



e3p

Noise Impact Assessment

Former Lake Garage, Littleborough

Reference: 50-224-R2-2

Date: March 2023



NOISE IMPACT ASSESSMENT

Proposed Convenience Store
Former Lake Garage, Littleborough

Prepared for:

JAMES HALL & CO
— ESTD • 1863 —
LTD

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EXECUTIVE SUMMARY

BACKGROUND

Site Address	Former Lake Garage, Smithy Bridge Road, Littleborough OL15 0BQ
National Grid Reference	E 393023 N 415011
Proposed Development	Construction of Convenience Store and car park 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 receptors in the immediate vicinity of the Site. The report follows current and relevant British Standards to provide a robust assessment.

ASSESSMENT

Surveys Completed	E3P have undertaken an unattended background and ambient sound survey in a position considered representative of the existing receptors over an entire weekday and weekend period.
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.
Mitigation Requirements	The assessment determined that the predicted rating levels would fall below the background sound levels, day and night. As such, no mitigation measures are required.

CONCLUSIONS

This assessment has shown that no adverse impact is predicted day or night at the receptors due to commercial/industrial sound with a positive indication of the specific sound source having a low impact.

As such, noise need not be a material consideration in the granting of planning permission.



TABLE OF CONTENTS

EXECUTIVE SUMMARY	2
Background	2
Assessment.....	2
Conclusions	2
1. INTRODUCTION	4
1.1. Background	4
1.2. Proposed Development.....	4
1.3. Limitations	4
2. ASSESSMENT METHODOLOGY	5
2.1. National Planning Policy Framework	5
2.2. National Planning Practice Guidance.....	5
2.3. BS 4142: 2014 'Methods for rating and assessing industrial and commercial sound'	7
3. SURVEY RESULTS.....	9
3.1. Source Noise Levels – Deliveries	9
3.2. Unattended Background and Ambient Sound Survey	10
4. NOISE IMPACT ASSESSMENT	12
4.1. Daytime Assessment – All Activity 07:00-23:00.....	14
4.2. Night-time Assessment – Plant Only 23:00-06:00	14
4.3. Night-time Assessment – Deliveries and Plant 06:00-07:00	15
5. CONCLUSION AND RECOMMENDATIONS.....	16
APPENDIX I GLOSSARY OF ACOUSTIC TERMINOLOGY.....	17
APPENDIX II MEASURED BACKGROUND SOUND LEVELS.....	20
APPENDIX III FIGURES	25



1. INTRODUCTION

1.1. BACKGROUND

E3P were commissioned by James Hall & Co to undertake a Noise Impact Assessment for a proposed Convenience Store at the former Lake Garage on Smithy Bridge Road in Littleborough, 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

James Hall & Co intend to demolish the existing buildings and construct a Convenience Store and car park along with associated infrastructure.

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

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

-  Site Plan (2016-333 21 Rev P8) dated December 2022.

The Plan is shown in Figure 1 of Appendix III.

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 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 '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.



3. SURVEY RESULTS

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

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.

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 undertaken an unattended background and ambient sound survey in a position considered representative of the existing residential receptors. The survey was carried out over the following period:

📅 11:00 Thursday 8th October to 10:00 Monday 12th October 2020.

The survey was initially carried out in 2020. However, it is unlikely that the existing soundscape has change significantly over this time period and is therefore useable for the assessment.

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

📍 Noise Measurement Position 1 (NMP1): Located on the south eastern boundary of the Site immediately adjacent to the closest residential dwellings along Smithy Bridge Road to the south east. The microphone of the sound level meter was located in free-field conditions and at a height of 1.5 m above ground level. The sound climate was dominated by road traffic along Smithy Bridge Road.

Weather conditions during the survey were noted to be acceptable and were monitored daily to ensure compliance. Table 3.2 details the modal measured values for each respective period following statistical analysis. Hourly data is shown in Appendix II and full datasets are available upon request. Levels highlighted in bold represent those to be used in the assessment.

TABLE 3.2 STATISTICAL VALUES FOR EACH DAYTIME AND NIGHT-TIME PERIOD

DATE	ASSESSMENT PERIOD	MODAL BACKGROUND SOUND LEVEL, $L_{A90,T}$ (dB)	AVERAGE AMBIENT NOISE LEVEL, $L_{Aeq,T}$ (dB)
THURSDAY 8th OCTOBER 2020	Daytime	49	58
	Night-time	35	49
FRIDAY 9th OCTOBER 2020	Daytime	52	59
	Night-time	43	50
SATURDAY 10th OCTOBER 2020	Daytime	51	59
	Night-time	30	48
SUNDAY 11th OCTOBER 2020	Daytime	49	58
	Night-time	30	47

The equipment outlined in Table 3.2 was used for the noise survey.



Proposed Convenience Store, Littleborough

Noise Impact Assessment

March 2023

TABLE 3.2 NOISE MEASUREMENT EQUIPMENT AND CALIBRATION DATES

MEASUREMENT POSITION	EQUIPMENT DESCRIPTION	MANUFACTURER & TYPE NUMBER	SERIAL NUMBER	CALIBRATION DUE DATE AT TIME OF SURVEY
NMP1	Sound Level Meter	01dB Fusion	12039	26th March 2021
	Pre-amplifier	01dB Pre22	Internal	
	Microphone	01dB 40CE	330832	
	Calibrator	01dB Cal31	87281	25th February 2021

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 2022 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:

- ✳ Site Plan Rev P8.
- ✳ 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, $L_{A,r}$.
- ✳ Car usage on site is accounted for by way of a parking lot source, within the software with 29 spaces set to account for the 18 parking spaces, assuming 18 vehicles entering and leaving in any given one-hour daytime period and 5 vehicles in any given 15 minute night-time period to inform a worst case assessment. This involves vehicle movement through the site and parking in the allocated spaces.
- ✳ 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 dedicated source data and data provided by James Hall & Co for previous applications for similar sites 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	OPERATIONAL ON-TIME	DAY SOUND POWER LEVEL, L_w (dB)	NIGHT SOUND POWER LEVEL, L_w (dB)
3 x ZANOTTI AIR CONDENSORS	24/7 with reduced loads typically, during the night-time	Constant	70	70
DRY COOLERS	As above	Constant	50	50
PUMP STATION	As above	Constant	61	61
MAIN CONVENIENCE STORE DELIVERY	Assumed to take place day or night (06:00-07:00)	Approximately 30 minutes	78	80
FRESH PRODUCE DELIVERY	Assumed to take place day or night (06:00-07:00)	Approximately 15 minutes	74	80



Proposed Convenience Store, Littleborough

Noise Impact Assessment

March 2023

SOURCE	OPERATIONAL PERIODS	OPERATIONAL ON-TIME	DAY SOUND POWER LEVEL, L_w (dB)	NIGHT SOUND POWER LEVEL, L_w (dB)
REFRIGERATION UNIT DURING FRESH DELIVERY	Associated with Fresh Produce Delivery to take place day or night (06:00-07:00)	Approximately 15 minutes	85	-

It is also assumed that both deliveries can take place during the same one-hour period in the daytime, i.e. main delivery for 30 minutes then fresh delivery for 15 minutes in an hour. This informs a worst-case assessment and thus worst-case mitigation requirements. Only the main delivery is assumed at night as in a 15-minute period, both deliveries couldn't take place due to the time it takes for unloading.

The resultant sound pressure level is likely to be much lower once operational as deliveries are likely to be staggered and so any mitigation proposed may likely overcompensate or could be reviewed at the detailed design stage. Furthermore, deliveries, at night, are limited to 06:00-07:00 when background sound levels are much higher. The night-time period is defined from 23:00 to 07:00.

The above plant is typical of this type of store, however, the specific plant used will be dependent on the detailed design of the mechanical services which has not yet been undertaken.

With regards the plant room, internal to external calculations have been undertaken below. Therefore, the noise levels of the facades of the building have been calculated as follows assuming the equipment detailed in Table 4.2. acoustic louvres are to be located on north eastern facades of the plant room with other facades and the roof considered solid construction. As such, only the north eastern façade is considered to have significant break-out.

The direct sound pressure levels (Direct SPL) within the reception building have been calculated based on the following formula:

$$\text{Direct SPL} = L_w + (10 \times \log(1 / ((4 \times 3.14) \times D^2)))$$

Where: L_w is the sound power level of the source
 D is the distance of the source from the facade

Each Direct SPL of each item of plant on each façade have been logarithmically added together to provide the Direct SPL for each façade.

The reverberant sound pressure level (Reverb SPL) has been calculated as follows:

$$\text{Reverb SPL} = L_w + (10 \times \log(4 / R_c))$$

Where: L_w is the sound power level of the source
 R_c is the room constant

These have again been logarithmically added together to provide the Reverb SPL for each façade for all sources. The Reverb SPL has then been logarithmically added to the Direct SPL for each façade.

The following equation has been used to determine the sound power level of each façade:

$$L_w = L_p + (10 \times \log(S))$$



Where: L_P is the sound pressure level of the façade assuming -6 directivity
 S is the surface area of the facade

Given the plant run continuously during daytime and night-time periods, no deviation is expected between each period. A sound reduction index of 8 dB is given for the louvres for the centre frequency. An SRI of 31 dB is assumed for the tiled roof given the specification.

The building facades are inputted as vertical area sources. The roof is sufficiently low enough not to consider.

For the BS 4142:2014 assessments, penalties are applied to the specific sound level 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 and refrigeration units will result in a just perceptible tonality at the closest receptors.
Impulsivity	No	-	No impulsivity expected.
Intermittency	Yes	3 dB	Intermittent HGV movements for deliveries 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 and at the closest receptors during the daytime and night-time periods, respectively, due to commercial/industrial sound. The daytime levels relate to external levels in gardens or at ground floor level. Night-time levels are calculated at first floor height.

4.1. DAYTIME ASSESSMENT – ALL ACTIVITY 07:00-23:00

Figure 2 should be used to view the daytime rating level, $L_{A,r}$, at the existing receptors. To inform the assessment, the lowest modal background level, 49 dB $L_{A90,1hr}$ has been used.

As can be seen, the highest predicted rating level at existing receptors is up to 48 dB to the north west at the very edges of the gardens, not accounting for fencing or the numerous garages. As such, no adverse impact is predicted. The closest receptors to the south east will experience a rating level of up to 45 dB, 4 dB below the background. This is therefore a positive indication of the specific sound source having a low impact.

4.2. NIGHT-TIME ASSESSMENT – PLANT ONLY 23:00-06:00

Figure 3 should be used to view the night-time rating level, $L_{A,r}$, at the receptors with the plant running. This assessment assumes worst case night-time periods when plant will be running. . The lowest modal measured 15-minute background sound level across all night-time periods between 23:00 and 06:00 has been used, specifically 30 dB. This background sound level is considered very low.



As can be seen, the highest predicted rating level at the closest facades of existing receptors is 32 dB. This exceeds the background sound level by up to 2 dB at receptors to the north west and south east.

However, it is worth noting that the lowest average night-time ambient noise level was 47 dB, which when considering the specific sound level predicted here, 30 dB, would strongly suggest that proposed activities would not influence the ambient noise level. As such, it is more prudent to consider internal noise level impact within bedrooms considering the main sources of sound here are steady state fixed plant. The calculated specific noise level at the closest facades is, at most, 30 dB. When considering a reduction of 13 dB for an open window, this results in an internal noise level of 17 dB, 13 dB below the criterion.

As such, no adverse impact is predicted.

4.3. NIGHT-TIME ASSESSMENT – DELIVERIES AND PLANT 06:00-07:00

Figure 4 should be used to view the night-time rating level, $L_{A,r}$, at the receptors with the plant running and a delivery taking place. The lowest modal measured 15-minute background sound level across all night-time periods between 06:00 and 07:00 has been used, specifically 44 dB.

As can be seen, the highest predicted rating level at closest facades of existing receptors is 37 dB. This falls below the background sound level by 7 dB at the receptors to the north west.

As such, no adverse impact is predicted.



5. CONCLUSION AND RECOMMENDATIONS

E3P were commissioned by James Hall & Co to undertake a Noise Impact Assessment for a proposed Convenience Store at the former Lake Garage in Littleborough.

An unattended background and ambient sound survey has been undertaken in October 2020 representative of the closest residential receptors to the site. E3P have relied upon previously measured data for deliveries and details on plant items provided by the client.

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 periods, at existing receptors, would fall below the typical background sound levels and therefore giving a positive indication of the specific sound source having a low impact. Delivery noise was found to be of low impact during the day and night.

With regards to the night-time period, there is predicted to be a minor exceedance of the background sound level at receptors due to fixed plant sound but internal noise levels in bedrooms would fall well below the required criterion given in BS 8233:2014. Furthermore, the existing ambient noise levels are sufficiently high so much so that the proposed development would not influence the existing sound levels.

As such, noise need not be a material consideration in the granting of planning permission.

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.
L₁₀ and L₉₀	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 BACKGROUND SOUND LEVELS

Proposed Convenience Store, Littleborough

Noise Impact Assessment

March 2023

TABLE A1: HOURLY AMBIENT AND BACKGROUND SOUND LEVEL DATA

PERIOD START	AMBIENT SOUND LEVEL, $L_{Aeq,1hr}$ (dB)	BACKGROUND SOUND LEVEL, $L_{A90,1hr}$ (dB)
10/08/2020 11:00	61.0	48.2
10/08/2020 12:00	58.8	49.1
10/08/2020 13:00	62.2	47.8
10/08/2020 14:00	57.8	49.1
10/08/2020 15:00	58.2	50.3
10/08/2020 16:00	58.3	51.5
10/08/2020 17:00	58.9	50.9
10/08/2020 18:00	58.3	49.4
10/08/2020 19:00	57.2	47.0
10/08/2020 20:00	56.0	44.3
10/08/2020 21:00	55.5	41.3
10/08/2020 22:00	55.0	38.1
10/08/2020 23:00	51.1	36.7
10/09/2020 00:00	46.4	35.0
10/09/2020 01:00	47.4	34.6
10/09/2020 02:00	44.0	34.3
10/09/2020 03:00	45.5	35.0
10/09/2020 04:00	48.8	36.6
10/09/2020 05:00	52.4	41.0
10/09/2020 06:00	56.3	49.4
10/09/2020 07:00	59.7	52.4
10/09/2020 08:00	61.0	53.3
10/09/2020 09:00	59.5	51.7
10/09/2020 10:00	58.4	50.2
10/09/2020 11:00	58.9	50.6
10/09/2020 12:00	60.0	51.7
10/09/2020 13:00	59.6	51.6
10/09/2020 14:00	58.6	51.4
10/09/2020 15:00	59.3	52.8
10/09/2020 16:00	59.1	52.7



Proposed Convenience Store, Littleborough

Noise Impact Assessment

March 2023

PERIOD START	AMBIENT SOUND LEVEL, $L_{Aeq,1hr}$ (dB)	BACKGROUND SOUND LEVEL, $L_{A90,1hr}$ (dB)
10/09/2020 17:00	59.9	52.9
10/09/2020 18:00	59.7	50.5
10/09/2020 19:00	58.8	49.9
10/09/2020 20:00	57.7	48.0
10/09/2020 21:00	57.2	46.4
10/09/2020 22:00	58.2	48.6
10/09/2020 23:00	54.4	41.6
10/10/2020 00:00	50.4	38.0
10/10/2020 01:00	50.1	35.1
10/10/2020 02:00	46.9	33.0
10/10/2020 03:00	48.9	35.8
10/10/2020 04:00	45.7	33.5
10/10/2020 05:00	51.2	36.2
10/10/2020 06:00	52.5	38.6
10/10/2020 07:00	57.3	46.0
10/10/2020 08:00	59.2	49.5
10/10/2020 09:00	59.3	50.3
10/10/2020 10:00	60.0	51.0
10/10/2020 11:00	60.2	51.1
10/10/2020 12:00	59.5	52.1
10/10/2020 13:00	59.4	52.0
10/10/2020 14:00	58.6	51.0
10/10/2020 15:00	60.1	50.0
10/10/2020 16:00	58.7	50.6
10/10/2020 17:00	58.8	49.9
10/10/2020 18:00	58.5	48.8
10/10/2020 19:00	57.1	47.7
10/10/2020 20:00	56.4	44.7
10/10/2020 21:00	60.3	44.4
10/10/2020 22:00	55.3	42.3



Proposed Convenience Store, Littleborough

Noise Impact Assessment

March 2023

PERIOD START	AMBIENT SOUND LEVEL, $L_{Aeq,1hr}$ (dB)	BACKGROUND SOUND LEVEL, $L_{A90,1hr}$ (dB)
10/10/2020 23:00	56.7	34.7
10/11/2020 00:00	49.4	31.0
10/11/2020 01:00	49.7	31.3
10/11/2020 02:00	46.9	30.8
10/11/2020 03:00	46.4	30.1
10/11/2020 04:00	45.7	29.7
10/11/2020 05:00	48.7	31.7
10/11/2020 06:00	49.9	34.2
10/11/2020 07:00	54.4	40.6
10/11/2020 08:00	56.6	44.8
10/11/2020 09:00	57.6	48.5
10/11/2020 10:00	58.4	49.0
10/11/2020 11:00	58.4	50.1
10/11/2020 12:00	59.2	50.6
10/11/2020 13:00	59.0	49.8
10/11/2020 14:00	59.5	50.9
10/11/2020 15:00	58.1	49.3
10/11/2020 16:00	58.0	49.0
10/11/2020 17:00	58.0	48.6
10/11/2020 18:00	57.6	47.7
10/11/2020 19:00	63.9	44.7
10/11/2020 20:00	56.1	42.2
10/11/2020 21:00	53.0	38.2
10/11/2020 22:00	53.1	30.8
10/11/2020 23:00	49.1	29.9
10/12/2020 00:00	46.1	28.9
10/12/2020 01:00	44.9	26.6
10/12/2020 02:00	38.9	27.2
10/12/2020 03:00	45.0	28.5
10/12/2020 04:00	46.7	31.4



Proposed Convenience Store, Littleborough

Noise Impact Assessment

March 2023

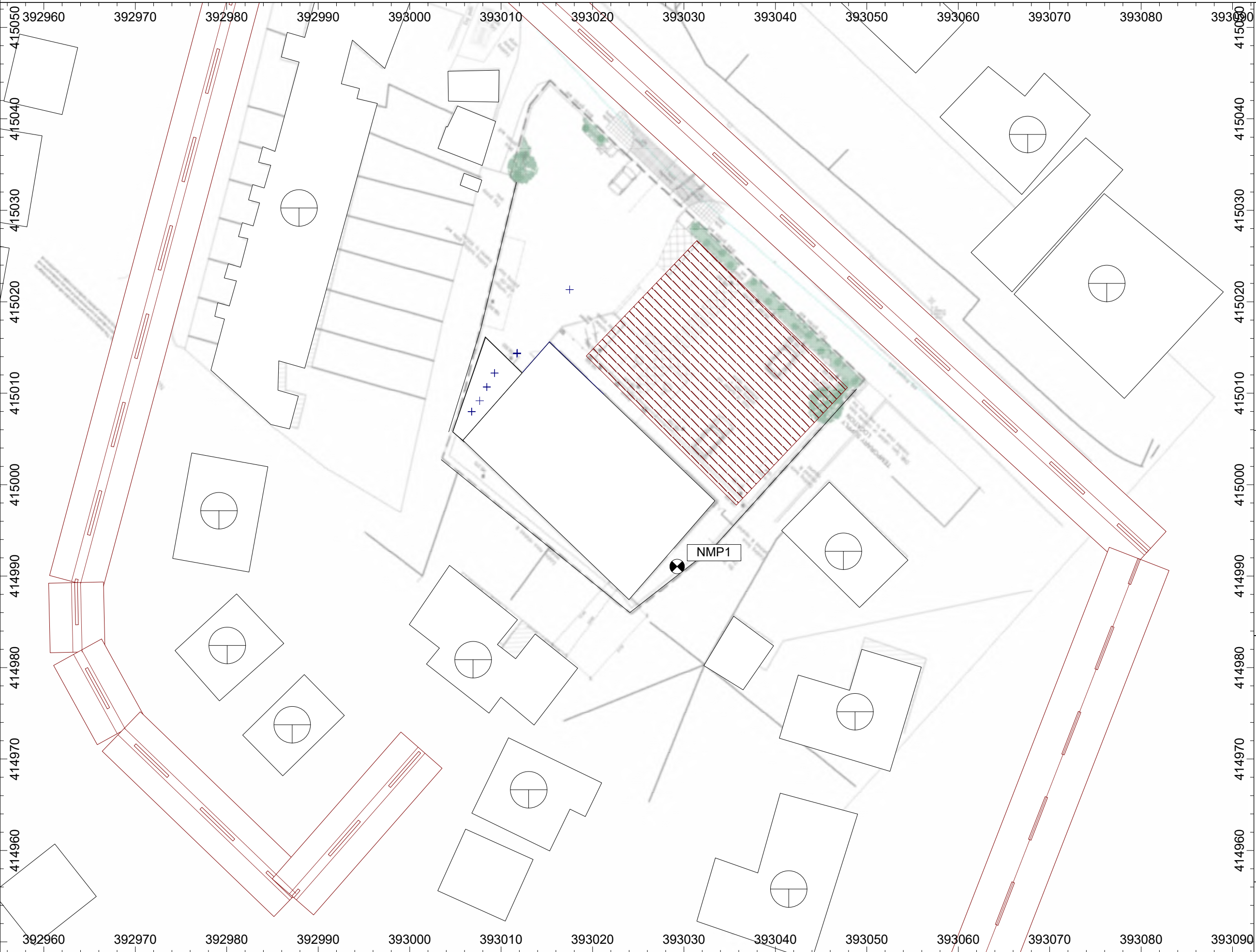
PERIOD START	AMBIENT SOUND LEVEL, $L_{Aeq,1hr}$ (dB)	BACKGROUND SOUND LEVEL, $L_{A90,1hr}$ (dB)
10/12/2020 05:00	52.5	37.3
10/12/2020 06:00	55.1	45.5
10/12/2020 07:00	57.2	49.3
10/12/2020 08:00	58.9	50.5
10/12/2020 09:00	58.8	49.8



APPENDIX III

FIGURES

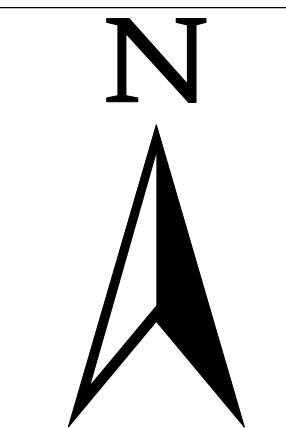
Figure 1 - Noise Survey Measurement Positions



Project:
Former Lake Garage,
Littleborough

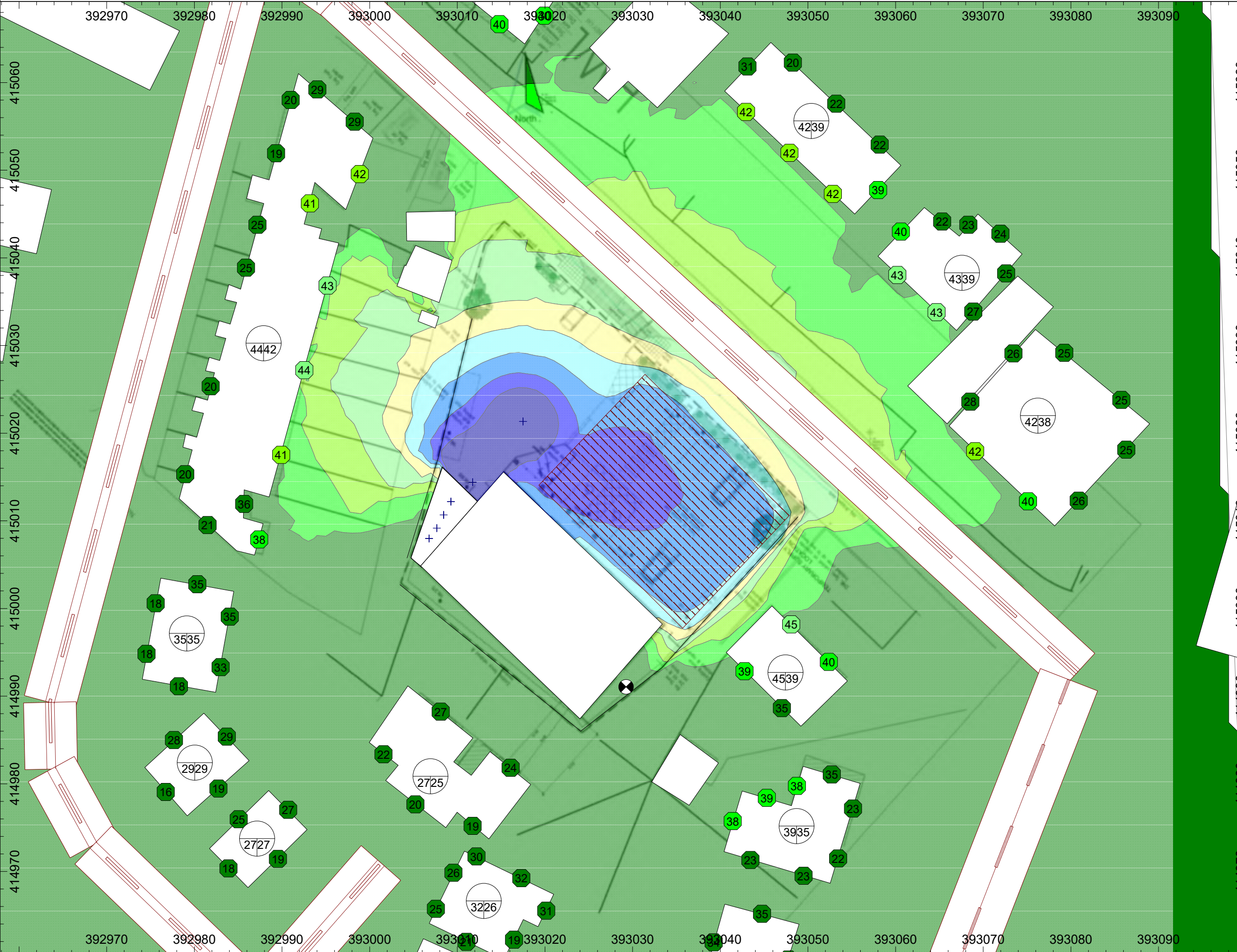
Project-No:
50-224

Client:
James Hall & Co



Project Engineer: L Faulkner
Date: 13/02/2023

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



Project:
Former Lake Garage,
Littleborough

Project-No:
50-224

Client:
James Hall & Co

**Daytime Rating Level,
LA,r (dB)**

...	≤ 38
38 < ...	≤ 40
40 < ...	≤ 42
42 < ...	≤ 45
45 < ...	≤ 48
48 < ...	≤ 50
50 < ...	≤ 52
52 < ...	≤ 55
55 < ...	

Noise Map Objects

- + Point Source
- x vert. Area Source
- Road
- ▨ Parking Lot
- Building
- Barrier
- - - Contour Line
- Receiver
- ⊕ Building Evaluation
- Calculation Area

e3p

Project Engineer: L Faulkner
Date: 13/02/2023

Figure 3 - Night-time (23:00-06:00) Grid Noise Map with Plant Only - Calculation at 3.5m above ground level

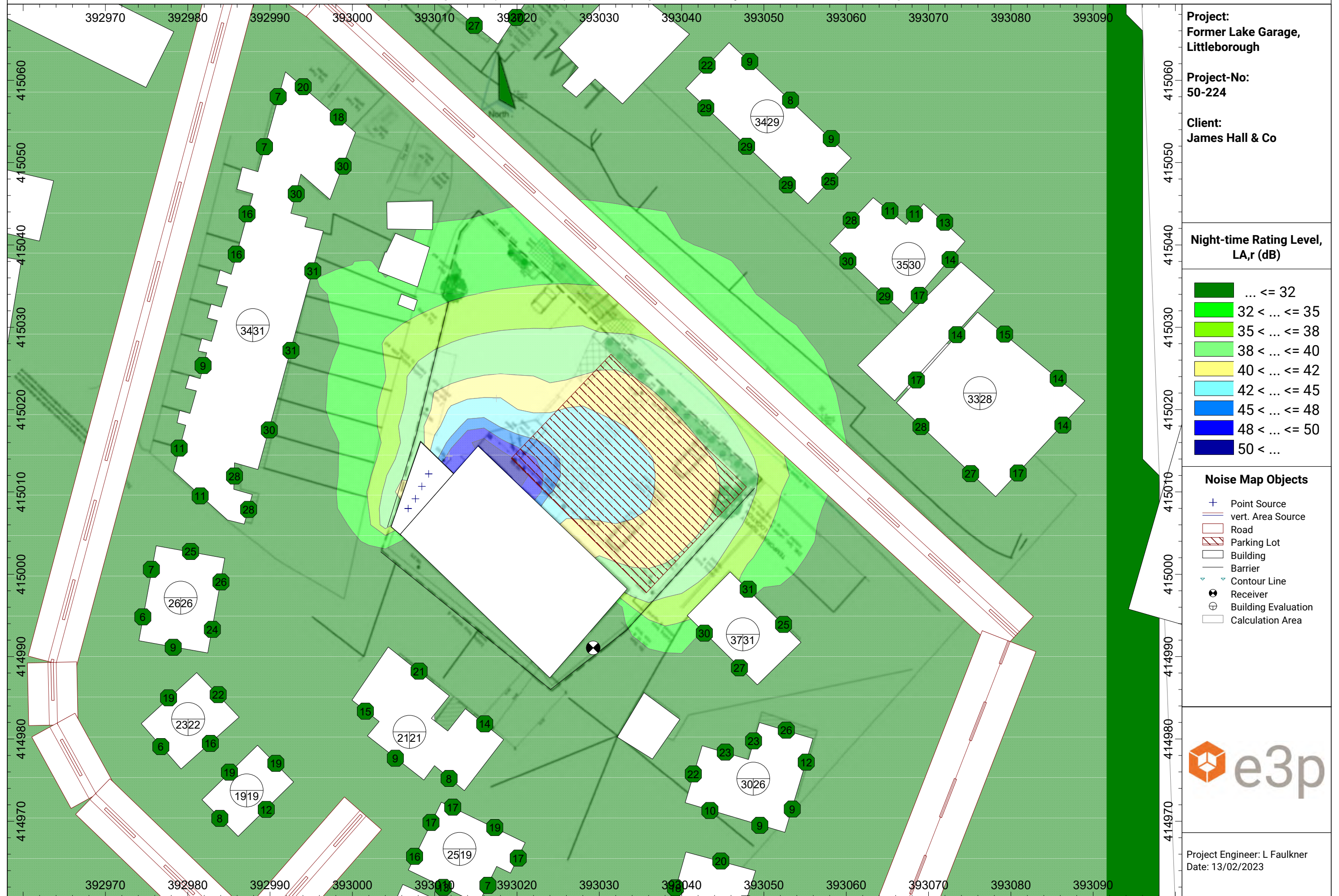
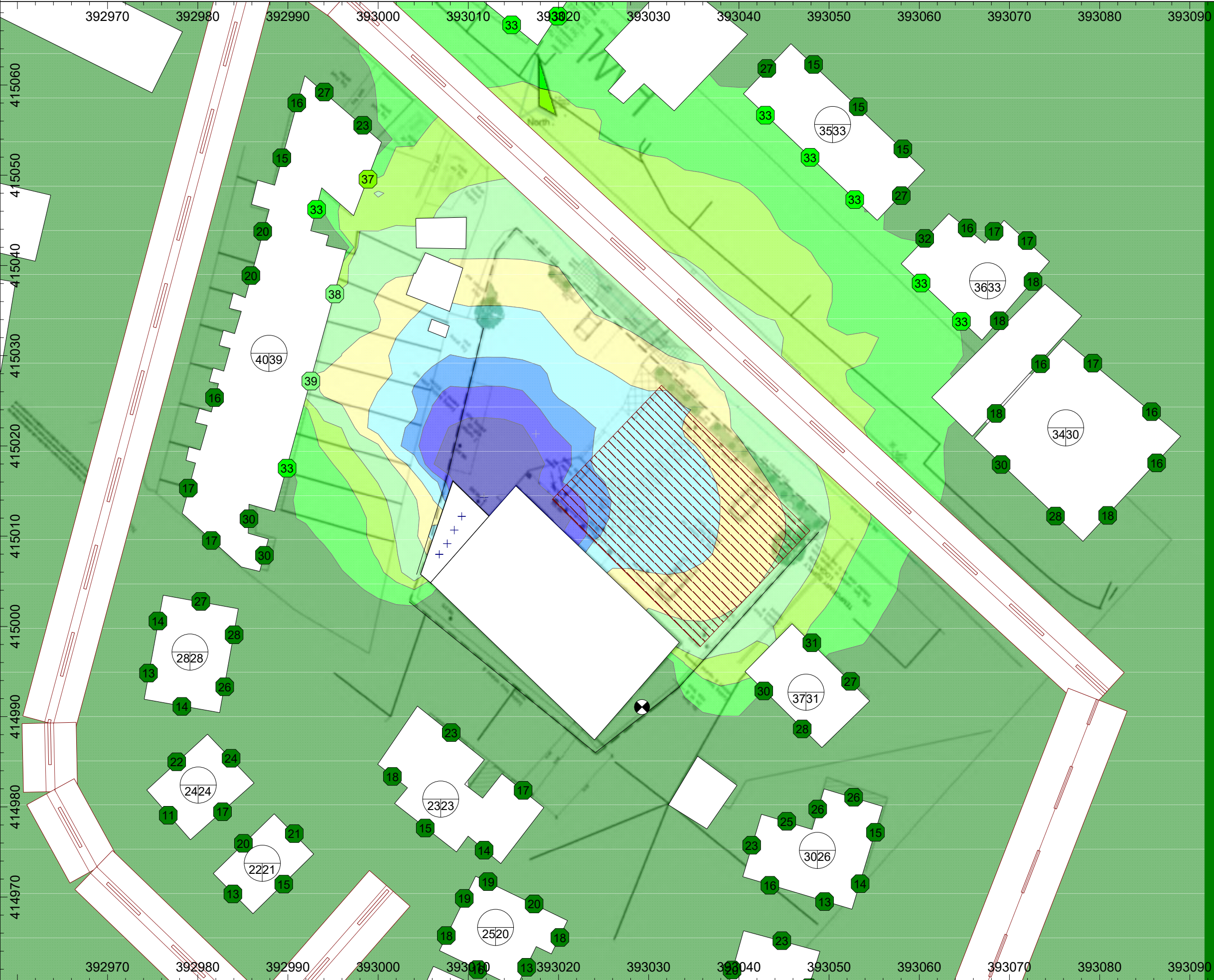


Figure 4 - Night-time (06:00-07:00) Grid Noise Map with Plant and Deliveries - Calculation at 3.5m above ground level



Project:
Former Lake Garage,
Littleborough

Project-No:
50-224

Client:
James Hall & Co

**Night-time Rating Level,
LA,r (dB)**

...	<= 32
32 < ...	<= 35
35 < ...	<= 38
38 < ...	<= 40
40 < ...	<= 42
42 < ...	<= 45
45 < ...	<= 48
48 < ...	<= 50
50 < ...	

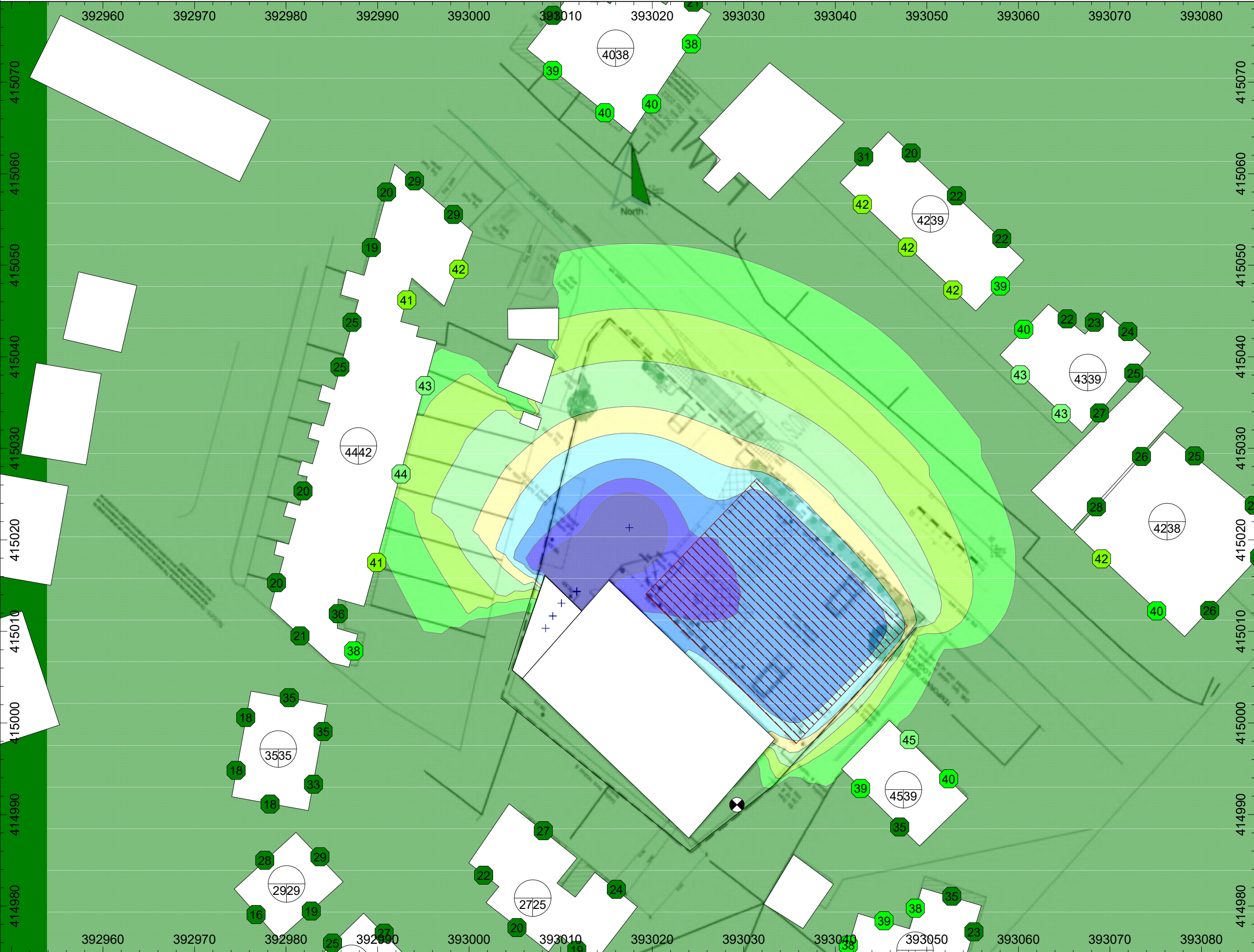
Noise Map Objects

- + Point Source
- vert. Area Source
- Road
- Parking Lot
- Building
- Barrier
- Contour Line
- Receiver
- Building Evaluation
- Calculation Area

e3p

Project Engineer: L Faulkner
Date: 13/02/2023

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



Project:
 Former Lake Garage,
 Littleborough

Project-No:
 50-224

Client:
 James Hall & Co

**Daytime Rating Level,
 LA,r (dB)**

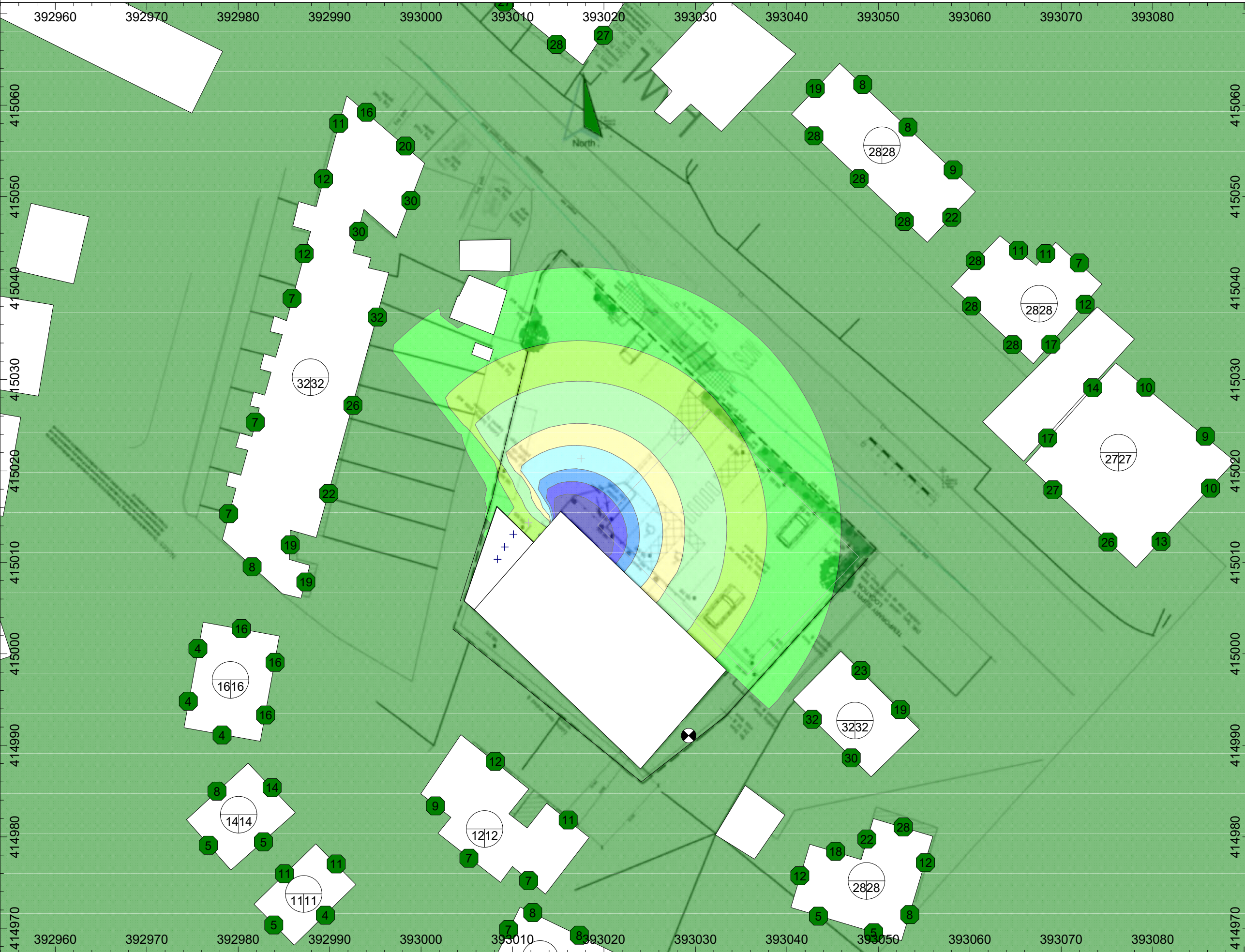
...	<= 38
38 < ...	<= 40
40 < ...	<= 42
42 < ...	<= 45
45 < ...	<= 48
48 < ...	<= 50
50 < ...	<= 52
52 < ...	<= 55
55 < ...	

Noise Map Objects

+	Point Source
—	vert. Area Source
▨	Parking Lot
□	Building
—	Barrier
⊗	Receiver
⊕	Building Evaluation
○	Calculation Area

Project Engineer: L Faulkner
 Date: 30/03/2023

Figure 3 - Night-time (23:00-06:00) Grid Noise Map with Plant Only - Calculation at 3.5m above ground level



Project:
Former Lake Garage,
Littleborough

Project-No:
50-224

Client:
James Hall & Co

**Night-time Rating Level,
LA,r (dB)**

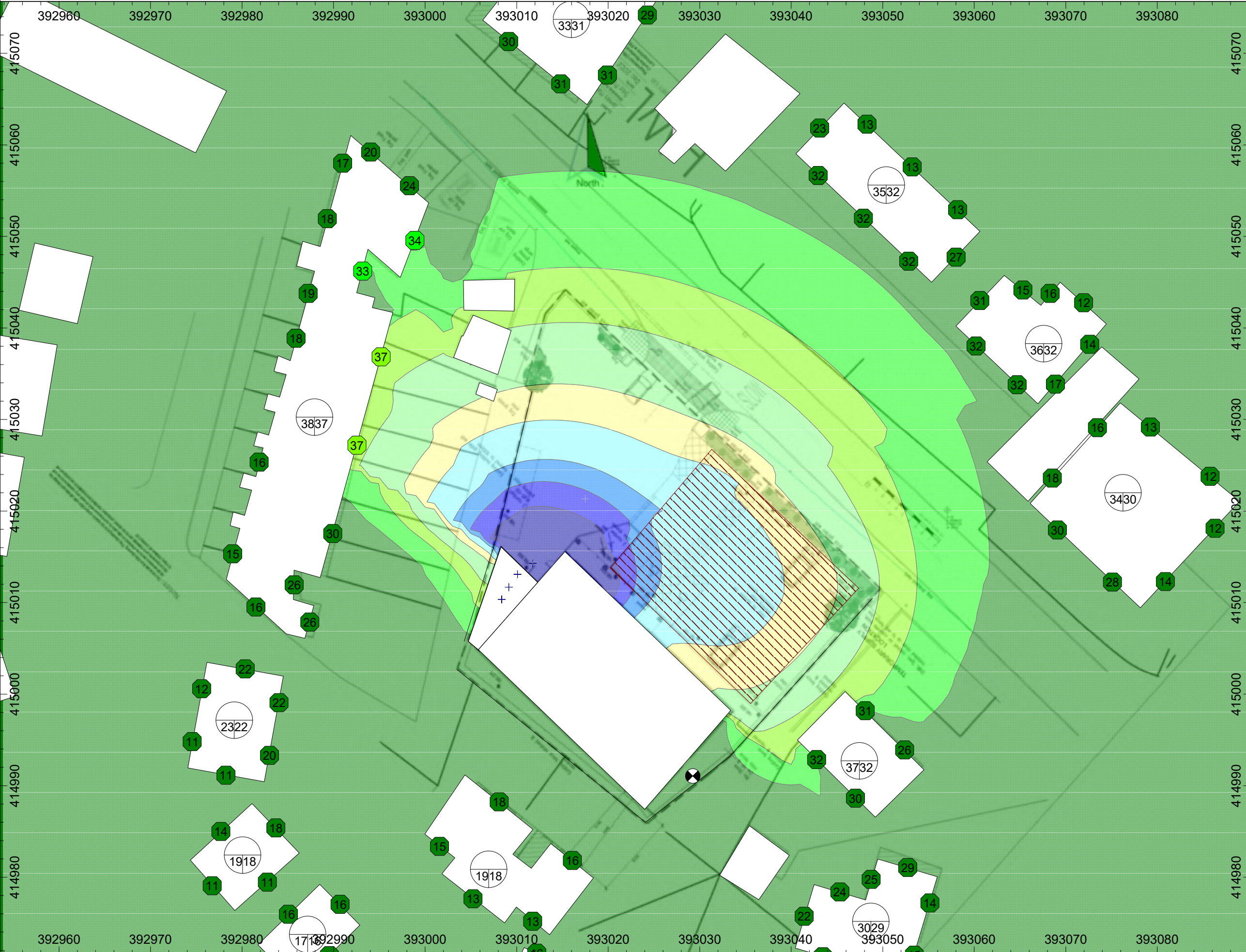
Dark Green	... <= 32
Light Green	32 < ... <= 35
Yellow-Green	35 < ... <= 38
Yellow	38 < ... <= 40
Orange	40 < ... <= 42
Light Blue	42 < ... <= 45
Blue	45 < ... <= 48
Dark Blue	48 < ... <= 50
Very Dark Blue	50 < ...

Noise Map Objects

- + Point Source
- vert. Area Source
- Parking Lot
- Building
- Barrier
- Receiver
- Building Evaluation
- Calculation Area

Project Engineer: L Faulkner
Date: 30/03/2023

Figure 4 - Night-time (06:00-08:00) Grid Noise Map with Plant and Delivery - Calculation at 3.5m above ground level



Project:
Former Lake Garage,
Littleborough

Project-No:
50-224

Client:
James Hall & Co

**Night-time Rating Level,
LA,r (dB)**

Dark Green	... <= 32
Light Green	32 < ... <= 35
Yellow-Green	35 < ... <= 38
Light Yellow	38 < ... <= 40
Yellow	40 < ... <= 42
Light Blue	42 < ... <= 45
Blue	45 < ... <= 48
Dark Blue	48 < ... <= 50
Very Dark Blue	50 < ...

Noise Map Objects

- + Point Source
- vert. Area Source
- ▨ Parking Lot
- ▭ Building
- Barrier
- ⊗ Receiver
- ⊕ Building Evaluation
- Calculation Area

Project Engineer: L Faulkner
Date: 30/03/2023