Ancholme Way, Brigg
Keigar Homes Ltd

Environmental Noise Assessment

07478
February 2008

CONTENTS

1.0 EXECUTIVE SUMMARY

1.1 BSP Consulting has been commissioned by Keigar Homes to undertake an environmental noise assessment for a proposed Residential development. The proposed development is situated off Ancholme Way, Brigg. The location of the site is shown on Figure 1. The first part of the assessment was prepared in order to determine the level of noise emitted from the adjacent road (Ancholme Way) and its potential effect on the proposed development. The second part of the assessment was prepared in order to determine the likelihood of complaints from the proposed residents due to the adjacent industrial estate. The survey was carried out on Friday 19th/Saturday 20th January 2007 with further readings being taken on Friday 12th/Saturday 13th October 2007.

1.2 It can be seen from the calculations in Appendix 2 and also Figure 4 that the site is in NEC A for the daytime period in accordance with PPG24. Figure 5 and Appendix 2 show that for the night-time period the site is again in NEC A. Therefore no further attenuation methods will be required for noise generated from Ancholme Way traffic.

1.3 The second part of the assessment was carried out in accordance with BS4142. The Calculation sheets in Appendix 2 show the BS4142 assessment for site. The results of the assessment indicate that under the existing noise conditions there is a difference between the distance corrected rating level and the background noise level of -2.8dB(A) in the daytime. BS4142 states that:

'A difference of around +10dB or more indicates that complaints are likely.

A difference of around +5dB is of marginal significance

If the rating level is more than 10dB below the measured background noise level then this is a positive indication that complaints are unlikely.'

1.4 The assessment discussed above does not take into account any structural boundary conditions proposed for the development, which may further reduce the received noise levels at the development.

1.5 The assessment demonstrates that under the current conditions, the proposed site falls

into the zone where complaints are unlikely for the daytime period in line with BS4142, and falls into NEC A for both periods in line with PPG24. We therefore consider that the site is suitable for residential development when considering environmental noise.

2.0 INTRODUCTION

2.1 BSP Consulting has been commissioned by Keigar Homes to undertake an environmental noise assessment for a proposed Residential development. The proposed development is situated off Ancholme Way, Brigg. The location of the site is shown on Figure 1.

2.2 The site is bounded by the Old River Ancholme to the north, Ancholme Way (A18) to the east, Bridge Street (A18) to the south, the New River Ancholme and Island Carr Road to the west.

2.3 The site is situated adjacent to Ancholme Way, which is a main route into Brigg town centre. The assessment was prepared to determine the existing noise environment of the site, in order to determine what, if any, further attenuation requirements are needed.

2.4 In order to ensure that the assessment is representative of the noise climate affecting the site, it was established that a 24-hour noise survey would be required to measure the existing noise environment. The assessment would therefore be carried out in accordance with The Department of the Environments' Planning Policy Guidance: Planning and Noise (PPG 24).

2.5 It was also considered that an assessment in accordance with 'BS4142 Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas' would be required. The assessment determines whether the combined noise levels would be excessive and therefore detrimental to the enjoyment of residents of adjacent properties during the day time and night time period when the industrial unit is operational. Were the assessment to show that noise levels would be an issue, then proposals to help attenuate the received noise levels would be recommended.

2.6 For the PPG24 assessment of the site, a single noise-monitoring position adjacent to Ancholme Way would provide a representative view of the existing noise environment for the development. The exact location of the monitoring positions is shown on Figure 2.

2.7 The dominant noise source that affects the whole of the development emanates from the adjacent road, Ancholme Way. The Department of Environment, Planning Policy Guidance: Planning and Noise (PPG24), suggests a number of noise exposure categories based on the free-field L_{Aeq} measured or predicted noise levels, at the noise sensitive properties. These noise exposure categories are used by planning authorities to assess the impact of transportation noise on residential developments. For noise not to be a determining factor in the granting of planning permission the development will need to be in noise exposure Category A. The noise levels for this category have to be at/or below 55 dB(A) in the daytime (07.00 to 23.00 hours) and 45 dB(A) for the night-time (23.00 to 07.00 hours). If the site falls into noise Category B or above, then noise control measures will be required to reduce the noise level to Category A standard.

2.8 The BS4142 assessment has been carried out to assess the noise emanating from the adjacent industrial unit. To ensure that the assessment was based on the worst case in terms of noise, an assessment of the existing environment was carried out during a typical day time period for the site. We consider that one noise monitoring position would provide a representative assessment of the noise source affecting the site and therefore the residents of the proposed dwellings. No monitoring took place for the night-time period at this monitoring position, as it was witnessed on site that the motor repair shop adjacent to the site and the builders merchant were closed during the night time period. As these would have been the two industrial units affecting the site during this period, then it was decided no monitoring was required.

3.0 INSTRUMENTATION

3.1 Free-field noise levels were measured at a height of 1.5 metres above the ground using the following Norsonic integrating sound level metre and microphone:

Description	Model Type	Serial Number
Norsonic Sound Level Meter	Nor-118	31497
Acoustic Calibrator	Nor-1251	29215

3.2 The equipment was operated according to the manufacturers instructions and calibrated before and after use, using the above portable acoustic calibrator, with no significant drifting occurring (not more than 0.5 dB). Calibration certificates are included in Appendix 3.

4.0 NOISE SURVEY

4.1 The noise survey was carried out during a 24 hour period at a single monitoring position in accordance with PPG24, to ensure that the measured noise levels were representative of the worst case scenario in noise terms. The survey was carried out at position 1 (see Figure 2) on Friday 19th/Saturday 20th January 2007. The weather was dry and clear during both days. Conditions were mainly calm throughout the assessment period with a slight breeze in the southerly direction of around 5mph. Temperatures varied from around 4-6 degrees in the daytime periods falling to around 0 - 1 degrees during the night-time. Further readings were taken at monitoring position 3 on Friday 12th/Saturday 13th October 2007. Conditions were calm throughout the assessment period with a slight breeze, temperatures varied from around 10-11 degrees in the daytime periods falling to around 5-6 degrees during the night-time.

4.2 The results of the PPG 24 noise survey are shown on data sheets 1 and 2 in Appendix 1. The existing worst-case L_{Aeq} noise levels at monitoring position 1 have been calculated from these results as 60.2dB(A) during the daytime, and 50.7dB(A) during the night-time period. At position 3 the results have been calculated from these results as 61.7dB(A) during the daytime, and 53.8dB(A) during the night-time period. These results were then distance corrected to calculate the NEC boundaries, as specified in PPG24, in order for the site to be classified for development in terms of noise.

4.3 For the BS4142 assessment, the survey was carried out during the daytime period in accordance with BS4142 (monitoring position 2). A series of readings were taken throughout the period to ensure that the measured noise levels were representative of the worst case scenario in noise terms.

4.4 For the assessment, readings were taken on the site during a typical daytime period. Firstly, background noise levels, $L_{A90,}$ were taken adjacent to the existing industrial units. Secondly specific readings were taken adjacent to the existing unit. The results from this assessment were combined and compared as described in BS4142 using both the recorded background $L_{A90,\ 1hr}$ noise levels and specific noise levels, $L_{Aeq,\ 1hr}$. The results

of the BS4142 noise survey shown on data sheet 3 in Appendix 1.

4.5 The results of the BS4142 assessment in Appendix 2, show that under typical week day conditions on the site, the lowest external recorded background noise level for the daytime, $L_{A90,1hr}$, was 53.1dB(A), with the highest corresponding calculated external specific noise level, $L_{Aeq,1hr}$ of 56.6dB(A). These results, together with the BS4142 assessment are discussed in detail in the following sections, with the results of the BS4142 noise survey shown on data sheet 1 in Appendix 1.

5.0 DISCUSSION

5.1 Planning policy guidance notes set out the Government's policies on different aspects of planning. PPG24 gives guidance to local authorities on the use of their planning powers to minimise the adverse impacts of noise without imposing unreasonable restrictions on development, or adding unduly to the costs and administrative burdens of business.

5.2 PPG24 recommends appropriate levels of noise exposure for residential development and expresses these as noise exposure categories (NEC's) for different noise sources. Four NEC's are specified for new dwellings, these are identified as A to D, which represent an increasing concern regarding the noise climate, as shown in Table 1.

Table 1

Noise exposure categories

Category	Description
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

5.3 For road traffic noise, the noise levels corresponding to the NEC's above are as shown in Table 2 below

Table 2
Noise Levels in dB(A) Corresponding to Noise Exposure Categories (NEC's)

Time Period	NEC			
	A	B	C	D
07.00 – 23.00 (Daytime)	< 55	55 – 63	63 – 72	>72
23.00 – 07.00 (Night-Time)	< 45	45 – 57	57 – 66	>66

5.4 The existing average day and night-time L_{Aeq} values resulting from the measured noise levels in Appendix 1, have been used to calculate the noise contour positions of the above NEC boundaries and are superimposed on the proposed site layout plan. These existing noise contours are shown on Figures 4 and 5 for the day and night-time conditions respectively.

5.5 It can be seen from the calculations in Appendix 2 and also Figure 4 that the site is in NEC A for the daytime period. Figure 5 and Appendix 2 show that for the night-time period the site is again in NEC A. Therefore no further attenuation methods will be required regarding traffic noise.

5.6 The second part of the assessment was carried out in accordance with BS4142 Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas', using a 1 hour reference time interval for the daytime. The BS4142 assessment would determine whether the noise levels emitted from the existing industrial unit are sufficient enough to result in complaints from the proposed residents of the nearest dwellings. The building immediately adjacent to the site boundary is the office building, and hence the assessment has considered the impact on the nearest proposed residential dwelling.

5.7 The Calculation sheets in Appendix 2 show the BS4142 assessment for site. The results of the assessment indicate that under the existing noise conditions there is a difference between the distance corrected rating level and the background noise level of -2.8dB(A)

in the daytime, BS4142 states that:

'A difference of around +10dB or more indicates that complaints are likely.

A difference of around +5dB is of marginal significance

If the rating level is more than 10dB below the measured background noise level then this is a positive indication that complaints are unlikely.'

5.8 The assessment demonstrates that under the existing road noise conditions, the site falls into NEC A for both the daytime and night-time periods. Similarly, the levels of noise emitted from the adjacent industrial unit are unlikely to lead to complaints. Therefore we determine that the site is suitable for the proposed development in noise terms.

5.9 The assessment discussed above does not take into account any structural boundary conditions proposed for the development, which may further reduce the received noise levels at the site.

6.0 CONCLUSIONS

6.1 In order to ensure that the assessment is representative of the noise climate affecting the site, it was established that a 24-hour noise survey would be required to measure the existing noise environment for noise emanating from Ancholme Way. The assessment has therefore been carried out in accordance with The Department of the Environments' Planning Policy Guidance: Planning and Noise (PPG 24). It was also determined that due to the proximity of the existing industrial estate, a BS4142 assessment would be required at the closest affected residential property.

6.2 The noise survey was carried out during a 24 hour period at a single monitoring position in accordance with PPG24, to ensure that the measured noise levels were representative of the worst case scenario in noise terms. The survey was carried out at position 1 (see figure 2) on Friday 19th/Saturday 20th January 2007. The weather was dry and clear during both days. Conditions were mainly calm throughout the assessment period with a slight breeze in the southerly direction of around 5mph. Temperatures varied from around 4-6 degrees in the daytime periods falling to around 0 - 1 degrees during the night-time. Further readings were taken at monitoring position 3 on Friday 12th/Saturday 13th October 2007. Conditions were calm throughout the assessment period with a slight breeze, temperatures varied from around 10-11 degrees in the daytime periods falling to around 5-6 degrees during the night-time.

6.3 It can be seen from the calculations in Appendix 2 and also Figures 4 and 5 that the site is in NEC A for both the daytime and night-time periods. Therefore no further attenuation methods will be required with regard to road traffic noise.

6.4 The second part of the assessment was carried out in accordance with BS4142.The Calculation sheets in Appendix 2 show the BS4142 assessment for site. The results of the assessment indicate that under the existing noise conditions there is a difference between the distance corrected rating level and the background noise level of -2.8dB(A) in the daytime, BS4142 states that:

'A difference of around +10dB or more indicates that complaints are likely.
A difference of around +5dB is of marginal significance
If the rating level is more than 10dB below the measured background noise level then this is a positive indication that complaints are unlikely.'

6.5 The assessment discussed above does not take into account any structural boundary conditions proposed for the development (e.g. close boarded fences, walls etc), which may further reduce the received noise levels at the site.

6.6 This environmental noise assessment has demonstrated that:

- the proposed site falls into NEC category A in accordance with PPG24 regarding traffic noise on Ancholme Way,
- complaints are unlikely to arise from new residents regarding noise generated from the adjacent industrial units, in accordance with BS4142.

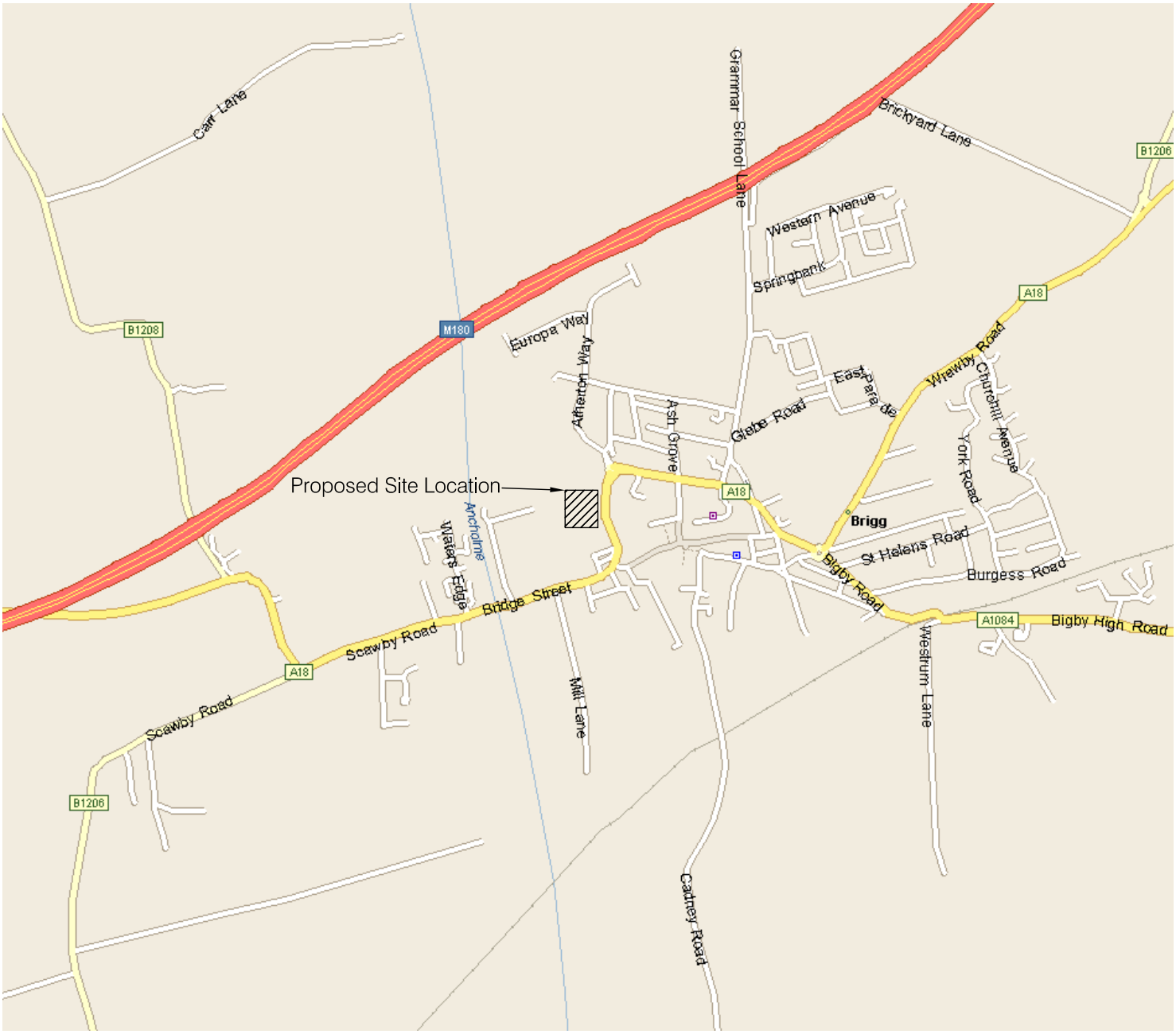
We therefore consider that the site is suitable for residential development, in terms of the existing noise climate.

For and on behalf of BSP Consulting

Fraser Poxon AMIHT
Senior Environmental Noise Technician

Jason Davenport
Associate Director

FIGURES 1 TO 5



The BSP Risk Assessments for this project must be reviewed PRIOR to the commencement of any works on site

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Rev.	Description	Date.	Drawn	Appr.

Drawing Status: FOR INFORMATION

Client: KIEGAR HOME

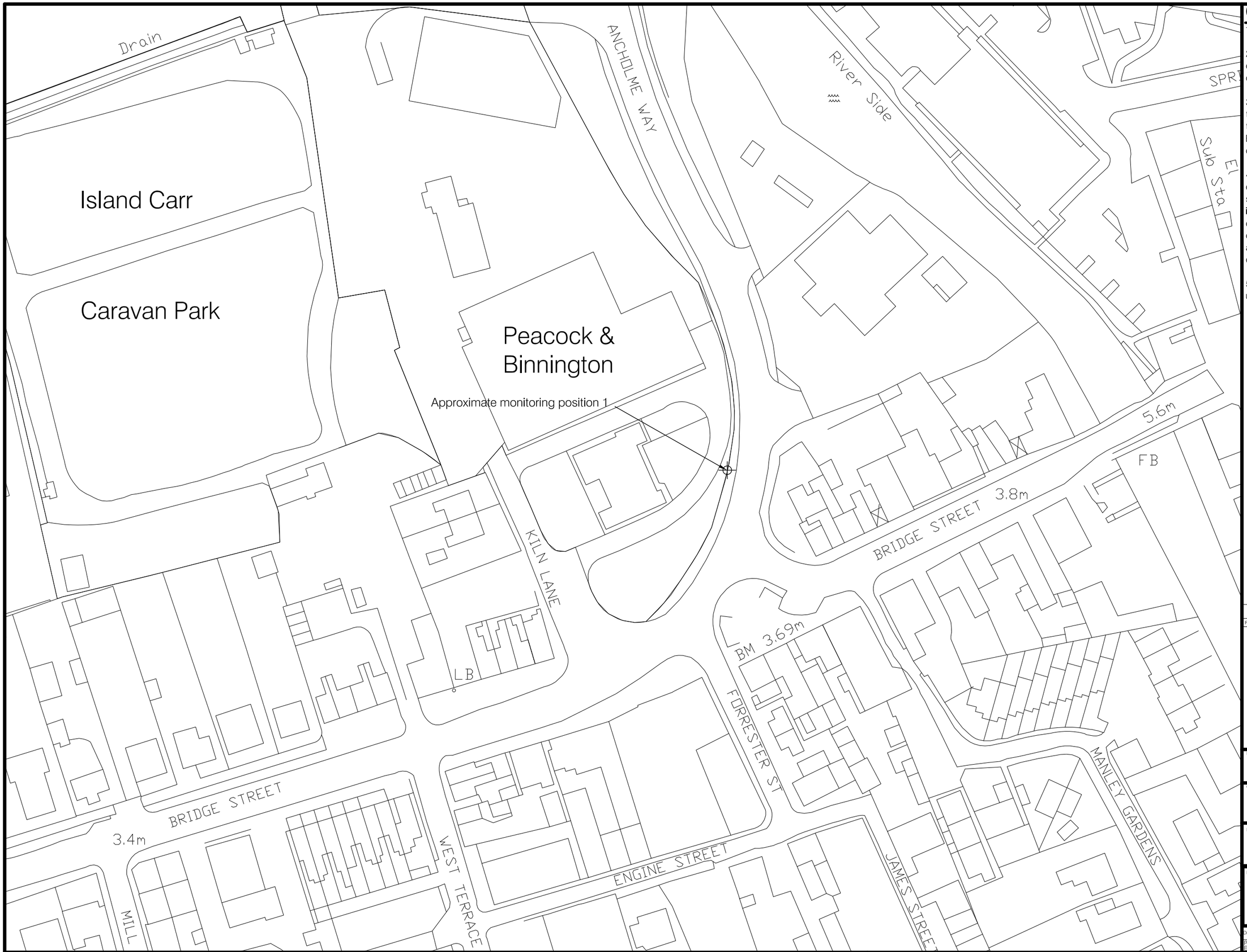
Project Title: PROPOSED RESIDENTIAL DEVELOPMENT, ANCHOLME WAY, BRIGG

Drawing Title: SITE LOCTION PLAN

Drawn By:	FDP	Checked By:	MWR	Scale:	1:1000@A4
Project Engineer:	MWR	Approved By:	MWR	Date:	FEB 07

Drawing Number: FIGURE 1

Revision:



General Notes

1. DO NOT SCALE.

2. This drawing is to be read in conjunction with all other relevant drawings.

3. Should there be any conflict between the details indicated on this drawing and those indicated on other drawings the Engineer should be informed PRIOR to construction on site.

4. Until technical approval has been obtained from the relevant Authority, it should be understood that all drawings issued are Preliminary and NOT for construction. Should the contractor commence site work prior to such approval being given, it is entirely at his own risk.

5. All dimensions are in millimetres unless otherwise stated.

Rev.	Description	Date.	Drawn	Appr.

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Drawing Status
FOR INFORMATION

Client
KEIGAR HOMES

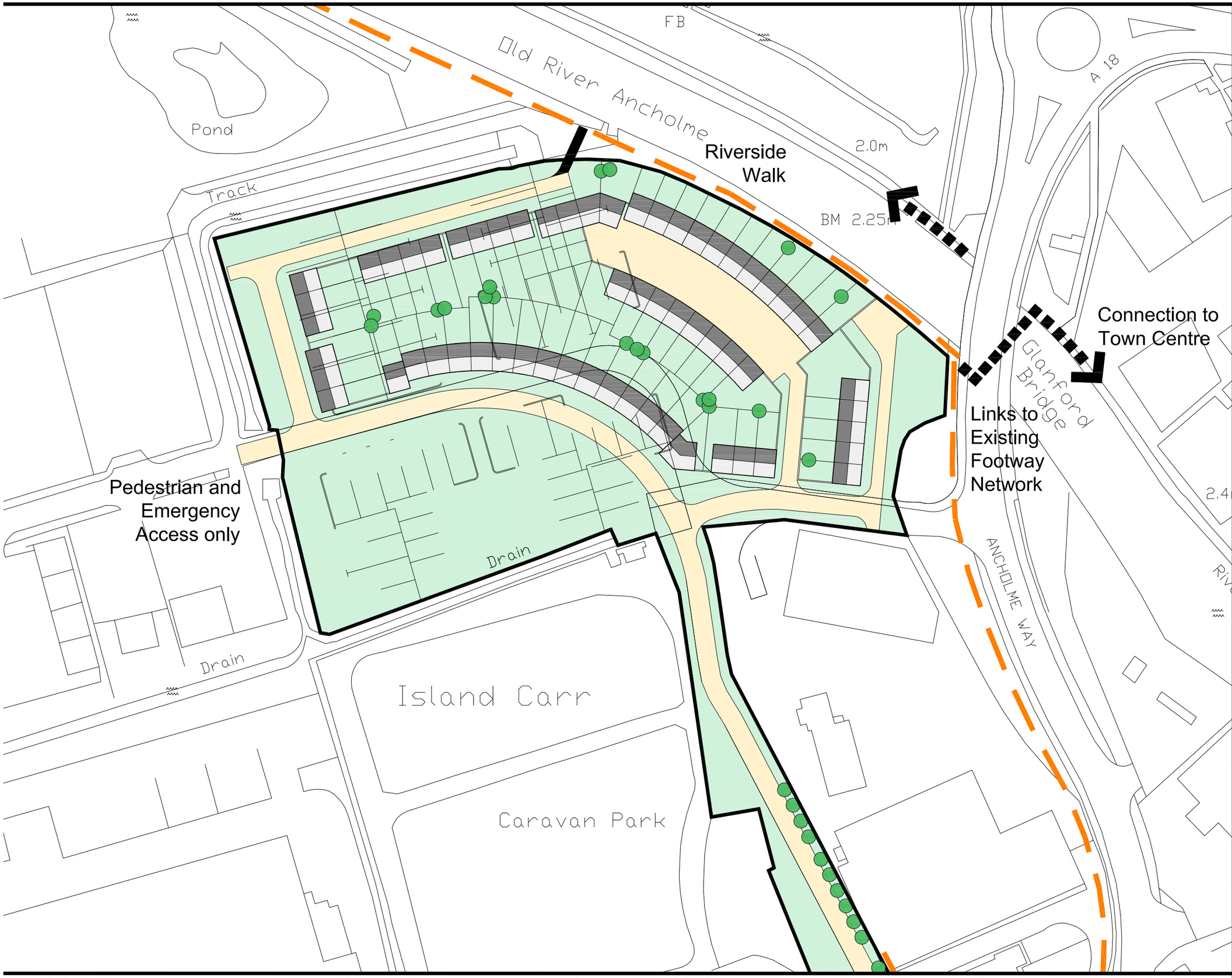
Project Title
Island Carr North
Mixed Use Site
Brigg, North Lincolnshire

Drawing Title
Existing site layout
and noise monitoring positions

Drawn By:	FDP	Checked By:	MWR	Scale:	1:1000
Project Engineer:	MWR	Approved By:	MWR	Date:	Nov 07

Drawing Number: Figure 2
Revision:

The BSP Risk Assessments for this project must be reviewed PRIOR to the commencement of any works on site



General Notes

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Rev.	Description	Date.	Drawn	Appr.

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Drawing Status
FOR INFORMATION

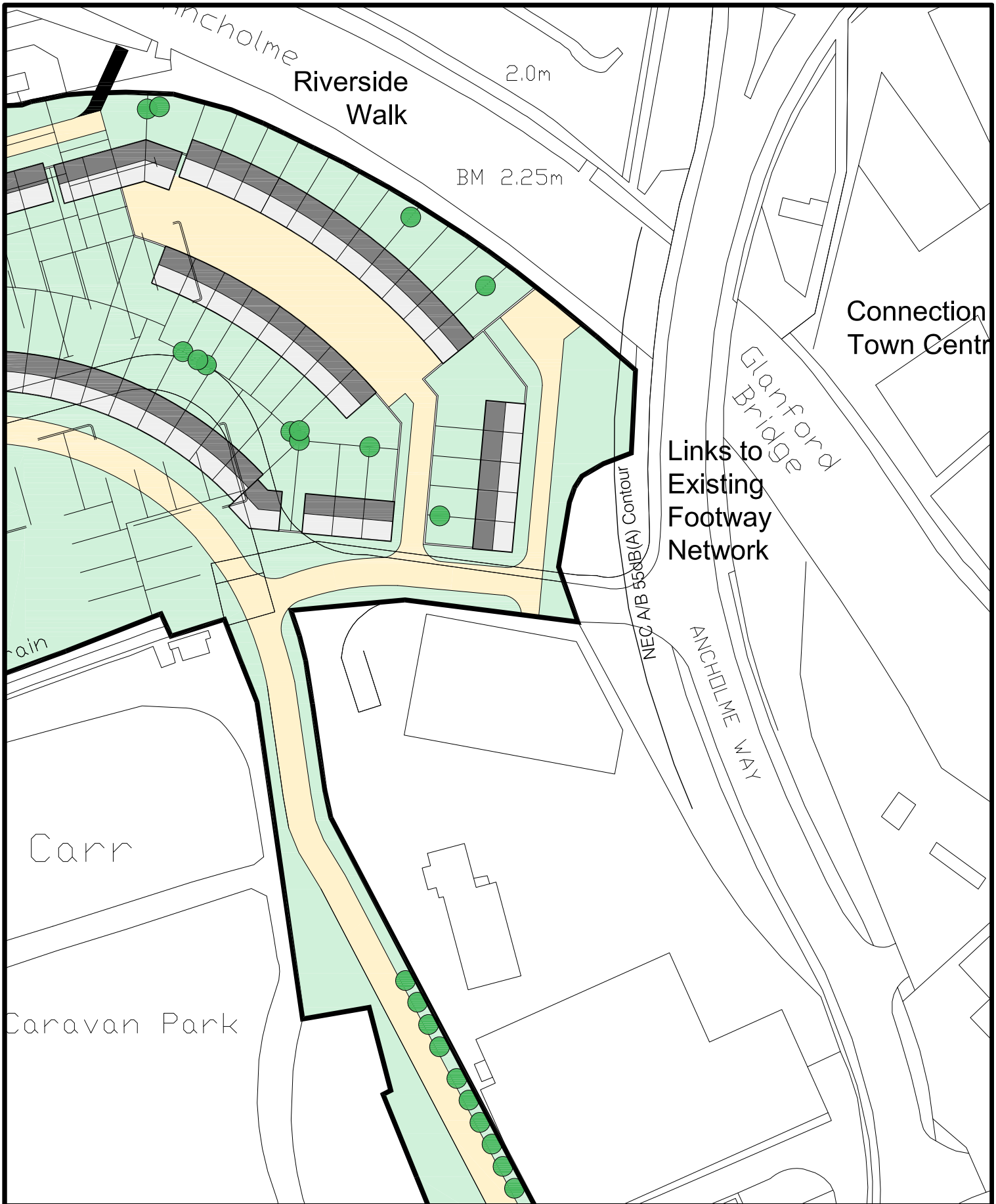
Client
KEIGAR HOMES

Project Title
Island Carr North
Mixed Use Site
Brigg, North Lincolnshire

Drawing Title
Proposed Site Layout

Drawn By:	FDP	Checked By:	MWR	Scale:	1:1000
Project Engineer:	MWR	Approved By:	MWR	Date:	Jan 07
Drawing Number: Figure 3				Revision:	

The BSP Risk Assessments for this project must be reviewed PRIOR to the commencement of any works on site



The BSP Risk Assessments for this project must be reviewed PRIOR to the commencement of any works on site

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Rev.	Description	Date.	Drawn	Appr.
A	SITE LAYOUT AMENDED	28/02 2008	FDP	MWR

Drawing Status: FOR INFORMATION

Client: KIEGAR HOME

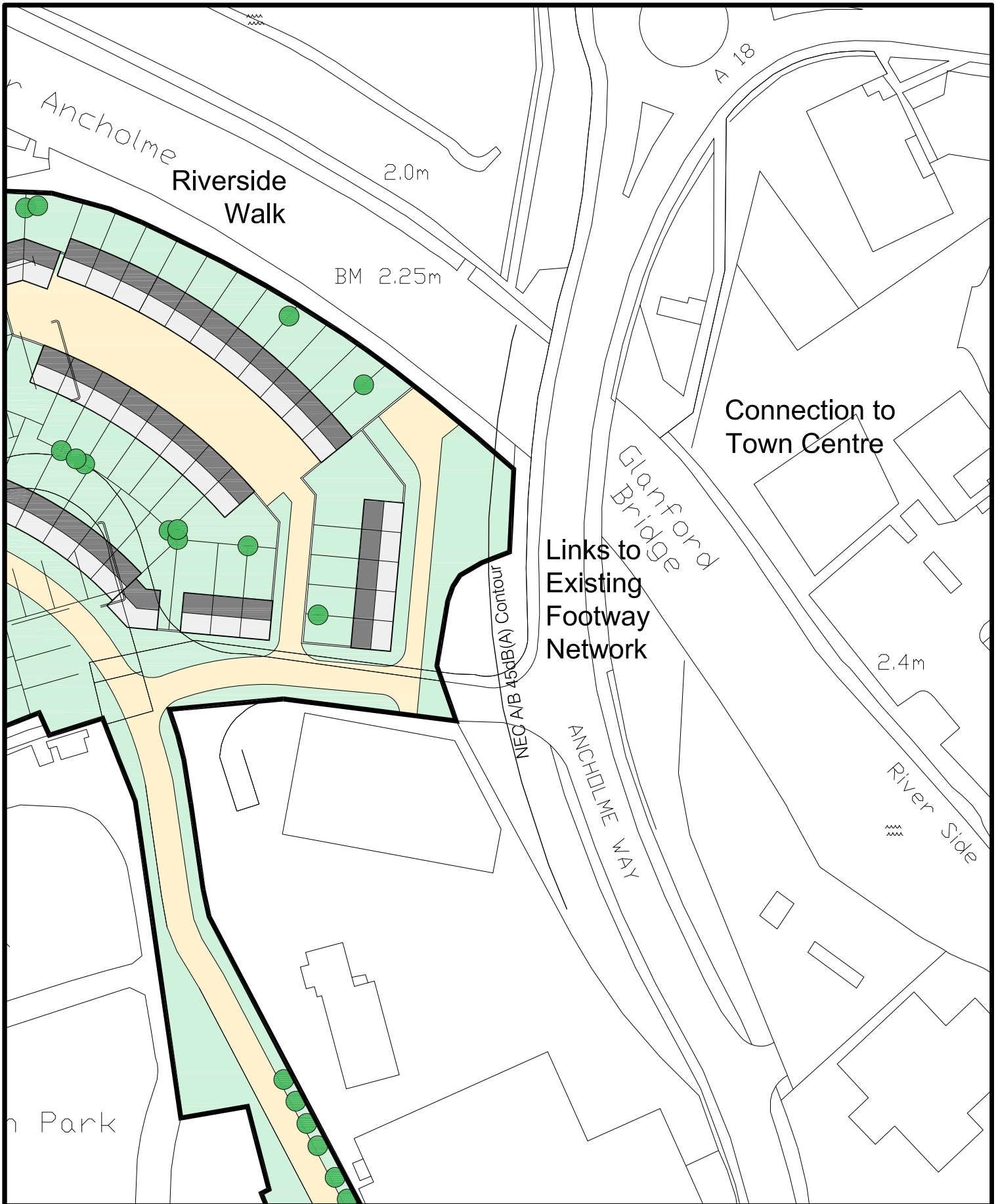
Project Title: PROPOSED RESIDENTIAL DEVELOPMENT, ANCHOLME WAY, BRIGG

Drawing Title: NEC DAYTIME COUNTOUR

Drawn By:	FDP	Checked By:	MWR	Scale:	1:1000@A4
Project Engineer:	MWR	Approved By:	MWR	Date:	FEB 07

Drawing Number: FIGURE 4

Revision: A



The BSP Risk Assessments for this project must be reviewed PRIOR to the commencement of any works on site

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Rev.	Description	Date.	Drawn	Appr.
A	SITE LAYOU AMENDED	28/02 2008	FDP	MWR

Drawing Status: FOR INFORMATION

Client: KIEGAR HOME

Project Title: PROPOSED RESIDENTIAL DEVELOPMENT, ANCHOLME WAY, BRIGG

Drawing Title: NEC NIGHT-TIME COUNTOUR

Drawn By:	FDP	Checked By:	MWR	Scale:	1:1000@A4
Project Engineer:	MWR	Approved By:	MWR	Date:	FEB 07

Drawing Number: FIGURE 5

Revision:

APPENDIX 1
Data Sheets

Ancholme Way, Brigg
North Lincolnshire
Environmental Noise Measurement Results

APPENDIX 1 - DATA SHEET 1
MEASURED NOISE LEVELS IN dB(A)
HOURLY Laeq,1hr

Period	Time	Noise Level dB(A)
		19/20th January
	07:00 - 08:00	62.6
	08:00 - 09:00	61.7
	09:00 - 10:00	59.8
D	10:00 - 11:00	61.0
A	11:00 - 12:00	62.2
Y	12:00 - 13:00	60.8
T	13:00 - 14:00	59.4
I	14:00 - 15:00	60.0
M	15:00 - 16:00	60.4
E	16:00 - 17:00	60.5
	17:00 - 18:00	61.6
	18:00 - 19:00	59.8
	19:00 - 20:00	57.8
	20:00 - 21:00	57.5
	21:00 - 22:00	56.3
	22:00 - 23:00	55.1
Average Daytime L_{Aeq}		**60.2**
	23:00 - 24:00	51.4
	24:00 - 01:00	50.8
N	01:00 - 02:00	46.6
I	02:00 - 03:00	48.5
G	03:00 - 04:00	49.4
H	04:00 - 05:00	48.5
T	05:00 - 06:00	50.1
	06:00 - 07:00	54.7
Average Night-time L_{Aeq}		**50.7**

Mean $L_{eq,t} = 10\log\{(10^{L1/10}+10^{L2/10}+10^{L3/10}\ldots\ldots)/N\}$

Night-time $L_{eq,8hr}$ = 50.7dB(A)

Day-time $L_{eq,16hr}$ = 60.2dB(A)

Ancholme Way, Brigg
North Lincolnshire
Environmental Noise Measurement Results

APPENDIX 1 - DATA SHEET 2
MEASURED NOISE LEVELS IN dB(A)
HOURLY Laeq,1hr

Period	Time	Noise Level dB(A)
		12/13th October
	07:00 - 08:00	63.8
	08:00 - 09:00	65.4
	09:00 - 10:00	61.7
D	10:00 - 11:00	62.3
A	11:00 - 12:00	64.0
Y	12:00 - 13:00	61.1
T	13:00 - 14:00	60.9
I	14:00 - 15:00	61.2
M	15:00 - 16:00	61.7
E	16:00 - 17:00	61.7
	17:00 - 18:00	62.0
	18:00 - 19:00	60.2
	19:00 - 20:00	59.1
	20:00 - 21:00	58.8
	21:00 - 22:00	58.3
	22:00 - 23:00	56.7
Average Daytime L_{Aeq}		**61.7**
	23:00 - 24:00	53.2
	24:00 - 01:00	51.6
N	01:00 - 02:00	49.5
I	02:00 - 03:00	48.7
G	03:00 - 04:00	47.0
H	04:00 - 05:00	59.2
T	05:00 - 06:00	52.6
	06:00 - 07:00	55.4
Average Night-time L_{Aeq}		**53.8**

Mean $L_{eq,t} = 10\log\{(10^{L1/10}+10^{L2/10}+10^{L3/10}\ldots\ldots)/N\}$

Night-time $L_{eq,8hr}$ = 53.8dB(A)

Day-time $L_{eq,16hr}$ = 61.7dB(A)

APPENDIX 1 - DATA SHEET 3
MEASURED NOISE LEVELS IN dB(A)

Period	Time	Recorded Noise Level		Type of noise recored
		LAeq dB(A)	LA90	
Daytime	09.00-10.00		53.1	Background
	09.00-10.00	55.2		Residual
	10.00-11.00	56.6		Specific

APPENDIX 2
Calculation Sheets

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Project:	Ancholme Way, Brigg	
Project No:	05178	
Sheet No:	1	**rev**
Date:	January 2007	
Part of Structure:	Noise Assessment	

Ref	Calculations	Output

Distance correction to garden area of closest affected proposed dwelling

ΔL 20log R1/R2 R1 = Monitoring position 1

ΔL = 20 log 7.65/16.0 = -6.4dB(A)

Therefore: Daytime $LA_{eq,}16h$ = 60.2 - 6.4 = 53.8dB(A)

Distance correction to façade of nearest affected proposed dwelling

ΔL = 20 log 7.65/19.8 = -8.3dB(A)

Therefore: Night Time $LA_{eq,}16h$ = 50.7 - 8.3 = 42.4dB(A)

Daytime - Determine distance to NEC A/B 55dB(A) boundary

Distance correction ΔL = 20log R2/R1

ΔL = 5.2dB(A), = ΔL 20log R2/R1

ΔL = 5.2dB(A), = ΔL 20log R2/7.65

$$\frac{5.2}{20} = \log R2/7.65$$

R2 = 13.9m

Night - time - Determine distance to NEC A/B 45dB(A) boundary

Distance correction ΔL = 20log R2/R1

ΔL = 5.7dB(A), = ΔL 20log R2/R1

ΔL =5.7dB(A), = ΔL 20log R2/7.65

$$\frac{5.7}{20} = \log R2/7.65$$

R2 = 14.7m

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website: www.bsp-consulting.co.uk

Project:	Ancholme Way	
Project No:	05178	
Sheet No:	2	**rev**
Date:	Feb-07	
Part of Structure:	Noise Assessment	

Ref	Calculations	Output

BS4142 Assessment - Daytime (Monitoring Position 1)

Lowest Recorded Daytime Background Noise Level,
$L_{A90,\ 1hr}$ = 53.1dB(A)

Residual Noise Level, $L_{Aeq,\ 1hr}$ = 55.2dB(A)

Specific Noise Level, $L_{Aeq,\ 1hr}$ = 56.6 dB(A)

Correction from table 1, BS4142 is:-

(56.6 - 55.2) =1.4 which equates to

-3dB(A) = 53.6dB(A)

Distance Correction - Centre of nearest affected dwelling

Noise Level Correction to centre of nearest garden area at proposed dwelling at a distance of approx 65m from the existing industrial unit

$\Delta L = 20 \log R_2 / R_1$ R_1 = 65m (Monitoring Position 2 - Proposed dwelling)

$\Delta L = 20 \log 25 / 65 = -8.3$dB(A)

Therefore 53.6 - 8.3 = 45.3dB(A)

Corrected Measured Noise Level = 45.3dB(A)

Specific Noise Level, $L_{Aeq\ 1hr}$ = 45.3dB(A)

Acoustic Feature Correction = +5dB(A)

Rating Level = (45.3+ 5) = 50.3dB(A)

Background Level = 53.1dB(A)

Excess of Rating over background level

= (50.3 - 53.1) = -2.8dB(A)

Therefore the Assessment indicates that as the noise level is below the existing background level then this is a possitive indication that complaints are unlikely.

APPENDIX 3

Calibration Certificate

Calibration Report

Certificate No.:3437

Manufacturer:	Norsonic
Type :	1251
Serial no:	29215

Customer:	Breakwell Sumner Partnership
Department:	
Place:	12 Oxford Street
City:	Nottingham NG1 5BG
Order No:	BSP/357
Contact Person:	Fraser Poxon
Phone/Mail:	0115 840 2227

Measurement Results:

	Level : (dB)	P. Stab : (dB)	Frequency : (Hz)	F. Stab : (%)	Distortion: (% TD)
1:	114.04	0.06	1000.02	0.00	0.02
2:	114.03	0.06	1000.01	0.00	0.02
3:	114.04	0.06	1000.02	0.00	0.02
Result (Average):	**114.04**	**0.06**	**1000.02**	**0.00**	**0.02**
Expanded Uncertainty:	0.07	0.02	1.00	0.01	0.01
Degree of Freedom:	>100	>100	>100	>100	>100
Coverage Factor:	2.00	2.00	2.00	2.00	2.00

The stated level is relative to 20µPa.

The following correction factors have been applied during the measurement:
Pressure : None Temperature : None Relative humidity : None
Reference microphone: WSM2 - GRAS40AG-28653. Volume correction: 0.000 dB

Records :K:\C A\Calibration\Nor-1504\Nor-1018 CalCal\2007\NOR1251_29215_M1.nmf

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA publication EA-4/02.

Environmental conditions:

Pressure :	Temperature :	Relative humidity :
101.581 ± 0.006 kPa	24.0 ± 1.1 °C	42.4 ± 3.3 %RH

Date of calibration:30/10/07
Date of issue:30/10/07

Supervisor : Ian Campbell MSc MIOA
Engineer :

[redacted]

Darren Batten Tech IOA

Campbell Associates
www.campbell-associates.co.uk

Calibration Report

Certificate No.:3435

Manufacturer:	Norsonic
Type :	1225
Serial no:	52229

Customer:	Breakwell Sumner Partnership
Place:	12 Oxford Street
City:	Nottingham NG1 5BG
Order No:	BSP/357
Contact Person:	Fraser Poxon
Phone/Mail:	0115 840 2227

Measurement Results:

	Sensitivity : (dB re 1V/Pa)	Capacitance : (pF)
1:	-25.65	23.6
2:	-25.65	23.6
3:	-25.65	23.5
Result (Average):	**-25.65**	**23.5**
Expanded Uncertainty:	0.10	1.00
Degree of Freedom:	>100	>100
Coverage Factor:	2.00	2.00

The following correction factors have been applied during the measurement:
Pressure :-0.010 dB/kPa Temperature :-0.007 dB/°C Relative humidity :0.000 dB/%RH

Reference Calibrator: WSC1 - Nor1253-24269. Volume correction: 0.000 dB

Records :K:\C A\Calibration\Nor-1504\Nor-1017 MicCal\2007\NOR1225_52229_M1.nmf

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EA publication EA-4/02.

Comment: Calibration Certificate Number 3435

Environmental conditions:

Pressure :	Temperature :	Relative humidity :
101.479 ± 0.008 kPa	23.3 ± 1.1 °C	42.3 ± 2.3 %RH

Date of calibration:30/10/07
Date of issue:30/10/07

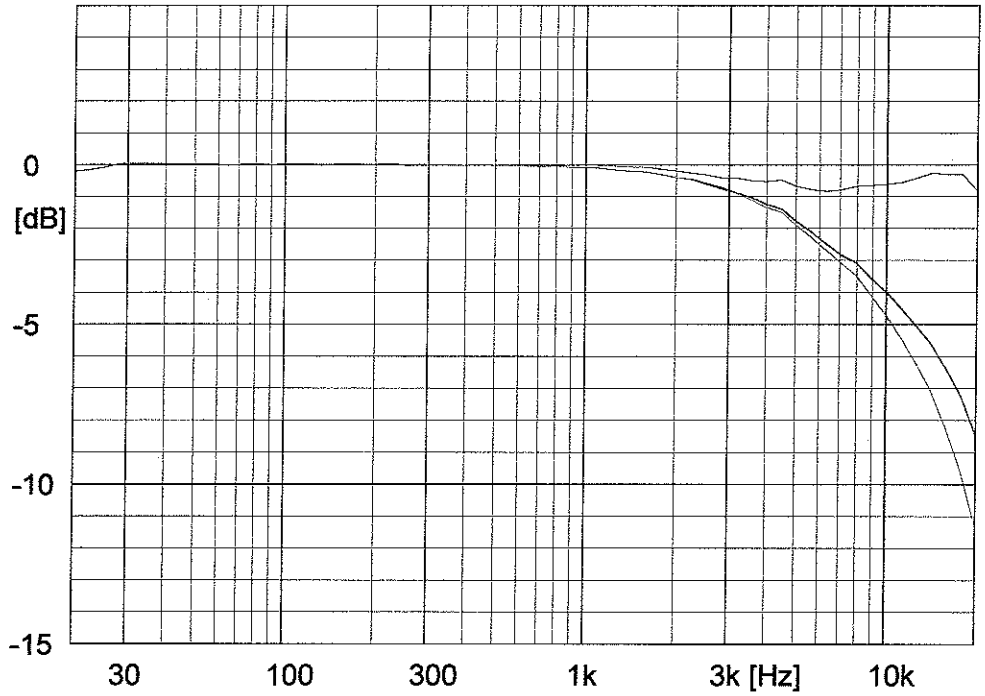
Supervisor : Ian Campbell MSc MIOA
Engineer :

[redacted]

Darren Batten TechIOA

Campbell Associates
www.campbell-associates.co.uk

Microphone Calibration Certificate



Norsonic
Type : 1225

Serial no : 52229

Sensitivity : 52.17 mV/Pa
-25.65 ±0.10 dB re. 1 V/Pa
Capacitance : 23.5 ±1.0 pF
Date : 30/10/07

Signature :

Measurement conditions :

Polarisation voltage :	200.0 V
Pressure :	101.48 ±0.01 kPa
Temperature :	23.3 ±1.1 °C
Relative humidity :	42.3 ±2.3 %RH

Results are normalised to the reference conditions.

Free field response
Diffuse field response
Pressure (Actuator) response

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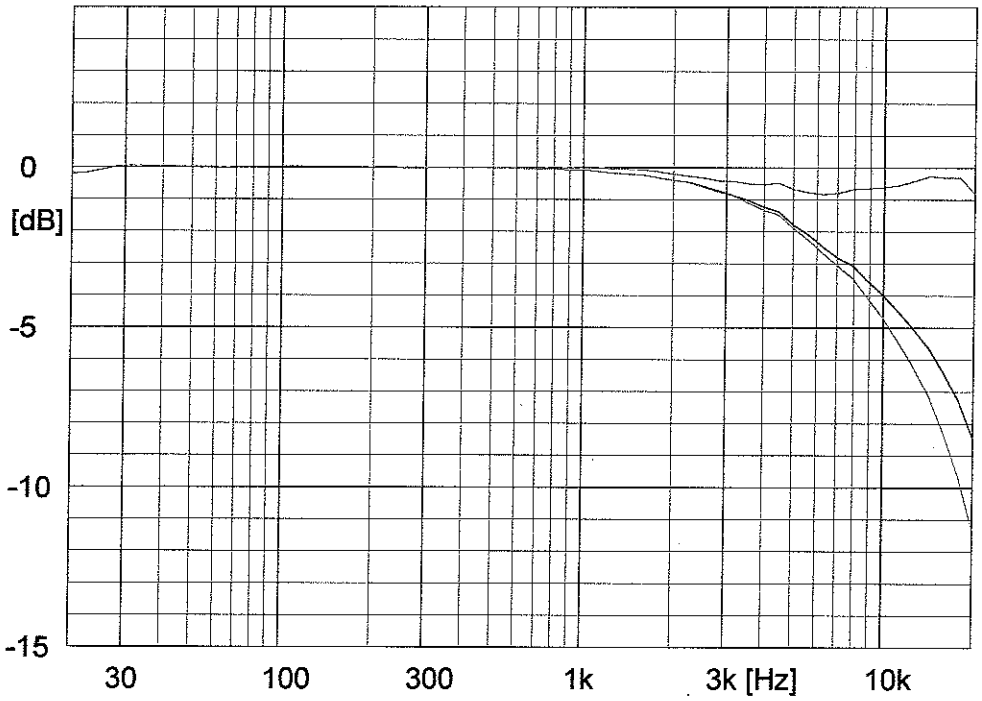
Microphone Calibration Certificate



Norsonic
Type : 1225

Serial no : 52229

Sensitivity : 52.17 mV/Pa
-25.65 ±0.10 dB re. 1 V/Pa
Capacitance : 23.5 ±1.0 pF
Date : 30/10/07

Signature :

Measurement conditions :

Polarisation voltage :	200.0 V
Pressure :	101.48 ±0.01 kPa
Temperature :	23.3 ±1.1 °C
Relative humidity :	42.3 ±2.3 %RH

Results are normalised to the reference conditions.

Free field response
Diffuse field response
Pressure (Actuator) response

Campbell Associates
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Comment : Calibration Certificate Number 3435

Calibration Report

Certificate No.:3434

Norsonic Type : 118 Serial no : 31497

Customer:	Breakwell Sumner Partnership Ltd
Department:	
Place:	12 Oxford Street
City:	Nottingham NG1 5BG
Order No:	BSP/357
Contact Person:	Fraser Poxon
Phone/Mail:	0115 840 2227

Microphone :	Norsonic	Type : 1225	Serial no : 52229	Sens:-25.65dB
Pre amplifier	Norsonic	Type : 1206	Serial no : 30543	
Calibrator :	Norsonic	Type : 1251	Serial no : 29215	Level:114.04dB

Measured with Pre Amplifier

Measurement Results:

Noise Test - IEC 60651 #9.4.1 & 9.4.3	Passed
Level Linearity Test - IEC 60651, #7.9 & 7.10	Passed
Weighting Network Test : A Network - IEC60651 #9.2.2	Passed
Weighting Network Test : C Network - IEC 60651 #9.2.2	Passed
Weighting Network Test : Linear Network - IEC 60651 #9.2.2	Passed
Overload Detector Test : A-Network - IEC 60651 #9.3.1	Passed
Overload Detector Test : Square wave - IEC 60651 #9.3.1	Passed
F/S/I/Peak Test : Steady State Response - IEC 60651 #7.4	Passed
Fast-Slow Test : Overshoot test - IEC 60651 #9.4.1	Passed
Fast-Slow Test: Single Sine Wave Burst - IEC 60651 #9.4.1 & 9.4.3	Passed
Impulse Test : Continuous Sine Wave Burst - IEC 60651 #9.4.3	Passed
Impulse Test : Single Sine Wave Burst - IEC 60651 #9.4.1 & 9.4.3	Passed
Impulse Decay Time Test - IEC 60651 #7.3	Passed
Peak Detector Test, single square wave burst - IEC 60651 #9.4.4	Passed
RMS Detector Test : Crest Factor Test - IEC 60651 #9.4.2	Passed
RMS Detector Test : Continuous Sine Wave Burst - IEC 60651 #9.4.2	Passed
Time Averaging Test: Pulse Range - IEC 60804 #9.3.4	Passed
Time Averaging Test : Averaging Functions - IEC 60804 #9.3.2	Passed
Linearity Test - IEC 804 #9.3.3	Passed

Environmental conditions:

Pressure :	Temperature :	Relative humidity :
101.358 kPa	22.2 °C	43 %RH

Date of calibration: 29/10/07
Date of issue: 30/10/07

Supervisor: Ian Campbell MSc MIOA

Engine[redacted]

Darren Batten TechIOA

Campbell Associates
www.campbell-associates.co.uk

GLOSSARY

1. The human ear responds to sound in an approximately logarithmic manner and the logarithmic decibel (dB) scale is used to measure and assess sound. The human ear does not respond equally to sounds at different frequencies. It is more sensitive at the mid-frequency range than it is at the lower and higher frequencies. Therefore, when measuring sound a weighting network, known as >A-weighting= is applied to the frequency spectrum to take account of this differing sensitivity. This unit is termed dB(A).

2. The L_{Aeq} equivalent continuous sound level, is the sound level of a steady sound having the same energy as a fluctuating sound over a specified measuring period. This may be as short as 1 second or as long as 24 hours when used to assess the noise level at a specified location.