NORTH

North Wood

BRUCEFIELD PARK EAST

MCADAM SQUARE

MP 0.25

MP 0.0

Tanks

Drain

Issues

Track

MURIESTON ROAD

Gas Governor

MURIESTON VALLEY

BERYE DRIVE

ST Sub Sta

Malvern House

Sandygate House

Sandygate Cottage

ALBYN DRIVE

171.0m

172.4m

177.7m

173.7m

182.6m

170.7m

168.3m

Camp Bridge

Campbridge Park

Pond

Path

Walkway

Westfield

OPEN SPACE

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ema
ARCHITECTURE + DESIGN

BDW TRADING LIMITED
LAND AT MURIESTON CASTLE FARM,
MURIESTON, LIVINGSTON

SITE LOCATION PLAN

SCALE	1:2500 @ A3	DO NOT SCALE FROM THIS DRAWING
DATE	22.04.15	THIS DRAWING IS COPYRIGHT ©
DRAWN BY	KGR	ANY DISCREPANCIES TO BE REPORTED TO EMA

14020 (OS) 001

STATUS | FILE REF:

CHARTERED ARCHITECTS
The Stables, 38 Baileyfield Road,
EDINBURGH EH15 1NA
T: 0131 468 6595
F: 0131 468 6596
E: info@ema-architects.co.uk

West Lothian Council

County Building High Street Linlithgow EH49 7EZ

Tel: 01506 282456

Fax: 01506 282449

Email: planning@westlothian.gov.uk

Applications cannot be validated until all necessary documentation has been submitted and the required fee has been paid.

Thank you for completing this application form:

ONLINE REFERENCE 000116878-001

The online ref number is the unique reference for your online form only. The Planning Authority will allocate an Application Number when your form is validated. Please quote this reference if you need to contact the Planning Authority about this application.

Type of Application

What is this application for? Please select one of the following: *

We strongly recommend that you refer to the help text before you complete this section.

- ☐ Application for Planning Permission (including changes of use and surface mineral working)
- ☑ Application for Planning Permission in Principle
- ☐ Further Application, (including renewal of planning permission, modification, variation or removal of a planning condition etc)
- ☐ Application for Approval of Matters specified in conditions

Description of Proposal

Please describe the proposal including any change of use: * (Max 500 characters)

Planning permission in principle for residential development with associated landscaping, roads and footpaths.

Is this a temporary permission? * ☐ Yes ☑ No

If a change of use is to be included in the proposal has it already taken place? (Answer 'No' if there is no change of use.) * ☐ Yes ☑ No

Have the works already been started or completed? *

☑ No ☐ Yes - Started ☐ Yes - Completed

Applicant or Agent Details

Are you an applicant, or an agent? * (An agent is an architect, consultant or someone else acting on behalf of the applicant in connection with this application) ☐ Applicant ☑ Agent

Agent Details

Please enter Agent details

Company/Organisation:	Clarendon Planning & Development Ltd
Ref. Number:	
First Name: *	Antony
Last Name: *	Duthie
Telephone Number: *	[redacted]
Extension Number:	
Mobile Number:	
Fax Number:	
Email Address: *	[redacted]

You must enter a Building Name or Number, or both:*

Building Name:	Exchange Place 2
Building Number:	5
Address 1 (Street): *	Semple Street
Address 2:	
Town/City: *	Edinburgh
Country: *	UK
Postcode: *	EH3 8BL

Is the applicant an individual or an organisation/corporate entity? *

☐ Individual ☑ Organisation/Corporate entity

Applicant Details

Please enter Applicant details

Title:	
Other Title:	
First Name:	
Last Name:	
Company/Organisation: *	BDW Trading Ltd & H & J Russell
Telephone Number:	
Extension Number:	
Mobile Number:	
Fax Number:	
Email Address:	

You must enter a Building Name or Number, or both:*

Building Name:	Care of agent
Building Number:	5
Address 1 (Street): *	Semple Street
Address 2:	Exchange Place 2
Town/City: *	Edinburgh
Country: *	UK
Postcode: *	EH3 8BL

Site Address Details

Planning Authority: West Lothian Council

Full postal address of the site (including postcode where available):

Address 1:		Address 5:	
Address 2:		Town/City/Settlement:	
Address 3:		Post Code:	
Address 4:			

Please identify/describe the location of the site or sites.

Northing	664214	Easting	304719

Pre-Application Discussion

Have you discussed your proposal with the planning authority? * ☑ Yes ☐ No

Pre-Application Discussion Details

In what format was the feedback given? *

☑ Meeting ☐ Telephone ☐ Letter ☐ Email

Please provide a description of the feedback you were given and the name of the officer who provided this feedback. If a processing agreement [note 1] is currently in place or if you are currently discussing a processing agreement with the planning authority, please provide details of this. (This will help the authority to deal with this application more efficiently.) * (Max 500 characters)

As per cover letter dated 22nd April 2015.

Title:	Please Select One	Other title:	
First Name:		Last Name:	
Correspondence Reference Number:		Date (dd/mm/yyyy):	

Note 1. A processing agreement involves setting out the key stages involved in determining a planning application, identifying what information is required and from whom and setting timescales for the delivery of various stages of the process.

Site Area

Please state the site area: 14.50

Please state the measurement type used: ☑ Hectares (ha) ☐ Square Metres (sq.m)

Existing Use

Please describe the current or most recent use: (Max 500 characters)

Agriculture

Access and Parking

Are you proposing a new or altered vehicle access to or from a public road? * ☑ Yes ☐ No

If Yes please describe and show on your drawings the position of any existing, altered or new access points, highlighting the changes you propose to make. You should also show existing footpaths and note if there will be any impact on these.

Are you proposing any changes to public paths, public rights of way or affecting any public rights of access? * ☐ Yes ☑ No

If Yes please show on your drawings the position of any affected areas highlighting the changes you propose to make, including arrangements for continuing or alternative public access.

Water Supply and Drainage Arrangements

Will your proposal require new or altered water supply or drainage arrangements? * ☑ Yes ☐ No

Are you proposing to connect to the public drainage network (eg. to an existing sewer)? *

- ☑ Yes – connecting to public drainage network
- ☐ No – proposing to make private drainage arrangements
- ☐ Not Applicable – only arrangements for water supply required

Do your proposals make provision for sustainable drainage of surface water? (e.g. SUDS arrangements) * ☑ Yes ☐ No

Note: -

Please include details of SUDS arrangements on your plans

Selecting 'No' to the above question means that you could be in breach of Environmental legislation.

Are you proposing to connect to the public water supply network? *

- ☑ Yes
- ☐ No, using a private water supply
- ☐ No connection required

If No, using a private water supply, please show on plans the supply and all works needed to provide it (on or off site).

Assessment of Flood Risk

Is the site within an area of known risk of flooding? * ☐ Yes ☑ No ☐ Don't Know

If the site is within an area of known risk of flooding you may need to submit a Flood Risk Assessment before your application can be determined. You may wish to contact your Planning Authority or SEPA for advice on what information may be required.

Do you think your proposal may increase the flood risk elsewhere? * ☐ Yes ☑ No ☐ Don't Know

Trees

Are there any trees on or adjacent to the application site? * ☑ Yes ☐ No

If Yes, please mark on your drawings any trees, known protected trees and their canopy spread close to the proposal site and indicate if any are to be cut back or felled.

All Types of Non Housing Development - Proposed New Floorspace

Does your proposal alter or create non-residential floorspace? * ☐ Yes ☑ No

Schedule 3 Development

Does the proposal involve a form of development listed in Schedule 3 of the Town and Country Planning (Development Management Procedure (Scotland) Regulations 2013 * ☐ Yes ☑ No ☐ Don't Know

If yes, your proposal will additionally have to be advertised in a newspaper circulating in the area of the development. Your planning authority will do this on your behalf but will charge you a fee. Please check the planning authority's website for advice on the additional fee and add this to your planning fee.

If you are unsure whether your proposal involves a form of development listed in Schedule 3, please check the Help Text and Guidance notes before contacting your planning authority.

Planning Service Employee/Elected Member Interest

Is the applicant, or the applicant's spouse/partner, either a member of staff within the planning service or an elected member of the planning authority? * ☐ Yes ☑ No

Certificates and Notices

CERTIFICATE AND NOTICE UNDER REGULATION 15 – TOWN AND COUNTRY PLANNING (DEVELOPMENT MANAGEMENT PROCEDURE) (SCOTLAND) REGULATIONS 2013

One Certificate must be completed and submitted along with this application form. This is most usually Certificate A, Form 1, Certificate B, Certificate C or Certificate E.

Are you/the applicant the sole owner of ALL the land ? * ☑ Yes ☐ No

Is any of the land part of an agricultural holding? * ☐ Yes ☑ No

Certificate Required

The following Land Ownership Certificate is required to complete this section of the proposal:

Certificate A

Land Ownership Certificate

Certificate and Notice under Regulation 15 of the Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013

Certificate A

I hereby certify that –

(1) - No person other than myself/the applicant was an owner (Any person who, in respect of any part of the land, is the owner or is the lessee under a lease thereof of which not less than 7 years remain unexpired.) of any part of the land to which the application relates at the beginning of the period of 21 days ending with the date of the accompanying application.

(2) - None of the land to which the application relates constitutes or forms part of an agricultural holding.

Signed: Antony Duthie

On behalf of: BDW Trading Ltd & H & J Russell

Date: 22/04/2015

☑ Please tick here to certify this Certificate. *

Checklist - Application for Planning Permission

Town and County Planning (Scotland) Act 1997

The Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013

Please take a few moments to complete the following checklist in order to ensure that you have provided all the necessary information in support of your application. Failure to submit sufficient information with your application may result in your application being deemed invalid. The planning authority will not start processing your application until it is valid.

a) If this is a further application where there is a variation of conditions attached to a previous consent, have you provided a statement to that effect? *

☐ Yes ☐ No ☑ Not applicable to this application

b) If this is an application for planning permission or planning permission in principal where there is a crown interest in the land, have you provided a statement to that effect? *

☐ Yes ☐ No ☑ Not applicable to this application

c) If this is an application for planning permission, planning permission in principle or a further application and the application is for development belonging to the categories of national or major developments (other than one under Section 42 of the planning Act), have you provided a Pre-Application Consultation Report? *

☑ Yes ☐ No ☐ Not applicable to this application

Town and County Planning (Scotland) Act 1997

The Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013

d) If this is an application for planning permission and the application relates to development belonging to the categories of national or major developments and you do not benefit from exemption under Regulation 13 of The Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013, have you provided a Design and Access Statement? *

☑ Yes ☐ No ☐ Not applicable to this application

e) If this is an application for planning permission and relates to development belonging to the category of local developments (subject to regulation 13. (2) and (3) of the Development Management Procedure (Scotland) Regulations 2013) have you provided a Design Statement? *

☐ Yes ☐ No ☑ Not applicable to this application

f) If your application relates to installation of an antenna to be employed in an electronic communication network, have you provided an ICNIRP Declaration? *

☐ Yes ☐ No ☑ Not applicable to this application

g) If this is an application for planning permission, planning permission in principle, an application for approval of matters specified in conditions or an application for mineral development, have you provided any other plans or drawings as necessary:

☑ Site Layout Plan or Block plan.

☐ Elevations.

☐ Floor plans.

☐ Cross sections.

☐ Roof plan.

☑ Master Plan/Framework Plan.

☑ Landscape plan.

☑ Photographs and/or photomontages.

☐ Other.

Provide copies of the following documents if applicable:

A copy of an Environmental Statement. *	☐ Yes	☑ N/A
A Design Statement or Design and Access Statement. *	☑ Yes	☐ N/A
A Flood Risk Assessment. *	☑ Yes	☐ N/A
A Drainage Impact Assessment (including proposals for Sustainable Drainage Systems). *	☐ Yes	☑ N/A
Drainage/SUDS layout. *	☐ Yes	☑ N/A
A Transport Assessment or Travel Plan. *	☑ Yes	☐ N/A
Contaminated Land Assessment. *	☑ Yes	☐ N/A
Habitat Survey. *	☑ Yes	☐ N/A
A Processing Agreement *	☐ Yes	☑ N/A

Other Statements (please specify). (Max 500 characters)

Planning Statement, Housing Land Assessment, Education Capacity Appraisal, PAC Report, LVIA, Archaeological Assessment, Tree Survey, Noise Assessment.

Declare - For Application to Planning Authority

I, the applicant/agent certify that this is an application to the planning authority as described in this form. The accompanying plans/drawings and additional information are provided as a part of this application .

Declaration Name:	Antony Duthie
Declaration Date:	22/04/2015
Submission Date:	22/04/2015

Payment Details

Cheque: Barratt Homes Ltd , 017490

Created: 22/04/2015 13:23

CHARLIE FLEMING ASSOCIATES
ACOUSTICAL CONSULTANTS
NOISE CONTROL ENGINEERS

Report on Railway and Industrial Noise

For

BDW Trading / H & J Russell

At

Murieston Road, Murieston, Livingston

CHARLIE FLEMING ASSOCIATES LIMITED

Eur Ing Charlie Fleming BSc MSc CEng FIOA MCIBSE MIET

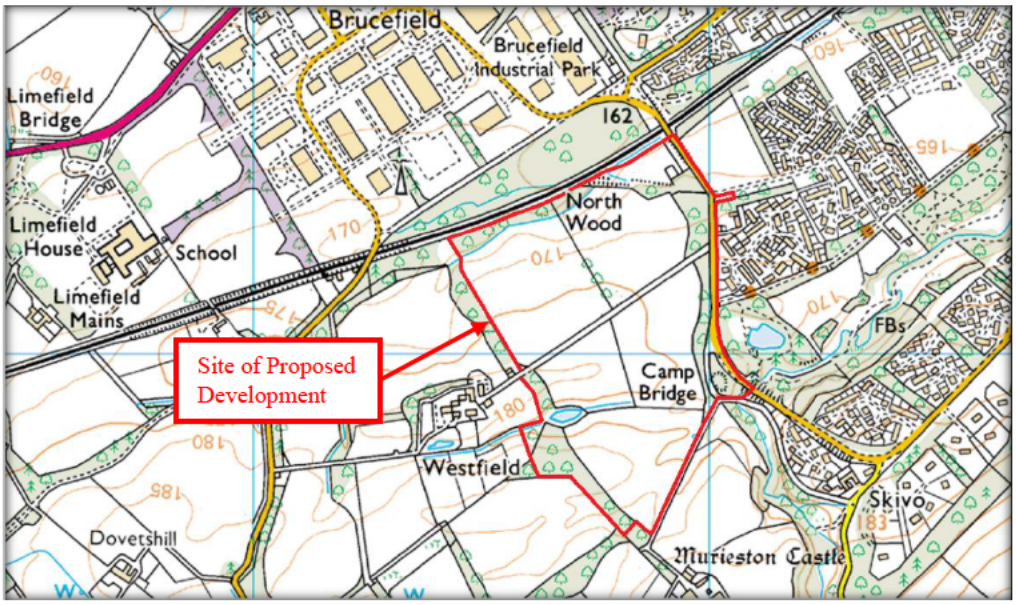
Table of Contents **Page No.**

1.0 Introduction

1.1 BDW Trading / H & J Russell propose to apply for planning permission to construct houses on land off Murieston Road, in Livingston. To the north-west of the land are railway lines. Beyond them, approximately 260m to the north-west of the land lies the nearest building in Brucefield Industrial Park. The boundary around the land is shown in red below on Figure 1(a), which is reproduced with the permission of Ordnance Survey. It is also shown overleaf on Figure 1(b), which is reproduced from a drawing titled *Location plan*, by Clarendon Planning and Development.

Figure 1(a)

Site of Land Proposed for Development
(Courtesy of Ordnance Survey)

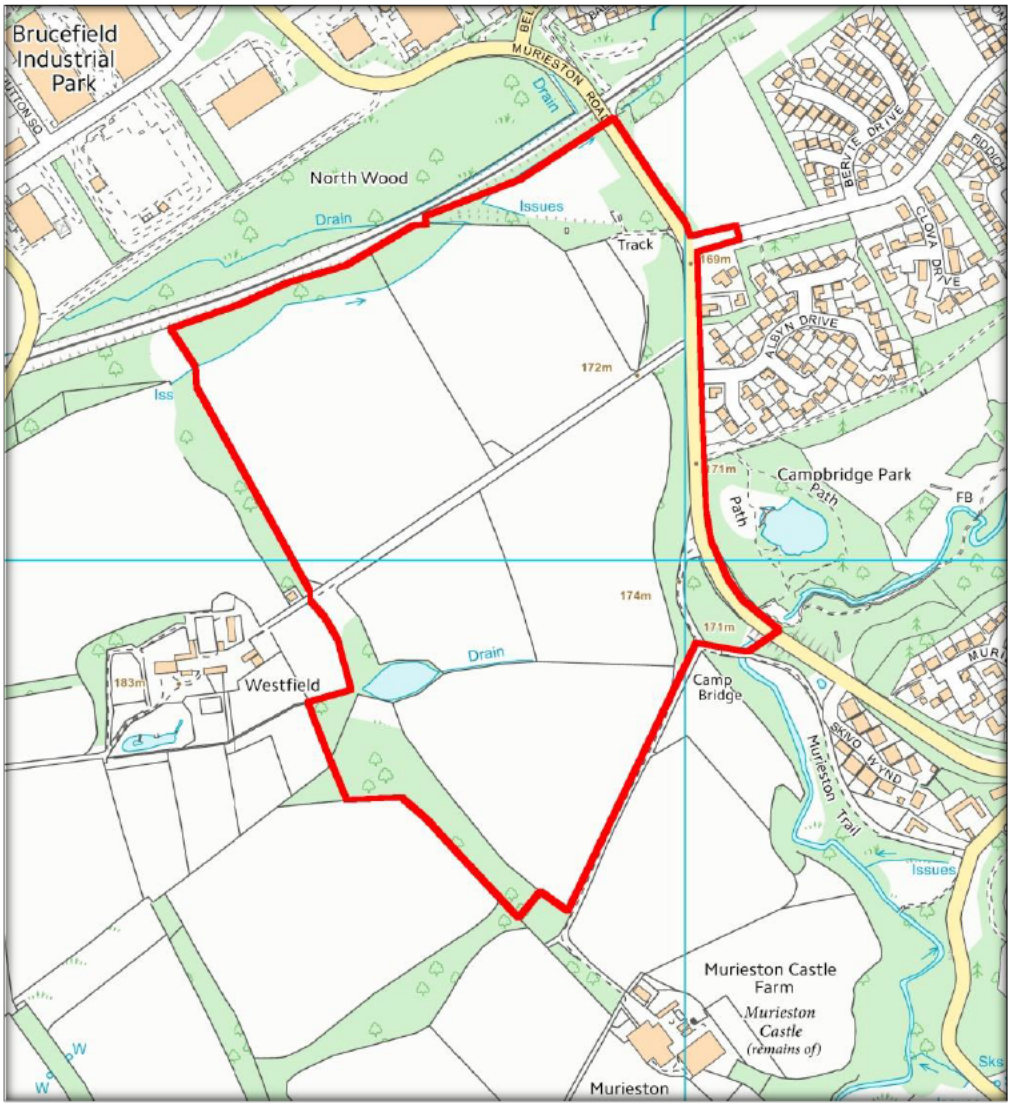


1.2 The concern was raised at the planning stage, by officers of West Lothian Council, that noise from the railway and industrial estate might disturb the residents of the new houses. Charlie Fleming Associates was asked by Mr Ross Manson, of Clarendon Planning and Development, acting as an agent of BDW Trading / H & J Russell, to quantify the levels of railway and industrial noise on the proposed development site, and determine whether they would be acceptable.

1.3 Railway noise, affecting the site of proposed residential development in West Lothian, is usually assessed in accordance with its own publication *supplementary planning guidance, Planning and noise*[1]. In turn, this refers to *Planning Advice Note 56 Planning and Noise*[2], (PAN 56), by the Scottish Executive. This document was replaced in 2011 by The Scottish Government publication titled *Planning Advice Note 1/2011: Planning and Noise*[3] (PAN1/2011). This, in turn, refers to *Technical Advice Note 2011: Assessment of Noise*[4] (TAN 2011) for technical guidance on noise assessment, also published by the Government.

Figure 1(b)

Site of Land Proposed for Development
(Courtesy of Clarendon Planning and Development)



1.4 TAN 2011 states that railway noise be considered over two periods, daytime from 07.00hrs to 23.00hrs, and night-time from 23.00hrs to 07.00hrs. The noise levels over these periods determine the *Magnitude of Impact* that the noise of the trains will have on the residents of the proposed development. In turn, this determines the *Level of Significance*, according to which it may, or may not, be necessary to reduce the noise.

1.5 It is extremely rare for a full 24-hour noise survey to be carried out. It is usual to measure the noise over 3 or 4 hours, calculate the average noise of the trains passing the site, and evaluate the total noise over the longer periods using information obtained from train timetables. This procedure is described in the Department of Transport document titled *Calculation of Railway Noise*[5]. This measurement

technique has been used many times before in West Lothian, the results it produces accepted by the council's officers and so it has been used in this case.

1.6 As mentioned in Section 1.3, noise affecting the site of proposed residential development in West Lothian is usually assessed in accordance with its own publication *supplementary planning guidance, Planning and noise*[1]. This, and the other documents referred to[2&3] do not offer definitive guidance on industrial noise, as its nature varies according to the source. What Charlie Fleming Associates usually does is measure the noise on the proposed development site. The results of the measurements are then used to calculate the levels likely in the houses, which are then compared to limits given in TAN 2011.

TAN2011[4] suggests that noise outside dwellings should not exceed 55dB $L_{Aeq, 16h}$, and that within dwellings it should not exceed 35dB $L_{Aeq, 16h}$. These limits apply to general environmental noise. TAN 2011 states that the nature of the noise should be taken into account, but does not advise on how to do this. British Standard 4142:1997 *Method for Rating industrial noise affecting mixed residential and industrial areas*[6] applies a 5dB(A) penalty to the noise if its characteristics are likely to disturb people. It is thus suggested that the limits be modified to 50dB(A) and 30dB(A).

1.7 Charlie Fleming Associates thus visited the site of the proposed development to measure the noise of the trains. Section 2.0 of this report describes how the noise levels were measured and the results are presented in Section 3.0. The calculations used to determine the *Magnitude of Impact* and *Level of Significance* that the railway noise will have on the residents of the proposed houses are described in Section 4.0.

1.8 Section 5.0 of this report describes how the industrial noise levels were measured and the results are presented and discussed in Section 6.0.

1.9 Section 7.0 concludes the main text of the report. Section 8.0 lists the documents referred to in the report, and is followed by an appendix which describes basic principles of acoustics, the measurement of sound, and explains the technical terms used herein.

2.0 Railway Noise Level Measurement Procedures

2.1 Mr Craig Cloy and Mr Iain Fleming, of Charlie Fleming Associates, visited the proposed development site between 11:00hrs and 15:30hrs, on Tuesday 5th August 2014, to measure the noise of the trains.

2.2 The following electroacoustical and meteorological instrumentation was used to conduct the measurements.

Brüel & Kjær Modular Precision Sound Analyzer Type 2260
Serial No. 2554046

Brüel & Kjær Sound Analysis Software Type BZ7210 Version 2.2
Serial No. Not applicable

Brüel & Kjær Prepolarised Condenser Microphone Cartridge Type 4189
Serial No. 2643248

Brüel & Kjær Sound Level Calibrator Type 4231
Serial No. 3010113

Brüel & Kjær Windscreen Type UA0237
Serial No. Not applicable

RS Components Digital Anemometer Type RS212-578 AM-4201
Serial No. L482154

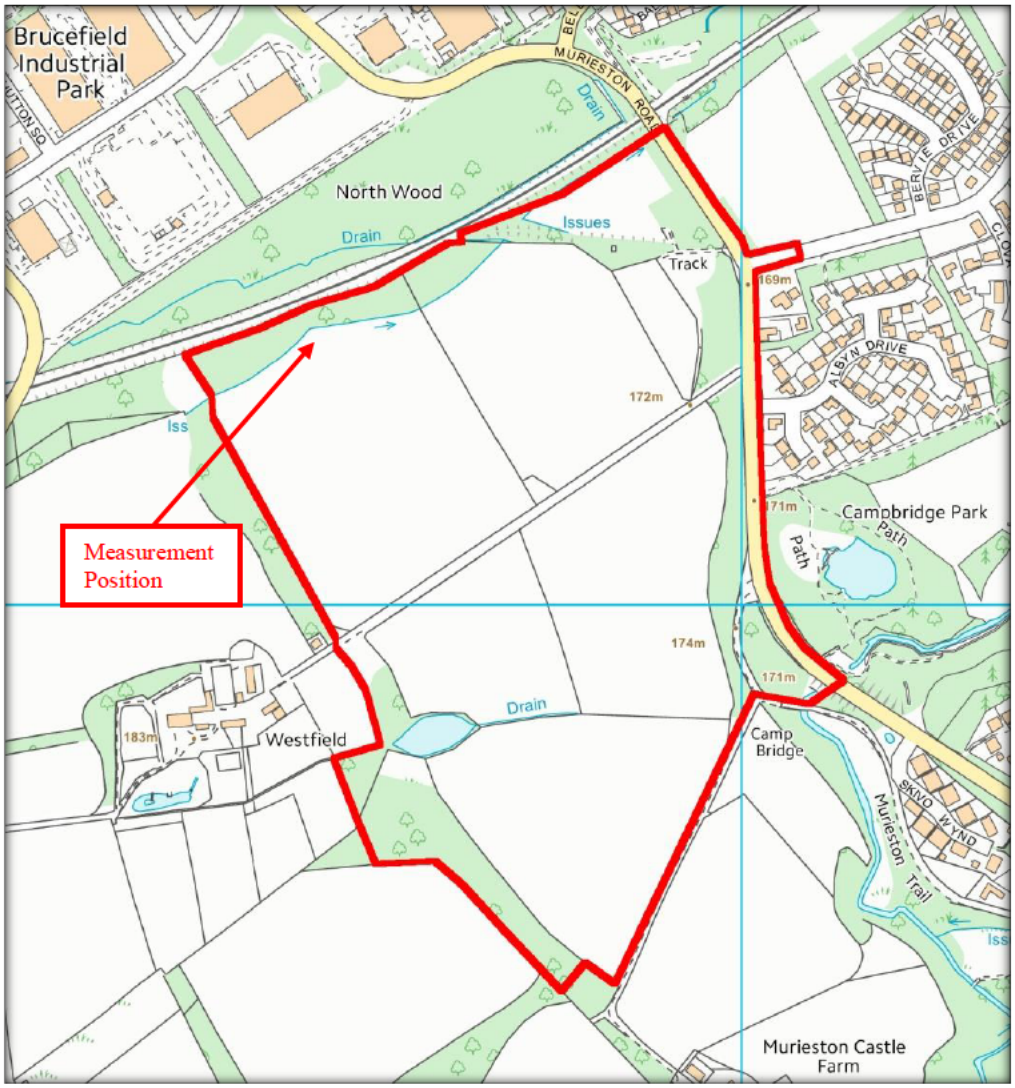
2.3 The noise levels were measured in accordance with the Department of Transport document titled *Calculation of Railway Noise 1995*[5]. This involves measurement of the A-weighted sound exposure level (L_{AE}) of each train. These can then be used to calculate the L_{Aeq} due to the trains over the day and night-time periods specified in TAN 2011. The sound level analyzer also measured the equivalent continuous sound levels, L_{Aeq}. The L_{eq}s were also measured in octave bands. All noise levels were measured in decibels referenced to 2×10^{-5} Pa.

2.4 It is usual, in an assessment like this, to measure the noise where the house which will be most exposed to it will be built. The principle in this is that, if the noise is acceptable at the most exposed house, it follows that it will also be acceptable elsewhere in the development. At the time of the visit, however, the layout of the development had not been drawn up. In situations like this, it is usually assumed that the nearest house will be 10m back from the boundary of the development site with Network Rail's land. This is because 10m is the length of a typical garden being provided with houses being built by developers in Scotland just now.

The measurement position is shown overleaf on Figure 2, which is reproduced from a drawing titled *Location plan*, provided by Clarendon Planning and Development.

Figure 2

Location of Measurement Position
(Courtesy of Clarendon Planning and Development)



2.5 In choosing the measurement position, it was assumed that the course of the burn close to the northern boundary of the development site would not be altered, as it would be impractical to move it further north, because of the railway line. This was, therefore, taken as being where the end of the gardens would be. The noise was measured 10m back from the burn.

A position at the north-eastern end of the development site was also considered, in the triangular area marked as "Issues", on Figure 2. At this position, 10m back from the northern site boundary, the noise would be greater than that measured as it is closer to the railway lines. The angle of view of the tracks, however, would be less than that from the measurement position, due to the proximity of the bridge taking Murieston Road over the railway. These effects would tend to cancel each other out, though empirical calculations suggest that the noise would be 0.5dB(A) greater at the position that was not used. It was also considered that the trains might be moving

more quickly, and thus generating more noise, on the tracks adjacent to the centre of the building line, that being further from Livingston South Station. Finally, another reason it was not used was because houses may not be built there at all, and the majority of the houses on the northern building line will be at the same distance back from the railway as the measurement position was.

In detail, the measurement position was 10m back from, and at 90º to, the burn flowing west to east close to the northern boundary of the development site. It was 111m in a south-westerly direction from the post and wire fence defining the north-eastern boundary of the field in which the measurements were conducted. The microphone of the sound level analyzer was horizontal, at a height of 1.60m above the existing ground level.

2.6 Measurements commenced as soon as the sound of a train was audible, and continued until it was inaudible. The measurement periods thus varied according to the speed, length and direction of travel of the train in question.

2.7 The sound level analyzer was calibrated at 94.0dB(A) prior to conducting the measurements. On completion of the measurement the calibration level was found to be the same.

3.0 Railway Noise Level Measurement Results

3.1 The results of the equivalent continuous, L_{Aeq}, and sound exposure, L_{AE}, noise level measurements are shown below in Table 1 and overleaf in Figure 3.

Table 1

Measured A-Weighted Train Noise Levels
(dB re 2 x 10^{-5}Pa)

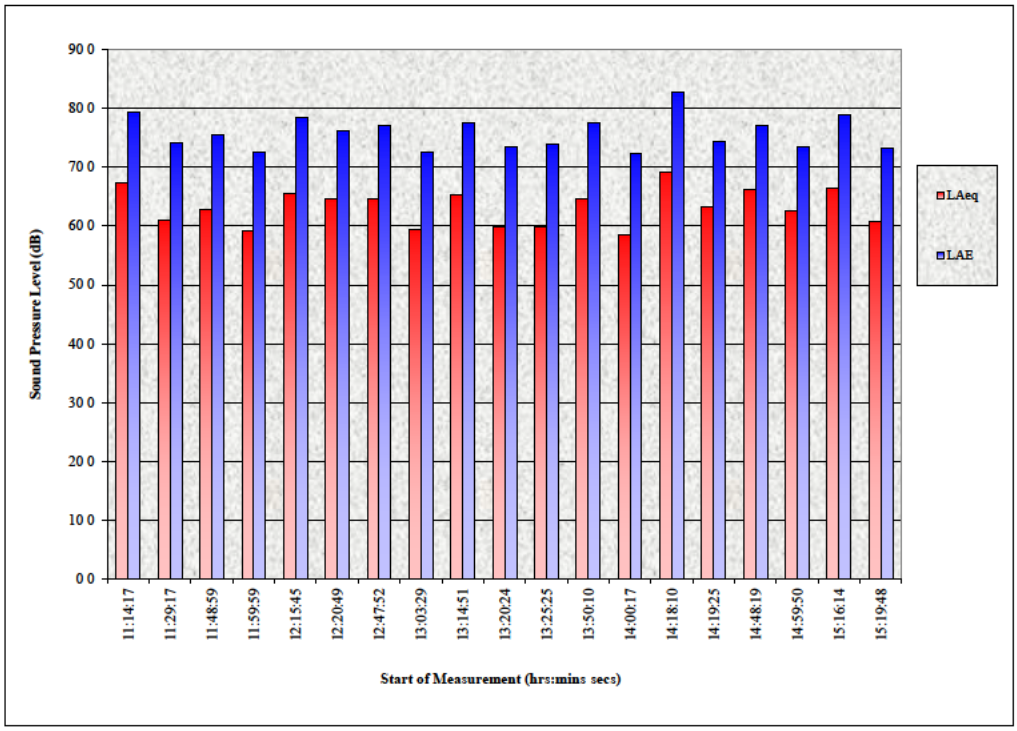
File No.	Start Time (hrs:mins:secs)	Type of Train	No. of Units	Direction of Travel	Approximate Speed (mph)	L_{Aeq} dB(A)	L_{AE} dB(A)
1	11:14:17	DMU	2	North-east	40	67.4	79.4
2	11:29:17	DMU	2	South-west	40	60.9	74.1
3	11:48:59	DMU	2	North-east	40	62.8	75.4
4	11:59:59	DMU	2	South-west	40	59.3	72.5
5	12:15:45	DMU	2	North-east	40	65.6	78.4
6	12:20:49	DMU	2	South-west	40	64.6	76.1
7	12:47:52	DMU	2	North-east	40	64.7	77.0
8	13:03:29	DMU	2	South-west	40	59.5	72.5
9	13:14:51	DMU	2	North-east	40	65.3	77.6
10	13:20:24	DMU	2	South-west	40	59.9	73.5
11	13:25:25	Freight	4	North-east	30	59.9	73.9
12	13:50:10	DMU	2	North-east	40	64.7	77.5
13	14:00:17	DMU	2	South-west	40	58.6	72.4
14	14:18:10	DMU	4	North-east	50	69.2	82.8
15	14:19:25	DMU	2	South-west	40	63.3	74.4
16	14:48:19	DMU	2	North-east	40	66.3	77.1
17	14:59:50	DMU	2	South-west	40	62.6	73.4
18	15:16:14	DMU	2	North-east	40	66.5	78.8
19	15:19:48	DMU	2	South-west	40	60.7	73.2

3.2 The majority of the trains that passed the site were passenger ones operated by First ScotRail. They were diesel multiple units, (DMUs), mostly consisting of 2 coaches. One freight train, consisting of four long wheel base coal wagons, pulled by an English Welsh & Scottish Railway class 66 locomotive passed the site.

3.3 The noise of trains is generally proportional to their length and speed. There was nothing unusual or remarkable about the results of the measurements.

Figure 3

Measured A-Weighted Train Noise Levels
(dB re 2 x 10^{-5}Pa)



3.4 The results of the octave band equivalent continuous, L_{eq}, noise level measurements are shown overleaf in Table 2.

Table 2

Measured Octave Band Train Noise Levels L_{eq}
(dB re 2 x 10^{-5}Pa)

Start Time (hrs:mins:secs)	Octave Band Centre Frequency (Hz)									A
	31.5	63	125	250	500	1000	2000	4000	8000	
11:14:17	62.5	62.0	52.4	60.8	64.6	64.9	57.9	50.2	37.8	67.4
11:29:17	64.3	68.0	66.2	51.5	55.8	57.9	53.3	46.3	38.3	60.9
11:48:59	64.7	71.1	61.7	49.0	57.7	60.4	55.4	46.7	34.9	62.8
11:59:59	63.8	72.9	61.4	48.4	54.4	55.9	51.3	44.6	34.7	59.3
12:15:45	63.1	63.6	58.3	50.9	59.4	63.9	57.3	47.8	39.5	65.6
12:20:49	63.9	67.5	68.5	53.3	58.7	62.9	55.0	47.8	37.8	64.6
12:47:52	63.5	62.6	55.5	49.0	58.2	63.1	56.3	46.2	35.9	64.7
13:03:29	63.2	67.8	67.6	53.5	57.8	54.5	51.2	44.1	34.1	59.5
13:14:51	67.8	69.5	55.2	46.2	56.8	63.9	57.1	47.7	37.7	65.3
13:20:24	61.6	75.3	61.0	49.3	55.4	56.9	50.3	44.2	38.6	59.9
13:25:25	72.8	66.8	56.6	49.0	57.3	56.5	52.0	45.0	33.1	59.9
13:50:10	62.7	63.3	58.7	48.8	58.3	63.0	57.0	46.0	34.5	64.7
14:00:17	62.7	74.2	60.9	47.3	53.0	55.3	50.1	43.9	34.7	58.6
14:18:10	68.0	71.6	65.9	52.1	59.0	67.3	62.9	50.4	37.8	69.2
14:19:25	66.7	76.4	67.7	52.7	57.8	60.2	55.8	47.6	36.9	63.3
14:48:19	67.7	73.7	66.8	52.0	59.7	63.3	60.6	50.4	37.3	66.3
14:59:50	66.6	81.5	67.8	51.1	56.6	58.1	53.5	47.4	36.3	62.6
15:16:14	63.7	64.0	59.0	50.2	60.4	64.8	58.5	48.1	38.4	66.5
15:19:48	62.4	72.0	62.7	49.5	55.8	57.9	52.3	45.3	34.9	60.7

3.5 During the measurements the sky was clear for the first hour, then became partially cloudy. Other meteorological conditions prevailing whilst the noise levels were measured were as shown in Table 3 below.

Table 3

Meteorological Conditions Prevailing During Noise Measurements

Time (hrs)	Direction of Wind	Range of Wind Speed (ms^{-1})	Temperature (° Centigrade)	Relative Humidity (%)	Atmospheric Pressure (mBars)
11:30	None	0.0 to 0.5	18.0	68	1017
12:30	North-east	0.0 to 1.0	17.0	72	1016
13:30	None	0.0 to 0.2	18.0	68	1016
14:30	North-east	0.2 to 2.3	19.0	64	1015

3.6 The noise level measurements were thus generally conducted within the meteorological condition "window" given in *Calculation of Railway Noise 1995*[5]. One meteorological condition which was not satisfied was paragraph 41.1 on page 47, which states;

(i) the wind direction is such as to give a component from the nearest part of the rail towards the reception point exceeding the component parallel to the rail:

That this clause was not satisfied was not important given the absolute wind speeds involved and the distance between the road and microphone. (It is only at distances of 50m and more that the wind significantly affects the propagation of the noise).

Furthermore, if satisfying all three conditions relating to wind given in the document[5] was considered a fundamental requirement, no measurements would ever be carried out.

4.0 Determination of *Level of Significance* of Railway Noise

4.1 The first stage in the process for assessing the noise levels, as prescribed in TAN 2011[4], is to conduct the *Quantitative Assessment*, which involves calculating the *Magnitude of Impact* the railway noise will have on the residents of the proposed development.

4.2 To determine the *Magnitude of Impact* of the railway noise on the site, it is firstly necessary to calculate the average sound exposure level, L_{AE}, of each type of train which passed the site. The average L_{AE} of the DMUs which passed the site has been calculated to be 75.9dB(A).

The L_{AE} of the freight train which passed the site was 73.9dB(A). Freight trains usually generate greater levels of noise than DMUs. The relationship between the two on many other development sites in Scotland has been studied, and the difference is, on average, 5.8dB(A). The average L_{AE} due to freight trains has thus been taken to be 81.7dB(A).

No Main Line East Coast Company, CrossCountry or Virgin trains passed the site during the measurements, because none of these operators run trains on the lines.

4.3 The numbers of trains which pass the site on a typical weekday, a Wednesday, as shown in First ScotRail and Network Rail's timetables, have been counted and are shown below in Table 4. Network Rail's timetables designate certain freight trains as Q, *runs when required*, and Y, *Runs to and from terminals/ yards as determined by traffic demand*. The absolute maxima given in Table 4 include all freight trains with the Q and Y designation. It should be noted that the author has never encountered anything like the maximum number of timetabled freight trains to actually pass a site, hence the use of the maximum will over-estimate the noise. This approach is usually required by West Lothian Council.

Table 4

Summary of Train Sound Exposure Levels and Numbers
(dB re 2 x 10^{-5} Pa)

Train Type	Average L_{AE}	No. per Day	No. per Night
DMU	75.9	53	5
Freight (normally timetabled)	81.7	3	0
Freight (absolute maximum)	81.7	20	5

4.4 The night-time $L_{Aeq(23:00hrs\ to\ 07:00hrs)}$, based on the maximum number of trains and the L_{AE}s mentioned above, is 45.1dB(A). The daytime $L_{Aeq(07:00hrs\ to\ 23:00hrs)}$ has been found to be 49.4dB(A).

4.5 The *Magnitude of Impact* is determined by the amount by which the L_{Aeq} exceeds 45dB(A) at night, and 55dB(A) during the day, as shown overleaf in Table 5.

Table 5

Magnitude of Impacts Associated with Night and Day Exceedance Levels[4]

Night Noise Level[1], x = (Existing – 45) $L_{Aeq,8h}$	Day Noise Level[1], x = (Existing – 55) $L_{Aeq,16h}$	Magnitude of Impact
> 15	> 10	Major adverse
10 ≤ x ≤ 15	5 ≤ x ≤ 10	Moderate adverse
5 ≤ x < 10	3 ≤ x < 5	Minor adverse
0 ≤ x < 5	0 ≤ x < 3	Neglig ble adverse
x < 0	x < 0	No adverse impact

During the night, the noise of the railway will be around 45dB(A). According to TAN 2011[4], the noise will, therefore, have *Negligible adverse* impact on the residents of the houses.

During the day, the noise of the railway is less than 55dB(A). The noise will, therefore, have *No adverse impact* on the residents of the houses.

4.6 The second stage in the process is to conduct the *Qualitative Assessment*. In this case, however, it is considered that the *Quantitative Assessment* adequately addresses the noise impact of the railway on the houses. The final stage is to determine the *Level of Significance* of the railway noise. This is determined using Table 6, which is shown below.

Table 6

Significance of Effects[4]

Magnitude of Impact	Sensitivity of Receptor		
	Low	Medium	High
Major	Slight/Moderate	Moderate/Large	Large/Very Large
Moderate	Slight	Moderate	Moderate/Large
Minor	Neutral/Slight	Slight	Slight/Moderate
Negligible	Neutral/Slight	Neutral/Slight	Slight
No change	Neutral	Neutral	Neutral

The *Sensitivity of Receptor* will be high as it is houses which are to be constructed. As the impact of the railway noise during the night on the residents of the houses will be *Negligible*, the significance will be *Slight*, which is defined in TAN 2011[4] as:

Slight: *These effects may be raised but are unlikely to be of importance in the decision making process.*

As the impact of the railway noise during the day on the residents of the houses will be *No change*, the significance will be *Neutral*, which is defined in TAN 2011[4] as:

Neutral: *No effect, not significant, noise need not be considered as a determining factor in the decision making process.*

4.7 It is thus concluded that the railway noise levels are within the limits given in current planning guidance, and that no measures are required to reduce them.

5.0 Brucefield Industrial Park Noise Level Measurement Procedures

5.1 Mr Craig Cloy, of Charlie Fleming Associates, visited the site of the proposed development between 11:15hrs and 15:30hrs on Tuesday 5th August 2014, to measure the noise of the industrial park.

5.2 The following electroacoustical instrumentation was used to conduct the measurements.

Brüel & Kjær Modular Precision Sound Analyzer Type 2260
Serial No. 1875656

Brüel & Kjær Enhanced Sound Analysis Software Type BZ7202
Serial No. 9445FBA

Brüel & Kjær Prepolarised Condenser Microphone Cartridge Type 4189
Serial No. 2820088

Brüel & Kjær Sound Level Calibrator Type 4231
Serial No. 2656302

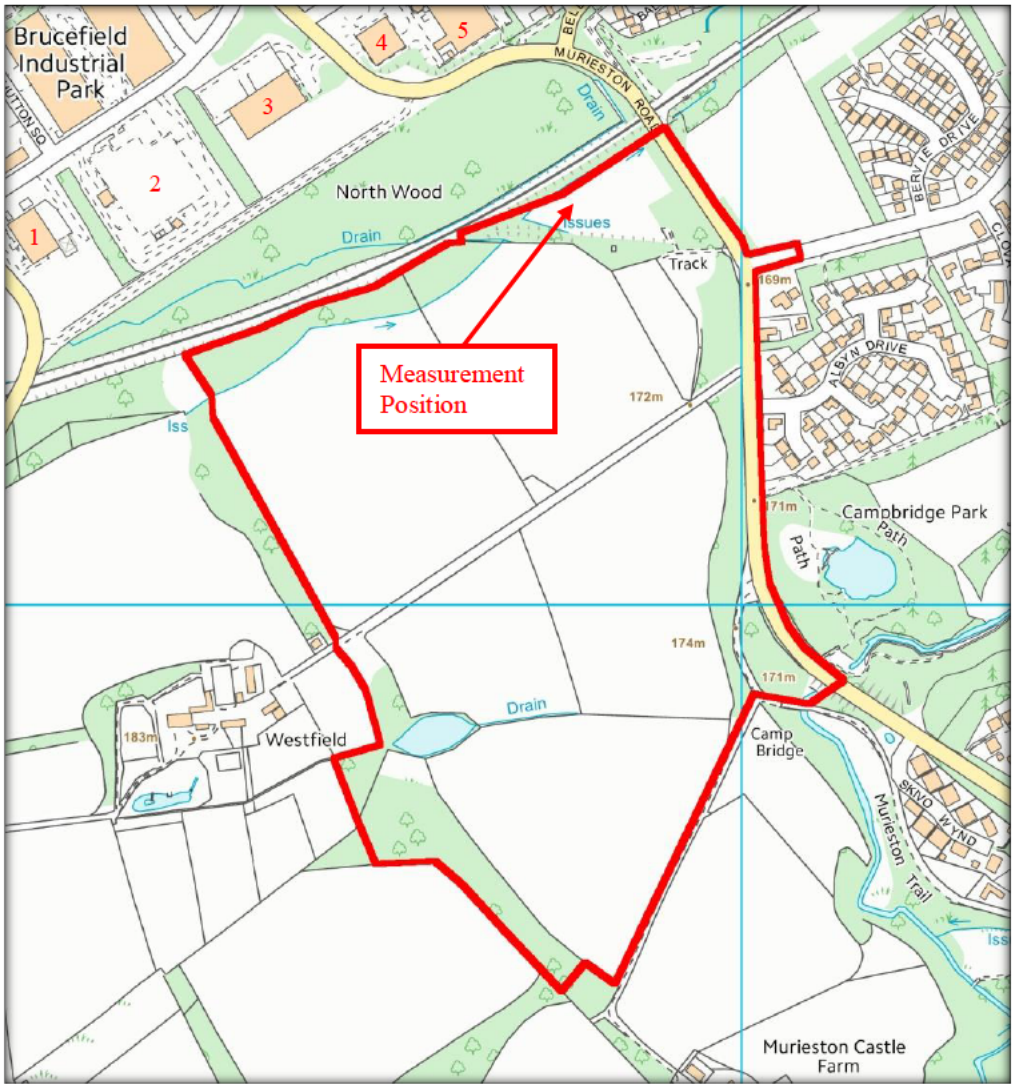
Brüel & Kjær Windscreen Type UA0237
Serial No. Not applicable

5.3 It is usual, in an assessment like this, to measure the noise where the house which will be most exposed to it will be built. The principle in this is that, if the noise is acceptable at the most exposed house, it follows that it will also be acceptable elsewhere in the development. At the time of the visit, however, the layout of the development had not been drawn up. In situations like this, it is usually assumed that the nearest house will be 10m back from the boundary of the development site with the industrial estate. This is because 10m is the length of a typical garden being provided with houses being built by developers in Scotland just now.

The measurement position is shown overleaf on Figure 2, which is reproduced from the drawing titled *Location plan*, provided by Clarendon Planning and Development.

Figure 4

Location of Brucefield Industrial Park Noise Measurement Position
(Courtesy of Clarendon Planning and Development)



5.4 In choosing the measurement position, to determine where the noise on the development site might be greatest, Mr Cloy visited the Industrial Park to ascertain what businesses occupy the units nearest the site.

The plots in the Industrial Park are numbered 1 to 5 on Figure 4 above. The businesses occupying the plots were as follows.

1) Unknown, but no obvious industrial noise sources visible or audible.
2) Vacant site, with no buildings or any other useage.
3) IBM Livingston Business Recovery Centre.
4) CB Technology.
5) Vacant industrial building.

CB Technology assembles, designs and tests electronic printed circuit boards. IBM Livingston Business Recovery Centre provides serviced workspaces for companies. Neither business was thus considered likely to generate noise that would be significant on the development site. Of the two, however, it seemed that if any noise was likely it would be from CB Technology rather than IBM Livingston Business Recovery Centre. The noise was, therefore, measured where it was considered that the nearest house to it might be built.

As mentioned earlier in Section 2.5, it was assumed that the course of the burn close to the northern boundary of the development site would not be altered, as it would be impractical to move it further north, because of the railway line. This was therefore, taken as being where the end of the gardens would be. The noise was measured 10m back from the burn. It was not measured directly adjacent to CB Technology because that part of the development site was covered in dense impenetrable vegetation.

In detail, the measurement position was located 10m back from, and at 90 degrees to, the post and wire fence defining the north-western boundary of the site. It was also 43m in a north-eastern direction from the aforementioned burn. The microphone of the sound level analyzer was horizontal, at a height of 1.40m above the ground.

5.5 Mr Cloy measured the noise on the development site between 11:15hrs and 15:30hrs, during which time businesses were operating as normal in Brucefield Industrial Park. No noise from them was audible. Measurements were thus made of the ambient noise, over periods of 10 minutes every half hour.

5.6 The equivalent continuous, L_{Aeq}, noise levels were measured at both positions. The analyzer also measured the maxima, L_{AFmax}, percentiles, L_{AF1}, L_{AF10}, L_{AF50}, L_{AF90}, L_{AF99}, minima, L_{AFmin} and octave band data. All noise levels were measured in decibels referenced to 2×10^{-5} Pa.

5.7 The sound level analyzer was calibrated before and after conducting the measurements. On completion of the measurements the calibration level was found not to have changed.

6.0 Brucefield Industrial Park Noise Level Measurement Results and Discussion

6.1 The results of the equivalent continuous, L_{Aeq}, maxima, L_{AFmax}, minima, L_{AFmin}, and percentile noise level measurements, L_{AFx}, are shown below in Table 7. The measurements of the ambient noise are shown in blue ink.

Table 7

Measured A-Weighted Ambient Noise Levels
(dB re 2 x 10^{-5} Pa)

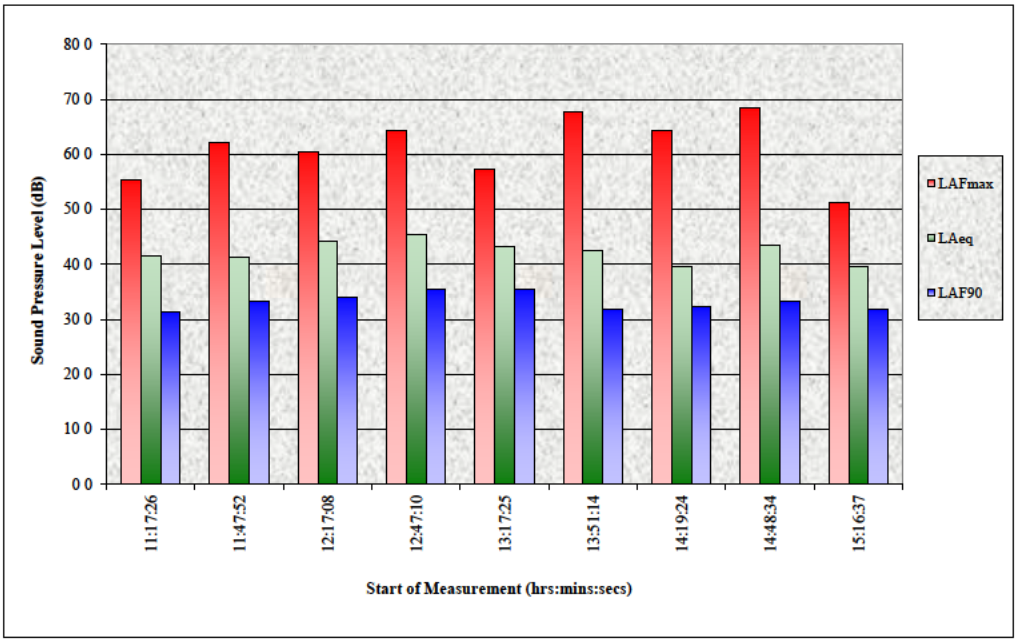
Start of Measurement (hrs:mins:secs)	L_{Aeq} dB(A)	L_{Amax} dB(A)	L_{A1} dB(A)	L_{A10} dB(A)	L_{A50} dB(A)	L_{A90} dB(A)	L_{A99} dB(A)	L_{Amin} dB(A)
11:17:26	41.4	55.4	48.4	45.4	38.8	31.4	29.0	28.2
11:47:52	41.2	62.1	48.2	44.6	39.0	33.4	31.2	29.9
12:17:08	44.1	60.4	53.8	47.4	40.4	34.0	31.6	30.3
12:47:10	45.5	64.2	55.2	48.4	42.0	35.4	31.8	30.3
13:17:25	43.2	57.3	51.8	46.4	40.8	35.4	32.4	30.3
13:51:14	42.5	67.8	51.2	43.6	37.8	31.8	29.6	28.6
14:19:24	39.7	64.3	48.2	42.2	36.4	32.4	30.6	30.0
14:48:34	43.5	68.4	49.8	44.6	39.6	33.4	31.2	30.0
15:16:37	39.5	51.3	47.2	43.4	36.2	31.8	29.4	28.6

Start of Measurement (hrs:mins:secs)	Duration of Measurement (hrs:mins:secs)	Description of Event	L_{Aeq} dB(A)
11:17:26	00:10:01	Road traffic noise on Murieston Road and surrounding roads, birdsong	41.4
11:47:52	00:10:02	Road traffic noise on Murieston Road and surrounding roads, birdsong, 11:49hrs meter paused for passing train	41.2
12:17:08	00:10:01	Road traffic noise on Murieston Road and surrounding roads, birdsong, distant aircraft noise	44.1
12:47:10	00:10:51	Road traffic noise on Murieston Road and surrounding roads, birdsong, 12:48hrs meter paused for passing train	45.5
13:17:25	00:10:02	Road traffic noise on Murieston Road and surrounding roads, birdsong, distant aircraft noise	43.2
13:51:14	00:10:17	Road traffic noise on Murieston Road and surrounding roads, birdsong, 13:59hrs meter paused for passing train	42.5
14:19:24	00:10:01	Road traffic noise on Murieston Road and surrounding roads, birdsong	39.7
14:48:34	00:10:54	Road traffic noise on Murieston Road and surrounding roads, birdsong	43.5
15:16:37	00:10:05	Road traffic noise on Murieston Road and surrounding roads, birdsong, 15:19hrs meter stopped for passing train	39.5

6.2 The most important of the parameters shown in Table 7, the equivalent continuous, L_{Aeq}, maximum, L_{AFmax}, and background, L_{AF90}, sound pressure levels are shown below in Figure 5.

Figure 5

Measured A-Weighted Ambient Noise Levels
(dB re 2 x 10^{-5} Pa)



6.3 Subjectively, no industrial noise was audible or discernible during the measurement period. The ambient noise was of mainly of traffic on Murieston, and other, roads in the vicinity, bird song and intermittent distant aircraft. The equivalent continuous noise level of all of the residual noise measurements, has been calculated, and found to be 42.7dB(A).

6.4 It was noted that the building numbered 5 on Figure 4 was industrial in nature, but vacant. It was not obvious what kind of manufacturing might have gone on in the building in the past. The building is some 260m from where the nearest house might be built. This distance will mean that any noise which may emanate from the building in future will be attenuated quite considerably. There is also a belt of trees just over 100m wide between the building and where the nearest of the proposed houses might be built. This will attenuate the noise by 9dB(A)[7]. With this attenuation due to distance and trees, it is unlikely that industrial activity inside, or outside, the building will generate noise that would disturb the residents of the new houses.

There are existing houses on New Park Road, Bellsquarry Road and Balmoral Gardens. These are all much closer to the vacant building than the nearest of the houses proposed on the development site. If industrial processes started in the building which were noisy, they would be more likely to generate complaints from the existing housing than the new houses. In this the onus would then be on the business generating the noise to control it, rather than it being a planning issue.

6.5 The meteorological conditions prevailing during the noise level measurements were as shown previously in Table 3. They were perfectly acceptable for measuring ambient noise.

7.0 Conclusions

7.1 BDW Trading / H & J Russell propose to apply for planning permission to construct houses on land off Murieston Road, in Livingston. To the north of the land are railway lines. Approximately 260m to the north-west of the land lies the nearest building in Brucefield Industrial Park. The concern was raised at the planning stage, by officers of West Lothian Council, that noise from the railway and industrial estate might disturb the residents of the houses. Charlie Fleming Associates was asked, by BDW Trading / H & J Russell, to quantify the levels of railway and industrial noise on the proposed development site, and determine whether they would be acceptable.

7.2 The railway noise was measured as described in Section 2.0 of this report, and the results are presented in Section 3.0. The noise levels have been assessed as prescribed in The Scottish Government publication titled *Technical Advice Note 2011: Assessment of Noise*[4] (TAN 2011).

7.3 The *Magnitude of Impact* of the railway noise, on the residents of the houses, was determined in Section 4.0. During the night, the noise will have *Negligible adverse* impact on the residents of the houses. The *Level of Significance* of the noise will therefore be *Slight*, which is defined in TAN 2011 as:

Slight: *These effects may be raised but are unlikely to be of importance in the decision making process.*

During the day, the noise will have *No adverse impact* on the residents of the houses. The *Level of Significance* of the noise will therefore be *Neutral*, which is defined in TAN 2011 as:

Neutral: *No effect, not significant, noise need not be considered as a determining factor in the decision making process.*

7.4 It is thus concluded that the railway noise levels are within the limits given in current planning guidance, and that no measures are required to reduce them.

7.5 The noise of Brucefield Industrial Park was measured as described in Section 5.0 of this report, and the results are presented in Section 6.0.

7.6 On the proposed development site, there was no industrial noise audible or measureable from Brucefield Industrial Park. The residents of the new houses will not, therefore, be disturbed.

[redacted]

BSc MSc CEng FIOA MCIBSE MIET

8.0 References

1) West Lothian Council, *supplementary planning guidance Planning and noise*, West Lothian Council, June 2008.

2) The Scottish Executive Development Department, *Planning Advice Note 56 Planning and Noise*, Crown Copyright April 1999, ISBN 0 7480 8157 7.

3) The Scottish Government, *Planning Advice Note PAN 1/2011 Planning and Noise*, Crown Copyright 2011, ISBN 978-1-78045-043-8 (web only).

4) The Scottish Government, *Technical Advice Note TAN 2011 Assessment of Noise*, Crown Copyright 2011, ISBN 978-1-78045-042-1 (web only).

5) Department of Transport, *Calculation of Railway Noise 1995*, HMSO, London, 1995, ISBN 0-11-551754-5.

6) British Standard 4142: 1997, *Method for Rating industrial noise affecting mixed residential and industrial areas.* British Standards Institution, London, 1997, ISBN 0-580-28300-3.

7) Bies D. A. and Hansen C. H., *Engineering Noise Control*, Unwin Hyman, London1988, ISBN 0 04 620022 3.

Appendix

A1.0 Basic Principles of Acoustics

A1.1 Sound Pressure

The sound we hear is due to tiny changes in pressure in the air, caused by something disturbing the air, such as a loudspeaker cone moving back and forward, the blades of a fan heater going round, the moving parts of a car engine, and so on. From the initial point of the disturbance the sound travels to the receiver in the form of a wave. It is not like a wave in water, rather like one that would travel along a stretched spring, such as a child's *Slinky* toy laid flat on the ground and "pinged" at one end. Whether the human ear can hear the sound wave as it travels through the air, however, depends on the size of the disturbance and the frequency of it. That is, if the loudspeaker moves very slightly we may not be able to hear the changes in air pressure that it causes because they are too small for the ear to detect. The magnitude of sound pressures that the human ear can detect ranges from about 0.00002Pascals (Pa) to 200Pa. This enormous range presents difficulties in calculation and so, for arithmetic convenience, the sound pressure is expressed in decibels, dB. Decibels are a logarithmic ratio as shown below:

Sound Pressure Level $L\ (dB) = 20Log_{10}\{ {}^{p}/_{P}\}$
Where p = the sound pressure to be expressed in dB
and P = reference sound pressure 0.00002Pa

Hence, if we substitute 0.00002Pa, the smallest sound the ear can hear, for *p*, the result is 0dB. Conversely, if we substitute 200Pa, the loudest sound the ear can hear, for *p*, the result is 140dB. Hence, sound is measured in terms of sound pressure level in dB relative to 0.00002Pa.

A1.2 Range of Audible Sound Pressure Levels

An approximate guide to the range of audible pressures is presented overleaf in Table A1. The sound pressure levels noted are typical of the source given and should not be considered to be precise. The notes in the "Threshold" column of the Table are for general guidance, the sound pressure levels of those thresholds varying between individuals.

Table A1

Range of Audible Sound Pressure Levels and Sound Pressures

Sound Pressure Level (dB re $2x10^{-5}$ Pa)	Sound Pressure (Pa)	Source	Threshold of:
160	2000	Rifle at ear	Damage
140	200	Jet aircraft take off @ 25m	Pain
120	20	Boiler riveting shop	Feeling
100	2	Disco, noisy factory	
80	0.2	Busy street	
60	0.02	Conversation @ 2m	
40	0.002	Quiet office or living room	
20	0.0002	Quiet, still night in country	
0	0.00002	Acoustic test laboratory	Hearing

A1.3 Frequency and Audible Sound

Returning to the example of the loudspeaker cone, if it moves back and forward very slowly, for example once or twice a second, then we will not be able to hear the sound because the ear cannot physically respond to such a low frequency sound. Human ears are sensitive to sound pressure waves with frequencies between about 30Hertz (Hz) and 16,000Hz, where Hz is the unit of frequency and is also known as the number of cycles per second. That is, the number of times each second that the loudspeaker cone moves in and out, the fan blade goes round, etc. At the other end of the frequency spectrum, a sound with a frequency of 30,000Hz will also be inaudible, again because the ear cannot physically respond to sound pressure waves having such a high frequency.

Across the audible frequency range, the response of the ear varies. For example, a sound having a frequency of 63Hz will not be perceived as being as loud as a sound of exactly the same sound pressure level, having a frequency of 250Hz. A sound having a frequency of 500Hz will not be perceived as being as loud as a sound of the same sound pressure level with a frequency of 1,000Hz. Indeed, for a given sound pressure level, the hearing becomes progressively more sensitive as the frequency increases up to around 2,500Hz. Thereafter, from 2,500Hz upwards to about 16,000Hz, the sensitivity decreases, with sounds having frequencies above 16,000Hz being inaudible to most adults.

Virtually all sounds are made up of a great many component sound waves of different sound pressure levels and frequencies combined together. To measure the sound pressure level contributed at each of the frequencies between 30Hz and 16,000Hz, that is, 15,970 individual frequencies, would require 15,970 individual measurements. This would yield a massive, unwieldy amount of data.

A1.4 Octave Bands of Frequency

As a compromise, the sound pressure level in particular ranges, or "bands", of frequencies can be measured. One of the commonest ranges of frequency is the octave band. An octave band of frequencies is defined as a range of frequencies with an upper limit twice the frequency of the lower limit, eg 500Hz to 1,000Hz. This octave is exactly the same as a musical octave, on the piano, violin, etc, or *doh* to high *doh* on the singing scale. Octave bands are defined in international standards

and are identified by their centre frequency. Sound measurements are generally made in the eight octave bands between 63Hz and 8,000Hz. This is because human hearing is at its most sensitive, in terms of its frequency response, over this range of frequencies. Furthermore, speech is made up of sound waves having frequencies in this range.

A1.5 "A-Weighting" and dB(A)

Whilst an octave band analysis gives quite detailed information as to the frequency content of the sound, it is rather clumsy in terms of presenting results of measurements, that is, having to note sound pressure levels measured at eight separate octave bands. Furthermore, the ear hears all these separate frequency components as a whole and thus it would seem sensible to measure sound in that way.

When sound pressure level is measured with a sound level meter, the instrument can analyse the sound in terms of its octave band content as described above in section A1.4, or measure all the frequencies at once. Bearing in mind that the response of the ear varies with frequency, the sound level meter can apply a correction to the sound it is measuring to simulate the frequency response of the ear. This correction is known as "A-weighting" and sound pressure levels measured with this applied are described as having been measured in dB(A).

A1.6 Variation of Sound Level With Time

Most sounds, for example, speech, music, a person hammering, road traffic, an aircraft flying overhead, vary with respect to time. Various terms can be applied to describe the temporal nature of a sound as shown in Table A2.

Table A2

Examples of the Temporal Nature of Sound

Description	Example of Noise Source
Constant or steady state	Fan heater, waterfall
Impulsive	Gun shot, hammer blow, quarry blast
Irregular or fluctuating	Road traffic, speech, music
Cyclical	Washing machine, grass mowing
Irregular impulsive	Clay pigeon shooting
Regular impulsive	Regular hammering, tap dripping, pile driving

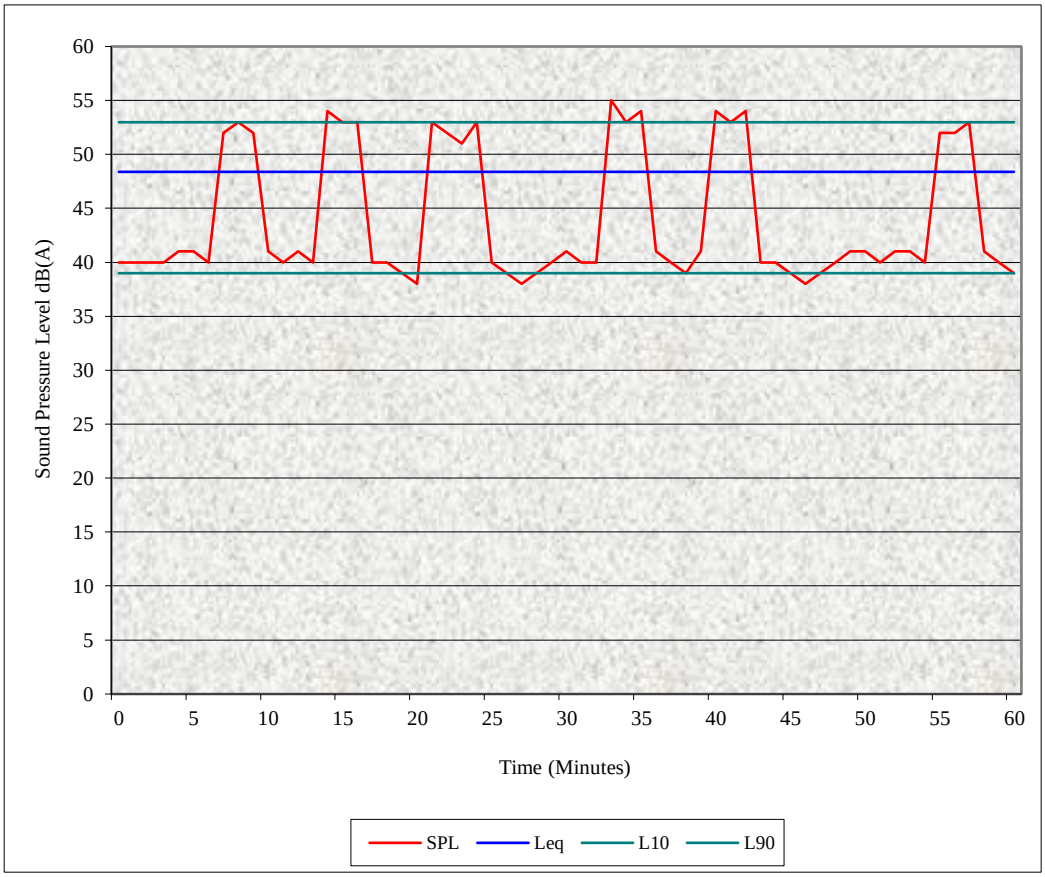
In practice, combinations of virtually any of the above can exist. In measuring noise it is necessary to deal with the level as it varies with respect to time.

A1.7 Time History

Consider the time history, as it is known, shown overleaf in Figure A1. Note that it is not an actual time history, rather an approximate representation of that which a person might experience some 100m away from a building site on which a man is operating a pneumatic drill.

Figure A2

Example of Time History of Construction Site Noise



The noise of the compressor and other activity on the site is reasonably constant with time, having a level of between 38dB(A) and 41dB(A). When the drill operates the noise level rises to between around 51dB(A) and 55dB(A).

A measurement of the noise between the 25th minute and the 32nd minute, when the noise is that of the compressor, would result in a level of about 40dB(A). This is very different from the result of a measurement made between the 33rd minute and the 35th minute, when the drill is operating, which would give a noise level of about 54dB(A). In the past acousticians therefore had to develop some way of measuring the noise which gives us information as to its variation in time. The easiest parameters to understand are the maximum and minimum levels, in this case 55dB(A) and 38dB(A) respectively. These do not tell us much about the noise other than the range of levels involved. The most widely used parameter is the equivalent continuous sound level, L_{eq}, which is explained in Section A1.8.

A1.8 Equivalent Continuous Sound Level, L_{eq}

A representative measurement of the noise to which the person in the example is exposed must deal with these changes in level. This can be done by measuring what is known as the equivalent continuous sound level, denoted as L_{eq}. If the measurement has been made in dB(A) it can be denoted as L_{Aeq} and expressed in dB. This is the sound level which, if maintained continuously over a given period, would

have the same sound energy as the actual sound (which varied with time) had. In the example the L_{eq} is 48.4dB(A) and it is shown on Figure A1 as a blue line. In layman's terms it may be considered to be the average of the sound over a period of time.

A1.9 Sound Exposure Level, SEL or L_{AE}

This is the sound level which if maintained constant for a period of one second would have the same sound energy as the time varying sound had. It may be considered to be a L_{eq} normalised to one second. It is very useful for measuring the noise of discrete events such as train pass-bys, aircraft flyovers, explosions and gunfire. A series of SEL's can be added together relatively easily and an L_{eq} calculated for a long period of time such as a whole day or night.

A1.10 Percentiles, L_x

Another parameter often used in describing noise is the percentile. This is a statistical parameter and with respect to noise is that level exceeded for x% of the measurement period. Hence the L_{10} is that level which was exceeded for 10% of the measurement period. In the example this is 53dB(A) and it is shown in green on Figure A1. It can be seen to be a reasonable representation of the typical value of the peaks in the time history. The L_{10} is often used to describe road traffic noise, such as in the *Calculation of Road Traffic Noise* by the Department of Transport and in the *Noise Insulation Regulations 1975/1988*.

Conversely, the L_{90} is that level exceeded for 90% of the time. In the example it is 39dB(A) and is also shown in green. It is a good descriptor of the troughs in the time history. Another way of thinking of the L_{90} is that it describes the background noise, during lulls in the more obvious noise, in this case the drill. The L_{90} is used in BS 4142:1997 *Method for Rating industrial noise affecting mixed residential and industrial areas*, as the descriptor of the background noise.

Any percentile can be specified such as L_{21}, L_{65}, L_8 ,L_{87} and so on. In practice however the only other percentiles used are the L_1, which is very similar to the maximum level that occurred during the measurement period and the $L_{99,}$ which is similar to the minimum level that occurred. Very occasionally the L_5 and L_{95} might be specified in a measurement procedure.

A1.11 Maximum, L_{max}

The greatest level occurring during a given measurement period. From the example illustrated in Figure A1 it would be 55dB(A).

A1.12 Time Weighting, Fast, L_F, or Slow, L_S

Time weighting refers to the speed at which the sound level meter follows variations in the time history. The “fast” weighting of 125 milli-seconds corresponds to the way in which the human ear follows sound. The “slow” weighting effectively introduces more averaging of the noise. Note that the L_{eq} is independent of the time weighting, which only applies in the measurement of maxima, minima and percentiles.