REC

Resource & Environmental Consultants Ltd

Noise Impact Assessment

Proposed Residential Development
Land off Heath Drive
Hampstead
London NW3

REC Report: 90427r0
Issued: 5th November 2013

Prepared for:
Zen Developments

REC Acoustics

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Date	5th November 2013		
Prepared by	John Goodwin		
Qualifications	BSc (Hons), MIOA		
Signature			
Checked by	Lee Faulkner		
Qualifications	BSc (Hons), TIOA		
Signature			
Authorised by	Paul Furmston		
Qualifications	BSc (Hons)		
Signature			
Project number	90427r0		
Doc. Ref – QR3-3 Issued – Jan -13 By – A Edgar			

REC Offices

Manchester
Osprey House
Pacific Quay
Broadway
Manchester
M50 2UE
Tel: 0161 868 1300

London Stansted
Environment House
Bullock Lane
Takeley
Bishop's Stortford
Hertfordshire
CM22 6TA
Tel: 01279 879 416

Birmingham
Unit 19 Bordesley Trading Estate
Bordesley Green Road
Birmingham
B8 1BZ
Tel: 0121 326 7007

Dundee
Unit 1.7 Discovery House
Gemini Crescent
Dundee
DD2 1SW
Tel: 01382 561 985

Plymouth
Unit 13, Barn Close, Langage Business Park
Plymouth
Devon
PL7 5HQ
Tel: 0844 561 6735

Swindon
Unit 58, Shrivenham Hundred Business Park
Majors Road
Watchfield
Swindon
SN6 8TY
Tel: 01793 784 935

Newcastle
Unit 20, Hubway House
Bassington Industrial Estate
Bassington Lane
Cramlington
Northumberland
NE23 8AD
Tel: 0167 0700 927

Northern Ireland
69A Killyman Street
Moy
County Tyrone
BT71 7EA
Tel: 02887 789 180

Southampton
Environment House
Segensworth Business Centre
Segensworth Road (West)
Fareham
Hampshire
PO15 5RQ
Tel: 01329 847 783

Stirling
11 Murchison Park
Doune
Stirling
FK16 6AY
Tel: 0845 676 9303

Glasgow
16 Langlands Place
Kelvin South Business Park
East Kilbride
Glasgow
G75 0YF
Tel: 01355 573 350

London
85 Tottenham Court Road
London
W1T 4TQ
Tel: 02034 022 352

Port Talbot
Unit 19 Kenfig Industrial Estate
Margam
Port Talbot
SA13 2PE
Tel: 01659 749 823

www.recltd.co.uk

REC
Resource & Environmental Consultants

EXECUTIVE SUMMARY

Noise Surveys

A series of Noise Surveys have been completed in order to measure the impact of road traffic and to measure the existing background noise level which prevails at the Site.

Noise Impact Assessment

The Noise Impact Assessment has been completed with due regard to the requirements of Camden Council's Environmental Health Department.

The Noise Impact Assessment has identified that the key noise sources impacting upon the development is from road traffic using the A41. Accordingly appropriate mitigation has been specified in order to reduce these impacts for internal habitable areas.

Recommended Scheme of Mitigation

The following mitigation measures are recommended:

- Acoustic glazing has been recommended for a number of habitable rooms with windows which have line of sight to the A41.

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APPENDICES

1.0 INTRODUCTION

1.1 Background

Resource and Environmental Consultants (REC) Limited have been commissioned by Zen Developments to undertake a Noise Impact Assessment for a proposed residential development on land located off Heath Drive in Hampstead NW3, to be referred to hereafter as 'the Site'.

This assessment has been undertaken to identify key noise sources in the vicinity of the Site which may have the potential to impact upon the proposed noise sensitive residential development.

This Noise Impact Assessment has been completed with due regard to the requirements of Camden Council's Environmental Health Department.

All acronyms used within this report are defined in the Glossary presented in Appendix II.

1.2 Site Location & Proposed Development

The Site comprises a parcel of land within a predominantly residential area. Heath Drive lies to the west of the Site and existing residential dwellings to the north and east. The A41 Finchley Road runs to the south of the Site, itself a major arterial route into the City.

The key noise source impacting upon the Site is from vehicles using the A41 Finchley Road.

Proposals include for the development of 22 apartments across four floors. Also included in the development is a leisure facility and plant room located on the lower ground floor.

This assessment has been undertaken with due regard to the supplied Site plan shown on the following planning drawing:

- Proposed Site Plans, Lower Ground – Fourth Floors, dated 11th October 2013 issued by MR Partnership.

The Proposed Site Plan for the ground floor, including measurement positions are shown in Figure 1 of Appendix III.

1.3 Limitations

The limitations of this report are presented in Appendix I.

1.4 Confidentiality

REC has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from REC; a charge may be levied against such approval.

2.0 ASSESSMENT CRITERIA

2.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF) provides very brief guidance on planning and noise. The NPPF replaces the now revoked Planning Policy Guidance (PPG) Note 24. Paragraph 123 of the NPPF document 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 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; and,*
- *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*.'

This has been considered throughout the assessment where applicable.

No further guidance is given as to what a 'significant' impact would entail. It is therefore considered that meeting the criteria outlined in BS 8233 and recommendations contained within the World Health Organisation guidelines, "significant adverse impacts" on health and quality of life associated with noise would be avoided.

2.2 Local Authority Guidance and Criteria – Camden Council's Environmental Health Department

Camden Council's Development Policy DP28 recognises the importance of noise and vibration in the borough due to Camden's high density and mixed -use nature.

DP28 – Noise and vibration states that:

'The Council will seek to ensure that noise and vibration is controlled and managed and will not grant permission for:

a) Development likely to generate noise pollution; or

b) Development sensitive to noise in locations with noise pollution, unless appropriate attenuation measures are provided.

Development that exceeds Camden's Noise and Vibration Thresholds will not be permitted.

The Council will only grant permission for plant or machinery if it can be operated without cause harm to amenity and does not exceed our noise thresholds.

The Council will seek to minimise the impact on local amenity from the demolition an construction phases of development. Where these phases are likely to cause harm, conditions and planning obligations may be used to minimise the impact.'

Camden Council have regard to the following Noise Thresholds set out in Tables 3.1, 3.2 and 3.3.

Table 3.1: Noise levels on residential sites adjoining railways and roads at which planning permission will not be granted

Noise Description and location of measurement	Period	Time	Sites adjoining railways	Sites adjoining roads
Noise at 1m external to a sensitive façade	Day	07:00 – 19:00	74 dB $L_{Aeq, 12hr}$	72 dB $L_{Aeq, 12hr}$
Noise at 1m external to a sensitive façade	Evening	19:00 – 23:00	74 dB $L_{Aeq, 4hr}$	72 dB $L_{Aeq, 4hr}$
Noise at 1m external to a sensitive façade	Night	23:00 – 07:00	66 dB $L_{Aeq, 8hr}$	66 dB $L_{Aeq, 8hr}$

Table 3.2: Noise levels on residential sites adjoining railways and roads at and above which noise attenuation measures will be required.

Noise Description and location of measurement	Period	Time	Sites adjoining railways	Sites adjoining roads
Noise at 1m external to a sensitive façade	Day	07:00 – 19:00	65 dB $L_{Aeq, 12hr}$	62 dB $L_{Aeq, 12hr}$
Noise at 1m external to a sensitive façade	Evening	19:00 – 23:00	60 dB $L_{Aeq, 4hr}$	57 dB $L_{Aeq, 4hr}$
Noise at 1m external to a sensitive façade	Night	23:00 – 07:00	55 dB $L_{Aeq, 1hr}$	52 dB $L_{Aeq, 1hr}$
Individual noise events several times an hour	Night	23:00 – 07:00	>82 dB $L_{Amax,s}$	>82 dB $L_{Amax,s}$

Table 3.3: Noise levels from plant and machinery at which planning permission will not be granted

Noise Description and location of measurement	Period	Time	Noise Level
Noise at 1m external to a sensitive façade	Day	00:00 – 24:00	5dB(A) <L_{A90}
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1m external to sensitive façade	Day, evening and night	00:00 – 24:00	10dB(A) <L_{A90}
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1m external to a sensitive façade	Day, evening and night	00:00 – 24:00	10dB(A) <L_{A90}
Noise at 1m external to sensitive façade where L_{A90} >60dB	Day, evening and night	00:00 – 24:00	55dB L_{Aeq}

In addition to obtaining the relevant policy on noise, REC have contacted the relevant Environmental Health Officer (EHO) Maya Rhodes of Camden Council by email in order to agree the methodology for the Noise Surveys and assessment criteria. REC had liaised with Maya recently regarding a different project and the following criteria was agreed:

- The internal noise levels within bedrooms shall not exceed the BS 8233 'good' internal target noise level which is 30dB $L_{Aeq,8hr}$;
- The internal noise levels within living rooms shall not exceed the BS 8233 'good' internal target noise level which is 30dB $L_{Aeq,16hr}$;
- Noise in external amenity areas shall not exceed 55dB L_{Aeq} with reference to WHO Guidelines; and,
- The design criteria for plant noise will be at least 5dB(A) below the existing background noise measurement (L_{A90}) level unless the plant will have a noise that has a distinguishable, discrete continuous note (whine, hiss, screech or hum) and /or if there are distinct impulses (bangs, clicks, clatters, thumps), then at least 10dB below would be required. Noise levels are as measured, 1m external to the sensitive façade.

It was proposed that Heath Drive is scoped out of the assessment due to low traffic flows and the significant noise climate generated by the A41 across the Site.

2.3 British Standard BS 8233:1999: Sound Insulation and Noise Reduction for Buildings – Code of Practice

The scope of this standard is the provision of recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new buildings or refurbished buildings undergoing a change of use, rather than to assess the effect of changes in the external noise climate.

The standard suggests suitable internal noise levels within different types of buildings, including plots, as shown in Table 2.1.

Table 2.1: BS 8233 Recommended Internal Target Noise Levels

Criterion	Typical Situation	Design Range $L_{Aeq,T}$ dB	
		Good	Reasonable
Suitable resting / sleeping conditions	Living Room	30	40
	Bedroom	30	35
For a reasonable standard in bedrooms at night, individual noise events (measured with fast time weighting) should not normally exceed 45dB L_{Amax}			

BS 8233 goes on to recommend noise levels for gardens. According to BS 8233, it is desirable that the steady noise level does not exceed $L_{Aeq,T}$ 50dB, and 55dB should be regarded as the upper limit.

2.4 World Health Organisation's (WHO) 'Guidelines for Community Noise'

The WHO gives guidance on desirable levels of environmental noise. The levels presented in the WHO Community Guidelines are those at which adverse effects become measurable. The 1980 WHO document suggested that "*general daytime outdoor noise levels of less than 55dB(A) $L_{eq,16hr}$ are desirable to prevent any significant community annoyance*" This level is an external free-field noise level. The 1980 document also stated in relation to internal

levels "*that night-time noise levels of 35dB(A) $L_{eq,8hr}$ or less will not interfere with the restorative process of sleep*".

A report was submitted to the WHO in 1995 for consideration as a revision to the 1980 document and revised community guidelines were issued in 2000. In the 2000 guidelines, it is considered that the sleep disturbance criteria should be taken as an internal noise level of 30dB $L_{Aeq,8hr}$ or an external level of 45dB $L_{Aeq,8hr}$. It also recommends that internal L_{Amax} levels of 45dB and external L_{Amax} levels of 60dB should be limited where possible.

The 2000 WHO document also states that "*To protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55dB $L_{Aeq,16hr}$ for a steady continuous noise*." i.e. the daytime levels effectively remain unchanged.

2.5 British Standard BS 4142: 1997: Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas

This standard is intended to be used to assess where noise from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises is likely to give rise to complaints from people residing in nearby dwellings.

The procedure contained in BS 4142 for assessing the likelihood of complaints is to compare the measured or predicted noise level from the source in question, the 'specific noise level' immediately outside the dwelling, with the background noise level. Where the noise contains a 'distinguishable discrete continuous note (whine, hiss, screech, hum etc.) or if there are distinct impulses in the noise (bangs, clicks, clatters or thumps), or if the noise is irregular enough to attract attention' then a correction of +5dB is added to the specific noise level to obtain the 'rating level'.

The likelihood of noise provoking complaints is assessed by subtracting the background noise level from the rating noise level. BS 4142 states:

> *"A difference of around 10dB or higher indicates that complaints are likely. A difference of around 5dB is of marginal significance. A difference of -10dB is a positive indication that complaints are unlikely."*

For the daytime, this assessment is carried out over a 1-hour period, and over a 5-minute period at night. The day and night-time periods are not defined in the Standard but it states that night should cover the times when the general adult population are preparing for sleep or are actually sleeping. For the purposes of this assessment it is assumed that the day and night periods reflect those stated in the now revoked Planning Policy Guidance Note 24 (PPG24), i.e. day is 07:00 to 23:00 hours and night 23:00 to 07:00 hours.

3.0 NOISE SURVEYS

REC has conducted a series of Noise Surveys at the Site which included:

- Road Traffic Noise Survey for the A41 Finchley Road as it is expected that this road will be the dominant noise source impacting upon the proposed development; and,
- A Background Noise Survey, as the development contains a plant room and a satisfactory noise impact upon the closest residential window will need to be established.

3.1 Road Traffic Noise Survey

REC has conducted a Road Traffic Noise Survey in order to measure the level of noise generated by vehicles using the A41 Finchley Road '*the A41*'. The survey was carried out over the following time period:

- 09:00 Thursday 31st October 2013 - 09:00 Friday 1st November 2013.

The following noise measurement position was chosen for the Road Traffic Noise Survey:

- Noise Measurement Position 1 (NMP1): Located on the southern site boundary, 5m from the nearside kerbstone of the A41. The microphone was located 2.0m above ground level and in free-field conditions. Noise sources at this location consisted of vehicle pass-bys on the A41 only.

A summary of the measured sound pressure levels from the Road Traffic Noise Survey are presented in Table 3.1.

Table 3.1: Summary of Measured Noise Levels for NMP1

Measurement Position	Period	Measured Sound Pressure Level, free-field (dB)			
		$L_{Aeq,T}$	$L_{Amax,fast}$ [1]	$L_{A90,T}$	$L_{A10,T}$
NMP1	Daytime (07:00 – 23:00)	71.7	-	59.0	73.7
	Night-time (23:00 – 07:00)	69.7	91.3	52.3	72.9

[1] 10th highest $L_{Amax,fast}$ measured during the night-time period

3.2 Background Noise Survey

As the proposed development includes for a plant room, a background noise survey has been conducted in order to measure the existing lowest background noise levels during a typical weekday period. The survey was conducted over the following time period:

- 09:00 Thursday 31st October 2013 - 09:00 Friday 1st November 2013.

The following noise measurement position was chosen for the Background Noise Survey:

- Noise Measurement Position 2 (NMP2): Located on the western site boundary, 4m from the nearside kerbstone of Heath Drive towards the rear of the Site. The microphone was located 1.8m above ground level and in free-field conditions. Noise

sources at this location consisted of distant road traffic noise from the A41 with intermittent noise from vehicles using Heath Drive.

A summary of the lowest measured sound pressure levels from the Background Noise Survey are presented in Table 3.2.

Table 3.2: Summary of Lowest Measured Noise Levels for NMP2

Measurement Position	Period	Range of Measured Background Noise Levels, free-field $L_{A90,1hr}$ (dB)
NMP2	Daytime (07:00 – 23:00)	51.1 – 55.9
	Night-time (23:00 – 07:00)	42.9 – 50.4

The following equipment was used for the Noise Surveys.

Table 3.3: Noise Measurement Equipment

Measurement Position	Equipment Description	Manufacturer & Type No.	Serial No.	Calibration Due Date
NMP1	Sound Level Meter	01dB-Metravib Black Solo	65629	19th November 2014
	Pre-amplifier	01dB-Metravib PRE 21 S	166569	
	Microphone	01dB Metravib MCE212	16255	
	Calibrator	01dB-Metravib CAL-21	34924066	16th November 2013
NMP2	Sound Level Meter	01dB-Metravib Black Solo	65771	27th August 2015
	Pre-amplifier	01dB-Metravib PRE 21 S	16640	
	Microphone	01dB Metravib MCE212	16539	
	Calibrator	01dB-Metravib CAL-21	34634218	29th August 2014

The sound level meters were field-calibrated on Site prior to and after noise measurements were taken. No significant drift was witnessed. Calibration certificates are available upon request.

The weather conditions during the Noise Surveys were conducive towards the measurement of environmental noise, being fine and dry with wind speeds of less than 5.0m/s.

4.0 NOISE IMPACT ASSESSMENT

This section will consider the following assessments:

- Noise Impact Assessment for the A41; and,
- Plant Noise Emission Limits Assessment.

Analysis of the Site Plan indicates that there is a lower ground floor to the development and this has been taken as a basement floor. As such it is expected that any windows will be fully screened from traffic on the A41 and so formal assessment has not been completed for the lower ground floor. Where this is not the case and windows have line of sight to traffic on the A41, the specifications for the ground floor should be adopted.

4.1 Road Traffic Noise

4.1.1 External Amenity Areas

Analysis of the supplied planning drawing indicate that there is a patio area on the south-western elevation of the building facing the A41. This patio area is considered to be a feature within the general external space provided as part of trhe development and is not attributable to any one particular dwelling. As such it is not appropriate to compare this outdoor space with the WHO guidelines.

There are no external balcony areas associated with any of the dwellings.

4.1.2 Internal Habitable Rooms – Ground Floor Dwellings

In order to determine an accurate internal noise level within each dwelling, it is necessary to calculate an external noise level outside each dwelling façade.

In determining the level of noise impact at the various dwellings, the following equation has been used to determine the resulting noise level from the daytime and night-time 'average' noise levels:

$$L_{Aeq,2} = L_{Aeq,1} - (10 \times \log (D_2/D_1)$$

Where $L_{Aeq,2}$ = noise level under investigation
$L_{Aeq,1}$ = measured noise level
D_2 = distance under investigation
D_1 = measurement distance

The following equation has been used to determine the resulting noise level from the night-time measured maximum noise level:

$$L_{Amax,fast,2} = L_{Amax,fast,1} - (20 \times \log (D_2/D_1)$$

Where $L_{Amax,fast,2}$ = noise level under investigation
$L_{Amax,fast,1}$ =measured noise level
D_2 = distance under investigation
D_1 = measurement distance

It is noted that numerous façades lie at varying angles of incidence to the A41 and so the following angle of view correction has been applied:

$$\text{Correction} = 10 \times \log (\theta / 180)$$

For the first, second, third and fourth floor dwellings, trigonometry has been used to calculate the distance from the centre of the A41 to the respective floor façade.

Table 4.1 details the corrected noise levels for the ground floor façade.

Table 4.1: Calculation of Noise Levels at the Ground-floor Facade

Dwelling	Period	Measured Noise Level (dB)	Measurement Distance (m)	Distance to Façade (m)	Angle of View Correction (dB)	Calculated External Noise Level at Façade (dB)
5	Daytime	71.7 $L_{Aeq,16hr}$	8.5	18.9	0.0	68.2
	Night-time	69.7 $L_{Aeq,8hr}$			0.0	66.2
		91.3 $L_{Amax,fast}$			0.0	84.4
6	Daytime	71.7 $L_{Aeq,16hr}$	8.5	25.5	-1.2	65.7
	Night-time	69.7 $L_{Aeq,8hr}$		19.5	-1.2	64.8
		91.3 $L_{Amax,fast}$		19.5	-1.2	82.8
8	Daytime	71.7 $L_{Aeq,16hr}$	8.5	38.1	-1.2	63.9
	Night-time	69.7 $L_{Aeq,8hr}$		34.5	-1.2	62.4
		91.3 $L_{Amax,fast}$		34.5	-1.2	77.9
4	Daytime	71.7 $L_{Aeq,16hr}$	8.5	29.4	-3.0	63.3

The now revoked PPG24 suggests that the sound reduction index afforded by standard thermal double glazing set into a brick block wall will reduce road traffic external to internal noise levels by approximately 33dB. Table 4.2 calculates the internal noise level using standard thermal double glazing.

Table 4.2: Calculation of Internal Noise Levels with Standard Thermal Double Glazing – Ground Floor

Dwelling	Period	Calculated External Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Criteria Noise Level (dB)	Difference +/- (dB)
5	Daytime	68.2 $L_{Aeq,16hr}$	33	35.2	30	+5.2
	Night-time	66.2 $L_{Aeq,8hr}$	33	33.2	30	+3.2
		84.4 $L_{Amax,fast}$	33	51.4	45	+6.4
6	Daytime	65.7 $L_{Aeq,16hr}$	33	32.7	30	+2.7

	Night-time	64.8 $L_{Aeq,8hr}$	33	31.8	30	+1.8
		82.8 $L_{Amax,fast}$	33	49.8	45	+4.8
8	Daytime	63.9 $L_{Aeq,16hr}$	33	30.9	30	+0.9
	Night-time	62.4 $L_{Aeq,8hr}$	33	29.4	30	-0.6
		77.9 $L_{Amax,fast}$	33	44.9	45	-0.1
4	Daytime	63.3 $L_{Aeq,16hr}$	33	30.3	30	+0.3

Table 4.2 indicates that standard thermal double glazing will not be sufficient for the identified habitable rooms facing the A41 and so the following section considers appropriate mitigation.

During summer months it may be necessary to open windows in order to provide a supply of fresh air to cool the habitable room. BS8233 suggests that the sound reduction index of a partially open window will attenuate noise by approximately 10dB – 15dB and so this assessment has adopted 12dB.

Table 4.3: Calculation of Internal Noise Levels with a Partially Open Window

Dwelling	Period	Calculated External Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Criteria Noise Level (dB)	Difference +/- (dB)
10	Daytime	68.2 $L_{Aeq,16hr}$	12	56.2	30	+26.2
	Night-time	66.2 $L_{Aeq,8hr}$	12	54.2	30	+24.2
		84.4 $L_{Amax,fast}$	12	72.4	45	+27.4
11	Daytime	65.7 $L_{Aeq,16hr}$	12	53.7	30	+23.7
	Night-time	64.8 $L_{Aeq,8hr}$	12	52.8	30	+22.8
		82.8 $L_{Amax,fast}$	12	70.8	45	+25.8
13	Daytime	63.9 $L_{Aeq,16hr}$	12	51.9	30	+21.9
	Night-time	62.4 $L_{Aeq,8hr}$	12	50.4	30	+20.4
		77.9 $L_{Amax,fast}$	12	65.9	45	+20.9
9	Daytime	63.3 $L_{Aeq,16hr}$	12	51.3	30	+21.3

Table 4.3 indicates that the internal target noise levels will be exceeded for all habitable rooms in proposed dwellings which face the A41 and so the following section considers alternative ventilation to opening windows.

4.1.3 Internal Habitable Rooms – First Floor Dwellings

Table 4.4 details the corrected noise levels for the first floor façade.

Table 4.4: Calculation of Noise Levels at the First-floor Facade

Dwelling	Period	Measured Noise Level (dB)	Measurement Distance (m)	Distance to Façade (m)	Angle of View Correction (dB)	Calculated External Noise Level at Façade (dB)
10	Daytime	68.2 $L_{Aeq,16hr}$	8.5	19.4	0.0	68.1
	Night-time	66.2 $L_{Aeq,8hr}$			0.0	66.1
		84.4 $L_{Amax,fast}$			0.0	84.1
11	Daytime	65.7 $L_{Aeq,16hr}$	8.5	26.1	-1.2	65.6
	Night-time	64.8 $L_{Aeq,8hr}$		20.1	-1.2	64.7
		82.8 $L_{Amax,fast}$		20.1	-1.2	82.6
13	Daytime	63.9 $L_{Aeq,16hr}$	8.5	38.3	-1.2	63.9
	Night-time	62.4 $L_{Aeq,8hr}$		35.1	-1.2	62.3
		77.9 $L_{Amax,fast}$		35.1	-1.2	77.7
9	Daytime	63.3 $L_{Aeq,16hr}$	8.5	30.0	-3.0	63.2

The now revoked PPG24 suggests that the sound reduction index afforded by standard thermal double glazing set into a brick block wall will reduce road traffic external to internal noise levels by approximately 33dB. Table 4.5 calculates the internal noise level using standard thermal double glazing.

Table 4.5: Calculation of Internal Noise Levels with Standard Thermal Double Glazing – First-floor

Dwelling	Period	Calculated External Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Criteria Noise Level (dB)	Difference +/- (dB)
10	Daytime	68.2 $L_{Aeq,16hr}$	33	35.1	30	+5.1
	Night-time	66.2 $L_{Aeq,8hr}$	33	33.1	30	+3.1
		84.4 $L_{Amax,fast}$	33	51.1	45	+6.1
11	Daytime	65.7 $L_{Aeq,16hr}$	33	32.6	30	+2.6
	Night-time	64.8 $L_{Aeq,8hr}$	33	31.7	30	+1.7

		82.8 $L_{Amax,fast}$	33	49.6	45	+4.6
13	Daytime	63.9 $L_{Aeq,16hr}$	33	30.9	30	+0.9
	Night-time	62.4 $L_{Aeq,8hr}$	33	29.3	30	-0.7
		77.9 $L_{Amax,fast}$	33	44.7	45	-0.3
9	Daytime	63.3 $L_{Aeq,16hr}$	33	30.2	30	+0.2

Table 4.5 indicates that standard thermal double glazing will not be sufficient for the identified habitable rooms facing the A41 and so the following section considers appropriate mitigation.

During summer months it may be necessary to open windows in order to provide a supply of fresh air to cool the habitable room. BS8233 suggests that the sound reduction index of a partially open window will attenuate noise by approximately 10dB – 15dB and so this assessment has adopted 12dB.

Table 4.6: Calculation of Internal Noise Levels with a Partially Open Window

Dwelling	Period	Calculated External Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Criteria Noise Level (dB)	Difference +/- (dB)
10	Daytime	68.2 $L_{Aeq,16hr}$	12	56.1	30	+26.1
	Night-time	66.2 $L_{Aeq,8hr}$	12	54.1	30	+24.1
		84.4 $L_{Amax,fast}$	12	72.1	45	+27.1
11	Daytime	65.7 $L_{Aeq,16hr}$	12	53.6	30	+23.6
	Night-time	64.8 $L_{Aeq,8hr}$	12	52.7	30	+22.7
		82.8 $L_{Amax,fast}$	12	70.6	45	+25.6
13	Daytime	63.9 $L_{Aeq,16hr}$	12	51.9	30	+21.9
	Night-time	62.4 $L_{Aeq,8hr}$	12	50.3	30	+20.3
		77.9 $L_{Amax,fast}$	12	65.7	45	+20.7
9	Daytime	63.3 $L_{Aeq,16hr}$	12	51.2	30	+21.2

Table 4.6 indicates that the internal target noise levels will be exceeded for all habitable rooms in proposed dwellings which face the A41 and so the following section considers alternative ventilation to opening windows.

4.1.4 Internal Habitable Rooms – Second Floor Dwellings

Table 4.7 details the corrected noise levels for the second floor façade.

Table 4.7: Calculation of Noise Levels at the Second-floor Facade

Dwelling	Period	Measured Noise Level (dB)	Measurement Distance (m)	Distance to Façade (m)	Angle of View Correction (dB)	Calculated External Noise Level at Façade (dB)
15	Daytime	68.2 $L_{Aeq,16hr}$	8.5	20.3	0.0	67.9
	Night-time	66.2 $L_{Aeq,8hr}$			0.0	65.9
		84.4 $L_{Amax,fast}$			0.0	83.7
16	Daytime	65.7 $L_{Aeq,16hr}$	8.5	26.6	-1.2	65.5
	Night-time	64.8 $L_{Aeq,8hr}$		20.9	-1.2	64.5
		82.8 $L_{Amax,fast}$		20.9	-1.2	82.2
18	Daytime	63.9 $L_{Aeq,16hr}$	8.5	38.2	-1.2	63.9
	Night-time	62.4 $L_{Aeq,8hr}$		35.3	-1.2	62.3
		77.9 $L_{Amax,fast}$		35.3	-1.2	77.7
14	Daytime	63.3 $L_{Aeq,16hr}$	8.5	30.3	-3.0	63.2

The now revoked PPG24 suggests that the sound reduction index afforded by standard thermal double glazing set into a brick block wall will reduce road traffic external to internal noise levels by approximately 33dB. Table 4.8 calculates the internal noise level using standard thermal double glazing.

Table 4.8: Calculation of Internal Noise Levels with Standard Thermal Double Glazing – Second-floor

Dwelling	Period	Calculated External Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Criteria Noise Level (dB)	Difference +/- (dB)
15	Daytime	67.9 $L_{Aeq,16hr}$	33	34.9	30	+4.9
	Night-time	65.9 $L_{Aeq,8hr}$	33	32.9	30	+2.9
		83.7 $L_{Amax,fast}$	33	50.7	45	+5.7
16	Daytime	65.5 $L_{Aeq,16hr}$	33	32.5	30	+2.5
	Night-time	64.5 $L_{Amax,fast}$	33	31.5	30	+1.5

		82.2 $L_{Amax,fast}$	33	49.2	45	+4.2
18	Daytime	63.9 $L_{Aeq,16hr}$	33	30.9	30	+0.9
	Night-time	62.3 $L_{Aeq,8hr}$	33	29.3	30	-0.7
		77.7 $L_{Amax,fast}$	33	44.7	45	-0.3
14	Daytime	63.2 $L_{Aeq,16hr}$	33	30.2	30	+0.2

Table 4.8 indicates that standard thermal double glazing will not be sufficient for the identified habitable rooms facing the A41 and so the following section considers appropriate mitigation.

During summer months it may be necessary to open windows in order to provide a supply of fresh air to cool the habitable room. BS8233 suggests that the sound reduction index of a partially open window will attenuate noise by approximately 10dB – 15dB and so this assessment has adopted 12dB.

Table 4.9: Calculation of Internal Noise Levels with a Partially Open Window

Dwelling	Period	Calculated External Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Criteria Noise Level (dB)	Difference +/- (dB)
15	Daytime	67.9 $L_{Aeq,16hr}$	12	55.9	30	+25.9
	Night-time	65.9 $L_{Aeq,8hr}$	12	53.9	30	+23.9
		83.7 $L_{Amax,fast}$	12	71.7	45	+26.7
16	Daytime	65.5 $L_{Aeq,16hr}$	12	53.5	30	+23.5
	Night-time	64.5 $L_{Aeq,8hr}$	12	52.5	30	+22.5
		82.2 $L_{Amax,fast}$	12	70.2	45	+25.2
18	Daytime	63.9 $L_{Aeq,16hr}$	12	51.9	30	+21.9
	Night-time	62.3 $L_{Aeq,8hr}$	12	50.3	30	+20.3
		77.7 $L_{Amax,fast}$	12	65.7	45	+20.7
14	Daytime	63.2 $L_{Aeq,16hr}$	12	51.2	30	+21.2

Table 4.9 indicates that the internal target noise levels will be exceeded for all habitable rooms in proposed dwellings which face the A41 and so the following section considers alternative ventilation to opening windows.

4.1.5 Internal Habitable Rooms – Third Floor Dwellings

Table 4.10 details the corrected noise levels for the third floor façade.

Table 4.10: Calculation of Noise Levels at the Third-floor Facade

Dwelling	Period	Measured Noise Level (dB)	Measurement Distance (m)	Distance to Façade (m)	Angle of View Correction (dB)	Calculated External Noise Level at Façade (dB)
20	Daytime	68.2 $L_{Aeq,16hr}$	8.5	21.6	0.0	67.7
	Night-time	66.2 $L_{Aeq,8hr}$		21.6	0.0	65.6
		84.4 $L_{Amax,fast}$		21.6	0.0	83.2
21	Daytime	65.7 $L_{Aeq,16hr}$	8.5	36.9	-1.2	64.1
	Night-time	64.8 $L_{Aeq,8hr}$		29.2	-1.2	63.1
		82.8 $L_{Amax,fast}$		29.2	-1.2	79.3

The now revoked PPG24 suggests that the sound reduction index afforded by standard thermal double glazing set into a brick block wall will reduce road traffic external to internal noise levels by approximately 33dB. Table 4.11 calculates the internal noise level using standard thermal double glazing.

Table 4.11: Calculation of Internal Noise Levels with Standard Thermal Double Glazing – Third-floor

Dwelling	Period	Calculated External Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Criteria Noise Level (dB)	Difference +/- (dB)
20	Daytime	67.7 $L_{Aeq,16hr}$	33	34.7	30	+4.7
	Night-time	65.6 $L_{Aeq,8hr}$	33	32.6	30	+2.6
		83.2 $L_{Amax,fast}$	33	50.2	45	+5.2
21	Daytime	64.1 $L_{Aeq,16hr}$	33	31.1	30	+1.1
	Night-time	63.1 $L_{Aeq,8hr}$	33	30.1	30	+0.1
		79.3 $L_{Amax,fast}$	33	46.3	45	+1.3

Table 4.11 indicates that standard thermal double glazing will not be sufficient for the identified habitable rooms facing the A41 and so the following section considers appropriate mitigation.

During summer months it may be necessary to open windows in order to provide a supply of fresh air to cool the habitable room. BS8233 suggests that the sound reduction index of a

partially open window will attenuate noise by approximately 10dB – 15dB and so this assessment has adopted 12dB.

Table 4.12: Calculation of Internal Noise Levels with a Partially Open Window

Dwelling	Period	Calculated External Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Criteria Noise Level (dB)	Difference +/- (dB)
20	Daytime	67.7 $L_{Aeq,16hr}$	12	55.7	30	+25.7
	Night-time	65.6 $L_{Aeq,8hr}$	12	53.6	30	+23.6
		83.2 $L_{Amax,fast}$	12	71.2	45	+26.2
21	Daytime	64.1 $L_{Aeq,16hr}$	12	52.1	30	+22.1
	Night-time	63.1 $L_{Aeq,8hr}$	12	51.1	30	+21.1
		79.3 $L_{Amax,fast}$	12	67.3	45	+22.3

Table 4.12 indicates that the internal target noise levels will be exceeded for all habitable rooms in proposed dwellings which face the A41 and so the following section considers alternative ventilation to opening windows.

4.1.6 Internal Habitable Rooms – Fourth Floor Dwellings

Table 4.13 details the corrected noise levels for the fourth floor façade.

Table 4.13: Calculation of Noise Levels at the Fourth-floor Facade

Dwelling	Period	Measured Noise Level (dB)	Measurement Distance (m)	Distance to Façade (m)	Angle of View Correction (dB)	Calculated External Noise Level at Façade (dB)
22	Daytime	71.7 $L_{Aeq,16hr}$	8.5	24.5	0.0	67.1
	Night-time	69.7 $L_{Aeq,8hr}$		24.5	0.0	65.1
		91.3 $L_{Amax,fast}$		24.5	0.0	82.1

The now revoked PPG24 suggests that the sound reduction index afforded by standard thermal double glazing set into a brick block wall will reduce road traffic external to internal noise levels by approximately 33dB. Table 4.14 calculates the internal noise level using standard thermal double glazing.

Table 4.14: Calculation of Internal Noise Levels with Standard Thermal Double Glazing – Fourth-floor

Dwelling	Period	Calculated External Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Criteria Noise Level (dB)	Difference +/- (dB)
22	Daytime	67.1 $L_{Aeq,16hr}$	33	34.1	30	+4.1
	Night-time	65.1 $L_{Aeq,8hr}$	33	32.1	30	+2.1
		82.1 $L_{Amax,fast}$	33	49.1	45	+4.1

Table 4.14 indicates that standard thermal double glazing will not be sufficient for the identified habitable rooms facing the A41 and so the following section considers appropriate mitigation.

During summer months it may be necessary to open windows in order to provide a supply of fresh air to cool the habitable room. BS8233 suggests that the sound reduction index of a partially open window will attenuate noise by approximately 10dB – 15dB and so this assessment has adopted 12dB.

Table 4.15: Calculation of Internal Noise Levels with a Partially Open Window

Dwelling	Period	Calculated External Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Criteria Noise Level (dB)	Difference +/- (dB)
20	Daytime	67.1 $L_{Aeq,16hr}$	12	55.1	30	+25.1
	Night-time	65.1 $L_{Aeq,8hr}$	12	53.1	30	+23.1
		82.1 $L_{Amax,fast}$	12	70.1	45	+25.1

Table 4.15 indicates that the internal target noise levels will be exceeded for all habitable rooms in proposed dwellings which face the A41 and so the following section considers alternative ventilation to opening windows.

4.2 Plant Noise Emission Limits Assessment

The background noise survey was conducted over a full 24-hour period and so plant noise emission limits have been set based on these measured background noise levels, for daytime and night-time periods, and the criteria specified by Camden Council. Table 4.16 details the assessment.

Table 4.16: Calculation of Plant Noise Emission Limits

Period	Lowest Measured Background Noise Level $L_{A90,1hr}$ (dB)	Camden Council Criteria (dB)	Calculated Plant Noise Emission Limit $L_{A,r}$ (dB)	Applicable Plant Noise Emission Limit $L_{A,r}$ (dB)
Daytime (07:00 – 23:00)	51.1	$L_{A,r} = L_{A90,t} - 10dB$	41.1	41.1
Night-time (23:00 – 07:00)	42.9		32.9	35.0

Table 4.16 details the applicable plant noise emission limits for the daytime and night-time periods. As the night-time calculated plant noise emission limit falls below the criteria specified in BS4142 (35dB $L_{A,r}$), the applicable plant noise emission limit has been set at 35dB $L_{A,r}$ which is sufficiently low enough to protect residential amenity yet will not unduly constrain specification of mechanical plant.

The applicable plant noise emission limit is the maximum noise rating level which shall not be exceeded outside the closest residential window (either existing or proposed) to any fixed mechanical plant which forms part of the development. As the plant noise emission limits contain an acoustic feature correction or penalty of 5dB, the actual measured or predicted sound pressure level at the closest window should be 5dB below the stated applicable plant noise emission limits detailed in Table 4.16.

5.0 MITIGATION

5.1 Road Traffic Noise

5.1.1 Internal Amenity Areas – Ground Floor Dwellings

The previous section has indicated that habitable rooms that face the A41 will require upgraded glazing and so Table 5.1 details the required specification of glazing.

Table 5.1: Upgraded Glazing Specifications

Dwelling	Period	Difference +/- (dB)	Required Sound Reduction Index of Acoustic Glazing $R_w + C_{tr}$ (dB)	Example Glazing Unit Specification
5	Daytime (Living Rooms)	+5.2	35	4 / 16 / 8.8A
	Night-time (Bedrooms)	+3.2	33	6 / 15 / 8.4A
		+6.4	36	
6	Daytime (Living Rooms)	+2.7	32	4 / 16 / 6.4A
	Night-time (Bedrooms)	+1.8	31	4 / 8 / 8.4A
		+4.8	34	
8	Daytime (Living Rooms)	+0.9	30	4 / 12 / 6.4A
4	Daytime (Living Rooms)	+0.3	30	4 / 12 / 6.4A

The previous section indicated that with a partially open window, the internal noise levels for any habitable rooms which have line of sight to the A41 will exceed the internal target criteria. Accordingly, It is recommended that a through-frame window mounted trickle ventilator is incorporated into the glazing unit of the habitable rooms so that fresh air can enter the room without having to open windows. One such acoustic trickle ventilator is as follows:

- Greenwoods EAR42W Trickle Ventilator, which provides acoustic attenuation of up to 42 dB $D_{n,e,w} + C_{tr}$ in its open position.

The trickle ventilator should be combined with a Mechanical Extract Ventilation (MEV), a Mechanical Ventilation Heat Recovery (MVHR) or a Passive Extract Ventilation (PEV) system which extracts air from the habitable rooms.

5.1.2 Internal Amenity Areas – First Floor Dwellings

The previous section has indicated that habitable rooms that face the A41 will require upgraded glazing and so Table 5.2 details the required specification of glazing.

Table 5.2: Upgraded Glazing Specifications

Dwelling	Period	Difference +/- (dB)	Required Sound Reduction Index of Acoustic Glazing $R_w + C_{tr}$ (dB)	Example Glazing Unit Specification
10	Daytime (Living Rooms)	+5.1	35	4 / 16 / 8.8A
	Night-time (Bedrooms)	+3.1	33	6 / 15 / 8.4A
		+6.1	36	
11	Daytime (Living Rooms)	+2.6	32	4 / 16 / 6.4A
	Night-time (Bedrooms)	+1.7	31	4 / 8 / 8.4A
		+4.6	34	
13	Daytime (Living Rooms)	+0.9	30	4 / 12 / 6.4A
9	Daytime (Living Rooms)	+0.2	30	4 / 12 / 6.4A

The previous section indicated that with a partially open window, the internal noise levels for any habitable rooms which have line of sight to the A41 will exceed the internal target criteria. Accordingly, It is recommended that a through-frame window mounted trickle ventilator is incorporated into the glazing unit of the habitable rooms so that fresh air can enter the room without having to open windows. One such acoustic trickle ventilator is as follows:

- Greenwoods EAR42W Trickle Ventilator, which provides acoustic attenuation of up to 42 dB $D_{n,e,w} + C_{tr}$ in its open position.

The trickle ventilator should be combined with a Mechanical Extract Ventilation (MEV), a Mechanical Ventilation Heat Recovery (MVHR) or a Passive Extract Ventilation (PEV) system which extracts air from the habitable rooms.

5.1.3 Internal Amenity Areas – Second Floor Dwellings

The previous section has indicated that habitable rooms that face the A41 will require upgraded glazing and so Table 5.3 details the required specification of glazing.

Table 5.3: Upgraded Glazing Specifications

Dwelling	Period	Difference +/- (dB)	Required Sound Reduction Index of Acoustic Glazing $R_w + C_{tr}$ (dB)	Example Glazing Unit Specification
10	Daytime (Living Rooms)	+4.9	34	4 / 8 / 8.4A
	Night-time (Bedrooms)	+2.9	32	4 / 16 / 8.8A
		+5.7	35	
11	Daytime (Living Rooms)	+2.5	32	4 / 16 / 6.4A
	Night-time (Bedrooms)	+1.5	31	4 / 8 / 8.4A
		+4.2	34	
13	Daytime (Living Rooms)	+0.9	30	4 / 12 / 6.4A
9	Daytime (Living Rooms)	+0.2	30	4 / 12 / 6.4A

The previous section indicated that with a partially open window, the internal noise levels for any habitable rooms which have line of sight to the A41 will exceed the internal target criteria. Accordingly, It is recommended that a through-frame window mounted trickle ventilator is incorporated into the glazing unit of the habitable rooms so that fresh air can enter the room without having to open windows. One such acoustic trickle ventilator is as follows:

- Greenwoods EAR42W Trickle Ventilator, which provides acoustic attenuation of up to 42 dB $D_{n,e,w} + C_{tr}$ in its open position.

The trickle ventilator should be combined with a Mechanical Extract Ventilation (MEV), a Mechanical Ventilation Heat Recovery (MVHR) or a Passive Extract Ventilation (PEV) system which extracts air from the habitable rooms.

5.1.4 Internal Amenity Areas – Third Floor Dwellings

The previous section has indicated that habitable rooms that face the A41 will require upgraded glazing and so Table 5.4 details the required specification of glazing.

Table 5.4: Upgraded Glazing Specifications

Dwelling	Period	Difference +/- (dB)	Required Sound Reduction Index of Acoustic Glazing $R_w + C_{tr}$ (dB)	Example Glazing Unit Specification
20	Daytime (Living Rooms)	+4.7	34	4 / 8 / 8.4A
	Night-time (Bedrooms)	+2.6	32	4 / 16 / 8.8A
		+5.2	35	
21	Daytime (Living Rooms)	+1.1	31	4 / 6 / 5
	Night-time (Bedrooms)	+0.1	30	4 / 16 / 6.4A
		+1.3	32	

The previous section indicated that with a partially open window, the internal noise levels for any habitable rooms which have line of sight to the A41 will exceed the internal target criteria. Accordingly, It is recommended that a through-frame window mounted trickle ventilator is incorporated into the glazing unit of the habitable rooms so that fresh air can enter the room without having to open windows. One such acoustic trickle ventilator is as follows:

- Greenwoods EAR42W Trickle Ventilator, which provides acoustic attenuation of up to 42 dB $D_{n,e,w} + C_{tr}$ in its open position.

The trickle ventilator should be combined with a Mechanical Extract Ventilation (MEV), a Mechanical Ventilation Heat Recovery (MVHR) or a Passive Extract Ventilation (PEV) system which extracts air from the habitable rooms.

5.1.5 Internal Amenity Areas – Fourth Floor Dwellings

The previous section has indicated that habitable rooms that face the A41 will require upgraded glazing and so Table 5.5 details the required specification of glazing.

Table 5.5: Upgraded Glazing Specifications

Dwelling	Period	Difference +/- (dB)	Required Sound Reduction Index of Acoustic Glazing $R_w + C_{tr}$ (dB)	Example Glazing Unit Specification
22	Daytime (Living Rooms)	+4.1	34	4 / 8 / 8.4A
	Night-time (Bedrooms)	+2.1	32	4 / 8 / 8.4A
		+4.1	34	

The previous section indicated that with a partially open window, the internal noise levels for any habitable rooms which have line of sight to the A41 will exceed the internal target criteria. Accordingly, It is recommended that a through-frame window mounted trickle

ventilator is incorporated into the glazing unit of the habitable rooms so that fresh air can enter the room without having to open windows. One such acoustic trickle ventilator is as follows:

- Greenwoods EAR42W Trickle Ventilator, which provides acoustic attenuation of up to 42 dB $D_{n,e,w} + C_{tr}$ in its open position.

The trickle ventilator should be combined with a Mechanical Extract Ventilation (MEV), a Mechanical Ventilation Heat Recovery (MVHR) or a Passive Extract Ventilation (PEV) system which extracts air from the habitable rooms.

6.0 CONCLUSION

REC Limited have been commissioned by Zen Developments to undertake a Noise Impact Assessment for a proposed residential development on land located off Heath Drive in Hampstead NW3.

This assessment has been undertaken to identify key noise sources in the vicinity of the Site which may have the potential to impact upon the proposed noise sensitive residential development.

This Noise Impact Assessment has been completed with due regard to the requirements of Camden Council's Environmental Health Department.

The Noise Impact Assessment has identified that the key noise source impacting upon the Site is from road traffic using the A41. Accordingly appropriate mitigation has been specified in order to reduce these impacts for internal habitable areas. This assessment has set plant noise emission limits for any proposed mechanical plant which may be installed as part of this development in the interests of protecting amenity.

It should be noted that all of the calculations performed in this assessment are based on worst-case assumptions and so the actual level of noise within internal habitable rooms is likely to be lower than the calculated noise levels.

Subject to the incorporation of the identified mitigation measures, it is considered that the Site is suitable for the promotion of residential development.

APPENDIX I LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between REC Limited and the Client as indicated in Section 1.2.

2. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.

3. REC cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by REC is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by REC in this connection without their explicit written agreement there to by REC.

APPENDIX II GLOSSARY OF ACOUSTICAL 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 dB(A)	Location
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 factory
100 - 110	Burglar alarm at 1m 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 (2x10-5Pa).
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 Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L_{10} & 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 Ln 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 125millisecond time constant.
Slow	A time weighting used in the root mean square section of a sound level meter with a 1000millisecond time constant.

APPENDIX III FIGURES

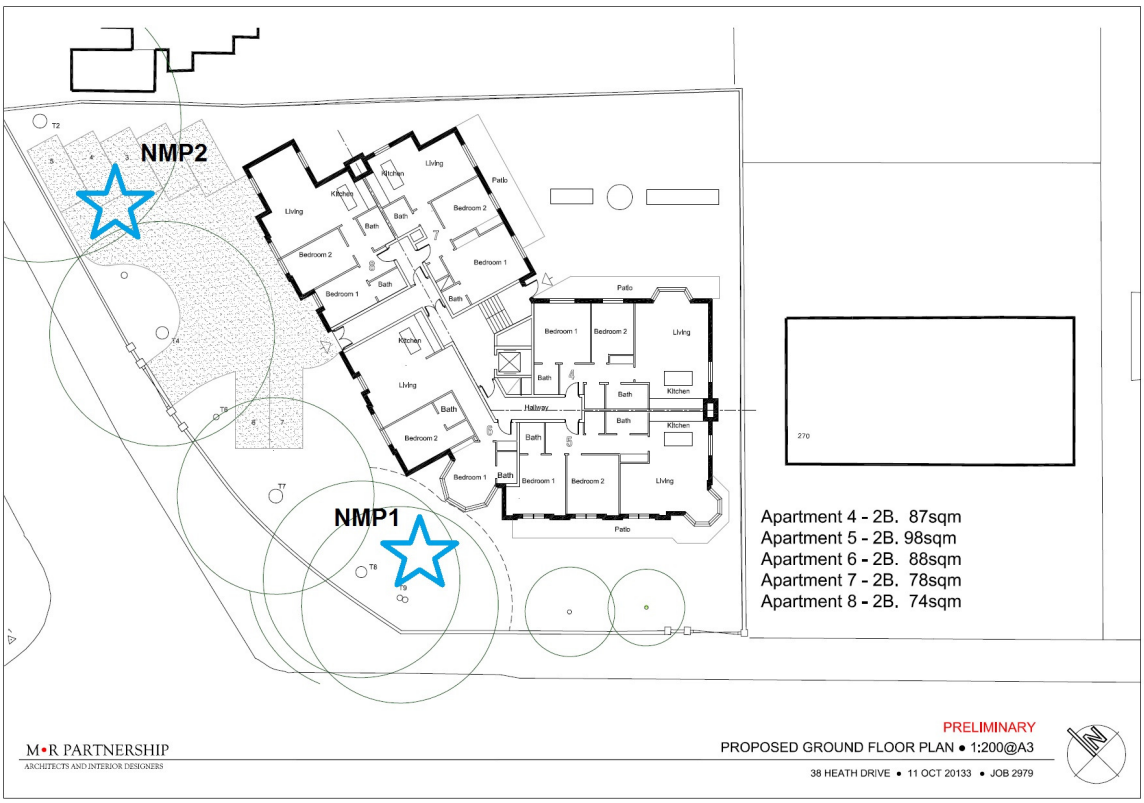

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Figure 1

Proposed Ground Floor Layout & Noise Measurement Positions

APPENDIX IV MEASURED SOUND PRESSURE LEVEL DATA

Table A3: Measured Sound Pressure Levels from the Background Noise Survey

Period start	Measured Sound Pressure Level, free-field	
	L_{Aeq}	L_{A90}
31/10/2013 09:00	64.9	54.3
31/10/2013 10:00	64.5	53.2
31/10/2013 11:00	63.8	53.0
31/10/2013 12:00	64.2	54
31/10/2013 13:00	64.0	54.1
31/10/2013 14:00	64.9	54.7
31/10/2013 15:00	63.6	54.5
31/10/2013 16:00	64.3	55.0
31/10/2013 17:00	63.4	54.1
31/10/2013 18:00	66.9	54.7
31/10/2013 19:00	62.5	55.8
31/10/2013 20:00	63.2	55.9
31/10/2013 21:00	62.3	51.4
31/10/2013 22:00	61.5	51.1
31/10/2013 23:00	61.5	50.4
01/11/2013 00:00	65.0	46.1
01/11/2013 01:00	59.7	46.9
01/11/2013 02:00	59.6	42.9
01/11/2013 03:00	64.9	43.1
01/11/2013 04:00	59.7	45.2
01/11/2013 05:00	61.5	45.8
01/11/2013 06:00	64.6	49.8
01/11/2013 07:00	65.3	52.2
01/11/2013 08:00	65.1	55.2

Table A4: Measured Sound Pressure Levels from the Road Traffic Noise Survey

Period start	Measured Sound Pressure Level, free-field			
	L_{Aeq}	L_{A90}	$L_{A10,1hr}$	$L_{Amax,fast}$
31/10/2013 09:00	72.1	59.1	75.3	93.3
31/10/2013 10:00	71.4	58.4	75	91.2
31/10/2013 11:00	71.3	58.3	74.4	90.8
31/10/2013 12:00	72	59.1	74.1	98.2
31/10/2013 13:00	72	59.1	74.5	93.2
31/10/2013 14:00	73	59.6	74.7	99.5
31/10/2013 15:00	71.1	59.1	74.4	88.7
31/10/2013 16:00	72.2	60.4	74.1	96.7

31/10/2013 17:00	71.6	59.1	73.6	101.9
31/10/2013 18:00	72.9	59.6	70.9	97.9
31/10/2013 19:00	68.9	60.9	70.1	91.7
31/10/2013 20:00	71.6	61.4	72.9	99.7
31/10/2013 21:00	70	56.8	73.6	89.9
31/10/2013 22:00	69.4	56.3	73.5	88.6
01/11/2013 07:00	73.8	57.4	74.3	104.2
01/11/2013 08:00	71.2	60.1	74	94.9

REC are a multi-disciplinary health, safety, environmental and energy consultancy. Our national coverage enables our local experts to provide cost effective and pragmatic consultancy services in an efficient and sustainable manner.

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- Health & Safety Training
- CDM Training
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- Combined Heat and Power Systems

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- Sound Insulation Testing
- Noise at Work Assessment
- Development Related Noise
- Environmental Noise

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- Environmental Management
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- Environmental Management Systems
- CDM Co-Ordination
- Environment Permit Application

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- Demolition/Refurbishment Surveys
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- BREEAM & Code 4 Sustainable Homes
- Habitat Management Plans
- Management planning and targeted Biodiversity Action Plan survey
- Environmental Impact Assessment