9.0 NOISE AND VIBRATION

9.1 INTRODUCTION

9.1.1 This chapter provides the noise and vibration assessment for the proposed trunk road improvement scheme located on the A737 at The Den (Drawing 10/SW/0901/037/013 Rev H).

Noise

9.1.2 Noise can be defined as unwanted sound, with this definition relating to industrial and domestic noise as well as transportation noise sources.

9.1.3 Table 9.1 lists common sounds and the corresponding sound level.

Table 9.1 Sound Levels of Common Sources

Source	Sound Level dB(A)
Threshold of hearing	0
Quiet bedroom	35
Communication starts becoming difficult	55
Busy general office	60
Passenger car or light van 60km/h 7m distance	70
Twinned engine modern jet during take-off at a 152m distance	82
Heavy diesel lorry at 40km/h 7m distance	85
Hazard to hearing from continuous exposure	90
Pneumatic drill (not silenced) 7m distance	95
Threshold of pain	120

Human Perception of Changes in Noise Levels

9.1.4 Humans perceive changes in noise levels in the following way:

- A 1dB(A) change is the lowest change in sound level perceptible by humans. A 1dB(A) change would typically result from a traffic flow increase of 25% or decrease of 20%;
- A 3dB(A) change in noise levels is generally considered to be noticeable by humans; and
- An increase in sound level of 10dB(A) is perceived as a doubling of loudness to the ear.

Traffic noise

9.1.5 The main sources of noise associated with road traffic can be separated into two components;

- Engine noise generated by the engine exhaust system and transmission - this is the dominant noise source when traffic is not freely flowing. Noise from heavy vehicles, particularly when accelerating, braking or changing gears, is a significant contributor to low frequency noise; and
- Tyre noise from the interaction of tyres with the road surface. This is the dominant source under free flowing traffic conditions at moderate to high road speeds and contributes a significant proportion of the high frequency noise.

9.1.6 At any one instant, traffic noise experienced by an individual at a reception point is composed of noise from many vehicles at various distances. Factors influences traffic noise includes;

- Traffic flow, speed and composition i.e. the percentage of Heavy Goods Vehicles (HGV), road gradient and road surface characteristics, whether the road surface is wet or dry; and
- Noise propagation characteristics, such as distance of the receptor from the source, the topography and nature of the ground between the source and receptor, the presence of any obstructions, wind strength and direction.

Traffic Noise Indices

9.1.7 The noise from traffic streams is not constant and varies continually. The DMRB methodology utilises the $L_{A10,18h}$ index to achieve a single-figure estimate of the overall noise level for assessment purposes. This value is the arithmetic mean of the noise level exceeded for 10% of the time in each of the 18 one hour periods between 6am and midnight. Reasonably good correlation has been shown to exist between this index and residents annoyance with existing traffic noise over a wide range of exposures.

9.1.8 An alternative index is the equivalent continuous sound level L_{Aeq}. This is defined as the steady noise level over the measurement period that delivers the same noise energy as the actual intermittent noise. This measurement permits a fluctuating noise to be described in terms of a single noise level over the same exposure period.

Noise Nuisance

9.1.9 The World Health Organisation (WHO) defines noise nuisance as “a feeling of displeasure evoked by noise.” Nuisance caused by noise usually affects people in their own homes, however areas of open space used for recreational purposes can also suffer from noise pollution.

Vibration

9.1.10 Traffic vibration is a low frequency disturbance producing physical movement in buildings and their occupants. Vibration can be transmitted through the air or through the ground. Air borne vibration from traffic can be produced by the engines or exhausts with dominant frequencies in the 50 - 100Hz range. Ground borne vibration is more often in the 8-20 Hz range and is produced by the interaction between rolling wheels and the road surface. There are two effects of traffic vibration that need to be considered: effects on buildings and disturbances to occupiers.

Effects on Buildings

9.1.11 Ground borne vibrations are produced by the movement of rolling wheels on the road surface and can be perceptible in nearby buildings if heavy vehicles pass over irregularities in the road. Since significant ground borne vibrations are generated by irregularities in the road surface they are unlikely to be important when considering disturbance from new roads.

Disturbance to Occupiers

9.1.12 Ground-borne vibration is much less likely to be the cause of disturbance than airborne vibration but where it is the cause; its effects can be more severe. At high risk are occupants of buildings on soft soils which are close to heavily trafficked older roads where the road surface is uneven or constructed from concrete slabs which can deflect under the weight of passing heavy vehicles.

9.1.13 Traffic induced vibrations from low frequency sound emitted by vehicle engines and exhausts can be a source of annoyance to local people and can occur to some extent along any type of road. Such sound may result in detectable vibrations in building elements (for example windows, doors and in some cases, floors). Research has shown that $L_{A10,18hr}$ index was among the physical variables most closely associated with average vibration disturbance ratings. On average, traffic induced vibration is expected to affect a very small percentage of people at exposure levels below 58 dB(A) and therefore zero percent can be assumed in these cases.

9.2 METHODOLOGY

Planning Policy, Legislative Context and Standards

Planning Policy

PLANNING ADVICE NOTE 1/2011: PLANNING AND NOISE

9.2.1 This Planning Advice Note (PAN) provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise. It supersedes Circular 10/1999 *Planning and Noise* and PAN 56 *Planning and Noise.* The PAN promotes the principles of good acoustic design and a sensitive approach to the location of new development. It promotes the appropriate location of new potentially noisy development, and a pragmatic approach to the location of new development within the vicinity of existing noise generating uses, to ensure that quality of life is not unreasonably affected and that new development continues to support sustainable economic growth.

Legislative Context

THE NOISE INSULATION (SCOTLAND) REGULATIONS 1975, SI 1095/460

9.2.2 The Noise Insulation (Scotland) Regulations 1975 imposes a duty on authorities to provide, or make a grant towards, installation of noise insulation at eligible properties affected by new roads or an altered road. The regulations refer specifically to residential properties within 300m of the new and altered road, and the noise level reaches or exceeds 68 dB(A)$L_{10(18hr)}$ with at least 1dB(A) resulting from the increase in traffic.

9.2.3 Grants are not currently available to householders affected by increased traffic noise along existing roads resulting from re-routing or traffic management schemes or general increase in traffic flow.

LAND COMPENSATION (SCOTLAND) ACT 1973

9.2.4 At present where noise from a new or altered road exceeds a certain trigger level, and meets other qualifying criteria, the Land Compensation (Scotland) Act 1973 provide for insulation work to be carried out or a grant to be made in respect of that insulation work. “Altered" road is defined within the Noise Insulation (Scotland) Regulations 1975 (NISR). Under the NISR, the Land Compensation (Scotland) Act 1973 also confers a right to compensation for depreciation in the value of land caused by public works.

THE ENVIRONMENTAL PROTECTION ACT 1990

9.2.5 Since April 1st 1996, by virtue of the Environment Act 1995, the Environmental Protection Act 1990 (the 1990 Act) has given Scottish Local Authorities considerable and wide-ranging powers to tackle noise nuisance. S. 79 of the 1990 Act imposes a duty on local authorities to take reasonable steps to investigate complaints of nuisance and to inspect their area from time to time to detect statutory noise nuisances.

THE CONTROL OF POLLUTION ACT 1974

9.2.6 The Control of Pollution Act 1974 (the 1974 Act) was largely repealed by the Environmental Protection Act 1990. However, sections that are extant give local authorities powers to control noise from construction sites. Section 61 of this act sets out procedures for those undertaking works to obtain a ‘prior Consent’ for construction works within agreed noise limits.

Standards

9.2.7 This assessment was undertaken in accordance with the following standards:

- DMRB Volume 11 Section 3 Part 7 HA 213/11 – Revision 1, Noise and Vibration (2011); and
- Calculation of Road Traffic Noise, Department of Transport, Welsh Office 1988 (CRTN).

9.2.8 The DMRB Volume 11 Section 3 Part 7 HA 213/11 – Revision 1, Noise and Vibration provides guidance and procedures for the assessment noise and vibration impacts of road schemes. Three levels of assessment are described in DMRB, including:

- Scoping – to determine the likely extent of any assessment and to identify sensitive receptors;
- Simple – assessment of noise and vibration impact at dwellings and other sensitive receptors; and,
- Detailed –assessment of noise and vibration impact at dwellings and other sensitive receptors.

9.2.9 Determining the appropriate level of assessment is dependent upon threshold criteria being met. The threshold criteria used for traffic noise is a permanent change in magnitude of 1 dB(A) in the short term, or a 3 dB(A) change in the long term. For vibration, the threshold criterion of traffic is a peak particle velocity (PPV) rise to above a level of 0.3 mm/s, or an existing level above 0.3 mm/s is predicted to increase.

9.2.10 To determine whether these threshold levels may be exceeded the following are considered at scoping stage:

- The project alters the line or level of any existing carriageways;
- Traffic volumes on the existing roads or new routes will increase by at least 25% or decrease by 20% either during construction or when project is finished;
- The traffic speed or proportion of heavy vehicles on existing or new routes is altered and causes a change in noise level of more than 1dB(A) either during construction or when the project is complete;
- Changes in traffic volume and composition on existing roads or new routes during the night which may cause either of the threshold values to be exceeded; and
- Changes to the infrastructure surrounding the road that could, when the project is complete, cause a change in noise level of more than 1 dB(A).

9.2.11 The proposed scheme, as described within Chapter 1, is not anticipated to alter existing traffic volumes or composition either during construction or when the project is complete, however proposals will alter traffic speeds. The alignment of the existing carriageway will be altered.

BS5228

9.2.12 BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites – Noise, and BS 5228-2:2009 Code of practice for noise and vibration control on construction and open sites – Vibration, gives recommendations for basic methods of noise and vibration control relating to construction and open sites. It applies to work activities and operations that generate significant noise levels, and includes industry-specific guidance.

WORLD HEALTH ORGANISATION GUIDELINES

9.2.13 WHO guidelines state “general daytime outdoor noise levels of less than L_{Aeq} 55 dB are desirable to prevent any significant community annoyance”. An aspirational target was also set for dwellings of L_{Aeq} 50 dB for day and L_{Aeq} 45 dB for night.

Assessment Methodology

9.2.14 In agreement with the Overseeing Organisation (Transport Scotland), the assessment was undertaken in accordance with the Detailed Assessment methodology described within DMRB Volume 11 Section 3 Part 7 HA 213/11 – Revision 1, Noise and Vibration (2011). The Detailed Assessment evaluates the change in noise levels experienced by receptors by three comparisons:

- Do-Minimum scenario in baseline year against Do-Minimum scenario in the future assessment year;
- Do-Minimum scenario in the baseline year against Do-Something scenario in the baseline year; and
- Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year.

9.2.15 DMRB considers the baseline year as the year of opening of the project. The future assessment year is typically the 15th year after the opening year of the

project. For this scheme the baseline opening year is considered 2014, the future assessment year 2029.

9.2.16 Noise levels at various noise sensitive receivers were predicted in accordance with CRTN using CadnaA propriety acoustic modelling software (DataKustik version 4.1). It is recognised that this method has its limitations and that predicted noise levels are approximate. To assess accuracy, predicted baseline noise levels were compared with measured. The noise model includes terrain data, buildings, ground cover type, road surface type, and other structures that may screen or reflect noise. To ensure an accurate representation of the proposed routes, design drawings were incorporated into the model. Noise levels were generated utilising existing and future traffic flow data. This data includes 18-hour traffic flows between 06:00 and 24:00 hours and percentage of Heavy Goods Vehicles (HGV).

9.2.17 Road surfacing for Do-Minimum and Do-Something Baseline 2014, and for Do-Minimum and Do-Something Future year 2029 will be impervious bitumen. Following CRTN paragraph 16, as the traffic for each option is greater than 75km/h the following correction has been used for basic noise level:

9.2.18 For bituminous surfaces:

Correction = 10 Log10 (20 TD + 60) – 20 Db (A)

*(where TD is Texture Depth = 0.5mm)

= -1.549 rounded up to the nearest whole number

Correction = -2dB

9.2.19 Noise levels at dwellings were calculated in $L_{A10.18hrs,}$ at a default height of 1.5 metres above ground level. Noise levels at dwellings with a first floor were calculated at 4 metres above ground level. Dwellings with a first floor are specified below, all other dwellings are single-storey:

- Fernside
- No 1 The Den
- No 24 The Den
- No 25 The Den
- No 27 The Den
- No 29 The Den
- Nidaros
- Dungoyle
- West Muirhouse
- Glenshaft
- Maulside

9.2.20 DMRB requires a night time assessment to be undertaken when the threshold criterion of 3 dB $L_{night,outside}$ noise change in the long term is exceeded, but only where an $L_{night,outside}$ greater than 55dB is predicted in any scenario. The TRL report 'Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping' provides a technique for predicting L_{night}. Three methods are presented with Method 1, which relies on the provision of hourly traffic flows, preferred. Here, CRTN is used to calculate values of $L_{A10,1h}$ which can then be converted to $L_{Aeq,1h}$ values to derive L_{night}. However,

CRTN notes calculations of noise level for traffic flows below 50 veh/h are unreliable. As detailed within Table 9.2, night time traffic flows fall below these levels and therefore this method was not used. Method 2 was not used as the required traffic data was not available, therefore Method 3 was implemented. This method is considered potentially the least reliable of the three since it relies on the assumption that different road types will, on average, produce a reasonably consistent diurnal flow pattern.

Table 9.2: Night time hourly traffic flows

	2014	2029
23:00 - 24:00	115	123
00:00 - 01:00	71	76
01:00 - 02:00	38	41
02:00 - 03:00	28	30
03:00 - 04:00	28	30
04:00 - 05:00	51	55
05:00 - 06:00	139	150

9.2.21 With Method 3, CRTN is used to determine $L_{A10,18h}$ which is then used to determine L_{night} using the following relationship:

$Lnight = 0.90 \times L_{A10,18h} - 3.77$ dB

9.2.22 A correction of 2.5dB is then deducted from the derived L_{night} level to obtain the equivalent $L_{night,outside}$ free-field level.

9.2.23 DMRB states 'an assessment of cumulative noise and vibration impacts should be undertaken. This should include identifying where impacts are expected from the combined action of noise or vibration with other environmental topic-specific impacts upon people, dwellings or other sensitive receptors. The cumulative assessment is discussed within Chapter 15 (Conclusion in Relation to Impacts).

9.2.24 DMRB requires an assessment of traffic–induced vibration to be undertaken, where appropriate, for dwellings located within 40m of the carriageway, with the following comparisons considered:

- Do-Minimum scenario in baseline year against Do-Minimum scenario in the future assessment year; and
- Do-Minimum scenario in baseline year against Do-Something scenario in the future assessment year.

9.2.25 Noise measurements were undertaken, with results, limitations and constraints discussed within Appendix F1.

Determination of Baseline Conditions

9.2.26 The predicted baseline noise levels were supplemented with short-term attended noise surveys (Appendix F1). Drawing 10/SW/0901/037/203 Rev A illustrates the noise measurement locations. A comparison of measured noise levels with those predicted by the noise model is provided in Table 9.3.

Table 9.3 Comparison of Predicted and Measured Noise Levels

Sample Location	Predicted dB $L_{A10,18hr}$	Measured dB $L_{A10,15min}$
No 1 The Den (Front)	62.6	66.2
No.29 The Den (Rear)	51.6	55.1
No. 25 The Den (Front)	49.7	42.9 (night-time)
No. 29 The Den (Front)	64.4	71.5

9.2.27 Noise level predictions have been made at approximately the same positions as those which were measured. Differences between predicted and measured varies between 3.6 to 7.1 dB; this is due to the difference between the AAWT flows used in the noise level prediction method and the specific traffic flow on the day of the survey (traffic counts were not undertaken during noise measurements).

9.2.28 Overall, it is considered that CadnaA noise modelling software is suitably accurate for determining road traffic noise levels in accordance with CRTN, as required for this assessment.

Study Area

9.2.29 In accordance with DMRB, the study area considers land one kilometre from the carriageway edge of the bypassed or improved routes located within the start and end points of the physical works associated with the scheme. The calculation area includes land within 600m of the same routes, plus any other affected route within the 1km study area. An affected route is where there is the possibility of a change of 1 dB($L_{A10,18h}$) or more in the short-term or 3 dB($L_{A10,18h}$) in the long-term. As the works will not alter traffic volume or speed on any route within 1km the only affected route will be the A737.

9.2.30 The study area is therefore defined as 600m around the new/altered highway, 'the affected route', as illustrated within Drawing 10/SW/0901/037/013 Rev A. Noise calculations have been undertaken at each dwelling within 600m either side of the centreline of existing and proposed routes. A qualitative assessment of receptors out with 600 metres but within one kilometre of the project boundary has been undertaken. The study area is illustrated in Drawing 10/SW/0901/037/204 Rev A, Environmental – Noise and Vibration Study Areas.

9.2.31 The main source of noise and vibration in the area is considered to be A737 traffic noise.

Consultation

9.2.32 Consultation was undertaken with North Ayrshire Council Environmental Health Department however no response has been received. The consultation process is discussed in full detail within Chapter 3.

9.2.33 Extensive consultation was undertaken with owners of the following properties:

- No 1 The Den
- No 25 The Den
- No 27 The Den
- No 29 The Den
- Fernside

9.2.34 Owners expressed a preference for current design proposals, with landform shaped to negate the requirement for noise barriers.

Determination of Impact Significance

9.2.35 Assessment of Impact Significance was conducted in accordance with Chapter 2: Environmental Impact Assessment Methodology. Criteria for assessing the sensitivity of noise receptors are provided in Table 9.4. Factors considered in the assessment of magnitude of impact are presented in Tables 9.5 and 9.6.

Table 9.4 Determination of Receptor Sensitivity

Sensitivity	Typical Descriptors
Very High	The receptor has no ability to absorb change without fundamentally altering its present character. The receptor is of international importance.
High	The receptor has a low ability to absorb change without fundamentally altering its character. The receptor is of national importance.
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character. The receptor is of regional or local importance
Low	The receptor is tolerant of change without detriment to its character. The receptor is of local importance.
Negligible	The receptor is of little importance, any impact on the receptor will not be noticeable.

Table 9.5 Criteria for classification of magnitude of noise impact in the long term

Magnitude of Impact	Noise change $L_{A10,18h}$ (dB)
Major adverse	> 10.0
Moderate adverse	5.0 to 9.9
Minor adverse	3.0 to 4.9
Negligible	0.1 to 2.9
No Change	0
Negligible	-0.1 to -2.9
Minor beneficial	-3.0 to -4.9
Moderate beneficial	-5.0 to -9.9
Major beneficial	> -10.0

Table 9.6 Criteria for classification of magnitude of noise impact in the short term

Magnitude of Impact	Noise change $L_{A10,18h}$ (dB)
Major adverse	> 5.0
Moderate adverse	3.0 to 4.9
Minor adverse	1.0 to 2.9
Negligible	0.1 to 0.9
No Change	0
Negligible	-0.9 to -0.1
Minor beneficial	-2.9 to -1.0
Moderate beneficial	-4.9 to -3.0
Major beneficial	> -5.0

9.3 BASELINE CONDITIONS

Distribution of Noise Sensitive Receptors

9.3.1 Noise sensitive receptors located within 600m of the centreline of both existing and proposed road alignments are detailed within Table 9.7. Ten receptors are located within 50m of the centreline of the existing alignment and six are within 50m of the proposed route (Drawings 10/SW/0901/037/213 and 10/SW/0901/037/214). As detailed within DMRB, examples of sensitive receptors include dwellings, hospitals, schools, community facilities, designated sites (e.g. AONB, National Park, SAC, SPA, SSSI, SAM) and public rights of way.

Table 9.7 Noise Sensitive Receptors

Noise Sensitive Receptor	Distance from Existing Road Alignment (m)	Distance from Proposed Road Alignment (m)
No 1 The Den	27	19
No 17/19 The Den	7	76
No 18/20 The Den	8	97
No 22 The Den	66	150
No 24 The Den	67	151
No 25a The Den	174	80
No 25 The Den	156	70
No 27 The Den	31	40
No 29 The Den	22	44
Dungoyle	44	93
Nidaros	46	111
Maulside 1	445	445
Maulside 2	451	451
Fernside	8	10
West Muirhouse	236	315
East Muirhouse	428	516
Barkip Stables	409	472
Park Cottage	486	486
Hareshaw	247	247
Glenshaft	528	528
Highden	495	495
Maulside Lodge	17	17
The Graze (restaurant)	24	23

9.3.2 No 17/19 The Den and No 18/20 The Den are semi-detached properties and have been assessed as one sensitive receptor.

9.3.3 No AONB, National Park, SAC, SPA, SSSI or SAM designated sites are located within the 1km study area.

9.3.4 No community facilities are located within the study area, with the closest facilities located within the town of Dalry approximately 4km southwest of the scheme extents.

9.4 IMPACT ASSESSMENT

9.4.1 Currently, the A737 carriageway passes to the front of the dwellings listed below. The proposed realignment of the A737 will direct the route to the rear of these properties (Drawing 10/SW/0901/037/013 Rev H): These dwellings are therefore anticipated to experience a decrease in noise levels on façades facing the existing route and an increase on façades facing the proposed route.

- No. 1 The Den
- No. 17/19 The Den
- No. 27 The Den
- No. 29 The Den

9.4.2 DMRB paragraph A1.17 vi states '*Where a building is predicted to experience different changes on different facades, the least beneficial should be reported in the assessment table'. 'If this approach would lead to the reporting of two or more facades (i.e. where the same least beneficial change is shown on two or more facades) then the change on the façades with the highest noise level in the Do-Minimum scenario should be reported'.* Within this assessment, the worst case change is considered the change where an increased noise level is experienced. This is reported within the assessment tables, where appropriate, noise levels at multiple facades are discussed within the text of this report.

During Construction (Temporary Impacts)

9.4.3 Full details of construction works are not available at this stage however, works are likely to occur in four stages:

- Stage 1 - diversion of the water main and power cabling, installation of boundary fencing and walling. Commencement of the sheet piling will occur in advance of the earthworks at the west end of the scheme. Sacrificial sheet piling will be used to facilitate a single traffic flow through the site and allow peat and soft clay to be excavated.
- Stage 2 - construction of the eastbound carriageway. Initially some of the colliery spoil will be excavated to allow excavation of the underlying peat. In the short term some of this spoil will require to be stockpiled. Once the sheet piling is in place then the peat underlying the eastbound carriageway at the west end of the scheme will be excavated and the colliery spoil deposited as granular infill. Excavation of the clay cutting will also be commenced with the material run as suitable fill above the deposited colliery spoil. Sheeting piling will commence to the east of scheme extents upon completion of piling to the west. Over the centre section of the scheme the full width of the construction can take place. Installation of ducting for British Telecommunications to facilitate the cabling works and permit the existing cabling to become redundant. Construction of the permanent accesses to The Den and to Meadowhead Farm
- Stage 3 - removal of peat under the proposed westbound carriageway at either end of the scheme.

- Stage 4 - final surfacing to the proposed carriageway, including the tie-ins to the existing carriageway. Also at this stage the permanent road markings will be installed and the final utility diversion works carried out.

9.4.4 The impact of construction noise and vibration is assessed with reference to:

- BS 5228-Part 1:2009 Code of Practice for noise and vibration control on construction and open sites. Noise;
- BS 5228-Part 2:2009 Code of Practice for noise and vibration control on construction and open sites. Vibration;
- Environmental Protection Act (1990); and
- Control of Pollution Act (1974).

9.4.5 Noise sensitive receptors likely to experience disruption due to construction are listed within Table 9.7.

9.4.6 Properties close to the tie in of the new bypass and the current route where junctions are being altered; The Graze Restaurant and Fernside are likely to experience a significant impact during construction. No 1, 27 and 29 The Den are located within 50m of the Bypass route and will therefore suffer a detrimental impact during construction.

9.4.7 Noise in the vicinity of working areas will be unavoidable, arising from the movement and loading/unloading of vehicles and machinery, earthworks, rock removal, tipping of rock and all other associated construction activities. The extent of the noise and vibration impacts will vary throughout the scheme; depending on design and the contractor's methods of working and working hours.

9.4.8 Works are anticipated to last 32 weeks. Night time working will not be required. Traffic management will be designed to minimise disruption. The location of welfare facilities is not resolved at this stage, but should be located to minimise disruption to local residents.

Post Construction (Permanent Impacts)

Noise

9.4.9 DMRB requires a qualitative assessment of the noise impact to be undertaken for dwellings and other sensitive receptors that are within 1km of the proposed scheme boundary but not within 600m of an affected route. Receptors are described within section 9.3 and Drawing 10/SW/0901/037/204 Rev A, the qualitative assessment is detailed below:

- Little Barkip, High Swindridgemuir, Wheatyfauld and Glenlora located to the south of the scheme extents would be subject to negligible impacts at both opening and future assessment years.
- Meikle Barcosh/ Barcosh Farm, Brackenhills Station Cottage and Maulside Mains located to the east of the scheme extents would be subject to negligible impacts at both opening and future assessment years.
- Sidehouse, Sylwood, Glenside, Davidshill, Meikle Auchengree and Langmuir of Auchengree located to the north of the scheme extents would be subject to negligible impacts at both opening and future assessment years.

- Brownhill House, Birkentop Cottage and Easter Highfield to the west of the scheme extents would be subject to negligible impacts at both opening and future assessment years.

9.4.10 For a Detailed Assessment, HD 213/11 requires the completion of assessment tables comparing the following:

- Do-Minimum scenario in baseline year against Do-Minimum scenario in the future assessment year;
- Do-Minimum scenario in the baseline year against Do-Something scenario in the baseline year; and
- Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year.

9.4.11 The findings of this process are discussed in the following paragraphs. A summary of the predicted overall impact of the proposed scheme is presented within Tables 9.15 and 9.16. Noise contour maps are provided within Drawings 10/SW/0901/037/219 - 222, and a list of predicted noise levels for all sensitive receptors in the study area provided in Appendix F2.

DO-MINIMUM SCENARIO IN BASELINE YEAR COMPARED AGAINST DO-MINIMUM SCENARIO IN THE FUTURE ASSESSMENT YEAR

9.4.12 To investigate the long-term noise changes experienced by receptors should the proposed scheme not be constructed, noise levels associated with the existing route alignment were calculated for both the baseline (2014) and future assessment year (2029).

9.4.13 During daytime hours, all properties within the 600m calculation area are predicted to experience a 0.3-0.4 dB increase in sound levels (Tables 9.8 and 9.9). As traffic travelling on the A737 is the predominant noise source in area (Appendix F1), properties located close to the A737 experience higher noise levels.

9.4.14 Night-time noise levels experienced by receptors (within 600m) are predicted to increase by 0.1-0.3 dB.

Table 9.8: Sound Levels Experienced by Receptors - Do-Minimum (DM) scenario in baseline year (BY) compared against Do-Minimum scenario in the future assessment year (FY)

Receptor		Daytime (dB(A))			Night-time (dB(A))		
		DM BY (2014)	DM FY (2029)	Change in noise	DM BY (2014)	DM FY (2029)	Change in noise
No 1 The Den	'front' façade	62.6	63.0	0.4	50.1	50.4	0.3
	'rear' façade	50.6	50.9	0.3	39.3	39.5	0.2
No 17/19 The Den	south façade	69.8	70.1	0.3	56.6	56.8	0.2
	north façade	55.8	56.1	0.3	44.0	44.2	0.2
No 18/20 The Den		68.9	69.2	0.3	55.8	56.0	0.2
No 22 The Den		55.5	55.8	0.3	43.9	44.0	0.1
No 24 The Den		54.8	55.1	0.3	43.1	43.3	0.2
No 25a The Den		47.3	47.6	0.3	36.3	36.6	0.3
No 25 The Den	east façade	49.0	49.3	0.3	37.8	38.1	0.3
	west façade	44.7	45.0	0.3	34.0	34.2	0.2
	south façade	49.7	50.0	0.3	38.5	38.7	0.2
No 27 The Den	'rear' façade	49.0	49.3	0.3	37.8	38.1	0.3
	'front' façade	60.8	61.1	0.3	48.5	48.7	0.2
No 29 The Den	'front' façade	64.4	64.7	0.3	51.7	52.0	0.3
	'rear' façade	51.6	51.9	0.3	40.2	40.4	0.2
Dungoyle		59.1	59.4	0.3	46.9	47.2	0.3
Nidaros		58.4	58.7	0.3	46.3	46.6	0.3
Maulside 1		42.1	42.4	0.3	31.6	31.9	0.3
Maulside 2		43.2	43.5	0.3	32.6	32.9	0.3
Fernside		69.5	69.9	0.4	56.3	56.6	0.3
West Muirhouse	east façade	43.6	43.9	0.3	33.0	33.2	0.2
	north façade	46.9	47.2	0.3	36.0	36.2	0.2
East Muirhouse		41.2	41.6	0.4	31.0	31.2	0.2
Barkip	north façade	39.7	40.0	0.3	29.5	29.7	0.2
	east façade	36.8	37.1	0.3	26.9	27.1	0.2
Park Cottage	north façade	38.9	39.2	0.3	28.7	29.0	0.2
	west façade	38.0	38.4	0.4	28.0	28.3	0.3
Hareshaw		43.8	44.1	0.3	33.2	33.4	0.2
Glenshaft		40.0	40.3	0.3	29.7	30.0	0.3
Highden		38.2	38.5	0.3	28.1	28.4	0.3
Maulside Lodge	'front' façade	56.4	56.7	0.3	44.5	44.8	0.3
	'rear' façade	58.0	58.3	0.3	45.9	46.2	0.3
The Graze (Restaurant)		62.3	62.6	0.3	49.8	50.1	0.3

Table 9.9: Long-term traffic noise reporting table for simple and detailed assessment (DMRB Assessment Table A1.2)

Project/Option: The Den				
Scenario/Comparison: Do-Minimum scenario in the baseline year against Do-Minimum scenario in the future assessment year				
		Daytime		Night-time
Change in noise level		Number of dwellings	Number of other sensitive receptors	Number of dwellings
Increase in noise level, $L_{A10,18hr}$	0.1 - 2.9	22	1	23
	3.0 - 4.9	0	0	0
	5.0 - 9.9	0	0	0
	10 +	0	0	0
No Change	0	0	0	0
Decrease in noise level, $L_{A10,18hr}$	0.1 - 2.9	0	0	0
	3.0 - 4.9	0	0	0
	5.0 - 9.9	0	0	0
	10 +	0	0	0

*For night-time assessment threshold criteria see paragraph 9.4.17.

DO-MINIMUM SCENARIO IN THE BASELINE YEAR AGAINST DO-SOMETHING SCENARIO IN THE BASELINE AND FUTURE ASSESSMENT YEARS.

9.4.15 To investigate both the long and short-term noise changes experienced by receptors should the proposed scheme be constructed, noise levels associated with the proposed route alignment were calculated for both the baseline (2014) and future assessment year (2029). This data was compared with noise levels calculated for the existing route alignment (2014), presented within Tables 9.10 – 9.11 and Tables 9.12-9.13 respectively.

9.4.16 The proposed realignment of the A737 will redirect the route from the front to the rear of the following properties (Drawing 10/SW/0901/037/013 Rev H), with these dwellings therefore anticipated to experience a decrease in noise levels on façades facing the existing route and an increase on façades facing the proposed route.

- No. 1 The Den
- No. 17/19 The Den
- No. 27 The Den
- No. 29 The Den

9.4.17 The proposed scheme will decrease the distance between the following receptors and the road centreline, thereby increasing noise levels on façades facing the proposed route (Tables 9.10 and 9.12):

- The Graze (restaurant)
- No 1 The Den

- No 25 The Den
- No 25a The Den

Table 9.10: Sound Levels Experienced by Receptors - Do-Minimum scenario in baseline year compared against Do-Something scenario in the baseline year

Receptor		Do-Minimum Baseline Year (2014) (dB(A))	Do-Something Baseline Year (2014) (dB(A))	Change in noise
No 1 The Den	'front' façade	62.6	60.2	-2.4
	'rear' façade	50.6	65.1	14.5
No 17/19 The Den	north façade	69.8	54.8	-15
	south façade	55.8	42.7	-13.1
No 18/20 The Den		68.9	54.0	-14.9
No 22 The Den		55.5	53.8	-1.7
No 24 The Den		54.8	53.6	-1.2
No 25a The Den		47.3	55.0	7.7
No 25 The Den	south façade	49.7	58.4	8.7
	east façade	49.0	57.3	8.3
	west façade	44.7	52.2	7.5
No 27 The Den	'rear' façade	49.0	61.5	12.5
	'front' façade	60.8	52.7	-8.1
No 29 The Den	'front' façade	64.4	56.1	-8.3
	'rear' façade	51.6	60.6	9
Dungoyle		59.1	58.2	-0.9
Nidaros		58.4	55.8	-2.6
Maulside 1		42.1	47.0	4.9
Maulside 2		43.2	48.0	4.8
Fernside		69.5	72.8	3.3
West Muirhouse	east façade	43.6	47.7	4.1
	north façade	46.9	50.7	3.8
East Muirhouse		41.2	45.6	4.4
Barkip	north façade	39.7	44.2	4.5
	east façade	36.8	41.4	4.6
Park cottage	north façade	38.9	43.7	4.8
	west façade	38.0	42.9	4.9
Hareshaw		43.8	48.9	5.1
Glenshaft		40.0	44.8	4.8
Highden		38.2	43.1	4.9
Maulside Lodge	'front' façade	56.4	62.0	5.6
	'rear' façade	58.0	62.8	4.8
The Graze (restaurant)		62.3	66.5	4.2

Table 9.11: Short-term traffic noise reporting table for simple and detailed assessment (DMRB Assessment Table A1.1)

Project/Option: The Den			
Scenario/Comparison: Do-Minimum scenario in the baseline year against Do-Something scenario in the baseline assessment year			
		Daytime	
Change in noise level		Number of dwellings	Number of other sensitive receptors
Increase in noise level, $L_{A10,18hr}$	0.1 - 0.9	0	0
	1.0 - 2.9	0	0
	3.0 - 4.9	9	1
	5 +	7	0
No Change	0	0	0
Decrease in noise level, $L_{A10,18hr}$	0.1 - 0.9	1	0
	1.0 - 2.9	3	0
	3.0 - 4.9	0	0
	5 +	2	0

Table 9.12: Sound Levels Experienced by Receptors - Do-Minimum scenario in baseline year compared against Do-Something scenario in the future assessment year

Receptor		Daytime (dB(A))			Night -time (dB(A))		
		DM BY (2014)	DS FY (2029)	Change in noise	DM BY (2014)	DS FY (2029)	Change in noise
No 1 The Den	'front' façade	62.6	60.3	-2.3	50.1	48.0	-2.1
	'rear' façade	50.6	65.4	14.8	39.3	52.6	13.32
No 17/19 The Den	north façade	55.8	54.7	-1.1	44.0	43.0	-1.0
	south façade	69.8	42.8	-27	56.6	32.3	-24.3
No 18/20 The Den		68.9	53.9	-15	55.8	42.2	-13.6
No 22 The Den		55.5	53.8	-1.7	43.9	42.2	-1.7
No 24 The Den		54.8	53.5	-1.3	43.1	41.9	-1.2
No 25a The Den		47.3	55.3	8	36.3	43.5	7.2
No 25 The Den	south façade	49.7	58.6	8.9	38.5	46.5	8.0
	east façade	49.0	57.5	8.5	37.8	45.5	7.7
	west façade	44.7	52.4	7.7	34.0	40.9	6.9
No 27 The Den	'rear' façade	49.0	61.8	12.8	37.8	49.4	11.6
	'front' façade	60.8	52.7	-8.1	48.5	41.2	-7.3
No 29 The Den	'rear' façade	51.6	60.9	9.3	40.2	48.5	8.3
	'front' façade	64.4	55.9	-8.5	51.2	44.0	-7.2
Dungoyle		59.1	58.3	-0.8	46.9	46.2	-0.7
Nidaros		58.4	56.0	-2.4	46.3	44.1	-2.2
Maulside 1		42.1	46.3	4.2	31.6	35.4	3.8
Maulside 2		43.2	47.4	4.2	32.6	36.4	3.8
Fernside		69.5	73.0	3.5	56.3	59.4	3.1
West Muirhouse	east façade	43.6	47.3	3.7	33.0	36.3	3.3
	north façade	46.9	50.4	3.5	36.0	39.1	3.1
East Muirhouse		41.2	45.3	4.1	31.0	34.5	3.5
Barkip	north façade	39.7	43.8	4.1	29.5	33.2	3.7
	east façade	36.8	41.0	4.2	26.9	30.6	3.7
Park Cottage	north façade	38.9	43.2	4.3	28.7	32.6	3.9
	west façade	38.0	42.2	4.2	28.0	31.7	3.7
Hareshaw		43.8	48.0	4.2	33.2	36.9	3.7
Glenshaft		40.0	44.2	4.2	29.7	33.5	3.8
Highden		38.2	42.5	4.3	28.1	32.0	3.9
Maulside Lodge	'front' façade	56.4	61.1	4.7	44.5	48.7	4.2
	'rear' façade	58.0	62.0	4.0	45.9	49.5	3.6
The Graze (restaurant)		62.3	65.8	3.5	49.8	53.0	3.2

Table 9.13: Long-term traffic noise reporting table for simple and detailed assessment (DMRB Assessment Table A1.2)

Project/Option: The Den				
Scenario/Comparison: Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year				
Change in noise level		Daytime		Night-time
		Number of dwellings	Number of other sensitive receptors	Number of dwellings
Increase in noise level, $L_{A10,18hr}$	0.1 - 2.9	0	0	0
	3.0 - 4.9	12	1	12
	5.0 - 9.9	3	0	3
	10 +	2	0	2
No Change	0	0	0	0
Decrease in noise level, $L_{A10,18hr}$	0.1 - 2.9	5	0	5
	3.0 - 4.9	0	0	0
	5.0 - 9.9	0	0	0
	10 +	1	0	1

* For night-time assessment threshold criteria see paragraph 9.4.17.

NIGHT-TIME ASSESSMENT

9.4.18 DMRB stipulates a noise assessment must be undertaken when the following threshold criterion is met:

- A 3dB change in noise level; but only where an Lnight,outside greater than 55dB is predicted in any scenario.

9.4.19 In table 9.8 and 9.9 there are no changes of greater then 3dB therefore no night-time assessment required.

9.4.20 As detailed within Table 9.12 three properties; No 17/19 The Den south facade, No 18/20 The Den; No 29 The Den front façade meet the criterion above. These properties all show a positive impact with a decrease in noise levels of greater than 3dB from a baseline noise level of above 55dB.

Nuisance

9.4.21 A nuisance assessment was undertaken with the increase or decrease of the number of people bothered by noise calculated. Nuisance calculations were undertaken to consider the façade with the least beneficial change in noise. The results from this assessment are presented within Table 9.14.

Table 9.14: Traffic Noise Nuisance Reporting Table for Detailed Assessments (DMRB Assessment Table A1.3)

Project/Option: The Den			
Scenario/Comparison: Do-Minimum 2014 compared to Do-Minimum 2029 and Do-Minimum 2014 compared to Do-Something 2029			
Change in nuisance level		Do-Minimum 2029	Do-Something 2029
		Number of dwellings	Number of dwellings
Increase in nuisance level	< 10%	7	15
	10 < 20%	0	0
	20 < 30%	0	0
	30 < 40 %	0	0
	> 40 %	0	0
No Change	0	15	0
Decrease in nuisance level	< 10%	0	4
	10 < 20%	0	1
	20 < 30%	0	2
	30 < 40 %	0	0
	> 40 %	0	0

IMPACTS OF PROPOSED SCHEME

9.4.22 The receptor sensitivity, magnitude and significance of impacts in both the long and short term were determined in accordance with Section 9.2 Methodology and are presented within Tables 9.15 and 9.16 respectively.

Table 9.15: Impacts of the Proposed Scheme in the Short Term

Receptor		Sensitivity	Magnitude	Significance
No 1 The Den	'front' façade	High	Negligible	Slight Beneficial
	'rear' façade	High	Major Adverse	Very Large
No 22 The Den		High	Negligible	Slight Beneficial
No 24 The Den		High	Negligible	Slight Beneficial
No 27 The Den	'rear' façade	High	Major Adverse	Very Large
	'front' façade	High	Moderate Beneficial	Large Beneficial
No 29 The Den	'rear' façade	High	Moderate Beneficial	Large Beneficial
	'front' façade	High	Moderate Adverse	Large
No 18/20 The Den		High	Major Beneficial	Very Large Beneficial
No 17/19 The Den	north façade	High	Major Beneficial	Very Large Beneficial
	south façade	High	Major Beneficial	Very Large Beneficial
No 25a The Den		High	Moderate Adverse	Moderate
No 25 The Den	south façade	High	Moderate Adverse	Large
	east façade	High	Moderate Adverse	Large
	west façade	High	Moderate Adverse	Large
Dungoyle		High	Negligible	Slight Beneficial
Nidaros		High	Negligible	Slight Beneficial
Maulside 1		High	Minor Adverse	Moderate
Maulside 2		High	Minor Adverse	Moderate
Fernside		High	Minor Adverse	Slight
West Muirhouse	east façade	High	Minor Adverse	Slight
	north façade	High	Minor Adverse	Slight
East Muirhouse		High	Minor Adverse	Slight
Barkip	north façade	High	Minor Adverse	Slight
	east façade	High	Minor Adverse	Slight
Park cottage	north façade	High	Minor Adverse	Slight
	west façade	High	Minor Adverse	Slight
Hareshaw		High	Moderate Adverse	Moderate
Glenshaft		High	Minor Adverse	Slight
Highden		High	Minor Adverse	Slight
Maulside Lodge -	'front' façade	High	Moderate Adverse	Slight
	'rear' façade	High	Minor Adverse	Slight
The Graze		Medium	Minor Adverse	Slight

Table 9.16: Noise – Impacts of Proposed Scheme in the Long Term

Receptor		Sensitivity	Magnitude	Significance
No 1 The Den	'rear' façade	High	Major Adverse	Large
	'front' façade	High	Negligible	Slight Beneficial
No 17/19 The Den	north façade	High	Negligible	Slight Beneficial
	south façade	High	Major Beneficial	Very Large Beneficial
No 18/20 The Den		High	Major Beneficial	Very Large Beneficial
No 22 The Den		High	Negligible	Slight Beneficial
No 24 The Den		High	Negligible	Slight Beneficial
No 25a The Den		High	Moderate Adverse	Large
No 25 The Den	south façade	High	Moderate Adverse	Large
	east façade	High	Moderate Adverse	Large
	west façade	High	Moderate Adverse	Large
No 27 The Den	'rear' façade	High	Major Adverse	Large
	'front' façade	High	Moderate Beneficial	Moderate Beneficial
No 29 The Den	'rear' façade	High	Moderate Adverse	Moderate
	'front' façade	High	Moderate Beneficial	Moderate Beneficial
Dungoyle		High	Negligible	Slight Beneficial
Nidaros		High	Negligible	Slight Beneficial
Maulside 1		High	Minor Adverse	Moderate
Maulside 2		High	Minor Adverse	Moderate
Fernside		High	Minor Adverse	Slight
West Muirhouse	east façade	High	Minor Adverse	Slight
	north façade	High	Minor Adverse	Slight
East Muirhouse		High	Minor Adverse	Moderate
Barkip	north façade	High	Minor Adverse	Moderate
	east façade	High	Minor Adverse	Moderate
Park cottage	north façade	High	Minor Adverse	Moderate
	west façade	High	Minor Adverse	Moderate
Hareshaw		High	Minor Adverse	Moderate
Glenshaft		High	Minor Adverse	Moderate
Highden		High	Minor Adverse	Moderate
Maulside Lodge	'front' façade	High	Minor Adverse	Moderate
	'rear' façade	High	Minor Adverse	Moderate
The Graze (restaurant)		Medium	Minor Adverse	Slight

Vibration

9.4.23 In accordance with DMRB, the vibration assessment is restricted to dwellings within 40m of the carriageway. As detailed within Table 9.17, seven dwellings fall within this category.

Table 9.17 Dwellings within 40m

Receptor	Distance from alignment centreline (m)	
	Existing	Proposed
Fernside	8	10
No 1 The Den	27	19
No 17/19 The Den	7	76
No 18/20 The Den	8	97
No 27 The Den	31	40
No 29 The Den	22	44
Maulside Lodge	17	17

9.4.24 DMRB reports that the relationship between the percentage of people bothered by largely airborne vibration and the noise exposure index is similar to that for noise nuisance except the percentage of people bothered by vibration is lower at all exposure levels. For a given level of noise exposure the percentage of people bothered very much or quite a lot by vibration is 10% lower than the corresponding figure for noise nuisance. An assessment of vibration nuisance is provided in Table 9.18.

Table 9.18: Traffic Airborne Vibration Nuisance Reporting Table for Detailed Assessments (DMRB Table A1.4)

Project/Option: The Den			
Scenario/Comparison: Do-Minimum 2014 compared to Do-Minimum 2029 and Do-Minimum 2014 compared to Do-Something 2029			
Change in nuisance level		Do-Minimum 2029 Number of dwellings	Do-Something 2029 Number of dwellings
Increase in nuisance level	< 10%	0	0
	10 < 20%	0	0
	20 < 30%	0	0
	30 < 40 %	0	0
	> 40 %	0	0
No Change	0	7	4
Decrease in nuisance level	< 10%	0	1
	10 < 20%	0	2
	20 < 30%	0	0
	30 < 40 %	0	0
	> 40 %	0	0

Cumulative Impacts

9.4.25 Cumulative noise and vibration impacts are considered likely to occur where:

- Construction of the proposed scheme coincides with works on any other site within the study area;
- Traffic on local roads is affected by other developments; or
- Operational noise from other developments affects the identified receptors.

9.4.26 No other developments within the study area have been identified which would increase noise levels at receptors. Therefore, no cumulative noise and vibration impacts are predicted.

9.5 MITIGATION

Construction Noise and Vibration

9.5.1 Best practicable means of noise control, as described within BS 5228-1:2009 Code of practice for noise and vibration control on construction and open sites – Noise, and BS 5228-2:2009 Code of practice for noise and vibration control on construction and open sites – Vibration, will be included in the contract specifications in order to minimise the risk of disturbance. These British Standards provide specific detail on suitable measures for noise control in respect of construction operations. Measures considered for works include:

- Operatives should receive training to effectively employ techniques to reduce site noise;
- Unnecessary noise should be avoided when carrying out manual operations and when operating plant and equipment;
- Appropriate mufflers and silencers should be fitted to machinery. All exhaust silencers should be checked at regular intervals to ensure efficiency and replaced immediately if required;
- Worker noise should be minimised e.g. radios/phones provided to aid communication across the site;
- Vehicles must not idle needlessly, and equipment switched off when not required;
- Where a choice of plant is available, the quieter option should be chosen.
- All plant must be well-maintained and service documentation available for inspection;
- Static plant items should be sympathetically sited away from noise sensitive areas, or alternatively screened where ever possible;
- Temporary acoustic screening should be utilised at sensitive parts of the boundary of the construction site. Effective acoustic screening must be manufactured from material with adequate sound transmission loss characteristics and must, at least, break the line of sight between source and receiver;
- Noise levels should be monitored through regular noise assessments during works;
- Percentage on-time of noise-generating equipment should be minimised;
- The local community should be informed in advanced of noise-generating works.

Operational Noise and Vibration

9.5.2 The road is located within a cutting with embankments specifically sculptured to negate the requirement for noise barriers. The effectiveness of this approach was modelled with CadnaA and discussed with local residents (refer to consultation). Therefore, no mitigation is required for residual noise impacts.

9.6 NOISE INSULATION REGULATIONS

9.6.1 With the proposed scheme, no dwellings qualify for noise insulation under NISR.

9.7 CONCLUSIONS

9.7.1 Seventeen dwellings located outside the 600m calculation area but within the 1km study area, will be subject to negligible impacts at both opening and future assessment years.

9.7.2 The proposed realignment of the A737 will redirect the route from the front to the rear of the following properties, with these dwellings therefore anticipated to experience an adverse impact on 'rear' facades and a beneficial impact on the 'front' façade in the long term. With the 'rear' facades of No's 1and 27 the Den experiencing a large adverse impact, and No 29, a moderate adverse impact:

- No. 1 The Den
- No. 27 The Den
- No. 29 The Den

9.7.3

9.7.4 The proposed scheme will decrease the distance between the following receptors and the road centreline, thereby increasing noise levels on façades facing the proposed route, with all properties predicted to experience a moderate adverse impact:

- No 25 The Den
- No 25a The Den

9.7.5 The proposed scheme will increase the distance between the following receptors and the road centreline, thereby decreasing noise levels on façades facing the proposed route, with all properties predicted to experience a beneficial impact:

- No 17/19 The den (slight – very large beneficial)
- No 22 The Den (slight beneficial)
- No 24 The Den (slight beneficial)
- Dungoyle (slight beneficial)
- Nidaros (slight beneficial)

9.7.6 In the long term, the proposed scheme is predicted to have a neutral impact on The Graze restaurant, a slight adverse impact on Fernside, West Muirhouse and a moderate adverse impact on the following receptors:

- Maulside 1

- Maulside 2
- Barkip
- Park Cottage
- Hareshaw
- Glenshaft
- Highden
- Maulside Lodge

9.7.7 With the proposed scheme, no dwellings qualify for noise insulation under NISR.

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0 100

Land to be Made Available
The Graze
A
B
Track
Brownhill Road
Proposed pedestrian/cycle link (formal)
Proposed ditch
Cut Line 1
Land to be Made Available
Proposed location of SUDS basins (wetland)
Meadowhead Farm
25a
25
Land to be Made Available
Site of orig rows - m
Maintenance draw-in
Cut Line 2
Proposed pedestrian link (informal)
Cut Line
Crossroads
12
Fernside
Proposed sheet piling
Proposed boundary wall
Proposed equestrian link (informal)
Extent of peat extraction
Proposed access to Fernside
Proposed boundary wall
Proposed sheet piling
Land to be Made Available
1
Proposed Turning Head
Land
27
29
17/19
18
20
Proposed ditch
Extent of peat extraction
Track
Nidaros
Dungoyle
Auchengree Road
Existing ditch and proposed drainage outfall
Proposed stopping up of Auchengree Road
Site of original miners' rows - made ground
Land to be Made Available
Maintenance draw-in
Proposed pedestrian link (informal)
Proposed Treatment/Attenuation Basin
Proposed pedestrian/cycle link (informal)
Proposed ditch
Proposed boundary wall
Land to be Made Available
Maulside Lodge
A737
Proposed Turning Head
Land to be Made Available
Proposed side road giving access to The Den and Muirhouse Road
Proposed Traeatment/Attenuation Basin
Proposed sheet piling
Proposed ditch
Extent of extraction
Land to be Made Available
Farm track used occasionally to access land further east off the A737
Proposed access for utilities and maintenance
Muirhouse Road
The Den

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Legend

- Land to be Made Available
- Area of Peat Extraction
- Location of Demolished Houses - Made Ground
- Location of Sheet Piling
- Land made available

Rev	Revision details	Chkd	Appd	Date
H	Pond adjusted at Auchengree Road	Q.L.	I.H.	27/09/12
G	Land Made Available added	I.H.	I.H.	27/09/12
F	OS licence changed	I.H.	I.H.	07/02/12
E	Drainage, earthworks, junction adjustments & additional text	I.H.	I.H.	12/12/11
D	North verge widened at east to permit construction	Q.L.	I.H.	06/10/11
C	Layout changed at Fernside and Meadowhead Road	Q.L.	I.H.	28/09/11
B	Layout changed	Q.L.	I.H.	25/08/11
A	Layout changed at west & ped links added	Q.L.	I.H.	16/08/11

Drawn:	QL	Preliminary	✓
Design:	QL	For comment	
Chkd:	I.H.	For tender	
Appd:	I.H.	For construction	
Date:	15/06/11	As constructed	

amey

Client: TRANSPORT SCOTLAND

Project Name: A737 TRUNK ROAD THE DEN, DALRY

Drawing Title: GENERAL LAYOUT

Original Drawing Size : A1	Dimensions : m-
Scale : 1 in 1000 @ A1	Copyright © Amey

Drawing No: 10/SW/0901/037/013 — Rev: H

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NOTES

Measurement Location No. 1 - 25 The Den

Measurement Location No. 2 - 29 The Den (Front)

Measurement Location No. 3 - 29 The Den (Rear)

Measurement Location No. 4 - 1 The Den (Front)

Rev	Revision details	Chkd	Appd	Date
A	Minor changes to layout	AEF	NS	27/1/13

Drawn:	I.H.	Preliminary	✓
Design:	J.P.	For comment	
Chkd:	H.F.	For tender	
Appd:	N.C.	For construction	
Date:	14/02/12	As constructed	

amey

Client
MTRIPS

TRANSPORT SCOTLAND

Project Name
A737/A738 TRUNK ROAD
THE DEN, DALRY

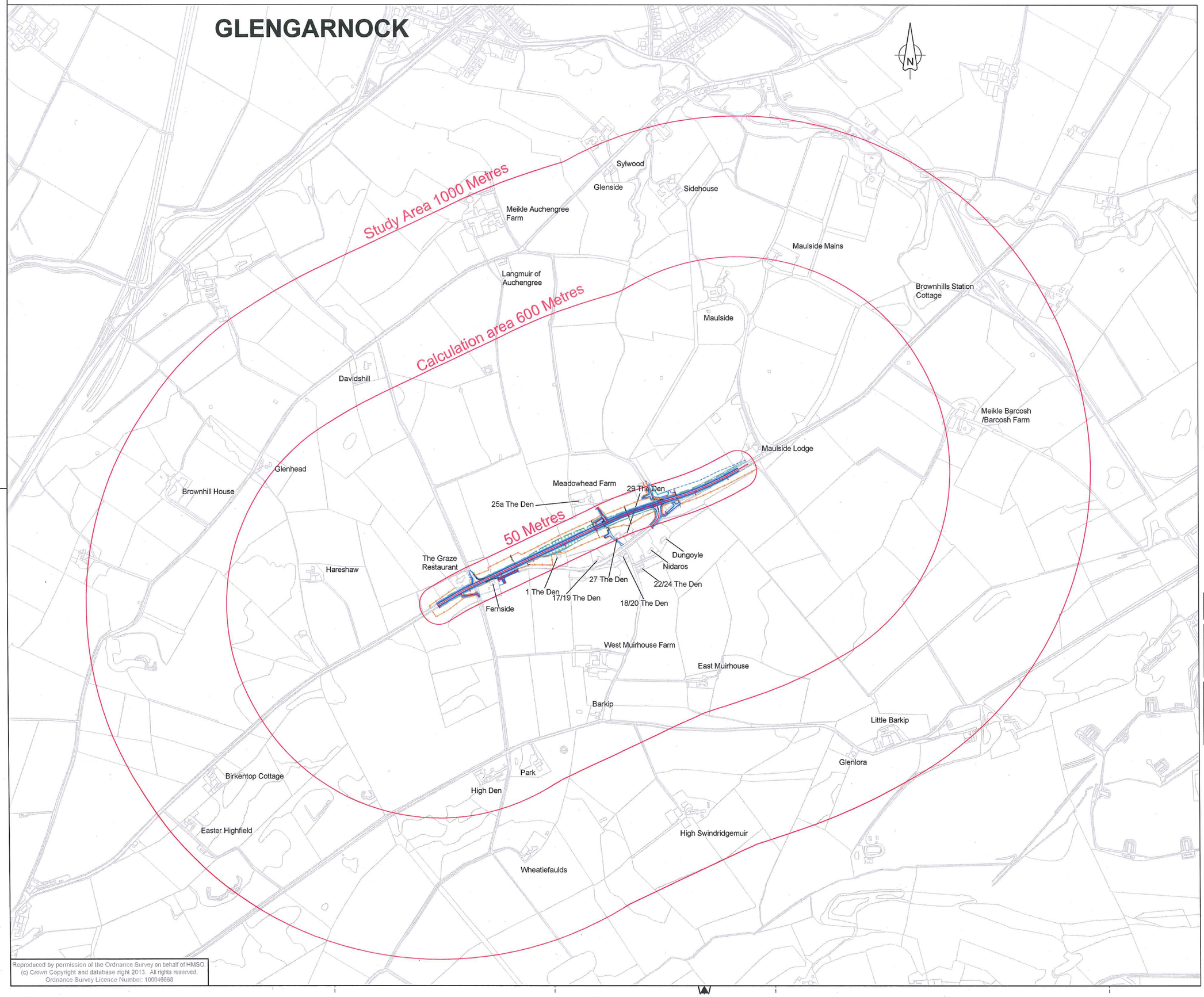
Drawing Title
ENVIRONMENTAL
NOISE
MEASUREMENT LOCATIONS

Original Drawing Size : A1	Dimensions : -
Scale : 1 in 2000	Copyright © Amey

Drawing No
10/SW/0901/037/203

Rev
A

GLENGARNOCK



Rev	Revision details	Chkd	Appd	Date
A	Minor changes to layout	H.F	NS	27/11/12

Drawn:	I.H.	Preliminary	✓
Design:	J.P.	For comment	
Chkd:	H.F.	For tender	
Appd:	N.C.	For construction	
Date:	14/02/12	As constructed	

amey

Client
MTRIPS

TRANSPORT SCOTLAND

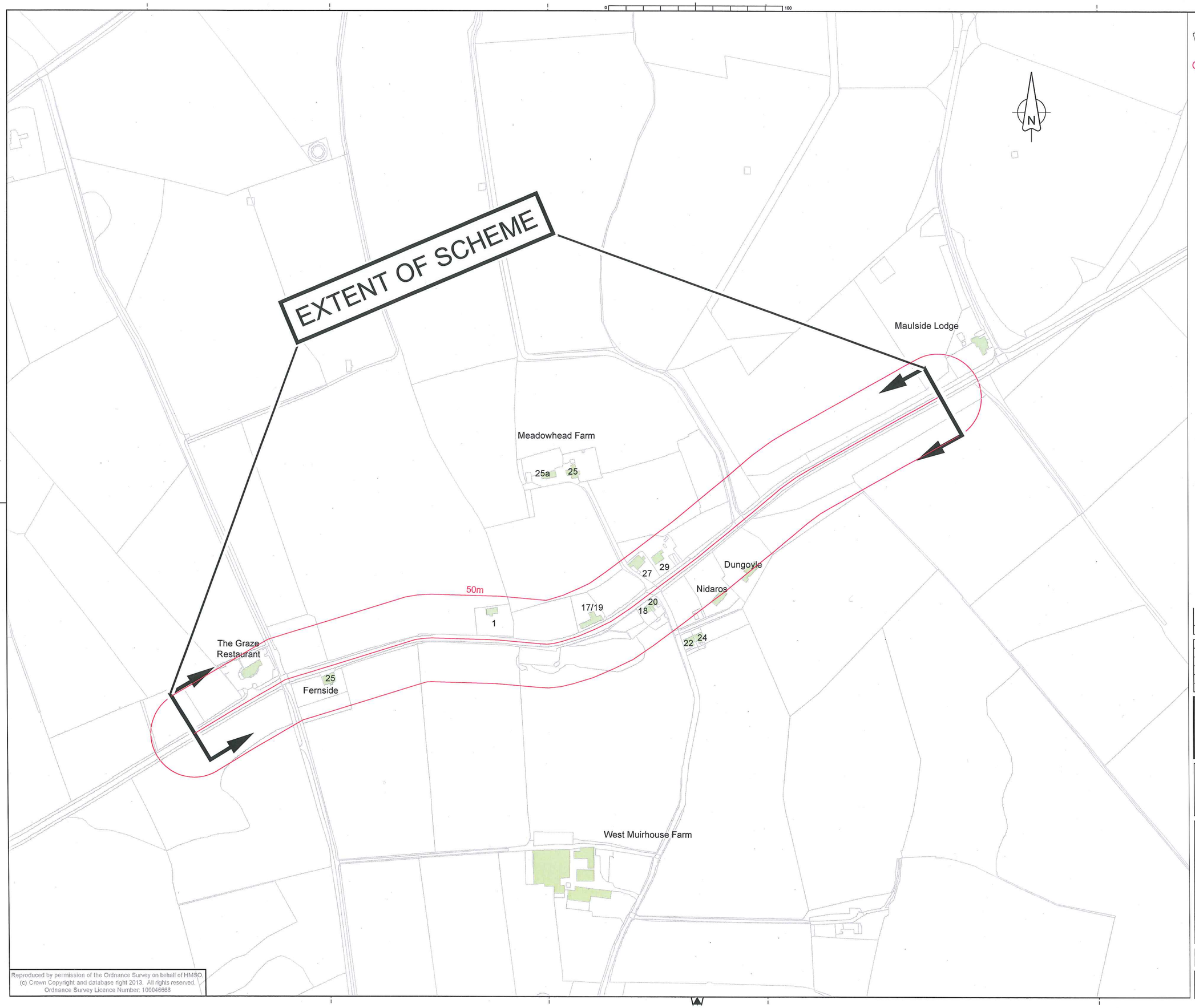
Project Name
A737A738 TRUNK ROAD
THE DEN, DALRY

Drawing Title
ENVIRONMENTAL
NOISE AND VIBRATION
STUDY AREAS

Original Drawing Size : A1	Dimensions : -
Scale : 1 x 5000	Copyright © Amey

Drawing No	Rev
10/SW/0901/037/204	A

S:\#SHARED\S001 - MTRIPS\09007 - The Den, Dalry\003 Design\002 Drawings\Work Area\1 Live Drawings\Environmental\Post Ext Audit\10_SW_0901_037_204 Study Areas Rev A.dwg, 25/01/2013 14:35:54, Iholland



General Legend

Scheme Extent

Noise Legend

50 Metre Zone

Rev	Revision details	Chkd	Appd	Date
A	Minor changes to title block	HF	NS	23/11/12

Drawn:	I.H.	Preliminary	✓
Design:	L.W. & J.P..	For comment	
Chkd:	H.F	For tender	
Appd:	N.C.	For construction	
Date:	14/02/12	As constructed	

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Client
MTRIPS

TRANSPORT SCOTLAND

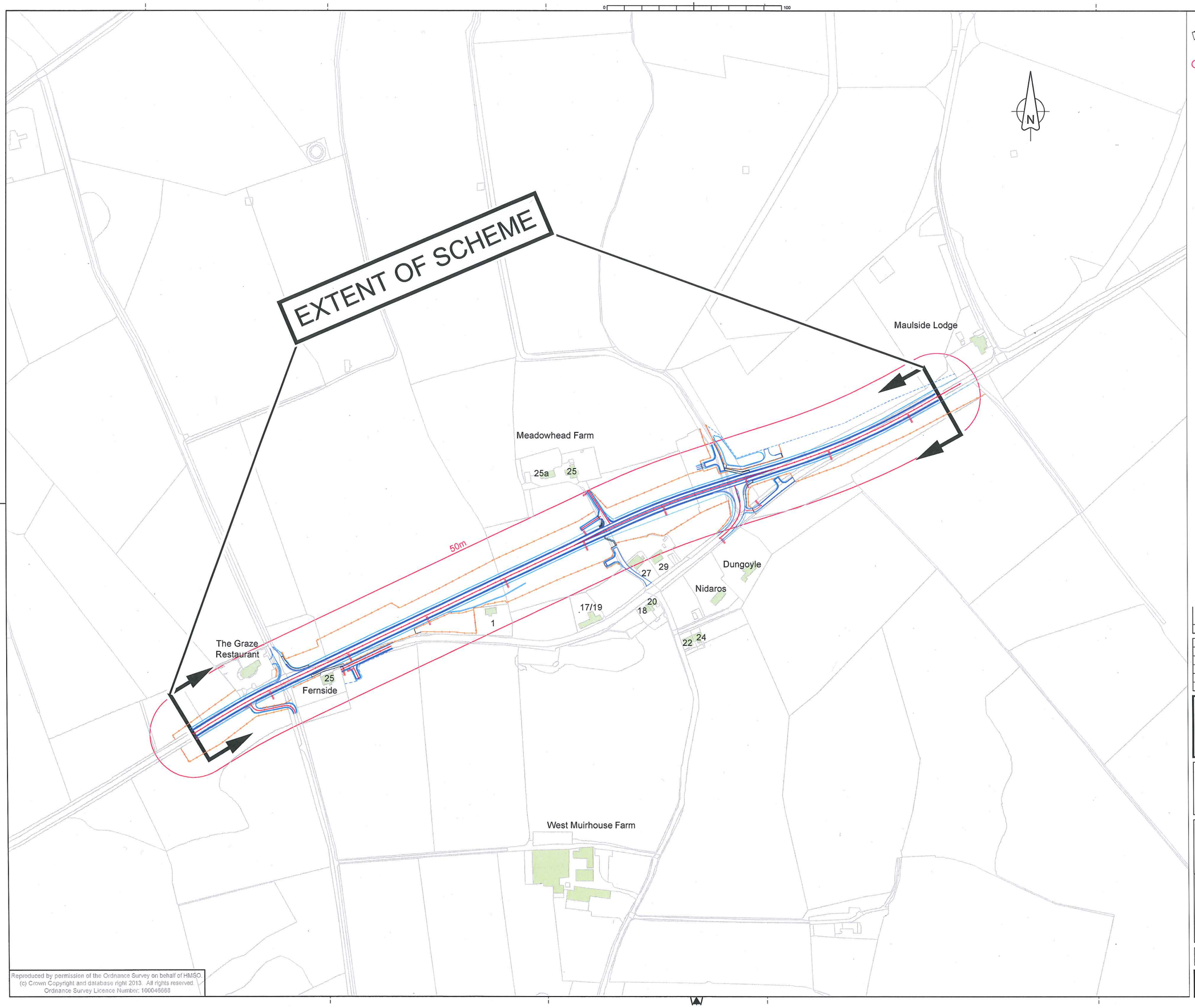
Project Name
A737/A738 TRUNK ROAD
THE DEN, DALRY

Drawing Title
ENVIRONMENTAL
NOISE RECEPTORS
EXISTING ALIGNMENT

Original Drawing Size : A1	Dimensions : -
Scale : 1:2000 @ A1	Copyright © Amey

Drawing No
10/SW/0901/037/213

Rev
A



General Legend

Scheme Extent

Noise Legend

50 Metre Zone

Rev	Revision details	Chkd	Appd	Date
A	Minor changes to layout	H/F	NS	27/11/12

Drawn:	I.H.	Preliminary	✓
Design:	L.W. & J.P.	For comment	
Chkd:	H.F.	For tender	
Appd:	N.C.	For construction	
Date:	14/02/12	As constructed	

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Client
MTRIPS

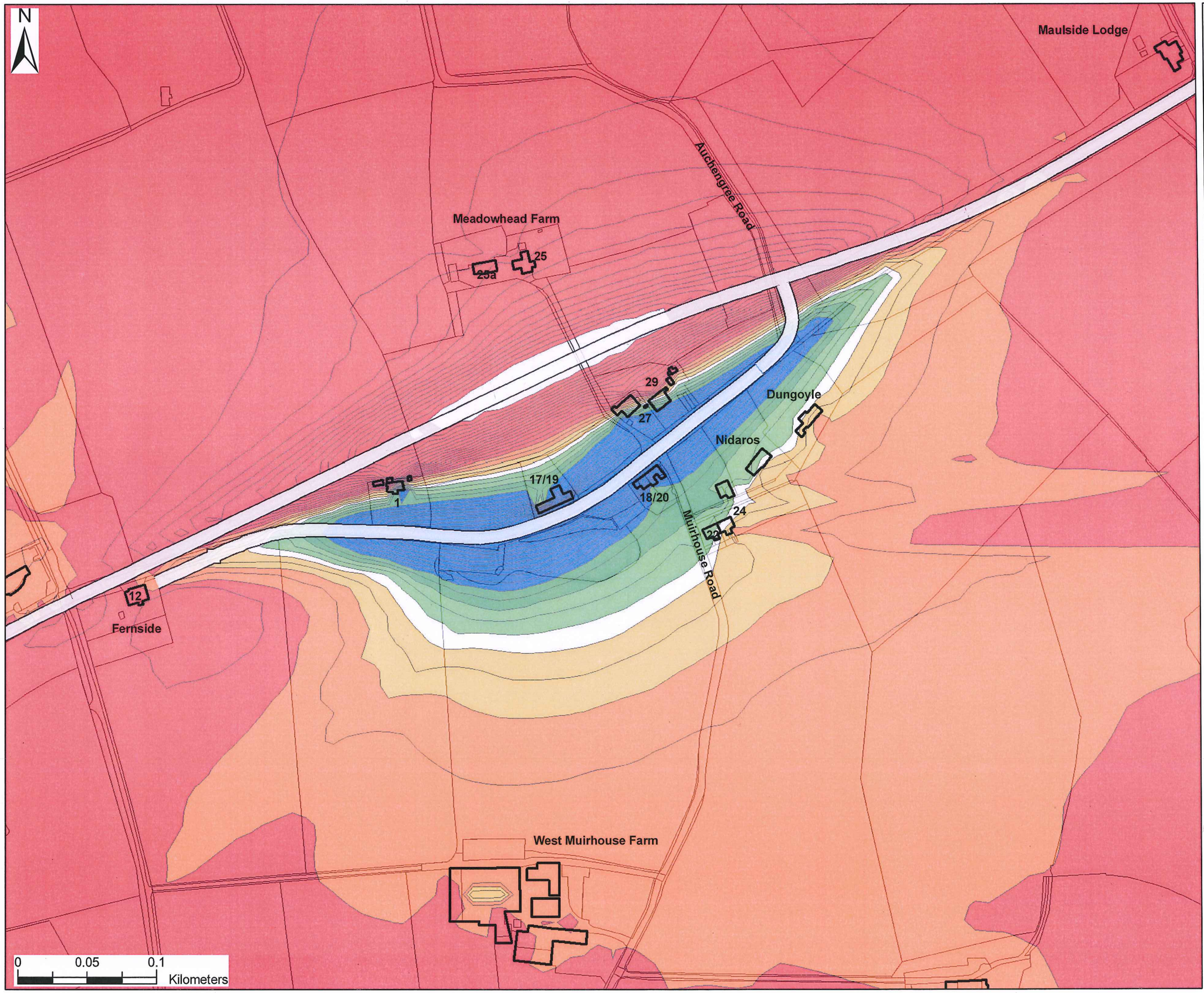
TRANSPORT SCOTLAND

Project Name
A737/A738 TRUNK ROAD
THE DEN, DALRY

Drawing Title
ENVIRONMENTAL
NOISE RECEPTORS
PROPOSED ALIGNMENT

Original Drawing Size : A1	Dimensions : -
Scale : 1:2000 @ A1	Copyright © Amey

Drawing No	Rev
10/SW/0901/037/214	A



Legend

- New Road Layout
- Buildings

Predicted Noise Level Difference dB

- > 5.0
- 3.0 to 4.9
- 1.0 to 2.9
- (-0.9 - 0.9)
- -2.9 to -1.0
- -4.9 to -3.0
- < -5.0

Rev	Revision Details	Chkd	Appd	Date
A	Traffic Figures Updated	ML	[illegible]	26/02/2013

Drawn : JB	Preliminary
Design : ML	For Comment ✓
Chkd : LW	For tender
Appd : IH	For construction
Date : 05/12/2012	As constructed
-	Other

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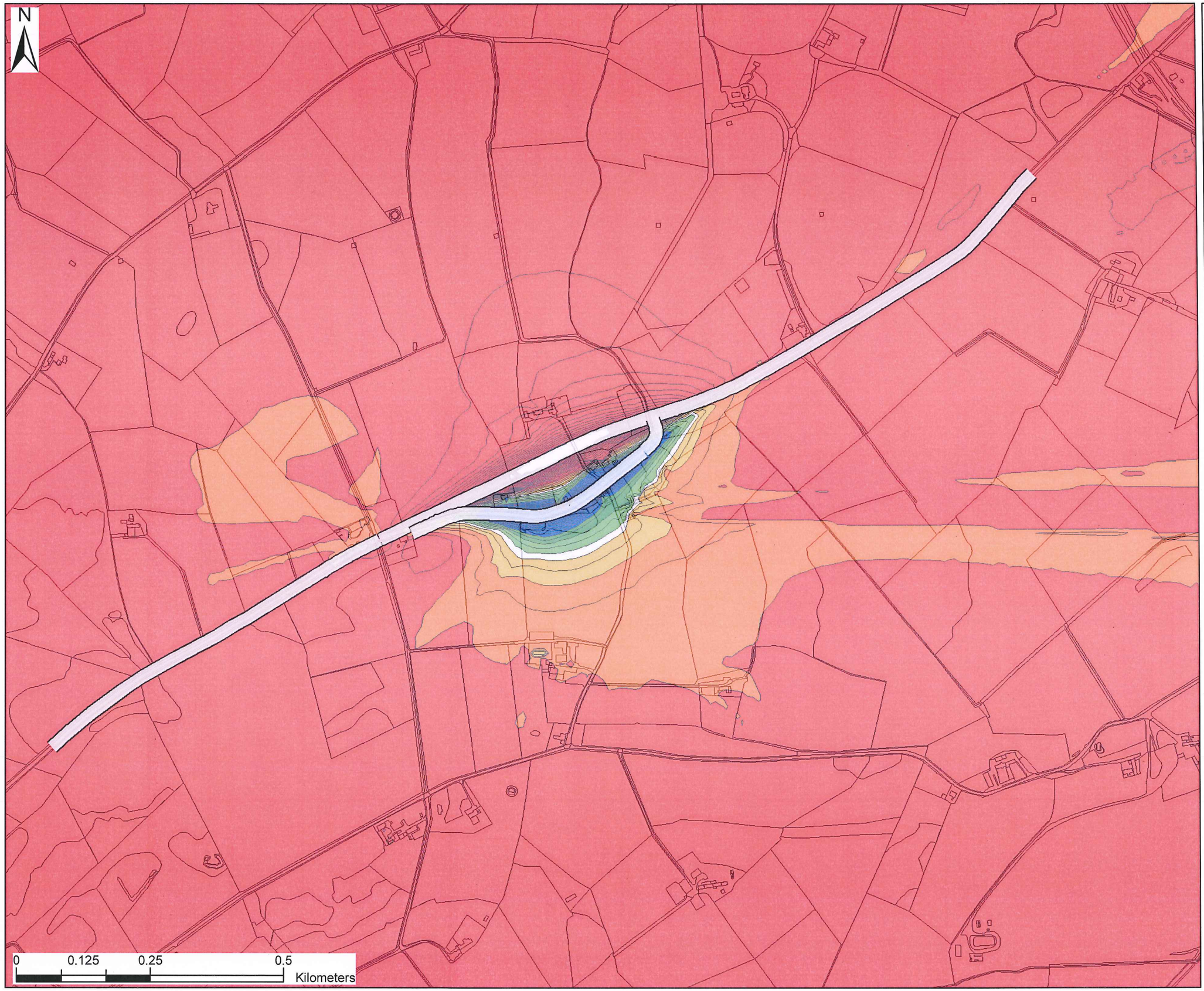
Client : TRANSPORT SCOTLAND

Project Name :
A737 TRUNK ROAD
THE DEN, DALRY

Drawing Title :
Noise Level Difference with
Do Minimum 2014 and
Do Something 2029

Original Drawing Size : A3	
Scale : 1:2,500	Dimensions : -

Drawing No	Rev
10/SW/0901/037/219	R0



Legend

New Road Layout

Predicted Noise Level Difference dB

- > 5.0
- 3.0 to 4.9
- 1.0 to 2.9
- (-0.9 - 0.9)
- -2.9 to -1.0
- -4.9 to -3.0
- < -5.0

Rev	Revision Details	Chkd	Appd	Date
A	Traffic Figures Updated	ML	LW	26/02/2013

Drawn : JB	Preliminary
Design : ML	For Comment ✓
Chkd : LW	For tender
Appd : IH	For construction
Date : 05/12/2012	As constructed
	Other

Client : TRANSPORT SCOTLAND

Project Name :

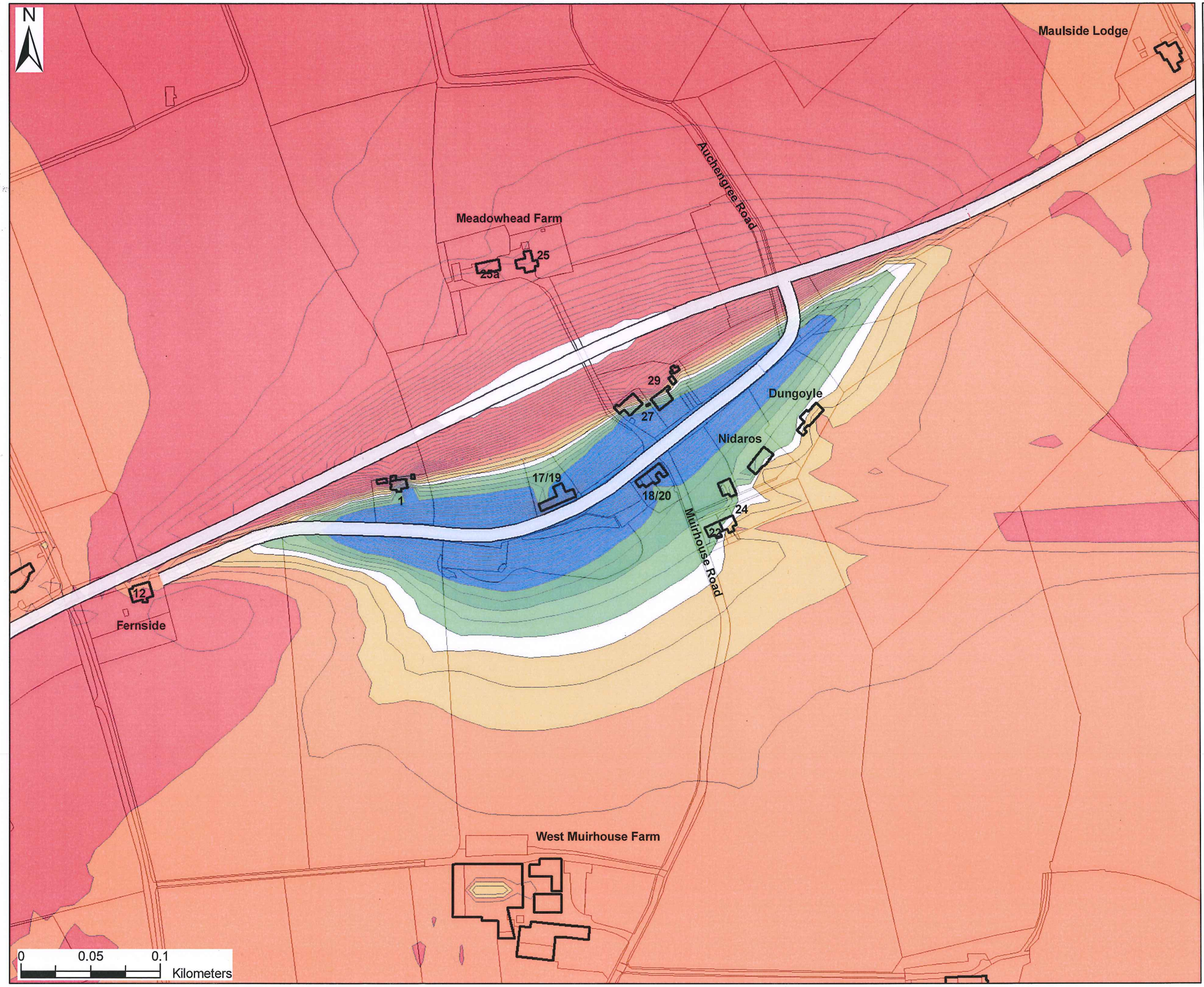
A737 TRUNK ROAD THE DEN, DALRY

Drawing Title :

Noise Level Difference with Do Minimum 2014 and Do Something 2029

Original Drawing Size : A3	
Scale : 1:6,500	Dimensions : -

Drawing No	Rev
10/SW/0901/037/220	R0



Legend

- New Road Layout
- Buildings

Predicted Noise Level Difference dB

- > 5.0
- 3.0 to 4.9
- 1.0 to 2.9
- (-0.9 - 0.9)
- -2.9 to -1.0
- -4.9 to -3.0
- < -5.0

Rev	Revision Details	Chkd	Appd	Date
A	Traffic Figures Updated	ML	JW	26/02/2013

Drawn : JB		Preliminary	
Design : ML		For Comment	✓
Chkd : LW		For tender	
Appd : IH		For construction	
Date : 05/12/2012		As constructed	
		Other	

amey

Client : TRANSPORT SCOTLAND

Project Name :
A737 TRUNK ROAD
THE DEN, DALRY

Drawing Title :
Noise Level Difference with
Do Minimum 2014 and
Do Something 2014

Original Drawing Size : A3	
Scale : 1:2,500	Dimensions : -

Drawing No	Rev
10/SW/0901/037/221	R0

Legend

New Road Layout

Predicted Noise Level Difference dB

- > 5.0
- 3.0 to 4.9
- 1.0 to 2.9
- (-0.9 - 0.9)
- -2.9 to -1.0
- -4.9 to -3.0
- < -5.0

Rev	Revision Details	Chkd	Appd	Date
A	Traffic Figures Updated	ML	LW	26/02/2013

Drawn : JB		Preliminary	
Design : ML		For Comment	✓
Chkd : LW		For tender	
Appd : IH		For construction	
Date : 05/12/2012		As constructed	
		Other	

amey

Client : TRANSPORT SCOTLAND

Project Name :
A737 TRUNK ROAD
THE DEN, DALRY

Drawing Title :
Noise Level Difference with
Do Minimum 2014 and
Do Something 2014

Original Drawing Size : A3	
Scale : 1:6,500	Dimensions : -

Drawing No	Rev
10/SW/0901/037/222	R0