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GLADMAN DEVELOPMENTS LTD

Land off Bangor Road, Johnstown

Noise Assessment DRAFT

May 2013

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Noise Assessment DRAFT

May 2013

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1 INTRODUCTION

- 1.1.1 By written instruction dated 2nd April 2012, Wardell Armstrong LLP were commissioned to undertake a noise assessment for a proposed mixed use development at land off Bangor Road, Johnstown, Wrexham.
- 1.1.2 The proposed development site currently comprises a former tile manufacturing works (Hafod Tileries) in the northern part of the site, with open land in the southern and western parts of the site. The offices of the former tile works, which are currently in use, are located off Hafod Road to the east of the site. However, the remaining buildings of the site consist of vacant and/or derelict buildings. Approximately 150-200m to the west of the site runs the Shrewsbury to Chester railway line, and the A483, which is a major road traffic route, runs approximately 200m to the west of the site. To the immediate east of the development site runs Hafod Road, beyond which lie the residential properties of Hafod House (Nursing Home), Hafod House Farm, and Hafod Cottage.
- 1.1.3 Further to the above, the site is bordered to the north by Eco-Readymix, which is a concrete plant consisting of an external mixing area and several mobile mixers used to transport product to external sites. In addition, a bottled gas storage facility (Key Gas) is located to the north of the site, together with a vehicle scrap yard. Hafod Quarry/Landfill is situated to the south of the site on the opposite side of the Bangor Road Carriageway. The location and context of the proposed development are shown on drawing number LE11510-001.
- 1.1.4 The proposed mixed use development will comprise up to 300 residential dwellings, 465sqm (B2/B8) industrial, storage and distribution and 235sqm (A1) retail unit. Vehicular access to the development will be via Bangor Road to the south of the site. The proposed site layout is shown on the development framework drawing prepared by FPCR Environment and Design Ltd, drawing reference 4355-P-05 revision F.
- 1.1.5 This noise assessment report has been prepared in support of the outline planning application for the proposed residential development. This report details the results of a noise assessment undertaken for the proposed development, and assesses the results of a noise survey carried out in accordance with current guidance, including recommendations for noise mitigation as appropriate.

2 ASSESSMENT METHODOLOGY

2.1 Consultation and Scope of Works

2.1.1 Prior to carrying out the noise assessment the potential impacts of the proposed development and general principles of the assessment methodology were discussed and agreed with Andrew Jordan of Wrexham County Borough Council (WCBC) in April 2012. Further to this consultation, it was agreed that potential impacts of the existing and future sources of noise on the proposed residential area of the development would be assessed with reference to appropriate current guidance, including Technical Advice Note (Wales) 11, Noise, October 1997, the World Health Organisation's (WHO) Guidelines for Community Noise 1999, as well as British Standard 5228 -1:2009 "Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise" (BS5228-1).

2.1.2 The scope of works included in this assessment is as follows:

- *Existing Sensitive Receptors:* The impact of noise on existing sensitive receptors surrounding the development site. This considers the potential impact of noise from the earthworks and construction phase of the development, as well as the impact of noise from development generated traffic; and
- *Proposed Sensitive Receptors:* The impact of existing noise levels at sensitive areas of proposed development, i.e. proposed residential areas, specifically in terms of the potential impact of existing transportation noise, and noise from the nearby industries.

2.2 Noise Survey

2.2.1 As part of this assessment, Wardell Armstrong LLP has carried out an attended noise survey to assess the current ambient noise levels at both existing and proposed receptor locations. The noise survey is discussed in greater detail in Section 3 of this report.

2.3 Existing Sensitive Receptors Assessment

Noise from Earthworks and Construction Phase Activities

- 2.3.1 The activities associated with the earthworks and construction phase of the proposed development will have the potential to generate noise and create an impact on the surrounding area.
- 2.3.2 Guidance on the prediction and assessment of noise from development sites is given in British Standard 5228 -1:2009 "Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise" (BS5228-1).
- 2.3.3 Construction noise can have disturbing effects on the surrounding neighbourhood. The effects are varied and are complicated further by the nature of the site works, which will be characterised by noise sources which will change location throughout the construction period. The duration of site operations is also an important consideration. Higher noise levels may be acceptable if it is known that the levels will occur for a limited period. Table 1, details the nearest sensitive receptors to the development.

Table 1: Existing Noise Sensitive Receptor Locations					
Receptor	Address	Location		Bearing from Site	Approximate Distance to Site Boundary
		Easting	Northing		
ESR1	Existing residential receptors of Hafod House (Nursing Home)	331229	346062	West	50m
ESR2	Existing residential receptors of Hafod House Farm	331279	346089	West	95m
ESR3	Existing residential receptors of Hafod Cottage	331308	346103	West	135m

- 2.3.4 Local authorities may also have their own procedures for control of construction activities that are proposed in their catchment area. WCBC permit construction works between the following hours:
- Monday - Friday: 07:30 – 18:00 hours.
 - Saturday: 08:00 – 14:00 hours.
 - Sunday / Bank Holidays: No work at these times.

- 2.3.5 In addition to the permitted hours of operation outlined by WCBC, the Control of Pollution Act 1974 (COPA 1974) gives the local authority power to serve a notice under Section 60 imposing requirements as to the way in which works are to be carried out. This could specify times of operation, maximum levels of noise which should be emitted and the type of plant which should or should not be used.
- 2.3.6 However it might be preferable for the chosen contractor to obtain prior consent under Section 61 of COPA 1974. Section 61, enables anyone who intends to carry out works to apply to the local authority for consent. Under Section 61 the local authorities and those responsible for construction work, have an opportunity to settle any problems, relating to the potential noise, before work starts.
- 2.3.7 In addition to COPA 1974, BS5228-1 provides guidance on significance criteria for assessing the potential noise impacts associated with the construction phase of large projects. For the purposes of this noise assessment, the noise likely to be generated by the earthworks and construction phase, have been assessed against significance criteria established, using the BS5228-1 ABC Method.
- 2.3.8 The ABC method for determining significance criteria requires the ambient noise levels at existing sensitive receptors to be determined. The ambient noise levels at each existing receptor location are then rounded to the nearest 5dB(A) to determine the appropriate threshold value in accordance with the category value, A B or C, as detailed in Table 2.

Table 2: Thresholds of Significant Impact from Construction Noise at Residential Receptors in accordance with the ABC Method of BS5228-1			
Assessment Category and Threshold Value Period (L_{Aeq})	Threshold Value, in decibels (dB)		
	Category A ^{*1}	Category B ^{*2}	Category C ^{*3}
Daytime (0700 to 1900 hours) and Saturdays (0700 to 1300 hours)	65	70	75
^{*1} Category A: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than this value.			
^{*2} Category B: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as Category A values.			
^{*3} Category C: Threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than Category A values.			

- 2.3.9 The noise level likely to be generated at the receptor during the construction phase, i.e. the ambient noise level plus construction noise, is then compared to the

appropriate category value. If the noise level is greater than the appropriate category value, a significant noise impact may be registered.

2.3.10 In accordance with the requirements of WCBC, the enabling and construction works will be restricted to daytime hours, i.e. between 0730 and 1800 hours Monday to Friday and 0800 to 1800 hours on a Saturday. Based on the ambient noise levels measured during the daytime period, the appropriate category value has been determined for each of the sensitive receptors, as detailed in Table 3. Details of the noise survey carried out at the sensitive receptors are set out in Section 3 of this report.

Table 3: Construction Noise Assessment Significance Criteria				
Receptor	Average Measured Noise Levels (dB L _{Aes})	Ambient Noise Level Rounded to the nearest 5dB(A) (dB L _{Aeq})	Appropriate Category Value A, B or C in accordance with BS5228-1	Noise Level above which activities of the Construction Phase may cause a significant impact at the Receptor (dB L _{Aeq})
ESR1: Existing residential receptors of Hafod House (Nursing Home)	60.6	60	A	65
ESR2: Existing residential receptors of Hafod House Farm	60.6	60	A	65
ESR3: Existing residential receptors of Hafod Cottage	60.6	60	A	65

2.3.11 Additional receptors are located to the west (Linley Avenue), and to the southeast (Edisbury Grange) of the site. However, these receptors are located further from the site than those identified in Table 3. Therefore, meeting acceptable limits at the receptors identified in Table 3 would also ensure that appropriate limits are met at any additional, and more distant, receptors.

2.3.12 The noise assessment for the construction phase details baseline daytime noise levels recorded at sensitive receptor locations and outlines the main construction activities that could give rise to noise impacts at receptors in the vicinity of the proposed development. It also sets out details of 'best practice' management and control measures to ensure that impacts are minimised as far as possible.

Road Traffic Noise and Existing Sensitive Receptors

2.3.13 The operational phase of the development will generate additional traffic movements on the existing road network. These additional vehicle movements have

the potential to increase road traffic noise levels at existing receptors located adjacent to the main routes to and from the development.

- 2.3.14 The current and future traffic noise levels at a number of sensitive receptors; both with and without the development in place, have been predicted using the calculation procedures set out in the Department of Transport's memorandum, "Calculation of Road Traffic Noise" (CRTN), 1988. The memorandum was prepared to enable entitlement under the Noise Insulation Regulations 1975 to be determined; but it is stated in the document, that the guidance is equally appropriate for the calculation of traffic noise for land use planning purposes.
- 2.3.15 The procedures outlined in CRTN assume typical traffic and noise propagation conditions that are consistent with moderately adverse wind velocities and directions during specified periods. In CRTN, all noise levels can be expressed in terms of the index L_{10} (18 hour) dB(A).
- 2.3.16 The data used in the road traffic noise assessment is detailed in the Transport Assessment (TA) produced by Ashley Helme Associates; the traffic and transportation consultant for the proposed development.
- 2.3.17 For this noise assessment, CRTN has been used to determine the noise levels at each existing sensitive receptor, for a total of 3 scenarios:
- Scenario 1: 2012 – Baseline (Without Development)
 - Scenario 2: 2018 – Year of opening (Without Development); and
 - Scenario 3: 2018 – Year of opening (With Development).
- 2.3.18 In addition to the 18 hour AAWT flows provided by Ashley Helme Associates, HGV percentages were also provided. The flows used in the noise assessment are included in Appendix A.
- 2.3.19 An assessment of the change in noise levels has been carried out at 3 existing, representative sensitive, residential locations. The existing receptor locations (identified as CRTN1 to CRTN3) have been chosen along those routes most likely to be affected by traffic associated with the proposed development. Receptors adjacent to affected junctions have been considered. Details of the sensitive receptor locations are given in Table 4.

Table 4: Existing Noise Sensitive Receptor Locations considered for CRTN predictions			
CRTN Receptor Number	Address	Grid Reference	
		x	y
CRTN 1	Hafod House (Nursing Home)	331229	346062
CRTN 2	Edisbury Grange, Gyfelia, Wrexham	330617	345983
CRTN 3	18 Linley Avenue, Johnstown	331581	345700

2.3.20 Impacts will also be felt at receptors adjacent to and beyond those listed above. However impacts at these receptors will be less than at the listed receptors.

2.3.21 The changes in road traffic noise levels have been assessed against a set of significance criteria. The criteria shown in Table 5 are based upon guidance contained within the Design Manual for Roads and Bridges, Volume 11, Section 3, Part 7, 2011 (DMRB) for the assessment of long term changes in road traffic noise. The criteria do not relate to the actual existing noise levels (i.e. traffic noise due to the current residential development) but only the predicted changes.

Table 5: Road Traffic Noise Assessment Significance Criteria	
Magnitude of Impact	Criteria for Assessing Road Traffic Noise
Major Adverse	> 10.0 dB increase in traffic noise (equating to a clearly perceptible increase in the loudness of noise).
Moderate Adverse	5.0 – 9.9 dB increase in traffic noise (equating to an increase in the loudness of the noise which is at or about the threshold of perception)
Minor Adverse	3.0 – 4.9 dB increase in traffic noise
Negligible	0.1 – 2.9 dB increase in traffic noise.

Noise from the Proposed Employment Area

2.3.22 The development framework drawing prepared by FPCR Environment and Design Ltd, drawing reference 4355-P-05 revision F, shows that the proposed employment areas will be approximately 300m from the nearest existing sensitive receptor and will be screened by the Shrewsbury to Chester railway line, and/or the A483.

2.3.23 It is therefore considered that, due to the distance and screening between existing receptors and the proposed employment area, noise from the proposed

employment area is unlikely to cause any significant impact at existing sensitive receptors and therefore this has not been considered further in this assessment.

2.4 Proposed Sensitive Receptors Assessment

2.4.1 An assessment is required to consider any potentially noise sensitive areas of the proposed development. These areas, i.e. residential dwellings, primary school site and offices, will be subjected to noise from existing and proposed sources.

2.4.2 The potential impacts of existing and future sources of noise on the proposed sensitive areas of the development have been assessed with reference to the following guidance.

Proposed Residential Areas

Technical Advice Note (Wales) 11, Noise, October 1997 (TAN 11):

2.4.3 The potential impacts of the existing and future sources of noise at the proposed residential areas of the proposed development have been assessed with reference to the methodology set out in TAN 11. TAN 11 gives guidance to local authorities in Wales on the use of their planning powers to minimise the adverse impact of noise. It:

- outlines the considerations to be taken into account in determining planning applications both for noise sensitive developments and for those activities which will generate noise;
- introduces the concept of noise exposure categories for residential development, encourages their use and recommends appropriate levels for exposure to different sources of noise; and
- advises on the use of conditions to minimise the impact of noise.

2.4.4 TAN 11 introduces the concept of Noise Exposure Categories (NECs), ranging from A-D to help local authorities in their consideration of applications for residential development near transport related noise sources.

2.4.5 In accordance with TAN 11, monitoring results should be divided into daytime (0700 to 2300 hours) and night-time (2300 to 0700 hours) periods. The individual levels should then be arithmetically averaged and rounded up to give a single daytime and night-time level for each monitoring location. The average daytime and night-time noise levels are then assessed against the recommended Noise Exposure Categories (NECs) as detailed in PPG24. The recommended NECs are shown in Table 6.

Table 6: Noise Levels Corresponding to the Noise Exposure Categories (NECs) for New Dwellings $L_{Aeq,t}$				
Noise Source	Noise Exposure Category			
	A	B	C	D
Road traffic 0700-2300 2300-0700	<55 <45	55-63 45-57	63-72 57-66	>72 >66
Rail traffic 0700-2300 2300-0700	<55 <45	55-66 45-59	66-74 59-66	>74 >66
Air traffic 0700-2300 2300-0700	<57 <48	57-66 48-57	66-72 57-66	>72 >66
Mixed sources 0700-2300 2300-0700	<55 <45	55-63 45-57	63-72 57-66	>72 >66

2.4.6 TAN 11 further recommends that, should a site experience several events per hour during the night-time period, which exceed 82dB L_{Amax} (slow-time weighting), the site should be considered as NEC C regardless of the measured L_{Aeq} .

2.4.7 In accordance with the guidance contained in TAN 11, when assessing a proposal for residential development near a source of noise, local planning authorities should determine into which of the four NECs the proposed site falls, taking into account both day and night-time noise levels. PPG24 indicates that local planning authorities should have regard to the advice in the appropriate NEC, as shown in Table 7:

Table 7: Advice Given in TAN 11 Corresponding to the Noise Exposure Categories (NECs)	
NEC	Advice in TAN 11
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.

2.4.8 Where the site does not lie within NEC A the implementation of mitigation measures should be considered.

World Health Organisation Guidelines for Community Noise, 1999:

2.4.9 In addition to the requirements of TAN 11, WCBC has indicated that the internal noise levels across the developed site should be set in accordance with the World Health Organisation's "Guidelines for Community Noise", 1999 (WHO 1999). The guidelines suggest appropriate criteria and noise limits for habitable rooms of residential dwellings for noise from external sources:

- 35dB L_{Aeq} (16 hour) during the daytime in noise sensitive rooms other than bedrooms.
- 30dB L_{Aeq} (8 hour) during the night-time in bedroom areas.
- 45dB $L_{Amax,f}$ should not be exceeded during the night-time in bedroom areas.

2.4.10 WHO 1999 also identifies that the attenuation provided by a window open for ventilation purposes is up to 15dB. Relating this information to the above internal noise levels equates to allowable external noise levels of 50dB L_{Aeq} (16 hour) during the daytime and 45dB L_{Aeq} (8 hour) at night, with maximum noise levels of 60dB $L_{Amax,f}$.

2.4.11 These levels are equivalent to the upper limits of Noise Exposure Category A, where no mitigation measures would be required in order to meet suitable internal noise levels. Should these levels be exceeded, the relevant receptor would be placed in higher Noise Exposure Category and mitigation measures would be required.

2.4.12 WHO 1999 also proposes an external noise limit of 55dB L_{Aeq} (16 hour) during the daytime in outdoor living areas.

British Standard 4142:1997 (BS4142), Method for Rating Industrial Noise Affecting Mixed Residential and Industrial Areas:

2.4.13 In order to provide an indication of the potential noise impact the existing concrete works may have on the proposed residential development areas of the site, a BS4142 assessment has been carried out for properties proposed to the north of the development site (adjacent to the concrete works).

2.4.14 The purpose of the BS4142 assessment procedure is to assess whether noise levels from factories, industrial premises, fixed installations or sources of noise of an

industrial nature in commercial premises, are likely to give rise to complaints from people residing nearby.

2.4.15 BS4142 refers to noise from the industrial source as the 'specific noise' and this is the term used in this report to refer to noises associated with the garages and substations. The 'specific noise' levels that have been used as part of this assessment are detailed further in Section 4 of this report.

2.4.16 BS4142 assesses the likelihood of complaint by comparing the specific noise level to the background noise level (L_{A90}), both as measured during the noise survey. Section 3 provides details of the noise survey undertaken.

2.4.17 Certain acoustic features can increase the likelihood of complaints over that expected from a simple comparison between the specific noise level and the background noise level. In particular, BS4142 identifies noise that contains discrete impulses and/or audible tonal qualities and in these cases recommends that a 5dB correction be added to the specific noise level. The specific noise level along with any applicable correction is referred to as the 'rating level'.

2.4.18 Based on on-site observations, activities associated with the concrete works are intermittent. Therefore, a 5dB correction has been applied to the specific noise levels of these sources.

2.4.19 BS4142 identifies that the greater the exceedance between the rating level and the background noise level; the greater the likelihood of complaints. The assessment criteria given by BS4142 are as follows:

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

2.4.20 During the daytime, BS4142 requires that noise levels are assessed over 1-hour periods. However, during the night-time, because individual events have the potential to cause sleep disturbance, noise levels are assessed over a shorter period of 5-minutes, to take this into account.

3 NOISE SURVEY

3.1.1 On the 30th April and 3rd May 2012 Wardell Armstrong LLP carried out a noise survey to assess noise levels across the development site and at locations representative of proposed and existing sensitive receptor locations.

3.1.2 Noise measurements were taken at six monitoring locations, considered to be representative of the proposed and existing residential receptors, in the immediate vicinity of the proposed development. This also included a location representative of the employment area to the south of the site. Attended noise monitoring was carried out between approximately 1445 and 1715 hours on the 30th April, and from 0500 to 1200 hours on the 3rd May 2012. The monitoring locations are as follows, and are shown on Drawing Number LE11510-001:

- Monitoring Location 1: to the eastern part of the site, representative of proposed residential development adjacent to Hafod Road, and of the nearest sensitive receivers (Hafod House, Hafod House Farm, Hafod Cottage). 5m from Hafod Road, approximately 260m from the A483
- Monitoring Location 2: In western part of the site, representative of proposed residential dwellings facing the Shrewsbury to Chester railway line. Approximately 230m from the railway line.
- Monitoring Location 3: In the southern part of the site, 3m from the carriageway of Bangor Road. Opposite to the Hafod Quarry/Landfill site.
- Monitoring Location 4: In the north-eastern part of the site, representative of proposed residential development adjacent to Hafod Road. 5m from Hafod Road.
- Monitoring Location 5: At the northern part of the site, representative of proposed residential development. Approximately 40m from concrete works entrance and approximately 80-90m from main activities area.
- Monitoring Location 6: At the most north-easterly part of the site, 10m from the carriageway of Hafod Road.

3.1.3 The noise measurements were made using a Type 1, integrating sound level meter. The sound level meter was mounted vertically on a tripod 1.2m above the ground and more than 3.5 metres from any other reflecting surfaces.

- 3.1.4 All noise monitoring took place during dry and calm weather conditions. The sound level meter was calibrated to a reference level of 94dB at 1kHz both before, and on completion of the noise survey. No drift in calibration was recorded during the survey.
- 3.1.5 The attended noise measurements were typically taken over 15 minute periods during the daytime, and 10 minute periods at night. A-weighted¹ L_{eqs} ² were recorded to comply with the requirements of WHO 1999, together with A-weighted L_{90s} ³ to comply with the requirements of BS4142. The maximum and minimum sound pressure levels were also recorded to provide additional information. The measured noise levels are set out in full in Appendix B. In addition, noise from train movements, as measured at monitoring location 2 is provided in Appendix C.
- 3.1.6 Attended noise monitoring allows observations and detailed notes to be made of the significant noise sources which contribute to each of the measured levels. Observations identified the following significant noise sources at the site:

Road Traffic: Noise from road traffic on A483 was audible and continuous throughout the survey at all measurement locations. At monitoring locations 1, 4, and 6, road traffic on Hafod Road was noted to be regular, but infrequent during the night. At monitoring location 3, road traffic on Bangor Road was noted as frequent during the daytime period.

Railway Traffic Noise: Noise from the passenger train movements along the Chester to Shrewsbury Line, located to the west of the site were audible at monitoring location 2. Although noise levels from trains were obtained at this location it is unknown whether the trains measured were passenger trains only or included a freight movement. Details of the train movements noted during the survey are set out in full in Appendix C.

Industrial Noise: During the daytime, activities associated with the existing concrete works, and gas bottle storage facility to the north of the site were audible at monitoring locations 5 and 6. In addition, noise from activities associated with the concrete works was audible at monitoring location 2. At monitoring location 3, noise associated with the CHP engine of Hafod Quarry/Landfill was audible during the

¹ A' Weighting	An electronic filter in a sound level meter which mimics the human ear's response to sounds at different frequencies under defined conditions
² L_{eqs}	Equivalent continuous noise level; the steady sound pressure which contains an equivalent quantity of sound energy as the time-varying sound pressure levels.
³ L_{90}	The noise level which is exceeded for 90% of the measurement period.

daytime, together with noise from visiting HGVs and mobile plant (e.g. excavator) on the site access road.

Birdsong/Foliage: There are trees and shrubs in the vicinity of the survey locations. Foliage rustling and birdsong were audible during the measurements, during various daytime and night-time periods.

4 NOISE IMPACT ASSESSMENT

4.1.1 The noise impact assessment has been based on the development framework drawing prepared by FPCR Environment and Design Ltd, drawing reference 4355-P-05 revision F.

4.2 Existing Sensitive Receptors Assessment

Noise from Earthworks and Construction Phase Activities

4.2.1 During the earthworks and construction phase, any work carried out at the proposed development is likely to generate noise that may propagate beyond the proposed development boundary.

4.2.2 At this stage, detailed information regarding the nature and timescales of activities likely to take place during the earthworks and construction phase are not known. Activities on the site, which could give rise to construction noise impacts include (but are not limited to):

- Site preparation i.e. ground excavation, levelling of ground, trenching, trench filling, unloading and levelling of hardcore and compacting filling.
- Construction of the proposed development including piling, construction of access roads, fabrication processes e.g. planing, sanding, routing, cutting, drilling and laying foundations.

4.2.3 The above activities have the potential to generate short term increases in noise levels, above those recommended in BS5228-1. The levels of noise received at the receptors closest to the proposed development would depend on the sound power levels of the machines used, the distance to the properties, the presence of screening or reflecting surfaces and the ability of the intervening ground to absorb the propagating noise.

4.2.4 The nearest noise sensitive receptors to the development works, as detailed in Table 1, will vary depending on the area of the proposed development under construction. Given the potentially small distances between the construction activities and residential dwellings, noise levels at the receptors may occur above those detailed in Table 3. The noise generated by the earthworks and construction phases of the development may therefore have a short-term, adverse impact at the sensitive receptors located in the immediate vicinity of the construction phases of the development.

4.2.5 It is therefore recommended that mitigation measures be put in place that will reduce the scale of the potential effect. Details can be found in Section 5 of this report.

Road Traffic Noise and Existing Sensitive Receptors

4.2.6 Noise prediction calculations have been carried out to assess the potential change in road traffic noise at existing receptor locations due to the additional traffic generated by the development. The prediction calculations have been carried out in accordance with the method specified in CRTN 1988 for existing receptor locations.

4.2.7 Details of the sensitive receptor locations assessed are given in Table 4 (i.e. CRTN1 to CRTN3). Impacts may also be felt at receptors beyond those listed above. However impacts at these receptors will be less than at the listed receptors. With increasing distance from these road links, impacts will decline to zero.

4.2.8 In accordance with CRTN, the predicted level of road traffic noise at the façade of the existing receptors has been determined based on the number and composition of vehicles travelling along the local road links (i.e. the number and proportion of HGVs and LGVs), together with the speed of vehicles, distance of the receptor from the edge of the carriageway and angle of view of the road link. Further details of the CRTN predictions are included in Appendix D.

4.2.9 The predicted 2012 Baseline, 2019 “without development” and 2019 “with development” noise levels are shown in Table 8 for each of the receptors considered.

Table 8: CRTN Predictions for 2011 Baseline, 2018 Without Development and 2018 With Development				
Receptor	Predicted L_{10} (18 hour) dB(A) at the façade of the receptor			Changes in Predicted Road Traffic Noise levels 2012 baseline to 2019 with development (L_{10} 18 hour dB(A))
	2012 Baseline	2019 Without Development	2019 With Development	
CRTN1	60.0	58.3	58.3	-1.7
CRTN2	67.1	65.5	65.7	-1.4
CRTN3	62.9	63.4	63.6	+0.7

4.2.10 The results of the prediction calculations indicate that, in the absence of the development, noise levels will increase between 2012 and 2019. The increase in noise is due to the growth in traffic which would take place even without the development taking place, and would be up to +0.5dB(A).

4.2.11 The changes in noise levels which would occur with the development in place are also shown in Table 8. The increases in road traffic noise are less than +1dB(A), therefore there will be no perceptible increase in road traffic noise at these receptors. It is therefore considered that the impact of the increase in road traffic noise at the existing receptors which are most likely to be affected will be negligible.

4.3 Proposed Sensitive Receptors Assessment

Proposed Residential Areas

Technical Advice Note (Wales) 11, Noise, October 1997 (TAN 11) Assessment

4.3.1 In accordance with TAN 11 the daytime and night-time noise measurements have been divided into daytime (07:00-23:00) and night-time (23:00-07:00) categories. The individual levels have been arithmetically averaged and then rounded up to give a single daytime and night-time level for each proposed residential receptor location, as shown in Table 9. To be robust, noise from train movements throughout the daytime and night-time period have been at Monitoring Location 2 in accordance with CORN. Monitoring Locations 3 and 5 have not been included in the TAN 11 assessment as these locations were used to determine the potential noise impact of the proposed employment area, and the noise impact from activities associated with the concrete works, respectively. Both of these items are discussed later in this report.

Table 9: Average Daytime and Night-time Noise Monitoring Results (Figures in dB L _{Aeq})		
Monitoring Location	Time	Average Measured Noise Levels (Unrounded figures in brackets)
1	0700-2300	60.6
	2300-0700	56.1
2	0700-2300	50.2*
	2300-0700	48.3 *
4	0700-2300	59.7
	2300-0700	52.6
6	0700-2300	56.9
	2300-0700	-- **

* Including noise from train movements calculated in accordance with CORN

** Would be similar to monitoring location 4 at night

- 4.3.2 In addition to the average daytime and night-time noise levels, the range of maximum noise levels recorded during each measurement period of the night-time survey, at each of the monitoring locations in the vicinity of proposed residential areas, are summarised in Table 10. Maximum noise levels were not measured at monitoring location 3 during the night-time as this location was chosen to obtain information relating to daytime noise levels only.

Table 10: Maximum Night-time Noise Levels	
Monitoring Location	Maximum Measured Noise Levels (Figures in dB $L_{Amax,f}$)
1	53.6 – 55.0
2	47.1 – 51.7
4	54.5 – 56.5

- 4.3.3 Taking into consideration TAN 11's 82dB $L_{Amax,f}$ criterion as detailed in paragraph 2.4.6, individual maximum noise levels do not regularly exceed 82dB $L_{Amax,f}$ during the night-time period at any monitoring location.
- 4.3.4 In accordance with TAN 11 the average daytime and night-time noise levels shown in Table 9 have been assessed against the Noise Exposure Categories (NECs) detailed in Table 6. Road traffic noise is the dominant source of noise at the site; therefore the NECs for road traffic have been used. The NECs at the monitoring locations are shown in Table 11.

Table 11: Daytime and Night-time NECs at Monitoring Locations 1, 2, 4, and 6		
Monitoring Location	Time	Average Measured Noise Levels (Unrounded figures in brackets)
1	0700-2300	B
	2300-0700	B
2	0700-2300	A
	2300-0700	B
4	0700-2300	B
	2300-0700	B
6	0700-2300	B
	2300-0700	B

- 4.3.5 Table 11 shows that the whole area of the site proposed for residential development falls within NEC B during the daytime and night-time. The results of the TAN 11 assessment indicates that the noise levels at the proposed development should not therefore be a determining factor in granting planning permission. However, mitigation measures will be required to ensure that the required external noise limits detailed in TAN 11 are achieved at the proposed residential areas of the development. Mitigation measures and discussed further in Section 5 of this report.

Daytime Noise Levels in Living Room Areas

- 4.3.6 The measured daytime noise levels, as detailed in Table 9, have been used to determine the noise levels likely at the façades of properties in the vicinity of the monitoring locations during the daytime period.
- 4.3.7 Before internal noise levels can be calculated 2.5dB(A) must be added to the freefield measured levels to allow for the reflection of noise from the proposed housing façades when the buildings are in place.
- 4.3.8 Once operational, vehicle movements on the proposed site access of the development sites have the potential to increase road traffic noise levels at the proposed residential areas of the development. To be robust, the future traffic noise levels at facades of proposed residential properties in the immediate vicinity of site access road have been predicted in accordance with CRTN.
- 4.3.9 The calculations are based on the 2018 'With Development' traffic data provided by Ashely Helme Associates and are detailed in Appendix D. The results of the noise predictions can be compared to WHO 1999 by making small adjustments to the predicted noise levels, in accordance with a method set out in Tan 11. The $L_{A10\ 18\ \text{hour}}$ can be converted to an $L_{Aeq\ 16\ \text{hour}}$ (as required by WHO 1999) by subtracting 2dB(A).
- 4.3.10 The calculated noise levels at the façades of the properties, together with the level of attenuation required to achieve 35dB L_{Aeq} in the living room areas, are summarised in Table 12.

Table 12: Façade Noise Level at Properties in the Vicinity of the Monitoring Locations and Level of Attenuation Required to Achieve the Internal Daytime Noise Limit (Figures in dB(A))		
Residential Properties	Noise Level at the Façade of the Property	Level of Attenuation Needed To Achieve Noise Limit in Living Room Areas
Monitoring location 1 – Residential properties in the eastern part of the site, adjacent to Hafod Road.	63.1	28.1
Monitoring location 2 – Residential properties in the western part of the site, facing the railway line.	52.7*	17.7
Monitoring location 4 – Residential properties in the northeastern part of the site adjacent to Hafod Road.	62.2	27.2

* Including noise from train movements calculated in accordance with CORN

4.3.11 The facades of the properties further into the site will be protected by the buildings themselves and/or screened by other buildings and topography. It is considered that the noise levels at these facades, and therefore the level of attenuation the facades would need to attenuate, to achieve 35dB L_{Aeq} in the living room areas, will be less than those detailed in Table 12.

4.3.12 Mitigation measures are discussed further in Section 5.2 of this report.

Night-time Noise Levels in Bedrooms

4.3.13 The measured night-time noise levels, as detailed in Tables 9 and 10, have been used to determine the noise levels likely at the façades of properties in the vicinity of the monitoring locations, during the night-time period.

4.3.14 To be robust, the calculated maximum noise levels at these façades are based on the highest maximum noise levels recorded during the night-time survey.

4.3.15 Before internal noise levels can be calculated 2.5dB(A) must be added to the freefield measured levels to allow for the reflection of noise from the proposed housing facades when the buildings are in place.

4.3.16 Traffic flow information with regards to night-time vehicle movements on the access road was not available. It is therefore difficult to determine the future night-time noise levels at the proposed residential properties in the vicinity of the site access road. To be robust, prediction calculations have therefore been carried out based on measured noise levels to determine the night-time noise levels at the facades of these proposed residential properties.

4.3.17 The calculated noise levels at the façades of properties, together with the level of attenuation required to achieve 30dB L_{Aeq} and 45dB $L_{Amax,f}$ in the bedrooms, are summarised in Table 13.

Table 13: Façade Noise Level at Properties in the Vicinity of the Monitoring Locations and Level of Attenuation Required to Achieve the Internal Night-time Noise Limit (Figures in dB(A))			
Residential Properties	Noise Level at the Façade of the Property (L_{Aeq})	Maximum Noise Level at the Façade of the Property ($L_{Amax,f}$)	Level of Attenuation Needed To Achieve the Noise Limits in Bedrooms
Monitoring location 1 – Residential properties in the eastern part of the site, adjacent to Hafod Road.	58.6	57.5	28.6
Monitoring location 2 – Residential properties in the western part of the site, facing the railway line.	50.8	54.7	20.8
Monitoring location 4 – Residential properties in the northeastern part of the site adjacent to Hafod Road.	55.1	59.0	25.1

4.3.18 The facades of the properties further into the site will be protected by the buildings themselves and/or screened by other buildings and topography. It is considered that the noise levels at these facades and therefore the level of attenuation the facades would need to attenuate to achieve the 30dB L_{Aeq} and 45dB $L_{Amax,f}$ in the bedrooms will be less than those detailed in Table 13.

4.3.19 Mitigation measures are discussed further in Section 5.2 of this report.

Proposed Employment Area

- 4.3.20 The development framework drawing prepared by FPCR Environment and Design Ltd, drawing reference 4355-P-05 revision F, shows a proposed area of employment in the southern part of the site, adjacent to Bangor Road. From the information provided by Gladman Developments Ltd, it is understood that the employment area will comprise premises of B2 and B8 use, i.e. industrial, storage and distribution along with an A1 retail unit .
- 4.3.21 The development framework drawing shows that the proposed employment areas will be approximately 180m from the nearest proposed sensitive receptor and will be located adjacent to Bangor Road.
- 4.3.22 It is therefore considered that, due to the distance and screening which exist between proposed receptors and the proposed employment area, noise from the proposed employment area is unlikely to cause any significant impact at proposed sensitive receptors and therefore this has not been considered further in this assessment.

4.4 Assessment of Activities Associated with Industrial Sources to the North of the Development

- 4.4.1 Activities associated with Eco-ReadyMix Concrete Works are audible in the northern and western parts of the proposed residential areas of the development during the daytime, and potentially between 0600 to 0700h at night. Although some activities were audible from the gas bottle storage site, and from the scrap yard, these activities were generally infrequent and screened by a 4-5m perimeter fence. Eco-ReadyMix concrete works has the greatest potential noise impact on the proposed residential areas of the development.
- 4.4.2 Observations made during the noise survey indicate that the major noise sources associated with Eco-ReadyMix are due concrete mixer truck movements in/out of the site, together with a loading shovel moving products such as sand around the site, and the mixing hoppers once loaded with product from the loading shovel. Mixer trucks awaiting a product loading were observed to idle by the hopper area until loaded.
- 4.4.3 Noise levels of typical activities were measured at monitoring location 5, which was chosen to be representative of the nearest proposed residential receivers.

4.4.4 Based on the daytime and night-time noise levels, the calculated noise levels at the façades of the properties, together with the level of attenuation required to achieve 35dB L_{Aeq} in the living rooms, and 30dB L_{Aeq} in bedrooms are summarised in Table 14. To be robust, the greatest daytime and night-time noise levels have been considered, and an average maximum noise level of 83.7dB L_{Aeq} has also been considered. As identified previously, 2.5dB(A) must be added to the free-field measured levels to allow for the reflection of noise from the proposed housing façades when the buildings are in place.

Table 14: Façade Noise Level at Properties in the Vicinity of Monitoring Location 5 and Level of Attenuation Required to Achieve the Internal Daytime and Night-time Noise Limit (Figures in dB(A))				
Residential Properties		Noise Level at the Façade of the Property (L_{Aeq})	Maximum Noise Level at the Façade of the Property ($L_{Amax,f}$)	Level of Attenuation Needed To Achieve the Noise Limits in Bedrooms
Residential properties in the north/ north-western part of the site, i.e. Monitoring Location 5	Daytime 0700 - 2300	63.2	N/A	28.2
	Night-time 2300 - 0700	62.2	86.2	41.2
* Based on the maximum noise level of a mixer truck passing a monitoring location at 6m, assumed to be similar in distance to that of the façade of the proposed residential properties in the vicinity of the Eco-ReadyMix site access.				

4.4.5 The above identifies that, mitigation measures should be considered where dwellings are proposed close to the Eco-ReadyMix site, and/or access route for this business. In particular, maximum noise levels due to mixer trucks during the one hour night-time period will require consideration. The above also demonstrates that without any mitigation in place, noise levels within external areas are unlikely to meet the WHO 1999 limit for outdoor areas of 55dB L_{Aeq} . Mitigation measures are discussed in greater detail in Section 5 of this report.

4.4.6 Observations made during the noise survey indicate that the operations of the Hafod Quarry to the south of the site are occasionally audible in the southern parts of the development site. However, the noise generated by this site was never dominant. A separate assessment of the noise generated by the activities at Hafod Quarry, in accordance with the procedures contained in BS4142, would not therefore be appropriate.

5 NOISE ATTENUATION SCHEME

5.1 Proposed Sensitive Receptors and Noise

- 5.1.1 The results of the WHO 1999, and BS4142 assessments in Section 4, indicate that some noise mitigation measures would need to be incorporated into the proposed site design to ensure that the required noise levels are achieved within outdoor living areas, internal living room areas and bedrooms.

5.2 Glazing Requirements for Living Room Areas

- 5.2.1 When assessing daytime noise levels in living rooms the noise attenuation provided by the overall building facade should be considered. To mitigate noise levels the composition of the building facade can be designed to provide the level of attenuation required. Glazing is generally the building element which attenuates noise the least, so the proportion of glazing in a building facade is an important consideration when assessing overall noise attenuation.
- 5.2.2 In the absence of design details for the building facades, it has been assumed that the glazing to noise sensitive rooms would comprise about 25% of the facade area. To calculate the overall attenuation provided by this percentage of glazing in a brick or block facade, a non-uniform partition calculation can be used.
- 5.2.3 The calculation combines the different degrees of attenuation of the wall element and the window element. A facade element comprising a solid brick or blockwork, will attenuate by 45-50dB (British Standard 8233: "Sound insulation and noise reduction for buildings – Code of practice" 1999) whereas standard double glazing will attenuate noise road traffic noise by 26-29dB(A) (BRE Digest 379 "Double glazing for heat and sound insulation"). The overall noise attenuation provided by this combination is, therefore, between 31.9dB(A) and 34.9dB(A).
- 5.2.4 A number of types of glazing would be able to achieve between 26-29dB. For example a 6/12/6 Pilkington glazing would achieve 26dB(A) attenuation and a 10/12/4 glazing would achieve 29dB(A) attenuation.
- 5.2.5 The noise attenuation requirements for living rooms in properties in different areas of the site are summarised in Table 12 and Table 14.

- 5.2.6 Table 12 and Table 14 indicate that standard thermal double glazing would ensure that internal noise levels are met with the windows closed. However, with windows open, the attenuation provided by the façade will be approximately 15dB(A). This would allow the recommended internal noise limit to be exceeded in a number of living room areas. On occasions this may be acceptable to the resident, but when quiet conditions are required, the resident should be able to close the windows whilst maintaining adequate ventilation. Some form of acoustic ventilation would therefore need to be installed in some of the living rooms.
- 5.2.7 Some facades, which do not face directly on to the existing noise sources in the vicinity of the site will also be protected by the buildings themselves and/or screened by other buildings. Where this is the case, it may be possible to achieve the required internal noise levels during the day with windows open for ventilation purposes.
- 5.2.8 At this stage a detailed layout has not yet been confirmed. Glazing requirements will be confirmed on a plot by plot basis at reserved matters stage.

5.3 Glazing Requirements for Bedroom Areas

- 5.3.1 The noise attenuation requirements for bedrooms in properties in different areas of the site are summarised in Table 13, and Table 14. Table 13 and Table 14 indicate that standard thermal double glazing could ensure that internal noise levels are met with the windows closed at all monitoring locations except monitoring location 5, where enhanced glazing would be required. However with windows open the attenuation provided by the facade will fall to approximately 15dB(A), which would result in the recommended internal noise limits being exceeded in a number of bedroom room areas. Therefore, some form of acoustic ventilation will need to be installed in some of the bedrooms.
- 5.3.2 At this stage a detailed layout has not yet been confirmed. Glazing requirements will be confirmed on a plot by plot basis at reserved matters stage.

5.4 Acoustic Ventilation Requirements

- 5.4.1 It is recommended that the acoustic ventilation proposed at the site should, as a minimum, comply with Building Regulations 2010 Approved Document F1 Means of Ventilation and British Standard BS5925 1991: "Code of Practice for Ventilation Principles and Designing for Natural Ventilation". Ventilation is only recommended for noise sensitive rooms, which are bedrooms and living rooms.
- 5.4.2 The implementation of the recommended glazing together with acoustic ventilation should ensure that the required internal daytime and night-time noise limits are met.
- 5.4.3 The façades of some of the properties further into the site will be protected by the buildings themselves and/or screened by other buildings. Therefore, acoustic ventilation may not need to be installed in some of the living room areas and/or bedrooms of these properties.
- 5.4.4 The requirement for acoustic ventilation will be confirmed on a plot by plot basis at reserved matters stage.

5.5 Outdoor Living Areas

- 5.5.1 The measured noise levels, as detailed in Table 9, indicate that the western part of the site will achieve the required daytime noise levels of 55dB L_{Aeq}.
- 5.5.2 The development framework for the residential development is shown on the development framework drawing prepared by FPCR Environment and Design Ltd,

drawing reference 4355-P-05 revision F. The development framework drawing indicates that the majority of outdoor living areas, located nearest to the A483 and existing industrial premises, will be screened by the proposed residential buildings themselves and would therefore be likely to achieve the required daytime noise levels.

- 5.5.3 It is recommended that any outdoor living areas located closest to, and with a direct line of sight of the A483 and existing industrial premises be provided with local mitigation comprising a close boarded fence or wall. Mitigation requirements can be provided, on a plot by plot basis, at the detailed application/reserved matters stage.

6 CONCLUSIONS

6.1 Introduction

- 6.1.1 Wardell Armstrong has carried out a noise assessment for a proposed residential development, at land off Bangor Road, Johnstown.

6.2 Proposed Sensitive Receptors and Noise

- 6.2.1 The dominant noise sources, which will potentially affect the residents of the proposed residential area of the development, include road traffic, railway movements, and existing industrial activity.
- 6.2.2 The assessment indicates that on-site mitigation measures will need to be implemented to ensure that the noise from road/rail traffic, and noise from the existing industrial premises is reduced to acceptable internal and external noise levels.
- 6.2.3 The WHO Guidelines for Community Noise, 1999 and Tan 11 have been used as the basis of setting appropriate noise limits. The requirements include internal noise levels of 35dB L_{Aeq} during the daytime, 30dB L_{Aeq} and 45dB $L_{Amax,f}$ during the night-time period, and an external noise limit of 55dB L_{Aeq} during the daytime.
- 6.2.4 Standard thermal double glazing would ensure that internal noise levels are met with the windows closed in living rooms across the site and for the majority of bedrooms across the site. The only exception is for bedrooms in the vicinity of monitoring location 5, where enhanced glazing would be required. At this stage a detailed layout has not yet been confirmed. Glazing requirements will be confirmed on a plot by plot basis at reserved matters stage.
- 6.2.5 The above glazing types should ensure that internal noise levels are met in living rooms and bedrooms with the windows closed. However, with the windows open the attenuation provided by the façade will be no more than approximately 15dB(A), which would allow the internal noise limit to be exceeded in a number of living rooms and bedrooms. Acoustic ventilation would therefore need to be installed in some of the rooms, to avoid the need to open the windows.
- 6.2.6 The facades of the properties further into the site will be protected by the buildings themselves and/or screened by other buildings. Acoustic ventilation may not need to be installed in the living rooms and/or bedrooms of these properties.

- 6.2.7 The requirement for acoustic ventilation can be confirmed on a plot by plot basis at the reserved matters stage.
- 6.2.8 The requirement to achieve 55dB_{L_{Aeq}} in outdoor areas is expected to be met in the western part of the site. The development framework drawing indicates that the majority of outdoor living areas, located nearest to the A483 and existing industrial premises, will be screened by the proposed residential buildings themselves and would therefore be likely to achieve the required daytime noise levels.
- 6.2.9 It is recommended that any outdoor living areas located closest to, and with a direct line of sight of the A483 and existing industrial premises be provided with local mitigation comprising a close boarded fence or wall. Mitigation requirements can be provided, on a plot by plot basis, at the detailed application/reserved matters stage.

Appendix A
Traffic Data Used in the Noise Assessment

Appendix A: Traffic Flow Information Used in the Noise Assessment, Provided by Ashley Helme Associates on 30/05/2013

Link Name	2012 Base Year	2019 'Without Development'	2019 'With Development'	HGV%
A483 (South of Bangor Road)	45360	47877	48156	3.7
A483 Slip Road	1777	1535	1814	4.7
Bangor Road (East of A483)	6954	4487	4785	2.9
Bangor Road (East of Site Access)	-	3628	5411	4.1
Bangor Road (West of Site Access)	4594	5056	5293	2.4
Hafod Road	1125	762	762	15.2
Site Access	-	-	2450	2.3

All traffic flows 18 hour AAWT (Annual Average Weekday Traffic) flows

Appendix B
Noise Monitoring Results

Appendix B: Noise Monitoring Results

Time, h	L _{Aeq} dB	L _{AMIN} dB	L _{AFMAX} dB	L _{A90} dB	L _{A10} dB	Comments
Monitoring Location 1:						
Daytime (30/04/2012)						
1443 – 1458	62.5	51.7	83.5	54.6	61.6	Main noise source is local road traffic on Hafod Road and background noise due to road traffic on the A438.
1543 – 1558	60.9	51.9	81.0	54.7	60.1	As above.
1649 – 1705	62.1	53.3	81.5	56.0	61.2	As above.
Night-time(03/05/2012)						
0523 – 0538	52.1	41.1	76.4	45.6	53.6	Background noise due to road traffic on the A438, and birdsong. No vehicle movements on Hafod Road.
0640 – 0650	60.0	46.4	83.1	49.8	55.0	As above. Two light and two heavy goods vehicle movements on Hafod Road.
Daytime (03/05/2012)						
0848 – 0903	59.9	47.2	82.0	80.7	56.8	Main noise source is local road traffic on Hafod Road and background noise due to road traffic on the A438.
1051 – 1102	57.6	43.0	78.7	45.5	52.2	As above.

Time, h	L _{Aeq} dB	L _{AMIN} dB	L _{AFMAX} dB	L _{A90} dB	L _{A10} dB	Comments
Monitoring Location 2:						
Daytime (30/04/2012)						
1522 – 1537	52.0	48.5	63.8	50.3	53.4	Background noise due to road traffic on the A438, and birdsong. Occasional noise from concrete works audible.
1629 – 1644	53.0	49.2	61.0	51.3	54.3	As above.
Night-time(03/05/2012)						
0543 – 0558	46.5	40.8	61.0	43.3	48.1	Background noise due to road traffic on the A438, and birdsong. Noise from electricity lines of pylon audible. Train pass at 0552h (northbound).
0653 – 0700	49.7	45.4	59.9	47.1	51.7	As above (no train pass).
Daytime (03/05/2012)						
0700 – 0715	50.1	45.7	59.9	47.6	51.7	As above. Train pass at 0700h (northbound).
0908 – 0923	47.8	42.3	60.8	45.8	49.3	As above (no train pass).

Time, h	L _{Aeq} dB	L _{AMIN} dB	L _{AFMAX} dB	L _{A90} dB	L _{A10} dB	Comments
Monitoring Location 3:						
Daytime (30/04/2012)						
1604 – 1620	68.3	52.9	86.8	55.6	73.2	Noise climate dominated by road traffic on Bangor Road. Background noise due to road traffic on the A438, and CHP engine of Hafod quarry/landfill. Excavator moving on site for approximately 3 minutes.
Daytime (03/05/2012)						
0724 – 0739	70.3	51.0	85.0	53.1	75.5	As above (no excavator). Four HGVs exiting the Hafod Quarry/Landfill site.
0932 – 0947	66.9	48.0	84.2	50.1	70.0	As above (no excavator). Two HGVs entering the Hafod Quarry/Landfill site and one exiting. One JCB on site access road.

Time, h	L _{Aeq} dB	L _{AMIN} dB	L _{AFMAX} dB	L _{A90} dB	L _{A10} dB	Comments
Monitoring Location 4:						
Night-time(03/05/2012)						
0504 – 0519	51.3	35.1	63.9	41.8	54.5	Background noise due to road traffic on the A438, and birdsong. No vehicle movements on Hafod Road.
0608 – 0618	53.8	37.5	63.0	46.4	56.5	As above.
Daytime (03/05/2012)						
0747 – 0802	61.1	54.0	77.3	57.3	61.8	Background noise due to road traffic on the A438, and birdsong. Several vehicle movements on Hafod Road.
0954 – 1009	59.3	47.3	79.7	51.1	57.4	As above. Three HGV movements.
1105 – 1120	58.7	44.4	77.8	49.5	56.1	As above. One HGV movement.

Time, h	L _{Aeq} dB	L _{AMIN} dB	L _{AFMAX} dB	L _{A90} dB	L _{A10} dB	Comments
Monitoring Location 5:						
Night-time(03/05/2012)						
0626 – 0636	59.7	42.8	77.1	46.7	64.0	One cement mixer on to site. Mixer idle at approximately 100m from monitoring location. Mixer exited site. One van on to site.
Daytime (03/05/2012)						
0825 – 0840	60.3	48.1	78.9	50.2	61.6	Noise climate dominated by activities at Concrete Works (loading hoppers with loading shovel). One van in and out of site.
1029 – 1044	53.4	37.8	70.4	42.4	55.7	As above.
1138 – 1153	60.7	48.8	85.9	50.8	57.1	As above. One cement mixer exiting Concrete Works site. HGV audible at Key Gas site.

Time, h	L _{Aeq} dB	L _{AMIN} dB	L _{AFMAX} dB	L _{A90} dB	L _{A10} dB	Comments
Monitoring Location 6:						
Daytime (03/05/2012)						
0806 – 0823	56.2	47.8	74.0	51.8	58.0	Background noise due to road traffic on the A438, and birdsong. Infrequent vehicle movements on Hafod Road. Occasional impact noises from Key Gas site.
1012 – 1027	56.9	47.0	76.3	49.4	58.1	Background noise due to road traffic on the A438, and birdsong. Infrequent vehicle movements on Hafod Road. Two cement mixers out of Concrete Works.
1122 – 1137	57.7	43.0	79.2	47.3	56.1	Background noise due to road traffic on the A438, and birdsong. Infrequent vehicle movements on Hafod Road. One mixer in to site. One car in and out of site.

Daytime and Night-time Noise Levels Across the Development Site

During the noise survey, rail movements were audible at monitoring locations ML2, ML3, and ML5. However, the frequency of train movements varies throughout the day and night, and therefore short period measured levels are not necessarily representative of the entire day or night time periods.

To adjust the measured levels to properly account for train movements throughout the 24 hour period, the following steps are taken: Firstly, remove railway noise from the measured levels (by omitting it from the time history output of the sound level meter) to obtain the 'residual' noise levels. These are set out in Table 1.

Table 1: Summary of Residual Noise Levels Across the Site		
Monitoring Location	Time, h	Residual L _{Aeq} dB
Daytime Measurements		
2	0700 - 0715	50.1
	0908 – 0923	47.8*
	1522 – 1537	48.5*
	1629 – 1644	49.2*
	Daytime Average	48.9
Night –time Measurements		
2	0543 – 0558	46.1
	0653 – 0700	49.7*
	Night-time Average	47.9

*No train movements occurred during these monitoring periods

Secondly, the average noise level of all trains using the line must be determined from the measurement data. During the noise survey, the Sound Exposure Levels (SEL) of all trains passing the site were recorded, as summarised in Appendix B. For the purpose of this assessment, the average SEL measured at each monitoring location, during the daytime and night-time periods, has been used in the predictions.

The third step is to determine the total number of train movements during the daytime and night time. The passenger train movements were counted using the Electronic National Rail Timetable (eNRT), valid from 14th May to 8th December 2012. To be robust, the highest number of timetabled daytime and night time movements throughout the week has been used in this assessment.

Based on a discussion with Network Rail, Wardell Armstrong understand that the railway line in question is not heavily used by freight. As a 'guide' only, up to eight freight trains could occur during the daytime, and none may occur at night. To be robust it has been assumed that one freight train may occur during the night. In the absence of any measured noise levels from freight movements, it has been assumed that the SEL of a freight train could be 10dB greater than a regular passenger train. This assumption has been based on Wardell Armstrong's experience with other developments situated near to railway lines.

The total number of train movements passing the site is shown in Table 2:

Table 2: Train Movements Adjacent to the Site	
Time	Number of Train Movements During the Week (Monday-Friday)
0700-2300	Weekday = 49 passenger train movements and 8 freight movements
2300-0700	Weekday = 5 passenger train movements and 1 freight movements

The final step is to combine the results of the previous three steps to obtain noise levels which are inclusive of all train movements. Following the prediction methodology set out in CORN (Calculation of Railway Noise, 1995), the daytime and night time noise levels have been determined (including all train movements in Table 2) as shown in Table 3.

Table 3: Calculation of Daytime 16 hour L_{Aeq} and Night-time 8 hour L_{Aeq} at Monitoring Locations Across the Site

	Passenger/Freight Train noise only (calculated)	Residual noise Taken from Table 1.	Ambient noise including all train movements (calculated)
Monitoring Location 2			
Daytime $L_{Aeq} = SEL + 10\log(N) - 10\log(T)$ Passenger train SEL = 71.0dB(A) No of Passenger Trains N = 49 Time period T = 16 hours = 57600 seconds	40.3	48.9	50.2
$L_{Aeq} = SEL + 10\log(N) - 10\log(T)$ Assumed freight train SEL = 81.0dB(A) No of Freight Trains N = 8 Time period T = 16 hours = 57600 seconds	42.4		
Night-time $L_{Aeq} = SEL + 10\log(N) - 10\log(T)$ Passenger train SEL = 71.0dB(A) No of passenger trains N = 5 Time period T = 8 hours = 28800 seconds	33.4	47.9	48.3
$L_{Aeq} = SEL + 10\log(N) - 10\log(T)$ Assumed freight train SEL = 81.0dB(A) No of freight trains N = 1 Time period T = 8 hours = 28800 seconds	36.4		

Appendix C
Summary of Train Movements

Appendix C: Summary of Train Movements Observed during the Noise Survey

Time	Approx No of Carriages	Type	Direction Travelling	Approx Speed (mph)	Measured SEL	Measured L _{MAX} dB
Monitoring Location 2						
0552	Not visible	Passenger	North	Not visible	66.3	57.2
0700	Not visible	Passenger	North	Not visible	71.0	58.4

Appendix D
CRTN Noise Prediction Calculations

Appendix C: CRTN Calculations

* Valid for d ≥ 4 metres

** Values from traffic data obtained from Ashley Helme Associates in April 2012

Stage 1		Stage 2				Stage 2		Stage 3				Stage 4				Stage 5																																
CRTN 1																																																
2012 Base																																																
Link	Receptor	Traffic Flow, Q veh/18- hour day**	L10 (18- hour) dB(A) (CRTN Chart 3)	Traffic Speed		HGV, p %**	Correction for Mean Traffic Speed, V, and Percentage Heavy Vehicles, p (CRTN Chart 4)	Road surface	Road Surface Correction (CRTN Para. 16)	Basic Noise Level dB(A)	Shortest horizontal distance, d (m)	Height of reception point relative to effective source position, h (m)	Shortest slant distance from the effective source position, d' (m) (CRTN Chart 7)	Distance Correction dB(A) (CRTN Chart 7)*	Average Height of Propagation, H (m) (Para 20.2 CRTN)	Absorbent Ground Cover, I (Para 20.4 CRTN)	Absorbent Ground Cover Correction dB(A) (CRTN Chart 8)	Propagation Correction dB(A) (CRTN Para. 26.1)	Façade Correction dB(A) (CRTN Para. 26.1)	Angle of view segment, θ (deg)	Angle of View Correction dB(A) (CRTN Chart 10)	Site Layout Correction dB(A)	Combined Noise Level dB(A)	Combined Façade Noise Level dB(A)																								
				Mean Speed, V mph**	Mean Speed, V km/h																																											
Hafod Road	Hafod House	1125	59.6	50	80.5	15.2	3.5	Impervious (SMA)	-1	62.1	16.0	1.2	19.5	-1.6	1.1	≥90	1.00	-3.0	-4.6	2.5	180.0	0.0	2.5	60.0	60.0																							
2019 without Dev																																																
Link	Receptor	Traffic Flow, Q veh/18- hour day**	L10 (18- hour) dB(A) (CRTN Chart 3)	Traffic Speed		HGV, p %**	Correction for Mean Traffic Speed, V, and Percentage Heavy Vehicles, p (CRTN Chart 4)	Road surface	Road Surface Correction (CRTN Para. 16)	Basic Noise Level dB(A)	Shortest horizontal distance, d (m)	Height of reception point relative to effective source position, h (m)	Shortest slant distance from the effective source position, d' (m) (CRTN Chart 7)	Distance Correction dB(A) (CRTN Chart 7)*	Average Height of Propagation, H (m) (Para 20.2 CRTN)	Absorbent Ground Cover, I (Para 20.4 CRTN)	Absorbent Ground Cover Correction dB(A) (CRTN Chart 8)	Propagation Correction dB(A) (CRTN Para. 26.1)	Façade Correction dB(A) (CRTN Para. 26.1)	Angle of view segment, θ (deg)	Angle of View Correction dB(A) (CRTN Chart 10)	Site Layout Correction dB(A)	Combined Noise Level dB(A)	Combined Façade Noise Level dB(A)																								
				Mean Speed, V mph**	Mean Speed, V km/h																																											
Hafod Road	Hafod House	762	57.9	50	80.5	15.2	3.5	Impervious (SMA)	-1	60.4	16.0	1.2	19.5	-1.6	1.1	≥90	1.00	-3.0	-4.6	2.5	180.0	0.0	2.5	58.3	58.3																							
2019 with Dev																																																
Link	Receptor	Traffic Flow, Q veh/18- hour day**	L10 (18- hour) dB(A) (CRTN Chart 3)	Traffic Speed		HGV, p %**	Correction for Mean Traffic Speed, V, and Percentage Heavy Vehicles, p (CRTN Chart 4)	Road surface	Road Surface Correction (CRTN Para. 16)	Basic Noise Level dB(A)	Shortest horizontal distance, d (m)	Height of reception point relative to effective source position, h (m)	Shortest slant distance from the effective source position, d' (m) (CRTN Chart 7)	Distance Correction dB(A) (CRTN Chart 7)*	Average Height of Propagation, H (m) (Para 20.2 CRTN)	Absorbent Ground Cover, I (Para 20.4 CRTN)	Absorbent Ground Cover Correction dB(A) (CRTN Chart 8)	Propagation Correction dB(A) (CRTN Para. 26.1)	Façade Correction dB(A) (CRTN Para. 26.1)	Angle of view segment, θ (deg)	Angle of View Correction dB(A) (CRTN Chart 10)	Site Layout Correction dB(A)	Combined Noise Level dB(A)	Combined Façade Noise Level dB(A)																								
				Mean Speed, V mph**	Mean Speed, V km/h																																											
Hafod Road	Hafod House	762	57.9	50	80.5	15.2	3.5	Impervious (SMA)	-1	60.4	16.0	1.2	19.5	-1.6	1.1	≥90	1.00	-3.0	-4.6	2.5	180.0	0.0	2.5	58.3	58.3																							
CRTN 2																																																
2012 Base																																																
Link	Receptor	Traffic Flow, Q veh/18- hour day**	L10 (18- hour) dB(A) (CRTN Chart 3)	Traffic Speed		HGV, p %**	Correction for Mean Traffic Speed, V, and Percentage Heavy Vehicles, p (CRTN Chart 4)	Road surface	Road Surface Correction (CRTN Para. 16)	Basic Noise Level dB(A)	Shortest horizontal distance, d (m)	Height of reception point relative to effective source position, h (m)	Shortest slant distance from the effective source position, d' (m) (CRTN Chart 7)	Distance Correction dB(A) (CRTN Chart 7)*	Average Height of Propagation, H (m) (Para 20.2 CRTN)	Absorbent Ground Cover, I (Para 20.4 CRTN)	Absorbent Ground Cover Correction dB(A) (CRTN Chart 8)	Propagation Correction dB(A) (CRTN Para. 26.1)	Façade Correction dB(A) (CRTN Para. 26.1)	Angle of view segment, θ (deg)	Angle of View Correction dB(A) (CRTN Chart 10)	Site Layout Correction dB(A)	Combined Noise Level dB(A)	Combined Façade Noise Level dB(A)																								
				Mean Speed, V mph**	Mean Speed, V km/h																																											
				Bangor Road																					6954	67.5	60	96.5	2.9	2.8	Impervious (SMA)	-1	69.3	17.5	1.2	21.0	-1.9	1.1	≥90	1.00	-3.2	-5.1	2.5	170.0	-0.2	2.3	66.5	
				A483 Northbound off Slip																					1777	61.6	40	64.4	4.7	0.2	Impervious (SMA)	-1	60.8	125.0	1.2	128.5	-9.8	1.1	≥90	1.00	-7.3	-17.1	2.5	140.0	-1.1	1.4	45.1	
A483 (Direct line of sight)	Edisbury Grange	45360	75.7	70	112.6	3.7	4.3	Impervious (SMA)	-1	79.0	150.0	1.2	153.5	-10.6	1.1	≥90	1.00	-7.7	-18.2	2.5	100.0	-2.6	-0.1	50.9	67.1																							
A483 (screened line of sight)		45360	75.7	70	112.6	3.7	4.3	Impervious (SMA)	-1	79.0	150.0	1.2	153.5	-10.6	1.1	≥90	1.00	-7.7	-18.2	2.5	40.0	-6.5	-4.0	56.7																								
																							67.1																									
2019 without Dev																																																
Link	Receptor	Traffic Flow, Q veh/18- hour day**	L10 (18- hour) dB(A) (CRTN Chart 3)	Traffic Speed		HGV, p %**	Correction for Mean Traffic Speed, V, and Percentage Heavy Vehicles, p (CRTN Chart 4)	Road surface	Road Surface Correction (CRTN Para. 16)	Basic Noise Level dB(A)	Shortest horizontal distance, d (m)	Height of reception point relative to effective source position, h (m)	Shortest slant distance from the effective source position, d' (m) (CRTN Chart 7)	Distance Correction dB(A) (CRTN Chart 7)*	Average Height of Propagation, H (m) (Para 20.2 CRTN)	Absorbent Ground Cover, I (Para 20.4 CRTN)	Absorbent Ground Cover Correction dB(A) (CRTN Chart 8)	Propagation Correction dB(A) (CRTN Para. 26.1)	Façade Correction dB(A) (CRTN Para. 26.1)	Angle of view segment, θ (deg)	Angle of View Correction dB(A) (CRTN Chart 10)	Site Layout Correction dB(A)	Combined Noise Level dB(A)	Combined Façade Noise Level dB(A)																								
				Mean Speed, V mph**	Mean Speed, V km/h																																											
				Bangor Road																					4487	65.6	60	96.5	2.9	2.8	Impervious (SMA)	-1	67.4	17.5	1.2	21.0	-1.9	1.1	≥90	1.00	-3.2	-5.1	2.5	170.0	-0.2	2.3	64.6	
				A483 Northbound off																					1535	61.0	40	64.4	4.7	0.2	Impervious (SMA)	-1	60.2	125.0	1.2	128.5	-9.8	1.1	≥90	1.00	-7.3	-17.1	2.5	140.0	-1.1	1.4	44.5	
A483 (Direct line of sight)	Edisbury Grange	47877	75.9	70	112.6	3.7	4.3	Impervious (SMA)	-1	79.2	150.0	1.2	153.5	-10.6	1.1	≥90	1.00	-7.7	-18.2	2.5	100.0	-2.6	-0.1	51.1	65.5																							
A483 (screened line of sight)		47877	75.9	70	112.6	3.7	4.3	Impervious (SMA)	-1	79.2	150.0	1.2	153.5	-10.6	1.1	≥90	1.00	-7.7	-18.2	2.5	40.0	-6.5	-4.0	57.0																								
																							65.5																									

2019 with Dev																									
Link	Receptor	Traffic Flow, Q veh/18- hour day**	L10 (18- hour) dB(A) (CRTN Chart 3)	Traffic Speed		HGV, p %**	Correction for Mean Traffic Speed, V, and Percentage Heavy Vehicles, p (CRTN Chart 4)	Road surface	Road Surface Correction (CRTN Para. 16)	Basic Noise Level dB(A)	Shortest horizontal distance, d (m)	Height of reception point relative to effective source position, h (m)	Shortest slant distance from the effective source position, d' (m) (CRTN Chart 7)	Distance Correction dB(A) (CRTN Chart 7)*	Average Height of Propagation, H (m) (Para 20.2 CRTN)	Absorbent Ground Cover % (Para 20.4 CRTN)	Absorbent Ground Cover, I (CRTN Chart 8)	Propagation Correction dB(A) (CRTN Para. 26.1)	Façade Correction dB(A) (CRTN Para. 26.1)	Angle of view segment, θ (deg)	Angle of View Correction dB(A) (CRTN Chart 10)	Site Layout Correction dB(A)	Combined Noise Level dB(A)	Combined Façade Noise Level dB(A)	
				Mean Speed, V mph**	Mean Speed, V km/h																				
Bangor Road East of A483	Edisbury Grange	4785	65.9	60	96.5	2.9	2.8	Impervious (SMA)	-1	67.7	17.5	1.2	21.0	-1.9	1.1	≥90	1.00	-3.2	-5.1	2.5	170.0	-0.2	2.3	64.8	65.7
A483 Northbound off Slip		1814	61.7	40	64.4	4.7	0.2	Impervious (SMA)	-1	60.9	125.0	1.2	128.5	-9.8	1.1	≥90	1.00	-7.3	-17.1	2.5	140.0	-1.1	1.4	45.2	
A483 (Direct line of sight)		48156	75.9	70	112.6	3.7	4.3	Impervious (SMA)	-1	79.3	150.0	1.2	153.5	-10.6	1.1	≥90	1.00	-7.7	-18.2	2.5	100.0	-2.6	-0.1	51.2	
A483 (screened line of sight)		48156	75.9	70	112.6	3.7	4.3	Impervious (SMA)	-1	79.3	150.0	1.2	153.5	-10.6	1.1	≥90	1.00	-7.7	-18.2	2.5	40.0	-6.5	-4.0	57.0	
																						65.7			

CRTN 3

2012 Base																									
Link	Receptor	Traffic Flow, Q veh/18- hour day**	L10 (18- hour) dB(A) (CRTN Chart 3)	Traffic Speed		HGV, p %**	Correction for Mean Traffic Speed, V, and Percentage Heavy Vehicles, p (CRTN Chart 4)	Road surface	Road Surface Correction (CRTN Para. 16)	Basic Noise Level dB(A)	Shortest horizontal distance, d (m)	Height of reception point relative to effective source position, h (m)	Shortest slant distance from the effective source position, d' (m) (CRTN Chart 7)	Distance Correction dB(A) (CRTN Chart 7)*	Average Height of Propagation, H (m) (Para 20.2 CRTN)	Absorbent Ground Cover % (Para 20.4 CRTN)	Absorbent Ground Cover, I (Para 20.4 CRTN)	Absorbent Ground Cover Correction dB(A) (CRTN Chart 8)	Propagation Correction dB(A) (CRTN Para. 26.1)	Façade Correction dB(A) (CRTN Chart 10)	Angle of view segment, θ (deg)	Angle of View Correction dB(A) (CRTN Chart 10)	Site Layout Correction dB(A)	Combined Noise Level dB(A)	Combined Façade Noise Level dB(A)
				Mean Speed, V mph**	Mean Speed, V km/h																				
Bangor Road West of Site Access	18 Unley Avenue	4594	65.7	30	48.3	2.3	-2.1	Impervious (SMA)	-1	62.7	10.0	1.2	13.6	0.0	1.1	≥90	1.00	-2.2	-2.2	2.5	180.0	0.0	2.5	62.9	62.9
																							62.9		

2019 without Dev																								
Link	Receptor	Traffic Flow, Q veh/18- hour day**	Traffic Speed		L10 (18- hour) dB(A) (CRTN Chart 3)	HGV, p %**	Correction for Mean Traffic Speed, V, and Percentage Heavy Vehicles, p (CRTN Chart 4)	Road surface	Road Surface Correction (CRTN Para. 16)	Basic Noise Level dB(A)	Shortest horizontal distance, d (m)	Height of reception point relative to effective source position, h (m)	Shortest slant distance from the effective source position, d' (m) (CRTN Chart 7)	Distance Correction dB(A) (CRTN Chart 7)*	Average Height H (m) (Para 20.2 CRTN)	Absorbent Ground Cover % (Para 20.4 CRTN)	Absorbent Ground Cover, I (CRTN Chart 8)	Propagation Correction dB(A) (Para. 26.1)	Façade Correction dB(A) (CRTN Chart 10)	Angle of view segment, θ (deg)	Angle of View Correction dB(A) (CRTN Chart 10)	Site Layout Correction dB(A)	Combined Noise Level dB(A)	Combined Façade Noise Level dB(A)
			Mean Speed, V mph**	Mean Speed, V km/h																				
Bangor Road West of Site Access	18 Unley Avenue	5056	30	48.3	66.1	2.3	-2.1	Impervious (SMA)	-1	63.1	10.0	1.2	13.6	0.0	1.1	≥90	1.00	-2.2	2.5	180.0	0.0	2.5	63.4	63.4
																							63.4	

2019 with Dev																									
Link	Receptor	Traffic Flow, Q veh/18- hour day**	L10 (18- hour) dB(A) (CRTN Chart 3)	Traffic Speed		HGV, p %**	Correction for Mean Traffic Speed, V, and Percentage Heavy Vehicles, p (CRTN Chart 4)	Road surface	Road Surface Correction (CRTN Para. 16)	Basic Noise Level dB(A)	Shortest horizontal distance, d (m)	Height of reception point relative to effective source position, h (m)	Shortest slant distance from the effective source position, d' (m) (CRTN Chart 7)	Distance Correction dB(A) (CRTN Chart 7)*	Average Height of Propagation, H (m) (Para 20.2 CRTN)	Absorbent Ground Cover % (Para 20.4 CRTN)	Absorbent Ground Cover, I (Para 20.4 CRTN)	Absorbent Ground Cover Correction dB(A) (CRTN Chart 8)	Propagation Correction dB(A)	Façade Correction dB(A) (Para. 26.1)	Angle of view segment, θ (deg)	Angle of View Correction dB(A) (CRTN Chart 10)	Site Layout Correction dB(A)	Combined Noise Level dB(A)	Combined Façade Noise Level dB(A)
				Mean Speed, V mph**	Mean Speed, V km/h																				
Bangor Road West of Site Access	18 Linley Avenue	5293	66.3	30	48.3	2.3	-2.1	Impervious (SMA)	-1	63.3	10.0	1.2	13.6	0.0	1.1	≥90	1.00	-2.2	-2.2	2.5	180.0	0.0	2.5	63.6	63.6
																							63.6		

PROPOSED RESIDENTIAL PREMISES

2019 with Dev																										
Link	Receptor	Traffic Flow, Q veh/18- hour day**	L10 (18- hour) dB(A) (CRTN Chart 3)	Traffic Speed		HGV, p %**	Correction for Mean Traffic Speed, V, and Percentage Heavy Vehicles, p (CRTN Chart 4)	Road surface	Road Surface Correction (CRTN Para. 16)	Basic Noise Level dB(A)	Shortest horizontal distance, d (m)	Height of reception point relative to effective source position, h (m)	Shortest slant distance from the effective source position, d' (m) (CRTN Chart 7)	Distance Correction dB(A) (CRTN Chart 7)*	Average Height of Propagation, H (m) (Para 20.2 CRTN)	Absorbent Ground Cover % (Para 20.4 CRTN)	Absorbent Ground Cover, I (Para 20.4 CRTN)	Absorbent Ground Cover Correction dB(A) (CRTN Chart 8)	Propagation Correction dB(A) (CRTN Para. 26.1)	Façade Correction dB(A) (CRTN Para. 26.1)	Angle of view segment, θ (deg)	Angle of View Correction dB(A) (CRTN Chart 10)	Site Layout Correction dB(A)	Combined Noise Level dB(A)	Combined Façade Noise Level dB(A)	
				Mean Speed, V mph**	Mean Speed, V km/h																					
Bangor Road West of Site Access	Proposed Residential	5293	66.3	60	96.5	2.4	2.7	Impervious (SMA)	-1	68.0	20.0	1.2	23.5	-2.4	1.1	≥90	1.00	-3.5	-5.9	2.5	130.0	-1.4	1.1		63.3	
Bangor Road East of Site Access	Proposed Residential	5411	66.4	60	96.5	4.1	3.0	Impervious (SMA)	-1	68.5	20.0	1.2	23.5	-2.4	1.1	≥90	1.00	-3.5	-5.9	2.5	40.0	-6.5	-4.0		58.6	65.3
Site Access	Proposed Residential Premises	2450	63.0	30	48.3	2	-2.2	Impervious (SMA)	-1	59.8	10.0	1.2	13.6	0.0	1.1	≥90	1.00	-2.2	-2.2	2.5	100.0	-2.6	-0.1		57.5	
																							65.3			

Drawing LE11510-001
Noise Monitoring Locations

REFERENCE



NOISE MONITORING LOCATION



BASE PLAN AND SITE BOUNDARY FROM DRAWING
2010-002/100, TITLED 'LOCATION PLAN', DATED 24.06.10,
PROVIDED BY THE CLIENT.

Gladman Developments Limited

DRAWING TITLE

ORG No.	SCALE	DATE
LE11510-001	1:2500 @ A3	25/03/13

PROGRAM BY	CHECKED BY	APPROVED BY
JV	GAH	MD
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