7	49.4
09/01/2022 16:00	60.6	47.4
09/01/2022 17:00	59.6	44.5
09/01/2022 18:00	58.7	39.9
09/01/2022 19:00	56.6	35.3
09/01/2022 20:00	55.9	33.7
09/01/2022 21:00	55.0	31.4
09/01/2022 22:00	52.0	28.1
09/01/2022 23:00	49.6	26.6
10/01/2022 00:00	46.1	25.9
10/01/2022 01:00	47.4	26.0
10/01/2022 02:00	37.2	26.4
10/01/2022 03:00	43.4	26.5
10/01/2022 04:00	51.1	27.4

PERIOD START	MEASURED AMBIENT SOUND PRESSURE LEVEL, $L_{Aeq,1HR}$ (dB)	MEASURED BACKGROUND SOUND LEVEL, $L_{A90,1HR}$ (dB)
10/01/2022 05:00	56.5	33.7
10/01/2022 06:00	58.2	40.4
10/01/2022 07:00	59.8	46.5
10/01/2022 08:00	61.8	53.3
10/01/2022 09:00	60.5	49.3

APPENDIX III
FIGURES

Figure 1 - Noise Survey Measurement Positions



Project:
Frizington

Project-No:
50-500

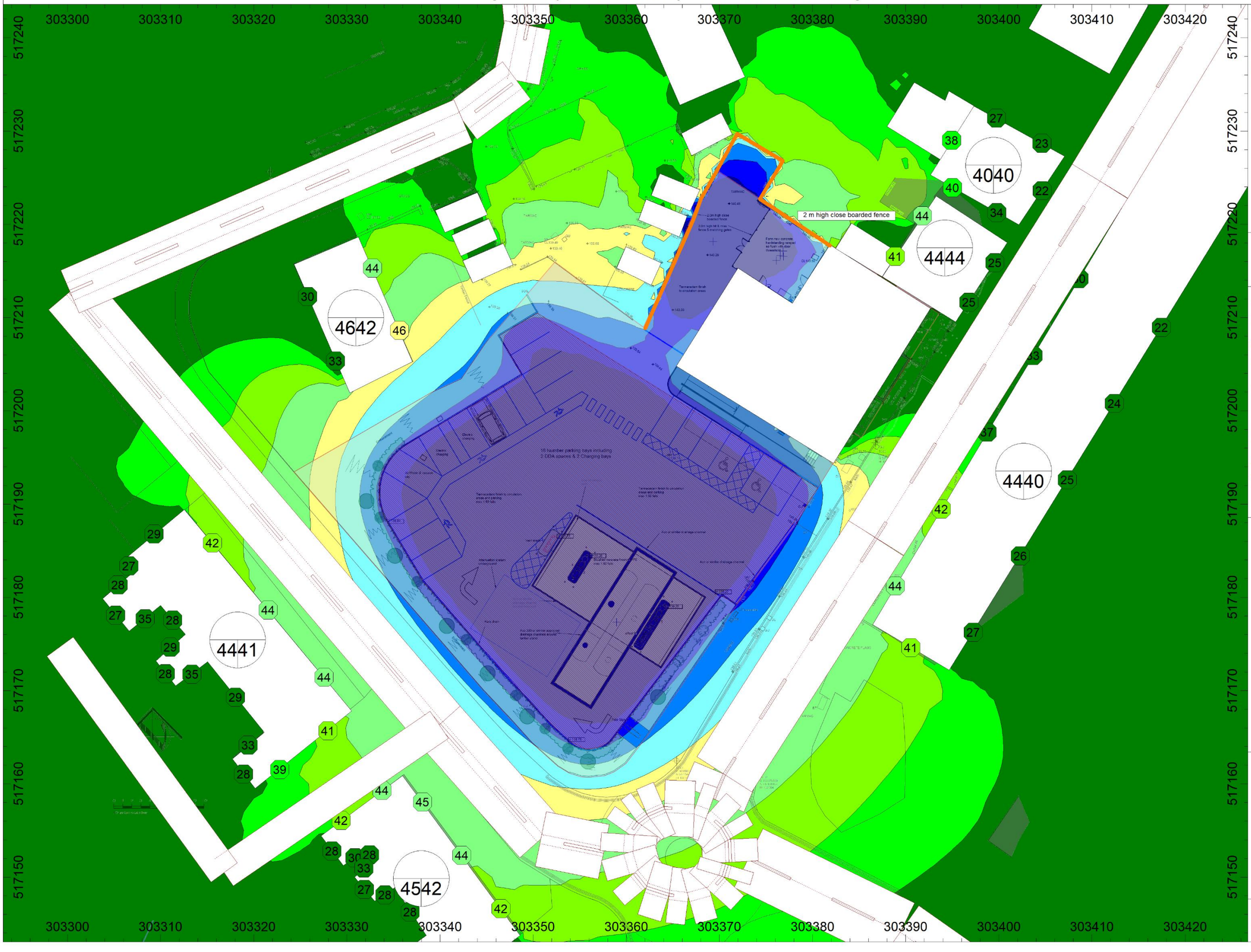
Client:
M&L Richardson & Sons Ltd

N

e3p

Project Engineer: L Faulkner
Date: 16/02/2022

Figure 2 - Daytime Grid Noise Map - Calculation at 1.5m above ground level



Project:
Frizington

Project-No:
50-500

Client:
M&L Richardson & Sons Ltd

Rating Level, LA,r (dB)

- ... <= 38
- 38 < ... <= 40
- 40 < ... <= 43
- 43 < ... <= 45
- 45 < ... <= 48
- 48 < ... <= 50
- 50 < ... <= 53
- 53 < ... <= 55
- 55 < ...

Noise Map Objects

- Point Source
- Road
- Parking Lot
- Building
- Barrier
- Contour Line
- Building Evaluation
- Calculation Area

e3p

Project Engineer: L Faulkner
Date: 16/02/2022

Figure 3 - Night-time Grid Noise Map - Calculation at 4m above ground level

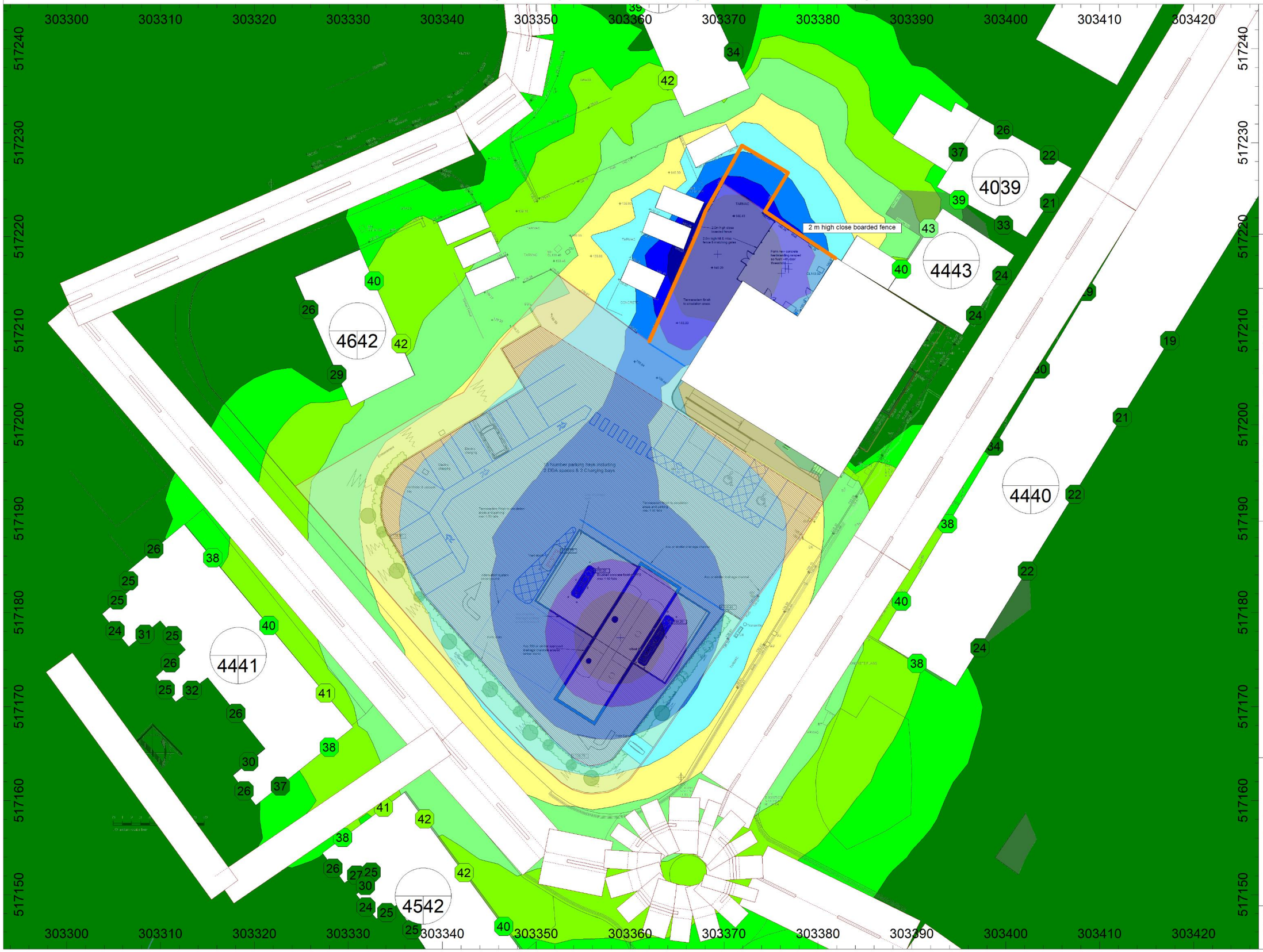


Figure 4 - Daytime with Mitigation Grid Noise Map - Calculation at 1.5 m above ground level