# Chapter 9
# Noise and Vibration

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# 9 NOISE AND VIBRATION

## 9.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) identifies, describes and presents an assessment of the likely significant noise and vibration effects of the proposed N2 Slane Bypass and Public Realm Enhancement Scheme (hereafter referred to as the 'Proposed Scheme') on the receiving environment during both the construction and operational phases of the scheme. The assessment presented is informed by, and should be read in conjunction with, the following key chapters of the EIAR: **Chapter 4 – Description of the Proposed Scheme**, **Chapter 5 – Description of the Construction Phase** and **Chapter 7 – Traffic and Transport**.

Other matters relevant to Noise and Vibration are addressed in the specific chapters of the EIAR, namely:

- **Chapter 11 – Human Health:** predicted health effects;
- **Chapter 13 – Archaeology and Cultural Heritage:** predicted effects on the UNESCO World Heritage Property of Brú na Bóinne;
- **Chapter 14 – Architectural Heritage:** predicted effects on Slane village and environs;
- **Chapter 15 – Biodiversity: Terrestrial Ecology:** predicted effects on local fauna; and
- **Chapter 16 – Biodiversity: Aquatic Ecology:** predicted effects on fish within the River Boyne.

## 9.2 Methodology

The noise and vibration impact assessment has followed the overall methodology and guidance relating to the EIA process and preparation as set out in **Section 1.3.3** of **Chapter 1 – Introduction**. The impact of the Proposed Scheme arising from noise and vibration effects has been assessed for both the construction and operational phases by considering the requirement to use heavy plant and machinery during the Proposed Scheme construction and public realm works as well from construction traffic off-site. Impacts arising from road traffic on the proposed alignment once operational as well roads in proximity to the Proposed Scheme where traffic flows may change because of the proposed road scheme have also been considered.

### 9.2.1 Legislation, Policy and Guidance

#### 9.2.1.1 Legislation

Specifically in relation to Noise and Vibration, the following principal European and National legislation is relevant to the assessment:

**EU Legislation**

- EU Directive 2011/92/EU as amended by Directive 2014/52/EU on the assessment of the effects of certain public and private projects on the environment;
- Commission Directive (EU) 2015/996 of 19 May 2015 establishing common noise assessment methods according to Directive 2002/49/EC;
- European Council Directive 2002/49/EC relating to the assessment and management of environmental noise (the Environmental Noise Directive); and
- Commission Delegated Directive (EU) 2021/1226 of 21.12.2020 amending, for the purpose of adapting to scientific and technical progress, Annex II of Directive 2002/49/EC of the European Parliament and the Council as regards common noise assessment methods.

**National Legislation**

- European Communities (Environmental Noise) Regulations (S.I. No. 549 of 2018);
- European Communities (Environmental Noise) (Amendment) Regulations 2021, S.I. No. 663 of 2021;

- EC (Environmental Noise) Regulations 2006 (S.I. No. 140/2006); and
- EC Noise Emission by Equipment for Use Outdoors (Amendment) Regulations (S.I. No. 241 / 2006).

### 9.2.1.2 Policy

The Proposed Scheme is located in the administrative area of Meath County Council (MCC) and the County Meath Noise Action Plan (2019) and Meath County Development Plan 2021-2027 have been considered in the preparation of this chapter.

The National Planning Framework Objective 65 which states… *"Promote the pro-active management of noise where it is likely to have significant adverse impacts on health and quality of life and support the aims of the Environmental Noise Regulations through national planning guidance and Noise Action Plans"* has been considered in the preparation of this chapter.

### 9.2.1.3 Guidance

There is no specific legislation relating to road traffic noise and vibration however there is a considerable body of standards and guidance which apply to the measurement and treatment of noise and vibration for roads schemes which have been considered within this chapter of the EIAR and are listed as follows:

- Association of Noise Consultants & Institute of Acoustics (January 2021) Joint Guidance on the impact of Covid-19 on the Practicality and Reliability of Baseline Sound Level Surveying and the Provision of Sound and Noise Impact Assessments, Version 6;
- Highways England (2020) LA 111 Sustainability & Environment Appraisal Noise and Vibration, Rev 2, Design Manual for Roads and Bridges, Highways England;
- Volpe, J. (2018) Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration Report No. 0123;
- DIN 4150-3 2016 Edition, Vibrations in Buildings - Part 3: Effects on structures;
- NRA (2014) Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes;
- British Standards Institution (2009) BS 5228-1:2009 (+A1:2014). Code of practice for noise and vibration control on construction and open sites. Noise;
- British Standards Institution (2009) BS 5228-2:2009 (+A1:2014). Code of practice for noise and vibration control on construction and open sites. Vibration;
- International Organization for Standardization [ISO] (2003) ISO 2631-2:2003 Mechanical vibration and shock - Evaluation of human exposure to whole-body vibration - Part 2: Vibration in buildings (1 Hz to 80 Hz);
- NRA (2004) Guidelines for the Treatment of Noise and Vibration in National Road Schemes;
- Abbott and Nelson (2002) Converting the UK traffic noise index $L_{A10,\,18\,h}$ to EU noise indices for noise mapping. Traffic Research Laboratory;
- International Organization for Standardization (1996) ISO 1996-1:2016. Acoustics – Description, measurement and assessment of environmental noise — Part 1: Basic quantities and assessment procedures;
- International Organization for Standardization (1997) ISO 2631-1:1997/AMD 1:2010. Mechanical vibration and shock – Evaluation of human exposure to whole-body vibration - Part 1: General requirements;
- Department of Transport (1988) Calculation of Road Traffic Noise (CRTN). UK Department of Transport (Welsh Office); and
- Institute of Environmental Management & Assessment [IEMA] (2014) Guidelines for Environmental Noise Impact Assessment, Version 1.2.

## 9.2.2 Zone of Influence

The study area for the noise and vibration impact assessment is predominantly focused on areas likely to be affected by the proposed road scheme. The NRA Guidelines (2004) recognise this to include noise and vibration sensitive receptors within 300 m of the road centrelines and noise and vibration sensitive receptors adjacent to existing roads in proximity to the Proposed Scheme. It also includes locations adjacent to roads where traffic flows are reduced by 20% or more, and where existing flows are increased by 25% or more as a result of the Proposed Scheme.

For the purposes of this scheme, the Brú na Bóinne UNESCO World Heritage Property has been considered as noise and vibration sensitive receptors and the environmental noise conditions at these sites were considered as part of the study.

The most sensitive noise sensitive locations (NSL) for the purpose of this EIAR assessment are residential dwellings where people are present for day, evening and night periods and thereby continuously exposed to road traffic noise. Residences, pre-schools/ schools and places of worship are also regarded as more sensitive than sporting grounds or commercial operations.

A total of 1,391 receptors were considered in the noise model including residential receptors, schools, places of worship, hotels and B&Bs, commercial premises etc. A map showing the location of the noise sensitive locations is presented in **Appendix 9.2**.

## 9.2.3 Sources of Information to Inform the Assessment

The information to inform the assessment has been obtained through a combination of desktop study of publicly available datasets and literature, GeoDirectory datasets, field survey monitoring, and modelling.

### 9.2.3.1 Desktop Study

**Table 9-1** outlines the key datasets used to inform the noise and vibration assessment.

**Table 9-1: Summary of Key Datasets and Data Sources Used**

| Title | Source | Year |
|---|---|---|
| Terrain data | OSi mapping | 2022 |
| Traffic flow data | EIAR Chapter 7 | 2022 |
| Property information | GeoDirectory (Q1 2022) | 2021 - 2022 |
| Meath County Development Plan 2021-2027 | Meath County Council | 2021 |
| County Meath Noise Action Plan | Meath County Council | 2019 |

### 9.2.3.2 Site-specific Surveys

A series of site-specific baseline noise surveys were undertaken to quantify the existing noise environment and to provide baseline noise data for the validation of the noise model. Measurements were undertaken in accordance with the NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes (2004) and the supplemental Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (2014). The sound level meters and acoustical calibrator used for the site surveys were within specified manufacturer periods of calibration and the calibration certificates are presented in **Appendix 9.1**.

**Unattended Measurements**

Unattended measurements were undertaken at four locations for a period of 24 hours. Measurements were undertaken using Brüel and Kjaer 2250 and 2250L sound level meters with a Brüel and Kjaer UA-1404 outdoor microphone kit. The microphones were mounted on a tripod at a height of 1.5 m above ground level. The meters were calibrated prior to noise monitoring with a Brüel & Kjaer 4231 acoustical calibrator (94 dB noise source at 1,000 Hz). The calibrations were within the acceptable range of 0.5 dB deviation. The measured $L_{Aeq,1hr}$ noise levels were used to calculate the $L_{den}$ values at the monitoring locations.

**Attended Measurements**

Attended short-term measurements were undertaken 20 locations in accordance with the NRA Guidelines (2004) and NRA Good Practice Guidance (2014). This involved undertaking a series of three 15-minute measurements over any three consecutive hours between 10:00 and 17:00 hrs. Measurements were undertaken using a Brüel and Kjaer 2250 and 2250L sound level meters mounted at a height of 1.5 m above ground level. The meters were calibrated before and after the series of three measurements and calibrations were within the acceptable range of 0.5 dB deviation.

Where road traffic is the principal source of noise, $LA_{10}$ (18-hour) values may be derived by subtracting 1 dB(A) from the arithmetic mean of the $LA_{10}$ values measured during the three sample periods. The methodology presented in Section 3.1 of the 2004 Guidelines may then be used to derive the $L_{den}$ value from the $LA_{10}$ (18-hour) value.

Details on the noise monitoring locations are presented in **Section 9.3.1.4** (Baseline Scenario).

### 9.2.3.3 Noise Modelling

Predictor LimA 7810 noise modelling software was used to predict the noise impact from the Proposed Scheme. Traffic noise levels were predicted using the methodology set out in the Calculation of Road Traffic Noise (CRTN) with the application of the relevant conversion factors as detailed in the NRA Guidelines (2004) and the updated advice on using CRTN recommended in the NRA *Good Practice Guidance* (2014). The CRTN method of predicting noise from a road scheme consists of the following five elements:

1. Divide the road scheme into segments so that the variation of noise within this segment is small;
2. Calculate the basic noise level at a reference distance of 10 m from the nearside carriageway edge for each segment;
3. Assess for each segment the noise level at the reception point taking into account distance attenuation and screening of the source line;
4. Correct the noise level at the reception point to take account of site layout features including reflections from buildings and facades, and the size of source segment; and
5. Combine the contributions from all segments to give the predicted noise level at the receiver location for the whole road scheme.

#### 9.2.3.3.1 Inputs to the Noise Model

The noise model was prepared using the following data:

- Road alignments based on the proposed design and OSi mapping.
- Topographical data was provided by Bluesky and with site specific survey data provided by Murphy Surveys.
- OSi mapping was used for identifying building footprints, existing roads including centrelines and road extents.
- GeoDirectory data from 2021 and 2022 was used to identify noise sensitive receptor locations. This was supplemented with a review of aerial imagery and site visits to identify the receptor height (i.e. single storey, two storey or other).
- Traffic volumes, percentage of heavy commercial vehicles (HCVs) and average speeds used in the noise model were provided by the traffic modelling team. Further details on the traffic and transportation are set out in **Chapter 7 – Traffic and Transport**.
- The road surfaces modelled were based on road surfaces observed during the site visit on the 25 January 2022.

Noise predictions were undertaken for 1,391 receptor locations (see **Appendix 9.2**). At some of these locations, predictions were undertaken adjacent to multiple façades and elevations (depending on the number of storeys) as the most exposed façade is not obvious.

The prediction method took the following factors into account: hourly traffic flow rate, mean traffic speed, percentage of heavy commercial vehicles. Other information required for the calculation included road

surface and gradient; ground type; height of noise source; shielding of barriers and cuttings; reflections at facades and from nearby buildings; angle of view of the road.

In accordance with the NRA Good Practice Guidance (2014) the extent of the noise model not only includes the Proposed Scheme, but it also included areas where traffic flows were shown to be reduced by 20% or more, and where existing flows were shown to be increased by 25% or more.

### 9.2.3.3.2 Noise Model Validation

The purpose of validating the noise model is to ensure the input data is correct and to confirm the noise modelling software is correctly interpreting the input data. The NRA Guidelines (2004) state:

> "*… whilst there is no need for further validation of the established CRTN prediction methodology, the Authority considers that the noise models themselves should be validated in order to ensure that the roads, topography and other crucial features have been correctly represented and incorporated into the model. This could be done in a number of ways, for example, the survey results could be compared with the predicted results obtained using traffic data that are representative of the conditions during the period when the survey was conducted. The exact method of validation is left to the discretion of the Acoustic Engineer*."

To validate the traffic noise model, the baseline noise survey at two locations was compared with the predicted results obtained using traffic data that was representative of the conditions during the period when the survey was conducted.

The NRA Guidelines (2014) refer to *an "example [of] work undertaken by the EU[1] to improve noise prediction models suggested that 'ambition levels' for the discrepancies between predictions and measurements should be ≤ 2 dB for flat terrain up to a distance of 2 km, and ≤ 5 dB for hilly terrain and up to 2 km or in urban areas. However, it is recognised that it would be extremely difficult to replicate such levels using CRTN."*

**Table 9-2** presents the predicted noise levels against the measured noise levels. In all instances, the predicted and measured noise levels are within 2 dB. There is good agreement between the noise model and measurements, and it is considered that the noise modelling software is correctly interpreting the input data.

**Table 9-2: Measured vs Modelled Noise Levels**

| Survey Location | Location Description | Measured $L_{den}$, dB | Predicted $L_{den}$, dB | Difference |
|---|---|---|---|---|
| **24-1** | In a garden of a dwelling adjacent to the N2 between McGruder's Cross (junction L1600 and N2) and Rossnaree Road. | 73 | 71 | -2 |
| **24-3** | In a garden of a dwelling adjacent to the Proposed Scheme between Boyne River and junction with the N51. The monitoring location is approximately 325 m south of the N51 and 760 m northeast of the N2. | 50* | 51 | 1 |

* Noise data likely attributable local sources was removed from the baseline measurements i.e. activity at the residence.

The following scenarios were modelled:

- Base Year 2021;
- Opening Year 2026: Do-Minimum and Do-Something scenarios;
- Design Year 2041: Do-Minimum and Do-Something scenarios;
- Opening Year 2026: Do-Something scenario with mitigation; and
- Design Year 2041: Do-Something scenario with mitigation.

[1] Watts G.R. (2005) Harmonoise Prediction Model for Road Traffic Noise TRL Published Project Report PPR 034. July 2005.

The NRA Guidelines (2004) require predictions to be reported for the Opening Year (2026), and for a Design Year (2041), 15 years after opening. Noise levels in the Design Year differ from those in the Opening Year by different amounts at some receptor locations and hence the predicted noise levels from both the opening year and design year are considered.

Free-field traffic noise levels were predicted at a total of 1,391 receptors (1,259 of which are residential receptors). For some receptors several locations around the building have been modelled given their proximity to both existing roads and the proposed scheme. All receptors were modelled at heights of 1.5 and 4.0 m above ground level at a minimum corresponding to ground floor and first floor levels, respectively. Some receptor locations had a higher number of floors and these were modelled as appropriate. Conversely, some receptors were single storey and only results at ground floor height were considered for those locations. For all other locations the highest predicted noise level from each case (i.e. 1.5 m and 4.0 m height receiver point) has been presented.

## 9.2.4 Key Parameters for Assessment

### 9.2.4.1 Noise and Vibration Sensitive Receptors

The NRA Guidelines (2004)[2] provide a characterisation of a sensitive receptor and state "*Receptors that are, or have the potential to be, particularly sensitive to noise and/or vibration should be identified. Examples of such receptors are schools, hospitals, places of worship, heritage buildings, special habitats, amenity areas in common use and designated quiet areas*".

This definition has been broadened by best practice and the range of sensitivities as described in **Table 9-3**. The sensitivity of different receptor types is set out in the table although circumstances may justify a receptor specific sensitivity. In the context of the Proposed Scheme, the Brú na Bóinne World Heritage Property has been defined in this assessment as having 'High' noise and vibration sensitivity given its status as a World Heritage Property.

**Table 9-3: Criteria to Define Receptor Sensitivity**

| Sensitivity | Description | Examples of Receptors |
|---|---|---|
| **High** | Receptors where people or operations are particularly susceptible to noise | • Residential, including private gardens where appropriate<br>• Hospitals/residential care homes<br>• Schools during the daytime<br>• Quiet outdoor areas used for recreation<br>• Places of worship |
| **Medium** | Receptors moderately sensitive to noise, where it may cause some distraction or disturbance and wildlife sensitive areas | • Offices<br>• Bars/Cafes/Restaurants where external noise may be intrusive<br>• Community facilities and amenity areas<br>• Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, fishing and golf)<br>• Wildlife refuges or areas identified by the ecology team as having general sensitivity for wildlife.<br>• Recording studios and some concert halls are also included in this category |
| **Low** | Receptors where distraction or disturbance from noise is low | • Buildings not occupied during the daytime<br>• Sports grounds when spectator noise is a normal part of the event.<br>• Nightclubs |
| **Negligible** | Receptors where distraction or disturbance from noise is negligible | • All other areas such as those used primarily for industrial or agricultural purposes. |

[2] All references to NRA Guidelines (2004) and NRA Good Practice Guidance (2014) and their content acknowledge that the NRA was reformed as part of TII in 2015, however the publication of both documents pre-date this.

The majority of receptors which have the potential to be affected by noise and vibration impacts arising from the Proposed Scheme are the residents of dwellings in the vicinity of the Proposed Scheme. Residents, due to the nature and use of residential receptors are deemed to have 'High' sensitivity. Hotels and commercial accommodation have a high sensitivity at night and medium sensitivity during the daytime period. Commercial developments such as offices (including those co-located with warehouses) are considered 'Medium' sensitivity during daytime periods with the sensitivity reducing to 'Low' during evening for commercial developments. At night-time periods both community facilities and commercial developments are considered low sensitivity as the have reduced occupancy or are unoccupied.

### 9.2.4.2 Construction Noise Criteria

Guidelines relating to construction noise and vibration limits are set out within the NRA guidance documents and other relevant national and international documentation for the control of noise and vibration from construction sites. The noise limits from the NRA Guidelines (2004) during given times are set out in **Table 9-4**.Working hours for the scheme are set out in **Chapter 5** in **Section 5.9** (Employment and Welfare) and **Section 5.14.1** (Construction Phase Hours of Operation).

**Table 9-4: Maximum Permissible Noise Levels at the Façade of Dwellings during Construction**

| Days | Times | Noise Levels | |
|---|---|---|---|
| | | $L_{Aeq(1hr)}$ dB | $L_{pA(max)slow}$ dB |
| Monday to Friday – normal working hours | 07:00 to 19:00 hrs | 70 | 80 |
| Monday to Friday - out of hours work (subject to agreement in advance) | 19:00 to 22:00 hrs | 60* | 65* |
| Saturdays | 08:00 to 16:30 hrs | 65 | 75 |
| Sundays & Bank Holidays | 08:00 to 16:30 hrs | 60* | 65* |

** Construction activity at these times, other than that required for emergency works, will normally require the explicit permission of the relevant authority.*

Given the nature of the project, it is expected that the mainline works will be predominately undertaken during daytime periods. However, work outside these hours to facilitate construction activities that would otherwise result in serious traffic disruptions or by its nature cannot be completed during a normal working day, such as the delivery from oversized vehicles or major concrete pours. For the public realm works, it is expected that some pavement works will be undertaken outside of normal hours to minimise traffic disruption in Slane village and the surrounding area.

For periods outside of the days and hours identified in **Table 9-4**, reference is made to the ABC method in Annex E of British Standard BS5228 – 1: 2009 +A1 2014: Code of practice for noise and vibration control on construction and open sites – Noise. This standard provides guidance on controlling the effect of construction noise based on exiting ambient noise levels. For the purpose of this assessment the ABC method in Annex E of BS5228 will be applied where NRA guidance is not applicable, i.e. when works are being carried out at night. **Table 9-5** outlines the applicable noise threshold of potential significant effect at the nearest noise sensitive locations during the periods not covered by the NRA guidelines.

**Table 9-5: Threshold of Potential Significant Effect at Nearest Sensitive Receptors**

| Assessment Category and Threshold Value Period ($L_{Aeq}$) | Noise Threshold Value, in decibels (dB) | | |
|---|---|---|---|
| | Category A[A] | Category B[B] | Category C[C] |
| Night-time (23.00 – 07.00) | 45 | 50 | 55 |
| Evenings and weekends[D] | 55 | 60 | 65 |
| Daytime (07.00 – 19.00) and Saturdays (07.00 – 13.00) | 65 | 70 | 75 |

*NOTE 1: A potential significant effect is indicated if the $L_{Aeq, T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.*

*NOTE 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq, T}$ noise level for the period increases by more than 3 dB due to site noise.*

*NOTE 3: Applied to residential receptors only.*

*A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.*

*B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.*

*C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.*

*D) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.*

Using the baseline noise measurement data, it was determined that the appropriate construction noise threshold value for determining the potential significant effects for residential receptors in the vicinity of the Proposed Scheme varies from Category A (i.e. 45 dB $L_{Aeq}$ during night-time periods) to Category C (i.e. 55 dB $L_{Aeq}$ during night-time periods) to 3 dB above the ambient noise level depending on location of the receptor. The thresholds apply to residential buildings and receptors with a high sensitivity as described in **Table 9-3**. For commercial buildings (offices, industrial facilities, sport clubs etc.) which are less noise sensitive, a minimum of Category C values from **Table 9-5** apply.

Over-runs/emergencies may occur on occasion particularly where, for health and safety reasons or due to engineering requirements, a specific work item needs to be completed before the worksite can be left in a safe state, or there is a risk of an engineering or structural failure if the works are not completed.

### 9.2.4.3 Construction Traffic Noise Criteria

There is currently no Irish legislation that restricts noise levels from construction traffic to a limit value. Hence the impact of off-site traffic associated with construction phase of the Proposed Scheme has been assessed with respect to the UK Highways Agency publication, Design Manual for Roads and Bridges LA111 – Noise and Vibration Revision 2, UK Highways Agency (2020). This document presents details on the classification of magnitude of noise impacts and noise level changes and associated magnitude of impact are presented in **Table 9-6**.

**Table 9-6: Noise Level - Magnitude of Impact (Highway Agency, UK)**

| Magnitude of Impact | Increase in Baseline Noise Level of Closest Public Road Used for Construction Traffic |
|---|---|
| Major | Greater than or equal to 5.0 |
| Moderate | Greater than or equal to 3.0 and less than 5.0 |
| Minor | Greater than or equal to 1.0 and less than 3.0 |
| Negligible | Less than 1.0 |

The magnitude of impact classifications in **Table 9-6** will apply to residential buildings and receptors with a high sensitivity as described in **Table 9-3**. Commercial buildings (offices, industrial facilities, sport clubs etc.) are considered less noise sensitive and can tolerate greater increases in baseline noise level.

### 9.2.4.4 Construction Vibration Criteria

There is no statutory Irish guidance relating to the maximum permissible vibration level that may be generated during the construction phase of a road scheme. In absence of specific vibration limits, appropriate vibration emission criteria relating to permissible construction vibration levels for a development of this scale may be found in NRA Guidelines (2004). **Table 9-7** presents the vibration levels recommended in the NRA guidelines and compliance with the values ensures that there is little to no risk of even cosmetic damage to buildings.

**Table 9-7: Construction Vibration Guidelines**

| Allowable vibration (Peak Particle Velocity) at the closest part of any sensitive property | | | |
|---|---|---|---|
| Vibration Frequency (Hertz) | Less than 10Hz | 10 to 50Hz | 50 to 100Hz (and above) |
| Peak Particle Velocity (mm/s) | 8 mm/s | 12.5 mm/s | 20 mm/s |

These guidelines are stricter than those outlined in BS 5228 which states that "*buildings of historical value should not (unless it is structurally unsound) be assumed to be more sensitive*". Good practice on national road schemes in Ireland has led to the adoption of lower thresholds for older properties such as recorded structures.

The German standard DIN4150 provides limits below which it is very unlikely that there will be any cosmetic damage to older buildings. For structures that are of 'great intrinsic value' and are particularly sensitive to vibration, transient vibration should not exceed 3 mm/s at low frequencies. Allowable levels increase to 8 mm/s at 50 Hz and 10 mm/s at 100 Hz and above.

Human beings are known to be sensitive to vibration, the threshold of perception being typically in the Peak Particle Velocity (PPV) range of 0.14 mm/s to 0.3 mm/s. Vibrations above these values can disturb, startle, cause annoyance or interfere with work activities. At higher levels they can be described as unpleasant or even painful. In residential accommodation, vibrations can promote concerns about possible structural damage. Guidance of effects of vibration levels are illustrated in **Table 9-8**.

**Table 9-8: Guidance on Human Perception of Vibration Levels**

| Vibration Level | Effect |
|---|---|
| 0.14 mm/s | Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration. |
| 0.3 mm/s | Vibration might be just perceptible in residential environments. |
| 1.0 mm/s | It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents. |
| 10 mm/s | Vibration is likely to be intolerable for any more than a very brief exposure to this level. |

### 9.2.4.5 Operational Noise Criteria

**NRA Guidelines**

There are no statutory guidelines relating to noise from road schemes in Ireland. In the absence of statutory guidance, the most commonly applied standard is that in the NRA Guidelines (2004). The document specifies that the following absolute noise design criterion for new national road schemes in Ireland is appropriate: Day-evening-night value of **60dB $L_{den}$** free field façade level. In EIA terms, this means that it is to be applied to existing sensitive receptors in respect of both the year of opening and the design year (i.e. 15 years after projected year of opening).

The NRA Guidelines (2004) states that: "*The Authority accepts that it may not always be sustainable to provide adequate mitigation in order to achieve the design goal. Therefore, a structured approach should be taken in order to ameliorate as far as practicable road traffic noise through the consideration of measures such as alignment changes, barrier type (e.g. earth mounds), low noise road surfaces etc*."

Mitigation measures are only deemed necessary when the following three conditions in the NRA Guidelines (2004) are satisfied at designated sensitive receptors:

*(a) the combined expected maximum traffic noise level, i.e. the relevant noise level, from the proposed road scheme together with other traffic in the vicinity is greater than the design goal of* 60dB $L_{den}$*;*
*(b) the relevant noise level is at least 1dB more than the expected traffic noise level without the proposed road scheme in place; and*
*(c) the contribution to the increase in the relevant noise level from the proposed road scheme is at least 1dB.*

**County Meath Noise Action Plan 2019**

Meath NAP states:

> "*At present there is no existing legislation that limits environmental noise levels to a particular value. Several difficulties arise when attempting to choose a reasonable value for noise level limits, mainly due to the subjective nature of noise exposure and annoyance. The effects of noise exposure are highly dependent on the perception of the exposed person and the effectiveness of noise reduction can often be dependent as much on relative changes as on absolute levels. Attempting to apply the same limit value to a city centre park and rural countryside may be inappropriate, despite the fact that both can be perceived as tranquil areas relative to the surroundings.*"

The County Meath Noise Action Plan 2019 set guideline values of over 70 dB(A) $L_{den}$ and 57 dB(A) $L_{night}$ as upper limit values for the prioritisation of noise management relating to road traffic noise. Meath NAP goes on to state that. "*These values can be seen as indicative criteria in the decision-making process."* Various factors are considered when deciding if environmental noise management is necessary, such as, the type of buildings and land use in the area, the source of the noise and as well as the level of noise predicted. Further details can be found in Meath County Council's Noise Action Plan.

**WHO Environmental Noise Guidelines for the European Region**

The World Health Organisation (WHO) published Environmental Noise Guidelines for the European Region in October 2018. The objective of these guidelines is to provide recommendations for protecting human health from exposure to environmental noise from transportation (road traffic, railway and aircraft), wind turbine noise and leisure noise. The guidelines set out recommended exposure levels for environmental noise in order to protect population health. The guidelines recommend $L_{den}$ and $L_{night}$ levels above which there is risk of adverse health risks for each source type.

The WHO guideline values are recommended to serve as the basis for a policy-making process to allow evidence based public health orientated recommendations. They are not intended to be noise limits and the WHO document states the following regarding the implementation of the guidelines:

> "*The WHO guideline values are evidence-based public health-oriented recommendations. As such, they are recommended to serve as the basis for a policy-making process in which policy options are considered. In the policy decisions on reference values, such as noise limits for a possible standard or legislation, additional considerations – such as feasibility, costs, preferences and so on – feature in and can influence the ultimate value chosen as a noise limit. WHO acknowledges that implementing the guideline recommendations will require coordinated effort from ministries, public and private sectors and nongovernmental organizations, as well as possible input from international development and finance organizations. WHO will work with Member States and support the implementation process through its regional and country offices*."

Noise at continuously high levels, in excess of 80 dB(A) (General Application Regulations 2007, Chapter 1 of Part 5: Control of Noise at Work), can cause hearing impairment. It is rare however for road traffic noise to reach this level. Road traffic noise has been linked to increased risk of direct and indirect health effects such as ischemic heart disease (IHD), high levels of annoyance and sleep disturbance. WHO (2018) found that a 5% relevant risk increase of the incidence of IHD occurs at a noise exposure level of 59.3 dB $L_{den}$ a level that is consistent with the NRA Guidelines set out earlier in this section.

WHO (2018) cites moderate quality evidence that there is an absolute risk of 10% of the population being 'highly annoyed' by road traffic noise at a level of 53.3 dB $L_{den}$. Annoyance is an indirect health effect, and this threshold has not been adopted by any country for road traffic noise. It will be a decision for national and local policy makers to adopt the WHO guidelines and propose noise limits. The current NRA Guidelines for operational noise set out above is therefore considered appropriate for this assessment.

### 9.2.4.6 Operational Vibration Criteria

The rubber tires and suspension systems of vehicles provide vibration isolation, it is not usual for traffic to cause ground-borne vibration problems on well-maintained road surfaces. For most issues with HGV-related vibration, such as rattling of windows, the cause is almost always directly related to running surface conditions such as potholes, bumps, expansion joints, or other discontinuities in the road surface which is usually resolved by smoothing such discontinuities and this will not be an issue for Proposed Scheme.

The NRA Guidelines (2004) state: *"It has been found that ground vibrations produced by road traffic are unlikely to cause perceptible structural vibration in properties located near to well-maintained and smooth road surfaces. The Authority does not therefore consider it necessary to set limits for vibration during the operational phase of a road scheme."* Hence, vibration during the operational phase of the Proposed Scheme will not be considered further in this assessment.

### 9.2.4.7 Underwater Noise Criteria

Underwater noise will arise during construction of the bridge. No works will be carried out in the river and any potential impact on fish is considered to be low due to the construction methodology being adopted. Nonetheless the underwater noise impact has been assessed using the Popper et al. (2014) and the California Department of Transportation (Caltrans) Guidance (2015) as shown in **Table 9-9**.

Section 6 of Popper et al. (2014) classifies drilling and vibratory pile drivers as continuous sound sources. The guidance only provides numerical physical injury guidelines for continuous noises on fish whose swim bladders are involved in hearing which is not applicable in this case. For fish in which the swim bladder is not involved in hearing and fish without a swim bladder, Section 7 of Popper et al. (2014) indicates that the risk of mortality or physical injury is 'Low' in the near, intermediate and far fields. The risk of Temporary Threshold Shift is 'Moderate' in the near field only and the risk of behavioural changes is 'Moderate' in the near and intermediate fields and low in the far field. It is clear from the Popper et al. guidance that any impacts on fish will be no more than moderately likely and localised close to the source.

The Caltrans guidance relates to 'the effects of pile driving on fish'. It suggests that alternative piling methodologies can be used to reduce underwater noise levels and includes the use of cofferdams and isolation casings under 'Best Management Practices'. The Caltrans thresholds (for piledriving) were set by an expert working group and are shown in **Table 9-9**.

**Table 9-9: Underwater Noise Criteria**

| Effect | Metric | Fish Mass | Threshold |
|---|---|---|---|
| Onset of Physical Injury | Peak Pressure | n/a | 206 dB (re 1 µPa)[1] |
| | Accumulated Sound Exposure Level (SEL)[2] | ≥ 2 g | 187 dB (re 1 $\mu Pa^{2}$-s) |
| | | < 2 g | 183 dB (re 1 $\mu Pa^{2}$-s) |
| Adverse Behavioural Effects | Root Mean Square Pressure (RMS)[3] | n/a | 150 dB (re 1 µPa)[3] |

*NOTE 1: Underwater sound levels are referenced to 1 µPa, dB underwater cannot therefore be directly compared to airborne noise dB which are referenced to a different pressure level.*

*NOTE 2: The SEL is the time integral of the square pressure over a time window long enough to include the entire pressure signal characteristic. SEL values are calculated in one second intervals.*

*NOTE 3: RMS is the root mean square of the amplitude of a continuous pressure signal in a specified frequency band, for a specified averaging time.*

## 9.2.5 Assessment Criteria and Significance

The following terminology and definitions are defined:

- **Noise Impact:** The difference in the acoustic environment before and after the implementation of the proposals (also known as the magnitude of change). This includes any change in noise level and in

[3] The 150 dB (re 1 µPa) is used by the US National Marine fisheries Service. It states that sound pressure above the 150 $dB_{rms}$ level are expected to cause temporary changes in fish behaviour. However, Popper et al. 2018 have noted limitations with this value related to among others the assumption that fish respond to SPL rather than other acoustic signals and that all species would respond in a similar way to the one criterion.

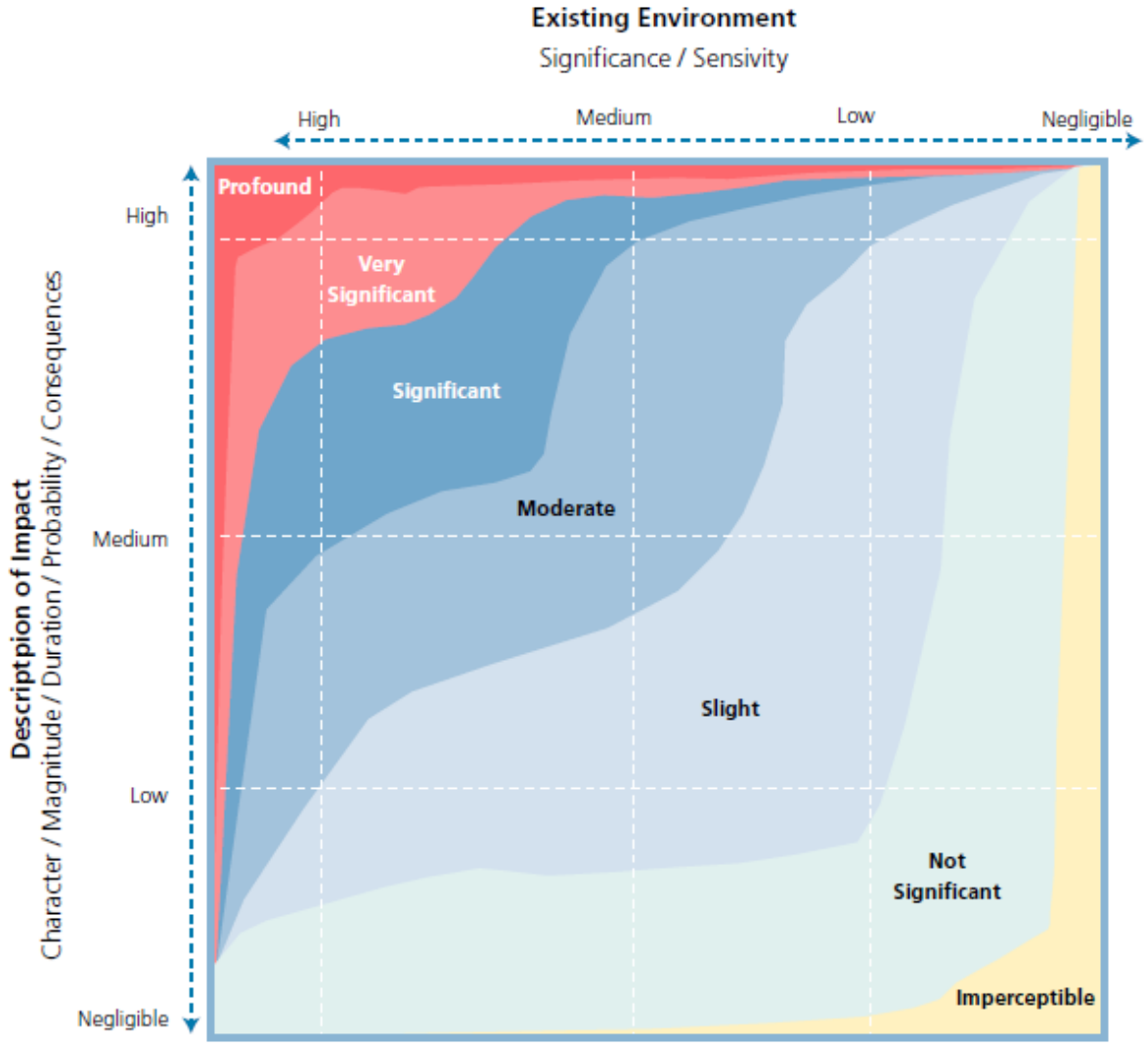
other characteristics/features, and the relationship of the resulting noise level to any standard benchmarks;

- **Noise Effect:** The consequence of the noise impact. This may be in the form of a change in the annoyance caused, a change in the degree of intrusion or disturbance caused by the acoustic environment, or the potential for the change to alter the character of an area such that there is a perceived change in quality of life. This will be dependent on the receptor and its sensitivity; and
- **Significance of Effect:** The evaluation of the noise effect and, particularly if the noise impact assessment is part of a formal EIA, deciding whether or not that impact is significant.

This criterion is applicable to airborne noise. The assessment criteria and significance of underwater noise effects is set out in **Chapter 16 – Biodiversity: Aquatic Ecology** and **Appendix 16.3**.

### 9.2.5.1 EPA Guidance

The significance of noise and vibration effects means the importance of the outcome of the noise and vibration effects on the receptors. The significance is a function of the magnitude and quality of the effect, positive or adverse, the geographical extent and duration of the effect, the frequency and likelihood of the effect occurring and the sensitivity of the receptor. The significance is assessed by weighing up these attributes and categorising it according to the generalised degree of impact significance set out in the EPA 2022 guidance as shown in **Figure 9.1**.




***Source:*** *Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, 2021)*

**Figure 9.1: Classification of the significance of impacts**

### 9.2.5.2 Construction Noise

**Section 9.2.4.2** outlined that the maximum permissible construction noise levels in the NRA Guidelines are used to determine the construction noise impact during all periods except night-time periods. The 'ABC' method in BS 5228 is to determine the construction noise impact during night-time periods. **Table 9-10** presents the construction noise significance rating.

For assessing the significance of effect, reference has been made to the EPA Guidelines (2022) and specifically the DMRB which states:

> "*Construction noise and construction traffic noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:*
>
> *1) 10 or more days or nights in any 15 consecutive days or nights;*
>
> *2) A total number of days exceeding 40 in any 6 consecutive months.*"

**Table 9-10: Construction Noise – Significance Rating**

| Noise Levels | EPA Magnitude of Impact | Initial Significance Rating | Modifier |
|---|---|---|---|
| ≤ Baseline noise level | Negligible | Imperceptible / Not Significant | Depends on NRA/BS 5228 threshold value, baseline noise levels, duration and frequency. Public attitudes to, and acceptability of, the project itself. |
| > Baseline noise level and ≤ NRA/BS 5228 threshold | Low | Slight/ Moderate | |
| > NRA/BS 5228 threshold to ≤NRA/BS 5228 threshold + 5 dB | Medium | Moderate/ Significant | |
| > NRA/BS 5228 threshold +5 to + 10 dB | High | Significant - Profound | |
| > NRA/BS 5228 threshold + 10 dB | | | |

Due to the nature and duration of the Proposed Scheme, the maximum permissible construction noise levels will be exceeded during certain construction phases, particularly at receptor locations which form the boundary with work sites or where night-time works are required. Due to the potential for significant effects at these locations and taking account of the duration of the works, reference is made to BS 5228 for determining the requirement for temporary rehousing.

### 9.2.5.3 Construction Traffic Noise

**Section 9.2.4.3** outlined the DMRB magnitude of impact criteria used to determine the construction traffic noise impact. For assessing the significance of effect, reference is made to the EPA Guidelines (2022) and the DMRB with the same criteria used for construction noise and construction traffic noise. **Table 9-11** presents the construction traffic noise significance rating.

**Table 9-11: Construction Traffic Noise – Significance Rating**

| Noise Level Increase | DMRB Magnitude | EPA Magnitude of Impact | Initial Significance Rating | Modifier |
|---|---|---|---|---|
| Less than 1.0 | Negligible | Negligible | Impercetible / Not Significant | Depends on baseline noise levels, duration, and frequency. |
| 1.0 to 2.9 | Minor | Low | Slight / Moderate | |
| 3.0 to 4.9 | Moderate | Medium | Moderate / Significant | |
| Greater than or equal to 5.0 | Major | High | Significant - Profound | |

### 9.2.5.4 Criteria for Eligibility of Temporary Rehousing

Reference is made to Section E.4 of BS 5228-1:2009+A1:2014 for thresholds and criteria for temporary re-housing (TRH). Temporary rehousing, or the reasonable costs thereof, will be offered to eligible owners/ occupiers where the construction of the Proposed Scheme causes, or is expected to cause, a measured or predicted airborne construction noise level that exceeds either of the following at a property lawfully occupied as a permanent dwelling:

- A noise level 10 dB above any of the trigger noise levels presented in **Table 9-12** for the corresponding times of day; or
- A noise level 10 dB or more above the existing pre-construction ambient noise level for the corresponding times of day.

Whichever of the above is the higher; and occurs for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.

**Table 9-12: Criteria for Eligibility of Temporary Accommodation**

| Time | Relevant Time Period | Average Time, T | Temporary Accommodation Trigger Level, dB $L_{Aeq,T}$ * |
|---|---|---|---|
| Monday to Friday | 07:00 – 08:00 | 1 hr | 70 |
| | 08:00 – 18:00 | 10 hr | 75 |
| | 18:00 – 19:00 | 1 hr | 70 |
| | 19:00 – 22:00 | 3 hr | 65 |
| | 22:00 – 07:00 | 1 hr | 55 |
| Saturday | 07:00 – 08:00 | 1 hr | 70 |
| | 08:00 – 13:00 | 5 hr | 75 |
| | 13:00 – 14:00 | 1 hr | 70 |
| | 14:00 – 22:00 | 3 hr | 65 |
| | 22:00 – 07:00 | 1 hr | 55 |
| Sunday and Public Holidays | 07:00 – 21:00 | 1 hr | 65 |
| | 21:00 – 07:00 | 1 hr | 55 |

** All noise levels are predicted or measured at a point 1 m in front of the most exposed of any windows and doors in any façade of any eligible dwelling.*

Following a review of the construction programme in conjunction with the predicted construction noise impacts from the Proposed Scheme, it is highly unlikely that any of the noise sensitive locations in proximity to the proposed scheme will meet the criteria for temporary accommodation.

### 9.2.5.5 Construction Vibration

**Section 9.2.4.4** outlined guidance on effects of vibration levels on humans and limits of transient vibration, above which cosmetic damage to structures could occur. For assessing the significance of effect, reference is made to the DMRB which states:

> "*Construction vibration shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:*
>
> *1) 10 or more days or nights in any 15 consecutive days or nights;*
>
> *2) a total number of days exceeding 40 in any 6 consecutive months.*"

**Table 9-13** presents the construction vibration significance rating.

**Table 9-13: Construction Vibration – Significance Rating**

| Vibration Level | DMRB Magnitude | EPA Magnitude of Impact | Initial Significance Rating | Modifier |
|---|---|---|---|---|
| Less than 0.3 mm/s | Negligible | Negligible | Impercetible/ Not Significant | Depends on duration, occurrence, and frequency. |
| Greater than or equal to 0.3 mm/s and less than 1.0 mm/s | Minor | Low | Slight/ Moderate | |
| Greater than or equal to 1.0 mm/s and less than 10 mm/s | Moderate | Medium | Moderate/ Significant | |
| Greater than or equal to 10 mm/s | Major | High | Significant - Profound | |

### 9.2.5.6 Operational Noise

As outlined in **Section 9.2.4.5**, the 2004 and 2014 NRA guidance documents specifies a 60 dB $L_{den}$ design goal for receptors.

Road traffic noise can result in direct health effects at high levels but is more prevalent at levels that cause annoyance and sleep disturbance. There is strong evidence that both annoyance and sleep disturbance increase with increasing noise levels. The nature of road traffic noise is such that significant changes in road traffic are required on existing roads to change noise levels whereas the introduction of a new road in a greenfield area can result in a significant change in noise levels. The UK DMRB distinguishes between short-term and long-term impacts on the basis that receptors habituate to road traffic noise and annoyance/sleep disturbance effects reduce over time. The short-term effects will be assessed by comparing the Do-Minimum scenario with the Do-Something scenario for the year of opening and the long-term effects will be compared with the Do-Something in the design year.

In the case of the proposed road scheme, road traffic noise is expected to reduce on the N2 through Slane village providing reduced levels for a large number of residents. However, noise levels are expected to increase on the N51 given the increased number of vehicles travelling along the N51. Noise levels will also increase in open areas where new roads are constructed.

The aim is to avoid significant adverse impacts on health and quality of life from noise as a result of the Proposed Scheme. Where operational road traffic noise is below the NRA design goal of 60 dB $L_{den}$ in respect of both the year of opening and the design year, the initial significance rating is determined to be not significant. Where operational traffic noise levels are above the design goal, the impact rating is dependent on the magnitude above the design goal and the increase above the baseline noise environment.

Where pre-existing noise levels are already high (well above the design goal), a small change in noise levels will not be noticeable and a larger change may cause disturbance and be significant. The scale of the impact will depend on the degree of noise change. If the ambient noise level is currently low (below the threshold), then the scale of impact is dependent on the extent to which the predicted noise levels exceed the thresholds. The noise level criteria associated magnitude of impact and initial significance rating for high sensitivity receptors is summarised in **Table 9-14**.

**Table 9-14: Operational Noise – Significance Rating**

| Predicted Noise Level above the NRA Design Goal / Baseline | | DMRB Magnitude | EPA Magnitude of Impact | Initial Significance Rating | Modifier |
|---|---|---|---|---|---|
| Short-Term | Long-Term | | | | |
| Less than 1.0 | Less than 3.0 | Negligible | Negligible | Not Significant | Depends on the absolute level, acoustic context, difference in noise level and likely perception of change by residents' noise levels, duration, and frequency. |
| 1.0 to 2.9 | 3.0 to 4.9 | Minor | Low | Slight/ Moderate | |
| 3.0 to 4.9 | 5.0 to 9.9 | Moderate | Medium | Moderate/Significant | |
| Greater than or equal to 5.0 | Greater than or equal to 10.0 | Major | High | Significant - Profound | |

Where the sensitivity of a receptor is medium or low, the magnitude of impact reduces and initial significance rating changes.

### 9.2.6 Data Limitations

This chapter of the EIAR has been prepared based upon the best available information and in accordance with current best practice and relevant guidelines.

Baseline noise measurements were undertaken on 13, 14, 16 and 17 December 2021 and 11 January 2022. The baseline noise surveys on the 11 January were undertaken during a period when restaurant, bars and cafes had to close at 8 pm. This limitation is acknowledged and once incorporated into the assessment, is deemed to not affect the certainty or predictability of the assessment.

## 9.3 Description of Existing Environment (Baseline Scenario)

### 9.3.1 Current Environmental Baseline

#### 9.3.1.1 Meath County Development Plan 2021-2027

The Meath County Development Plan 2021-2027 (CDP) recognises environmental noise obligations and refers to the County Meath Noise Action Plan 2019 (NAP). While specific provisions are made regarding aircraft noise from Dublin Airport, these do not relate to the Slane area.

The Meath CDP includes the following objective (INF OBJ 73): *To support and facilitate the preparation of strategic noise maps and action plans, in conjunction with EMRA[4], that support proactive measures to avoid, mitigate and minimise noise, in all instances where it is likely to have adverse impacts*. To date, this work has not yet been undertaken. The EPA has taken over a supervisory role in relation to the Environmental Noise Directive (END) and Round 4 Strategic Noise mapping has commenced. Round 4 results were not published at the time this chapter was prepared.

There is no specific objective relating to road traffic noise or the Slane area in the CDP.

#### 9.3.1.2 County Meath Noise Action Plan 2019

The County Meath Noise Action Plan 2019 set guideline values of over 70 dB(A) $L_{den}$ and 57 dB(A) $L_{night}$ as upper limit values for the prioritisation of noise management relating to road traffic noise. The NAP states that the strategic noise mapping and population exposure estimation processes indicate that approximately 11,911 people are located within the coverage area of the strategic noise maps in the NAP. It further states that approximately 11,911 people are predicted to experience traffic noise levels of greater than 55 dB(A) $L_{den}$, approximately 2,232 people are predicted to be exposed to traffic noise levels of greater than 65 dB(A) $L_{den}$, and approximately 22 people are predicted to be exposed to traffic noise levels of greater than 75 dB(A) $L_{den}$.

Slane is one of the four population centres considered in the Meath NAP, and the N2 and N51 national roads were mapped as part of the preparation of the NAP. The NAP recognises that noise pollution can have a greater impact at certain locations and certain building types than others including schools, hospitals and nursing homes. The plan identifies 15 locations as being noise sensitive, comprising 14 schools and one nursing home. One of the Schools, St Patrick's National School, is located approximately 600 m north of N2/N51 junction.

An assessment of the predicted noise exposure levels at these 15 locations identified in Meath NAP indicated that there was no exceedance of the upper limit values for noise assessment which showed a need for priority action based on decision support criteria. Further detailed noise modelling and assessment is proposed under the Meath NAP in the future. There are no specific works planned for the Slane Area under the NAP until this modelling is undertaken.

[4] EMRA – Eastern and Midlands Regional Assembly.

### 9.3.1.3 Existing Environment and Receptors

The description of the Proposed Scheme is included in **Chapter 4 – Description of the Proposed Scheme.** The existing noise environment comprises of traffic noise and distant traffic noise from the N2, N51 and local roads. Parts of the Proposed Scheme travel through more rural areas and at these locations noise from farming activity and livestock was noted.

A total of 1,391 receptors were considered in the model including residential receptors, schools, places of worship and commercial premises. The most sensitive NSL for the purpose of this assessment were residential dwellings where people are present for day, evening and night periods and thereby continuously exposed to road traffic noise and as noted previously, Brú na Bóinne World Heritage Property was also categorised as a NSL in this assessment.

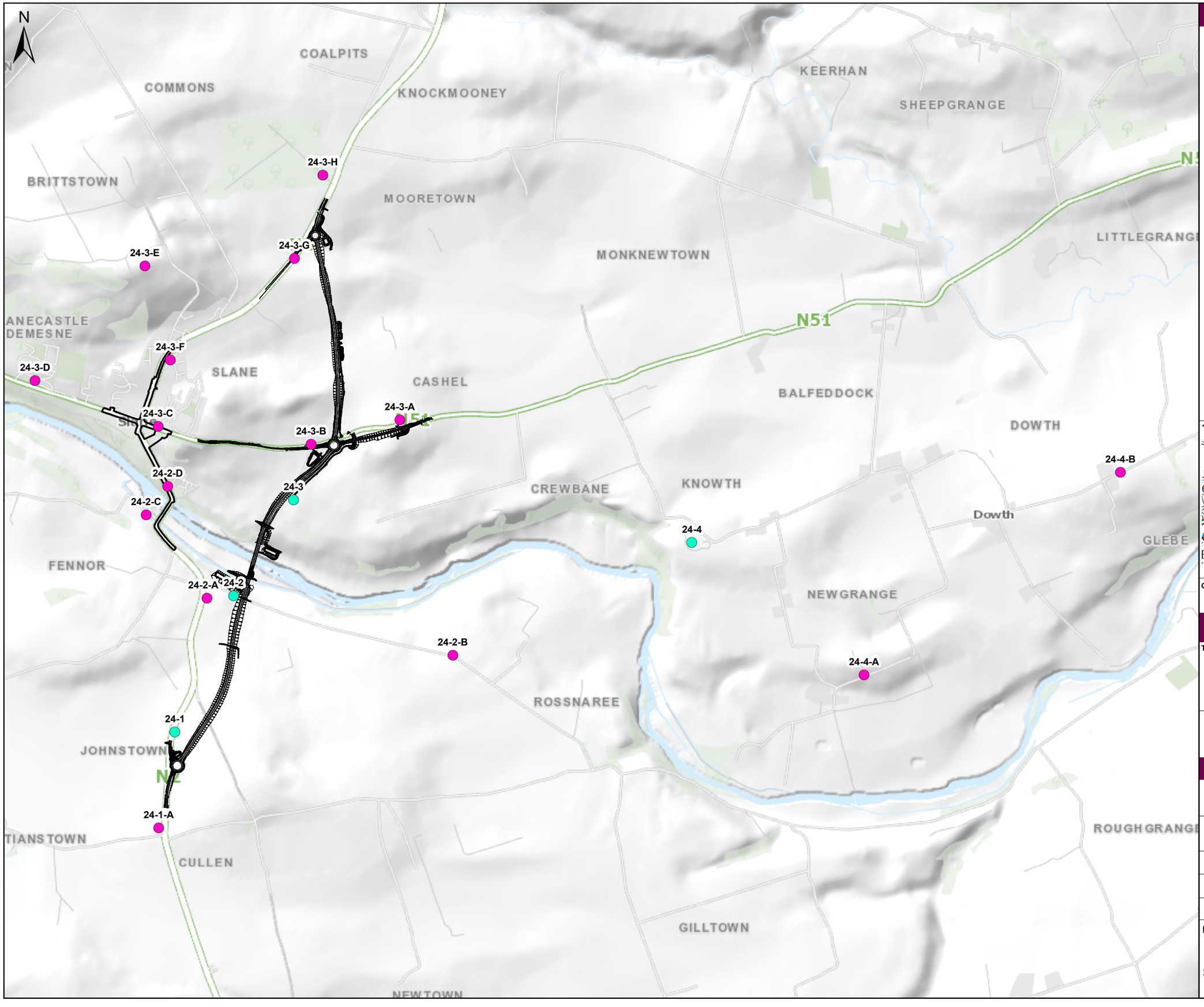
### 9.3.1.4 Current Baseline Environment

Baseline noise monitoring was undertaken on the 13, 14, 16 and 17 December 2021 and 11 January 2022 at 24 noise monitoring locations which were chosen to inform the assessment. Noise monitoring was carried out using four 24-hour stations and 20 locations using the shortened measurement procedure in the NRA 2014 Good Practice Guidance (see **Section 9.2 Methodology**). Monitoring was undertaken at locations in proximity to the Proposed Scheme as well as along the existing N2 and N51. Locations in Collon village were also monitored as the Proposed Scheme is predicted to increase traffic volumes through the village. Details on the noise monitoring locations are presented in **Table 9-15**. The noise monitoring locations are shown in **Figure 9.2** and **Figure 9.3**.

**Table 9-15: Baseline Noise Monitoring Locations**

| Noise Monitoring Location (NML) | Easting (X Coordinate) | Northing (Y Coordinate) | Location Description | Survey Type |
|---|---|---|---|---|
| 24-1 | 696384 | 772268 | In a garden of a dwelling adjacent to the N2 between McGruder's Cross (junction L1600 and N2) and Rossnaree Road. | Unattended |
| 24-2 | 696749 | 773114 | In the front garden of a dwelling adjacent to the Rossnaree Road. Monitoring location was approx. 200 m west of the N2. | Unattended |
| 24 - 3 | 697123 | 773712 | In a garden of a dwelling adjacent to the Proposed Scheme between Boyne River and junction with the N51. The monitoring location was approx. 325 m south of the N51 and 760 m northeast of the N2. | Unattended |
| 24 - 4 | 699599 | 773444 | Located at Knowth part of the WHS on top of a large mound known as Site 1. The monitoring location is approximately 3 km from the N2, approx. 1.1 km from the N51 and approx. 2.5 km from the Proposed Scheme. | Unattended |
| 24-1-A | 696284 | 771671 | In a garden of a dwelling at the McGruder's Cross (junction L1600 and N2). | Attended |
| 24-2-A | 696584 | 773098 | In a garden of a dwelling adjacent to the N2 approx. 100 m south of the junction with Rossnaree Road. | Attended |
| 24-2-B | 698114 | 772745 | Located at an entrance to a field in proximity to dwellings adjacent to Rossnaree Road. The monitoring location was approx. 1.6 km from the N2. | Attended |
| 24-2-C | 696206 | 773617 | Located adjacent to the car park of an amenity area south of Slane Bridge. The monitoring location was approx. 80 m from the N2. | Attended |
| 24-2-D | 696340 | 773795 | Adjacent to a dwelling at Boyne view located off the N2 approx. 95 m northwest of Slane Bridge. | Attended |
| 24-3-A | 697784 | 774206 | Located adjacent to dwellings adjacent to the N51. The proposed location was approx. 460 m east of the junction of the N51 and the proposed road scheme. | Attended |
| 24-3-B | 697232 | 774056 | Located adjacent to the Ledwidge Cottage Museum adjacent to the N51 approx. 1.1 km east of the Slane village. This location was approx. 115 m from the intersection between the N51 and the proposed road scheme. | Attended |
| 24-3-C | 696280 | 774167 | Located in Slane village at the intersection of the N51 and access road to Ledwidge Hall Apartments. | Attended |
| 24-3-D | 695515 | 774451 | Located adjacent to dwellings at Marians Terrace approx. 35 m away from the N51. The monitoring location was approx. 700 m west of Slane village. | Attended |
| 24-3-E | 696198 | 775165 | Located adjacent to Slane Abbey. The monitoring location was approx. 500 m from the N2. | Attended |
| 24-3-F | 696356 | 774579 | Located adjacent to dwellings at Stanley Heights approximately 40 m away from the N2. The monitoring location was approx. 430 m north of Slane village. | Attended |

| Noise Monitoring Location (NML) | Easting (X Coordinate) | Northing (Y Coordinate) | Location Description | Survey Type |
|---|---|---|---|---|
| 24-3-G | 697128 | 775211 | Located at an entrance to a field adjacent to the N2. The monitoring location was a proxy location for two dwelling 50 and 80 m southwest of the monitoring location. The monitoring location was in proximity to where the Proposed Scheme will tie in with the existing N2. | Attended |
| 24-3-H | 697305 | 775730 | Located in Littlewood Forest located adjacent to the N2. The forest is approx. 400 m northeast of where the Proposed Scheme will tie in with the existing N2. The monitoring location was approx. 80 m from the N2. | Attended |
| 24-4-A | 700671 | 772623 | Located at the entrance to Knowth passage tomb within the Brú na Bóinne World Heritage Property. The monitoring location was approx. 4.1 km from the existing N2 and approx. 2.2 km from the N51. | Attended |
| 24-4-B | 702266 | 773883 | Located at the entrance to the Dowth monument within the Brú na Bóinne World Heritage Property. The monitoring location was approx. 5.7 km from the existing N2 and approx.1.5 km from the N51. | Attended |
| 24-5-A | 698770 | 781812 | Adjacent to a dwelling off Kells Road which was approx. 1 km west of Collon village. | Attended |
| 24-5-B | 699759 | 782173 | In an open area off the N2 approx. 205 m north of Collon village. | Attended |
| 24-5-C | 700280 | 782057 | Adjacent to dwellings at The Cloisters and Priest Hill approx. 150 m east of Collon village. | Attended |
| 24-5-D | 699719 | 781792 | Adjacent to dwellings approx. 160 m south of Collon village (intersection between N2 and R168). | Attended |
| 24-5-E | 699095 | 779188 | The monitoring location was in an area of open land at the junction of the N2 and L5605, located between Slane village and Collon village. | Attended |




## Legend

Proposed Scheme

**Noise Monitoring Locations**

- 24 Hour Monitoring Locations
- Attended Monitoring Locations

Data Source: OSi

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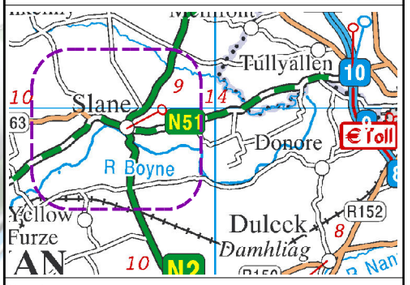
Kilometres




**Client**

**Meath County Council**

**N2 Slane Bypass and Public Realm Enhancement Scheme**

**Title**

**Figure 9.2**

**Noise Monitoring Locations - Slane**


rps

West Pier
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Dun Laoghaire,
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**Issue Details**

**File Identifier:**
MDT0806-RPS-00-N2-DR-Z-AG-3023

| Status: | Rev: | Model File Identifier: |
|---|---|---|
| A1 | C01 | MDT0806-RPS-01-N2-M2-C-XM1001<br>MDT0806-RPS-01-PR-M2-C-XR9000 |

| | |
|---|---|
| **Drawn:** NR | **Date:** 27/06/2023 |
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## Legend

**Noise Monitoring Locations**

- Attended Monitoring Locations

Data Source: OSi

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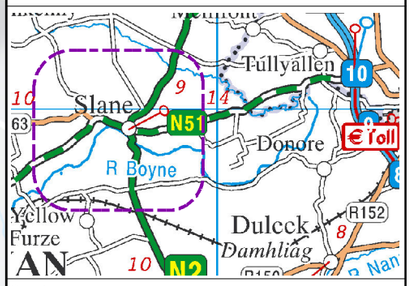
Kilometres




Client

**Meath County Council**

**N2 Slane Bypass and Public Realm Enhancement Scheme**

Title

**Figure 9.3**

**Noise Monitoring Locations - Collon**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MDT0806-RPS-00-N2-DR-Z-AG-3023

| Status: | Rev: | Model File Identifier: |
|---|---|---|
| A1 | C01 | MDT0806-RPS-01-N2-M2-C-XM1001<br>MDT0806-RPS-01-PR-M2-C-XR9000 |

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| **Drawn:** NR | **Date:** 27/06/2023 |
| **Checked:** JM | **Scale:** 1:15,000 (A3) |
| **Approved:** NO'N | **Projection:** ITM |

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### 9.3.1.4.1 Baseline Noise Survey Results

#### Meteorological Conditions

Baseline noise monitoring was undertaken on the 13, 14, 16 and 17 December 2021 and 11 January 2022. The weather conditions on the 13 and 14 December 2021 were overcast and dry. Temperatures ranged from 2 to 5 °C during the daytime. Temperatures throughout the evening and night-time ranged between 2 to 4 °C. The average wind speeds were less than 3 m/s and the wind was from a southerly direction.

The weather conditions on the 16 and 17 of December were overcast and dry. Temperatures ranged from 6 to 8 °C during all periods. The average wind speeds were less than 3 m/s and the wind was from an east and south-easterly direction. The weather conditions on the 11 January 2022 were bright, sunny, cool and dry day. Temperatures ranged from 6 to 9 °C during the daytime. The average wind speeds were less than 3 m/s and the wind was from an east and south-easterly direction.

#### Baseline Noise Levels

The measured $L_{den}$ noise levels for the measurements undertaken at the long-term (24-hour) measurement locations are presented in **Table 9-16**. Further details on the baseline noise survey results are presented in **Appendix 9.3 – Baseline Noise Survey Data**. The derived $L_{den}$ noise levels for the measurements for the short-term measurement locations are presented in **Table 9-17**.

**Table 9-16: Baseline Noise Monitoring Locations – Long-term Measurements**

| Noise Monitoring Location (NML) | Measured $L_{den}$ |
|---|---|
| 24-1 | 73 |
| 24-2 | 58 |
| 24-3 | 55 |
| 24-4 | 47 |

**Table 9-17: Baseline Noise Monitoring Locations – Short-term Measurements**

| Noise Monitoring Location (NML) | Derived $L_{den}$ |
|---|---|
| 24-1-A | 66 |
| 24-2-A | 61 |
| 24-2-B | 55 |
| 24-2-C | 58 |
| 24-2-D | 69 |
| 24-3-A | 71 |
| 24-3-B | 73 |
| 24-3-C | 66 |
| 24-3-D | 64 |
| 24-3-E | 52 |
| 24-3-F | 59 |
| 24-3-G | 78 |
| 24-3-H | 63 |
| 24-4-A | 47 |
| 24-4-B | 50 |
| 24-5-A | 60 |
| 24-5-B | 65 |
| 24-5-C | 56 |
| 24-5-D | 74 |
| 24-5-E | 74 |

#### 9.3.1.4.2 Underwater Noise Baseline

The River Boyne at Slane is a relatively noisy underwater environment for migrating fish. Underwater noise sources include the weir west of Slane bridge, a small waterfall at the bridge and traffic noise and vibration transmitted to the water column through the bridge piers. There are other weirs and falls upstream and downstream at which underwater noise levels are elevated. As no works are proposed in the river channel it was not considered necessary to carry out baseline underwater noise measurements.

### 9.3.2 Evolution of the Environment in the Absence of the Proposed Scheme

Assuming the proposed scheme is not constructed, traffic volumes are expected to increase along existing routes (N2 and N51 National roads) accessing Slane village. This will result in an increase in noise levels over and above the current scenario at sensitive receptors located along the main national and regional roads. For sensitive receptors setback from trafficked roads, noise levels measured as part of the baseline noise survey are expected to be broadly similar. The noise environment in absence of the proposed scheme is represented by the Do-Minimum scenarios. Further details on the Do-Minimum scenarios can be found in **Sections 9.4.2** and **9.6.2.1**.

## 9.4 Description of Likely Significant Effects

**Sections 9.4.1** and **9.4.2** provide a description of the likely significant effects of the Proposed Scheme on noise and vibration in cumulation with other existing development in the area. A description of the likely significant effects in cumulation with approved development i.e., development not yet built, is presented in **Section 9.4.3** based on the detailed methodology for the CIA included in **Chapter 25**.

The impact interaction between noise and vibration and other environmental factors is described in **Chapter 26** and assessed throughout **Sections 9.4.1** to **9.4.3**.

Noise levels at noise sensitive locations from both the construction and operational phases are below the threshold of hearing damage and are assessed on the basis of annoyance. When considering the potential noise impacts on the surrounding environment, it must be considered for each of the two phases: the temporary or short-term impact of the construction phase and the longer-term impact of the operational phase.

### 9.4.1 Construction Phase

Short-term increases in noise impacts will occur during the construction phase of the works due to the requirement to use heavy plant and machinery. There is generally a higher tolerance for short-term construction related noise than that which causes annoyance over the long-term. This is reflected in Section 6.7 of the NRA Guidelines.

Construction activities associated with Proposed Scheme can be classified as particular types of activity as shown in **Table 9-18**. The proposed N2 bypass is linear in nature and the construction activity will be mobile over the course of the proposed works i.e. works will not be taking place at any one location permanently. Activities will vary in intensity and duration throughout the course of the works. This variation in location, intensity and duration results in significant variation in the noise levels at any noise sensitive location.

Noise levels at a noise sensitive receptor are influenced by the intensity of the source, proximity to the source and any screening effect between the source and the receiver.

For the purpose of this assessment, we have considered the specific works which are quasi mobile e.g. rock extraction and road formation and ‘static’ works such as demolition works and works at structures. The activities considered for the purpose of this project are summarised in **Table 9-18**.

**Table 9-18: Construction Activities – Description**

| Activity | Description | Classification |
|---|---|---|
| Site Enabling Works | It is intended that the works will include for a full site clearance of vegetation within the lands required for construction of the proposed works. It will also include site access works and the provision of site compounds. By their nature, these works must be complete before the main works start. Some may start well in advance of the main construction activities. Equipment | Mobile works |

| Activity | Description | Classification |
|---|---|---|
| | includes chainsaws, mulchers, excavators, dozers, dumper trucks, lorries, and concrete breaking equipment. | |
| Demolition works | Demolition may arise in the case of buildings or old structures. Equipment includes excavators, dumper trucks, lorries, and concrete breaking equipment. | Static works |
| Earthworks | The project entails considerable earthworks as the preferred alignment is set low in the landscape. Equipment includes excavators, dozers, dumper trucks, lorries, and rolling and compaction equipment. | Mobile works |
| Rock Extraction and Processing | Rock extraction is required along the scheme alignment. The excavatability of the rock has been assessed and it is expected that it will be possible to excavate the rock with conventional plant with some hard ripping being required. No rock blasting is planned. Equipment includes excavators, dozers, dumper trucks and lorries.<br>Rock processing is required and will occur at 2 locations. Equipment includes loaders, crushers, screeners and dumper trucks. | Mobile works / Static works |
| Watercourse Works | The proposed alignment crosses several existing watercourses and agricultural drains. There are thirteen culverts required to accommodate existing watercourses. Equipment includes excavators, dozers, rolling and compaction equipment, concreting equipment, a mobile crane and lorries. | Static works |
| Road Formation and Paving | The road formation works comprise of surface finished earthworks on which a road pavement is constructed. Equipment includes excavators, dozers, graders, pavers, rollers, dumper trucks and lorries. | Mobile works |
| Boyne Bridge | A new bridge structure to span the Boyne River. There are several construction stages including provision of hardstanding areas, substructure and superstructure. Equipment includes excavators, dozers, cranes, rolling and compaction equipment, concreting equipment dumper trucks and lorries. | Static works |
| Overpass and Bridge Structures | The construction of an overpass will involve removal of material and erection of concrete structures. Equipment includes excavators, dumper trucks and concreting equipment. | Static works |
| Signage and Lighting | Signage and lighting include the erection of safety and acoustic barriers. Activities include foundation works and erection of barriers, lights and signs with some works being carried out at height. Equipment includes small earthworks equipment and mobile lifting equipment. | Mobile works |
| Landscaping | Landscaping is usually completed towards the end of the project when heavy construction is completed. Equipment includes tractors, excavators and dumper trucks. | Mobile works |
| Public Realm Construction | Activities will include the removal or existing road pavement and footpaths, utility diversion, installation of new road pavements and footpaths, and construction of an off-street car park. Equipment includes excavators, dumpers, planners, rollers and pavers. | Static and Mobile Works |

As some of the construction works may need to be carried out over the length of the scheme, the assessment has been carried out by considering the distance between the nearest noise sensitive location to the potential construction activities. The predicted noise levels at the closest distance to noise sensitive locations are tabulated. The modelled noise level will be further reduced as the distance to the noise sensitive location increases or screening effects arise.

The noisiest activities have been considered as part of the assessment and if compliance can be demonstrated for these activities' compliance will be demonstrated from other less intrusive activities. Plant items such as generators, pumps, temporary lighting, and hand tools amongst others have the potential to generate noise albeit at much lower levels than the plant items modelled in the construction tasks described in the subsequent sections. Nonetheless, mitigation measures are outlined to mitigate the noise from these items of plant and these are discussed in **Section 9.5.1**.

#### 9.4.1.1 Site Enabling Works

It is intended that the works will include for a full site clearance of vegetation within the lands required for construction of the proposed works. This is a mobile activity which will be carried out over the length of the

proposed works. Temporary lands will be required for some aspects of the construction and for the proposed site compounds. Specifically, temporary lands will be required on the south side of the River Boyne in order to facilitate construction of the River Boyne bridge. Temporary stockpile areas for topsoil and other earthworks materials will also be required, e.g. rock to be processed for re-use in the construction have been included in the scheme. As noted above, the majority of earthworks material arising from excavations is expected to be removed directly from the site.

The closest noise sensitive location to site enabling works for the construction compounds is approx.12m away from the main site compound to be located adjacent to the intersection between the proposed road scheme and the intersection with the N51. Site enabling works at the construction compounds have been modelled and **Table 9-19** presents the expected plant required as part of the activity.

**Table 9-19: Plant for Site Enabling Works – Site Compounds**

| Plant | BS 5228 Ref. | Description | Sound Power Level |
|---|---|---|---|
| Chainsaw | Manufacturers Datasheet | Stihl MS461 Chainsaw | 117.0 |
| Wood chipper | Manufacturers Datasheet | QuadTrak 160 | 116.0 |
| Mulcher | Manufacturers Datasheet | BE TMS 2300 Mulcher | 114.6 |
| Tracked excavator | C.2.5 | Clearing Site | 104.4 |
| Road lorry (full)* | C.6.21 | Delivery / Removal of Material | 108.6 |
| Dozer | C.5.12 | Spreading Chipping | 104.7 |
| Vibratory Roller | C.5.28 | Rolling and Compaction | 104.5 |
| Dump truck (tipping fill) | C2.30 | Tipping Fill | 107.1 |
| Lorry with lifting boom | C.4.53 | Lifting material | 104.7 |

** Drive-by maximum sound level*

The predicted noise level at the nearest noise sensitive locations are presented in **Table 9-20**.

**Table 9-20: Predicted Noise Levels for Site Enabling Works at Nearest Noise Sensitive Location**

| Location / Activity | Distance to Activity | Predicted Façade Noise Level | Predicted Façade Noise Level Limited Plant* |
|---|---|---|---|
| Nearest NSL to Site Compound (R941) | 12 - 20m | 85 | 73 |
| Next Nearest NSL to Site Compound (R942) | 70m (line of sight partially blocked) | 70 | 65 |
| Nearest NSL to Satellite Site Compound (R571) | 42m | 74 | 66 |
| Next Nearest NSLs to Satellite Site Compound (R534) | 46 - 52m | 74 | 65 |
| Next Nearest NSL to Satellite Site Compound (R762) | 65 - 90m | 69 | 63 |

** No chainsaw, wood chipper or mulcher*

The noise levels are predicted to be above the NRA/ TII construction noise limit of 70 dB $L_{Aeq,1hr}$ at the nearest noise sensitive location to the main site compound. The predicted noise level at all other locations are predicted not to exceed the noise limit. The noisiest items of plant relate to tree felling and processing. The site compound works are expected to last 2 months. However, the noisiest activities are expected to occur for much shorter durations. It is also expected that the actual noise levels will be lower as it is not practical to have all plant operating at the closest distance to the nearest noise sensitive location.

Noise predictions without the tree felling and processing activities have been modelled. The predicted noise level reduces by over 10 dB. However, there is potential for the noise limit to be exceeded when all works are occurring simultaneously at the closest distance to the nearest noise sensitive location. It is expected that the actual noise levels will be lower as it is not practical to have all plant operating at the closest distance to the nearest noise sensitive location.

In practice, it is likely that the noise levels will be below the noise limits most of the time and there may be occasional higher levels when plant is located at the nearest boundary to the noise sensitive locations predicting a moderate significance of effect. Nonetheless, there is potential for elevated noise levels at the noise sensitive locations closest to these activities and measures to mitigate the noise impact are discussed in **Section 9.5.1**.

It is also proposed to have a satellite site compound located south of the River Boyne which is c. 40 m from the nearest NSL. The maximum predicted noise level is above the 70 dB $L_{Aeq,1hr}$ assuming activities occur in proximity to the nearest NSL. In practice, the setback distance will vary, and the actual noise levels will be lower. When the tree felling and processing activities are not occurring, the predicted noise levels are below the noise limit.

Once the site compounds have been established, they will be used to provide office and welfare facilities for site staff. The construction compound will also provide facilities for material storage, laydown and maintenance of construction plant, and possibly material testing. The noise emissions from these activities will be less than that associated with the site enabling works. In addition, it is proposed to install hoarding along site compound boundary facing the nearest noise sensitive locations.

As noted above, it is intended that the site enabling works will include for a full site clearance of vegetation within the lands required for construction of the proposed works. This is a mobile activity which will be carried out over the length of the proposed works. **Table 9-21** presents the expected plant required as part of the activity. This phase of works is expected to last one month for works north of the River Boyne and south of the River Boyne.

**Table 9-21: Plant for Site Enabling Works**

| Plant | BS 5228 Ref. | Description | Sound Power Level |
|---|---|---|---|
| Chainsaw | Manufacturers Datasheet | Stihl MS461 Chainsaw | 117.0 |
| Wood chipper | Manufacturers Datasheet | QuadTrak 160 | 116.0 |
| Mulcher | Manufacturers Datasheet | BE TMS 2300 Mulcher | 114.6 |
| Tracked excavator | C.4.63 | Ground excavation/ earthworks/ trenching | 105.5 |
| Road lorry (full)* | C.6.21 | Distribution of material | 108.6 |
| Articulated dump truck* | C.6.18 | Distribution of material | 114.0 |
| Dozer* | C.2.1 | Clearance/ earthworks | 103.3 |

** Drive-by maximum sound level*

**Table 9-22: Predicted Noise Levels for Site Enabling Works at Nearest Noise Sensitive Location**

| Location / Activity | Distance to Activity | Predicted Façade Noise Level | Predicted Façade Noise Level limited plant |
|---|---|---|---|
| Nearest NSL (R696) – South of Boyne Bridge | 25 m | 83 | 74 |
| Next Nearest NSL (R762) – South of Boyne Bridge | 80 m | 70 | 64 |
| Nearest NSL (R956) – North near Tie-in with N2 | 175 m | 62 | 54 |
| Nearest NSL (R732) – South near Tie-in with N2 | 100 m | 67 | 58 |

The predicted noise level at the nearest noise sensitive location are presented in **Table 9-22**. The noise levels are predicted to be above the NRA noise limit of 70 dB $L_{Aeq,1hr}$ at two locations (R696 and R762[5]). The noisiest items of plant relate to tree felling and processing and once construction plant are at least 80 m away, the predicted noise are expected be below the noise limit. The site clearance works south of the River

[5] Noise Level presented for receptor R762 when the construction activity is occurring adjacent to receptor R696. However, when the construction activity occurs adjacent to receptor R762 the predicted noise levels are similar to those shown for receptor R696 in **Table 9-22.**

Boyne are expected to last 1 month. The noisiest activities are expected to occur for much shorter durations and plant will be operating at greater distances than those modelled. It is expected that the actual noise levels will be lower than the levels predicted in **Table 9-22**.

Noise predictions without the tree felling and processing activities have also been modelled. The predicted noise level reduces by over 10 dB. However, there is potential for the noise limit to be exceeded when all works are occurring simultaneously at the closest distance to the nearest noise sensitive location. It is expected that the actual noise levels will be lower as it is not practical to have all plant operating at the closest distance to the nearest noise sensitive location. Nonetheless, there are two NSLs with the potential for noise levels to be in excess of 70 dB $L_{Aeq,1hr}$ albeit under specific conditions. Overall, the noise impact from this activity it is predicted to have a moderate significance of effect. Details on the mitigation measures are discussed in **Section 9.5.1**.

### 9.4.1.2 Demolition

The construction of this scheme will require the acquisition and demolition of several of buildings and details and further information can be found in **Chapter 4**, **Section 4.4.15.1** (Landtake).

Demolition is classified as a static activity. The closest noise sensitive location to demolition of buildings is c. 66 m away from the private dwelling at N51 East Ch. 75. **Table 9-23** presents the expected plant required associated with this activity. This phase of works is expected to last several days.

**Table 9-23: Plant for Building Demolition Works**

| Plant | BS 5228 Ref. | Description | Sound Power Level |
|---|---|---|---|
| Pulveriser mounted on excavator | C.1.4 | Demolition of structure | 103.8 |
| Wheeled excavator | C.5.11 | Loading of material | 100.7 |
| Road lorry (full)* | C.6.21 | Lorry for removal of waste material | 108.6 |
| Backhoe mounted hydraulic breaker | C.5.1 | Breaking foundations | 116.6 |

** Drive-by maximum sound pressure level*

**Table 9-24: Predicted Noise Levels for Building Demolition Works at Nearest NSL**

| Location / Activity | Distance to Activity | Predicted Façade Noise Level |
|---|---|---|
| Private Dwelling at N51 East Ch. 75 / Nearest NSL (R941) | 66 m | 69 |

The predicted noise level is presented in **Table 9-24**. The noise level is predicted to be below the noise limit of 70 dB $L_{Aeq,1hr}$ at the nearest noise sensitive locations. The predicted noise level is lower at more distant noise sensitive locations. The noisiest individual item of plant is the backhoe mounted hydraulic breaker and it has potential to generate high levels of noise but in practice the backhoe mounted hydraulic breaker is likely to be used sporadically. It is unlikely all plant will be operated simultaneously, and it is expected that the actual noise level will generally be lower than the noise levels predicted in **Table 9-24**. The predicted noise levels are not significant in EIA terms.

### 9.4.1.3 Earthworks

Earthworks will form a significant part of the construction programme and is expected to occur during months 5 to 27 albeit the works will not be concentrated at a given location for this period. This is a mobile activity which will be carried out over the length of the Proposed Scheme. More material will be excavated from cuts than is required for embankments for this scheme. The surplus material will be exported off-site.

**Table 9-25** presents the expected plant associated with this activity. This phase of works is expected to last 23 months. However, the distance between the earthworks and noise sensitive locations will vary throughout that period.

**Table 9-25: Plant for Earthworks**

| Plant | BS 5228 Ref. | Description | Sound Power Level |
|---|---|---|---|
| Tracked excavator (x3) | C.4.63 | Ground excavation/ earthworks/ trenching | 105.5 |
| Road lorry (full)* | C.6.21 | Distribution of Material | 108.6 |
| Articulated dump truck* | C.6.18 | Distribution of Material | 114.0 |
| Vibratory roller | C.5.25 | Rolling and Compaction | 103.3 |
| Dozer* | C.2.1 | Earthworks | 103.3 |

** Drive-by maximum sound level*

The predicted noise level at the nearest noise sensitive locations are presented in **Table 9-26**. The noise levels are predicted to be above the noise limit of 70 dB $L_{Aeq,1hr}$ at two locations adjacent to the proposed mainline (R696 and R762[6]). Similarly, noise levels are predicted to be above the noise limit of 70 dB $L_{Aeq,1hr}$ at locations adjacent to the proposed N51 realignment work east of the proposed bypass. If all plant was operating simultaneously, the predicted noise levels could reach 76 dB $L_{Aeq,1hr}$. Given the duration, frequency, and quantum of other construction activities in proximity to these receptor locations, there is likely to be a significant effect.

The noisiest individual item of plant is the tracked excavator operating adjacent to the site boundary in proximity to nearest noise sensitive locations. The predicted noise levels for all other NSLs is less than the noise limit of 70 dB $L_{Aeq,1hr}$ when activities are occurring over 55 m away. Furthermore, the noise modelling has assumed direct line of sight between the construction plant and the noise sensitive locations. As material is being excavated, there is potential that line of sight will be obscured, and the actual noise levels will be lower than the predicted noise levels in **Table 9-26**.

**Table 9-26: Predicted Noise Levels for Earthworks at Nearest Noise Sensitive Location**

| Location / Activity | Distance to Activity | Predicted Façade Noise Level |
|---|---|---|
| Mainline / R696 | 25 m | 76 |
| Mainline / R762 | 55 m | 69 |
| Mainline / R32 | 100 m | 64 |
| N51 / R945 | 25 m | 76 |
| N51 / R1068 | 40 m | 72 |
| N51 / R943 | 45 m | 72 |
| N51 / R946 | 60 m | 69 |

In practice, it is likely, that the noise levels will be below the noise limits for the majority of the time and there may be occasional higher levels for short periods when plant is located at the nearest boundary to the noise sensitive locations and there may be temporary significant effects at a limited number of noise sensitive locations. There are several NSLs along the mainline and the N51 with the potential for noise levels to be in excess of 70 dB $L_{Aeq,1hr}$ and details on measures to mitigate the noise impact are discussed in **Section 9.5.1**.

### 9.4.1.4 Rock Extraction

Rock extraction is considered part of earthworks. For the noise impact assessment, it has been considered as a separate activity to the earthworks. The rock underlying the soil across the site is mostly limestone but is also occasionally recorded as sandstone, mudstone or greywacke on the ground investigation logs. The excavatability of the rock has been assessed and it is expected that it will be possible to excavate the rock with conventional plant with some hard ripping being required. Rock blasting is not expected to be necessary. Excavation in overburden is not envisaged to be problematic for conventional earthworks plant. However, it may be necessary to employ more robust plant for removal of large boulders. It has been

[6] Noise Level presented for receptor R762 when the construction activity is occurring adjacent to receptor R696. However, when the construction activity occurs adjacent to receptor R762, the predicted noise levels are similar to those shown for receptor R696 in Table **9-27**.

assumed that the requirement for rock break is the exception and is considered on that basis. **Table 9-27** presents the expected plant associated with this activity. This is a mobile activity which will be carried out over the length of the proposed scheme. However, the distance to noise sensitive locations will vary. Furthermore, the scenario modelled assumes that cutting does not provide any attenuation.

**Table 9-27: Plant for Rock Extraction**

| Plant | BS 5228 Ref. | Description | Sound Power Level |
|---|---|---|---|
| Tracked excavator | C.6.8 | Breaking out and Loading | 107.8 |
| Dozer | C.2.10 | Ripping Rock | 108.1 |
| Articulated Dump Truck* | C.6.18 | Distribution of Material | 102.7 |

** Drive-by maximum sound level*

**Table 9-28: Predicted Noise Levels for Rock Extraction at Nearest Noise Sensitive Location**

| Location / Activity | Distance to Activity | Predicted Façade Noise Level |
|---|---|---|
| Mainline / R732 | 100 m | 63 |
| Mainline / R762 | 100 m | 63 |
| N51 / R945 | 25 m | 76 |
| N51 / R1068 | 40 m | 72 |
| N51 / R943 | 45 m | 71 |
| N51 / R946 | 60 m | 69 |

The predicted noise levels at the nearest noise sensitive locations are presented in **Table 9-28**. The noise levels are predicted to be below the noise limit of 70 dB $L_{Aeq,1hr}$ for rock extraction activity along the proposed mainline. However, noise levels are predicted to be above the noise limit of 70 dB $L_{Aeq,1hr}$ for rock extraction activity on the N51 east of the proposed bypass. The scenario modelled assumes no attenuation from the cutting and when line of sight is obscured, the actual noise level at noise sensitive locations is expected to be lower. When the distance between the construction activity and receptor location is increased to 55 m the noise levels are predicted to be below the noise limit.

It is noted that it may be necessary to employ more robust plant for removal of large boulders e.g. the use of an excavator mounted rock breaker. This type of material is not commonly occurring, but the maximum predicted noise impact could be as high as 85 dB if the plant was operating at the boundary with direct line of sight to the noise sensitive location. In practice, this is unlikely to happen as depth where rock is likely to be encountered is expected to be below the current ground level and this will mean that direct line of sight will be obscured, and the predicted noise impact will be lower. Given the duration and frequency of this activity there is likely to be a moderate significance of effect. Nonetheless, mitigation measures will be necessary when there is direct line of sight between the activity and the noise sensitive receptor, and the distance is less than 55 m. Details on the mitigation measures are discussed in **Section 9.5.1**.

It is expected that the granular fill requirements of the project will be met using materials arising from excavations. Therefore, processing of rock will be necessary and temporary areas have been identified on site where rock processing, including crushing, grading and stockpiling will take place. **Table 9-29** presents the expected plant associated with this activity. The nearest NSL to the rock stockpile areas is approx. 230 m away.

**Table 9-29: Plant for Rock Processing**

| Plant | BS 5228 Ref. | Description | Sound Power Level |
|---|---|---|---|
| Tracked crusher | C.1.14 | Crushing Rock | 109.4 |
| Screen stockpiler | C.10.15 | Screen and grading of material | 109.1 |
| Articulated dump truck | C.6.26 | Dumping Load | 107.2 |
| Articulated dump truck* | C.6.18 | Distribution of Material | 114.0 |
| Wheeled loader | C.10.5 | Loading material | 107.8 |

** Drive-by maximum sound level*

The activity noise level, maximum activity noise level and the noisiest individual piece of equipment used for that activity predicted at the nearest noise sensitive location are presented in **Table 9-30**.

**Table 9-30: Predicted Noise Levels for Rock Processing at Nearest Noise Sensitive Location**

| Location / Activity | Distance to Activity | Predicted Façade Noise Level |
|---|---|---|
| Nearest NSL (R732) | 230 m | 61 |

The noise levels are predicted to be below the noise limit of 70 dB $L_{Aeq,1hr}$ and the noise from this activity is not expected to result in a significant effect at the nearest noise sensitive locations. The predicted noise impact from this activity at more distant locations are lower than the noise levels presented in **Table 9-30**. No specific mitigation measures are required other than application of best practice measures which will be implemented, and these are discussed in **Section 9.5.1**.

### 9.4.1.5 Culverts

The proposed alignment crosses several existing watercourses and agricultural drains. Hydrological assessments were carried out to determine the design flow for each culvert. There are thirteen culverts required to accommodate existing watercourses through the scheme such as streams and land drains. Further details can be found in the scheme description in **Chapter 4 – Description of the Proposed Scheme** and **Chapter 5 – Description of the Construction Phase**. Construction noise modelling was undertaken for three culverts (2D, 4A and 6A). These are located at different setback distances to the nearest dwelling with culvert 2D approx. 20 m[7] to the nearest noise sensitive location, Culvert 4A is approx. 85 m to the nearest noise sensitive location and culvert 6A is approx. 170 m to the nearest noise sensitive location. The culvert construction works are a static activity and the closest distance to a noise sensitive location has been modelled.

**Table 9-31** presents the expected plant required associated with this activity. This phase of works is expected to last a total of two months for all culverts. However, the distance to noise sensitive locations will vary depending on the culvert under construction.

**Table 9-31: Plant for Culvert Works**

| Plant | BS 5228 Ref. | Description | Sound Power Level |
|---|---|---|---|
| Tracked excavator | C.5.35 | Trenching/Earthworks | 102.7 |
| Vibratory roller* | C.5.21 | Rolling and Compaction | 108.4 |
| Lorry with lifting boom | C.4.53 | Lifting material | 104.9 |
| Concrete mixer truck | C.4.27 | Pouring concrete | 107.1 |
| Wheeled mobile crane | C.5.37 | lifting material | 103.7 |
| Vibratory plate (petrol) | C.2.41 | Compaction | 108.1 |

** Drive-by maximum sound level*

The predicted noise level at the nearest noise sensitive location are presented in **Table 9-32**.

**Table 9-32: Predicted Noise Levels for Rock Extraction at Nearest Noise Sensitive Location**

| Location / Activity | Distance to Activity | Predicted Façade Noise Level |
|---|---|---|
| Nearest NSL (R762) to Culvert 2D | 20 m | 78 |
| Next nearest NSL (R696) to Culvert 2D | 80 m | 66 |
| Nearest NSL (R941) to Culvert 4A | 82 m | 65 |
| Nearest NSL (R957) to Culvert 6A | 175 m | 56 |

[7] Note: Culvert 2C is also approx. 20 m from the nearest noise sensitive location.

For the majority of noise sensitive locations, the predicted noise levels from the culvert construction works are predicted to be less than noise limit of 70 dB $L_{Aeq,1hr}$. However, there is one dwelling located approx. 20 m from culvert 2C and one dwelling located approx. 20 m from culvert 2D where the predicted noise levels have the potential to exceed the noise limit. The scenario modelled assumes all plant operating simultaneously but in practice this will not occur, and it is expected that the actual noise level will be lower than the noise level predicted in **Table 9-32**. The noise level at the next nearest dwelling is predicted to have noise levels below the noise limit. The duration of the construction works at each culvert is anticipated to be less than one week and there is potential for periods where the noise level is elevated. Given the frequency and duration of the activity, it is predicted that this activity will result in a moderate significance of effect at the nearest noise sensitive locations. Measures to mitigate the noise impact are discussed in **Section 9.5.1**.

### 9.4.1.6 Road Formation and Paving

The road formation works comprise of surface finished earthworks on which a road pavement is constructed. It includes the earthworks and the general shaping of the road. This is a mobile activity which will be carried out over the length of the proposed works. Once the surface beneath the road has been prepared with a compact sub-base, the top layers are laid. A significant portion of the Proposed Scheme is in cut and the cutting will attenuate the noise impact. Several scenarios were modelled including where works occur on sections of the scheme in cut and at grade as well as the noise sensitive locations in proximity to the works.

**Table 9-33** presents the expected plant required as well as the duty cycle modelled as part of the scenario associated with this activity. This phase of works is expected to last eight months. However, the distance to noise sensitive locations will vary. For our assessment, the closest distance to a noise sensitive location has been modelled with all plant operating simultaneously.

**Table 9-33: Plant for Road Formation and Paving**

| Plant | BS 5228 Ref. | Description | Sound Power Level |
|---|---|---|---|
| Dozer | C.5.12 | Spreading Chipping | 104.7 |
| Road lorry (full)* | C.6.21 | Distribution of Material | 108.6 |
| Grader * | C.6.31 | Levelling road | 114.5 |
| Tracked excavator | C.5.35 | Trenching | 102.7 |
| Road roller* | C.5.19 | Rolling and Compaction | 107.7 |
| Articulated dump truck* | C.6.18 | Distribution of Material | 114.0 |
| Asphalt paver (+ tipper lorry)* | C.5.32 | Paving | 111.8 |
| Vibratory roller (not vibrating)* | C.5.23 | Rolling and Compaction | 110.9 |
| Wheeled excavator | C.5.11 | Removing material | 100.7 |
| Road sweeper | C.4.90 | Sweeping and dust suppression | 103.9 |
| Loading dump truck with pebbles | C.10.12 | Loading material from stockpile area | 109.5 |

** Drive-by maximum sound pressure level*

The predicted noise level at the nearest noise sensitive location to the mainline are presented in **Table 9-34**.

**Table 9-34: Predicted Noise Levels for Road Formation and Paving at Nearest Noise Sensitive Location**

| Location / Activity | Approx. Distance to Activity | Predicted Façade Noise Level |
|---|---|---|
| Mainline / Nearest NSL (R696) | 35 m | 70 |
| Mainline / Next Nearest NSL (R941) | 110 m | 65 |
| N51 West of Proposed Bypass / R939 | 8 m | 85 |
| N51 East of Proposed Bypass / R947 | 30 m | 76 |
| N51 East of Proposed Bypass / R947 | 30 m | 75 |

The noise level at the nearest noise sensitive location to the proposed bypass mainline does not exceed the noise limit of 70 dB $L_{Aeq,1hr}$. However, predicted noise level for noise sensitive locations adjacent to the N51

are above the noise limit. In practice, the actual noise levels are expected to be lower as it is unlikely that all plant will be operating simultaneously in proximity to the NSL given that grading of sub-base material will not occur concurrently with the paving of the finish course. For noise sensitive receptors adjacent to N51 east of the proposed mainline, the potential exceedances associated with this construction activity are limited periods when plant such as the vibration roller is adjacent to the NSLs. For noise sensitive receptors adjacent to N51 west of the proposed mainline, some NSLs are in close proximity and there is potential for elevated noise levels when plant is in close proximity. The nature of the road formation works and surfacing works means plant are at their closest to NSL for brief periods. It is expected that surface paving will be progressed at a coverage of 100 m a day and hence the impact is expected to occur for a limited duration and is likely to result in a moderate significance of effect. Measures to mitigate the noise impact are discussed in **Section 9.5.1**.

### 9.4.1.7 River Boyne Bridge Construction

#### 9.4.1.7.1 Airborne Noise Impacts

The proposed new structure comprises a four-span steel plate girder bridge made composite with a reinforced concrete deck slab. This is a static activity with the distance to noise sensitive locations depending on which side of the river works are being carried out; work will be required both north and south of the crossing. Each of the bridge construction stages was modelled. For the purpose of this assessment, activity to the south has been modelled as representing the greatest impact from this activity.

**Table 9-35** presents the expected plant associated with this River Boyne bridge construction. This phase of works is expected to last 36 months but specific stages will be of a shorter duration.

**Table 9-35: Plant for River Boyne Bridge Construction Works**

| Activity | Plant | BS 5228 Reference | Description | Sound Power Level |
|---|---|---|---|---|
| Preparation of Hardstanding Areas | Road Lorry(full)* | C.6.21 | Distribution of material | 108.6 |
| | Dump truck (tipping fill) | C2.30 | Tipping Fill | 107.1 |
| | Tracked excavator | C.2.19 | Ground Excavation/earthworks | 105.5 |
| | Dozer | C.5.12 | Spreading chipping/fill | 104.7 |
| | Vibratory roller | C.5.27 | Rolling and Compaction | 94.6 |
| | Tracked excavator | C.4.65 | Trenching | 99.3 |
| Substructure | Tracked excavator | C.5.35 | Trenching/Excavation/Earthworks | 102.7 |
| | Road lorry (full)* | C.6.21 | Distribution of Material | 108.6 |
| | Road roller* | C.5.19 | Rolling and Compaction | 107.7 |
| | Crawler mounted rig | C.3.22 | Continuous flight auger piling – cast in situ | 107.8 |
| | Lorry with lifting boom | C.4.53 | Lifting material | 104.9 |
| | Wheeled mobile crane | C.5.37 | Lifting | 103.7 |
| | Truck mounted concrete pump + boom arm | C.4.30 | Pumping concrete | 107.5 |
| | Hand-held circular saw (petrol-cutting concrete) | C.4.72 | Cutting Concrete | 107.2 |
| Superstructure | Lorry with lifting boom | C.4.53 | Lifting material | 104.9 |
| | Wheeled mobile crane | C.5.37 | Lifting | 103.7 |
| | Tracked mobile crane | C.4.50 | Lifting | 98.6 |
| | Truck mounted concrete pump + boom arm | C.4.30 | Pumping Concrete | 107.5 |
| | Hand-held pneumatic breaker | C.1.6 | Breaking concrete | 111.5 |
| | Hand-held circular saw (petrol-cutting concrete | C.4.72 | Cutting concrete | 107.2 |

| Activity | Plant | BS 5228 Reference | Description | Sound Power Level |
|---|---|---|---|---|
| | Poker vibrator | C.4.34 | Vibrate concrete | 96.7 |
| | Road lorry (full)* | C.6.21 | Delivery of material | 108.6 |

** Drive-by maximum sound level*

The predicted noise levels at the nearest noise sensitive location are presented in **Table 9-36**. The noise levels are predicted to be below the noise limit of 70 dB $L_{Aeq,1hr}$ during all activities associated with the bridge construction. Nonetheless, activity in this general area is likely to occur over the duration of the project and measures to mitigate the noise impact are discussed in **Section 9.5.1**.

**Table 9-36: Predicted Noise Levels for River Boyne Bridge Construction Works at Nearest Noise Sensitive Location**

| Location / Activity | Approx. Distance to Activity | Predicted Façade Noise Level |
|---|---|---|
| Nearest NSL (R696) / Hardstandings | 45 m | 66 |
| Nearest NSL (R696) / Substructure | 68 m | 69 |
| Nearest NSL (R696) / Superstructure | 68 m | 67 |

### 9.4.1.7.2 Underwater and Ground-borne Noise Impacts

The two most significant noise sources during the construction phase are the installation of the cofferdams using sheet-piling and the foundation piles for the bridge piers. The cofferdams will be constructed 10 m from the side of the River Boyne and the bored piles will be installed a minimum distance of 12.29 m from side of the river channel.

The sheet-piles will be installed using a 'press-in' piling technique. Press-in piling uses hydraulic rams to provide the force necessary to jack pre-formed piles into the ground. The technique has significantly lower noise and vibration levels than traditional piling methods. A study in The Netherlands reported Peak Particle Velocity (PPV) levels of 15.2 mm/s for diesel hammer (impact piling), 8.3 mm/s for vibratory piling and 0.3 to 0.7 mm/s using the press-in method on the same operation[8].

The foundation piles will be installed using a bored piling rig. Bored piling is carried out using an auger drilling technique which also minimises noise and vibration levels. This work will be carried out within the cofferdam, which acts as an isolation casing. An isolation casing is a method of isolating ground-borne noise and vibration but no additional reduction for its use has been included in the calculations here.

Bored piling and press-in piling techniques have low and extremely low environmental noise and vibration impacts and are normally screened out of an assessment. Consequently, there is limited data available on potential underwater noise impacts from either method. BS 5228 provides data indicating that the PPV level associated with a 600 mm diameter bored pile was 0.54 mm/s. Scaling this[9] up for a 1,200 mm diameter pile the PPV level is expected to be 2.16 mm/s at 5 m, considerably lower than the alternative methods i.e. impact piling or vibratory piling. It is clear however that bored piling (and press-in piling) are not impulsive sound sources and must be considered as 'other continuous sources' in impact assessments.

The bridge is proposed as a four span bridge to avoid construction in the river channel, and thus avoid potential underwater noise impacts. The three proposed bridge piers need to be constructed on piled foundations drilled into rock underneath the bridge. A cross section of the bridge showing the results of the ground investigations is shown on drawing **MDT0806-RPS-01-N2-DR-C-GI4000** in **Volume 3**. An extract from that drawing showing the proposed piers on either side of the river channel is shown in **Figure 9.4**.

[8] White, D., and Bolton, M., Press-in Piling: Ground Vibration and Noise during Pile Installation, Proceedings of the International Deep Foundations Congress. Orlando, USA. ASCE Special Publication 116 pp363-371.

[9] Simon, R., (1963), Energy Balance in Rock Drilling, Society of Petroleum Engineers Journal, Vol 3 (04): 298–306.

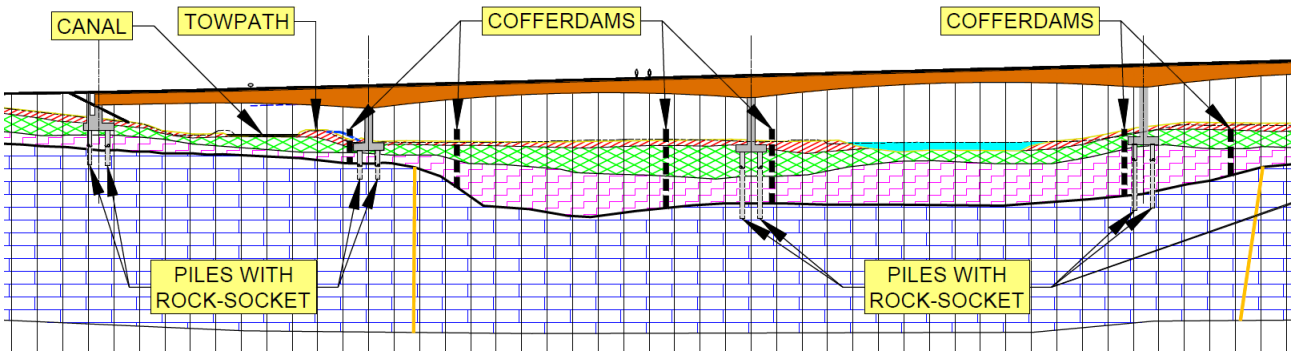



**Figure 9.4: Cross section of bridge construction**

The transmission of ground-borne noise and vibration can be considered to have similar characteristics. From **Chapter 18 – Land, Soils, Geology and Hydrogeology**, the surface layer is very soft to soft or loose topsoil or made ground. The layer under the river channel is firm to stiff or medium dense to dense overburden or some very poor weathered limestone. The proposed construction methodology requires the construction of cofferdams in the upper layers, excavating these upper layers and then drilling the piles through the consolidated overburden into the limestone layer (**Table 9-36**).

**Table 9-37: Acoustic Properties of Sediment Layers at Slane**

| Sediment Layer | Density (ρ) $Mg/m^3$ | Sound Velocity (v) m/s | Specific Acoustic Impedance $kg/m^2s$ |
|---|---|---|---|
| River water | 1.0 | 1,450 | 1,450 |
| Very soft to soft or loose topsoil or made ground | 1.57 | 180 - 240 | 283 - 377 |
| Firm to stiff or medium dense to dense overburden or some very poor weathered limestone | 1.84 | 1,100 – 1,700 | 2,024 – 3,128 |
| Very stiff to hard or very dense consolidated overburden or some very poor weathered limestone | 2.13 | 2,100 – 2,200 | 4,473 – 4,686 |

The transmission of sound between sediment layers results in reflection and transmission which are determined by the density, sound velocity and attenuation coefficients of the sediment layers. In thin sediment layers the layer thickness is small in comparison to the sound wavelength and plane wave propagation can be considered. Where a layer has a high acoustic impedance and joins a lower impedance layer sound energy tends to be 'trapped' in the high impedance layer and does not transmit effectively.

RPS has separately carried out underwater noise monitoring for a horizontal directional drilling (HDD) project under the River Foyle. The drilling operation required a 600 mm diameter bore underneath the riverbed. Underwater noise measurements were carried out in the water column directly over the drilling operation. At the time of measurement, the drill was 22 m below the riverbed. HDD operations at the River Foyle were through weak/very weak schist under five meters of riverbed sediments. Limestone and schist are both durable, medium hardness rocks with similar densities but schist is rated at 6 Mohs and limestone at 4 Mohs on the 10 point hardness scale. While the slant distance from the source to the river may be shorter, the sediment and rock at Slane is softer. No correction for distance is therefore warranted.

The noise from both bored piling and HDD is relatively steady state i.e. consistent drilling noise level with relatively long breaks to add drilling stems or to check alignment. Noise levels recorded for the HDD operation at the River Foyle were from 112 dB to 126 dB re 1 µPa (peak level), while RMS/SEL levels varied from 95 to 107 dB re 1 $\mu Pa^2$-s. To correct for a 1,200 mm diameter pile (+6 dB) and a 50% duty cycle over 24 hours (+46 dB), the predicted levels at Slane are presented along with the underwater noise criteria in **Table 9-38**.

**Table 9-38: Predicted Underwater Noise Levels from Bored Piling**

| | Peak dB re 1 µPa | SEL (24 hours) dB re 1 $\mu Pa^2$-s | RMS dB re 1 µPa |
|---|---|---|---|
| Threshold | 206 | 183 | 150 |
| Predicted Level | 132 | 159 | 113 |
| Impact | None | None | None |

Press-in piling and bored piling are low impact methodologies. Conservative estimates have been made of underwater noise levels arising from these operations. As the predicted underwater noise levels are below the potential impact thresholds, there will be no underwater noise impact from piling operations for the bridge piers. See **Chapter 16 – Biodiversity: Aquatic Ecology** for consideration of noise levels in relation to impacts to fish.

### 9.4.1.8 Overbridges

There are three overbridges on the proposed scheme to carry two farm accommodation tracks and Local Road L16002 (Rossnaree Road) over the proposed N2 Slane Bypass primary route. Further details on the overbridges can be found in **Chapter 4 – Section 4.4.10.2 Overbridges**. Overbridges are static activities with significant screening opportunities during the course of the works. The two accommodation bridges are at least 180 m from noise sensitive locations will be below the 70 dB $L_{Aeq,1hr}$ noise limit. The Rossnaree overbridge is approx. 25 m from the nearest noise sensitive location.

**Table 9-39** presents the expected plant associated with this activity. This phase of works is expected to last seven months. Furthermore, the scenario modelled assumes that cutting does not provide any attenuation.

**Table 9-39: Plant for Construction of Overbridges**

| Plant | BS 5228 Ref | Description | Sound Power Level |
|---|---|---|---|
| Tracked excavator | C.5.35 | Trenching/Excavation/Earthworks | 102.7 |
| Road lorry (full)* | C.6.21 | Distribution of Material | 108.6 |
| Vibratory roller* | C.5.21 | Rolling and Compaction | 108.4 |
| Wheeled mobile crane | C.5.37 | Lifting materials | 103.7 |
| Poker vibrator | C.4.34 | Vibrate concrete | 96.7 |
| Vibratory plate (petrol) | C.2.41 | Compaction | 108.1 |
| Truck mounted concrete pump & boom arm | C.4.30 | Pumping concrete | 107.5 |

** Drive-by maximum sound pressure level*

**Table 9-40: Predicted Noise Levels for Overbridge Construction at Nearest Noise Sensitive Location**

| Location / Activity | Distance to Activity | Predicted Façade Noise Level |
|---|---|---|
| Overbridge Rossnaree Road / R762 | 25 m | 75 |
| Overbridge Rossnaree Road / R696 | 75 m | 66 |

The predicted noise level at the nearest noise sensitive locations are presented in **Table 9-40**. The cumulative noise levels are predicted to be above the noise limit of 70 dB $L_{Aeq,1hr}$ at one dwelling. In practice, the predicted noise levels are expected to be lower than those presented in **Table 9-40** as not all plant will be operating simultaneously. It is likely, there will be elevated noise when activities are occurring at the closest distance to noise sensitive locations. Furthermore, it is assumed that plant will be located at grade and when construction plant is located in cut along the proposed mainline, direct line sight will be obscured and the predicted noise level will be lower. Nonetheless, given that the nearest dwelling is approximately 25 m away, mitigation measures are likely to be required to mitigate the noise impact from this activity. Further details on the mitigation measures are discussed in **Section 9.5.1**.

### 9.4.1.9 Signage and Lighting

This is a mobile activity which will be carried out over the length of the proposed works. Signage for the Proposed Scheme will be provided in as outlined in **Chapter 4 – Description of the Proposed Scheme** and **Chapter 5 – Description of the Construction Phase**. **Table 9-41** presents the expected plant associated with this activity. This phase of works is expected to last one month but the duration of the construction works at each light or sign is anticipated less than a day in total.

**Table 9-41: Plant for Signage and Lighting**

| Plant | BS 5228 Ref. | Description | Sound Power Level |
|---|---|---|---|
| Lorry with lifting boom | C.4.53 | Lifting material | 104.9 |
| Lifting platform | C.4.57 | Accessing raised areas | 95.2 |
| Wheeled excavator | C.5.11 | removal of broken road surface or soil | 100.7 |
| Mini piling rig | C.3.17 | Piling lighting columns or signage supports | 104.2 |
| Compressor for mini piling | C.3.19 | Compressor for mini piling rig | 102.9 |

**Table 9-42: Predicted Noise Levels for installation of Lighting at Nearest Noise Sensitive Location**

| Location / Activity | Distance to Activity | Predicted Façade Noise Level |
|---|---|---|
| Mainline / R941 | 100 m | 58 |
| N51 / R939 | 5 m | 85 |
| N51 / R1065 | 10 m | 81 |
| N51 / R1066 | 70 m | 61 |

The predicted noise levels at the nearest noise sensitive locations are presented in **Table 9-42**. The maximum noise levels from activities occurring on the N2 Slane bypass mainline are predicted to be below the noise limit of 70 dB $L_{Aeq,1hr}$ with the noisiest individual item of plant a lorry with a lifting boom also below 70 dB $L_{Aeq,1hr}$. However, there is potential for high noise levels along the N51 West realignment into Slane village. The nearest dwelling is approximately 5 m away and there may be occasional higher levels for short periods. Given the nature of the works and the duration of this activity at this closest location will be brief, it is predicted that there will be moderate significance of effect at the nearest noise sensitive locations. Measures to mitigate the noise impact are discussed in **Section 9.5.1**.

### 9.4.1.10 Landscaping

**Table 9-43** presents the expected plant associated with this activity. This is a mobile activity which will be carried out over the length of the proposed works. This phase of works is expected to last 2 months.

**Table 9-43: Plant for Landscaping**

| Plant | BS 5228 Ref. | Description | Sound Power Level |
|---|---|---|---|
| Tractor (towing equipment) | C.4.74 | Tractor and Rotovator<br>Tractor and Seeder | 108.1 |
| Tracked excavator | C.5.35 | Groundworks/ Earthworks/ Trenching | 102.7 |
| Articulated dump truck* | C.6.18 | Distribution of Material | 114.0 |
| Articulated dump truck | C.6.26 | Dumping Load | 107.2 |
| Loading sand to lorry | C.10.7 | Loading Soil | 104.9 |

** Drive-by maximum sound level*

The predicted noise level at the nearest noise sensitive location to areas where landscaping works at embanked areas are presented in **Table 9-44**. The noise levels are predicted to be below the noise limit of 70 dB $L_{Aeq,1hr}$ and are not significant.

**Table 9-44: Predicted Noise Levels for Landscaping works at Nearest Noise Sensitive Location**

| Location / Activity | Distance to Activity | Predicted Façade Noise Level |
|---|---|---|
| Nearest NSL (R696) | 40 m | 69 |
| Next Nearest NSL (R762) | 100 m | 56 |

### 9.4.1.11 Public Realm Construction

The scheme includes for the construction of traffic management measures and public realm enhancement works within Slane village. The proposed works in Slane comprise predominantly on-street works in addition to the construction of the proposed off-street carpark and cycle/pedestrian link.

The proposed works on the existing N2 and N51 in Slane generally consist of carriageway narrowing, rearrangement of kerbing, footway and road construction and resurfacing. Undergrounding of utilities, installation of new public lighting, removal of overhead gantries, and some drainage works are also included.

The proposed works will take place after the proposed N2 Slane bypass is constructed and is open to traffic. Therefore, this work will be undertaken as a separate construction contract after the bypass has been completed. The activities with the potential generate the greatest noise impact are presented in **Table 9-45**.

**Table 9-45: Plant for Public Realm Construction Works**

| Activity | Plant | BS 5228 Ref. | Description | Sound Power Level |
|---|---|---|---|---|
| Road Planing | Road Planner | C.5.7 | Road Planning | 109.7 |
| | Road lorry (full)* | C.6.21 | Distribution of Material | 108.6 |
| Footway Works and Utility Diversion | Mini excavator with hydraulic breaker | C.5.2 | Breaking Surface | 110.5 |
| | Mini tracked excavator | C.4.67 | Trenching | 101.8 |
| | Vibratory plate (petrol) | C.2.41 | Rolling and Compaction | 108.1 |
| | Dumper* | C.4.3 | Distribution of materials | 104.3 |
| | Dump truck (tipping fill) | C.2.30 | Tipping Fill | 107.1 |
| | Vibratory roller | C.5.27 | Rolling and Compaction | 94.6 |
| | Concrete mixer truck | C.4.27 | Pouring concrete | 107.1 |
| Road Paving | Road roller* | C.5.19 | Rolling and Compaction | 107.7 |
| | Asphalt paver (+ tipper lorry)* | C.5.32 | Paving | 114.0 |
| | Vibratory roller (not vibrating)* | C.5.23 | Rolling and Compaction | 111.8 |
| | Road sweeper | C.4.90 | Sweeping and dust suppression | 110.9 |
| | Road lorry (full)* | C.6.21 | Distribution of Material | 108.6 |
| Site Clearance for Car Park | Wood chipper | Manufacturers Datasheet | QuadTrak 160 | 116.0 |
| | Chainsaw | Manufacturers Datasheet | Stihl MS461 Chainsaw BE | 117.0 |
| | Mulcher | Manufacturers Datasheet | TMS 2300 Mulcher | 114.6 |
| | Tracked excavator | C.2.5 | Clearing Site | 104.4 |
| | Dumper* | C.4.3 | Distribution of materials | 104.3 |
| | Road lorry (full)* | C.6.21 | Distribution of Material | 108.6 |
| | Dozer* | C.2.1 | Clearance/ earthworks | 103.3 |
| Car Park Works | Road lorry (full)* | C.6.21 | Distribution of Material | 108.6 |
| | Dozer | C.5.12 | Spreading Chipping | 104.7 |
| | Tracked excavator | C.5.35 | Trenching | 102.7 |
| | Road roller* | C.5.19 | Rolling and Compaction | 107.7 |

| Activity | Plant | BS 5228 Ref. | Description | Sound Power Level |
|---|---|---|---|---|
| | Asphalt paver (+ tipper lorry)* | C.5.32 | Paving | 114.0 |
| | Vibratory roller (not vibrating)* | C.5.23 | Rolling and Compaction | 111.8 |
| | Road sweeper | C.4.90 | Sweeping and dust suppression | 110.9 |
| | Dumper* | C.4.3 | Distribution of materials | 104.3 |

** Drive-by maximum sound level*

There is potential for elevated noise levels from the public realm works. However, the noise level is dependent on the activity and the distance between the activity and the noise sensitive location. **Table 9-46** presents the predicted noise levels at distances of 25, 50 and 75 m from the construction plant.

**Table 9-46: Predicted Noise Levels for Public Realm Works at Nearest Noise Sensitive Location**

| Activity | Plant | BS 5228 Ref. | Sound Pressure Level $L_{Aeq,1hr}$ | | |
|---|---|---|---|---|---|
| | | | 25 m | 50 m | 75 m |
| Road Planing | Road Planner | C.5.7 | 71 | 67 | 64 |
| | Road lorry (full)* | C.6.21 | 62 | 53 | 48 |
| Footway Works and Utility Diversion | Mini excavator with hydraulic breaker | C.5.2 | 76 | 68 | 64 |
| | Mini tracked excavator | C.4.67 | 67 | 59 | 54 |
| | Vibratory plate (petrol) | C.2.41 | 73 | 65 | 60 |
| | Dumper* | C.4.3 | 50 | 46 | 43 |
| | Dump truck (tipping fill) | C.2.30 | 65 | 57 | 52 |
| | Vibratory roller | C.5.27 | 62 | 53 | 48 |
| | Concrete mixer truck | C.4.27 | 75 | 67 | 62 |
| Road Paving | Road roller* | C.5.19 | 72 | 68 | 65 |
| | Asphalt paver (+ tipper lorry)* | C.5.32 | 70 | 65 | 62 |
| | Vibratory roller (not vibrating)* | C.5.23 | 77 | 72 | 69 |
| | Road sweeper | C.4.90 | 60 | 55 | 52 |
| | Road lorry (full)* | C.6.21 | 62 | 53 | 48 |
| Site Clearance for Car Park | Wood chipper | Manufacturers Datasheet | 81 | 73 | 68 |
| | Chainsaw | Manufacturers Datasheet | 81 | 73 | 69 |
| | Mulcher | Manufacturers Datasheet | 75 | 67 | 63 |
| | Tracked excavator | C.2.5 | 67 | 58 | 52 |
| | Dumper* | C.4.3 | 47 | 44 | 42 |
| | Road lorry (full)* | C.6.21 | 58 | 49 | 44 |
| | Dozer* | C.2.1 | 68 | 60 | 55 |
| Car Park Works | Road lorry (full)* | C.6.21 | 62 | 53 | 48 |
| | Dozer | C.5.12 | 69 | 60 | 55 |
| | Tracked excavator | C.5.35 | 65 | 57 | 52 |
| | Road roller* | C.5.19 | 70 | 62 | 57 |
| | Asphalt paver (+ tipper lorry)* | C.5.32 | 73 | 65 | 60 |

| Activity | Plant | BS 5228 Ref. | Sound Pressure Level $L_{Aeq,1hr}$ | | |
|---|---|---|---|---|---|
| | | | 25 m | 50 m | 75 m |
| | Vibratory roller (not vibrating)* | C.5.23 | 77 | 69 | 64 |
| | Road sweeper | C.4.90 | 61 | 53 | 48 |
| | Dumper* | C.4.3 | 49 | 45 | 43 |

** Drive-by maximum sound level*

There is potential for elevated noise levels from some plant items. Activities that occur within the footway are expected to be undertaken during the daytime. To minimise traffic impacts on residents and businesses, temporary road closures during evening and night-time periods are likely occur for some on-street works. Further details are presented in **Chapter 5 – Description of the Construction Phase**. Typical works likely include road planning and paving. Road planning will be limited where possible to a period from 19:00 – 22:00 hrs and road paving will occur during night-time periods. The planning works are expected occur no more than 20 – 30 minutes in front of a noise sensitive location. It is also expected that a distance of at least 50 – 100 m of paving will occur per night limiting the highest noise levels observed. The public realm works are likely to have a moderate significance of effect with the potential for a significant effect at some noise sensitive locations. Measures to mitigate the noise impact are discussed in **Section 9.5.1**.

### 9.4.1.12 Construction Traffic

During the construction phase, there will be a need to generate additional traffic trips to enable site staff and plant/materials access and egress the construction site. This will temporarily increase traffic in the locality of Slane. The traffic volumes will vary significantly across the construction period. The peak period of daily HGV movements is predicted to be in month 15, with over 564 HGV movements in a day. The primary factor for the increase in HGV movements is due the surplus of earthworks material. The surplus of earthworks material will be distributed to Huntstown Inert Waste Recovery Facility (Roadstone Ltd.) and to a much lesser extent, Mullaghcrone [Donore] Quarry (Roadstone). Further details and breakdown of construction traffic including site access points are presented in **Chapter 5 – Description of the Construction Phase**. For the purpose of this assessment, the construction traffic noise impacts have been assessed during the peak period of daily HGV movements. This will result in increased traffic volumes on the following roads:

- N2 North of Slane;
- N2 South of Slane;
- N51 East of Slane;
- N51 West of Slane;
- N51 East of Proposed Construction Compound;
- Rossnaree Road;
- M1 (Junction 10 N51 intersection and Junction 9 L1601);
- M1 (Junction 9 L1601 intersection and Junction 1 M50 intersection);
- M50 (Junction 3 M1 Intersection and Junction 5 N2 intersection);
- N2 North of M50;
- N2 side road to Huntstown Inert Waste Recovery Facility;
- R135; and
- L1601.

The predicted change in noise from construction traffic was calculated using Calculation of Road Traffic Noise (CRTN), Department of Transport Welsh Office, HMSO 1988. The change in noise levels associated with construction traffic is shown in **Table 9-47**.

**Table 9-47: Change in Noise Level associated with Construction Traffic**

| Activity | Baseline Traffic | | Baseline plus Construction Traffic | | Change in Noise Level (dB) | Significance Rating |
|---|---|---|---|---|---|---|
| | AADT | %HGVs | AADT | %HGVs | | |
| N2 North of Slane village | 7,798 | 12.5% | 7931 | 12.8% | 0.2 | Imperceptible |
| N51 West | 8,506 | 10.7% | 8582 | 10.9% | 0 | Imperceptible |
| N51 East of Slane village | 4,951 | 7.4% | 5110 | 7.7% | 0.4 | Imperceptible |
| N51 East of Slane village to Construction Compound | 4,938 | 6.3% | 5097 | 6.6% | 0.3 | Imperceptible |
| N2 South of Slane village | 6,428 | 14.6% | 6618 | 15.2% | 0.2 | Imperceptible |
| N2 / Rossnaree | 6,675 | 13.7% | 7038 | 16.8% | 0.9 | Not Significant |
| N2 / R150 Intersection South | 7,951 | 12.7% | 8314 | 15.3% | 0.5 | Not Significant |
| N2 / South of Asbourne | 21,773 | 11.9% | 22137 | 12.9% | 0.3 | Imperceptible |
| N2 slip road to Huntstown | 6,780 | 10.1% | 7146 | 14.7% | 1 | Slight |
| M50 Jct 3 to 4* | 62,508 | 8.4% | 62596 | 8.5% | 0.1 | Imperceptible |
| M50 Jct 3 to 4* | 59,148 | 10.1% | 59236 | 10.2% | 0 | Imperceptible |
| N1 Jct 8 to 9 (Travelling North)* | 17,248 | 12.7% | 17336 | 13.1% | 0.1 | Imperceptible |
| N1 Jct 8 to 9 (Travelling South)* | 14,891 | 12.8% | 14979 | 13.2% | 0.2 | Imperceptible |
| N51 East / N1* | 4,436 | 6.4% | 4696 | 11.0% | 1.3 | Slight |
| L1601 | 4,062 | 8.4% | 4462 | 14.6% | 1.4 | Slight |
| Rossnaree Road | – | – | 400 | 77.5% | – | Significant |

** Some road links are broken into several sections. Traffic volumes vary from section to section for a given road link. For the purpose of this assessment, the section of road with the lowest baseline traffic volumes has been presented as this is section with the greatest potential impact.*

The significance of impact varies depending on the road link. The greatest potential for impact is for noise sensitive locations on the Rossnaree Road between the junction with the N2 and intersection with the proposed bypass where a significant effect has been predicted during the peak periods of daily HGV movements predicted in month 15. This is due to the fact that baseline traffic volumes on the Rossnaree Road are low. The predicted construction traffic noise level at receptor R762 is 57 dB $L_{Aeq,1hr}$ which is below the construction noise limit. Nonetheless, mitigation measures are discussed in **Section 9.5.1**.

Slight effects are identified for noise sensitive locations adjacent to the N51 between the main site compound and the intersection with the N1. Slight effects are also identified on the N2 slip road to Huntstown Inert Waste Recovery Facility and L1601 Mullaghcrone Quarry. For all other road links the significance of effect has been predicted as not significant or imperceptible.

### 9.4.1.13 Construction Vibration

Construction vibration levels arises during piling, rock breaking and use of heavy construction equipment close to sensitive properties. Construction vibrations propagate through the ground to a receiver by means of surface and to a lesser extent by shear and compressional waves. The amplitude of the waves decreases rapidly with distance from the source. The attenuation is due to geometrical spreading and energy losses within the ground (material damping).

Construction related vibration is only significant close to the source as it attenuates rapidly. BS 5228-2 includes 174 datasets of ground borne vibration measurements. Of the extensive data collated in BS 5228-2 only one set was measured over 100 m from the source with the vast majority of measurements taken within 50 m, thus indicating the limited scale of impact for construction vibrations. Consideration of potential vibration impacts has therefore been limited to properties within 50 m of the site boundary or in the case of structures of significant intrinsic value, i.e. protected structures, a radius of 300 m has been considered.

Wiss (1981)[10] presented a methodology and typical values for vibrations due to construction activities. Geometric spreading means that vibration levels decrease exponentially as the distance from the source increases. The exponent value lies between 1.0 and 2.0 and Wiss (1981) suggests a relatively common value of 1.5. Typical construction activities on this project include pile driving, rock-breaking, compaction and earthmoving. **Table 9-48** shows a range of vibration source levels at 7.6 m.

**Table 9-48: Vibration source levels for Construction Equipment[11]**

| Equipment | PPV at 7.6 m (mm/s) |
|---|---|
| Bored Piling** | 2.16 |
| Vibratory Roller | 5.3 |
| Large Rock-Breaker | 2.3 |
| Large Bulldozer | 2.3 |
| Auger piling | 2.3 |
| Loaded trucks | 1.9 |
| Jackhammer | 0.9 |
| Small bulldozer | 0.1 |

***BS 5228 provides data indicating that the PPV level associated with a 600 mm diameter bored pile was 0.54 mm/s. Scaling this up for a 1,200 mm diameter pile the PPV level is expected to be 2.16 mm/s at 5 m.*

Using a conservative approach where losses due to material damping are ignored, vibration levels can therefore be estimated at a distance using the following formula, where D = distance from the source to the NSR in metres:

$$PPV_{NSR} = PPV_{Source} \times \left[\frac{7.6}{D}\right]^{1.5}$$

As outlined in **Section 9.2.4.4** construction vibrations need to be assessed for property damage and the impact on humans. The usual criteria applied for construction vibration effects on buildings from road projects are those published in the NRA Guidelines and shown in **Section 9.2.4.4**. Given the distance between plant items and the nearest buildings, construction vibration levels from work on the proposed mainline are below the NRA criteria and are likely to be below the threshold of perception at the nearest sensitive locations.

Construction works on the N51 and public realm works occur at short distances to sensitive receptors and the vibratory roller used for rolling and compaction is the plant item with the greatest potential to generate vibration associated with these works. Vibration levels are predicted to be below the NRA criteria. However, the vibration levels experienced at some sensitive locations are likely to be greater than 1 mm/s and are likely to result in a brief moderate significance of effect. It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents. To put the vibration levels presented in **Table 9-48** in context, some examples of PPV levels in a modern masonry dwelling house are presented in New (1986)[12]. The PPV levels are reproduced in **Table 9-49**.

**Table 9-49 Typical Vibration Levels in a Modern Residence**

| Vibration Source | Resultant PPV (mm/s) |
|---|---|
| Normal footfalls | 0.05 - 0.5 |
| Foot stamping | 0.3 – 3.0 |
| Door slams | 11 - 17 |
| Percussive drilling | 10 - 20 |

[10] Wiss, J. F., "Construction Vibrations: State of the Art," Journal of the Geotechnical Division, ASCE, v. 107, no. GT2, Proc. Paper. 6030, Feb. 1981, pp. 167-181.

[11] Compiled from: Quagliata, A., ed., Transit Noise and Vibration Impact Assessment Manual, FTA Report No. 0123, September 2018 and BS 5228

[12] New, B. M. (1986) Ground Vibration caused by civil engineering works, Traffic Research Laboratory Report 53, UK.

## 9.4.2 Operational Phase

The number of receptors with noise levels greater than 60 dB $L_{den}$ within the study area for both the Do-Minimum and Do-Something Opening Year and Design Year scenarios is presented in **Table 9-50**. It is observed that the Proposed Scheme results in an overall positive impact as the number of receptors with predicted noise levels greater than 60 dB $L_{den}$ reduces as high levels of traffic travelling through Slane village via the N2 will use the proposed N2 Slane bypass. However, the Proposed Scheme will run adjacent to several receptors where no road currently exists and will introduce a new noise source. The scheme also includes realignment of the N51 either side of the proposed bypass, to improve alignment deficiencies. The proposed bypass will result in an increase in the number of vehicles using the N51. Hence, there is potential for an increase the road traffic noise levels and the change in traffic volumes on the N51 as a result of the Proposed Scheme have been captured in the Do-Something scenarios.

**Table 9-50: Predicted Traffic Noise Levels Greater than 60 dB $L_{den}$**

| Receptor Description | Opening Year (2026) | | Design Year (2041) | |
|---|---|---|---|---|
| | Do-Minimum | Do-Something | Do-Minimum | Do-Something |
| **All Property Types** | 516 | 439 | 565 | 486 |
| **Residential** | 424 | 356 | 467 | 393 |
| **Educational and Childcare Facilities** | 2 | 1 | 2 | 2 |
| **Hotels and Accommodation** | 3 | 3 | 3 | 3 |
| **Activities of Religious Organisations** | 4 | 3 | 4 | 3 |
| **Other** | 83 | 76 | 89 | 85 |

Given the large number of receptor locations modelled, only receptors where mitigation is required are presented in the main chapter; all results are presented in **Appendix 9.4 – Operational Noise Predictions**.

Mitigation measures are only deemed necessary when the following three conditions in the NRA Guidelines (2004) are satisfied at designated sensitive receptors:

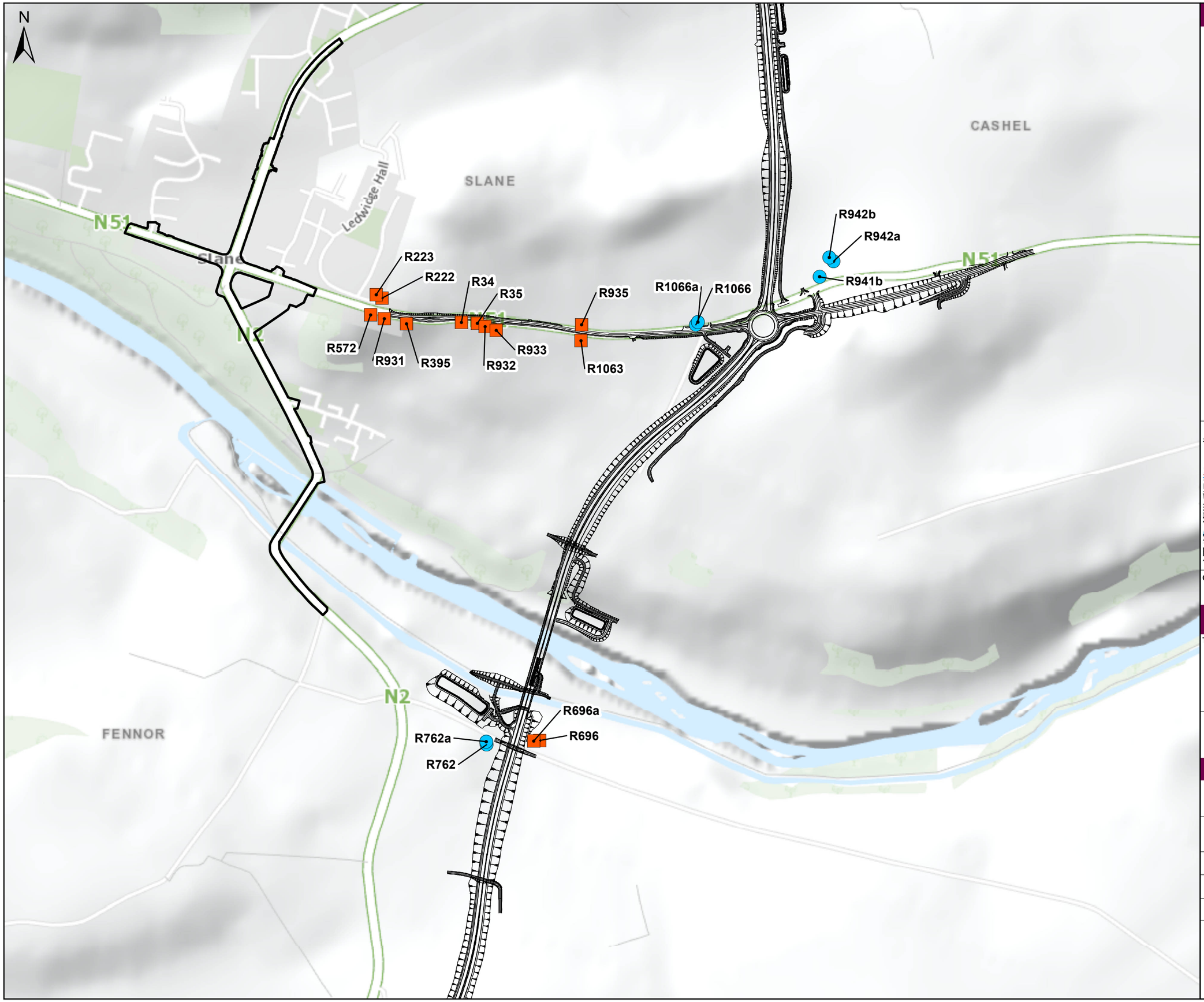
*(a) the combined expected maximum traffic noise level, i.e. the relevant noise level, from the proposed road scheme together with other traffic in the vicinity is greater than the design goal of* 60dB $L_{den}$*;*
*(b) the relevant noise level is at least 1dB more than the expected traffic noise level without the proposed road scheme in place; and*
*(c) the contribution to the increase in the relevant noise level from the proposed road scheme is at least 1dB.*

**Table 9-51** presents the predicted noise levels for the Do-Minimum and Do-Something Opening Year (2026) and Design Year (2041) for the proposed road scheme and compares the calculated results against the three conditions for noise mitigation as outlined in the NRA Guidelines (2004). The noise sensitive locations where mitigation measures are required are shown in **Figure 9.5**. The figure also shows locations where residual impacts occur following mitigation. Some locations along the N51 between Slane Village and the proposed bypass show residual impacts. However, the residual impacts are negligible.

**Table 9-51: Predicted Traffic Noise Levels**

| Receptor ID* | Description | Predicted Noise Levels: Opening Year (2026) | | Condition for Noise Mitigation Satisfied? | | | Mitigation Required? | Predicted Noise Levels: Design Year (2041) | | TII Condition for Noise Mitigation Satisfied? | | | Mitigation Required? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Do-Minimum | Do-Something | (a) | (b) | (c) | | Do-Minimum | Do-Something | (a) | (b) | (c) | |
| R34 | Residential | 68 | 69 | Yes | Yes | Yes | **Yes** | 69 | 70 | Yes | Yes | Yes | **Yes** |
| R35 | Residential | 68 | 69 | Yes | Yes | Yes | **Yes** | 69 | 70 | Yes | Yes | Yes | **Yes** |
| R222 | Residential | 60 | 62 | Yes | Yes | Yes | **Yes** | 62 | 63 | Yes | Yes | Yes | **Yes** |
| R223 | Residential | 57 | 60 | No | Yes | Yes | No | 59 | 61 | Yes | Yes | Yes | **Yes** |
| R395 | Residential | 66 | 68 | Yes | Yes | Yes | **Yes** | 67 | 69 | Yes | Yes | Yes | **Yes** |
| R572 | Residential | 67 | 69 | Yes | Yes | Yes | **Yes** | 69 | 70 | Yes | Yes | Yes | **Yes** |
| R696 | Residential | 49 | 65 | Yes | Yes | Yes | **Yes** | 50 | 66 | Yes | Yes | Yes | **Yes** |
| R696a | Residential | 50 | 66 | Yes | Yes | Yes | **Yes** | 51 | 67 | Yes | Yes | Yes | **Yes** |
| R762 | Residential | 44 | 62 | Yes | Yes | Yes | **Yes** | 45 | 62 | Yes | Yes | Yes | **Yes** |
| R762a | Residential | 50 | 62 | Yes | Yes | Yes | **Yes** | 51 | 63 | Yes | Yes | Yes | **Yes** |
| R931 | Residential | 66 | 69 | Yes | Yes | Yes | **Yes** | 68 | 69 | Yes | Yes | Yes | **Yes** |
| R932 | Residential | 66 | 67 | Yes | Yes | Yes | **Yes** | 67 | 68 | Yes | Yes | Yes | **Yes** |
| R933 | Residential | 65 | 67 | Yes | Yes | Yes | **Yes** | 67 | 68 | Yes | Yes | Yes | **Yes** |
| R935 | Residential | 68 | 69 | Yes | Yes | Yes | **Yes** | 70 | 70 | Yes | No | No | No |
| R941b | Residential | 57 | 60 | No | Yes | Yes | No | 59 | 61 | Yes | Yes | Yes | **Yes** |
| R942a | Residential | 56 | 61 | Yes | Yes | Yes | **Yes** | 57 | 62 | Yes | Yes | Yes | **Yes** |
| R942b | Residential | 53 | 60 | No | Yes | Yes | No | 54 | 61 | Yes | Yes | Yes | **Yes** |
| R1063 | Residential | 66 | 67 | Yes | Yes | Yes | **Yes** | 67 | 68 | Yes | Yes | No | No |
| R1066 | Francis Ledwidge Museum | 70 | 69 | Yes | No | No | No | 71 | 70 | Yes | No | No | No |
| R1066a | Francis Ledwidge Museum | 66 | 67 | Yes | Yes | Yes | **Yes** | 67 | 68 | Yes | Yes | Yes | **Yes** |

* ***Note:*** *For some receptors several locations around the building have been modelled given their proximity to both existing roads and the proposed scheme and these locations have been denoted with letters 'a' and 'b'.*

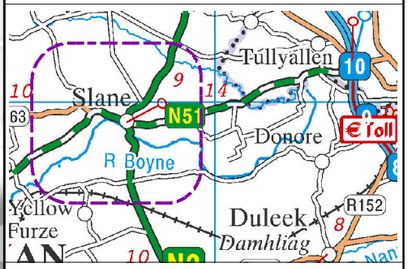



## Legend

- Proposed Scheme
- Noise Senstive Locations requiring Mitigation Measures
- Locations with Residual Impacts following Mitigation Measures

Data Source: OSi

0 0.1 0.2 0.4 Kilometres




Client

**Meath County Council**

**N2 Slane Bypass and Public Realm Enhancement Scheme**

Title

**Figure 9.5**

**Noise-sensitive Locations Requiring Mitigation Measures and those with Residual Impacts Post Mitigation**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### Issue Details

| | | |
|---|---|---|
| **File Identifier:** MDT0806-RPS-00-N2-DR-Z-AG-3072 | | |
| **Status:** A1 | **Rev:** C01 | **Model File Identifier:** MDT0806-RPS-01-N2-M2-C-XM1001 MDT0806-RPS-01-PR-M2-C-XR9000 |
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| **Checked:** JM | | **Scale:** 1:8,000 (A3) |
| **Approved:** NO'N | | **Projection:** ITM |

**NOTE:**

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All 1,391 receptors were assessed for road traffic noise. Sixteen receptor locations have been identified as meeting the NRA criteria for mitigation. There are two receptors (R696 and R762) along the mainline where mitigation is required. There are three receptors adjacent to both the proposed mainline and the N51. The remainder of the receptors are on the N51 between Slane village and the N51 / N2 Slane bypass roundabout.

There are several residential locations along the N2 north and south of the Proposed Scheme where the traffic noise levels increase but these do not meet the NRA noise mitigation criteria set out in **Section 9.4.2**. Further details on the operational phase mitigation measures are discussed in **Section 9.5.2** including the suitability and/or practicality of noise mitigation for each location.

In addition to the proposed bypass, public realm works are proposed in Slane village and surrounding area. Four new ramp-accessed raised platforms are proposed on the N51 and at the intersection between the N51/ N2. The purpose of these is as a traffic calming measure and controlled pedestrian crossings are provided at some of these locations. However, the raised platforms have the potential to generate impulse type noise as vehicles access and egress the raised platforms. There are several noise sensitive locations in proximity to the raise platforms and to minimise the potential for noise impacts, the inclination of the ramped sections has been reduced.

### 9.4.3 Cumulative Impact

A cumulative impact assessment (CIA) has been undertaken to consider potential for cumulative impact of the Proposed Scheme with other approved development. The detailed methodology for the CIA is described in **Chapter 25 – Cumulative Effects**. The assessment has considered cumulative sources and impact pathways which could impact on agricultural enterprise.

The projects listed in **Appendix 25.2** have been assessed. Each project has been considered on a case-by-case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/ temporal scales involved. Projects were screened-in to the CIA where located within the zone of influence (ZoI) of the Proposed Scheme or where projects have the scope to potentially alter the traffic volumes and/or flows assessed in the EIA chapter for determination of noise and vibration impact. The projects that were screened-in for the Noise and Vibration CIA are listed in **Table 9-52**.

**Table 9-52: Projects Screened-in for Potential Cumulative Effects on Noise and Vibration**

| Project Code | Project Location | Project Type | Potential for Cumulative Effect |
|---|---|---|---|
| PR 1 | Stanley Hill, Slane, Co. Meath | Wastewater Treatment Tank | Potential pathway for noise/ vibration effects – within 300 m of the ZoI for the Proposed Scheme |
| PR 2 | Millhouse, Slane, Co. Meath | Restaurant | |
| PR 3 | Ledwidge Hall, Drogheda Road, Slane, Co. Meath *(now constructed)* | Residential Development | |
| PR 4 | Ledwidge Hall Green, Drogheda Road, Slane, Co. Meath *(now constructed)* | Residential Development | |
| PR 5 | Former Parochial House, The Square, and adjacent Art Gallery, Main Street, Slane, Co. Meath | Commercial Building | |
| PR 6 | Conyngham Arms Hotel, Main Street, Slane, Co. Meath | Hotel | |
| PR 7 | Slane Wastewater Treatment Plant, Castle Hill, Navan Road, Slane, Co. Meath | Wastewater Treatment Plant | |
| PR 12 | Mullaghdillon, Slane, Co. Meath | Quarry | Potential – construction phase HGV movements |
| PR 13 | Harlinstown, Slane, Co. Meath | Road Works | Potential – construction phase traffic disruption from the proposed road works |
| PR 55 | N52 Ardee Bypass, Ardee, Co Louth | Road Works | Potential – proposed road scheme |
| PR 56 | Painestown, Beauparc, Navan, Co. Meath | Commercial Building | Potential – construction phase HGV movements |

| Project Code | Project Location | Project Type | Potential for Cumulative Effect |
|---|---|---|---|
| PR 57 | Towlands of Rathdrinagh Sicily Thomastown, Rahill Drumman & Knockcommon, near the town of Duleek Co Meath | Solar Farm | Potential – construction phase HGV movements |

For projects PR 1 to PR 7, to ensure a robust assessment, the ZoI for the construction phase noise/ vibration impacts for this project was set at 300 m from the temporary land take boundary. Each of these developments are modest in scale, and whilst they lie within the ZoI, given the scale of the Proposed Scheme, the potential for significant adverse effects as a result of in-combination noise and vibration is unlikely and not significant.

For PR 12, this project is located approx. 2.5 km from the Proposed Scheme and outside of the noise and vibration ZoI. However, as the project lies to the north-east of Slane, traffic from this project will likely use the N2 and N51 as haul routes. Permission for the project is restricted to up to six truck movements per day (Condition 3) and expires in three years (Condition 2), so the project is likely to be closed before the Proposed Scheme is operational. Therefore, there is no potential for cumulative adverse impacts from traffic noise.

PR 13 comprises modest road works with potential for some traffic disruption during the construction phase caused by installation of the underpass section of the project. However, this is considered a short-term impact and not likely to cause significant adverse cumulative impact with the Proposed Scheme.

For PR 55, this project lies approx. 15k m to the north of the Proposed Scheme and entails the construction of a single carriageway road for a distance of 4.5 km from a location 150 m north of the N52 junction with the regional road R165 in the townland of Mandistown, to a location 580 m north of the N33/N2/R171 roundabout junction on the N2 in the townland of Glebe. During the operational phase, the routing of national roads (N2 and N52) away from residential areas with both PR 55 and the Proposed Scheme has the potential to increase traffic volumes on the N2 north and south of the Proposed Scheme. The Do-Something scenario modelled for the Proposed Scheme identifies an increase in vehicle numbers north and south of the Proposed Scheme, with a potential to increase traffic noise. However, the increase in noise level is negligible and is quantified in the negligible impact rating in this EIA. The impacts of PR 55 are not likely therefore to result in a significant adverse cumulative impact with the Proposed Scheme.

PR 56 consists of the construction of a single storey industrial type building (338 $m^2$), change of use of existing single trailer enclosure and site development works including a new pavement, drainage, retaining walls and landscaping. The site is located approx. 2.1 km south-west of the Proposed Scheme and will likely use the N2 as a haul route. No details on traffic volumes were available from the planning file but given the scale of the development, it is not likely to cause significant adverse cumulative impact with the Proposed Scheme.

PR 57 comprises a solar farm with a total area of 188.9 hectares. The site is located approximately 3.7 km south of the Proposed Scheme. Traffic from the proposed solar farm will use the N2 south of Slane village and the N51 west of Slane village. Construction is expected to last 12 – 16 months and it is anticipated that there will be 76 daily trips generated by because of the construction of the proposed solar farm. The increase in vehicle numbers has potential to increase traffic noise. However, the cumulative increase in noise level is negligible. The impacts of PR 57 are not likely to result in a significant adverse cumulative impact with the Proposed Scheme.

## 9.5 Mitigation Measures

The following mitigation measures form an intrinsic part of the assessment and will be implemented during the construction and operational phases.

### 9.5.1 Construction Phase

The following mitigation measures will be implemented during the construction works:

- Noise barriers (reflective) of at least 2.4 m height up to 3.6 m height shall be installed and maintained at all site compounds for the duration of the construction phase. The noise barriers will, at a minimum,

block line of sight between the construction activities and noise sensitive locations. Noise barriers at the site compounds will be installed as early as practicable within the construction programme;

- Noise barriers (reflective) of at least 2.4 m height up to 3.6 m height shall be installed and maintained for the duration of the construction phase at the southern end of the Boyne bridge;
- Noise barriers (reflective) of at least 2.4 m height up 3.6 m height shall be installed and maintained for the duration of the construction phase along the northern boundary of the N51 east of the junction with the bypass. The noise barriers will, at a minimum, block line of sight between the construction activities and noise sensitive locations;
- When undertaking tree felling and processing during site clearance works, the distance between tree felling and processing plant required for site clearance and the nearest noise sensitive locations shall be maximised;
- During the public realm works there is potential for elevated noise levels at some noise sensitive locations due to the close proximity of some of the works. Where works are occurring over an extended period, the use of temporary noise barriers/screens or enclosure shall be implemented;
- Evening and night-time works will be required as part of the N51 improvement between the bypass and Slane village, and on-street public realm works in Slane village. Any works outside normal working hours shall require pre-approval from MCC. Notification to the general public and affected residents and businesses shall be provided;
- Where a hydraulic breaker is required, the following measures shall be implemented:
  - Fit suitably designed muffler or sound reduction equipment to reduce noise without impairing machine efficiency.
  - Use dampened bit to eliminate ringing.
  - Where works are occurring over an extended period, the use of temporary noise barriers/screens or enclosure shall be implemented;
- All traffic to and from the site shall only be by way of the proposed transport routes as outlined in **Chapter 5** of this EIAR. Haul routes shall be well maintained to minimise impulsive noise and vibration from vehicles running over discontinuities in the running surfaces;
- Construction shall be phased in accordance with the construction phase description (**Chapter 5– Description of the Construction Phase**) to minimise the duration of activities in each area. Due to the complex nature of the works detailed schedules, noise control measures and monitoring proposals shall, as a minimum, include the measures set out in this assessment and be documented in the EOP;
- Where works (outside of emergency works) need to be completed outside normal working hours or where proposed works indicate that the noise or vibration levels set out in **Section 9.2.4.2** (Construction Nosie Criteria) or **Section 9.2.4.4** (Construction Vibration Criteria) may be exceeded, permission for these works shall be sought from the County Council in advance of any works taking place. The application for such works shall require a detailed noise control plan and follow up report to be prepared by the Contractor. This plan shall include (i) a justification for the works being carried out in the manner proposed, (ii) an assessment indicating what alternatives have been considered, (iii) a statement of the noise control measures from B.S. 5228 to be adopted and how Best Practicable Means will be used to control noise, (iv) an activity specific noise monitoring programme including contact details for persons with the authority to cease working if required by the County Council. Each follow up report will include details of any complaints received and the action taken to address such complaints;
- A noise and vibration monitoring programme shall be implemented for the duration of the construction phase. Monitoring will assess compliance of the construction works with the noise limits set out in **Table 9-4** and **Table 9-5**. The noise and vibration programme shall also include actions for exceedances in the noise limits should they arise;
- Full details of the Contractor's provision for noise and vibration monitoring and procedures including provisions for publication of monitoring results shall be submitted to and approved by the County Council prior to commencement of work. The County Council shall have discretion to vary the monitoring requirements and publication of results during the course of construction; and
- Works will be carried out using Best Practicable Means (BPM) to minimise noise and vibration, such measures shall include:

- Limiting the hours of construction set out in **Section 5.9 Employment and Welfare** and **Section 5.14.1 Construction Phase Hours of Operation** in **Chapter 5**, except in certain circumstances as set out in **Section 9.2.4.2**.
- Work practices, equipment noise control and screening shall be in compliance with BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise, and BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part2: Vibration (together referred to as B.S. 5228). Typical work practices which shall be implemented include:
    - Noisy works shall be scheduled to normal working hours;
    - Quiet working methods, using plant with lower noise emission levels shall be used;
    - Working methods that minimise vibration generation particularly with regard to demolition activities and piling shall be adopted;
    - Plant such as pumps and generators used on or near sensitive locations will be contained within an acoustic enclosure and comply with the noise levels in **Table 9-4** and **Table 9-5**.
    - Plant and machinery used on-site will comply with the EC (Construction Plant and Equipment) Permissible, Noise Levels Regulations, 1988 (S.I. No. 320 of 1988);
    - All noise producing equipment will comply with S.I. No 632 of 2001 European Communities (Noise Emission by Equipment for Use Outdoors) Regulations 2001 and S.I. No. 241/2006 - European Communities (Noise Emission by Equipment for Use Outdoors) (Amendment) Regulations 2006;
    - Measures outlined in "*Environmental Good Practice Site Guide*" 2005 compiled by CIRIA and the UK Environmental Agency and the "London Good Practice Guide: Noise & Vibration Control for Demolition and Construction" 2016 will be applied as appropriate;
    - All plant shall be properly maintained, (mechanisms properly lubricated, faulty silencers replaced, worn bearings replaced, cutting tools sharpened etc.);
    - Acoustic covers to engines shall be closed when in use or idling;
    - For electricity generation at the construction compounds, hydrogen generators or electrified plant shall be utilised over traditional diesel generators. This will also apply to lower powered mobile plant as appropriate;
    - Hydraulic equipment shall be used in preference to pneumatic equipment;
    - Wheeled plant shall be used in preference to tracked plant;
    - Plant shall be located as far away from noise and vibration sensitive receptors as practicable;
    - Site hoardings or perimeter noise barriers shall be installed;
    - Temporary acoustic enclosures or screens around specific noisy static plant shall be used;
    - Large fully enclosed acoustic buildings shall be used to surround activities and/or worksites;
    - The unnecessary revving of engines shall be avoided and equipment shall be switched off when not in use;
    - Starting-up plant and vehicles sequentially shall be used rather than at the same time;
    - Internal haul routes shall be well maintained to minimise impulsive noise and vibration from vehicles running over discontinuities in the running surfaces;
    - Rubber linings shall be fitted to chutes, hoppers and dumper vehicles to reduce impact noise from material transfer;
    - Drop heights of materials shall be minimised;
    - Regular inspections of mitigation measures (BPM audits) shall be carried out to ensure compliance with noise and vibration commitments;
    - Regular briefings shall be provided for all site-based personnel so that noise and vibration issues (including the requirement to employ BPM at all locations at all times) are understood and that generic and site-specific mitigation measures are explained and adhered to;

- Unloading shall be carried out within the worksite rather than on adjacent roads or laybys;
- Phasing of materials deliveries shall be controlled on a 'just in time' basis to minimise noise and congestion on roads around the site;
- A formal stakeholder engagement process shall be put in place for the duration of the construction phase, including the provision of information to local residents about noise and vibration monitoring results, works likely to cause significant noise or vibration and/or works planned to take place outside of core working hours;
- Channels of communication between the Contractor, Meath County Council Planning Section (County Council) and residents shall be established at project commencement; and
- Records of any noise complaints relating to the construction operations will be investigated as soon as possible and reported to the County Council.

### 9.5.2 Operational Phase

The NRA Guidelines (2004) states that: *"The Authority accepts that it may not always be sustainable to provide adequate mitigation in order to achieve the design goal. Therefore, a structured approach should be taken in order to ameliorate as far as practicable road traffic noise through the consideration of measures such as alignment changes, barrier type (e.g. earth mounds), low noise road surfaces etc."*

In **Section 9.4.2 Table 9-51**, sixteen receptor locations[13] were identified as meeting the criteria for mitigation either in the opening year, the design year or both as defined in the NRA Guidelines (2004).

In order to reduce road traffic noise for as many properties as possible, all newly constructed roads will be constructed using low noise road surfaces. A low noise road surface is defined as a road surface that can provide a minimum noise reduction of 2.5dB(A) when compared to a standard Hot Rolled Asphalt road surface. However, even with a low noise road surface installed, the requirement for further mitigation was identified at many of the receptor locations.

**Table 9-53** presents the details of noise reducing measures that shall be required in addition to the use of a low noise road surface within the scheme boundary. The height and length of the noise barriers proposed are detailed in **Table 9-53**. The table refers to 'Noise Barriers'; this may take the form of walls, earthen berms and other landscaping features providing the required acoustic screening and meeting all other technical specifications. The locations of noise mitigation measures are shown on **Figure 9.6**.

**Table 9-53: Details of Noise Mitigation Measures**

| Receptor ID | Location | Chainage | Description | Length | Height |
|---|---|---|---|---|---|
| R696 | Mainline South | Ch. 1112 – 1178 | Earthen berm/false cut with a 76 m long by 3 m high reflective noise barrier on top | 76 m | 3 m |
| R762 | Realigned Rossnaree Road | Ch. 0 – 15 | Extended existing 1m stone wall by 15 m | 15 m | 1 m |
| R941b | Mainline North transitioning into Realigned N51 East | Mainline North Ch. 2240 – 2450 | Combined reflective noise barrier and bund/false cut with a total height of 2.5 m | 295 m | 2.5 m |
| R942a/R942b | | N51 West Ch. 0 – 80 | | | |
| R1066a | Realigned N51 West | Ch. 720 | Reflective noise barrier adjacent to property boundary | 21.5 m | 2 m |

[13] Note: For some receptors several locations around the building have been modelled given their proximity to both existing roads and the Proposed Scheme and these locations have been denoted with letters 'a' and 'b'.

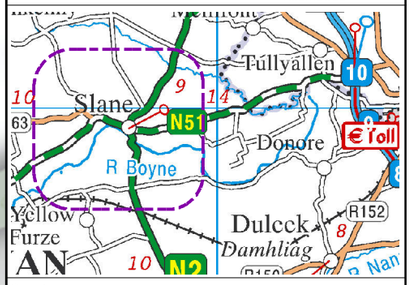

## Legend

- Proposed Scheme
- Proposed Scheme Boundary
- Noise Barrier/ Bund

Note: 'Noise Barriers' may take the form of walls, earthen berms and other landscaping features providing the required acoustic screening and meeting all other technical specifications.

Data Source: OSi

0 0.1 0.2 0.4
Kilometres




Client
**Meath County Council**

**N2 Slane Bypass and Public Realm Enhancement Scheme**

Title
**Figure 9.6**

**Locations of Noise-reducing Measures**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### Issue Details

**File Identifier:**
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| Status: | Rev: | Model File Identifier: |
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| | |
|---|---|
| **Drawn:** NR | **Date:** 24/05/2023 |
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| **Approved:** NO'N | **Projection:** ITM |

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In a number of cases, notably Receptors R696 and R762 south of the River Boyne, consideration was given to the need for additional mitigation measures in the context of views from the UNESCO World Heritage Property. The requirement to protect the views from the Brú na Bóinne site include measures that will also have a beneficial acoustic impact.

The predicted noise level at receptor R696 is above the design goal as defined in the NRA 2004 and 2014 publications. For receptor location R696 the mitigation proposed is an earthen berm/false cut with a 76 m long by 3 m high reflective noise barrier on top. Landscaping of the berm/false cut and barrier will be required from a visual perspective. With mitigation measures in place the predicted noise level reduces from 66 dB $L_{den}$ to 62 dB $L_{den}$ for the opening year and from 67 dB $L_{den}$ to 63 dB $L_{den}$ in the design year. The Do-Something noise level in the opening year and design year remains above the design goal, despite the application of a structured approach to mitigation measures.

The predicted noise level at receptor R762 is above the design goal. It is noted that there is a stone wall along the Rossnaree Road opposite the receptor and it is proposed to extend this wall by 15 m with an overall height of 1 m. With mitigation measures in place the predicted noise level reduces from 62 dB $L_{den}$ to 59 dB $L_{den}$ for the opening year and from 63 dB $L_{den}$ to 60 dB $L_{den}$ in the design year.

Locations R941b and R942a/R942b are northeast of the N51 intersection with the Proposed Scheme. The predicted noise level at receptor R941b is above the TII design goal for the design year. Receptor R942a is above the TII design goal for the opening and design years and Receptor R942b is above the design goal for the design year. To mitigate that noise impact for these receptors, a 1.25 m bund/false cut with 1.25 m high noise barrier on top is proposed along the mainline and the N51.

Receptor R1066a (Ledwidge Cottage Museum) is located to the northwest of the N51 intersection with the Proposed Scheme. The predicted noise levels at this receptor location are above the design goal for the opening year and design year. It is proposed that a 21.5 m long 2 m high noise barrier is located adjacent to the property boundary. The barrier will be offset from the existing trees and the foliage currently in place will help the barrier blend with the surroundings.

The remainder of receptor locations (R34, R35, R222, R223, R395, R572, R931, R932, R933, R935, R1063) that meet the noise mitigation criteria are located along the N51 between Slane village and the N51 / Slane bypass roundabout. The current road surface adjacent to these receptors is worn HRA surface. As part of the Proposed Scheme, the sections of road adjacent to these receptors will have a low noise road surface installed. It is also proposed to reduce the speed from 80 km/h to 60 km/h along these sections of road in line with the application of the TII structured approach. However, even with these measures in place, the predicted noise levels will remain above the design goal/Do-Minimum noise level at eleven noise sensitive locations.

The only other mitigation option available is the installation of barriers or extension of the boundary walls adjacent to the receptors. However, the close proximity of the residences to the footpath, limited set-back distances achievable, the elevation of some of the properties and the extent in length and / or height of barrier needed to achieve the required noise would result in unacceptable health and safety risks associated with accessing the properties onto the N51 and serious visual impact due to the close proximity of barriers to residences and the extent and height required. The Do-Something noise level in the design year remain above the design goal and/or above the Do-Minimum noise level at ten receptors despite the application of the TII structured approach.

There is one additional unquantified mitigation measure that has not been included in this assessment. This relates to effectiveness of a low noise surface performance which is limited in the modelling to 2.5 dB despite the limit being based on data that is 20 years old. Current low noise surface designs offer validated noise reductions greater than 2.5 dB. This factor provides a high degree of confidence that the road traffic noise levels will be lower than the predicted noise levels in the longer term.

**Table 9-54** shows the results at the NSLs following mitigation.

**Table 9-54: Predicted Traffic Noise Levels with Mitigation**

| Receptor ID | Description | Predicted Noise Levels Design Year | | | Significance Rating |
|---|---|---|---|---|---|
| | | Do-Minimum | Do-Something with Mitigation $L_{den}$ dB(A) | Do-Something with Mitigation $L_{night}$ dB(A) | |
| R34 | Residential | 69 | 70 | 63 | Not Significant |
| R35 | Residential | 69 | 70 | 63 | Not Significant |
| R222 | Residential | 62 | 63 | 56 | Not Significant |
| R223 | Residential | 59 | 61 | 53 | Not Significant |
| R395 | Residential | 67 | 69 | 62 | Not Significant |
| R572 | Residential | 69 | 70 | 63 | Not Significant |
| R696 | Residential | 50 | 63 | 55 | Significant |
| R696a | Residential | 51 | 63 | 55 | Significant |
| R762* | Residential | 45 | 60 | 52 | Moderate |
| R762a* | Residential | 51 | 60 | 52 | Moderate |
| R931 | Residential | 68 | 69 | 63 | Not Significant |
| R932 | Residential | 67 | 68 | 62 | Not Significant |
| R933 | Residential | 67 | 68 | 61 | Not Significant |
| R935 | Residential | 70 | 70 | 63 | Not Significant |
| R941b | Residential | 59 | 57 | 51 | Not Significant (Positive) |
| R942a | Residential | 57 | 60 | 54 | Not Significant |
| R942b | Residential | 54 | 57 | 51 | Not Significant |
| R1063 | Residential | 67 | 68 | 61 | Not Significant |
| R1066 | Francis Ledwidge Museum | 71 | 70 | 63 | Not Significant |
| R1066a | Francis Ledwidge Museum | 67 | 66 | 60 | Not Significant |

** The measured $L_{den}$ noise level at this location was 56 dB. The difference between the predicted Do-Minimum noise level and the measured noise level is because the noise model has not included the traffic volumes on the Rossnaree Road due to the low traffic volumes.*

There are several other locations along the N2 south and north of the Proposed Scheme where the predicted noise levels will increase. This is due to the increase in traffic volumes on these sections of road. There are also several locations along the N51 east of the proposed scheme, and this is due to the increased traffic flow. There is also an increase in traffic volume along the L1013 local road and this will result in an increase in noise levels. Although there are increases in traffic noise levels along these roads, for the majority of the noise sensitive locations, the magnitude of change is described as negligible in both the short-term and long-term. These locations do not meet the NRA Guidelines (2004) mitigation criteria outlined in **Section 9.2.4.5** of this chapter. However, the County Meath Noise Action Plan 2019 set guideline values of over 70 dB(A) $L_{den}$ and 57 dB(A) $L_{night}$ as upper limit values for the prioritisation of noise management relating to road traffic noise. Meath NAP goes on to state that: "*These values can be seen as indicative criteria in the decision making process.*" Various factors are considered when deciding if environmental noise management is necessary, such as, the type of buildings and land use in the area, the source of the noise and as well as the level of noise predicted. Further assessment on these locations will be undertaken as part of the County Meath Noise Action Plan.

## 9.6 Residual Impacts

### 9.6.1 Construction Phase

With the implementation of the mitigation measures outlined in **Section 9.5.1** alongside continuous noise and vibration monitoring during the construction phase (see **Section 9.7.1**) the residual noise impact for the

Slane Bypass works are 'short-term moderate adverse' for the majority of the noise sensitive locations. However, there is potential for 'temporary significant adverse' residual impacts for some noise sensitive locations during periods of high intensity work in close proximity to the noise sensitive locations.

With the implementation of the mitigation measures the residual noise impact for the Slane Public Realm works are 'temporary moderate adverse' for the majority of the noise sensitive locations. However, there is potential for 'temporary significant adverse' residual impacts for some noise sensitive locations in close proximity to the works.

The residual noise impacts as a result of construction traffic for the majority of the haul routes are 'short-term not significant or Imperceptible'. However, there is potential for temporary slight adverse residual impacts on some haul routes with the potential for temporary significant residual impacts on the Rossnaree Road between the junction with the N2 and the intersection with the proposed bypass.

No significant residual vibration impacts are predicted as a result of construction activities and construction traffic. However, construction works on the N51 and public realm works are likely to result in a brief moderate adverse effect.

### 9.6.2 Operational Phase

The results of the assessment indicate the majority of the receptors adjacent to the proposed road scheme have traffic noise levels at or below 60dB $L_{den}$, and/or the Do-Something noise levels can be reduced to the equivalent Do-Minimum traffic noise levels at the majority of locations with the recommended mitigation measures in place. However, a limited number of properties will experience a residual noise impact as a result of the proposed project, despite the application of a structured approach through the consideration of various mitigation measures.

Reducing traffic noise levels to at or below 60dB $L_{den}$ and/or below the Do-Minimum noise levels at these properties would require substantial additional mitigation (e.g. installation of barriers or extension of the boundary walls adjacent to the receptors) over and above those already proposed in order to achieve an insignificant change to the overall noise level at a property. As noted in **Section 9.5.2**, the application of these additional measures is not considered practical at the ten receptor locations for a combination of health and safety, proximity and visual concerns which would give rise to unsustainable conditions in order to achieve an imperceptible reduction in noise level.

With respect to achieving the 60 dB $L_{den}$ design goal, the NRA Best Practice Guidance (2014) state that "… *in some cases the attainment of the design goal may not be possible by sustainable means*". The guidance goes on to state *"… It may be unsustainable to increase barrier dimensions significantly where the result would be a reduction of 1dB or less, as such a reduction would be close to imperceptible in a laboratory situation and would not result in a difference in public response in the real world environment*."

The residual impacts are examined under both the END noise mapping noise level bands and the DMRB impact rating.

#### 9.6.2.1 END Noise Mapping

A summary of the Do Minimum and the Do Something outcomes in the year of opening and the design year are outlined in

**Table** 9-55. As can be seen from the table, one additional property is predicted to be within the 75 dB $L_{den}$ or greater band for the design year. This property is located immediately adjacent to the N2 north of the Proposed Scheme. The traffic on the N2 will increase over time and noise levels at this property will increase by less than 1 dB but this has the effect of moving it into the higher band level.

It is clear that for all bands between 55 dB and 74 dB the Do-Something with mitigation has a lower number of properties in the band than the Do-Minimum option. The <55 dB band increases substantially in the Do-Something option when compared to the Do-Minimum scenario. This presents a clear downward trend in noise exposure for the properties assessed in the EIAR. The aggregate residual impact under the END Noise Mapping criteria is positive.

**Table 9-55: Opening and Design Year $L_{den}$ Noise Level Bands**

| Noise Level Range (dB) | Do-Minimum | Do-Something with Mitigation | Do-Minimum | Do-Something with Mitigation |
|---|---|---|---|---|
| | Opening Year 2026 | | Design Year 2041 | |
| <55 | 628 | 722 | 572 | 668 |
| 55 – 59 | 219 | 201 | 230 | 210 |
| 60 – 64 | 171 | 156 | 177 | 146 |
| 65 – 69 | 185 | 151 | 178 | 166 |
| 70 - 74 | 115 | 88 | 160 | 126 |
| 75+ | 0 | 0 | 1 | 2 |

### 9.6.2.2 DMRB Impact Rating

A summary of the Do Minimum and the Do Something $L_{den}$ outcomes with respect to the DMRB/EPA impact ratings in the year of opening and the design year are outlined in **Table 9-56** and **Table 9-57**. The Proposed Scheme results in a greater number of NSLs with an increase in noise levels. However, this must be considered in the context of the impact rating band. Although there is an increase in the number of NSLs with higher noise levels, the increase in noise levels is limited to the negligible impact rating band. For NSLs with impact ratings in the low, medium and high bands, the proposed scheme results in a higher number of NSLs experiencing positive effects. The aggregate residual impact under the DMRB impact criteria is positive.

The NRA guidelines do not prescribe any night-time noise limit values within its guidance document. However, the $L_{den}$ noise indicator is a day–evening–night noise level over an entire day and the 60 dB $L_{den}$ design goal included in the NRA documents includes all three periods. The UK DMRB LA111 guidance refers to 55 dB $L_{night}$ as the significant observable adverse effect level. A summary of the Do Minimum and the Do Something outcomes for the $L_{night}$ noise indicator at noise levels greater than 55 dB with respect to the DMRB/EPA impact ratings in the year of opening and the design year are outlined in **Table 9-58** and **Table 9-59**.

The Proposed Scheme results in an increase in the number of NSLs with an adverse effect. However, this must be considered in the context of the impact rating band. Although there is an increase in the number of NSLs with adverse effects, the corresponding impact rating band is also an important factor when determining the overall impact of the Proposed Scheme, with the majority of the increases in noise level in the negligible magnitude of impact band. For the year of opening, there are more NSLs with positive effects where the change in noise level is greater than 5 dB (high magnitude of impact band). For the design year, where the magnitude of impact is low, medium and high, the Proposed Scheme results in a positive effect. The aggregate residual impact of $L_{night}$ noise levels under the DMRB impact criteria is positive.

In summary, the Proposed Scheme will result in a positive aggregate residual impact under the END Noise Mapping and the DMRB impact rating. This will result in beneficial environmental and health effects on the general population in the study area.

No significant residual vibration impacts are predicted as a result of the operational phase.

**Table 9-56: Change in Opening Year $L_{den}$ Noise Levels**

| Change in Noise Level (dB) | | DMRB Magnitude | EPA Magnitude of Impact | All Receptors | Residential | Educational and Childcare Facilities | Hotels and Accommodation | Activities of Religious Organisations | Other |
|---|---|---|---|---|---|---|---|---|---|
| Decrease in Noise Level | 5.0+ | Major | High | 209 | 194 | 1 | 0 | 1 | 13 |
| | 3.0 – 4.9 | Moderate | Medium | 44 | 44 | 0 | 0 | 0 | 0 |
| | 1.0 – 2.9 | Minor | Low | 144 | 135 | 0 | 1 | 0 | 8 |
| | 0.1 – 0.9 | Negligible | Negligible | 196 | 176 | 0 | 5 | 1 | 14 |
| No Change | | No Change | No Change | 166 | 131 | 1 | 2 | 2 | 30 |
| Increase in Noise Level | 0.1 – 0.9 | Negligible | Negligible | 524 | 483 | 1 | 0 | 1 | 39 |
| | 1.0 – 2.9 | Minor | Low | 108 | 93 | 0 | 1 | 0 | 14 |
| | 3.0 – 4.9 | Moderate | Medium | 12 | 11 | 0 | 1 | 0 | 0 |
| | 5.0+ | Major | High | 18 | 17 | 0 | 0 | 0 | 1 |

**Table 9-57: Change in Design Year $L_{den}$ Noise Levels**

| Change in Noise Level (dB) | | DMRB Magnitude | EPA Magnitude of Impact | All Receptors | Residential | Educational and Childcare Facilities | Hotels and Accommodation | Activities of Religious Organisations | Other |
|---|---|---|---|---|---|---|---|---|---|
| Decrease in Noise Level | 10.0+ | Major | High | 75 | 69 | 0 | 0 | 1 | 5 |
| | 5.0 – 9.9 | Moderate | Medium | 133 | 124 | 1 | 0 | 0 | 8 |
| | 3.0 – 4.9 | Minor | Low | 43 | 43 | 0 | 0 | 0 | 0 |
| | 0.1 – 2.9 | Negligible | Negligible | 361 | 319 | 1 | 2 | 2 | 37 |
| No Change | | No Change | No Change | 88 | 74 | 0 | 3 | 0 | 11 |
| Increase in Noise Level | 0.1 – 2.9 | Negligible | Negligible | 691 | 627 | 1 | 4 | 2 | 57 |
| | 3.0 – 4.9 | Minor | Low | 15 | 13 | 0 | 1 | 0 | 1 |
| | 5.0 – 9.9 | Moderate | Medium | 11 | 11 | 0 | 0 | 0 | 0 |
| | 10.0+ | Major | High | 4 | 4 | 0 | 0 | 0 | 0 |

**Table 9-58: Change in Opening Year $L_{night}$ Noise Levels**

| Change in Noise Level (dB) | | DMRB Magnitude | EPA Magnitude of Impact | All Receptors | Residential | Educational and Childcare Facilities | Hotels and Accommodation | Activities of Religious Organisations | Other |
|---|---|---|---|---|---|---|---|---|---|
| Decrease in Noise Level | 5.0+ | Major | High | 89 | 79 | 1 | 9 | 0 | 0 |
| | 3.0 – 4.9 | Moderate | Medium | 3 | 3 | 0 | 0 | 0 | 0 |
| | 1.0 – 2.9 | Minor | Low | 5 | 5 | 0 | 0 | 0 | 0 |
| | 0.1 – 0.9 | Negligible | Negligible | 35 | 28 | 1 | 0 | 0 | 6 |
| No Change | | No Change | No Change | 92 | 64 | 0 | 2 | 2 | 24 |
| Increase in Noise Level | 0.1 – 0.9 | Negligible | Negligible | 174 | 147 | 0 | 0 | 1 | 26 |
| | 1.0 – 2.9 | Minor | Low | 51 | 40 | 0 | 0 | 0 | 11 |
| | 3.0 – 4.9 | Moderate | Medium | 14 | 9 | 0 | 1 | 0 | 4 |
| | 5.0+ | Major | High | 0 | 0 | 0 | 0 | 0 | 0 |

**Table 9-59: Change in Design Year $L_{night}$ Noise Levels**

| Change in Noise Level (dB) | | DMRB Magnitude | EPA Magnitude of Impact | All Receptors | Residential | Educational and Childcare Facilities | Hotels and Accommodation | Activities of Religious Organisations | Other |
|---|---|---|---|---|---|---|---|---|---|
| Decrease in Noise Level | 10.0+ | Major | High | 61 | 54 | 0 | 0 | 1 | 6 |
| | 5.0 – 9.9 | Moderate | Medium | 33 | 28 | 1 | 0 | 0 | 4 |
| | 3.0 – 4.9 | Minor | Low | 4 | 4 | 0 | 0 | 0 | 0 |
| | 0.1 – 2.9 | Negligible | Negligible | 87 | 67 | 1 | 0 | 1 | 18 |
| No Change | | No Change | No Change | 36 | 26 | 0 | 0 | 0 | 10 |
| Increase in Noise Level | 0.1 – 2.9 | Negligible | Negligible | 275 | 225 | 0 | 3 | 2 | 45 |
| | 3.0 – 4.9 | Minor | Low | 0 | 0 | 0 | 0 | 0 | 0 |
| | 5.0 – 9.9 | Moderate | Medium | 0 | 0 | 0 | 0 | 0 | 0 |
| | 10.0+ | Major | High | 0 | 0 | 0 | 0 | 0 | 0 |

## 9.7 Monitoring

### 9.7.1 Construction Phase

During the construction phase, a noise and vibration monitoring programme shall be implemented to assess compliance of the construction works with the noise limits set out in **Table 9-4**, **Table 9-5** and **Table 9-9** in **Chapter 9**.

Full details of the Contractor's provision for noise and vibration monitoring and procedures including provisions for publication of monitoring results will be submitted to and approved by the County Council prior to commencement of work.

The mitigation in **Chapter 8** of this EIAR and the Environmental Operating Plan for the Proposed Scheme will detail channels of communication between the Contractor, Meath County Council and residents including a system for recording and investigating noise complaints relating to the construction operations.

### 9.7.2 Operational Phase

No specific noise or vibration monitoring is proposed.

## 9.8 Chapter References

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