APPENDIX F1

NOISE SURVEY REPORT (AMEY 2012)

Brüel & Kjær
The calibration Laboratory
Skodsborgvej 307, DK-2850 Nærum, Denmark

DANAK CAL Reg.nr. 307

CERTIFICATE OF CALIBRATION

No: C1005508

CALIBRATION OF:

Sound Level Meter:	Brüel & Kjær	2250	No: 2717775
Microphone:	Brüel & Kjær	4189	No: 2710690
Preamplifier:	Brüel & Kjær	ZC-0032	No: 13524
Supplied Calibrator:	Brüel & Kjær	4231	No: 2714830
Software version:	BZ7222 Version 3.3	Instruction manual:	BE-1712-16
Date of receipt:	2010-06-25	Identification:	
Pattern Approval:	PENDING		

CUSTOMER:

AMEY OW LIMITED
Precision House, McNeil Drive
Eurocentral. Motherwell
ML1 4UR Glasgow
United Kingdom

CALIBRATION CONDITIONS:

Preconditioning: 4 hours at 23 °C

Environment conditions: *see actual values in **Environmental conditions** sections*

SPECIFICATIONS:

The Sound Level Meter has been calibrated in accordance with the requirements as specified in IEC61672-3:2006 class 1. Procedures from IEC 61672-3:2006 were used to perform the periodic tests.

PROCEDURE:

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System B&K 3630 with application software type 7763 (version 4.3 - DB: 4.30) and test collection 2250-4189

RESULTS:

X	Initial calibration		Calibration prior to repair/adjustment
	Calibration without repair/adjustment		Calibration after repair/adjustment

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of Calibration: 2010-06-28

Jonas Johannessen
Calibration Technician

Certificate issued: 2010-06-28

Erik Bruus
Approved signatory

Summary

Preliminary inspection	**Passed**
Environmental conditions, Prior to calibration	**Passed**
Reference information	**Passed**
Indication at the calibration check frequency	**Passed**
Self-generated noise, Microphone installed	**Passed**
Acoustical signal tests of a frequency weighting, C weighting	**Passed**
Self-generated noise, Electrical	**Passed**
Electrical signal tests of frequency weightings, A weighting	**Passed**
Electrical signal tests of frequency weightings, C weighting	**Passed**
Electrical signal tests of frequency weightings, Z weighting	**Passed**
Frequency and time weightings at 1 kHz	**Passed**
Level linearity on the reference level range, Upper	**Passed**
Level linearity on the reference level range, Lower	**Passed**
Toneburst response, Time-weighting Fast	**Passed**
Toneburst response, Time-weighting Slow	**Passed**
Toneburst response, LAE	**Passed**
Peak C sound level, 8 kHz	**Passed**
Peak C sound level, 500 Hz	**Passed**
Overload indication	**Passed**
Environmental conditions, Following calibration	**Passed**

The sound level meter submitted for periodic testing successfully completed the class 1 tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed.
However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2002 because evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002 and because the periodic test of IEC 61672-3:2006 cover only a limited subset of the specifications in IEC 61672-1:2002.

Instruments

Category:	Type:	Manufacturer:	Serial No.:
Generator	Pulse Generator	Brüel & Kjær	2415705
Voltmeter	DMM34970A	Agilent	MY41020547
AmplifierDivider	3111 Output Module	Brüel & Kjær	2399410
Calibrator	4226	Brüel & Kjær	2305104
Adaptor	WA0302B, 15 pF	Brüel & Kjær	2456481

Preliminary inspection

Visually inspect instrument, and operate all relevant controls. (section 5)

Environmental conditions, Prior to calibration

Actual environmental conditions prior to calibration. (section 7)

	Measured [Deg C/ kPa / %RH]
Air temperature	23.20
Air pressure	102.00
Relative humidity	52.00

Reference information

Information about reference range, level and channel. (section 19.h + 19.m)

	Value [dB]
Reference sound pressure level	94
Reference level range	140
Channel number	1

Indication at the calibration check frequency

Measure and adjust sound level meter using the supplied calibrator. (section 9 + 19.m)

	Measured [dB / Hz]	Uncertainty [dB / Hz]
Initial indication (supplied calibrator)	93.88	0.14
Calibration check frequency (supplied calibrator)	1000.00	1.00
Adjusted indication (supplied calibrator)	93.86	0.14

Self-generated noise, Microphone installed

Self-generated noise measured with microphone submitted for periodic testing. Averaging time is 30 seconds. An anechoic chamber is used to isolate environmental noise. (section 10.1)

	Max	Measured	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]
A weighted	17.70	16.31	-1.39	1.00
Monitor Level	20.70	12.40	-8.30	1.00

Acoustical signal tests of a frequency weighting, C weighting

Frequency weightings measured acoustically with a calibrated multi-frequency sound calibrator. Averaging time is 10 seconds, and the result is the average of 2 measurements. (section 11)

	Coupler Pressure Lc	Mic. Correction C4226	Body Influence	Expected	Measured	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref. (1st)	94.20	0.10	-0.07	94.17	94.03	94.03	-1.1	1.1	-0.14	0.20
1000Hz, Ref. (2nd)	94.20	0.10	-0.07	94.17	94.01	94.01	-1.1	1.1	-0.16	0.20
1000Hz, Ref. (Average)	94.20	0.10	-0.07	94.17	94.02	94.02	-1.1	1.1	-0.15	0.20
125.89Hz (1st)	94.23	0.00	0.00	93.95	93.93	93.93	-1.5	1.5	-0.02	0.20
125.89Hz (2nd)	94.23	0.00	0.00	93.95	93.93	93.93	-1.5	1.5	-0.02	0.20
125.89Hz (Average)	94.23	0.00	0.00	93.95	93.93	93.93	-1.5	1.5	-0.02	0.20
3981.1Hz (1st)	94.15	0.90	-0.09	92.46	92.62	92.62	-1.6	1.6	0.16	0.30
3981.1Hz (2nd)	94.15	0.90	-0.09	92.46	92.63	92.63	-1.6	1.6	0.17	0.30
3981.1Hz (Average)	94.15	0.90	-0.09	92.46	92.63	92.63	-1.6	1.6	0.17	0.30
7943.3Hz (1st)	93.94	2.80	-0.08	88.14	88.35	88.35	-3.1	2.1	0.21	0.40
7943.3Hz (2nd)	93.94	2.80	-0.08	88.14	88.35	88.35	-3.1	2.1	0.21	0.40
7943.3Hz (Average)	93.94	2.80	-0.08	88.14	88.35	88.35	-3.1	2.1	0.21	0.40

Self-generated noise, Electrical

Self-generated noise measured in most sensitive range, with electrical substitution for microphone, according to manufactures specifications.
Exceedance of the measured level above the corresponding level given in the instruction manual does not, by itself, mean that the perfomance of the sound level meter is no longer acceptable for many practical application. (section 10.2)

	Max	Measured	Uncertainty
	[dB]	[dB]	[dB]
A weighted	13.60	12.71	0.30
C weighted	14.30	13.18	0.30
Z weighted	19.40	18.47	0.30

Electrical signal tests of frequency weightings, A weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	Acoustical Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-24.58	95.00	95.00	0.01	-0.07	94.94	-1.1	1.1	-0.06	0.12
63.096Hz	1.62	95.00	95.02	0.00	0.00	95.02	-1.5	1.5	0.02	0.12
125.89Hz	-8.48	95.00	95.00	0.00	0.00	95.00	-1.5	1.5	0.00	0.12
251.19Hz	-15.98	95.00	94.97	0.01	0.07	95.05	-1.4	1.4	0.05	0.12
501.19Hz	-21.38	95.00	94.97	-0.01	0.22	95.18	-1.4	1.4	0.18	0.12
1995.3Hz	-25.78	95.00	95.01	0.05	-0.09	94.97	-1.6	1.6	-0.03	0.12
3981.1Hz	-25.58	95.00	95.00	0.06	-0.09	94.97	-1.6	1.6	-0.03	0.12
7943.3Hz	-23.48	95.00	95.00	-0.03	-0.08	94.89	-3.1	2.1	-0.11	0.12
15849Hz	-17.98	95.00	94.10	0.00	0.11	94.21	-17.0	3.5	-0.79	0.12

Electrical signal tests of frequency weightings, C weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	Acoustical Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-24.58	95.00	95.00	0.01	-0.07	94.94	-1.1	1.1	-0.06	0.12
63.096Hz	-23.78	95.00	94.97	0.00	0.00	94.97	-1.5	1.5	-0.03	0.12
125.89Hz	-24.38	95.00	95.02	0.00	0.00	95.02	-1.5	1.5	0.02	0.12
251.19Hz	-24.58	95.00	95.00	0.01	0.07	95.08	-1.4	1.4	0.08	0.12
501.19Hz	-24.58	95.00	95.03	-0.01	0.22	95.24	-1.4	1.4	0.24	0.12
1995.3Hz	-24.38	95.00	95.04	0.05	-0.09	95.00	-1.6	1.6	0.00	0.12
3981.1Hz	-23.78	95.00	95.01	0.06	-0.09	94.98	-1.6	1.6	-0.02	0.12
7943.3Hz	-21.58	95.00	95.00	-0.03	-0.08	94.89	-3.1	2.1	-0.11	0.12
15849Hz	-16.08	95.00	94.08	0.00	0.11	94.19	-17.0	3.5	-0.81	0.12

Electrical signal tests of frequency weightings, Z weighting

Frequency response measured with electrical signal relative to level at 1 kHz in reference range. (section 12)

	Input Level	Expected	Measured	Acoustical Resp.	Body Influence	Corr. Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dBV]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
1000Hz, Ref.	-24.58	95.00	95.00	0.01	-0.07	94.94	-1.1	1.1	-0.06	0.12
63.096Hz	-24.58	95.00	95.00	0.00	0.00	95.00	-1.5	1.5	0.00	0.12
125.89Hz	-24.58	95.00	95.00	0.00	0.00	95.00	-1.5	1.5	0.00	0.12
251.19Hz	-24.58	95.00	95.00	0.01	0.07	95.08	-1.4	1.4	0.08	0.12
501.19Hz	-24.58	95.00	95.00	-0.01	0.22	95.21	-1.4	1.4	0.21	0.12
1995.3Hz	-24.58	95.00	95.01	0.05	-0.09	94.97	-1.6	1.6	-0.03	0.12
3981.1Hz	-24.58	95.00	95.03	0.06	-0.09	95.00	-1.6	1.6	0.00	0.12
7943.3Hz	-24.58	95.00	95.01	-0.03	-0.08	94.90	-3.1	2.1	-0.10	0.12
15849Hz	-24.58	95.00	94.13	0.00	0.11	94.24	-17.0	3.5	-0.76	0.12

Frequency and time weightings at 1 kHz

Frequency and time weighting measured at 1 kHz with electrical signal in reference range. Measured relative to A-weighted and Fast response. (section 13)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
LAF, Ref.	94.00	94.00	-0.4	0.4	0.00	0.12
LCF	94.00	94.00	-0.4	0.4	0.00	0.12
LZF	94.00	94.00	-0.4	0.4	0.00	0.12
LAS	94.00	93.98	-0.4	0.4	-0.02	0.12
LAeq	94.00	93.99	-0.4	0.4	-0.01	0.12

Level linearity on the reference level range, Upper

Level linearity in reference range, measured at 8 kHz until overload. (section 14)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
94 dB	94.00	94.00	-1.1	1.1	0.00	0.12
99 dB	99.00	99.00	-1.1	1.1	0.00	0.12
104 dB	104.00	104.00	-1.1	1.1	0.00	0.12
109 dB	109.00	109.01	-1.1	1.1	0.01	0.12
114 dB	114.00	114.01	-1.1	1.1	0.01	0.12
119 dB	119.00	119.01	-1.1	1.1	0.01	0.12
124 dB	124.00	124.01	-1.1	1.1	0.01	0.12
129 dB	129.00	129.02	-1.1	1.1	0.02	0.12
134 dB	134.00	134.02	-1.1	1.1	0.02	0.12
135 dB	135.00	135.02	-1.1	1.1	0.02	0.12
136 dB	136.00	136.01	-1.1	1.1	0.01	0.12
137 dB	137.00	137.01	-1.1	1.1	0.01	0.12
138 dB	138.00	138.02	-1.1	1.1	0.02	0.12
139 dB	139.00	139.01	-1.1	1.1	0.01	0.12
140 dB	140.00	140.01	-1.1	1.1	0.01	0.12

Level linearity on the reference level range, Lower

Level linearity in reference range, measured at 8 kHz down to lower limit, or until underrange. (section 14)

	Expected	Measured	Accept - Limit	Accept + Limit	Deviation	Uncertainty
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
94 dB	94.00	94.00	-1.1	1.1	0.00	0.12
89 dB	89.00	88.99	-1.1	1.1	-0.01	0.12
84 dB	84.00	83.99	-1.1	1.1	-0.01	0.12
79 dB	79.00	79.00	-1.1	1.1	0.00	0.12
74 dB	74.00	74.00	-1.1	1.1	0.00	0.12
69 dB	69.00	69.00	-1.1	1.1	0.00	0.12
64 dB	64.00	63.99	-1.1	1.1	-0.01	0.12
59 dB	59.00	58.99	-1.1	1.1	-0.01	0.12
54 dB	54.00	54.00	-1.1	1.1	0.00	0.12
49 dB	49.00	49.01	-1.1	1.1	0.01	0.12
44 dB	44.00	44.01	-1.1	1.1	0.01	0.12
39 dB	39.00	39.03	-1.1	1.1	0.03	0.30
34 dB	34.00	34.05	-1.1	1.1	0.05	0.30
29 dB	29.00	29.14	-1.1	1.1	0.14	0.30
28 dB	28.00	28.16	-1.1	1.1	0.16	0.30
27 dB	27.00	27.20	-1.1	1.1	0.20	0.30
26 dB	26.00	26.25	-1.1	1.1	0.25	0.30
25 dB	25.00	25.28	-1.1	1.1	0.28	0.30

Toneburst response, Time-weighting Fast

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected [dB]	Measured [dB]	Accept - Limit [dB]	Accept + Limit [dB]	Deviation [dB]	Uncertainty [dB]
Continuous, Ref.	138.00	138.00	-0.8	0.8	0.00	0.11
200 ms Burst	137.00	136.99	-0.8	0.8	-0.01	0.11
2 ms Burst	120.00	119.93	-1.8	1.3	-0.07	0.11
0.25 ms Burst	111.00	110.85	-3.3	1.3	-0.15	0.11

Toneburst response, Time-weighting Slow

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected [dB]	Measured [dB]	Accept - Limit [dB]	Accept + Limit [dB]	Deviation [dB]	Uncertainty [dB]
Continuous, Ref.	138.00	138.00	-0.8	0.8	0.00	0.11
200 ms Burst	130.60	130.57	-0.8	0.8	-0.03	0.11
2 ms Burst	111.00	110.97	-3.3	1.3	-0.03	0.11

Toneburst response, LAE

Response to 4 kHz toneburst measured in reference range, relative to continuous signal. (section 16)

	Expected [dB]	Measured [dB]	Accept - Limit [dB]	Accept + Limit [dB]	Deviation [dB]	Uncertainty [dB]
Continuous, Ref.	138.00	138.00	-0.8	0.8	0.00	0.11
200 ms Burst	131.00	130.99	-0.8	0.8	-0.01	0.11
2 ms Burst	111.00	110.96	-1.8	1.3	-0.04	0.11
0.25 ms Burst	102.00	101.85	-3.3	1.3	-0.15	0.11

Peak C sound level, 8 kHz

Peak-response to a 8 kHz single- cycle sine measured in least-sensitive range, relative to continuous signal. (section 17)

	Expected [dB]	Measured [dB]	Accept - Limit [dB]	Accept + Limit [dB]	Deviation [dB]	Uncertainty [dB]
Continuous, Ref.	135.00	135.00	-0.4	0.4	0.00	0.11
Single Sine	138.40	138.43	-2.4	2.4	0.03	0.40

Peak C sound level, 500 Hz

Peak-response to a 500 Hz half-cycle sine measured in least-sensitive range, relative to continuous signal. (section 17)

	Expected [dB]	Measured [dB]	Accept - Limit [dB]	Accept + Limit [dB]	Deviation [dB]	Uncertainty [dB]
Continuous, Ref.	135.00	135.00	-0.4	0.4	0.00	0.11
Half-sine, Positive	137.40	137.12	-1.4	1.4	-0.28	0.40
Half-sine, Negative	137.40	137.12	-1.4	1.4	-0.28	0.40

Overload indication

Overload indication in the least sensitive range determined with a 4 kHz positive/negative half-cycle signal. (section 18)

	Measured [dB]	Accept - Limit [dB]	Accept + Limit [dB]	Deviation [dB]	Uncertainty [dB]
Continuous	140.00	-0.4	0.4	0.00	0.20
Half-sine, Positive	141.40	-10.0	10.0	1.40	0.20
Half-sine, Negative	141.40	-10.0	10.0	1.40	0.20
Difference	141.40	-1.8	1.8	0.00	0.30

Environmental conditions, Following calibration

Actual environmental conditions following calibration. (section 7)

	Measured [Deg / kPa / %RH]
Air temperature	23.10
Air pressure	101.94
Relative humidity	52.00

DANAK (Danish Accreditation)

DANAK was established in 1991 in pursuance of the Danish Act No. 394 of 13 June 1990 on the promotion of Trade and Industry.

The requirements to be met by accredited laboratories are laid down in the "Danish Agency for Trade and Industry's" ("Erhvervsfremme Styrelsen's") Statutory Order on accreditation of laboratories to perform testing etc., and GLP-inspection. The statutory order refers to other documents where the criteria for accreditation are specified further.

The standards DS/EN ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories" and DS/EN 45002 "General criteria for the assessment of testing laboratories" describes fundamental criteria for accreditation. DANAK uses guidance documents to clarify the requirements in the standards, where this is considered to be necessary. These will mainly be drawn up by the "European co-operation for Accreditation (EA)" or the "International Laboratory Accreditation Co-operation (ILAC)" with a view to obtaining uniform criteria for accreditation worldwide. In addition, DANAK draws up Technical Regulations with specific requirements for accreditation that are not contained in the standards.

In order for a laboratory to be accredited it is, among other things, required:

- that the laboratory and its personnel are not subject to any commercial, financial or other pressures, which might influence their technical judgment,
- that the laboratory operates a documented quality system,
- that the laboratory has at its disposal all items of equipment, facilities and premises required for correct performance of the service that it is accredited to perform,
- that the laboratory management and personnel have technical competence and practical experience in performing the service that they are accredited to perform,
- that the laboratory has procedures for traceability and uncertainty calculations,
- that accredited testing or calibration is performed in accordance with fully validated and documented methods,
- that the laboratory keeps records which contain sufficient information to permit repetition of the accredited test or calibration,
- that the laboratory is subject to surveillance by DANAK on a regular basis,
- that the laboratory shall take out an insurance, which covers liability in connection with the performance of accredited services.

Reports carrying DANAK's logo are used when reporting accredited services and show that these have been performed in accordance with the rules for accreditation.

CERTIFICATE OF CALIBRATION

Date of issue: 30 June 2011 Certificate Number: C1105055

0174

Brüel & Kjær

The Calibration Laboratory
Skodsborgvej 307. DK-2850 Nærum, Denmark
Tel: +45 45 800 500 Fax: +45 45 801 405
Email: ukservice@bksv.com

Morten Høngård Hansen
Approved Signatory

CALIBRATION OF:

Sound Level Calibrator: Brüel & Kjær Type 4231 No: 2714830 Id: -

Date of calibration: 29 June 2011

CUSTOMER:

Amey OW Limited
Precision House, McNeil Drive
Eurocentral. Motherwell
ML1 4UR Glasgow
United Kingdom

Customer Ref: 2000122066

CALIBRATION CONDITIONS:

Preconditioning: 5 hours at 23°C ± 3°C

Environment conditions: Air Temperature: 22.7 °C, Air Pressure: 101.16 kPa, Relative Humidity: 53 % RH.

SPECIFICATIONS:

The Sound Level Calibrator Brüel & Kjær Type 4231 has been calibrated in accordance with the requirements as specified in IEC60942:2003 Annex B.

PROCEDURE:

The measurements have been performed with the assistance of UKAS Calibrator Calibration System 150065 by using procedure TWI-104-DK.

RESULTS:

Unless otherwise stated herein, the reported uncertainty is based upon a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements. The uncertainties refer to the measured values only with no account being taken of the ability of the device under test to maintain its calibration.

Note: Calibration prior to repair/adjustment.

CERTIFICATE OF CALIBRATION

Certificate Number:
C1105055

UKAS ACCREDITED CALIBRATION LABORATORY No. 0174

1. Visual Inspection

OK.

2. Procedure Description

Sound pressure level in the coupler of this calibrator was measured with a calibrated, laboratory grade condenser microphone specified in the certificate. In the case of 1/2 inch microphone, the 1/2 inch adaptor supplied with the calibrator was used. Choice of 1 or 1/2 inch microphone is specified in the customers order.

Sound pressure level measured was compared with sound pressure level generated in the coupler of a working standard pistonphone calibrated by the National Physical Laboratory using the same microphone and at the same ambient conditions.

Appropriate corrections for atmospheric pressure during calibration and for measurement system frequency and level response were taken into account.
Sound pressure level results given in the certificate are the mean of 5 measurements. Calibration results apply at ambient conditions during the process of calibration, which are given in the certificate.

3. Acoustic Measurements

Coupler Configuration	Microphone Type (without grid)	Output Level, dB re 20 µPa at ambient test conditions	+20 dB Level Step in dB	Frequency Hz *	Total Harmonic Distortion % *
1/2"	4180	94.09	20.00	1000.0	0.4
1"	-	-	-	-	-
Measurement Uncertainty	-	0.15	0.04	0.1	0.3

* Frequency and Distortion measurements are not covered by the UKAS accreditation, but is included for completeness.

4. Note

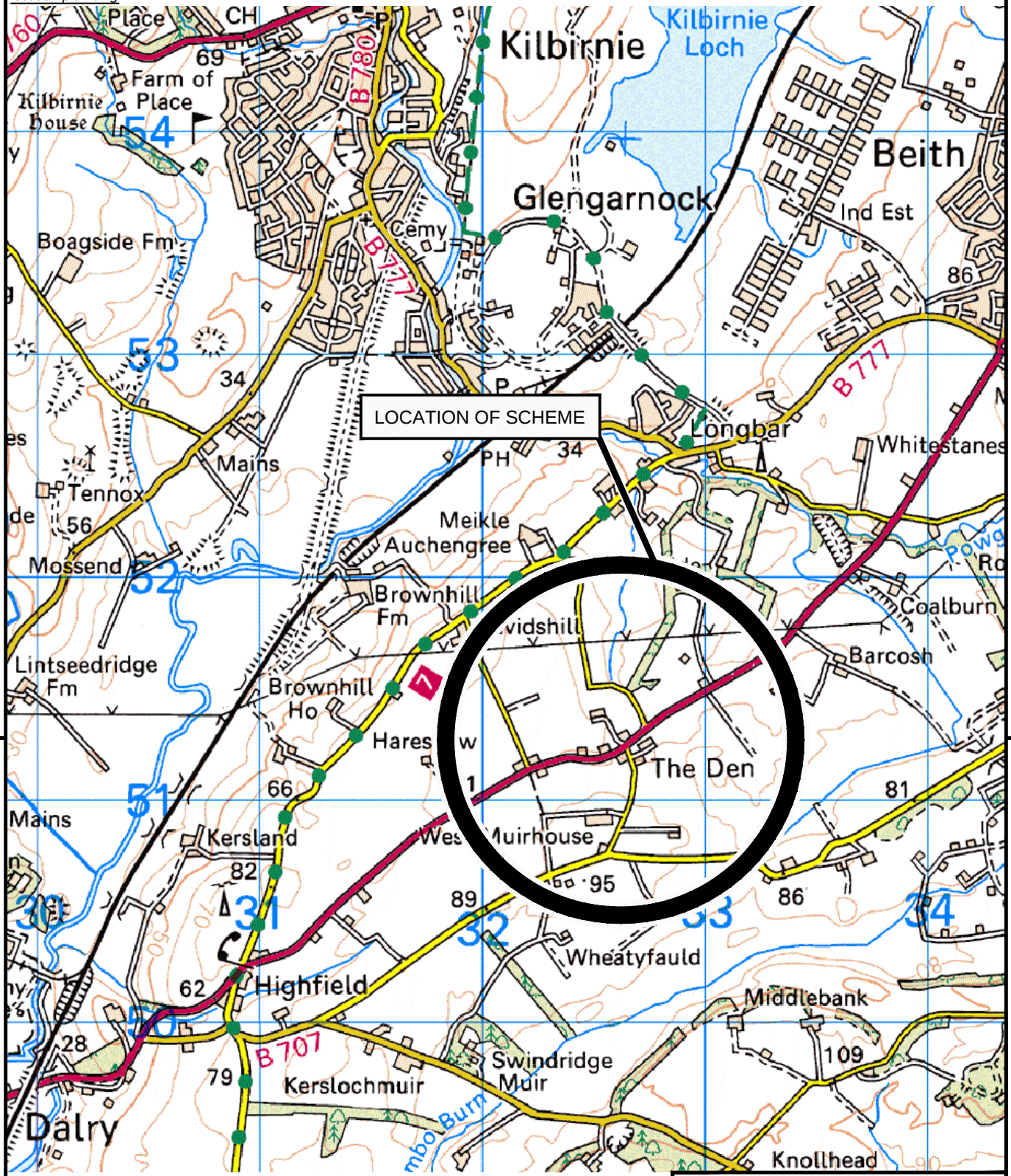
Manufacturers manual shall be consulted when the calibrator is used with free field microphones which are normally supplied with sound level meters.

This instrument was calibrated by: Lene Petersen.

End

0 100

File ref - p:\#shared\t - minor improvements\t04 - a737\2010-2011\a737 the den\003 design\002 drawings\work area\1 live drawings\10_sw_0901_037_101 - location plan.dwg



Rev	Revision details	Chkd	Appd	Date

Drawn: QL	
Design: QL	
Chkd: IH	
Appd: IH	
Date: 16/09/2011	

Preliminary	✓
For comment	
For tender	
For construction	
As constructed	
Other	

Project Name

A737 TRUNK ROAD
THE DEN,DALRY

Drawing Title

Location Plan

Original Drg Size : A4	Dimensions : -
Scale : 1 in 20,000	Copyright © Amey

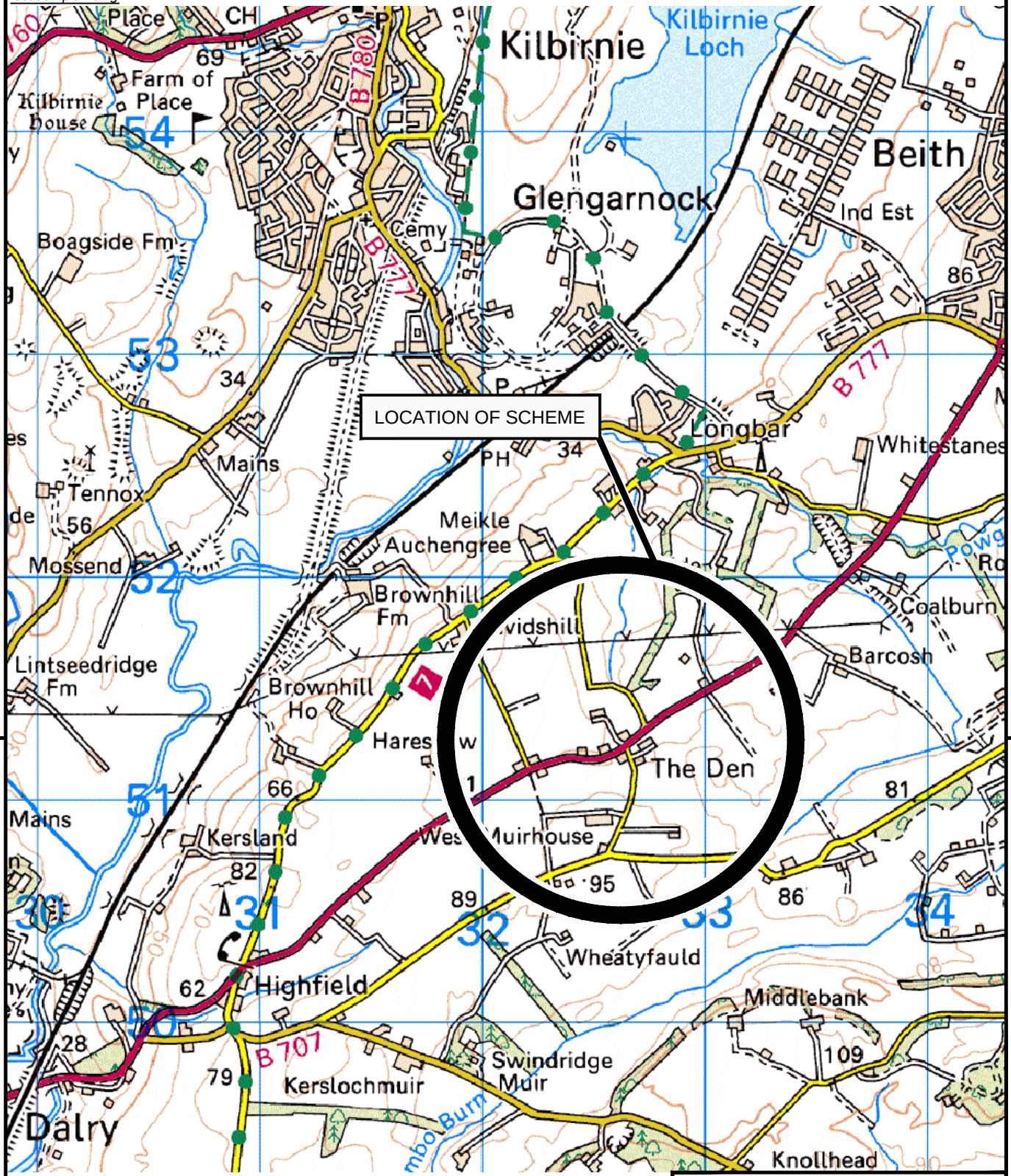
Client

TRANSPORT SCOTLAND

Drawing No	Rev
10/SW/0901/037/101	P0

0 100

File ref - p:\#shared\t - minor improvements\t04 - a737\2010-2011\a737 the den\003 design\002 drawings\work area\1 live drawings\10_sw_0901_037_101 - location plan.dwg



Rev	Revision details	Chkd	Appd	Date

Drawn: QL	
Design: QL	
Chkd: IH	
Appd: IH	
Date: 16/09/2011	

Preliminary	✓
For comment	
For tender	
For construction	
As constructed	
Other	

Project Name

A737 TRUNK ROAD
THE DEN,DALRY

Drawing Title

Location Plan

Original Drg Size : A4	Dimensions : -
Scale : 1 in 20,000	Copyright © Amey

Client

TRANSPORT SCOTLAND

Drawing No	Rev
10/SW/0901/037/101	P0

1.1 INTRODUCTION

1.1.1 The purpose of this report is to present the results of noise survey measurements undertaken at The Den to inform the environmental impact assessment.

1.2 GLOSSARY

Table 1 Glossary of terms

Term	Definition
"A" weighting	Abbreviated dBA, or dBA, or dB(A) - an expression of the relative loudness of sounds in air as perceived by the human ear. In the A-weighted system, the decibel values of sounds at low frequencies are reduced compared with unweighted decibels, in which no correction is made for audio frequency. This correction is made because the human ear is less sensitive at low audio frequencies, especially below 1000 Hz, than at high audio frequencies.
Decibel (dB) :	The decibel (dB) is a logarithmic unit of measurement that expresses the magnitude of a physical quantity (usually power or intensity) relative to a specified or implied reference level. Its logarithmic nature allows very large or very small ratios to be represented by a convenient number, in a similar manner to scientific notation. Since it expresses a ratio of two (same unit) quantities, it is a dimensionless unit. The decibel is useful for a wide variety of measurements in science and engineering (e.g. acoustics and electronics) and other disciplines because it linearizes a physical value – e.g. light intensity or level of noise – in which exponential changes of magnitude are perceived by humans as being more or less linearly related (in other words, a doubling of actual intensity causes perceived intensity to always increase by roughly the same amount, irrespective of the original intensity level).
F(fast) time weighting	Averaging time used in sound level meters
L_{Aeq}, T Equivalent Continuous A-weighted sound pressure level	The value of the A-weighted sound pressure level in decibels of continuous steady sound that within a specified time interval, T, has the same mean-square sound pressure as a sound that varies with time.
L_{AF90}	Sound pressure levels exceeded for 90% of the measurement period
L_{AF10}	Sound pressure levels exceeded for 10% of the measurement period
Frequency (of sound):	Sound is a wave associated with the transmission of mechanical energy through a supporting medium. It can be shown experimentally that sound cannot travel through a vacuum. The energy available in a sound wave disturbs the medium in a periodic manner. Periodicity is important if a sound wave is to carry information. In air, the disturbance propagates as the successive compression and decompression (the latter

Term	Definition
	sometimes called rarefaction) of small regions in the medium. If we generate a pure note and place a detector (our ear, for example) at a point in the surrounding medium, a distance from the source, the number of compression-decompression sequences arriving at the detector during a unit time interval is called the frequency. The time interval between successive maximal compressions is called the period. The product of the frequency and the wavelength is the velocity
Frequency	Frequency is a measure of the number of occurrences of a repeating event per unit time. It is also referred to as temporal frequency.
Noise	An unwanted or undesired sound by the recipient
PNS	Predominate Noise Source
SLM	Sound Level Meter

1.3 SITE DESCRIPTION

Site Location

1.3.1 The A737 is an important trunk road which provides the main link between the towns Kilbirnie, Dalry, Kilwinning, Ardrossan, Saltcoats, Stevenston, West Kilbride, and Largs within North Ayrshire, to central Scotland. The proposed scheme is located on the A737 at The Den; approximately 3km east of Dalry (see Drawing 10/SW/0901/037/101 Location Plan).

1.3.2 The scheme lies within a rural area with farmland to the north and south. There are three side road junctions within the scheme extents; however these are not heavily trafficked with the majority of traffic travelling on the A737. There are a number of private accesses within the scheme.

Measurement Locations

1.3.3 Measurement locations are illustrated within Drawing 10/SW/0901/037/203 and summarised below.

Measurement Location 1 – No. 25 The Den

1.3.4 The sound level meter (SLM) was positioned in line with the front façade of No. 25, The Den approximately 150m from the nearside carriageway edge of the existing road, and 65m from the proposed. This measurement was undertaken during night-time hours.

Measurement Location 2 – No. 29 The Den

1.3.5 The SLM was positioned in line with the front façade of No. 29 The Den approximately 19m from the nearside carriageway edge of the existing road.

Measurement Location 3 – No. 29 The Den

1.3.6 The SLM was positioned in line with the rear façade of No.29 The Den approximately 40m from the nearside carriageway edge of the proposed road.

Measurement Location 4 – No 1 The Den

1.3.7 The SLM was positioned in line with the front façade of the dwelling house, approximately 24m from the nearside carriage way edge of the existing road.

1.4 METHODOLOGY

Relevant Standards

1.4.1 Baseline conditions were determined in accordance with Calculation of Road Traffic Noise (CRTN - ISBN 0 11 550847 3) issued by the Department of Transport, Welsh office in 1988.

1.5 MEASUREMENT PROCEDURE

Instrumentation

1.5.1 The following equipment was used during the noise survey:

- Brüel & Kjaer Type 2250 Sound Level Meter (Serial No. 2717775)
- Brüel & Kjaer Type 4189 Microphone (Serial No. 2710690)
- Brüel & Kjaer Type 4231 Acoustic Calibrator (Serial No. 2714830)
- Richard Paul Russell Ltd., Kestrel Wind Speed Meter (Serial No. 1621547).

1.5.2 The battery power level was regularly monitored throughout the measurement period.

1.5.3 The sound level meter was mounted on a tripod to minimise operator interference, to ease meter reading and level recording. The sound level meter was set at approximately 1.2m in height from the ground with the microphone pointing in the direction of the existing road in free-field conditions.

1.5.4 As the scheme lies within a rural area with farmland to the north and south, the A737 is considered to be the main source of noise within the study area. A wind shield was fitted to minimise the effects of wind-induced noise.

Calibration

1.5.5 The sound level meter was calibrated in accordance with the manufacturer's instructions before and after all series of measurements. Copies of valid accredited calibration certificates are enclosed within Appendix 1.

Meteorological Conditions

1.5.6 A number of site visits were made during the winter period to carry out noise measurements during both daytime and night time periods. Due to poor weather conditions (such as wind speed, gusting winds, rain), and/or the road surface not being dry (resulting in higher road surface noise levels), the conditions found on site did not comply fully with the requirements of CRTN meteorological conditions for the entire measurement period. This is a limitation of the survey.

1.5.7 During the winter, it is extremely difficult to obtain accurate environmental noise readings due to the weather constraints.

Measurement Period

1.5.8 No unusual acoustic events occurred during measurements, and the data is considered to provide a fair representation of the acoustic environment at each measurement location.

Recommendations/Findings

1.5.9 Due to the limitations identified (paragraphs 1.5.6 and 1.5.7) it is recommended that additional Short Term (3 consecutive 1 hour readings) or Long Term (18 consecutive 1 hour readings) Noise measurement should be carried out. The additional measurements should be undertaken in accordance with weather conditions stated within the CRTN guidance (i.e. dry, calm conditions, wind speed less than $5ms^{-1}$ etc.) to verify the current measurements, so as in the event of a Public Local Inquiry (PLI) they will stand up against any possible external examination.

1.6 RESULTS

Table 2 Measured Sound Levels

Date	Start Time	Stop Time	Elapsed Time	L_{Aeq} (dB)	L_{AF90} (dB)	L_{AF10} (dB)
	Measurement Location 1 No. 25 The Den (Front)					
15/09/2011	23:20	00:20	1:00	43.21	31.04	44.92
16/09/2011	00:25	01:25	1:00	39.41	28.57	40.96
	Measurement Location 2 No. 29 The Den (Front)					
02/11/2011	14:00	17:00	3:00	66.7	48.7	71.49
	Measurement Location 3 No.29 The Den (Rear)					
01/12/2011	15:35	15:50	00:15	50.38	41.57	53.74
01/12/2011	16:38	16:53	00:15	54.22	49.86	56.49
	Measurement Location 4 No. 1 The Den (Front)					
15/12/2011	10:45	11:00	00:15	61.5	47.37	66.07
15/12/2011	11:01	11:16	00:15	61.6	45.4	66.33

APPENDIX F2

PREDICTED NOISE LEVELS

Predicted Noise Levels for Sensitive receptors in the Study Area

Receptor	Do-Minimum 2012 (dBA)	Do-Minimum 2027 (dBA)	Do - Something 2012 (dBA)	Do - Something 2027 (dBA)
No 1 The Den - front	67.7	68.3	61.8	62.3
No 1 The Den - rear	55.7	56.2	66.9	67.5
No 17/19 The Den - south	74.8	75.4	44.2	44.8
No 17/19 The Den - north	60.9	61.4	56.0	56.6
No 18/20 The Den	73.9	74.5	55.4	55.9
No 22 The Den	60.5	61.1	55.2	55.7
No 24 The Den	59.9	60.4	54.8	55.4
No 25a The Den	52.4	52.9	56.8	57.4
No 25 The Den - east	54.0	54.6	59.0	59.5
No 25 The Den - west	49.8	50.3	54.0	54.5
Receiver_25_south	54.8	55.3	60.0	60.6
No 27 The Den - rear	54.1	54.7	63.4	63.9
No 27 The Den - front	65.9	66.4	54.2	54.7
No 29 The Den - front	69.5	70.1	57.2	57.8
No 29 The Den - rear	56.7	57.2	62.4	63.0
Dungoyle	64.2	64.7	59.7	60.3
Nidaros	63.4	64.0	57.5	58.1
Maulside1	47.2	47.7	47.4	47.9
Maulside2	48.2	48.8	48.5	49.0
Fernside	74.6	75.2	74.6	75.1
West Muirhouse - east	48.6	49.2	48.6	49.1
West Muirhouse - north	52.0	52.5	51.7	52.3
East Muirhouse	46.3	46.9	46.5	47.0
Barkip-north	44.7	45.3	45.0	45.5
Barkip-east	41.9	42.5	42.2	42.7
Park Cottage -north	44.0	44.5	44.3	44.9
Park Cottage - west	43.1	43.7	43.3	43.8
Hareshaw	48.9	49.4	49.0	49.6
Glenshaft	45.1	45.7	45.3	45.9
Highden	43.3	43.9	43.6	44.2
Maulside Lodge - Front	61.5	62.1	62.0	62.5
Maulside Lodge - rear	63.1	63.6	63.0	63.5
The Graze	67.4	67.9	66.8	67.4

Predicted Noise Levels for Sensitive receptors in the Study Area

Receptor	Do-Minimum 2014 (dBA)	Do-Minimum 2029 (dBA)	Do - Something 2014 (dBA)	Do - Something 2029 (dBA)
No 1 The Den - front	62.6	63.0	60.2	60.3
No 1 The Den - rear	50.6	50.9	65.1	65.4
No 17/19 The Den - south	69.8	70.1	42.7	42.8
No 17/19 The Den - north	55.8	56.1	54.8	54.7
No 18/20 The Den	68.9	69.2	54.0	53.9
No 22 The Den	55.5	55.8	53.8	53.8
No 24 The Den	54.8	55.1	53.6	53.5
No 25a The Den	47.3	47.6	55.0	55.3
No 25 The Den - east	49.0	49.3	52.2	57.5
No 25 The Den - west	44.7	45.0	57.3	52.4
No 25 The Den - south	49.7	50.0	58.4	58.6
No 27 The Den - rear	60.8	49.3	61.5	61.8
No 27 The Den - front	49.0	61.1	52.7	52.7
No 29 The Den - front	64.4	64.7	56.1	55.9
No 29 The Den - rear	51.6	51.9	60.6	60.9
Dungoyle	59.1	59.4	58.2	58.3
Nidaros	58.4	58.7	55.8	56.0
Maulside1	42.1	42.4	47.0	46.3
Maulside2	43.2	43.5	48.0	47.4
Fernside	69.5	69.9	72.8	73.0
West Muirhouse - east	43.6	43.9	47.7	47.3
West Muirhouse - north	46.9	47.2	50.7	50.4
East Muirhouse	41.2	41.6	45.6	45.3
Barkip-north	39.7	40.0	44.2	43.8
Barkip-east	36.8	37.1	41.4	41.0
Park Cottage -north	38.9	39.2	43.7	43.2
Park Cottage - west	38.0	38.4	42.9	42.2
Hareshaw	43.8	44.1	48.9	48.0
Glenshaft	40.0	40.3	44.8	44.2
Highden	38.2	38.5	43.1	42.5
Maulside Lodge - Front	56.4	56.7	62.0	61.1
Maulside Lodge - rear	58.0	58.3	62.8	62.0
The Graze	62.3	62.6	66.5	65.8