# 13 Noise and Vibration

## 13.1 Scope of the Assessment

13.1.1 This chapter considers the potential noise and vibration impacts resulting from the construction and operation of the Proposed Scheme.

13.1.2 The assessment of noise and vibration impacts has been undertaken in accordance with the requirements of the *Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7 HD 213/11 'Noise and Vibration'* (The Highways Agency et al., 2011) Detailed Assessment Methodology. Road traffic noise levels have been predicted in accordance with the guidance contained in the Department of Transport and Welsh Office publication *Calculation of Road Traffic Noise*, 1988 (CRTN) (Department of Transport, 1988) and, where appropriate, supplemented with the additional guidance contained in Annex 4 of HD 213/11 (The Highways Agency et al., 2011).

13.1.3 The objective of this chapter is to report the assessment of the noise and vibration impacts associated with the Proposed Scheme on Noise Sensitive Receptors (NSRs). In addition, this chapter provides a description, both qualitative and quantitative, of the existing noise climate in the area likely to be affected by the Proposed Scheme.

13.1.4 A map of the local area showing the Proposed Scheme, existing roads and the study area can be viewed in Figure 13.1.

### Study Area

13.1.5 Paragraph A1.11 of DMRB HD 213/11 sets out the process for defining the Study and Calculation Areas. The Study Area extends one kilometre from existing routes that are being improved or bypassed, and any proposed new routes. The Calculation Area is then defined as being the area that extends 600m from affected routes within the study area: where an affected route is defined as those routes predicted to experience a 1dB or more change in noise levels as a consequence of the Proposed Scheme in the Baseline Year. Roads where a change of at least 1 dB are predicted to occur can be determined by considering changes in traffic flow; where a 25% increase equates to an increase in noise of 1 dB and a 20% decrease in traffic flow equates to a 1 dB decrease in noise level.

13.1.6 The area outside the study area is known as the wider study area. The assessment of noise impacts in the wider study area is based on the CRTN Basic Noise Level prediction methodology.

13.1.7 Figure 13.1 shows the full extent of the calculation area and presents the road traffic network for which road traffic data was made available within this area.

## 13.2 Legislative, Regulatory and Planning Context

13.2.1 The noise and vibration assessment has been carried out with reference to the following documents:

- Design Manual for Roads and Bridges (DMRB) (The Highways Agency et al., 1993).

- Calculation of Road Traffic Noise (CRTN) (Department of Transport, 1988).
- The Noise Insulation (Scotland) Regulations 1975 (NISR).
- Memorandum on the Noise Insulation (Scotland) Regulations 1975 (Memorandum).
- Scot-TAG: Scottish Transport Appraisal Guidance (STAG).
- World Health Organisation, (WHO), Guidelines for Community Noise, 1999.

## 13.3 Consultation

13.3.1 Consultations were had with North Ayrshire Council. In particular noise monitoring locations and noise monitoring methods were agreed with the Council's Environmental Health Officer Hugh McGhee.

## 13.4 Methods of Assessment

### General

13.4.1 To assist in the understanding of the noise assessment it is useful to consider how noise is described quantitatively, and the mechanisms that generate noise and vibration associated with a flow of road traffic vehicles.

13.4.2 Sound is measured in terms of decibels (dB). The decibel is not an absolute unit of measurement. It is a ratio between a measured quantity and an agreed reference level. The measured quantity is the variation in atmospheric pressure and the reference level is taken as the lowest pressure to which a healthy ear is able to hear as sound i.e. $2 \times 10^{-5}$ Pa. In addition, it should be appreciated that, although the audible frequency range extends from 20 Hertz (Hz) to 20,000 Hz, the ear is not equally sensitive to sound across this range of frequencies and therefore corrections or "weightings" are applied to the measured linear levels to simulate the response of the ear. Consequently, the A-weighting is used to simulate the response of the human ear, so environmental noise is generally measured in terms of dB(A). Accordingly, with noise assessed as a logarithmic ratio of pressure levels, i.e. decibels, it is sometimes helpful to consider the relationship between the subjective evaluations of objective levels, as shown in Table 13.1.

*Table 13.1 Typical Noise Levels and Subjective Evaluation*

| Description | Noise Level dB(A) |
|---|---|
| Threshold of pain | 120 |
| Pneumatic drill (unsilenced); 7m distance | 95 |
| Heavy diesel lorry (40 km/h at 7m distance) | 83 |
| Modern twin-engine jet (at take-off at 152m distance) | 81 |
| Passenger car (60 km/h at 7m distance) | 70 |
| Office environment | 60 |
| Ordinary conversation | 50 |
| Library | 40 |
| Quiet bedroom | 35 |
| Threshold of hearing | 0 |

### Road Traffic Noise

13.4.3 In terms of noise, road traffic noise can be separated into two components. The first is generated by the engine, exhaust system and transmission and is the dominant noise source when traffic is not freely flowing. This is particularly apparent from heavy vehicles, when accelerating, braking or changing of gears, and this contributes a significant proportion of low frequency noise. The second noise source component is generated from the interaction of tyres with the road surface. This is the dominant noise source under free flow traffic conditions at moderate to high road speeds and contributes a significant proportion of higher frequency noise.

13.4.4 The sound from a stream of traffic at a reception point is an aggregation of noise from each of a number of vehicles at various distances. The factors that influence the noise level experienced by any listener include the volume of traffic, vehicle speed, the composition of the traffic (i.e. the percentage of heavy goods vehicles (HGVs)), the gradient and the surface characteristics of the carriageway. In addition to the aforementioned variables there is the actual propagation of the sound from the source to the receiver to consider. The propagation is affected by characteristics, such as the distance of the receptor from the source, the topography and characteristics of the ground between the source and receptor, the presence of any screening or barrier effects, and the wind strength and direction.

### Measurement of Road Traffic Noise

13.4.5 Noise from traffic on a road would change as traffic flows alter during the day and would also fluctuate within shorter time periods as vehicles pass the reception point. In order to compare situations with different traffic noise levels it is necessary to use an index to produce single figure estimates of overall noise levels. The index used for road traffic noise is $L_{A10,18h}$, which is the arithmetic mean value of the 'A' weighted noise levels, which are exceeded for 10% of the time in each of the 18 one hour periods between 06:00 hours and 00:00 hours (midnight). A reasonably good correlation has been shown to exist between traffic noise levels expressed in $L_{A10,18h}$ and residents' dissatisfaction with the noise over a wide range of values. In general, environmental noise is described in terms of the equivalent continuous sound pressure level $L_{Aeq,T}$.

### Traffic Induced Vibration

13.4.6 Traffic-induced vibration is a low frequency disturbance, which can be transmitted through the air or ground. Air-borne vibration from traffic is produced by the drive-train of the vehicle, the engines and exhausts, whereas ground-borne vibration is produced by the interaction between rolling wheels and the road surface.

13.4.7 There are two effects of traffic vibration that need to be considered, these being the effects on buildings and the disturbance caused to occupiers of properties. Extensive research has been carried out on a range of buildings of various ages and types, and no evidence has been found to support the theory that traffic-induced ground-borne vibration is a source of significant damage to buildings (Department of Transport, 1988). Ground-borne vibration is also much less likely to be the cause of disturbance to occupiers than air-borne vibration (Baughan & Martin, 1981; and Watts, G.R., 1984). DMRB states: 'Normal use of buildings such as closing of doors, walking on suspended wooden floors and operating domestic appliances can generate similar levels of vibration to that from traffic'

13.4.8 Nor is there any evidence that traffic induced air-borne vibration can cause even minor damage to buildings. However, it can be a source of annoyance to local people, causing vibrations of flexible elements within the building, such as doors, windows and, on occasions, floors of properties close to the carriageway. The issue of nuisance at properties caused by vibration has been evaluated.

### Baseline Methods

13.4.9 To obtain an overview of the existing ambient noise climate, environmental noise surveys have been undertaken in March, April and May 2008 and supplemented with additional measurements during October 2012. Twenty one locations, as identified in Table 13.2 below, have been used as sample receptors for the baseline measurements. A Schematic of the Calculation Area, with the twenty one baseline monitoring locations are presented in Figure 13.1. A summary of the measurement results of the baseline monitoring are presented in Section 13.5.2. Site notes, measurement data and photographs are presented in Appendix 13.1 and 13.2.

*Table 13.2 Baseline Monitoring Locations*

| ID | Location | Measurement Time Period* | Grid Reference | |
|---|---|---|---|---|
| | | | Easting | Northing |
| 1 | Easter Highfield | 2008 (daytime and evening)<br>2012 (daytime and night time) | 231374 | 650463 |
| 2 | Pasturehill Cottage | 2008 (daytime and evening) | 231227 | 650406 |
| 3 | Greenacre | 2008 (daytime and evening)<br>2012 (daytime) | 230894 | 650148 |
| 4 | Suilven | 2008 (daytime and evening)<br>2012 (daytime) | 230839 | 650079 |
| 5 | Highfield Farm | 2008 (daytime and evening)<br>2012 (daytime and night time) | 231099 | 650054 |
| 6 | Highfield Cottage | 2008 (daytime and evening)<br>2012 (night time) | 23130 | 650038 |
| 7 | Jimmary Lodge (2008) /<br>1 Carsehead (2012) | 2008 (daytime and evening)<br>2012 (night time) | 230363 | 650004 |
| 8 | Glenfield | 2008 (daytime and evening)<br>2012 | 230406 | 649776 |
| 9 | 8 Blair Road | 2008 (daytime and evening)<br>2012 (night time) | 229890 | 649137 |
| 10 | 42 Blair Road | 2008 (daytime and evening)<br>2012 (daytime) | 230041 | 649063 |
| 11 | 78 Blair Road | 2008 (daytime and evening)<br>2012 (daytime) | 230208 | 648979 |
| 12 | 40 Kerse Avenue | 2008 (daytime and evening)<br>2012 (night time) | 230284 | 649118 |
| 13 | 71 Baidland Road | 2008 (daytime and evening) | 230033 | 648771 |
| 13a | Proxy location for 71 Baidland Road and Blairlands Farm | 2012 (daytime and night time) | 230044 | 648733 |
| 14 | Stoopshill Farm | 2008 (daytime and evening)<br>2012 (daytime and night time) | 230438 | 648863 |
| 15 | North Lodge (Blair Estate) | 2008 (daytime) | 230520 | 648810 |

| ID | Location | Measurement Time Period* | Grid Reference | |
|---|---|---|---|---|
| | | | Easting | Northing |
| 16 | The Main House (Blair Estate) | 2008 (daytime) | 230453 | 648029 |
| 17 | The Carriage House (Blair Estate) | 2008 (daytime) | 230476 | 647902 |
| 18 | Hillend Farm | 2008 (daytime and evening)<br>2012 (daytime and night time) | 229424 | 648106 |
| 19 | Open Land Adjacent to Greenacre | 2008 (daytime and evening)<br>2012 (daytime) | 230876 | 650121 |
| 20 | The Bungalow | 2012 (24hr logger) | 230886 | 650082 |
| 21 | 25 Baidland Avenue | 2012 (24hr logger) | 230153 | 648880 |

**Actual time periods are presented in Appendix 13.1*

13.4.10 In addition to the sample measurement locations, all properties within the study area have been identified and land usage assigned using AddressPoint data. The property usages have been categorised as follows:

- Residential;
- Industrial/Commercial;
- Industrial,
- Commercial;
- Educational;
- Health;
- Religious; and
- Amenity.

13.4.11 In addition to identifying property usage, where possible, potential noise sensitive community facilities/areas were also identified. A summary list of these community facilities/areas is provided in Table 13.3 and can be viewed in Figures 13.2a and 13.2b. Where relevant, Table 13.3 details the approximate total area, general location and the approximate grid reference for each community facility/area identified.

*Table 13.3 Community Facilities/Areas*

| ID | Name | Location | Grid Reference | | Total Area ($m^2$) or Length (m) |
|---|---|---|---|---|---|
| | | | Easting | Northing | |
| 1 | Dalry Trinity Church | North Street | 229207 | 649501 | 350 |
| 2 | Public Library | North Street | 229230 | 649465 | 224 |
| 3 | St. Margarets Church | North Street | 229160 | 649545 | 590 |
| 4 | Catholoic Church | Aitken Street | 229315 | 649285 | 1351 |
| 5 | Dalry Primary Scool | Sharon Street | 228927 | 649373 | 1203 |
| 6 | St. Palladius Primary School | Roche Way, Dalry | 229071 | 649307 | 725 |
| 7 | Nursary School | Near Vennel Street | 228884 | 649248 | 370 |

| ID | Name | Location | Grid Reference | | Total Area ($m^2$) or Length (m) |
|---|---|---|---|---|---|
| | | | Easting | Northing | |
| 8 | Healthcente | Vennel Street | 228995 | 649189 | 681 |
| 9 | Community Centre | St Margaret Avenue | 228816 | 649150 | 696 |
| 10 | Dalry Football Ground | St Margaret Avenue | 228867 | 649099 | 7958 |
| 11 | Dalry Train Station | Bridgend Lane | 229736 | 649209 | 1692 |
| 12 | Conservation Area | east of Roche Way | 229230 | 649411 | 59697 |
| 13 | SWT Wildife Site | | 229545 | 648747 | 197774 |
| 14 | Lynn Spout Geological SSSI | north-west of B714 | 228298 | 648446 | 34608 |
| 15 | SWT Provisional Wildlife Site | | 231510 | 648859 | 109088 |
| 16 | SWT Provisional Wildife Site | | 230592 | 648120 | 687074 |
| 17 | Historic Gardens | Blair Estate | 230468 | 648079 | 802718 |
| 18 | SWT Provisional Wildlife Site | | 229449 | 647403 | 237408 |
| - | Woodland Areas | various | n/a | n/a | 1259587 |
| - | Cycle Routes | various | n/a | n/a | 8309 |
| - | Foot Paths | various | n/a | n/a | 15086 |

**these are potentially noise sensitive public right of ways that have been identified. The grid reference is the approximate mid-point of the route.*

13.4.12 The identified Health and Educational buildings, their address and approximate grid references are presented in Table 13.4. A graphic showing the locations of these buildings is presented as Figure 13.4a.

*Table 13.4 List of Health and Educational Establishments Within the Study Area*

| ID | Name | Address | Usage | Grid Reference | |
|---|---|---|---|---|---|
| | | | | Easting | Northing |
| 1 | Dental Surgery | New Street | Healthcare | 229246 | 649451 |
| 2 | Dalry Primary School | Sharon Street | Educational | 228927 | 649373 |
| 3 | St. Palladius Primary School | Roche Way | Educational | 229071 | 649307 |
| 4 | AAHB Community Healthcare NHS Trust | Vennel Street | Healthcare | 228982 | 649213 |

## Requirements of a DMRB Detailed Assessment

13.4.13 To assess the potential noise and vibration impacts for the DMRB Detailed Assessment it is necessary to compare noise levels for the following scenarios:

- Do Minimum scenario in the Baseline Year (2016 DM) versus the Do Minimum scenario in the Future Year (2031 DM);
- Do Minimum scenario in the Baseline Year (2016 DM) versus the Do Something Scenario in the Baseline Year (2016 DS); and
- Do Minimum scenario in the Baseline Year (2016 DM) versus the Do Something scenario in the future assessment year (2031 DS).

13.4.14 The Do-Minimum Scenario refers to the road network as it would exist without the proposed road scheme, and the Do-Something scenario refers to the road network with the Proposed Scheme in place.

13.4.15 The detailed assessment also assesses changes in noise and traffic induced vibration nuisance.

### Impact Assessment Methods

13.4.16 Whilst DMRB does not provide guidance on assessing the significance of effects, the reported noise impacts have been assessed using a significance of noise impacts that is based on the predicted noise levels; the magnitude of noise level change between compared scenarios; and the sensitivity of noise receptors. The criteria used to classify the sensitivity of receptors to noise impacts associated with the Proposed Scheme are defined in Table 13.5 the magnitude of impacts in Table 13.6 and Table 13.7; and the significance of impact in Table 13.8.

### Sensitivity of Noise Sensitive Receptors

13.4.17 The sensitivity of receptors to traffic noise and vibration has been determined based on the criteria provided in Table 13.5.

*Table 13.5 Criteria used to Define Noise Sensitive Receptors*

| Sensitivity | Description | Examples of Receptor Usage |
|---|---|---|
| High | Receptors where people or operations are particularly susceptible to noise | - Residential<br>- Quiet outdoor areas used for recreation<br>- Conference facilities<br>- Auditoria/studios<br>- Schools in daytime<br>- Hospitals/residential care homes |
| Medium | Receptors moderately sensitive to noise, where it may cause some distraction or disturbance | - Offices<br>- Restaurants<br>- Health Centres / Dentists<br>- Sports grounds when spectator or noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf) |
| Low | Receptors where distraction or disturbance from noise is minimal | - Residences and other buildings not occupied during working hours.<br>- Factories and working environments with existing high noise levels.<br>- Sports grounds when spectator or noise is a normal part of the event. |

### Magnitude of Road traffic Noise Impacts

13.4.18 When considering two sounds with similar acoustic properties, i.e. similar spectral and temporal characteristics, a change of more than 3 dB(A) is regarded as being just perceptible to the human ear. The magnitude of impact can therefore be based on this acoustic ‘rule of thumb’, supplemented with the evidence contained within DMRB Vol. 11, Section 3, Part 7, Chapter 3, Paragraph 3.5. The latter highlights that ‘people are more sensitive to abrupt changes in traffic noise associated with new road schemes than would be predicted from the steady state evidence. In the period following a change in traffic flow, people may find benefits or dis-benefits when the noise changes are as small as 1 dB(A)'.

13.4.19 The magnitude of impact has been assessed by comparing the increase or decrease in noise levels between compared scenarios. The magnitude of noise impacts associated with road traffic noise is defined in DMRB HD 213/11 (Table 3.1 and 3.2); and reproduced in Table 13.6 (short term) and Table 13.7 (Long Term). Changes in noise level can either be increases or decreases. The sensitivity of receptors to traffic noise and vibration has been determined based on the criteria provided in Table 13.5, above.

*Table 13.6 Magnitude of Impacts due to Changes in Road Traffic Noise (Short Term)*

| Noise Level Change (rounded to 0.1 dB) dB $L_{A10,18hr}$ | Magnitude of Impact |
|---|---|
| 0 | No change |
| 0.1 – 0.9 | Negligible |
| 1 – 2.9 | Minor |
| 3 – 4.9 | Moderate |
| 5+ | Major |

*Table 13.7 Magnitude of Impacts due to Changes in Road Traffic Noise (Long Term)*

| Noise Level Change (rounded to 0.1 dB) dB $L_{A10,18hr}$ | Magnitude of Impact |
|---|---|
| 0 | No change |
| 0.1 – 2.9 | Negligible |
| 3 – 4.9 | Minor |
| 5 – 9.9 | Moderate |
| 10+ | Major |

## Significance of Noise Impacts

13.4.20 The significance of noise impacts was determined according to the relationship between magnitude and sensitivity, as shown in Table 13.8 below.

*Table 13.8 Significance of Noise Impacts*

| Magnitude | Sensitivity | | |
|---|---|---|---|
| | 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 |

## Predicting Noise Levels

13.4.21 All predicted road traffic noise levels have been calculated using the CadnaA© noise prediction software, which predicts the $L_{A10,18hr}$ traffic noise level at receptor locations in accordance with the CRTN (Department of Transport, 1988) and the supplementary guidance contained in Annex 4 of DMRB HD 213/11. CadnaA© models have been produced for the Do-Minimum and Do-Something Scenarios for both the Baseline Year (2016) and Future Year (2031). The only noise mitigation included in the noise model is that from existing and Proposed Scheme earthworks, and a low noise road surface for new roads, for example, SMA. All calculations are based on the predicted traffic flows and associated variables as supplied in the form of 18 Hour AAWT (Annual Average Weekday Traffic) for the Baseline and Future Years. Additional input data included annual average speeds (km/h) and HGV percentages for the relevant scenarios and years.

13.4.22 Historically, assuming that there is much less traffic at night has meant that night-time noise assessments have not been undertaken as part of the DMRB process. However, due to the increasing use of the strategic road network by long distance goods traffic during night-time hours and the associated potential to increase the level of noise and the perception of nuisance at night, a night-time noise impact assessment is now to be considered as part of the DMRB assessment process where an $L_{night,\ outside}$ noise level is greater than 55 dB and there is a noise level increase of 3dB $L_{night,\ outside}$ in the long term.

13.4.23 The TRL report 'Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping' (Abbott & Nelson, 2002) has been used to derive the night-time noise levels for each scenario. Method 3 of the TRL report has been used to convert the predicted daytime noise levels ($L_{A10,18h}$) to equivalent $L_{night,outdoors}$ noise levels.

13.4.24 The CadnaA noise prediction software was used to create 3-D noise models. The digital terrain model (dtm) consisted of data from the MX road design model, local survey data and supplemented by nextmap 5m grid data.

13.4.25 All buildings were assumed to be two storeys, with a default height of 8m.

13.4.26 With regard to ground absorption factors (G), residential areas were assumed to have G=0.5, open and agricultural land G = 1, and all other areas, for example roads G = 0.

### Noise Nuisance Assessment

13.4.27 The term 'nuisance' in DMRB HD 213/11 is defined as the percentage of people bothered by traffic noise (i.e. those who say they are 'very much' or 'quite a lot' bothered on a four point worded scale). The DMRB method of assessing traffic noise and vibration nuisance is outlined in Annex 6 of HD 213/11.

13.4.28 DMRB HD 213/11 states that the change in noise nuisance is to be carried out for each property where noise calculations have been undertaken. Due to variability in individual responses, DMRB HD 213/11 recommends that community annoyance ratings are used for each noise level. It is therefore important to note that the results of the DMRB HD 213/11 nuisance assessment should not be related to individual annoyance responses.

13.4.29 Noise nuisance is often defined as 'a feeling of displeasure evoked by noise', see, for example, the World Health Organization (WHO) 'Guidelines for Community Noise' (World Health Organization, 1999).

### Vibration

13.4.30 The DMRB Detailed Assessment requires an assessment of traffic induced vibration, including the assessment of the number of people bothered by airborne vibration. It should be appreciated that the vibration assessments are for comparison purposes only and, as such, are not indicative of an individual response. Also as recommended within DMRB, only properties within approximately 40m of the centre line which have predicted or measured traffic noise levels greater than 58 dB $L_{A10,18hr}$ have been included.

13.4.31 With regard to groundborne vibration, this should be assessed if considered to be a potential problem adjacent to existing roads. TRL report 246 (Watts, G.R., 1990) indicates that groundborne vibration should not be a problem for residents located adjacent to smooth and well maintained road surfaces free of discontinuities and potholes.

13.4.32 Within the vicinity of the Proposed Scheme there are no known complaints of groundborne vibration due to road traffic. Moreover, should in the future groundborne vibration complaints arise, it is likely that following suitable carriageway repairs these would desist. Hence, road traffic induced ground borne vibration is not considered to be of significance for the Proposed Scheme.

### Threshold for Mitigation

13.4.33 As best practice, mitigation would be implemented, where practicable, where the significance of impact is 'Slight/Moderate Adverse' or worse at ground floor. This is an onerous target as mitigation is therefore considered where there is an increase of greater than 1dB in the short term (in recognition of the sudden change effects as reported within DMRB), or 3dB in the long term, irrespective of the absolute noise level, and must be applied with caution in rural areas where there are at present no traffic sources.

13.4.34 For guidance on the onset of effects, reference can be made to the current WHO document entitled 'Community Noise' (WHO, 1999). This document does not contain recommendations, but provides guideline values based on the precautionary principle. The WHO document states that 'To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise should not exceed 55dB $L_{Aeq}$ on balconies, terraces and in outdoor living areas. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound level should not exceed 50dB $L_{Aeq}$. Where it is practical and feasible, the lower outdoor sound level should be considered the maximum desirable sound level for new development'.

13.4.35 The WHO refers to a daytime time base of 16 hours ($L_{Aeq,16hr}$, and CRTN predictions are in terms of $L_{A10,18h}$. To translate the WHO $L_{Aeq,16h}$ to $L_{A10,18h}$ a correction of approximately +2dB is required, with a further +2.5dB necessary to translate into façade levels. This translation applied to 55dB $L_{Aeq,16h}$ gives an equivalent threshold façade level of 59.5dB $L_{A10,18h}$.

13.4.36 In addition, it is necessary that in all cases where it is considered, mitigation should comply with acceptable standards in terms of traffic, safety, environmental and economic issues (DMRB Volume 11, Section 3, Part 7, Chapter 4 – Design and

Mitigation, Paragraph 4.10). Examples which could preclude the use of mitigation are disproportionate cost and unacceptable visual impact.

13.4.37 In summary, taking into account the above WHO and DMRB guidance, mitigation should be considered where the significance of impact at a receptor has been assessed as Slight/Moderate Adverse or worse, and where the predicted façade level exceeds 59.5dB $L_{A10,18h}$.

### Construction Noise

*BS 5228: Noise and Vibration Control on Construction and Open Sites*

13.4.38 Guidance on the approach to control construction noise is contained within British Standard BS 5228: Part 1:1997 and Part 4:1992 Noise and Vibration Control on Construction and Open Sites[1]. BS 5228 states that *'Good relations with people living and working in the vicinity of site operations are of paramount importance'*. It suggests that the early establishment and maintenance of these relations throughout the contract would go some way to allaying people's fears.

13.4.39 The standard also advises that it is not possible to provide detailed guidance for determining whether or not noise from a site would constitute a problem in a particular situation as a number of factors would affect the acceptability of the site noise and vibration. These factors are:-

- site location
- existing ambient noise and vibration levels
- duration of site operations
- hours of work
- attitude to site operator
- noise and vibration characteristics
- effect on buildings

13.4.40 The level of noise experienced by inhabitants in the vicinity would vary according to the following factors:

- sound power outputs of processes and plant
- periods of operation of processes and plant
- distances from source to receiver
- presence of screening by barriers
- reflection of sound associated with topographical features
- phasing/programming of demolition works
- soft ground attenuation

[1] It should be noted that a new version of BS 5228 came into force on 1st Jan 2009. At present the existing 1997 version is still officially approved under Section 71 of the Control Of Pollution Act 1974 via "The Control of Noise (Codes of Practice for Construction and Open Sites) (England) Order 2002 and equivalent legislation in Scotland and Wales. BS5228:1997" is therefore still referred to within this assessment.

- meteorological factors

*Control of Pollution Act 1974*

13.4.41 To facilitate accurate prediction of noise levels it is necessary to know working methods, timing and phasing of the works and the number and type of plant likely to be used. At this stage such information is not available.

13.4.42 However, should the scheme proceed and a Contractor be appointed an assessment would be required. Whilst residents may accept that it is inevitable that, as with any major infrastructure development, there would be some disturbance caused to those living nearby during the construction phase and that the provisions of sections 60 and 61 of the Control of Pollution Act 1974 offers some protection to them. Section 60 enables a local authority to serve a notice specifying its noise control requirements covering:

- Plant or machinery that is or is not to be used
- Hours of working
- Levels of noise or vibration that can be emitted.

13.4.43 Section 61 relates to prior consent, and is for situations where a contractor or developer takes the initiative and approaches the local authority before work starts to obtain approval for the methods to be used and any noise and vibration control techniques that may be required. North Ayrshire Council is unlikely to encourage this form of prior consent and would usually request that the contractor adopt and demonstrate best practicable means.

13.4.44 The term 'Best Practicable Means' is defined in Section 72 of the Control of Pollution Act where 'practicable' means reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications'. North Ayrshire Council are also unlikely to apply fixed levels as part of any requirement or planning condition in relation to noise. However, levels can be used as guidance. Guidance for noise from construction sites used elsewhere in the country can be found in Table 13.9, below.

*Table 13.9 Guidance on Construction Noise Limits*

| Pre Contract Ambient Noise Levels $L_{Aeq,2h}$ (08.00-10.00 19.00-21.00 or as appropriate) (Façade) | Time Periods | | | | | | |
|---|---|---|---|---|---|---|---|
| | Weekday working Monday to Friday excluding Public Holidays | | | | | Saturday | Sunday / Public Holidays |
| | Day (07.00-19.00) *$L_{Aeq,12hr}$ | $L_{Amax,F}$ | Evening (19.00-22.00) *$L_{Aeq,3hr}$ | $L_{Amax,F}$ | Night Hours (22.00-07.00) | | |
| 35 | 65 | 86 | 55 | 65 | Given on request | As week-day | Given on request |
| 40 | 65 | 86 | 55 | 65 | | | |
| 45 | 65 | 86 | 60 | 70 | | | |
| 50 | 70 | 92 | 60 | 70 | | | |
| 55 | 75 | 96 | 65 | 75 | | | |
| 60 | 75 | 96 | 65 | 75 | | | |
| 65 | 75 | 96 | 65 | 75 | | | |
| 70 | 80 | 101 | 80 | 90 | | | |
| 75 | 80 | 101 | 80 | 90 | | | |

**Façade Level*

### Construction Vibration

13.4.45 BS 5228: 2009 also provides recommendations for basic methods of vibration control and assessment of impacts relating to construction and open sites where work activities/operations generate significant vibration levels, including industry specific guidance. With consideration to the nature and size of the development as well as the likely construction processes, it is considered that piling processes are the only on site activities that have the potential to give rise to significant vibration impacts.

13.4.46 It is anticipated that all piling would be of the rotary bored type, or Continuous Flight Auger (CFA) rigs which typically generates lower levels of vibration than other forms of piling, such as driven piles. The use of these techniques coupled with the relative distance between the likely piling locations and the sensitive receptors means piling vibration problems are considered unlikely.

### Indication of Any Difficulties Encountered

13.4.47 No difficulties that were not satisfactorily resolved arose during the assessment.

## 13.5 Baseline Conditions

### Ambient Noise Levels

13.5.1 It is not strictly a requirement of DMRB to monitor ambient noise for this Proposed Scheme since changes in noise annoyance to local residents is undertaken by predictive methods for both the 'Do-Minimum' and 'Do-Something' scenarios. However, ambient noise level monitoring allows observation of local noise sources in addition to road traffic and ultimately enables a comparison between road traffic noise levels predicted for the baseline year and those measured, and may also be useful for demolition and construction noise assessments.

13.5.2 As previously mentioned in Section 13.4.9, environmental noise measurements have been carried out in 2008 and 2012 at a total of twenty one monitoring locations in the vicinity of the proposed Dalry Bypass scheme. At each location, representative noise level measurements were undertaken during various times of the day. Appendix 13.1

and 13.2 provide site notes, photographs and noise levels measured at each of the monitoring locations, while the details of the equipment used and serial numbers can be found in Appendix 13.3. The survey results are summarised in Table 13.10 and Table 13.11 below.

*Table 13.10 Summary of Baseline Noise Monitoring (during March, April and/or May 2008) (Free Field Noise Levels)*

| ID | Representative Location | Time Period* | Measurement Duration | Free Field Noise Level (dB) | | |
|---|---|---|---|---|---|---|
| | | | | $L_{Aeq,T}$ | $L_{A10,T}$ | $L_{A90,T}$ |
| 1 | Easter Highfield (at residential property) | Daytime | 00:30 | 58.7 | 63.2 | 40.9 |
| | | Evening | | 59.4 | 63.8 | 40.1 |
| 2 | Pasturehill Cottage | Daytime | 00:30 | 77.0 | 82.4 | 42.7 |
| | | Evening | | 80.6 | 85.5 | 53.7 |
| 3 | Greenacre | Daytime | 00:30 | 48.3 | 51.9 | 37.8 |
| | | Evening | | 50.1 | 51.9 | 39.6 |
| 4 | Suilven | Daytime | 00:30 | 60.8 | 59.3 | 46.2 |
| | | Evening | | 61.0 | 60.8 | 48.1 |
| 5 | Highfield Farm | Daytime | 00:30 | 51.1 | 53.6 | 45.9 |
| | | Evening | | 50.2 | 52.8 | 45.0 |
| 6 | Highfield Cottage | Daytime | 00:30 | 54.3 | 49.3 | 38.5 |
| | | Evening | | 56.9 | 53.8 | 41.3 |
| 7 | Jimmary Lodge / 1 Carsehead | Daytime | 00:30 | 52.2 | 52.7 | 44.7 |
| | | Evening | | 51.8 | 54.1 | 44.9 |
| 8 | Glenfield | Daytime | 00:30 | 61.9 | 65.7 | 49.0 |
| | | Evening | | 62.7 | 66.1 | 50.9 |
| 9 | 8 Blair Road | Daytime | 00:30 | 51.6 | 54.9 | 41.5 |
| | | Evening | | 52.7 | 56.7 | 43.3 |
| 10 | 42 Blair Road | Daytime | 00:30 | 53.6 | 57.8 | 40.6 |
| | | Evening | | 54.7 | 58.3 | 42.6 |
| 11 | 78 Blair Road | Daytime | 00:30 | 55.6 | 55.4 | 37.8 |
| | | Evening | | 52.3 | 53.1 | 39.6 |
| 12 | 40 Kerse Avenue | Daytime | 00:30 | 44.2 | 45.0 | 38.0 |
| | | Evening | | 41.5 | 42.6 | 34.7 |
| 13 | 71 Baidland Road | Daytime | 00:30 | 51.4 | 47.4 | 37.4 |
| | | Evening | | 47.6 | 48.8 | 39.0 |
| 14 | Stoopshill Farm | Daytime | 00:30 | 59.2 | 56.7 | 40.2 |

| ID | Representative Location | Time Period* | Measurement Duration | Free Field Noise Level (dB) | | |
|---|---|---|---|---|---|---|
| | | | | $L_{Aeq,T}$ | $L_{A10,T}$ | $L_{A90,T}$ |
| | | Evening | | 57.3 | 52.2 | 43.3 |
| 15 | North Lodge (Blair Estate) | Daytime | 00:30 | 46.0 | 50.1 | 31.9 |
| 16 | The Main House (Blair Estate) | Daytime | 00:30 | 46.0 | 49.2 | 39.4 |
| 17 | The Carriage House (Blair Estate) | Daytime | 00:30 | 52.8 | 52.8 | 39.3 |
| 18 | Hillend Farm | Daytime | 00:30 | 68.3 | 73.1 | 51.3 |
| | | Evening | | 67.5 | 72.6 | 50.8 |
| 19 | Open Land Adjacent to Greenacre | Daytime | 00:30 | 57.0 | 58.2 | 43.4 |
| | | Evening | | 51.6 | 54.9 | 37.1 |

*Table 13.11 Summary of Baseline Noise Monitoring (during October 2012)*

| ID | Representative Location | Time Period* | Measurement Duration | Noise Level (dB) | | |
|---|---|---|---|---|---|---|
| | | | | $L_{Aeq,T}$ | $L_{A10,T}$ | $L_{A90,T}$ |
| 1 | Easter Highfield (4m from the A737 during daytime and 3.5m from the residential property during night time) | Daytime | 1 hour (representative) | 75.0 | 80.4 | 43.7 |
| | | | 1 hour | 74.7 | 80.1 | 44.5 |
| | | | 1 hour (representative) | 75.8 | 81.1 | 46.2 |
| | | Night time | 15 min | 53.9 | 58.6 | 29.8 |
| | | | | 45.8 | 46.3 | 21.9 |
| | | | | 57.3 | 60.8 | 46.4 |
| 3 | Greenacre | Daytime | 15 min | 54.0 | 57.0 | 47.8 |
| 4 | Suilven | Daytime | 15 min | 57.7 | 58.4 | 47.4 |
| 5 | Highfield Farm | Daytime | 15 min | 51.5 | 54.5 | 43.8 |
| | | Night time | | 43.9 | 48.1 | 31.5 |
| | | | | 40.2 | 44.5 | 26.7 |
| 6 | Highfield Cottage | Night time | 15 min | 50.1 | 51.7 | 32.1 |
| | | | | 38.2 | 41.7 | 26.9 |
| 7 | Jimmary Lodge / 1 Carshead | Night time | 15 min | 47.3 | 51.9 | 31.2 |
| | | | | 43.0 | 46.5 | 32.8 |
| 9 | 8 Blair Road | Night time | 15 min | 36.8 | 38.7 | 34.6 |
| | | | | 45.9 | 47.2 | 38.4 |
| 10 | 42 Blair Road | Daytime | 15 min | 51.2 | 54.4 | 39.7 |
| 11 | 78 Blair Road | Daytime | 15 min | 51.4 | 50.9 | 39.4 |
| 12 | 40 Kerse Avenue | Night time | 15 min | 37.8 | 39.5 | 31.2 |
| | | | | 34.4 | 36.9 | 28.9 |
| 13a | Proxi location for 71 Baidland Road and Blairlands Farm | Daytime | 15 min | 40.4 | 42.3 | 34.7 |
| | | Night time | | 31.7 | 32.7 | 29.6 |

| ID | Representative Location | Time Period* | Measurement Duration | Noise Level (dB) | | |
|---|---|---|---|---|---|---|
| | | | | $L_{Aeq,T}$ | $L_{A10,T}$ | $L_{A90,T}$ |
| | | | | 34.8 | 37.1 | 30.4 |
| 14 | Stoopshill Farm | Daytime | 15 min | 52.3 | 47.3 | 37.0 |
| | | Night time | | 35.9 | 38.3 | 31.6 |
| | | | | 36.6 | 39.0 | 32.2 |
| 18 | Hillend Farm | Daytime | 1 hour | 74.3 | 79.2 | 52.1 |
| | | | | 75.4 | 80.0 | 53.6 |
| | | | | 76.4 | 81.3 | 58.0 |
| | | Daytime | 15 min | 47.2 | 33.7 | 29.1 |
| | | | | 60.5 | 65.3 | 38.0 |
| 19 | Open Land Adjacent to Greenacre | Daytime | 15 min | 54.5 | 57.8 | 45.4 |
| 20 | The Bungalow (24 hour noise logger location) | Daytime | 18 hour | 51.1 | 53.9 | 42.2 |
| | | | 16 hour | 51.3 | 54.0 | 43.3 |
| | | Night time | 8 hour | 45.4 | 50.4 | 25.5 |
| 21 | 25 Baidland Avenue (24 hour noise logger location) | Daytime | 18 hour | 46.5 | 46.6 | 31.5 |
| | | | 16 hour | 47.0 | 47.2 | 32.8 |
| | | Night time | 8 hour | 34.0 | 35.6 | 25.9 |

**Actual start times are provided in Appendix 13.1*

## 13.6 Predicted Impacts

### Construction Phase

13.6.1 Temporary impacts for road schemes normally occur between the start of advance works and the end of construction period. Although temporary, construction-related impacts can be significant due to the increase in noise and vibration.

13.6.2 Construction work of any type that involves heavy plant activities would generate noise, which may result in complaints if sensitive scheduling and control of works is not exercised. The noise levels generated by construction activities and experienced by nearby sensitive receptors such as residential properties, depends upon a number of variables, the most significant of which are:

- the noise generated by plant or equipment used on site, generally expressed as sound power levels (SWL);
- the periods of operation of the plant on the site, known as its ‘on-time’;
- the distance between the noise source and the receptor; and
- the attenuation due to ground absorption, air absorption and barrier effects.

13.6.3 In order to evaluate the noise during the demolition, blasting and construction phase it is necessary to have knowledge of the various activities that would be undertaken. Demolition and construction contractors may use different working methods and plant to achieve the same ends. An accurate demolition and construction noise and vibration impact assessment is not normally possible until appointment of the approved contractor with knowledge of the exact working routine and plant schedule. However, during the construction phase the use of plant, and the likely noise impact thereof, would be determined following the guidance detailed in BS 5228:2009 (BSI, 2009) and, where necessary, mitigation would be provided. Moreover, should complaints be received from local residents, the local authority would determine whether the best practicable means is being applied. Therefore, best practicable means would be employed to ensure that noise levels are minimised. Outline mitigation measures to minimise construction impacts can be found in the Section 13.9 below.

13.6.4 It is likely that the potentially worst affected properties due to construction noise would be those located directly adjacent to the new highway alignments, with lesser impacts at those properties located adjacent to the existing road network due to potential increases in HGV movements.

13.6.5 Disturbance due to construction noise from a scheme of this sort, although it may be significant, is usually short term since the period of noisy construction work is relatively limited and normally reversed once the noisy parts of the construction phase are completed.

13.6.6 Concern is often expressed by local residents that vibrations from construction activities would cause structural damage to their properties. However, it has been shown that vibrations experienced indoors that cause anxiety are often smaller than would be needed to cause structural damage.

13.6.7 It is likely that the construction of the viaduct over the River Garnock during the piling stage will generate the highest levels of noise and vibration. Accordingly, although the final working methods and plant associated with piling operations may ultimately be different from that which is assumed below an assessment of the likely noise and vibration impacts associated with this activity has been undertaken based on the use of Continuous Flight Auger (CFA) piling plant. Obviously various assumptions have been made and these are as follows:

- 3 or 4 Continuous Flight Auger (CFA) piling plant will be used (4 assumed)
- 1 or 2 piles installed per day per CFA
- CFA will operate 100% of the working day (as defined in Table 13.9, above)
- 1 concrete delivery per pile
- Discharge of concrete takes approximately 20 minutes
- Haul routes will along the proposed by-pass route corridor
- Speed on haul route no greater than 20km/h
- It is assumed that piling will only occur during the daytime period

13.6.8 The two residential properties located closest to the viaduct have been selected as being representative of the highest noise impacts associated with piling operations. These properties are:

- Blairland Cottage, located approximately 433m east of the eastern viaduct abutment
- Hillend Farm, located approximately 135m west of the western viaduct abutment

13.6.9 In order to predict the piling operational noise levels at each of the aforementioned properties a 3D CadnaA noise model was created, for which two variants were produced: East and West: the East variant assumed concurrent piling operations at the eastern abutment and the three closest piers to Blairland Cottage; the West variant assumed concurrent piling operations at the western abutment and the three closest piers to Hillend Farm. Figure 13.3 shows: the location of the CFA rigs and concrete discharging lorries (modelled as point sources); the haul routes (modelled as line sources, with a total of 8 movements per variant, which equates to one per pile; and two receptor locations (one for each property). The digital terrain model used was the same as that used for the Do-Minimum DMRB road traffic models. Also the piling operation noise levels were predicted using the methods BS 5228.

13.6.10 Based on the aforementioned piling variants and assumptions, the predicted daytime noise levels at each of the representative receptor locations are:

- Blairland Cottage: $L_{Aeq,12hr}$ 56.6 dB
- Hillend Cottage: $L_{Aeq,12hr}$ 47.1 dB

13.6.11 Accordingly, at each location, the predicted piling operations noise level is below the lowest limit values shown in Table 13.9 for the daytime period and, as such, it is predicted that the significance of impact associated with viaduct piling operations is Negligible Adverse.

13.6.12 In addition, given that the minimum separation distance between these activities and residential properties is approximately 135m, it is predicted that significance of vibration impacts vibration will be Neutral.

### Operational Phase – Noise

13.6.13 The finalised road traffic model for the proposed Dalry Bypass incorporates design elements which would mitigate traffic noise, such as sections of false cutting. The potential operational noise impacts described in this section are based on the finalised road model and therefore take these measures into account.

13.6.14 In total, there are 2860 residential properties within the DMRB HD 213/11 Calculation Area of the proposed Dalry Bypass. The results for the 21 selected sample receptors deemed to be representative of their locality, at ground (1.5m) and first floor (4m), for both the Baseline Year and the Design Year, with and without the Proposed Scheme are presented below, together with their associated Significance of Impact. It should be appreciated that, in order to determine the change in noise level between scenarios, the following process has been adopted: receptor points were located at a distance of 1m from each façade of each building and the receptor location with the highest noise level change for the scenario comparison between Do-Something scenario and Do-Minimum scenario is reported. This procedure is in accordance with DMRB HD 213/11. The results are presented in tabular format in the Tables 13.13 to 13.22 and are also reproduced graphically in Figures 13.5a to 13.8e.

*Sample Receptor Locations*

13.6.15 For each sample receptor location the Do-Minimum and Do Something noise levels have been predicted for the Baseline Year and Future Year for both daytime and night-time.

13.6.16 The noise levels for the Do Minimum Baseline Year (2016) and the Do Minimum Future Year (2031) with the associated long term significance of impacts for daytime periods are presented in Table 13.12 (and Figures 13.5a-e) at the ground floor and Table 13.13 (and Figures 13.6 a-e) for the first floor. The night time assessment results are shown in Table 13.14 (and Figures 13.7 a-e) and Table 13.15 (and Figures 13.8a-e).

*Table 13.12 Sample Property Do-Minimum Baseline Year (DM BL) versus Do-Minimum Future Year (DM FY) Significance of Noise Impacts at the Ground Floor during the Daytime (Figure 13.5a-e)*

| ID | Property | DM BL $L_{A10,18h}$ (Facade) | DM FY $L_{A10,18h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 1 | Easter Highfield Lodge | 58.8 | 59.0 | Neutral/ Slight Adverse |
| 2 | Pasturehill Cottage | 74.6 | 74.8 | Slight Adverse |
| 3 | Greenacre, Highfield | 51.0 | 51.3 | Slight Adverse |
| 4 | Siliven, Highfield | 51.0 | 51.6 | Slight Adverse |
| 5 | Highfield Farm | 43.3 | 43.5 | Neutral/ Slight Adverse |
| 6 | 1 Highfield Cottages | 47.3 | 47.5 | Slight Adverse |
| 7 | 1 Carsehead/Jimmary Lodge | 57.7 | 57.9 | Slight Adverse |
| 8 | Glenfield, Beith Road | 68.6 | 68.8 | Slight Adverse |
| 9 | 8 Blair Road | 58.7 | 58.7 | Neutral |
| 10 | 42 Blair Road | 36.9 | 37.2 | Slight Adverse |
| 11 | 78 Blair Road | 38.5 | 38.9 | Slight Adverse |
| 12 | 40 Kerse Avenue | 38.3 | 38.5 | Slight Adverse |
| 13 | 71 Baidland Avenue | 43.1 | 43.5 | Slight Adverse |
| 14 | Stoopshill Farm | 34.2 | 34.6 | Neutral/ Slight Adverse |
| 15 | North Lodge, Blair Estate | 43.0 | 43.4 | Slight Adverse |
| 16 | Blair House, Blair Estate | 43.4 | 43.9 | Slight Adverse |
| 17 | Carriage House, Blair Estate | 44.2 | 44.7 | Slight Adverse |
| 18 | Hillend Farm | 68.0 | 68.5 | Neutral/ Slight Adverse |
| 20 | The Bungalow | 47.2 | 47.8 | Slight Adverse |
| 21 | 25 Baidland Avenue | 39.7 | 40 | Slight Adverse |

*Table 13.13 Sample Property Do-Minimum Baseline Year (DM BL) versus Do-Minimum Future Year (DM FY) Significance of Noise Impacts at the First Floor during the Daytime (Figure 13.6a-e)*

| ID | Property | DM BL $L_{A10,18h}$ (Facade) | DM FY $L_{A10,18h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 1 | Easter Highfield Lodge | 60.7 | 60.9 | Slight Adverse |
| 2 | Pasturehill Cottage | 74.4 | 74.6 | Slight Adverse |
| 3 | Greenacre, Highfield | 64.8 | 65.0 | Slight Adverse |
| 4 | Siliven, Highfield | 52.3 | 52.8 | Slight Adverse |
| 5 | Highfield Farm | 42.7 | 43.0 | Slight Adverse |
| 6 | 1 Highfield Cottages | 37.9 | 38.2 | Slight Adverse |
| 7 | 1 Carsehead/Jimmary Lodge | 51.5 | 51.7 | Slight Adverse |
| 8 | Glenfield, Beith Road | 69.6 | 69.8 | Slight Adverse |
| 9 | 8 Blair Road | 59.8 | 59.8 | Neutral |
| 10 | 42 Blair Road | 39.6 | 39.9 | Slight Adverse |

| ID | Property | DM BL $L_{A10,18h}$ (Facade) | DM FY $L_{A10,18h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 11 | 78 Blair Road | 39.9 | 40.3 | Slight Adverse |
| 12 | 40 Kerse Avenue | 38.8 | 39.1 | Slight Adverse |
| 13 | 71 Baidland Avenue | 43.3 | 43.7 | Slight Adverse |
| 14 | Stoopshill Farm | 37.9 | 38.3 | Slight Adverse |
| 15 | North Lodge, Blair Estate | 42.3 | 42.7 | Slight Adverse |
| 16 | Blair House, Blair Estate | 42.8 | 43.3 | Slight Adverse |
| 17 | Carriage House, Blair Estate | 44.8 | 45.3 | Slight Adverse |
| 18 | Hillend Farm | 65.7 | 66.2 | Slight Adverse |
| 20 | The Bungalow | 49.8 | 50.4 | Slight Adverse |
| 21 | 25 Baidland Avenue | 41.5 | 41.8 | Slight Adverse |

*Table 13.14 Sample Property Do-Minimum Baseline Year (DM BL) versus Do-Minimum Future Year (DM FY) Significance of Noise Impacts at the Ground Floor during the Night Time (Figure 13.7a-e)*

| ID | Property | DM BL $L_{A10,6h}$ (Facade) | DM FY $L_{A10,6h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 1 | Easter Highfield Lodge | 46.9 | 47.1 | Neutral/ Slight Adverse |
| 2 | Pasturehill Cottage | 61.1 | 61.3 | Slight Adverse |
| 3 | Greenacre, Highfield | 39.9 | 40.1 | Slight Adverse |
| 4 | Siliven, Highfield | 39.9 | 40.4 | Slight Adverse |
| 5 | Highfield Farm | 32.9 | 33.1 | Neutral/ Slight Adverse |
| 6 | 1 Highfield Cottages | 36.5 | 36.7 | Slight Adverse |
| 7 | 1 Carsehead/Jimmary Lodge | 45.9 | 46.1 | Slight Adverse |
| 8 | Glenfield, Beith Road | 55.7 | 55.9 | Slight Adverse |
| 9 | 8 Blair Road | 46.8 | 46.8 | Neutral |
| 10 | 42 Blair Road | 27.2 | 27.5 | Slight Adverse |
| 11 | 78 Blair Road | 28.6 | 29.0 | Slight Adverse |
| 12 | 40 Kerse Avenue | 28.4 | 28.6 | Slight Adverse |
| 13 | 71 Baidland Avenue | 32.8 | 33.1 | Slight Adverse |
| 14 | Stoopshill Farm | 24.8 | 25.1 | Neutral/ Slight Adverse |
| 15 | North Lodge, Blair Estate | 32.7 | 33.0 | Slight Adverse |
| 16 | Blair House, Blair Estate | 33.0 | 33.5 | Slight Adverse |
| 17 | Carriage House, Blair Estate | 33.8 | 34.2 | Slight Adverse |
| 18 | Hillend Farm | 55.2 | 55.6 | Neutral/ Slight Adverse |
| 20 | The Bungalow | 36.5 | 37 | Slight Adverse |
| 21 | 25 Baidland Avenue | 29.7 | 30 | Slight Adverse |

*Table 13.15 Sample Property Do-Minimum Baseline Year (DM BL) versus Do-Minimum Future Year (DM FY) Significance of Noise Impacts at the First Floor during the Night Time (Figure 13.8a-e)*

| ID | Property | DM BL $L_{A10,6h}$ (Facade) | DM FY $L_{A10,6h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 1 | Easter Highfield Lodge | 48.6 | 48.8 | Slight Adverse |
| 2 | Pasturehill Cottage | 60.9 | 61.1 | Slight Adverse |
| 3 | Greenacre, Highfield | 52.3 | 52.5 | Slight Adverse |

| ID | Property | DM BL $L_{A10,6h}$ (Facade) | DM FY $L_{A10,6h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 4 | Siliven, Highfield | 41.0 | 41.5 | Slight Adverse |
| 5 | Highfield Farm | 32.4 | 32.7 | Slight Adverse |
| 6 | 1 Highfield Cottages | 28.1 | 28.4 | Slight Adverse |
| 7 | 1 Carsehead/Jimmary Lodge | 40.3 | 40.5 | Slight Adverse |
| 8 | Glenfield, Beith Road | 56.6 | 56.8 | Slight Adverse |
| 9 | 8 Blair Road | 47.8 | 47.8 | Neutral |
| 10 | 42 Blair Road | 29.6 | 29.9 | Slight Adverse |
| 11 | 78 Blair Road | 29.9 | 30.2 | Slight Adverse |
| 12 | 40 Kerse Avenue | 28.9 | 29.2 | Slight Adverse |
| 13 | 71 Baidland Avenue | 32.9 | 33.3 | Slight Adverse |
| 14 | Stoopshill Farm | 28.1 | 28.4 | Slight Adverse |
| 15 | North Lodge, Blair Estate | 32.0 | 32.4 | Slight Adverse |
| 16 | Blair House, Blair Estate | 32.5 | 32.9 | Slight Adverse |
| 17 | Carriage House, Blair Estate | 34.3 | 34.7 | Slight Adverse |
| 18 | Hillend Farm | 53.1 | 53.6 | Slight Adverse |
| 20 | The Bungalow | 38.8 | 39.3 | Slight Adverse |
| 21 | 25 Baidland Avenue | 31.3 | 31.6 | Slight Adverse |

13.6.17 The noise levels for the Do Minimum Baseline Year (2016) and the Do Something Baseline Year (2016), with associated short term significance of impacts for daytime periods are presented in Table 13.16 (and Figures 13.5a-e) at the ground floor and Table 13.17 (and Figures 13.6a-e) for the first floor.

13.6.18 The noise levels for the Do Minimum Baseline Year (2016) and the Do Something Future Year (2031), with associated long term significance of impacts for daytime periods are presented in Table 13.18 (and Figures 13.5a-e) at the ground floor and Table 13.19 (and Figures 13.6a-e) for the first floor. The night-time assessment results are show in Table 13.20 (and Figures 13.7a-e) and Table 13.21 (and Figures 13.8a-e).

*Table 13.16 Sample Property Do-Minimum Baseline Year (DM BL) versus Do-Something Baseline Year (DS BL) Significance of Noise Impacts at the Ground Floor during the Daytime (Figure 13.5a-e)*

| ID | Property | DM BL $L_{A10,18h}$ (Facade) | DS BL $L_{A10,18h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 1 | Easter Highfield Lodge | 40.3 | 44.7 | Slight Adverse |
| 2 | Pasturehill Cottage | 45.7 | 43.9 | Slight/ Moderate Beneficial |
| 3 | Greenacre, Highfield | 50.4 | 56.9 | Large/ Very Large Adverse |
| 4 | Siliven, Highfield | 51.0 | 53.7 | Slight/ Moderate Adverse |
| 5 | Highfield Farm | 38.7 | 42.4 | Slight Adverse |
| 6 | 1 Highfield Cottages | 33.1 | 37.6 | Moderate/ Large Adverse |
| 7 | 1 Carsehead/Jimmary Lodge | 46.0 | 44.5 | Slight/ Moderate Beneficial |
| 8 | Glenfield, Beith Road | 47.9 | 46.6 | Slight/ Moderate Beneficial |
| 9 | 8 Blair Road | 61.6 | 61.5 | Slight Beneficial |
| 10 | 42 Blair Road | 36.9 | 41.4 | Moderate/ Large Adverse |
| 11 | 78 Blair Road | 37.5 | 48.0 | Large/ Very Large Adverse |

| ID | Property | DM BL $L_{A10,18h}$ (Facade) | DS BL $L_{A10,18h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 12 | 40 Kerse Avenue | 36.7 | 47.1 | Large/ Very Large Adverse |
| 13 | 71 Baidland Avenue | 42.2 | 51.5 | Large/ Very Large Adverse |
| 14 | Stoopshill Farm | 40.8 | 51.3 | Slight/ Moderate Adverse |
| 15 | North Lodge, Blair Estate | 36.6 | 42.1 | Large/ Very Large Adverse |
| 16 | Blair House, Blair Estate | 31.9 | 37.4 | Large/ Very Large Adverse |
| 17 | Carriage House, Blair Estate | 32.8 | 39.5 | Large/ Very Large Adverse |
| 18 | Hillend Farm | 62.1 | 62.9 | Neutral/ Slight Adverse |
| 20 | The Bungalow | 47.2 | 57.1 | Large/ Very Large Adverse |
| 21 | 25 Baidland Avenue | 34.1 | 47.8 | Large/ Very Large Adverse |

*Table 13.17 Sample Property Do-Minimum Baseline Year (DM BL) versus Do-Something Baseline Year (DS BL) Significance of Noise Impacts at the First Floor during the Daytime (Figure 13.6a-e)*

| ID | Property | DM BL $L_{A10,18h}$ (Facade) | DS BL $L_{A10,18h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 1 | Easter Highfield Lodge | 43.4 | 46.8 | Moderate/ Large Adverse |
| 2 | Pasturehill Cottage | 48.2 | 46.8 | Slight/ Moderate Beneficial |
| 3 | Greenacre, Highfield | 53.2 | 58.3 | Large/ Very Large Adverse |
| 4 | Siliven, Highfield | 52.2 | 55.5 | Moderate/ Large Adverse |
| 5 | Highfield Farm | 41.7 | 45.1 | Moderate/ Large Adverse |
| 6 | 1 Highfield Cottages | 37.9 | 41.2 | Moderate/ Large Adverse |
| 7 | 1 Carsehead/Jimmary Lodge | 48.6 | 46.7 | Slight/ Moderate Beneficial |
| 8 | Glenfield, Beith Road | 51.2 | 49.3 | Slight/ Moderate Beneficial |
| 9 | 8 Blair Road | 62.3 | 62.2 | Slight Beneficial |
| 10 | 42 Blair Road | 39.5 | 43.3 | Moderate/ Large Adverse |
| 11 | 78 Blair Road | 39.0 | 48.8 | Large/ Very Large Adverse |
| 12 | 40 Kerse Avenue | 38.8 | 47.9 | Large/ Very Large Adverse |
| 13 | 71 Baidland Avenue | 42.8 | 52.1 | Large/ Very Large Adverse |
| 14 | Stoopshill Farm | 41.6 | 53.5 | Large/ Very Large Adverse |
| 15 | North Lodge, Blair Estate | 36.5 | 42.1 | Large/ Very Large Adverse |
| 16 | Blair House, Blair Estate | 33.2 | 38.6 | Large/ Very Large Adverse |
| 17 | Carriage House, Blair Estate | 33.7 | 40.3 | Large/ Very Large Adverse |
| 18 | Hillend Farm | 63.6 | 64.0 | Slight Adverse |
| 20 | The Bungalow | 49.8 | 59.6 | Large/ Very Large Adverse |
| 21 | 25 Baidland Avenue | 36.9 | 48.8 | Large/ Very Large Adverse |

*Table 13.18 Sample Property Do-Minimum Baseline Year (DM BL) versus Do-Something Future Year (DS FY) Significance of Noise Impacts at the Ground Floor during the Daytime (Figure 13.5a-e)*

| ID | Property | DM BL $L_{A10,18h}$ (Facade) | DS FY $L_{A10,18h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 1 | Easter Highfield Lodge | 40.3 | 45.1 | Neutral/ Slight Adverse |
| 2 | Pasturehill Cottage | 45.7 | 44.3 | Slight Beneficial |
| 3 | Greenacre, Highfield | 50.4 | 57.3 | Moderate/ Large Adverse |
| 4 | Siliven, Highfield | 51.0 | 54.0 | Slight/ Moderate Adverse |

| ID | Property | DM BL $L_{A10,18h}$ (Facade) | DS FY $L_{A10,18h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 5 | Highfield Farm | 38.7 | 42.8 | Neutral/ Slight Adverse |
| 6 | 1 Highfield Cottages | 33.4 | 38.5 | Moderate/ Large Adverse |
| 7 | 1 Carsehead/Jimmary Lodge | 45.6 | 44.5 | Slight Beneficial |
| 8 | Glenfield, Beith Road | 47.9 | 47.0 | Slight Beneficial |
| 9 | 8 Blair Road | 48.8 | 48.6 | Slight Beneficial |
| 10 | 42 Blair Road | 36.9 | 42.1 | Moderate/ Large Adverse |
| 11 | 78 Blair Road | 37.5 | 48.8 | Large/ Very Large Adverse |
| 12 | 40 Kerse Avenue | 36.7 | 47.8 | Large/ Very Large Adverse |
| 13 | 71 Baidland Avenue | 42.2 | 52.3 | Large/ Very Large Adverse |
| 14 | Stoopshill Farm | 40.8 | 52.1 | Slight/ Moderate Adverse |
| 15 | North Lodge, Blair Estate | 36.6 | 42.8 | Moderate/ Large Adverse |
| 16 | Blair House, Blair Estate | 31.9 | 38.1 | Moderate/ Large Adverse |
| 17 | Carriage House, Blair Estate | 32.8 | 40.2 | Moderate/ Large Adverse |
| 18 | Hillend Farm | 62.1 | 63.4 | Neutral/ Slight Adverse |
| 20 | The Bungalow | 47.2 | 57.5 | Large/ Very Large Adverse |
| 21 | 25 Baidland Avenue | 34.1 | 48.6 | Large/ Very Large Adverse |

*Table 13.19 Sample Property Do-Minimum Baseline Year (DM BL) versus Do-Something Future Year (DS FY) Significance of Noise Impacts at the First Floor during the Daytime (Figure 13.6a-e)*

| ID | Property | DM BL $L_{A10,18h}$ (Facade) | DS FY $L_{A10,18h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 1 | Easter Highfield Lodge | 43.4 | 47.2 | Slight/ Moderate Adverse |
| 2 | Pasturehill Cottage | 48.2 | 47.2 | Slight Beneficial |
| 3 | Greenacre, Highfield | 53.2 | 58.7 | Moderate/ Large Adverse |
| 4 | Siliven, Highfield | 52.2 | 55.9 | Slight/ Moderate Adverse |
| 5 | Highfield Farm | 41.7 | 45.5 | Slight/ Moderate Adverse |
| 6 | 1 Highfield Cottages | 36.1 | 40.0 | Slight/ Moderate Adverse |
| 7 | 1 Carsehead/Jimmary Lodge | 48.6 | 47.0 | Slight Beneficial |
| 8 | Glenfield, Beith Road | 51.2 | 49.6 | Slight Beneficial |
| 9 | 8 Blair Road | 49.8 | 49.7 | Slight Beneficial |
| 10 | 42 Blair Road | 39.6 | 44.0 | Slight/ Moderate Adverse |
| 11 | 78 Blair Road | 39.0 | 49.6 | Large/ Very Large Adverse |
| 12 | 40 Kerse Avenue | 38.8 | 48.6 | Moderate/ Large Adverse |
| 13 | 71 Baidland Avenue | 42.8 | 52.9 | Large/ Very Large Adverse |
| 14 | Stoopshill Farm | 41.6 | 54.3 | Large/ Very Large Adverse |
| 15 | North Lodge, Blair Estate | 36.5 | 42.8 | Moderate/ Large Adverse |
| 16 | Blair House, Blair Estate | 33.2 | 39.4 | Moderate/ Large Adverse |
| 17 | Carriage House, Blair Estate | 33.7 | 41.1 | Moderate/ Large Adverse |
| 18 | Hillend Farm | 63.6 | 64.5 | Slight Adverse |
| 20 | The Bungalow | 49.8 | 60 | Large/ Very Large Adverse |
| 21 | 25 Baidland Avenue | 36.9 | 49.6 | Large/ Very Large Adverse |

*Table 13.20 Sample Property Do-Minimum Baseline Year (DM BL) versus Do-Something Future Year (DS FY) Significance of Noise Impacts at the Ground Floor during the Night Time (Figure 13.7a-e)*

| ID | Property | DM BL $L_{A10,6h}$ (Facade) | DS FY $L_{A10,6h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 1 | Easter Highfield Lodge | 30.2 | 34.6 | Neutral/ Slight Adverse |
| 2 | Pasturehill Cottage | 35.1 | 33.8 | Slight Beneficial |
| 3 | Greenacre, Highfield | 39.3 | 45.6 | Moderate/ Large Adverse |
| 4 | Siliven, Highfield | 39.9 | 42.6 | Slight Adverse |
| 5 | Highfield Farm | 28.8 | 32.5 | Neutral/ Slight Adverse |
| 6 | 1 Highfield Cottages | 24.0 | 28.6 | Slight/ Moderate Adverse |
| 7 | 1 Carsehead/Jimmary Lodge | 35.0 | 34.0 | Slight Beneficial |
| 8 | Glenfield, Beith Road | 37.1 | 36.3 | Slight Beneficial |
| 9 | 8 Blair Road | 37.9 | 37.7 | Slight Beneficial |
| 10 | 42 Blair Road | 27.2 | 31.9 | Slight/ Moderate Adverse |
| 11 | 78 Blair Road | 27.7 | 37.9 | Large/ Very Large Adverse |
| 12 | 40 Kerse Avenue | 27.0 | 37.0 | Large/ Very Large Adverse |
| 13 | 71 Baidland Avenue | 32.0 | 41.0 | Moderate/ Large Adverse |
| 14 | Stoopshill Farm | 30.7 | 40.9 | Slight/ Moderate Adverse |
| 15 | North Lodge, Blair Estate | 26.9 | 32.5 | Moderate/ Large Adverse |
| 16 | Blair House, Blair Estate | 22.7 | 28.3 | Moderate/ Large Adverse |
| 17 | Carriage House, Blair Estate | 23.5 | 30.2 | Moderate/ Large Adverse |
| 18 | Hillend Farm | 49.9 | 51.0 | Neutral/ Slight Adverse |
| 20 | The Bungalow | 36.5 | 45.7 | Moderate/ Large Adverse |
| 21 | 25 Baidland Avenue | 24.7 | 37.7 | Large/ Very Large Adverse |

*Table 13.21 Sample Property Do-Minimum Baseline Year (DM BL) versus Do-Something Future Year (DS FY) Significance of Noise Impacts at the First Floor during the Night Time (Figure 13.8a-e)*

| ID | Property | DM BL $L_{A10,6h}$ (Facade) | DS FY $L_{A10,6h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 1 | Easter Highfield Lodge | 33.0 | 36.5 | Slight/ Moderate Adverse |
| 2 | Pasturehill Cottage | 37.4 | 36.5 | Slight Beneficial |
| 3 | Greenacre, Highfield | 41.9 | 46.8 | Slight/ Moderate Adverse |
| 4 | Siliven, Highfield | 41.0 | 44.3 | Slight/ Moderate Adverse |
| 5 | Highfield Farm | 31.5 | 34.9 | Slight/ Moderate Adverse |
| 6 | 1 Highfield Cottages | 26.5 | 30.0 | Slight/ Moderate Adverse |
| 7 | 1 Carsehead/Jimmary Lodge | 37.7 | 36.3 | Slight Beneficial |
| 8 | Glenfield, Beith Road | 40.1 | 38.6 | Slight Beneficial |
| 9 | 8 Blair Road | 38.8 | 38.7 | Slight Beneficial |
| 10 | 42 Blair Road | 29.6 | 33.6 | Slight/ Moderate Adverse |
| 11 | 78 Blair Road | 29.1 | 38.6 | Moderate/ Large Adverse |
| 12 | 40 Kerse Avenue | 28.9 | 37.7 | Moderate/ Large Adverse |
| 13 | 71 Baidland Avenue | 32.5 | 41.6 | Moderate/ Large Adverse |
| 14 | Stoopshill Farm | 31.4 | 42.8 | Large/ Very Large Adverse |
| 15 | North Lodge, Blair Estate | 26.8 | 32.5 | Moderate/ Large Adverse |

| ID | Property | DM BL $L_{A10,6h}$ (Facade) | DS FY $L_{A10,6h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 16 | Blair House, Blair Estate | 23.9 | 29.4 | Moderate/ Large Adverse |
| 17 | Carriage House, Blair Estate | 24.3 | 31.0 | Moderate/ Large Adverse |
| 18 | Hillend Farm | 51.2 | 52.0 | Slight Adverse |
| 20 | The Bungalow | 38.8 | 48 | Moderate/ Large Adverse |
| 21 | 25 Baidland Avenue | 27.2 | 38.6 | Large/ Very Large Adverse |

### *Do-Minimum Scenario in the Baseline Year versus Do-Minimum scenario in the Future Year*

13.6.19 Summaries of the magnitude of noise impacts at all dwellings and other identified noise sensitive receptors within the Calculation Area for the Do-Minimum Baseline Year versus the Do-Minimum Future Year, at the ground floor level are presented in Table 13.22 below and the first floor summary is presented in Table 13.23

*Table 13.22 Summary of Do-Minimum Scenario in the Baseline Year versus Do-Minimum Scenario in the Future Year Magnitude of Noise Impacts at the Ground Floor*

| Project: Dalry Bypass | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Scenario/ Comparison: Do-Minimum Scenario in the Baseline Year Versus Do-Minimum Scenario in the Future Year | | | | | | | | |
| Change in Noise Level, dB | | Magnitude of Impact | Daytime | | Night-Time | | | |
| | | | No. of Dwellings | No. of Other Sensitive Receptors | No. of Dwellings | Number of Dwellings (Do Minimum Baseline <55dB, Do Something Baseline ≥55dB) | Number of Dwellings (Do Minimum Baseline ≥55dB, Do Something Baseline ≥55dB) | Number of Dwellings (Do Minimum Baseline ≥55dB, Do Something Baseline <55dB) |
| Increase in noise level (Adverse), $L_{A10,18h}$ | 0.1-2.9 | Negligible | 2732 | 7 | 2712 | 13 | 230 | N/A |
| | 3.0-4.9 | Minor | 0 | 0 | 0 | 0 | 0 | N/A |
| | 5.0-9.9 | Moderate | 0 | 0 | 0 | 0 | 0 | N/A |
| | 10+ | Major | 0 | 0 | 0 | 0 | 0 | N/A |
| No Change | 0 | No Change | 56 | 0 | 80 | 0 | 1 | 0 |
| Decrease in noise level (Beneficial), $L_{A10,18h}$ | 0.1-2.9 | Negligible | 66 | 0 | 62 | N/A | 1 | 0 |
| | 3.0-4.9 | Minor | 0 | 0 | 0 | N/A | 0 | 0 |
| | 5.0-9.9 | Moderate | 0 | 0 | 0 | N/A | 0 | 0 |
| | 10+ | Major | 0 | 0 | 0 | N/A | 0 | 0 |

*Table 13.23 Summary of Do-Minimum Scenario in the Baseline Year versus Do-Minimum Scenario in the Future Year Magnitude of Noise Impacts at the First Floor*

| Project: Dalry Bypass | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Scenario/ Comparison: Do Minimum-Scenario in the Baseline Year Versus Do-Minimum Scenario in the Future Year | | | | | | | | |
| Change in Noise Level, dB | | Magnitude of Impact | Daytime | | Night-Time | | | |
| | | | No. of Dwellings | No. of Other Sensitive Receptors | No. of Dwellings | Number of Dwellings (Do Minimum Baseline <55dB, Do Something Baseline ≥55dB) | Number of Dwellings (Do Minimum Baseline ≥55dB, Do Something Baseline ≥55dB) | Number of Dwellings (Do Minimum Baseline ≥55dB, Do Something Baseline <55dB) |
| Increase in noise level (Adverse), $L_{A10,18h}$ | 0.1-2.9 | Negligible | 2747 | 3 | 2730 | 10 | 230 | N/A |
| | 3.0-4.9 | Minor | 0 | 0 | 0 | 0 | 0 | N/A |
| | 5.0-9.9 | Moderate | 0 | 0 | 0 | 0 | 0 | N/A |
| | 10+ | Major | 0 | 0 | 0 | 0 | 0 | N/A |
| No Change | 0 | No Change | 50 | 0 | 69 | 0 | 2 | 0 |
| Decrease in noise level (Beneficial), $L_{A10,18h}$ | 0.1-2.9 | Negligible | 63 | 0 | 61 | N/A | 2 | 0 |
| | 3.0-4.9 | Minor | 0 | 0 | 0 | N/A | 0 | 0 |
| | 5.0-9.9 | Moderate | 0 | 0 | 0 | N/A | 0 | 0 |
| | 10+ | Major | 0 | 0 | 0 | N/A | 0 | 0 |

13.6.20 Graphics illustrating the noise level changes, at the ground floor level, within the Calculation Area, for the Do-Minimum Baseline Year versus Do-Minimum Future Year scenarios are presented in Figures 13.9a and 13.9b (Figure 13.9a shows the noise level difference contour map based on predicted noise levels using a 10m x 10m grid spacing, whilst Figure 13.9b shows the buildings coloured in categories indicating the magnitude of noise level difference between the compared scenarios)[2], and the first floor noise level changes can be viewed in Figure 13.10a (noise level difference contour map) and Figure 13.10b (buildings noise level difference map). The night-time noise level changes for the ground and first floor can be seen in Figures 13.11a (ground floor noise level difference contour map) and 13.11b (ground floor buildings noise level difference map) and Figures 13.12a (first floor noise level difference contour map) and 13.12b (first floor buildings noise level difference map), respectively.

### *Do-Minimum Scenario in the Baseline Year versus Do-Something scenario in the Baseline Year*

13.6.21 Summaries of the magnitude of noise impacts at all dwellings and other identified noise sensitive receptors within the Calculation Area for the Do Minimum Baseline Year

[2] It should be appreciated that when determining the noise impact at an individual property noise levels are predicted at locations 1m from the façade of that property. The reported noise impact associated with a pair of scenarios, for example, the Year of opening Do-Minimum versus Year of Opening Do-Something, the noise level difference with the greatest adverse impact is used and, therefore, the worst case noise impact is reported for each property.

Moreover, to create the noise level difference maps it is necessary to calculate the noise levels over the entire calculation area for each scenario, and the extent of these areas can be very large; the calculation area for the proposed Dalry Bypass is approximately 13.8km$^2$. Therefore, the noise levels across the calculation area are determined on a 10m x 10m grid basis. Accordingly, the noise difference maps provide a reasonably accurate visual representation of the noise impacts across the calculation area. However, for individual properties, it is recommended that the noise levels determined using the 1m façade receptor point data is used to establish the predicted noise level change, rather than using the 10m x 10m grid data, as this façade point data provides a more accurate representation of the impact at that property.

versus the Do Something Baseline Year, at the ground floor level are presented in Table 13.24 and the first floor summary is presented in Table 13.25.

*Table 13.24 Summary of Do-Minimum Scenario in the Baseline Year versus Do-Something Scenario in the Baseline Year Magnitude of Noise Impacts at the Ground Floor*

| Project: Dalry Bypass | | | | |
|---|---|---|---|---|
| Scenario/ Comparison: Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Baseline Year | | | | |
| Change in Noise Level, dB | | Magnitude of Impact | Daytime | |
| | | | No. of Dwellings | No. of Other Sensitive Receptors |
| Increase in noise level (Adverse), $L_{A10,18h}$ | 0.1-0.9 | Negligible | 1263 | 4 |
| | 1.0-2.9 | Minor | 138 | 0 |
| | 3.0-4.9 | Moderate | 86 | 0 |
| | 5+ | Major | 201 | 0 |
| No Change | 0 | No Change | 385 | 1 |
| Decrease in noise level (Beneficial), $L_{A10,18h}$ | **0.1-0.9** | Negligible | 552 | 2 |
| | 1.0-2.9 | Minor | 224 | 0 |
| | 3.0-4.9 | Moderate | 3 | 0 |
| | 5+ | Major | 2 | 0 |

*Table 13.25 Summary of Do-Minimum Scenario in the Baseline Year versus Do-Something Scenario in the Baseline Year Magnitude of Noise Impacts at the First Floor*

| Scenario/ Comparison: Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Baseline Year | | | | |
|---|---|---|---|---|
| Change in Noise Level, dB | | Magnitude of Impact | Daytime | |
| | | | No. of Dwellings | No. of Other Sensitive Receptors |
| Increase in noise level (Adverse), $L_{A10,18h}$ | 0.1-0.9 | Negligible | 1324 | 2 |
| | 1.0-2.9 | Minor | 13 | 0 |
| | 3.0-4.9 | Moderate | 93 | 0 |
| | 5+ | Major | 181 | 0 |
| No Change | 0 | No Change | 332 | 0 |
| Decrease in noise level (Beneficial), $L_{A10,18h}$ | **0.1-0.9** | Negligible | 562 | 1 |
| | 1.0-2.9 | Minor | 232 | 0 |
| | 3.0-4.9 | Moderate | 1 | 0 |
| | 5+ | Major | 2 | 0 |

13.6.22 Graphics illustrating the noise level changes, at the ground floor level, within the Calculation Area, for the Do Minimum Baseline Year versus Do Something Baseline Year scenarios are presented in Figures 13.13a and 13.13b (Figure 13.13a shows the noise level difference contour map using a 10m x 10m grid spacing; Figure 13.13b shows the buildings coloured in categories indicating the magnitude of noise level difference between the compared scenarios)[2]. Figures 13.14a and 13.14b show the same for first floor noise level changes.

### *Do Minimum scenario in the Baseline Year versus Do Something in the Future Year*

13.6.23 The magnitude of noise impacts at all dwellings within the Study Area for the Do Minimum Baseline Year versus the Do Something Future Year, at the ground floor level is summarised in Table 13.26 and the first floor summary is presented in Table 13.27.

*Table 13.26 Summary of Do-Minimum Scenario in the Baseline Year versus Do-Something Scenario in the Future Year Magnitude of Noise Impacts at the Ground Floor*

| Scenario/ Comparison: Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Future Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Change in Noise Level, dB | | Magnitude of Impact | Daytime | | Night-Time | | | |
| | | | No. of Dwellings | No. of Other Sensitive Receptors | No. of Dwellings | Number of Dwellings (Do Minimum Baseline <55dB, Do Something Baseline ≥55dB) | Number of Dwellings (Do Minimum Baseline ≥55dB, Do Something Baseline ≥55dB) | Number of Dwellings (Do Minimum Baseline ≥55dB, Do Something Baseline <55dB) |
| Increase in noise level (Adverse), $L_{A10,18h}$ | 0.1-2.9 | Negligible | 1930 | 4 | 1940 | 8 | 124 | N/A |
| | 3.0-4.9 | Minor | 93 | 0 | 90 | 0 | 0 | N/A |
| | 5.0-9.9 | Moderate | 155 | 0 | 148 | 0 | 0 | N/A |
| | 10+ | Major | 70 | 0 | 59 | 0 | 0 | N/A |
| No Change | 0 | No Change | 104 | 1 | 126 | 0 | 2 | 0 |
| Decrease in noise level (Beneficial), $L_{A10,18h}$ | 0.1-2.9 | Negligible | 499 | 2 | 489 | N/A | 8 | 6 |
| | 3.0-4.9 | Minor | 1 | 0 | 0 | N/A | 0 | 0 |
| | 5.0-9.9 | Moderate | 0 | 0 | 0 | N/A | 0 | 0 |
| | 10+ | Major | 2 | 0 | 2 | N/A | 0 | 0 |

*Table 13.27 Summary of Do-Minimum Scenario in the Baseline Year versus Do-Something Scenario in the Future Year Magnitude of Noise Impacts at the First Floor*

| Project: Dalry Bypass | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Scenario/ Comparison: Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Future Year | | | | | | | | |
| Change in Noise Level, dB | | Magnitude of Impact | Daytime | | Night-Time | | | |
| | | | No. of Dwellings | No. of Other Sensitive Receptors | No. of Dwellings | Number of Dwellings (Do Minimum Baseline <55dB, Do Something Baseline ≥55dB) | Number of Dwellings (Do Minimum Baseline ≥55dB, Do Something Baseline ≥55dB) | Number of Dwellings (Do Minimum Baseline ≥55dB, Do Something Baseline <55dB) |
| Increase in noise level (Adverse), $L_{A10,18h}$ | 0.1-2.9 | Negligible | 1951 | 2 | 1954 | 14 | 131 | N/A |
| | 3.0-4.9 | Minor | 98 | 0 | 103 | 0 | 0 | N/A |
| | 5.0-9.9 | Moderate | 141 | 0 | 141 | 0 | 0 | N/A |
| | 10+ | Major | 66 | 0 | 43 | 0 | 0 | N/A |
| No Change | 0 | No Change | 97 | 1 | 124 | 0 | 0 | 0 |
| Decrease in noise level (Beneficial), $L_{A10,18h}$ | 0.1-2.9 | Negligible | 504 | 0 | 493 | N/A | 8 | 4 |
| | 3.0-4.9 | Minor | 1 | 0 | 0 | N/A | 0 | 0 |
| | 5.0-9.9 | Moderate | 0 | 0 | 0 | N/A | 0 | 0 |
| | 10+ | Major | 2 | 0 | 2 | N/A | 0 | 0 |

13.6.24 Graphics illustrating the noise level changes, at the ground floor level, within the Calculation Area, for the Do Minimum Baseline Year versus Do Something Future Year scenario can be found in Figures 13.15a and 13.15b (Figure 13.15a shows the noise level difference contour map based on predicted noise levels using a 10m x 10m grid spacing, whilst Figure 13.15b shows the buildings coloured in categories indicating the magnitude of noise level difference between the compared scenarios)[2], and the first floor noise level changes can be viewed in Figure 13.16a (noise level difference contour map) and Figure 13.16b (buildings noise level difference map). The night-time noise level changes for the ground and first floor can be seen in Figures 13.17a (ground floor noise level difference contour map) and 13.17b (ground floor buildings noise level difference map) and Figures 13.18a (first floor noise level difference contour map) and 13.18b (first floor buildings noise level difference map), respectively.

13.6.25 With regard to the day-time magnitude of noise impacts it can be seen that in the short term there would be an increase in the magnitude of noise impacts for 1263 dwellings where the increase in noise level is less than 1dB and there is predicted to be 138 Minor Adverse impacts, 86 Moderate Adverse impacts and 201 Major Adverse impacts. However, there would also be 552 decreases in noise level of less than 1dB, 224 properties would experience a Minor Beneficial noise impact, 3 properties would experience a Moderate beneficial noise impact and 2 properties would experience a Major Beneficial noise impact. Similar noise impacts are predicted to occur at the first floor level.

13.6.26 In the long term, there are 484 fewer properties predicted to have an increase in noise levels for the Do Minimum Baseline Year versus the Do Something Future Year scenario than for the Do Minimum Baseline year versus the Do Minimum Future year scenario at ground floor level.

13.6.27 With regard to night-time noise, when comparing the Do Minimum Baseline versus the Do Something Future Year scenario with the Do Minimum Baseline versus the Do Minimum Future Year scenario, there are 5 less dwellings that are predicted to experience noise increase such that noise level increase to above $L_{Aeq,16hr}$ 55dB with the scheme in place. Furthermore, there are 475 fewer properties predicted to experience an increase in noise levels with the scheme in place. Similar noise impacts are predicted to occur at the first floor level.

13.6.28 For the night time period, in the short term, there are more properties which would experience a decrease in noise levels (Beneficial impacts) with the scheme in place. Furthermore, in the long term there are fewer properties which would experience an increase in noise levels compared to the Do-Minimum scenario.

### *Health and Education Establishments*

13.6.29 Figure 13.4a identifies the location of Health and Educational Establishments.

13.6.30 For each of the Health and Educational buildings, the predicted noise levels for the Do-Minimum Baseline Year (2016) and the Do-Minimum Future Year (2031) with the associated magnitude of impacts are presented in Table 13.28 (and Figure 13.4a) and Table 13.29 (and Figure 13.4b), for the ground and first floors, respectively.

*Table 13.28 Table of Health and Educational Establishment Do-Minimum Baseline Year (DM BL) versus Do-Minimum Future Year (DM FY) Significance of Noise Impacts at the Ground Floor*

| ID | Name | DM BL $L_{A10,18h}$ (Facade) | DM FY $L_{A10,18h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 1 | Dental Surgery | 41.7 | 42.0 | Slight Adverse |
| 2 | Dalry Primary School | 50.8 | 51.2 | Slight Adverse |
| 3 | St. Palladius Primary School | 50.9 | 51.2 | Slight Adverse |
| 4 | AAHB Community Healthcare NHS Trust | 67.1 | 67.5 | Neutral/ Slight Adverse |

*Table 13.29 Table of Health and Educational Establishment Do-Minimum Baseline Year (DM BL) versus Do-Minimum Future Year (DM FY) Significance of Noise Impacts at the First Floor*

| ID | Name | DM BL $L_{A10,18h}$ (Facade) | DM FY $L_{A10,18h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 1 | Dental Surgery | 43.9 | 44.2 | Slight Adverse |
| 2 | Dalry Primary School | 52.5 | 52.9 | Slight Adverse |
| 3 | St. Palladius Primary School | 49.2 | 49.5 | Slight Adverse |
| 4 | AAHB Community Healthcare NHS Trust | 67.2 | 67.6 | Neutral/ Slight Adverse |

13.6.31 The predicted noise levels for the Do Minimum Baseline Year (2016) and the Do Something Baseline Year (2016) with the associated magnitude of impacts are presented in Table 13.320 below (and Figure 13.4a) andTable 13.31 (and Figure 13.4b), for the ground and first floors, respectively.

*Table 13.30 Table of Health and Educational Establishment Do-Minimum Baseline Year (DM BL) versus Do-Something Baseline Year (DS BL) Significance of Noise Impacts at the Ground Floor*

| ID | Name | DM BL $L_{A10,18h}$ (Facade) | DS BL $L_{A10,18h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 1 | Dental Surgery | 64.3 | 64.3 | Neutral |
| 2 | Dalry Primary School | 46.0 | 46.1 | Slight Adverse |
| 3 | St. Palladius Primary School | 52.2 | 52.3 | Slight Adverse |
| 4 | AAHB Community Healthcare NHS Trust | 67.0 | 67.1 | Neutral/ Slight Adverse |

*Table 13.31 Table of Health and Educational Establishment Do-Minimum Baseline Year (DM BL) versus Do-Something Baseline Year (DS BL) Significance of Noise Impacts at the First Floor*

| ID | Name | DM BL $L_{A10,18h}$ (Facade) | DS BL $L_{A10,18h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 1 | Dental Surgery | 66.7 | 66.6 | Slight Beneficial |
| 2 | Dalry Primary School | 47.8 | 47.9 | Slight Adverse |
| 3 | St. Palladius Primary School | 54.3 | 54.4 | Slight Adverse |
| 4 | AAHB Community Healthcare NHS Trust | 67.2 | 67.3 | Neutral/ Slight Adverse |

13.6.32 The predicted noise levels for the Do Minimum Baseline Year (2016) and the Do Something Future Year (2031) with the associated magnitude of impacts are presented in Table 13.32 (and Figure 13.4a) and Table 13.33 (and Figure 13.4b) for the ground and first floors, respectively.

*Table 13.32 Table of Health and Educational Establishment Do-Minimum Baseline Year (DM BL) versus Do-Something Future Year (DS FY) Significance of Noise Impacts at the Ground Floor*

| ID | Name | DM BL $L_{A10,18h}$ (Facade) | DS FY $L_{A10,18h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 1 | Dental Surgery | 67.0 | 67.0 | Neutral |
| 2 | Dalry Primary School | 51.3 | 51.9 | Slight Adverse |
| 3 | St. Palladius Primary School | 52.2 | 52.5 | Slight Adverse |
| 4 | AAHB Community Healthcare NHS Trust | 67.1 | 67.9 | Neutral/ Slight Adverse |

*Table 13.33 Table of Health and Educational Establishment Do-Minimum Baseline Year (DM BL) versus Do-Something Future Year (DS FY) Significance of Noise Impacts at the First Floor*

| ID | Name | DM BL $L_{A10,18h}$ (Facade) | DS FY $L_{A10,18h}$ (Facade) | Significance of Impact |
|---|---|---|---|---|
| 1 | Dental Surgery | 66.0 | 66.0 | Neutral |
| 2 | Dalry Primary School | 52.5 | 53.1 | Slight Adverse |
| 3 | St. Palladius Primary School | 54.3 | 54.6 | Slight Adverse |
| 4 | AAHB Community Healthcare NHS Trust | 67.2 | 68.0 | Neutral/ Slight Adverse |

13.6.33 In the short term, without the scheme in place (Do-Minimum Baseline Year versus Do-Minimum Future Year) all four buildings would experience either a neutral/slight adverse or a slight adverse significance of noise impact (i.e., an increase in noise level of less than 1 dB). With the scheme in place (Do-Minimum Baseline Year versus Do-Something Baseline Year), at ground floor level three buildings would experience either a neutral/slight adverse or a slight adverse significance of noise impact. However one building would experience a slight beneficial significance of noise impact (i.e., a decrease in noise level of less than 1 dB).

13.6.34 In the long term, at the ground floor level with the scheme in place (Do-Minimum Baseline Year versus Do-Something Future Year) all four buildings would experience either a neutral/slight adverse or a slight adverse significance of noise impact

13.6.35 In the long term, at the first floor level with the scheme in place (Do-Minimum Baseline Year versus Do-Something Future Year) all four buildings would experience either a neutral/slight adverse or a slight adverse significance of noise impact

### *Community Facility/Areas*

13.6.36 Figures 13.2a (woodland) and 13.2b (other community facilities/areas identifies the location of amenity, recreational areas and other noise sensitive community facilities/areas.

13.6.37 Given the large number of community facilities/areas a summary table of noise impacts is presented in Appendix 13.4.

13.6.38 The only community facilities that experience an increase in noise levels of more than 3dB when comparing the Do-Minimum Baseline Year with the Do-Minimum Future Year (Long Term) are as follows:

- 1 (ID: P_5) of the 4 cycle paths, of which 2% meets this criterion
- 1 (ID: P_4) of the 16 foot paths, of which 2% meets this criterion

13.6.39 For Do-Minimum Baseline Year versus Do-Something Baseline Year (Short Term) comparison, the community facilities that experience an increase in noise levels of more than 1dB are as follows:

- 83 of the 180 woodland and historic garden areas presented in Appendix 13.4 and can be visualised in Figures 13.20a and 13.20b.
- 3 of the 4 wildlife or provisional wildlife areas presented in Appendix 13.4 and can be visualised in Figure 13.20b.

- 2 of the 4 lengths of cycle paths presented in Appendix 13.4 (highlighted in grey shading) and can be visualised in Figure 13.20b.
- 12 of the 16 lengths of foot paths presented in Appendix 13.4 (highlighted in grey shading) and can be visualised in Figure 13.20b.

13.6.40 For the Do-Minimum Baseline Year versus Do-Something Future Year (Long Term) comparison, the community facilities that experience an increase in noise levels of more than 3dB are as follows:

- 47 of the 180 woodland and historic garden areas presented in Appendix.13.4 (highlighted in grey shading) and can be visualised in Figures 13.21a and 13.21b.
- 3 of the 4 wildlife or provisional wildlife areas presented in Appendix.13.4 (highlighted in grey shading) and can be visualised in Figure 13.21b).
- 2 of the 4 cycle paths presented in Appendix.13.4 highlighted in grey shading) and can be visualised in Figure 13.21b).
- 9 of the 16 footpaths presented in Appendix.13.4 (highlighted in grey shading and can be visualised in Figure 13.21b).

13.6.41 Finally, as detailed in Appendix.13.4, all the remaining community facility areas which have been assessed are predicted to experience either a decrease in noise levels or less than a 1dB or 3dB change in noise levels for short term and long term scenarios, respectively.

### Noise Nuisance

13.6.42 In Paragraph A1.34 of DMRB states that the nuisance calculations should be undertaken on the façade with the least beneficial change in noise (i.e. the one used for the noise assessment, A1.19(vi)). The predicted noise nuisance for the Do-Minimum Baseline Year versus Do-Minimum Future Year, and the Do-Minimum Baseline Year versus Do-Something Future Year, based on this approach has been determined, and is summarised in and Table 13.35 for the ground floor and first floor levels respectively.

*Table 13.34 Summary of Traffic Noise Nuisance for the Ground Floor*

| Project: Dalry Bypass | | | |
|---|---|---|---|
| Scenario/ Comparisons: Do-Minimum Scenario in the Baseline Year Versus Do-Minimum Scenario in the Future Year and Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Future Year | | | |
| Change in Nuisance Level, dB | | Do-Minimum | Do-Something |
| | | No. of Dwellings | No. of Dwellings |
| Increase (Adverse) in nuisance level | < 10% | 1760 | 1029 |
| | 10 < 20% | 0 | 648 |
| | 20 < 30% | 0 | 157 |
| | 30 < 40% | 0 | 158 |
| | > 40% | 0 | 134 |
| No Change | 0% | 1053 | 397 |
| Decrease (Beneficial) in nuisance level | < 10% | 47 | 335 |
| | 10 < 20% | 0 | 2 |
| | 20 < 30% | 0 | 0 |
| | 30 < 40% | 0 | 0 |
| | > 40% | 0 | 0 |

*Table 13.35 Summary of Traffic Noise Nuisance for the First Floor*

| Project: Dalry Bypass | | | |
|---|---|---|---|
| Scenario/ Comparisons: Do-Minimum Scenario in the Baseline Year Versus Do-Minimum Scenario in the Future Year and Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Future Year | | | |
| Change in Nuisance Level, dB | | Do-Minimum | Do-Something |
| | | No. of Dwellings | No. of Dwellings |
| Increase (Adverse) in nuisance level | < 10% | 2063 | 1028 |
| | 10 < 20% | 0 | 710 |
| | 20 < 30% | 0 | 146 |
| | 30 < 40% | 0 | 156 |
| | > 40% | 0 | 118 |
| No Change | 0% | 744 | 287 |
| Decrease (Beneficial) in nuisance level | < 10% | 53 | 413 |
| | 10 < 20% | 0 | 2 |
| | 20 < 30% | 0 | 0 |
| | 30 < 40% | 0 | 0 |
| | > 40% | 0 | 0 |

13.6.43 Paragraph A1.19.vii of DMRB states that it is acknowledged that the results from this assessment may often show the worst case and highlight mainly the adverse impacts of a road project. Where the road project has beneficial impacts that are not clear from the assessment these should be reported by the Overseeing Organisation’s supply chain. This is the case for the Dalry bypass scheme, as the methodology is such that noise level changes at relatively quiet façades, i.e. less than 45dB are assessed, rather than at façades where the greatest noise levels occur. Therefore, for example, noise level reductions at the noisiest façade of properties, i.e., those facing the main roads in

Dalry, where the traffic flows are predicted to reduce, do not appear as a benefit in the tables. To facilitate a better appreciation of these benefits the noise annoyance analysis has also been undertaken dwellings using the receptor with the maximum noise level at each property. These results are summarised in Tables 13.36 and Table 13.37 for the ground and first floors, respectively.

*Table 13.36 Summary of Traffic Noise Nuisance for the Ground Floor*

| Project: Dalry Bypass | | | |
|---|---|---|---|
| Scenario/ Comparisons:<br>Do-Minimum Scenario in the Baseline Year Versus Do-Minimum Scenario in the Future Year<br>and<br>Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Future Year | | | |
| Change in Nuisance Level, dB | | Do-Minimum | Do-Something |
| | | No. of Dwellings | No. of Dwellings |
| Increase (Adverse) in nuisance level | < 10% | 1844 | 971 |
| | 10 < 20% | 0 | 276 |
| | 20 < 30% | 0 | 74 |
| | 30 < 40% | 0 | 69 |
| | > 40% | 0 | 107 |
| No Change | 0% | 750 | 374 |
| Decrease (Beneficial) in nuisance level | < 10% | 266 | 973 |
| | 10 < 20% | 0 | 6 |
| | 20 < 30% | 0 | 4 |
| | 30 < 40% | 0 | 6 |
| | > 40% | 0 | 0 |

*Table 13.37 Summary of Traffic Noise Nuisance for the First Floor*

| Project: Dalry Bypass | | | |
|---|---|---|---|
| Scenario/ Comparisons:<br>Do-Minimum Scenario in the Baseline Year Versus Do-Minimum Scenario in the Future Year<br>and<br>Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Future Year | | | |
| Change in Nuisance Level, dB | | Do-Minimum | Do-Something |
| | | No. of Dwellings | No. of Dwellings |
| Increase (Adverse) in nuisance level | < 10% | 2061 | 1055 |
| | 10 < 20% | 0 | 286 |
| | 20 < 30% | 0 | 78 |
| | 30 < 40% | 0 | 101 |
| | > 40% | 0 | 76 |
| No Change | 0% | 538 | 293 |
| Decrease (Beneficial) in nuisance level | < 10% | 261 | 957 |
| | 10 < 20% | 0 | 4 |
| | 20 < 30% | 0 | 4 |
| | 30 < 40% | 0 | 6 |
| | > 40% | 0 | 0 |

13.6.44 As can be seen in Table 13.34, there is predicted to be an increase in noise nuisance for the Do Something scenario compared with the Do Minimum scenario. However, there is an increase in the number of dwellings experiencing a benefit with a noise nuisance reduction of 0 – 10% predicted to occur for 335 dwellings for the Do Something scenario compared with only 47 for the Do Minimum scenario.

13.6.45 Moreover, this analysis based on least beneficial noise level change underestimates the potential benefits of the scheme as often these changes occur at relatively quiet façades rather than at the façade facing the road, for example for those properties in Dalry where the traffic flows are predicted to decrease with the Proposed Scheme in place. This is evidenced in Table 13.36, which summarises the noise nuisance based on the maximum façade noise level at properties. Using this method, which better aligns with the original research undertaken to establish the relationship between road traffic noise level and annoyance, it can be seen that the overall number of adverse impacts for the Do Something scenario are less than the total adverse impacts for the Do Minimum scenario. However, it is acknowledged that approximately a third of the Do Something annoyance impacts occur in the higher annoyance bands. These higher noise nuisances are predicted to predominantly occur at properties at the Blairland Housing Scheme where maximum façade noise levels are predicted to rise following the introduction of the scheme to levels below the WHO seriously annoyed guideline level of $L_{Aeq,16hr}$ 55dB.

13.6.46 Also, this alternative analysis highlights that nearly 1000 dwellings will experience a noise nuisance benefit as a consequence of the scheme. Typically these benefits will occur in the vicinity of dwellings exposed to road traffic noise on existing roads that will by-passed with the scheme in place.

13.6.47 Similar effects will occur at the first floor of the properties.

### Vibration Nuisance

13.6.48 When determining vibration nuisance, Figures A6.1 and A6.2 of DMRB HD 213/11 have been used to determine the percentage of people bothered by traffic vibration, based on the predicted noise levels where the percentage of people bothered very much, or quite a lot, by vibration is 10% lower than the corresponding figure for noise nuisance. The predicted vibration nuisance for the Do-Minimum Baseline Year versus Do-Minimum Future Year, and the Do-Minimum Baseline Year versus Do-Something Future Year have been determined and summarised in Table 13.38 and Table 13.39, at the ground and first floors, respectively. Only properties that are within 40m of affected roads and have a predicted noise level greater than 58dB $_{LA10,18hr}$ have been assessed.

*Table 13.38 Summary of Traffic Induced Airborne Vibration Nuisance for the Ground Floor*

| Project: Dalry Bypass | | | |
|---|---|---|---|
| Scenario/ Comparisons:<br>Do-Minimum Scenario in the Baseline Year Versus Do-Minimum Scenario in the Future Year<br>and<br>Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Future Year | | | |
| Change in Nuisance Level, dB | | Do-Minimum | Do-Something |
| | | No. of Dwellings | No. of Dwellings |
| Increase (Adverse) in nuisance level | < 10% | 331 | 200 |
| | 10 < 20% | 0 | 93 |
| | 20 < 30% | 0 | 0 |
| | 30 < 40% | 0 | 0 |
| | > 40% | 0 | 0 |
| No Change | 0% | 914 | 943 |
| Decrease (Beneficial) in nuisance level | < 10% | 8 | 17 |
| | 10 < 20% | 0 | 0 |
| | 20 < 30% | 0 | 0 |
| | 30 < 40% | 0 | 0 |
| | > 40% | 0 | 0 |

*Table 13.39 Summary of Traffic Induced Airborne Vibration Nuisance for the First Floor*

| Project: Dalry Bypass | | | |
|---|---|---|---|
| Scenario/ Comparisons:<br>Do-Minimum Scenario in the Baseline Year Versus Do-Minimum Scenario in the Future Year<br>and<br>Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Future Year | | | |
| Change in Nuisance Level, dB | | Do-Minimum | Do-Something |
| | | No. of Dwellings | No. of Dwellings |
| Increase (Adverse) in nuisance level | < 10% | 339 | 206 |
| | 10 < 20% | 0 | 109 |
| | 20 < 30% | 0 | 0 |
| | 30 < 40% | 0 | 2 |
| | > 40% | 0 | 0 |
| No Change | 0% | 904 | 915 |
| Decrease (Beneficial) in nuisance level | < 10% | 10 | 21 |
| | 10 < 20% | 0 | 0 |
| | 20 < 30% | 0 | 0 |
| | 30 < 40% | 0 | 0 |
| | > 40% | 0 | 0 |

13.6.49 As for the noise nuisance the DMRB assessment methodology can underestimate the benefits offered by the proposed by-pass scheme and, as such, Tables 40 (ground floor) and 41 (first floor) summarise the vibration nuisance based on the use of maximum façade noise levels; i.e. the same basis as that for the alternate noise nuisance impacts reported in Tables 36 and 37 above.

*Table 13.40 Summary of Traffic Induced Airborne Vibration Nuisance for the Ground Floor*

| Project: Dalry Bypass | | | |
|---|---|---|---|
| Scenario/ Comparisons: Do-Minimum Scenario in the Baseline Year Versus Do-Minimum Scenario in the Future Year and Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Future Year | | | |
| Change in Nuisance Level, dB | | Do-Minimum | Do-Something |
| | | No. of Dwellings | No. of Dwellings |
| Increase (Adverse) in nuisance level | < 10% | 656 | 286 |
| | 10 < 20% | 0 | 84 |
| | 20 < 30% | 0 | 0 |
| | 30 < 40% | 0 | 0 |
| | > 40% | 0 | 0 |
| No Change | 0% | 489 | 483 |
| Decrease (Beneficial) in nuisance level | < 10% | 108 | 386 |
| | 10 < 20% | 0 | 5 |
| | 20 < 30% | 0 | 3 |
| | 30 < 40% | 0 | 6 |
| | > 40% | 0 | 0 |

*Table 13.41 Summary of Traffic Induced Airborne Vibration Nuisance for the First Floor*

| Project: Dalry Bypass | | | |
|---|---|---|---|
| Scenario/ Comparisons: Do-Minimum Scenario in the Baseline Year Versus Do-Minimum Scenario in the Future Year and Do-Minimum Scenario in the Baseline Year Versus Do-Something Scenario in the Future Year | | | |
| Change in Nuisance Level, dB | | Do-Minimum | Do-Something |
| | | No. of Dwellings | No. of Dwellings |
| Increase (Adverse) in nuisance level | < 10% | 654 | 314 |
| | 10 < 20% | 0 | 61 |
| | 20 < 30% | 0 | 0 |
| | 30 < 40% | 0 | 2 |
| | > 40% | 0 | 0 |
| No Change | 0% | 488 | 461 |
| Decrease (Beneficial) in nuisance level | < 10% | 111 | 402 |
| | 10 < 20% | 0 | 4 |
| | 20 < 30% | 0 | 3 |
| | 30 < 40% | 0 | 6 |
| | > 40% | 0 | 0 |

13.6.50 As can be seen Table 13.38, there are fewer increases in vibration nuisance for the Do Something scenario compared with the Do Minimum with 38 fewer properties predicted to experience an increase in vibration nuisance. Also there are 17 dwellings that are predicted to experience a vibration nuisance reduction at the ground floor compared with 8 properties for the Do Minimum Scenario. Again, this analysis is based on least beneficial changes in noise level, which, as already stated, may under estimate the beneficial impacts associated with the scheme. This is evidenced in Table 13.40, which summarises the vibration nuisance based on the maximum façade noise level at properties. Using this method, which better aligns with the original research undertaken to establish the relationship between road traffic noise level and annoyance, it can be seen that there are predicted to be approximately half as many adverse impacts for the Do Something scenario (370) as there are for the Do Minimum scenario (656) and that with the scheme in place 386 dwellings will experience a vibration nuisance reduction compared with only 108 for the Do Minimum.

13.6.51 Similar effects will occur at the first floor of the properties.

13.6.52 With regard to the occurrence of ground-borne vibration, it is necessary to have defects in the road surface for it this to occur. Since it must be assumed that the new road would initially have a surface that is of a high standard without defects, it can be assumed that, on opening, ground-borne vibration would not be an issue. However, should the road surface condition deteriorate sufficiently that road surface defects occur, then as vehicles traverse over these defects ground-borne vibrations would be generated. To mitigate against the potential adverse impacts that may arise because of defective road surfacing on the proposed roads, it is recommended that the authority responsible for the upkeep of the road maintain it in good repair. Accordingly, should the new road be maintained in good repair ground-borne vibration is unlikely to be an issue.

13.6.53 With regard to ground-borne vehicle induced vibration on existing roads, it is likely that if peak particle velocities equal to, or in excess of, 0.3mm/s were currently being experienced by residents, that complaints to appropriate authorities would have been registered by residents exposed to this level of vibration. There are no known complaints arising due to ground-borne vibration. Accordingly, ground-borne vibration from existing roads in the vicinity of the proposed route options is not considered to be an issue. Moreover, in the future, should ground-borne vibration become an issue, remedial action, in the form of road surface repairs, can be undertaken to return the round surface to a state of repair such that complaints cease.

## 13.7 Land Allocated for Residential Development

13.7.1 At the time of writing it is understood there are no committed developments within the study area. However, there is an area of land which has been allocated for possible future residential development and is identified in Figure 13.22.

13.7.2 The potential noise impact on this potential residential development area has been assessed. Table 13.42 details the percentage of development area that is less than $L_{Aeq,16hr}$ 55dB and that which is at least 55dB or greater for the Do-Minimum Baseline Year, Do-Minimum Future Year, Do-Something Baseline Year and the Do-Something Future Year. Thus the area that lies within the $L_{Aeq,16hr}$ 55dB meets with WHO external free field noise guideline levels. Clearly, the areas that exceed the $L_{Aeq,16hr}$ 55dB noise level would require mitigation to achieve acceptable external noise levels in accordance with WHO guidelines.

*Table 13.42 Predicted noise impact on potential development area*

| ID | Name | Total Area ($m^2$) | Do-Minimum Future | | Do-Minimum Baseline | | Do-Something Future | | Do-Something Baseline | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Percentage of Area Exposed to Noise Levels ($L_{Aeq,16hr}$ (dB)) | | | | | | | |
| | | | < 55 | ≥ 55 | < 55 | ≥ 55 | < 55 | ≥ 55 | < 55 | ≥ 55 |
| 1 | RES2 - Allocated Land for Residential Development | 229439 | 100 | 0 | 100 | 0 | 87 | 13 | 90 | 10 |

## 13.8 Wider Study Area

13.8.1 DMRB guidance indicates that an assessment of the impacts upon the wider network, i.e. properties that are within 50m of roads outside the core study area that are predicted to experience a +/- 1 dB change in noise as a result of changes in the flow of traffic along these roads. No road outwith the calculation area is predicted experience a change in traffic flow of more than +25% or -20% due to the scheme opening and, thus, a wider area assessment is not required.

## 13.9 Mitigation and Enhancement Measures

### Construction

13.9.1 As previously stated, at this stage of the proposed development, phasing, methods of working and type of plant that are likely to be employed during the construction phase is not known and, typically does not become available until the appointment of the contractor. Accordingly at this stage construction noise levels are not available.

13.9.2 When details on construction phasing and methodologies are available it is recommended that construction noise and, if necessary, vibration levels are predicted and assessed. Close liaison with the local authorities and local residents is essential.

13.9.3 If best practice is followed, including the use of appropriate mitigation it is likely that construction noise impacts can be minimised to acceptable levels.

13.9.4 The following recommended (mitigation) measures, as recommended in BS 5228, would be employed to minimise the noise impacts during the construction phase:

**1. Community Relations**

- The establishment and maintenance of good community relations would be a priority. This may include informing local residents on progress of the works by way of leaflet drops and/or public meetings and ensuring measures are put in place to minimise noise impacts. A telephone “hot line” and agreed procedure for the contractor to investigate and report on complaints would be set up.

**2. Training of Employees**

- Operatives would be trained to employ appropriate techniques to keep site noise to a minimum, and would be effectively supervised to ensure that best working practice in respect of noise reduction is followed.

**3. Execution of Works**

- Reasonably practicable measures to manage construction noise and vibration impacts that could be undertaken during these works include the following:
- The hours of working would be planned and account would be taken of the effects of noise upon persons in areas surrounding site operations and upon persons working on site, taking into account the nature of land use in the areas concerned, the duration of work and the likely consequence of any lengthening of work periods;
- Where reasonably practicable, quiet working methods would be employed, including use of the most suitable plant, reasonable hours of working for noisy operations, and economy and speed of operations. Site work continuing throughout 24 hours of a day would be programmed, when appropriate, so that haulage vehicles would not arrive at or leave the site between 18:00 h and 08:00 h, unless emergency works, or agreed with the local council environmental health department.
- Noise would be controlled at source, for example, by modification of existing plant/equipment, its use and location and ensuring maintenance of all noise-generating equipment;
- The spread of noise would be limited, i.e. by distance between source and receiver and/or screening.
- On-site noise levels would be monitored regularly, particularly if changes in machinery or project designs are introduced, by a suitably qualified person appointed specifically for the purpose. A method of noise measurement would be agreed prior to commencement of site works; and
- On those parts of a site where high levels of noise are likely to be a hazard to persons working on the site, prominent warning notices would be displayed and, where necessary, ear protectors would be provided.

13.9.5 A range of good site practices would be adopted in order to mitigate construction phase noise and vibration. Such measures, and other good site practice mitigation techniques, are defined below:

- Proper use of plant with respect to minimising noise emissions and regular maintenance. All vehicles and mechanical plant used for the purpose of the works would be fitted with effective exhaust silencers and would be maintained in good, efficient working order;
- Selection of inherently quiet plant where appropriate. All major compressors would be ‘sound reduced’ models fitted with properly lined and sealed acoustic covers which would be kept closed whenever the machines are in use and all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Machines in intermittent use would be shut down in the intervening periods between work or throttled down to a minimum;
- All ancillary plant such as generators, compressors and pumps would be positioned so as to cause minimum noise disturbance. If necessary, acoustic barriers or enclosures would be provided. A well-constructed 3m high barrier of 10mm softwood can reduce noise levels by 5-10 dB;

- Adherence to the codes of practice for construction working and piling given in British Standard BS 5228:2009 and the guidance given therein minimising noise emissions from the site and
- Blasting can be an emotive issue for residents. Good liaison between the contractor and residents is essential to prevent unnecessary anxiety. Wherever possible the operator would inform each resident of the proposed times of blasting and any deviation from this programme.
- Blasting can cause excessive noise emissions, the appropriate equipment would help to reduce the impact. Each blast would be carefully designed to maximise its efficiency and reduce the transmission of noise.

13.9.6 In order to minimise the likelihood of complaints, the Council and affected residents would be kept informed of the works to be carried out and of any proposed work outside normal hours. Residents would be provided with a point of contact for any queries or complaints.

13.9.7 In addition, the Council would be consulted regarding any proposed working outwith normal working hours.

## Operational Mitigation

13.9.8 Mitigation is considered in terms of incorporated mitigation (i.e. measures included as part of the road scheme's design and, if necessary receptor specific mitigation for properties predicted to experience a significance of noise impacts that are Slight/Moderate Adverse or worse and with a noise level exceeding 59.5dB $L_{A10,18h}$, as described in Paragraphs 13.4.34 – 13.3.38.

### *Incorporated Mitigation*

Earthworks

13.9.9 Earthworks have been incorporated into the design of the road scheme, and may provide noise and/or visual mitigation. Earthworks mitigation is fully described within Landscape Chapter.

Low Noise Surfacing

13.9.10 Low noise road surfacing is proposed throughout the scheme. Quieter road surfaces such as Stone Mastic Asphalt (SMA), or a pervious material, would be likely to reduce noise levels by approximately 2.5dB $L_{A10,18h}$ compared with conventional hot rolled asphalt surfacing. This benefit is related to the speed of the traffic on the road, and is effective at speeds in excess of approximately 50kph.

### *Receptor Specific Mitigation*

Acoustic Screens

13.9.11 If necessary, noise mitigation in the form of acoustic screens, would be positioned as close to the carriageway as possible to ensure maximum attenuation, taking into account alignment requirements, land available, and landscaping and visual requirements. The primary aim of any acoustic screens is to mitigate noise within residential amenity areas. However, in general, there may also be some benefit within first and ground floor internal spaces.

13.9.12 Typically, an acoustic screen would take the form of an earth bund, or closed boarded timber fence, or a combination of the two. It should be noted that any acoustic fencing would be of a minimum mass per unit area of 15kg/m$^2$ with no holes or gaps. Timbers must be overlapped to allow for shrinkage and timber screens should be well bedded in gravel (or equivalent) to avoid soil erosion, which could create gaps underneath the screens, reducing their noise attenuation effectiveness.

13.9.13 There are no properties that meet the recommended noise mitigation criteria. Accordingly, additional noise mitigation to compliment that which is incorporated in to the scheme design (earthworks and quiet road surfacing) is not required.

## 13.10 Residual Effects

13.10.1 The residual effects of the scheme, having taken mitigation in account (earthworks, low surface noise and receptor specific), there are no properties that that exceeds the threshold for mitigation.

*Committed Development*

13.10.2 There are no known committed development developments within the DMRB noise Study Area for the Dalry Bypass scheme. However, there is an area that has been designated for future residential development on the Local Plan. This area is located to the South and East of Douglas Avenue, Dalry, as shown in Figure 13.22. As can be seen in Figure 13.22 for both of the Do-Minimum scenarios, the predicted $L_{Aeq,16hr}$[3] is less than 55 dB across all of the proposed developable area and, thus, below the WHO guideline value of $L_{Aeq,16hr}$ 55dB threshold, which is commonly used as mitigation thresholds for residential developments during the planning process, for example see PAN 1/2001 and accompanying Technical advice Note (TAN). For the Baseline and Future Year Do-Something scenarios there is 10% and 13%, respectively, of the developable land that exceeds the 55dB threshold. Accordingly, at ground floor level it can be concluded that a typical PAN 1/2011 noise assessment for this designated future residential development area would conclude that noise mitigation may be required if there are amenity areas located in the areas where the predicted noise level exceeds the 55dB threshold. The extent of any mitigation could be determined at the detailed planning stage when a detailed noise assessment in accordance with Pan 1/2011 could be undertaken; in addition, appropriate acoustic glazing could be determined to meet with internal noise level requirements.

## 13.11 Summary & Conclusions

13.11.1 An assessment of the noise and vibration impacts associated with the construction and operational phases of the proposed Dalry Bypass scheme in accordance with the guidance contained in the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 7 (HD 213/11).

13.11.2 Summaries of the significance of impacts were presented in Tables 10.23 through to 10.28. With regard to the day-time magnitude of noise impacts it can be seen that in the short term there would be an increase in the magnitude of noise impacts for 656 dwellings where the increase in noise level is less than 1dB and there is predicted to be 119 Minor Adverse impacts, 79 Moderate Adverse impacts and 179 Major Adverse impacts. However, there would also be 885 decreases in noise level of less than 1dB,

[3] The $L_{aeq,16hr}$ noise level is derived from the predicted $L_{A10,18hr}$ by subtracting 2dB.

320 properties would experience a Minor Beneficial noise impact, 9 properties would experience a Moderate beneficial noise impact and 2 properties would experience a Major Beneficial noise impact. Similar noise impacts are predicted to occur at the first floor level.

13.11.3 In the long term, there are 903 fewer properties predicted to have an increase in noise levels for the Do Minimum Baseline Year versus the Do Something Future Year scenario than for the Do Minimum Baseline year versus the Do Minimum Future year scenario at ground floor level.

13.11.4 With regard to night-time noise, when comparing the Do Minimum Baseline versus the Do Something Future Year scenario with the Do Minimum Baseline versus the Do Minimum Future Year scenario, there is 1 less dwelling that is predicted to experience noise increase such that noise level increase to above $L_{Aeq,16hr}$ 55dB with the scheme in place. Furthermore, there are 922 fewer properties predicted to experience an increase in noise levels with the scheme in place. Similar noise impacts are predicted to occur at the first floor level.

13.11.5 The DMRB states that a change of 3dB is considered perceptible in the long term and that if a 3dB or more increase is predicted to occur at dwellings, when comparing the Do Minimum Baseline Year with Do Something Future Year then, where possible, mitigation should be offered.

13.11.6 There are no properties where the predicted façade noise level, as a consequence of the proposed Dalry bypass scheme, exceeds the noise mitigation criteria.

13.11.7 Noise nuisance analysis has been undertaken using the DMRB method of assessing the noise nuisance impacts based on least beneficial noise level changes. In addition, because this method may underestimate the potential benefits of these scheme an analysis based on maximum noise levels at façades has also been undertaken, which aligns better with the research method used to establish the relationship between road traffic noise level and annoyance. Summary tables of both sets of analysis are presented in Tables 13.34 – 13.37.

13.11.8 Similarly vibration nuisance has been assessed on the same basis as that for noise nuisance and summary tables are presented in Tables 13.38 – 13.41.

13.11.9 With regard to noise nuisance, as can be seen in Table 13.34, there is predicted to be an increase in noise nuisance for the Do Something scenario compared with the Do Minimum scenario. However, there is an increase in the number of dwellings experiencing a benefit with a noise nuisance reduction of 0 – 10% predicted to occur for 335 dwellings for the Do Something scenario compared with only 47 for the Do Minimum scenario.

13.11.10 Using the alternate method, it can be seen that the overall number of adverse impacts for the Do Something scenario are less than the total adverse impacts for the Do Minimum scenario. However, it is acknowledged that approximately a third of the Do Something annoyance impacts occur in the higher annoyance bands. These higher noise nuisances are predicted to predominantly occur at properties at the Blairland Housing Scheme where maximum façade noise levels are predicted to rise following the introduction of the scheme to levels below the WHO seriously annoyed guideline level of $L_{Aeq,16hr}$ 55dB.

13.11.11 Also, this alternative analysis highlights that nearly 1000 dwellings will experience a noise nuisance benefit as a consequence of the scheme. Typically these benefits will occur in the vicinity of dwellings exposed to road traffic noise on existing roads that will by-passed with the scheme in place.

13.11.12 Similar effects will occur at the first floor of the properties.

13.11.13 With regard to vibration nuisance, as can be seen in Table 13.38, there are fewer increases in vibration nuisance for the Do Something scenario compared with the Do Minimum with 38 fewer properties predicted to experience an increase in vibration nuisance. Also there are 17 dwellings that are predicted to experience a vibration nuisance reduction at the ground floor compared with 8 properties for the Do Minimum Scenario.

13.11.14 Using the alternate method, it can be seen that there are predicted to be approximately half as many adverse impacts for the Do Something scenario (370) as there are for the Do Minimum scenario (656) and that with the scheme in place 386 dwellings will experience a vibration nuisance reduction compared with only 108 for the Do Minimum.

13.11.15 With regard to the occurrence of groundborne vibration, should the new road be maintained in good repair groundborne vibration is not likely to be an issue.

13.11.16 With regard to groundborne vehicle induced vibration on existing roads, it is likely that if peak particle velocities equal to, or in excess of, 0.3mm/s were currently being experienced by residents that complaints to the appropriate authorities would have been registered by residents exposed to this level of vibration. There are no known complaints arising due to groundborne vibration. Accordingly, groundborne vibration from existing roads in the vicinity of the proposed route options is not considered to be an issue. Moreover, in the future, should groundborne vibration become an issue, remedial action, in the form of road surface repairs, can be undertaken to return the road surface to a state of repair such that complaints cease.

13.11.17 At this stage, a detailed assessment of the impact of noise and vibration from the construction work has not been undertaken as this would require detailed information on the type of plant and work scheduling which, in general, is not available until contractors have been appointed. However, it is likely that the piling associated with the construction of the viaduct over the River Garnock will generate the highest noise levels. Accordingly, an indicative assessment of piling operations based on Continuous Flight Auger rigs has been undertaken. The outcome of this assessment indicates that the significance of noise impacts associated with piling operations is predicted to be Negligible Adverse and that the vibration significance impacts will be Neutral.

13.11.18 Details on available guidance have been provided and with the adoption of best practicable means of noise and vibration mitigation, adverse impacts would be minimised.