BALLINA FLOOD RELIEF SCHEME

Environmental Impact Assessment Report
Chapter 15: Noise and Vibration

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Prepared by:

RPS

Prepared for:

Mayo County Council

Dublin | Cork | Galway | Sligo | Kilkenny
rpsgroup.com

RPS Group Limited, registered in Ireland No. 91911
RPS Consulting Engineers Limited, registered in Ireland No. 161581
RPS Engineering Services Limited, registered in Ireland No. 99795
The Registered office of each of the above companies is West Pier Business Campus, Dun Laoghaire, Co. Dublin, A96 N6T7

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GLOSSARY

Term	Meaning
A-weighting	A spectrum adaption that is applied to measured noise levels to represent human hearing. A-weighted levels are used as human hearing does not respond equally at all frequencies.
dB	Decibel—a unit of measurement used to express sound level. It is based on a logarithmic scale which means a sound that is 3 dB higher has twice as much energy. We typically perceive a 10 dB increase in sound as a doubling of loudness.
dB(A)	Units of the A-weighted sound level.
Frequency (Hz)	The number of times a vibrating object oscillates (moves back and forth) in one second. Fast movements produce high frequency sound (high pitch/tone), but slow movements mean the frequency (pitch/tone) is low. 1 Hz is equal to 1 cycle per second.
$L_{eq, t}$	Equivalent Noise Level—Energy averaged noise level over the measurement time (t).
$L_{Aeq, t}$	Equivalent A-weighted Noise Level—Energy averaged, a-weighted noise level over the measurement time (t).
L_{AFmax}	The highest fast time-weighted noise level recorded during the measurement.
L_{A90}	The noise level exceeded during 90 % of the measurement duration. This is generally referred to as the background noise level.
L_w	Sound power level.
spl	Sound pressure level.

ACRONYMS

Term	Meaning
BPM	Best Practicable Means
BSI	British Standards Institute
CEMP	Construction Environmental Management Plan
CIRIA	Construction Industry Research & Information Association
DIN	Deutsches Institut für Normung
DMRB	Design Manual for Roads and Bridges
EC	European Communities
EIAR	Environmental Impact Assessment Report
EPA	Environmental Protection Agency
HGV	Heavy Goods Vehicle
ITM	Irish Transverse Mercator
NSL	Noise Sensitive Locations
NSP	Noise Sensitive Premises
OSI	Ordnance Survey Ireland
PPV	Peak Particle Velocity
TII	Transport Infrastructure Ireland
UK	United Kingdom

15 NOISE AND VIBRATION

15.1 Introduction

This chapter describes effects which are likely to arise due to noise and vibration from the construction, operation and maintenance (as detailed in **Chapter 5: Project Description**) of the Proposed Scheme. Mitigation measures to reduce effects are identified where necessary and any residual effects which may remain are described.

15.2 Methodology

15.2.1 Legislation, Policy and Guidance

The following national legislation applies to noise:

- Environmental Noise Regulations (Minister for the Environment, Heritage and Local Government, 2006)
- Environmental Protection Agency (EPA) Act (Government of Ireland, 1992)

Local policy has been referred to as necessary, including:

- Mayo County Development Plan 2022-2028 (Mayo County Council, 2022)
- Ballina & Environs Development Plan 2009-2015 (Mayo County Council, 2009) (plan extended following abolition of Town Council)
- County Mayo Local Authorities Noise Action Plan 2018-2023 (Mayo County Council, 2018)

The assessment of impacts has been undertaken, as appropriate, in accordance with, or with reference to, the following guidance documents:

- Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (EPA, 2016)
- Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (TII, 2014)
- Guidelines for the Treatment of Noise and Vibration in National Road Schemes (TII, 2004).
- BS 5228-1 and 2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Noise and Vibration (BSI, 2009)
- BS 7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration (BSI, 1993)
- Design Manual for Roads and Bridges (DMRB) LA 111 Noise and Vibration (Highways England, 2020)

15.2.2 Study Area

There is no guidance or legislation in Ireland regarding the extent/size of the noise and vibration Study Area to adopt for the assessment of noise and vibration effects. The noise and vibration Study Areas for construction in this chapter have been set with consideration of the guidance contained in BS 5228 (BSI, 2009) and Transport Infrastructure Ireland (TII) Guidelines (TII, 2014). Professional judgment has been used to determine the distances over which noise impacts may occur during construction along with consideration of the likely magnitude and duration of impact and the sensitivity of receptors.

During the construction phase, the noise and vibration Study Area considers Noise Sensitive Locations (NSLs) up to 300 m from elements of the Proposed Scheme. No Study Area has been set for operational noise (see **Section 15.2.5**).

For assessment of the potential for cumulative effects with other projects, a zone of influence of twice the Study Area distance is set, i.e., projects up to 600 m from elements of the Proposed Scheme boundary.

15.2.3 Sources of Information to Inform the Assessment

Data sources utilised during the assessment include those listed in **Table 15-1**.

Table 15-1: Summary of Key Datasets

Title	Source	Year	Author(s)
Ordnance Survey Ireland (OSI)	OSI	2023	OSI
Google Earth Imagery	Google Earth	1984-2022	Google LLC
GeoDirectory	An Post	Q4 2020	An Post and OSI
Historic Environment Viewer	Historic Environment Viewer (archaeology.ie)	2023	National Monuments Service
Noise Modelling	RPS	2023	RPS
Baseline Noise Surveys	RPS	Q2 2023	RPS

15.2.3.1 Assessment Criteria and Significance

This chapter follows the assessment methodology set out in **Chapter 1: Introduction**. The significance of the effect of noise and vibration is determined by considering the magnitude of the impact and the sensitivity of the receptor in accordance with EPA 2022, Environmental Impact Assessment Report (EIAR) guidance. In referring to noise sensitive receptors, the term Noise Sensitive Location or NSL is most commonly used in Ireland as it is the terminology used in EPA guidance for noise. Hereafter in this chapter, NSL will be used to refer to noise and vibration sensitive receptors. NSLs are typically residential premises but can also include schools, places of worship and other NSLs. Site and project specific considerations play a part in determining the sensitivity of a receptor, and noise assessment standards in general include implicit considerations of sensitivity, e.g., through consideration of background noise levels.

Table 15-2 presents general categorisations of NSL sensitivities for use in Ireland. The table has been developed based on professional judgement and experience in completing noise assessments.

Table 15-2: General Categorisation of Receiver Sensitivity

Sensitivity	Description	Examples of Receptors	Modifiers
High	Receptors where people or operations are particularly susceptible to noise	Residential, including private gardens where appropriate Hospitals/residential care homes Schools during the daytime Quiet outdoor areas used for recreation Places of worship	Modifiers are factors that can change the sensitivity of receivers. These include: Magnitude and character of baseline noise, period of occupancy, noise insulation of buildings.
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	Offices Bars/Cafes/Restaurants where external noise may be intrusive Community facilities and amenity areas 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) Wildlife refuges Recording studios and concert halls are also included in this category	
Low	Receptors where distraction or disturbance from noise is low	Buildings not occupied during the daytime Sports grounds when spectator noise is a normal part of the event Night Clubs	
Negligible	Receptors where distraction or disturbance from noise is negligible.	All other areas such as those used primarily for industrial or agricultural purposes	

While the above tables are useful generally, the specific categorisations of magnitudes and sensitivities are determined using applicable standards, which are detailed in the following sections, and professional judgement. For noise and vibration, consideration of magnitudes and sensitivities are inherent to the assessment process for most categories of emissions.

15.2.3.2 Construction Vibration

There is no statutory Irish guidance relating to the maximum permissible vibration level that may be generated during the construction phase of a project. In the 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 BS5228 (BSI, 2009).

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 PPV levels (>15 mm/s) vibrations can lead to concerns about possible (not probable) structural damage. Guidance regarding effects of vibration levels on humans is set out in **Table 15-3**.

Table 15-3: Guidance on Human Perception of Vibration Levels (BSI, 2009, p. 36)

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.

Limits of transient vibration, above which cosmetic damage to property could occur, are given numerically in **Table 15-4** (BSI, 2009, p. 38). Minor damage is possible at vibration magnitudes which are greater than twice those given in **Table 15-4** and major damage to a building structure can occur at values greater than four times the tabulated values.

Table 15-4: Transient Vibration Guide Values for Cosmetic Damage (BSI, 2009, p. 38), (DIN, 2016)

Type of Building	PPV (mm/s) in Frequency Range of Predominant Pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings.	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
Unreinforced or light framed structures. Residential or light commercial buildings.	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above
Guideline limit values for premises with machinery that is highly sensitive to vibration or historic buildings that may be in poor repair	7 mm/s at 4 Hz increasing to 10 mm/s at 15 Hz	10 mm/s at 15 Hz increasing to 25 mm/s at 40 Hz and above
Limit values for historic buildings that have been assessed on a case-by-case basis to be structurally unsound (DIN, 2016)	3 mm/s	8 mm/s at 50 Hz Increasing to 10 mm/s at 100 Hz and above

Sensitivity

Sensitivity of NSLs is assessed in line with **Table 15-2**.

Magnitude

Magnitudes of impacts are assessed in line with the guidance stated in **Table 15-3** and **Table 15-4** and the impact magnitude levels are stated in **Table 15-5**. Predictions of vibration levels are limited to the nearest NSL on the basis that more distant NSLs will have lower vibration levels due to increased distance attenuation. This approach aligns with best practice.

Significance of Effects

Guidance has been listed in **Table 15-3** and **Table 15-4** above on effects of vibration levels on humans and limits of transient vibration, above which cosmetic damage could occur. For assessing the significance of effect, reference is made to the EPA Guidelines (EPA, 2022) and specifically the DMRB (Highways England, 2020) 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 15-5 presents the construction vibration significance rating.

Table 15-5: Construction Vibration – Initial Significance Rating of Effects.

Vibration Level	EPA Initial Magnitude of Impact	Initial Significance Rating	Modifiers
Less than 0.3 mm/s	Negligible	Imperceptible/ Not Significant	Modifiers are factors that can change the magnitude of impact or significance rating. These include: Duration, frequency and likelihood of occurrence. Public attitudes to, and acceptability of, the project itself.
Greater than or equal to 0.3 mm/s and less than 1.0 mm/s	Low	Slight/ Moderate	
Greater than or equal to 1.0 mm/s and less than 10 mm/s	Medium	Moderate/ Significant	
Greater than or equal to 10 mm/s	High	Very Significant / Profound	

15.2.3.3 Construction Noise

The ABC method outlined in section E3.2 of BS 5228 (BSI, 2009) has been used for the purposes of controlling noise. The approach adopted calls for the designation of an NSL into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates a potential significant noise impact is associated with the construction activities.

Table 15-6 outlines the applicable noise threshold of potential significant effect at the nearest NSLs. The determination of what category to apply is dependent on the existing ambient (L_{Aeq}) noise level (rounded to the nearest 5 dB) at the nearest noise sensitive property. For weekday daytime, if the ambient noise level is less than the Category A threshold limit, the Category A threshold limit (i.e., 65 dB) applies. If the ambient noise level is the same as the Category A threshold limit, the Category B threshold limit (i.e., 70 dB) applies. If the ambient noise level is more than the Category A threshold limit, the Category C threshold limit (i.e., 75 dB) applies.

Table 15-6: Threshold of Potential Significant Effect at NSLs (BSI, 2009, p. 119)

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.

Sensitivity

Sensitivity of NSLs is assessed in line with **Table 15-2**.

Magnitude

As a consequence of the 65 dBA lower cut-off, where existing noise levels are low, construction criteria are independent of the precise noise levels, i.e., unless daytime average ambient noise levels at NSLs are in excess of 62.5 dBA, the lower daytime noise threshold will default to 65 dBA. In general, only NSLs close to existing sources of high levels of noise, such as busy roads, have existing noise levels of sufficient magnitude to justify a threshold value higher than 65 dBA.

Predictions of noise levels are limited to the nearest NSL on the basis that more distant NSLs will have lower noise levels due to increased distance attenuation. This approach aligns with best practice.

Significance of Effects

Table 15-7 presents the construction noise initial significance rating of effects. The table provides an initial indication of the significance of effect which is then modified based upon the duration and frequency of the construction activity, and other relevant modifiers.

Table 15-7: Construction Noise - Initial Significance Rating of Effects

Noise Levels	EPA Initial Magnitude of Impact	Initial Significance Rating	Modifiers
≤ Baseline noise level or ≤ BS 5228 threshold – 10dB	Negligible	Imperceptible / Not Significant	Modifiers are factors that can change the magnitude of impact or significance rating. These include: Baseline noise levels, duration, frequency and likelihood of occurrence. Public attitudes to, and acceptability of, the project itself.
> Baseline noise level and ≤ BS 5228 threshold	Low	Slight/ Moderate	
> BS 5228 threshold to ≤ BS 5228 threshold + 5 dB	Medium	Moderate/ Significant	
> BS 5228 threshold +5 to + 10 dB	High	Significant/ Very Significant	
> BS 5228 threshold + 10 dB		Very Significant / Profound	

In many circumstances, the most important modifier of significance of effects for construction noise is the duration of the activities, with regard to which BS 5228 states the following:

> *"c) Duration of site operations. In general, the longer the duration of activities on a site, the more likely it is that noise from the site will prove to be an issue, assuming NSPs* [Noise Sensitive Premises] *are likely to be significantly affected. In this context, good public relations and communication are important. Local residents might be willing to accept higher levels of noise if they know that such levels will only last for a short time. It is then important that construction activities are carried out in accordance with the stated schedule and that the community is informed of their likely durations."*

In general, significant effects are not expected where the BS 5228 thresholds will be exceeded for a period of only 2 or 3 days, with the likelihood of significant effects increasing proportionally to the duration of any exceedances of the noise thresholds.

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; or
2. A total number of days exceeding 40 in any 6 consecutive months."

Another very important modifier is the attitude of affected parties to the Proposed Scheme. Generally, people exposed to noise and vibration from construction activities will be far more tolerant of these impacts where they perceive that the project is to their benefit, with regard to which BS 5228 states the following:

> *"It is well established that people's attitudes to noise can be influenced by their attitudes to the source or activity itself. Noise from a site will tend to be accepted more readily by local residents, if they consider that the contractor is taking all possible measures to avoid unnecessary noise. The attitude to the contractor can also be improved through good community liaison and information distribution and the provision of a helpline to respond to queries or complaints. The acceptability of the project itself can also be a factor in determining community reaction."*

Projects such as flood relief schemes have obvious and immediate benefits for local residents who in many cases have experienced past flood events. It is therefore assumed that a positive community attitude to the project will be prevalent provided that communities are made aware of the purpose of works. This assumption is supported by findings in **Chapter 3: Consultations** with overall comments in public consultations being positive and attendees expressing desire for progression of the Proposed Scheme.

In summary, exceedance of the BS 5228 threshold is not a firm indication that significant effects will occur and other factors in particular duration of the noisiest activities and community attitude to the project must be considered in determining the likelihood of significant effects due to noise and vibration.

15.2.4 Baseline Surveys

15.2.4.1 Instrumentation

A Class 1 Sound Level Meter/Noise Logger in accordance with IEC 61672-1:2013 was used for all measurements. **Table 15-8** below summarises the measurement equipment used.

Table 15-8: Measurement Equipment

Description	Model	Manufacturer	Serial Number
Sound Level Meter	Sound Expert LXT	Larson Davis	0006853
Acoustic Calibrator	CA250	Larson Davis	3034

All equipment has calibration certificates traceable back to the relevant Standard. A calibration check of the sound level meter was conducted prior to and following the survey using an external acoustic calibrator, with

0.05dB drift in calibration observed, well below the 0.5dB permitted drift for valid measurements (ISO, 2017). Calibration certificates are included in **Appendix 15.1**.

15.2.4.2 Measurement Procedure

Noise measurements at the various locations were undertaken in accordance with the following:

- For noise measurements the microphone of the sound level meter was at a height of approximately 1.2 metres.
- One 30-minute measurement was conducted at each position during the daytime.
- Care was taken to avoid any effect on the measurement of extraneous noise, acoustic vibration or electrical interference.
- A wind shield was used during all measurements, and the measurements were undertaken during calm, still weather (for which the wind velocity did not exceed 5 m/s).
- All measurement positions were free field.

15.2.5 Operational Noise and Vibration

Operational noise and vibration emissions will be limited to occasional activation of pumps and periodic maintenance. As such, operational noise and vibration effects would be not significant given durations would be brief and rare, and magnitudes would be low. Detailed assessment of operational noise and vibration effects is therefore unnecessary and has been **scoped out** of the assessment.

15.2.6 Data Limitations

No significant limitations of data sources or baseline data have been identified.

15.2.7 Consultations

Meetings and follow up consultations were arranged with stakeholders at all phases of the Proposed Scheme. Comments and queries from stakeholders informed design and are addressed throughout this report and summarised in **Table 15-9**.

Table 15-9: List of Consultations

Consultees	Feedback	Location where Comments were Addressed
TII Wed 22/07/2020	The EIAR should consider the Environmental Noise Regulations 2006 (SI 140 of 2006) and, in particular, how the development will affect future action plans by the relevant competent authority. The developer may need to consider the incorporation of noise barriers to reduce noise impacts (see Guidelines for the Treatment of Noise and Vibration in National Road Schemes (1st Rev., National Roads Authority, 2004)).	The recommended regulations and guidance have been considered in formulating the assessment methodology and criteria for the assessment (see **Section 15.2** Methodology). Noise barriers and other measures are detailed in **Section 15.5**.

15.3 Description of the Existing Environment

This section describes the existing (baseline) noise and vibration environment within the Study Area.

15.3.1 Baseline Environment

The Study Area includes locations both urban and suburban, and semi-rural locations where ribbon development has occurred.

15.3.1.1 Desktop Study

Information gathered in the baseline desktop study is summarised in **Table 15-10**.

Table 15-10: Summary of Outputs of the Desktop Baseline Study

Location	Description
Moy	The works area is located in the urban centre of Ballina with some quieter residential areas also included.
Tullyegan	The works area is in a residential area on the southern fringe of Ballina town with the rail line located adjacent to the western end.
Brusna	The works area is in a semi-rural location with ribbon residential development.
Behy Road	The works area is in a mixed industrial/residential area with ribbon and estate residential development alongside industry such as a sawmill, tool hire etc.
Quignamanger	The works area is in a semi-rural location with ribbon and estate residential development, a school and rugby club.

15.3.1.2 Baseline Survey

A baseline noise survey was carried out from 10:00 to 17:00 on 25th April 2023. A thirty-minute attended measurement of baseline noise was taken at each location. In addition, each linear site has been either walked or driven as appropriate in order to identify any vibration sensitive structures that may be present. The survey was carried out in general accordance with the guidance of (ISO, 2017).

It should be noted that flow conditions in the waterways close to measurement positions were normal and therefore did not give rise to elevated noise levels from these sources.

15.3.1.3 Measurement Locations

In order to characterise the existing soundscape in the vicinity of proposed works, attended noise measurements were taken at locations representative of prevalent baseline levels for the nearest NSLs. Irish Transverse Mercator (ITM) coordinates for the measurement positions are listed in **Table 15-11** and a map of the locations is shown in **Figure 15-1.**

Table 15-11: Baseline Survey Measurement Positions

Location	ITM Coordinates of Measurement Position		Description
	Easting	Northing	
Moy	524603	818657	Free-field position upstream of the upper bridge in an area without through traffic. All other locations near the Moy works site have higher baseline noise levels due to road traffic noise from the N59.
Tullyegan	523725	817556	Free-field position on footpath.
Brusna	526520	818374	Free-field position with ~50 m setback from main road.
Behy Road	526006	819566	Free-field position with ~20 m setback from road edge.
Quignamanger	525855	820985	Free-field position with ~20 m setback from road edge.

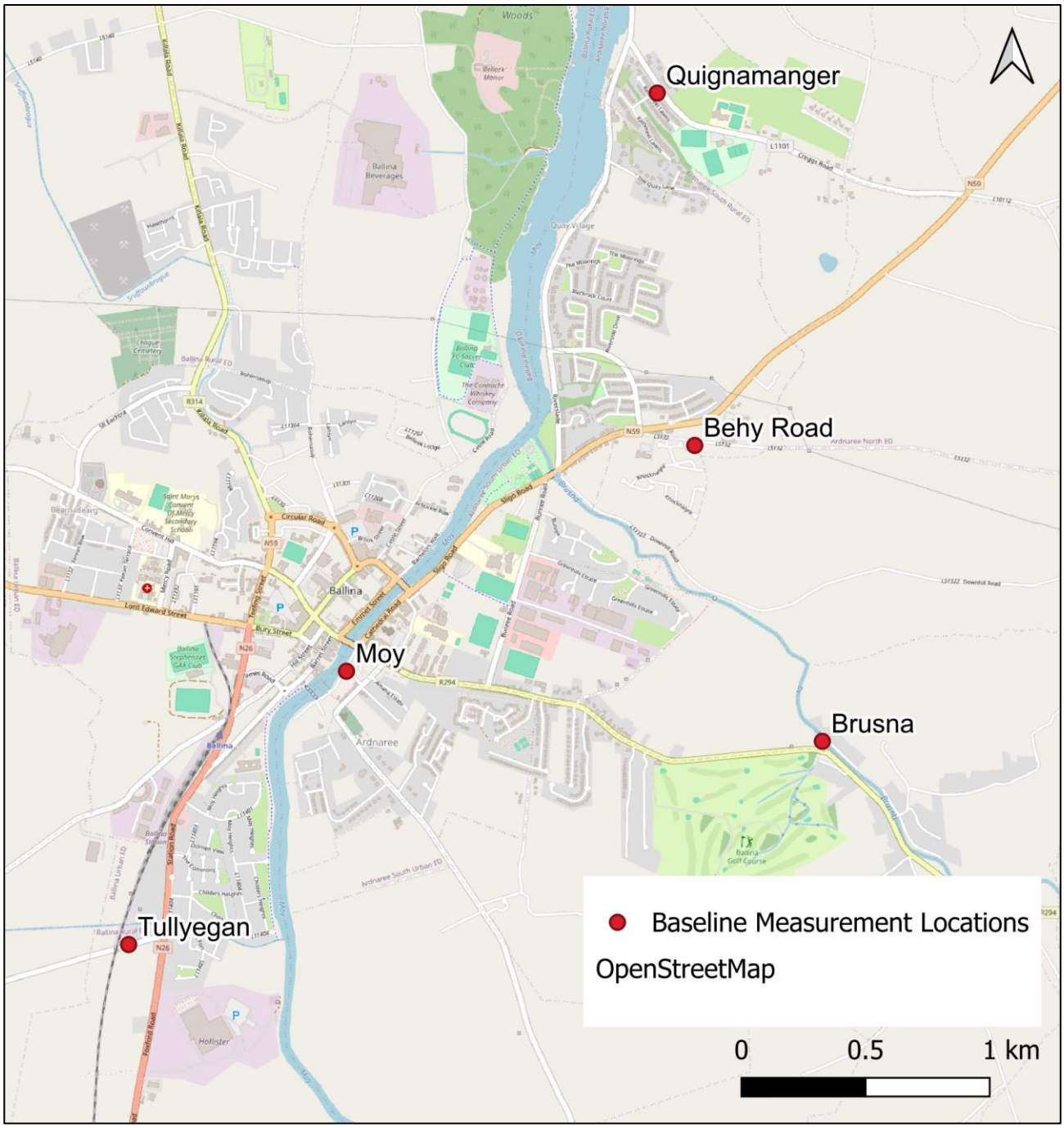

Figure 15-1: Baseline Noise Survey Measurement Locations

15.3.1.4 Meteorological Conditions

Weather during the attended survey was calm. Winds were very light and cloud cover was very low in the morning progressing to 90 % high altitude cloud cover in the evening. There was no precipitation during the survey.

15.3.1.5 Survey Results

Table 15-12 summarises the baseline noise survey results and observations. It can be seen from the results that all locations, are Category A using the BS 5228 ABC method. This results in a BS 5228 noise threshold for onset of significant effects of 65dB L_{Aeq} for all five locations.

Table 15-12: Baseline Survey Results

Location	Start time	duration	Measured level (dB)			Subjective Observations
			L_{Aeq}	L_{AFmax}	L_{A90}	
Moy	10:19	30 min	57	88.3	52	Noise from the salmon weir was dominant in the absence of passing traffic. Birdsong and low speed local traffic were also present.
Tullyegan	12:25	30 min	54	74	43	The location is a quiet residential street and the main sources of ambient sound during the survey were local traffic, activity at the childcare facility, birdsong, urban hum and a distant lawnmower.
Brusna	14:16	30 min	54	76	49	Birdsong and flow noise from the Brusna river were the main sound sources during the measurement. There was regular traffic on the adjacent road (60 km/hr zone). A distant lawnmower was heard and cloud cover increased to ~80 %.
Behy Road	15:10	30 min	55	73	52	Traffic noise on the N59 and noise from the nearby sawmill were dominant during the measurement. There was also birdsong and occasional low speed traffic on the adjacent Behy Road.
Quignamanger	10:19	30 min	55	74	37	Local activity, occasional road traffic and birdsong were the main sources of sound. High altitude cloud cover increased to ~90 %.

To inform the vibration assessment, the works areas were walked or driven as appropriate where possible and observations taken of any structures potentially sensitive to vibration. Observations are summarised in **Table 15-13**.

Table 15-13: Observations of Structures during Site Walk/Drive Over and Desktop Study

Location	Subjective Observations
Moy	• Upper and Lower Bridges (31204104 and 31204105) date 1830 – 1840 and neither are considered of particular sensitivity to vibration. • The Ridgepool weir (31204103) is not considered of particular sensitivity to vibration. • Ruins of the Ardnaree Abbey (MA030-074001-) are located approximately 30 m from proposed works on the Cathedral Street riverbank and are potentially sensitive to ground-borne vibration. • Saint Muredach's Catholic Cathedral (31204113) is not considered of particular sensitivity to vibration and is approximately 40 m distance from proposed works.
Tullyegan	• No vibration sensitive structures noted.
Brusna	• No vibration sensitive structures noted.
Behy Road	• No vibration sensitive structures noted.
Quignamanger	• No vibration sensitive structures noted.

15.3.1.6 BS 5228 Noise Thresholds

For clarity and ease of reference, the baseline noise survey results, BS 5228 ABC method category, and corresponding BS 5228 daytime noise threshold are presented in **Table 15-14**.

Table 15-14: Baseline Survey Results and BS 5228 ABC Method Noise Thresholds

Location	Start time	duration	Measured L_{Aeq} (dB)	BS 5228 ABC Category	BS 5228 noise threshold	Applicable hours
Moy	10:19	30 min	57	A	65	Daytime (07.00 – 19.00) and Saturdays (07.00 – 13.00)
Tullyegan	12:25	30 min	54	A	65	
Brusna	14:16	30 min	54	A	65	
Behy Road	15:10	30 min	55	A	65	
Quignamanger	10:19	30 min	55	A	65	

15.3.2 Evolution of the Environment in the Absence of the Proposed Scheme

In the scenario where the Proposed Scheme did not proceed as proposed, none of the described construction noise and vibration effects would occur and the baseline conditions described in **Section 15.3.1** would continue.

15.4 Description of the Likely Significant Effects

This section describes the significant effects which are likely to arise due to noise and vibration from the Proposed Scheme.

15.4.1 Receptor Sensitivity

All works locations are adjacent to residential locations. Consequently, all of the receptors (NSLs) assessed for noise and vibration effects from the Proposed Scheme are considered to be **high** sensitivity.

15.4.2 Assumed Plant Lists and Construction Phasing

It is not possible at this stage to predict the exact equipment which will be used by the contractor during the construction phase of the Proposed Scheme. Consequently, an assumed list of plant and equipment for each of the construction sites has been assembled, in consultation with the project team, based on experience of similar projects.

A single plant list is provided for each site is presented in the following sections. Various combinations of plant items will be in use at different phases of construction, for instance use of rock breakers and consaws will be for brief periods when breaking out footpaths or road surfaces before trench excavation.

15.4.3 Construction Phase Noise

Assumed construction plant, construction phases, and likely significant effects at each of the six construction sites are described in the following sections.

Construction noise from the Proposed Scheme has been predicted using a numerical model which implements the calculation methods described in BS 5228 (BSI, 2009). Assumed plant lists and separation distances of NSLs from activities are detailed in **Sections 15.4.3.1** to **15.4.3.5**, together with sound power levels for items of plant which have been sourced from BS 5228. Noise levels have been predicted for the nearest NSL to each site only since more distant NSLs will experience lower noise levels due to increased distance attenuation. This approach aligns with best practice.

15.4.3.1 Moy

Assumed Plant and Construction Phases

The River Moy works area extends from the salmon weir at Ridgepool to the northern end of Bachelors Walk. The following assumed phases of construction are based on details included in the project description:

1. Site Prep: installation of 1-ton sandbag cofferdams, construction of ramp in front of the IFI building and warehouse and removal of trees as required to accommodate new flood walls along Ridgepool Road, Cathedral Rd, Clare St., Bachelors Walk and the boat yard north of Arbuckle Row.
2. Demolition: break out footpaths and demolish existing riverside walls, utility diversions.
3. Foundations: excavate trench, backfill and compaction.
4. Construction: formwork and concrete pours, construction of pumping stations.
5. Finishes: stone cladding and glass barriers where planned.
6. Site Reinstatement: remove cofferdam sandbags.

The plant list for the Moy works area is shown in **Table 15-15**.

Table 15-15: Construction Plant List for Moy Works Area

Equipment	Notes	No.	BS 5228 Ref.	L_{WA} (dB)	on-time (%)	Used in Phase					
						1	2	3	4	5	6
Mobile telescopic crane	Used for installation/removal of 1-ton sandbags for cofferdams	1	C.4.46	95	30	Y					Y
Chain saw	Tree felling, likely only in use for 2 or 3 days at any particular location	1	D.2.14	114	20	Y					
Mini excavator with hydraulic breaker	Breaking out footpaths etc., 1 day or less at any given location	1	C.5.2	111	50		Y	Y			
Mini tracked excavator	Trench excavation for foundations	1	C.4.68	93	70	Y		Y	Y		Y
Articulated dump truck (tipping fill)	Loading/unloading of truck with rubble/fill	1	C.2.32	102	10		Y	Y			
Concrete pump + cement mixer truck (discharging)	Concrete pours at construction stage	1	C.4.24	95	20				Y		
Dumper (idling)	General use	1	C.4.5	91	50	Y	Y	Y			Y
Vibratory roller	Only to be used for 1 or 2 weeks (not in tandem w/ excavator or concrete truck)	1	C.5.27	95	50				Y		
Mini planer	May not be required	1	C.5.9	96	20		Y				
Articulated dump truck*	1 per hour	1	C.4.1	109	--	Y	Y	Y	Y	Y	Y
Hand-held circular saw (petrol)	Cutting footpaths, road surface etc., 1 day or less at any given location, stone cladding of walls	1	C.5.36	115	50		Y			Y	

* *Drive-by maximum sound pressure level in L_{Amax} (overall level)*

Noise Predictions

The predicted noise levels and initial magnitudes of impact for each phase of construction at the Moy site are shown in **Table 15-16**.

Table 15-16: Noise Predictions at Nearest NSL for Moy Construction Activities

Phase	Distance to centre of activity (m)	BS 5228 threshold value, dB L_{Aeq}	Predicted Noise Level, dB L_{Aeq}	Initial Magnitude of Impact
1. Site Preparation	15	65	75	High
2. Demolition	15	65	81	High
3. Excavation	15	65	76	High
4. Construction	15	65	64	Low
5. Finishes	15	65	73(1)	High
6. Site Reinstatement	15	65	64	Low

(1) Assumes use of the consaw for 10 % of the working day.

Predicted Significance of Effects

The significance of effects predicted for each phase of construction is as follows:

1. Site Preparation: The high predicted noise level of 75dB L_{Aeq} for the site preparation phase is due to the use of a chain saw for tree felling. When the chain saw is not in use the predicted noise level is 64 dB, below the BS5228 threshold. The chain saw is likely to be in use for only 2 or 3 days as the number of trees is small and the trees themselves are not particularly large. Given the short duration of the high noise levels from the chain saw, and the positive attitude of receptors to the Proposed Scheme, the predicted significance of effect for the site preparation phase is reduced to **moderate.**
2. Demolition: The predicted noise level for demolition is at levels sufficient for hearing damage (depending on duration of exposure) and predicted effects are therefore **profound**.
3. Excavation: The predicted noise levels exceed the BS5228 threshold by 11 dB due to the use of the rock breaker which is expected to be brief. Predicted effects are **significant**.
4. Construction: Predicted noise levels are below the BS5228 threshold and the predicted significance of effect is **moderate**.
5. Finishes: Predicted noise levels are 8 dB above the BS5228 threshold due to the use of the consaw which will be brief (10% on-time usage expected). The predicted significance of effect is **significant**.
6. Site Reinstatement: Predicted noise levels are below the BS5228 threshold and the predicted significance of effect is **moderate**.

To summarise, effects predicted for construction noise from activities at the Moy works area range from **moderate** to **profound** depending on the phase of construction.

15.4.3.2 Brusna (Glenree)

Assumed Plant and Construction Phases

The assumed phases of construction, and the plant list in **Table 15-17** are based on details included in the project description. The assumed phases of construction are:

1. Demolition: break out masonry walls.
2. Foundations: excavate trench, backfill and compaction.
3. Construction: formwork and concrete pours, earth embankments, bridge access road embankment, bridge beam support installation, instream works.

4. Finishes: stone cladding where planned.

Table 15-17: Construction Plant List for Brusna Works Area

Equipment	Notes	No.	BS 5228 Ref.	L_{wA} (dB)	on-time (%)	Use in Phase 1	2	3	4
Mini excavator with hydraulic breaker	Breaking out footpaths etc., 1 day or less at any given location	1	C.5.2	111	50	Y			
Chain saw	Tree felling, likely only in use for 2 or 3 days	1	D.2.14	114	20	Y			
Mini tracked excavator	Trench excavation for foundations, embankments	1	C.4.68	93	80		Y	Y	
Articulated dump truck (tipping fill)	Loading/unloading of truck with rubble/fill	1	C.2.32	102	10		Y	Y	
Concrete pump + cement mixer truck (discharging)	Concrete pours at construction stage	1	C.4.24	95	20			Y	
Dumper (idling)	General use	1	C.4.5	91	50		Y	Y	
Vibratory roller	Only to be used for week or two (not in tandem w/ excavator or concrete truck)	1	C.5.27	95	20			Y	
Articulated dump truck*	1 per hour	1	C.4.1	109	--	Y	Y	Y	
Hand-held circular saw (petrol)	Cutting footpaths, road surface etc., 1 day or less at any given location, stone cladding of walls	1	C.5.36	115	50				Y

* *Drive-by maximum sound pressure level in L_{Amax} (overall level)*

Noise Predictions

The predicted noise levels and initial magnitudes of impact for each phase of construction are shown in **Table 15-18**.

Table 15-18: Noise Predictions at Nearest NSL for Brusna Construction Activities

Phase	Distance to centre of activity (m)	BS 5228 threshold value, dB L_{Aeq}	Predicted Noise Level, dB L_{Aeq}	Initial Magnitude of Impact
1. Demolition	20	65	77	High
2. Foundations	20	65	63	High
3. Construction	20	65	64	Low
4. Finishes	20	65	71(1)	High

(1) Assumes use of the consaw for 10% of the working day.

Predicted Significance of Effects

The significance of effects predicted for each phase of construction is as follows:

1. Demolition: Predicted noise levels are 12 dB above the BS5228 threshold due to the use of the rock breaker and chain saw. The chain saw is likely to be in use for only 2 or 3 days as the number of trees is small. The predicted significance of effect is **significant**.

2. Foundations: Predicted noise levels are below the BS5228 threshold and the predicted significance of effect is **moderate**.
3. Construction: Predicted noise levels are below the BS5228 threshold and the predicted significance of effect is **moderate**.
4. Finishes: Predicted noise levels are 11 dB above the BS5228 threshold due to the use of the consaw which will be brief (10% on-time usage expected). The predicted significance of effect is **significant**.

To summarise, effects predicted for construction noise from activities at the Brusna works area range from **moderate** to **significant** depending on the phase of works.

15.4.3.3 Tullyegan

Assumed Plant and Construction Phases

The assumed phases of construction, and the plant list in **Table 15-19** are based on details included in the project description. The assumed phases of construction are:

1. Demolition: clearances of trees and vegetation.
2. Foundations: excavate trench, backfill and compaction.
3. Construction: formwork and concrete pours, earth embankments.
4. Finishes: stone cladding if planned.

Table 15-19: Construction Plant List for Tullyegan Works Area

Equipment	Notes	No.	BS 5228 Ref.	LwA (dB)	on-time (%)	Use in Phase			
						1	2	3	4
Mini excavator with hydraulic breaker	Breaking out footpaths etc., 1 day or less at any given location	1	C.5.2	111	50		Y		
Chain saw	Tree felling, likely only in use for 2 or 3 days	1	D.2.14	114	20	Y			
Mini tracked excavator	Trench excavation for foundations, embankments	1	C.4.68	93	80	Y	Y	Y	
Articulated dump truck (tipping fill)	Loading/unloading of truck with rubble/fill	1	C.2.32	102	10		Y	Y	
Concrete pump + cement mixer truck (discharging)	Concrete pours at construction stage	1	C.4.24	95	20			Y	
Dumper (idling)	General use	1	C.4.5	91	50	Y	Y	Y	
Hydraulic vibratory compactor (tracked excavator)	Compaction of backfill	1	C.2.42	106	20		Y		
Articulated dump truck*	1 per hour	1	C.4.1	109	--		Y	Y	
Hand-held circular saw (petrol)	Stone cladding of walls	1	C.5.36	115	10				Y

* *Drive-by maximum sound pressure level in L_{Amax} (overall level)*

Noise Predictions

The predicted noise levels and initial magnitudes of impact for each phase of construction are shown in **Table 15-20**.

Table 15-20: Noise Predictions at Nearest NSL for Tullyegan Construction Activities

Phase	Distance to centre of activity (m)	BS 5228 threshold value, dB L_{Aeq}	Predicted Noise Level, dB L_{Aeq}	Initial Magnitude of Impact
1. Demolition	10	65	77	High
2. Foundations	10	65	78	High
3. Construction	10	65	66	Medium
4. Finishes	10	65	74(1)	High

(1) Assumes use of the consaw for 10% of the working day.

Predicted Significance of Effects

1. Demolition: Predicted noise levels are 12 dB above the BS5228 threshold due to the use of the chain saw. The chain saw is likely to be in use for only 2 or 3 days as the number of trees is small. Given the short duration of the high noise levels the predicted effects for the demolition phase are **moderate**.
2. Foundations: Predicted noise levels are 13 dB above the BS5228 threshold due to the use of the rock breaker. The predicted significance of effect is **significant**.
3. Construction: Predicted noise levels are only marginally above the BS5228 threshold and the predicted significance of effect is **moderate**.
4. Finishes: Predicted noise levels are 9 dB above the BS5228 threshold due to the use of the consaw. The predicted significance of effect is **significant.**

To summarise, effects predicted for construction noise from activities at the Tullyegan works area range from **moderate** to **significant** depending on the phase of works.

15.4.3.4 Bunree / Behy Road

Assumed Plant and Construction Phases

The assumed phases of construction, and the plant list in **Table 15-21** are based on details included in the project description. The assumed phases of construction are:

1. Demolition: Excavation, culvert removal.
2. Construction: Install new diversion culvert piping and backfill trench, field bridge upgrade.
3. Finishes: Reinstate road surfaces etc.

Table 15-21: Construction Plant List for Bunree/Behy Road Works Area

Equipment	Notes	No.	BS 5228 Ref.	LwA (dB)	on-time (%)	Use in Phase		
						1	2	3
Mini tracked excavator	Trench excavation	1	C.4.68	93	80	Y	Y	
Articulated dump truck (tipping fill)	Loading/unloading of truck with rubble/fill	1	C.2.32	102	10	Y	Y	
Dumper (idling)	General use	1	C.4.5	91	50	Y	Y	
Hydraulic vibratory compactor (tracked excavator)	Compaction of backfill	1	C.2.42	106	20		Y	
Mini planer	Breaking road surface etc.	1	C.5.9	96	20	Y	Y	
Vibratory roller	Compaction of backfill, surface	1	C.5.27	95	20			Y

Equipment	Notes	No.	BS 5228 Ref.	LwA (dB)	on-time (%)	Use in Phase 1	2	3
Hand-held circular saw (petrol)	Cutting footpaths, road surface etc., 1 day or less at any given location	1	C.5.36	115	50	Y		
Articulated dump truck*	1 per hour	1	C.4.1	109	--	Y	Y	Y

* *Drive-by maximum sound pressure level in L_{Amax} (overall level)*

Noise Predictions

The predicted noise levels and initial magnitudes of impact for each phase of construction are shown in **Table 15-22**.

Table 15-22: Noise Predictions at Nearest NSL for Bunree/Behy Road Construction Activities

Phase	Distance to centre of activity (m)	BS 5228 threshold value, dB L_{Aeq}	Predicted Noise Level, dB L_{Aeq}	Initial Magnitude of Impact
1. Demolition	15	65	80	High
2. Construction	15	65	69	Medium
3. Finishes	15	65	57	Low

Predicted Significance of Effects

1. Demolition: The predicted noise level for demolition is at levels sufficient for hearing damage (depending on duration of exposure) and predicted effects are therefore **profound**.
2. Construction: While the initial magnitude of impact for the construction phase is medium, the high noise levels are due to the hydraulic compactor which will be brief at any given location. Therefore, the predicted effect of construction phase noise is reduced to **moderate**.
3. Finishes: Predicted impacts are **low** in magnitude, indicating **slight** or **moderate** effects due to noise from the Bunree works area.

To summarise, effects predicted for construction noise from activities at the Bunree/Behy Road works area range from **slight** to **profound** depending upon the phase of construction.

15.4.3.5 Quignamanger

Assumed Plant and Construction Phases

The assumed phases of construction, and the plant list in **Table 15-23** are based on details included in the project description. The assumed phases of construction are:

1. Demolition: Break out retaining wall and surfaces where required for foundations, break out road surface using appropriate combination of consaw, rock breaker and/or road planer, remove existing culvert pipes.
2. Foundations: Excavate trench, backfill and compaction.
3. Construction: Install larger diameter culvert piles and backfill trench, flood walls where planned.
4. Finishes: Stone cladding of flood walls where planned, reinstate road surfaces etc.

Table 15-23: Construction Plant List for Quignamanger Works Area

Equipment	Notes	No.	BS 5228 Ref.	L_{wA} (dB)	on-time (%)	Use in Phase 1	2	3	4
Mini planer	Breaking road surface etc.	1	C.5.9	96	20	Y			Y

Equipment	Notes	No.	BS 5228 Ref.	L_{wA} (dB)	on-time (%)	Use in Phase			
						1	2	3	4
Chain saw	Tree felling, likely only in use for 2 or 3 days	1	D.2.14	114	20	Y			
Mini tracked excavator	Trench excavation	1	C.4.68	93	10	Y	Y		
Articulated dump truck (tipping fill)	Loading/unloading of truck with rubble/fill	1	C.2.32	102	50	Y	Y	Y	
Dumper (idling)	General use	1	C.4.5	91	20	Y	Y	Y	Y
Hydraulic vibratory compactor (tracked excavator)	Compaction of backfill	1	C.2.42	106	20		Y	Y	
Vibratory roller	Compaction of backfill, surface	1	C.5.27	95	50				Y
Hand-held circular saw (petrol)	Cutting footpaths, road surface etc., 1 day or less at any given location	1	C.5.36	115	--	Y			
Articulated dump truck*	1 per hour	1	C.4.1	109	50	Y	Y	Y	Y
Mini excavator with hydraulic breaker	Breaking out footpaths etc., 1 day or less at any given location	1	C.5.2	111	0	Y	Y		

* *Drive-by maximum sound pressure level in L_{Amax} (overall level)*

Noise Predictions

The predicted noise levels and initial magnitudes of impact for each phase of construction are shown in **Table 15-24**

Table 15-24: Noise Predictions at Nearest NSL for Quignamanger Construction Activities

Phase	Distance to centre of activity (m)	BS 5228 threshold value, dB L_{Aeq}	Predicted Noise Level, dB L_{Aeq}	Initial Magnitude of Impact
1. Demolition	15	65	86	High
2. Foundations	15	65	83	High
3. Construction	15	65	70	Medium
4. Finishes	15	65	83	High

Predicted Significance of Effects

1. Demolition: The predicted noise level for demolition is at levels sufficient for hearing damage (depending on duration of exposure) and predicted effects are therefore **profound**.
2. Foundations: The predicted noise level for demolition is at levels sufficient for hearing damage (depending on duration of exposure) and predicted effects are therefore **profound**.
3. Construction: While the initial magnitude of impact for the construction phase is medium, the high noise levels are due to the hydraulic compactor, use of which will be brief at any given location. Therefore, the predicted effect of construction phase noise is reduced to **moderate**.

4. Finishes: The predicted noise level for demolition is at levels sufficient for hearing damage (depending on duration of exposure) and predicted effects are therefore **profound**.

To summarise, effects predicted for construction noise from activities at the Quignamanger works area range from **moderate** to **profound** depending upon the phase of construction.

15.4.4 Construction Phase Vibration

Use of a rock breaker will likely be necessary at some locations. However, separation distances of NSLs from works is sufficient for ground-borne vibration from rock breaking to attenuate well below levels which could conceivably result in damage and below levels that would be expected to give rise to complaints from residents. No structures of particular sensitivity to vibration have been identified in sufficient proximity to works for building vibration damage to arise from the Proposed Scheme. Ruins of the Ardnaree Augustinian Friary, which may be sensitive to ground-borne vibration, are located approximately 30 m from proposed works on the Moy, a distance which is sufficient for ground-borne vibration from rock breaking to attenuate well below levels which could conceivably result in damage.

The predicted significance of effect for vibration from the Proposed Scheme is **not significant**, i.e., there are **no significant vibration effects predicted**.

15.4.5 Construction Traffic

Anticipated construction traffic numbers have been reviewed. In all cases, the predicted increase in traffic flows due to construction traffic on the receiving road network is well below 25 %, implying a negligible noise level increase of less than 1 dB and therefore below the threshold for more detailed assessment.

In summary, there are **no significant effects predicted for construction traffic noise or vibration** associated with the Proposed Scheme, and predicted effects are **not significant**.

15.4.6 Construction Compounds

Locations of proposed construction compounds and expected activities therein have been reviewed and assessed. The compounds will primarily be used for storage of materials etc. in addition to welfare facilities and therefore activities within the compounds will not give rise to noise levels above the BS 5228 thresholds, predicted effects are **slight,** and there **no significant effects predicted for noise or vibration from Construction Compounds**.

The Bachelors Walk and Behy Road compounds are sited with bounding NSLs. General mitigation measures for noise at these sites are provided in **Section 15.5**.

15.4.7 Operational Phase

As stated earlier in this chapter, there are no likely significant effects due to noise and vibration for the operational phase of the Proposed Scheme and **operational noise and vibration have been scoped out of the assessment**.

15.5 Mitigation Measures

15.5.1 Construction Phase

A range of measures will be implemented during construction works to mitigate the noise impacts where possible. Activity specific mitigation measures are outlined later in this section. A list of general mitigation measures to be applied site wide are outlined below.

General Mitigation

- Works shall, as a minimum, include the measures set out in this assessment and these measures will be documented in the Construction Environmental Management Plan (CEMP).

- Works will be carried out using Best Practicable Means (BPM) to minimise noise and vibration, such measures shall include:
  - Limiting the hours of construction to daytime only unless absolutely necessary.
  - 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 – Part 2: Vibration (together referred to as B.S. 5228). Standard work practices include:
    - Scheduling of noisy works to normal working hours.
    - Adopting quiet working methods, using plant with lower noise emission levels.
    - Adopting working methods that minimise vibration generation particularly with regard to demolition.
    - Plant such as pumps and generators used on or near sensitive locations will be contained within an acoustic enclosure.
    - Plant and machinery used on-site will comply with the European Commission (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.
    - Ensuring that all plant is properly maintained, (mechanisms properly lubricated, faulty silencers replaced, worn bearings replaced, cutting tools sharpened etc.).
    - Closing acoustic covers to engines when in use or idling.
    - Use of electrically powered equipment in preference to internal combustion powered equipment.
    - Use of hydraulic equipment in preference to pneumatic equipment.
    - Use of wheeled plant in preference to tracked plant.
    - Locating plant as far away from noise and vibration sensitive receptors as practicable.
    - Installation of site hoardings or perimeter noise barriers.
    - Use of temporary acoustic enclosures or screens around specific noisy static plant.
    - Avoiding the unnecessary revving of engines and switch off equipment when not in use.
    - Starting-up plant and vehicles sequentially rather than at the same time.
    - Keeping internal haul routes well maintained to minimise impulsive noise and vibration from vehicles running over discontinuities in the running surfaces.
    - Fitting rubber linings to chutes, hoppers and dumper vehicles to reduce impact noise from material transfer.
    - Minimising drop heights of materials.
    - Carrying out regular inspections of mitigation measures (BPM audits) to ensure compliance with noise and vibration commitments.
    - Providing regular briefings 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.
    - Ensuring that unloading is carried out within the work site rather than on adjacent roads or laybys.
    - Phasing of materials deliveries to 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, the relevant Planning Section (Local Authority) and residents will be established at project commencement.
  - Records of any noise complaints relating to the construction operations will be investigated as soon as possible and reported to the Local Authority.
- Where works need to be completed outside normal working hours or where proposed works indicate that the noise or vibration levels set out in **Section 15.2.3.2** or **Section 15.2.3.3** may be exceeded, permission for these works must be sought from the Local Authority in advance of any works taking place. The application for such works will require a detailed noise control plan and follow up report to be prepared. This plan will 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 Local Authority. 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 will be implemented for the duration of the construction phase.
- 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 Local Authority prior to commencement of work. The Local Authority shall have discretion to vary the monitoring requirements and publication of results during the course of construction.

15.5.1.1 Rock Breaking and Consaws

Full acoustic screening of rock breakers and consaws, in the form of site hoarding or temporary noise barriers, will be used to block line of site from rock breaking or consaw activities where NSLs are located within 25 m of these activities. Locations where rock breakers and consaws are used will not be known until construction is in progress and therefore locations of the temporary noise barriers will be determined at construction stage.

A formal stakeholder engagement process will be put in place for the duration of the construction phase, including the provision of information to local residents regarding works likely to cause significant noise or vibration and/or works planned to take place outside of core working hours and also establish a process for handling all enquires including complaints.

15.5.2 Operational Phase

As stated earlier in this chapter, there are no likely significant effects due to noise and vibration for the operational phase of the Proposed Scheme. Consequently, no mitigation measures are necessary, and none are proposed.

15.6 Residual Impacts

Following implementation of construction noise mitigation efforts, some noise impacts will remain. The largest exceedances of BS5228 noise thresholds are predicted for use of rock breakers and consaws. Full acoustic screening will provide approximately 10 dB reduction in these noise levels (BSI, 2009). The noise levels that will remain following mitigation may exceed BS5228 noise thresholds at some NSLs for brief periods where use of the rock breaker and consaw is necessary. Taking into account the short duration of the predicted exceedances of the BS5228 noise thresholds, the predicted significance of effect is reduced to **moderate** for these residual impacts.

For NSLs which are located closest to activities in the various works areas, the predicted residual effects range from **slight** to **moderate**. There are **no significant residual effects** predicted for noise and vibration from the Proposed Scheme.

15.7 Monitoring

15.7.1 Construction Phase

Noise monitoring proposed for the Proposed Scheme is as follows:

- Prior to the commencement of construction, the contractor will set out and agree a schedule of noise monitoring with the Local Authority to include the number and locations at which noise monitoring will be carried out, the frequency and duration of the monitoring and the reporting of results.
- No specific requirements for vibration monitoring have been identified, however should this be required a similar process to the above for noise will be followed by the contractor.

15.7.2 Operational Phase

There is no noise or vibration monitoring proposed for the operational phase of the Proposed Scheme.

15.8 Interactions and Cumulative Effects

Inter-relationships are the impacts and associated effects of different aspects of the Proposed Scheme on the same receptor. The potential for cumulative effects has been considered for the construction and operation of the Proposed Scheme cumulatively with other projects. Please see **Chapter 20 Interactions and Cumulative Effects** for further details on the potential interactions and cumulative effects for Noise and Vibrations.

15.9 Schedule of Environmental Commitments

Please see **Chapter 22 Schedule of Environmental Commitments** which sets out all the mitigation and monitoring commitments to minimise the potential impacts for human health during the construction and operational phase of the Proposed Scheme.

15.10 Chapter References

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