MWP

Noise Impact Assessment

Bantry Mill Culvert Upgrade Project

Cork County Council

November 2024

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1. Introduction

A Part 8 Planning Application is being lodged by Cork County Council (CCC), hereafter referred to as "the Applicant" for the Bantry Mill Culvert Upgrade Project (BMCUP,) hereafter referred to as "the proposed development".

The purpose of the BMCUP is to upgrade the existing Mill River culvert within Bantry town and remove the existing foul connections to the culvert and connect these to the dedicated foul network.

MWP have been commissioned to carry out a noise impact assessment as part of the proposed development.

The proposed development comprises:

- Reconstruction of a new Mill River Culvert along Bridge Street and New Street and Wolfe Tone Square and connection to the existing Mill River Culvert at chainage 80m; This includes:
    - A new Mill River Culvert of internal dimensions 5.2m wide, 1.5m high which will be constructed from a tie in at Wolfe Tone Square, at Chainage 80m, to William Street, at Chainage 242m
    - A new Mill River Culvert of internal dimensions 3.6m wide, 1.5m high which will be constructed from William Street junction at Chainage 242m to the Mill on Bridge Street at Chainage 452m
- Connect to existing drainage/services at William Street and Main Street.
- Repair/upgrade works to be carried out to the Mill River Culvert from Chainage 0 to 80m.
- Road and footpath reinstatement works.
- Removal and reinstatement of the sections of Wolf Tone Square will be required to facilitate the tie in of the New Mill River culvert and backfilling of the old offline stone culvert.
- Construction of new services and utilities including foul water drainage. Surface water drainage, watermain infrastructure, gas, electricity and communications will be required at Wolfe Tone Square, New Street and Bridge Street;
- Including modifications to existing services including foul, surface water and services generally to facilitate the proposed scheme.
- Construction of 2 No. surface water pumping sumps in Wolfe Tone Square.

2. Methodology

2.1 Scope of Assessment

The scope of the assessment considers the noise and vibration emissions from the Bantry Mill Culvert Upgrade Project and its effects on the nearest noise sensitive receptors and vibration receptors.

2.1.1 Noise Sensitive Receptors and Monitoring Locations

In the first instance, it is considered appropriate to define a noise sensitive location (NSL). In this context, it is considered prudent to give consideration to the definition supplied by the Environmental Protection Agency (EPA) which states the following:

"NSL – any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels."

The closest noise sensitive locations (NSLs), to the proposed development were identified through review of the site layout design. The baseline noise monitoring locations (NMLs), NML1 to NML6, illustrated in Figure 2-1 can be considered representative of the ambient noise environment of the closest NSLs.

There are a number of commercial properties along the culvert route, including bars, restaurants, and shops, the closest of which come within 5m of the culvert works area. There are also some first floor residential NSLs along the culvert route. As well as residential receptors, there is a church and hotel nearby which can also be considered as NSLs. The Church of Saint Brendan the Navigator is located approximately 50m north of the culverts closest point and the Bantry Bay Hotel is located within c.10m of the culvert works area at its closest point.

Criteria for assessing effects of noise to NSLs are summarised in Section 2.3.

Photos of each NML are shown in Appendix A.

The selection of NMLs was supplemented by reviewing aerial images of the study area and other online sources of information (Google Earth) and verified on the ground.

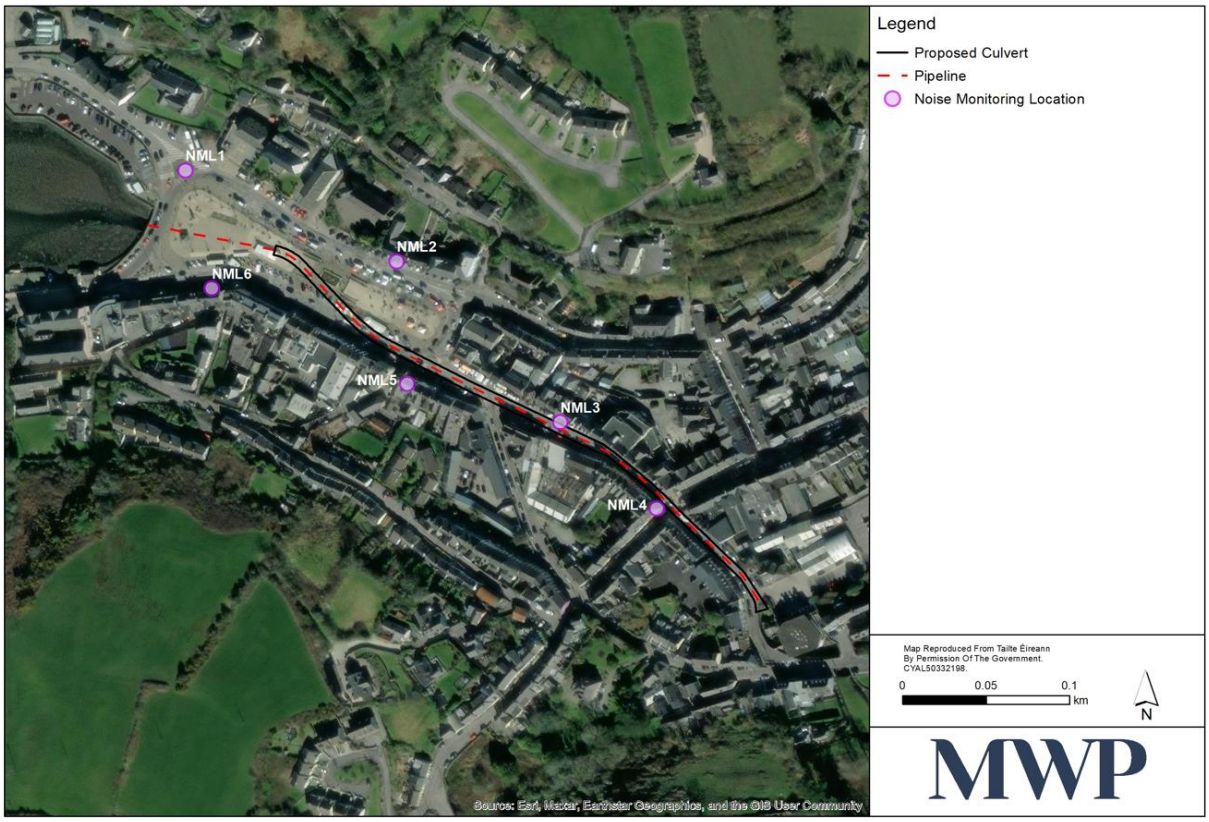


Figure 2-1 Noise Monitoring Locations

2.2 Fundamentals of Environmental Noise

Fundamentally, noise is vibrations of the air which are detectable by the ear. Sound waves radiate out spherically from a sound source in three dimensions. The human ear can detect a very wide range of pressure variations. In order to cope with this wide range, a logarithmic scale (decibel (dB) scale) is used to translate pressure values into manageable numbers from 0dB to 140dB. 0dB is the threshold of hearing, and 120dB is the threshold of pain.

Measuring in decibels means that a 3dB increase is equivalent to a doubling of the sound energy and a 10dB increase in a tenfold increase in energy. For broadband sounds which are very similar in all but magnitude, a change or difference in noise level of 1dB is just perceptible under laboratory conditions, 3dB is perceptible under most normal conditions and a 10dB increase generally appears twice as loud. A healthy human ear is also sensitive to a large range of frequencies (approximately 20 Hz to 20,000 Hz) and varies in sensitivity depending on the frequency.

The human ear is not equally sensitive to sound at all frequencies and is less sensitive to sound at low frequencies and high frequencies. A -weighting (dB A) is the main way of adjusting measured sound pressure levels (noise) to take account of the uneven human response to frequencies. Figure 1 illustrates some everyday sounds on the dB(A) scale. A quiet bedroom is around 35dB(A), a busy office around 60dB(A) and a rock concert around 100dB(A).

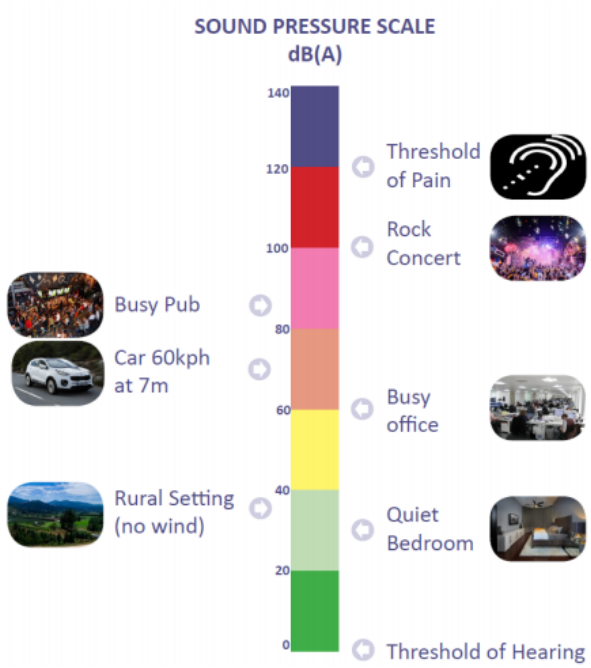


Figure 2-2 The Level of Typical Common Sounds on the dB(A) Scale

2.3 Criteria for Evaluating Construction Noise and Vibration Effects

2.3.1 Construction Phase - Noise

There is no statutory guidance in Ireland relating to the maximum noise levels permitted during construction works, and in the absence of statutory guidance or other specific limits prescribed by local authorities, the thresholds outlined in the British Standard (BS) 5228-12009+A1:2009, Code of Practice for Noise and Vibration Control on Construction and Open Sites - Noise has been adopted in this assessment, as they are recognised by the expert community as the most appropriate in the assessment of construction noise. The noise levels, which are reproduced in **Table 2-1**, are typically deemed acceptable at receptors.

Table 2-1 Construction Stage Noise Level Thresholds

Assessment category and threshold value period (T)	Threshold values, L_{AeqT}dB		
	Category A Note A	Category B Note B	Category C Note C
Night-time (23:00 to 07:00hrs)	45	50	55
Evening and Weekends Note D	55	60	65
Daytime (07:00 – 19:00hrs) and Saturdays (07:00 – 13:00hrs)	65	70	75

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

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

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

Note D: 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays and 07:00 – 23:00 Sundays.

The existing ambient noise levels (L_{Aeq}) within Bantry Town, refer to baseline survey results in **Section 3.1**, are the same as Category A threshold values from BS 5228 'Example method 1 – The ABC method' in the daytime and more than category A values for evening and night-time periods. Therefore, the following limits will be applied to assess whether noise is significant at an NSL.

Table 2-2 Adopted Construction Noise Limits

Assessment Period	Category and Threshold Limit
Night-time (23:00 to 07:00hrs)	Category C 55 L_{AeqT} dB
Evening and Weekends [Note D]	Category C 65 L_{AeqT} dB
Daytime (07:00 – 19:00hrs) and Saturdays (07:00 – 13:00hrs)	Category B 70 L_{AeqT} dB

2.3.2 Construction Phase – Traffic

There are no specific Irish guidance or limits relating to existing local traffic sources along the local or surrounding road network. As construction traffic for the proposed development will make use of these existing roads already carrying traffic volumes it is appropriate to assess the calculated increase in traffic noise levels that will arise because of vehicular movements associated with the development.

In order to assess the potential impact of construction traffic, the following two guidelines are referenced:

- *Design Manual for Roads and Bridges (DMRB) Sustainability & Environment Appraisal LA 111 Noise and Vibration* Revision 2
- *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*. 2022

Table 2-3 offers guidance to the likely impact associated with any particular change in traffic noise level.

Table 2-3 Magnitude of Impact – Construction Phase Traffic

Change in Sound Level (dB)	DMRB Magnitude of Impact	EPA Significance of Effect
Greater than or equal to 5.0	Major	Significant
Greater than or equal to 3.0 and less than 5.0	Moderate	Moderate
Greater than or equal to 1.0 and less than 3.0	Minor	Not Significant – Slight
Less than 1.0	Negligible	Imperceptible

2.3.3 Construction Phase – Vibration

According to NRA's 2014 Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes, there are two separate considerations for vibration during the construction phase namely 1) that which affects human comfort and 2) that which affects cosmetic or structural damage to buildings.

The guidelines suggest that human tolerance for daytime blasting and piling, two of the primary sources of construction vibration, limits vibration levels to a peak particle velocity (ppv) of 12mm/s and 2.5mm/s respectively. Blasting will not be required during this project.

To avoid the risk of even cosmetic damage to buildings, the guidelines suggest that vibration levels should be limited to 8mm/s at frequencies of less than 10Hz, to 12.5mm/s for frequencies of 10 to 50Hz, and to 20mm/s at frequencies of 50Hz and above.

2.4 Criteria for Evaluating Operational Phase Noise and Vibration Effects

2.4.1 Operational Phase – Noise and Vibration

There will be no noise effects from the operational phase of the proposed development. The only source of mechanical noise from the proposed development are the proposed sump pumps. These pumps are underground and therefore will not be a notable noise source which could add to the existing soundscape.

There will also be no vibration effects from the operational phase of the proposed development.

Therefore operational phase noise and vibration has been scoped from further assessment.

3. Existing Receiving Environment

3.1 Baseline Noise Survey

This section describes the baseline noise environment in terms of the NMLs, existing noise sources at these locations and the prevailing background noise levels.

A baseline environmental noise survey was undertaken in the vicinity of the proposed development to quantify the existing noise environment at the nearest noise-sensitive locations that may be affected by the proposed development.

3.1.1 Survey Periods

MWP personnel Kieran Barry conducted the noise monitoring on 18th and 19th April 2024. Noise monitoring was carried during day, evening, and night-time periods.

3.1.2 Instrumentation and Setup

The baseline noise survey was carried out in accordance with best practice and guidelines relevant to the measurement of environmental noise, particular guidance set out in the Environmental Protection Agencies (EPA) Noise Guidance 4 document.

The sound level meter was located away from reflective surfaces, in open ground. The microphone was at a height of 1.5m above the ground. The measurements were performed using the following equipment:

Table 3-1 Construction Stage Noise

Manufacturer	Equipment Model	Serial Number	Microphone	Calibration Date
Larson Davis	831	0003826	PCB PCB377B02	10th May 2022

The microphone was protected using a proprietary Larson Davis windshield. Before and after the survey the measurement apparatus was check calibrated using a Larson Davis CAL200 Sound Level Calibrator Serial Number 11262 that produces a sound level of 93.96dB re. 2 x 10^{-5} PA, at a frequency of 1k Hz.

The calibration certificates are attached as Appendix A. Weather conditions were dry and mild with sunny spells and winds were less than 5 meters per second.

3.1.3 Procedure

Noise measurements were conducted at the 6 no. NMLs identified. Measurements were conducted with sample periods of 15 minutes for both locations for daytime, evening and night-time periods.

The survey results were noted onto a Survey Record Sheet immediately following each sample and were also saved to the instrument memory for later analysis where appropriate. Survey personnel noted the primary sources contributing to noise build-up during the survey.

3.1.4 Measurement Parameters

The noise survey results are presented in terms of the following parameters:

- L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period. This parameter is representative of the specific noise from plant when plant is the dominant noise source, i.e., there is no extraneous noise from sources such as traffic.
- L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) relative to 2x10-5 Pa. A summary of the acoustic terminology used in this report is included in **Appendix B**.

3.1.5 Baseline Noise Survey Results

The results of the baseline noise survey are presented in **Table 3-2** to **Table 3-7**. Photos of each NML are included in **Appendix C** of this report.

During daytime measuring periods, the main source of noise in the Bantry town was passing traffic. Other contributing sounds included people chatting as walking through streets, occasional sound of seagulls and hourly ringing of church bells was noted at NMLs. Daytime L_{Aeq} readings ranged from 61 L_{Aeq} to 67 L_{Aeq} for NML1 to NML6 while L_{A90} measurements ranged from 53 L_{A90} to 61 L_{A90}.

During the evening monitoring periods, traffic was less prevalent within the town. There were people walking through the town and occasionally talking. Other noise contributing to evening measurements included sound of seagulls and church bell ringing hourly. Evening L_{Aeq} readings ranged from 59 L_{Aeq} to 65 L_{Aeq} for NML1 to NML6 while L_{A90} measurements ranged from 46 L_{A90} to 50 L_{A90}.

There was occasional cars passing through the town during the night-time measurements and this contributed to a quieter soundscape than earlier daytime and evening measurements. There was also few people within the town and therefore less conversation of passersby was noted. Night-time L_{Aeq} readings ranged from 57 L_{Aeq} to 58 L_{Aeq} for NML1 to NML6 while L_{A90} measurements ranged from 30 L_{A90} to 39 L_{A90}.

Table 3-2 NML1 Baseline Noise Results

NML1	Time and Date	$L_{Aeq,15min}$ dB	$L_{A90,\ 15min}$ dB
Daytime	18/04/24 13:25	65	61
Evening	18/04/24 19:27	62	50
Night	18/01/24 23:00	55	38

Table 3-3 NML2 Baseline Noise Results

NML1	Time and Date	L_{Aeq} 15min dB	L_{A90} 15min dB
Daytime	18/04/24 13:46	65	53
Evening	18/04/24 19:47	65	50
Night	18/04/24 23:18	58	39

Table 3-4 NML3 Baseline Noise Results

NML1	Time and Date	L_{Aeq} 15min dB	L_{A90} 15min dB
Daytime	18/04/24 14:45	61	53
Evening	18/04/24 20:09	59	50
Night	18/04/24 23:38	47	30

Table 3-5 NML4 Baseline Noise Results

NML1	Time and Date	L_{Aeq} 15min dB	L_{A90} 15min dB
Daytime	18/04/24 15:07	63	50
Evening	18/04/24 20:29	62	46
Night	18/04/24 23:56	52	35

Table 3-6 NML5 Baseline Noise Results

NML1	Time and Date	L_{Aeq} 15min dB	L_{A90} 15min dB
Daytime	18/04/24 15:29	64	58
Evening	18/04/24 20:48	60	46
Night	19/04/24 00:15	53	32

Table 3-7 NML6 Baseline Noise Results

NML1	Time and Date	L_{Aeq} 15min dB	L_{A90} 15min dB
Daytime	18/04/24 15:49	67	58
Evening	18/04/24 21:07	63	50
Night	19/04/24 00:33	53	34

4. Potential Impacts

4.1 Construction Phase Noise

This section presents the predicted noise levels associated with the construction of various elements of the proposed development as outlined in **Section 1** and shown on **Figure 4-1**.

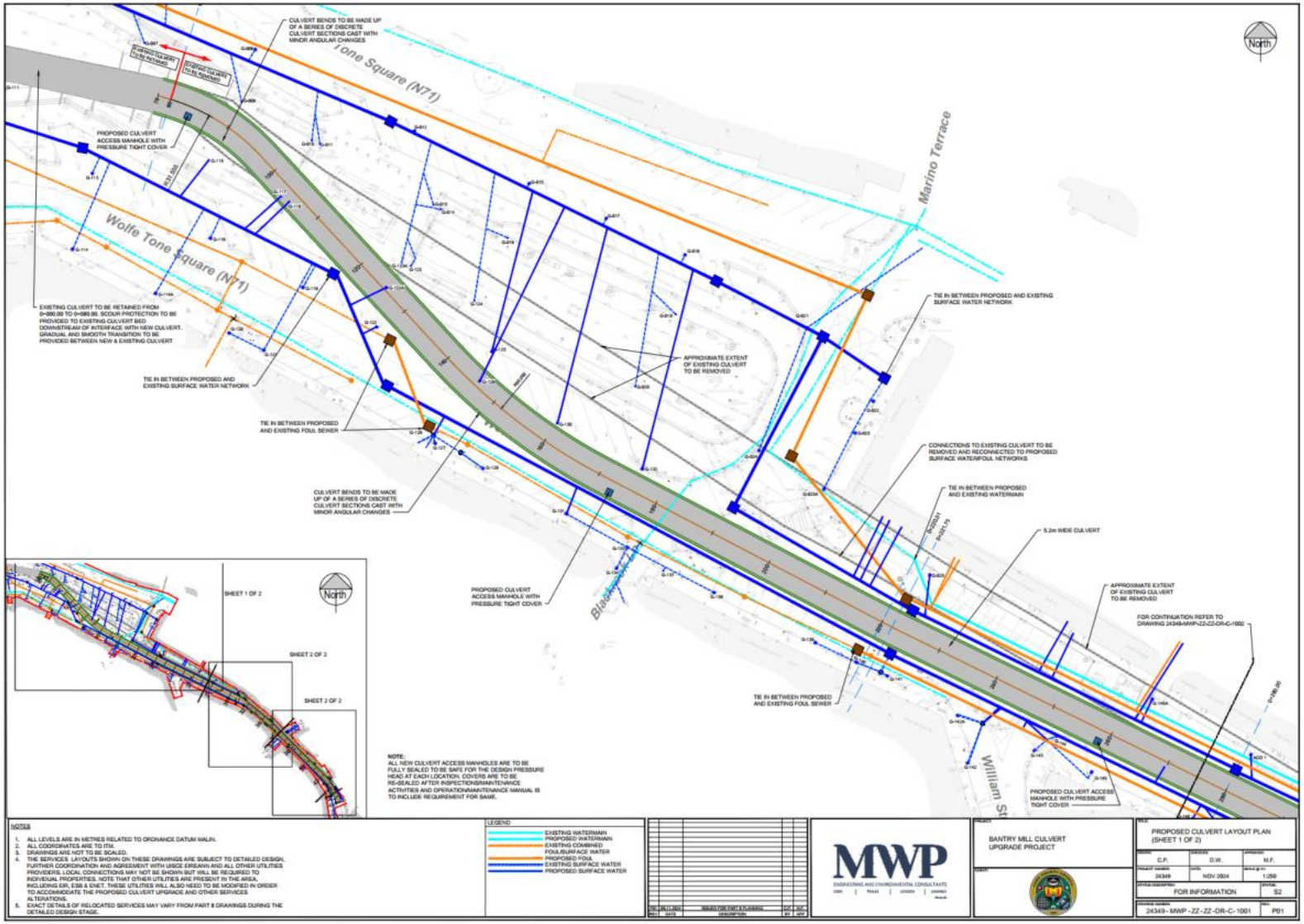


Figure 4-1 Proposed Culvert Layout Plan (Sheet 1 of 2)

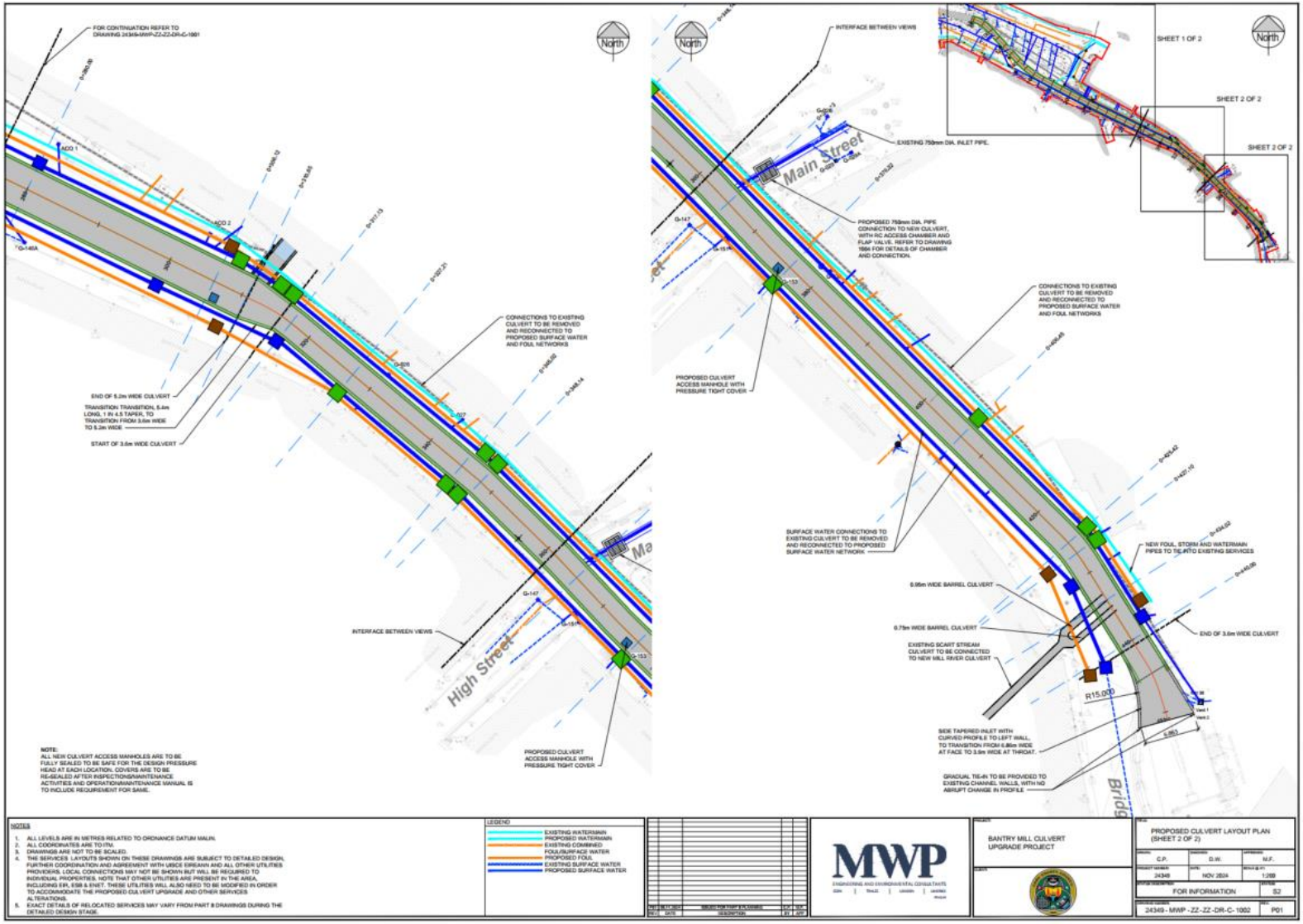


Figure 4-2 Proposed Culvert Layout Plan (Sheet 2 of 2)

The exact equipment to be used is not known at this stage, however the plant and machinery listed in below sections are typical of plant that are commonly used in construction projects of this nature and scale and can provide an accurate assessment of construction noise levels during the construction phase. Construction works are likely to be carried out over a 12-18 month period.

The Geotechnical Interpretive Report and Rippability Assessment carried out for the proposed development has indicated that removal of rock may be required between chainage 370m to the inlet at Chainage 440m For this reason, the effects from construction noise have been predicted for works in the absence of rock breaking, refer to Section 4.1.1, and also for works which may include rock breaking, refer to Section 4.1.2.

The associated noise levels have been sourced from BS 5228 *Noise and Vibration from open and construction sites*, totalled, and extrapolated to the nearest noise sensitive receptor. The resultant noise level is then compared against the relevant noise threshold. The result is a theoretical worst case, as it assumes all machinery will be operating simultaneously which will not be the case and accounts for attenuation due to distance only. In reality, there will be further noise attenuation due to atmospheric absorption, ground absorption, and landform screening. Therefore, the noise levels presented herein are overestimated

The formula, as shown below, to calculate sound attenuation over distance for a point source is based on the inverse square law[1]. Using the following equation, noise levels from the construction are extrapolated to the nearest noise sensitive receptor.

$$SPL = SPL_1 - 20\log(r2/r1)$$

Where:

- Sound Pressure Level 1 (SPL1) = Known noise level at 10m from construction site;
- Sound Pressure Level 2 (SPL2) = Unknown noise level at nearest receptor;
- R2 = Distance between noise sensitive receptor and construction site.

[1] https://www.wkcgroup.com/tools-room/inverse-square-law-sound-calculator/#:~:text=According%20to%20the%20inverse%20square,valves%2C%20small%20pumps%20and%20motors.

4.1.1 Construction Phase Noise Works (Chainage 0m to 370m)

The distance of NSLs to the culvert construction works range from within 5m to 50m. **Table 4-1** presents the predicted noise levels from a number of plant items required during the construction phase at chainage 0m to 370m. For the purpose of the assessment, the inclusion of a standard site hoarding along the site boundary has been included in the calculations. The calculations also assume that all listed equipment will not operate together continuously and will operate for 66% of the working time. Noise source levels at 10m have been sourced from BS 5228-1 and calculations have been made to include noise pressure levels at 5m as well as noise pressure levels up to 40m.

Table 4-1 Plant and Machinery and associated noise levels (chainage 0m to 370m)

Plant and Machinery	Sound Pressure Level @5m Leq dB(A)	Sound Pressure Level @10m Leq dB(A)	Sound Pressure Level @13m Leq dB(A)	Sound Pressure Level @ 20m Leq dB(A)	Sound Pressure Level @ 40m Leq dB(A)
Telescopic Handler		59			
Mobile Crane		58			
15-30T Excavator		66			
12T Roller		68			
Dump truck		66			
Tractor & Trailer	**79**	67	**71**	**67**	**61**
15-20T Rubber Tired Excavator		56			
3-10T mini digger		57			
Diesel Generator		49			
Total		**73**			

Table 4-1 shows that in the absence of mitigation, that the adopted construction noise threshold limit for residential NSLs, 70 dB (A), is exceeded within 13m during construction works located between chainage 0m and 370m.

As already mentioned, standard construction hoarding will provide a noise reduction of 10 dB (A), however as noise levels are still exceeding 70 dB (A) at the nearest NSLs even with hoarding in place, it is recommended that mitigation be implemented in the form of a temporary noise barrier which will be put around construction works which are within 15m of an NSL. Refer to **Section 5** for full list of mitigation measures during construction.

Table 4-4 shows predicted noise emissions, with a noise barrier in place. With the noise barrier in place, noise levels from construction are predicted to be within the adopted noise construction threshold limits of 70 dB (A) at 5m and beyond.

Table 4-2 Plant and Machinery and associated noise levels (chainage 0m to 370m) with barrier

Plant and Machinery	Sound Pressure Level @5m Leq dB(A)	Sound Pressure Level @10m Leq dB(A)	Sound Pressure Level @ 20m Leq dB(A)	Sound Pressure Level @ 40m Leq dB(A)	Sound Pressure Level @ 50m Leq dB(A)
Telescopic Handler		49			
Mobile Crane		48			
15-30T Excavator		56			
12T Roller		58			
Dump truck		56			
Tractor & Trailer	69	57	57	51	49
15-20T Rubber Tired Excavator		46			
3-10T mini digger		47			
Diesel Generator		39			
Total		**63**			

4.1.2 Construction Phase Noise Works (370m to 440m)

Table 4-3 presents the predicted noise levels from a number of plant items required during the construction phase from chainage 370m to 440m and takes in to account the breaking of rock which may be required at this section of works. For the purpose of the assessment, the inclusion of a standard site hoarding along the site boundary has been included in the calculations. The calculations also assume that all listed equipment will not operate together continuously and will operate for 66% of the working time. Noise source levels at 10m have been have been sourced from BS 5228-1 and calculations have been made to include noise pressure levels at 5m as well as noise pressure levels up to 40m.

Table 4-3 Plant and Machinery and associated noise levels (chainage 370m to 440m)

Plant and Machinery	Sound Pressure Level @5m Leq dB(A)	Sound Pressure Level @10m Leq dB(A)	Sound Pressure Level @ 16m Leq dB(A)	Sound Pressure Level @ 20m Leq dB(A)	Sound Pressure Level @ 40m Leq dB(A)
Telescopic Handler	81	59	71	69	63
Mobile Crane		58			
15-30T Excavator		66			
12T Roller		68			
Dump truck		66			
Tractor & Trailer		67			
15-20T Rubber Tired Excavator		56			
3-10T mini digger		57			
Diesel Generator		49			
Excavated mounted rock breaker		70			
Total		**75**			

Table 4-3 shows that, in the absence of mitigation, that the adopted construction noise threshold limit for residential NSLs, 70 dB (A), is exceeded within 16m during construction works located between chainage 370m and 440m.

It is therefore recommended that mitigation be implemented in the form of a temporary noise barrier which will be put around construction works which are within 20m of an NSL. This will reduce noise levels by 10 dB. A rock breaker shroud attachment should be attached to the rock breaker during construction. Rock breaker shrouds can provide up to 10 dB reduction. Refer to **Section 5** for full list of mitigation measures during construction.

Table 4-4 shows predicted noise emissions, with a noise barrier and rock breaker shroud in place. With the noise barrier and rock breaker shroud in place, noise levels from construction are predicted to be within the adopted noise construction threshold limits of 70 dB (A) at 5m and beyond.

Table 4-4 Plant and Machinery and associated noise levels (chainage 370m to 440m) with barrier and rock breaker shroud in place

Plant and Machinery	Sound Pressure Level @5m Leq dB(A)	Sound Pressure Level @10m Leq dB(A)	Sound Pressure Level @ 16m Leq dB(A)	Sound Pressure Level @ 20m Leq dB(A)	Sound Pressure Level @ 40m Leq dB(A)
Telescopic Handler		49			
Mobile Crane		48			
15-30T Excavator		56			
12T Roller		58			
Dump truck		56			
Tractor & Trailer		57			
15-20T Rubber Tired Excavator	70	46	60	58	52
3-10T mini digger		47			
Diesel Generator		39			
Excavated mounted rock breaker		50			
Total		**64**			

4.1.3 Construction Phase Traffic

During the construction works, there will be deliveries of building materials to the site, and removal of excavated material off-site. The volume of traffic generated by the transportation requirements will be minimal.

Construction traffic will include:

- HGVs importing construction materials including concrete and piping.
- HGVs exporting waste/spoil materials.
- HGVs delivering plant and fuel.
- Traffic associated with onsite construction personal.

Construction site traffic will use the existing roads surrounding the proposed development. The relatively low volume of additional traffic will be temporary and intermittent over the construction phase and will not be discernible from existing daytime traffic volumes on local roads surrounding the development.

4.2 Construction Phase Vibration

Rock breaking may give rise to vibration close to the breaking zone. However, the vibration tends to contain relatively little energy in the lower frequencies at which buildings and occupants are most vulnerable. In addition, higher frequencies attenuate more rapidly than low frequencies, thus minimising the impact zone. For this reason, most vibration guidance documents such as BS 5228-1:2009 ignore rock breaking vibration. Table 4-5 lists various peak particle velocity (PPV) levels reported in literature at sites where hydraulic rock breaking has been undertaken. The range in levels noted reflects variations in equipment power and rock type. The PPV levels shown in Table 4-5 are below vibration criteria limits set out in Section 2.3.3 for buildings.

Table 4-5 Reported rock breaking vibration PPV levels

At 5m	At 10m	At 20m	At 50m
0.2-4.5mm/s	0.06-3.0 mm/s	0.02-1.5 m/s	0.1-0.3 m/s

Humans are particularly sensitive to vibration and can detect vibration levels as low as 0.3 mm/sec PPV and levels above this may cause annoyance. However, significantly higher levels than this are tolerated for single short-term events and do not cause annoyance or disturbance to humans. British Standard BS 5228- 2:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites provides guidance on vibration and its control and management on various site types. The standard also presents details on the human response to vibration and Table 4-6 outlines these effects.

Table 4-6 Human Response to Vibration

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

The levels of vibration will not cause intolerable effects however the levels of vibration in the vicinity may cause complaint and therefore it is important that residents and business owners are notified prior to rock breaking activities. Vibration mitigation measures are outlined in Section 5.2.

5. Mitigation Measures

5.1 Construction Phase Noise

Construction works will be carried out in accordance with best practice and in line with recommendations contained within BS 5228-1:2009+A1:2014.

To mitigate against the impacts of noise on the local community during construction, the following measures are proposed:

- A pre-construction commitment to managing nuisance noise will be agreed through notification and consultation with affected parties, if deemed necessary.
- A nominated person from the appointed contractor will be appointed to liaise with local residents and businesses regarding noise nuisance events.
- Construction working hours will be normal daytime hours, typically 8.00am to 7.00pm Monday to Friday and from 08.00am to 2.00pm on Saturdays with no work on Sundays. All traffic movements will be carried out between the hours of 7.00am to 7.00pm on Monday to Friday and 8.00am to 2.00pm on Saturdays. Outside of these times works are limited to:
    - Working at road junctions to minimise disruption e.g. cross-roads in the town centre critical to traffic flow.
    - Commissioning and testing; and
    - Works required in an emergency where there is the potential of harm or damage to personnel, plant, equipment, or the environment, Deliveries will also be scheduled to avoid peak times where relevant, e.g. avoiding rush hours and after school pick up times.
- The working day may extend at times when critical elements of work need to be advanced. Longer working days can occur when there is a planned concrete pour, etc. In the event that activities outside of normal working time are needed, the Contractor shall prepare a suitable Method Statement, and the Contractor will seek the approval of the Local Authority and if required, the directly affected residents/other.
- Construction contractors will be required to comply with the requirements of the European Communities (Construction Plant and Equipment) (Permissible Noise Levels) Regulations, 1988 as amended in 1990 and 1996 (S.I. No. 320 of 1988, S.I. No. 297 of 1990 and S.I. No. 359 of 1996), and the Safety, Health and Welfare at Work (Control of Noise at Work) Regulations, 2006 (S.I. No. 371 of 2006).
- A noise barrier will be installed for any works which occur within 20m of an NSL at chainage 370m to 440m and works which occur within 15m of any NSL at chainage 0m to 370m. An effective acoustic barrier requires a minimum surface mass density of at least 10kg/m^2.
- Where rock breaking is required, a rock breaker shroud attachment should be attached to the rock breaker in order to provide attenuation of noise.

The main control measures will be control of noise at source using the following methods in line with Clause 8 ‘Control of noise’ of BS 5228-1:2009+A1:2014:

- Operators of all mobile equipment will be instructed to avoid unnecessary revving of machinery (Clause 8.2.1 General).
- Use of appropriate plant and equipment where possible with low noise level generation where possible (Clause 8.2.2 Specification and substitution).
- All construction plant to be used on site should have effective well-maintained silencers (Clause 8.2.3 Modification of existing plant and equipment).
- Noise generating equipment will be located as far as possible away from local noise sensitive areas identified (Clause 8.2.5 Use and siting of equipment); and,

Regular and effective maintenance of site machinery including a full maintenance schedule to ensure that all pieces of equipment are in good working order. With efficient use of well-maintained mobile equipment, considerably lower noise levels than those predicted can be attained (clause 8.2.6 Maintenance).In addition, the following best practice measures are proposed:

- Training of site staff in the proper use and maintenance of tools and equipment.
- Avoidance of unnecessary noise when carrying out manual operations and when operating plant and equipment.
- Machines that could be in intermittent use will be shut down between work periods or will be throttled down to a minimum.
- Plant start-up will be sequential rather than all together.
- Internal access tracks to be well maintained.
- Plant known to emit noise strongly in one direction will, when possible, be orientated so that the noise is directed away from noise-sensitive locations.
- Drop heights for materials such as gravels will be minimised whenever practicable.

A programme of noise monitoring at sensitive receivers will be detailed by the Contractor prior to works beginning. This will allow for a constant review of noise levels generated by the construction of the proposed scheme and will highlight the need for further mitigation measures should they be required.

5.2 Construction Phase Vibration

It is proposed that vibration monitoring will be carried out for all properties in close proximity to construction works where rock breaking is required and that residents and business owners are notified prior to rock breaking activities.

Precondition surveys will be carried out at properties in close proximity to the construction works. Survey and monitoring locations will be identified prior to rock breaking activities and agreed with residents and business owners. A nominated person from the appointed contractor will be appointed to liaise with local residents and businesses regarding noise nuisance events.

A programme of vibration monitoring (if required) at sensitive receivers will be detailed by the Contractor prior to works beginning. This will allow for a constant review of vibration (if required) levels generated by the construction of the proposed scheme and will highlight the need for further mitigation measures should they be required.

Vibration levels will be controlled to not exceed those described in BS5228 –1&2:2009 + A1 2014, *Code of Practice for the Control of Noise and Vibration on Construction and Open Sites* and this chapter. The contractor undertaking the construction works will be responsible for construction phase noise mitigation.

6. Conclusion

There will be noise emissions associated with the construction phase, but these will be short-term duration and not considered to be significant, with mitigation in place. The predicted noise emissions based on the representative machinery typical for this scale of project are expected not to exceed the recommended noise thresholds typically adopted for construction projects in Ireland.

There will be some vibration associated with the proposed development, particularly during rock breaking activities should they required. Provided vibration levels are controlled to not exceed those described in BS5228 –1&2:2009 + A1 2014, *Code of Practice for the Control of Noise and Vibration on Construction and Open Sites*, no significant impacts are predicted.

Mitigation measures outlined in Section 5 will be incorporated in to all site construction activities to minimise any potential noise and vibration impacts on the nearest receptors. Overall, it is considered that the proposed development will not have significant impacts on the nearest noise and vibration receptors, when mitigation measures are implemented.

7. References

Banty Culvert Upgrade Geotechnical Interpretive Report and Rippability Assessment, MWP, 2023

BS 4142: 2014: Methods for Rating and Assessing Industrial and Commercial Sound.

BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise.

BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2 – Vibration.

BS 6472 Guide to evaluation of human exposure to vibration in buildings (2008): Part 1 - Vibration sources other than blasting.

BS 7385-2:1993 Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration.

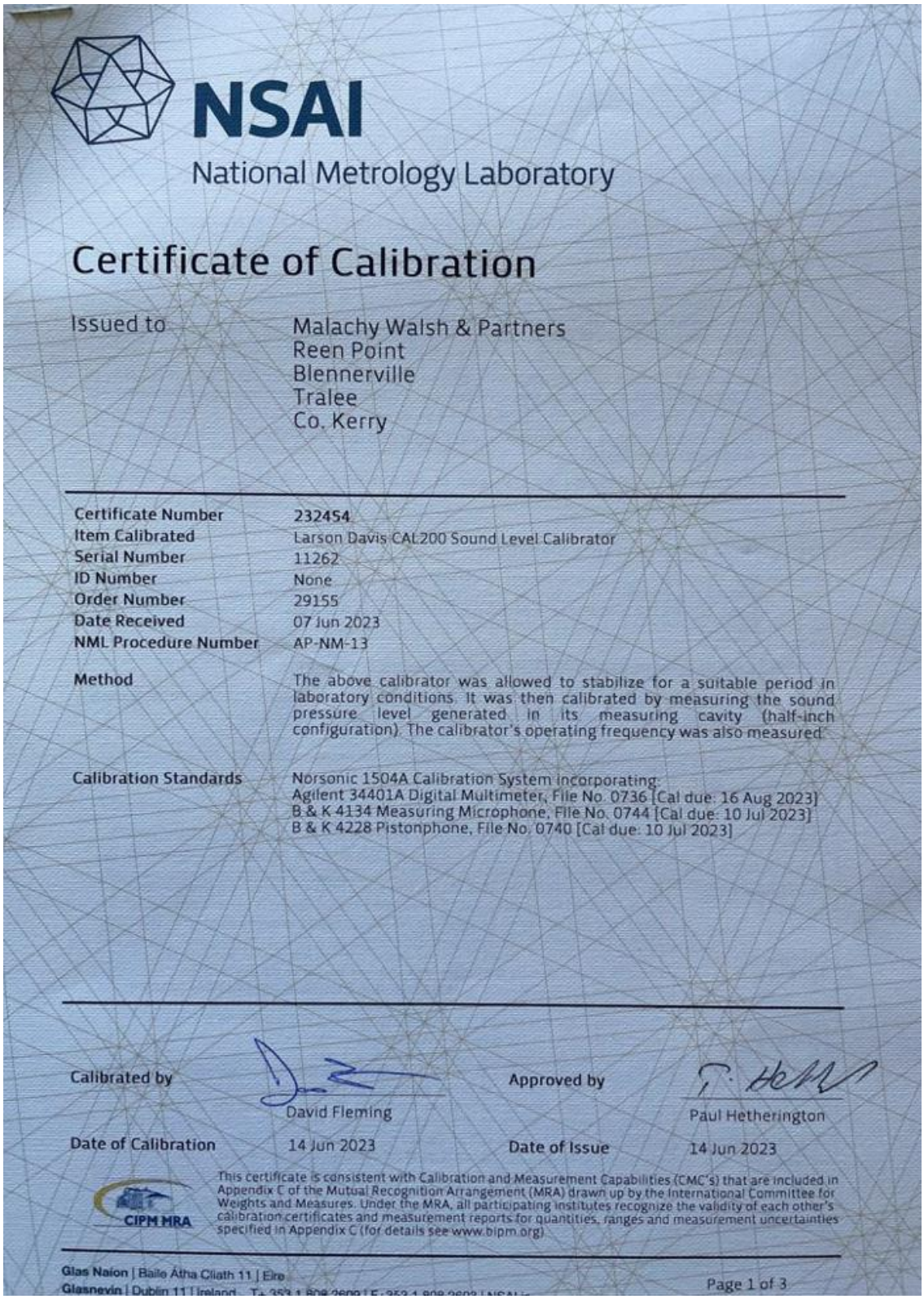
BS 8233: 2014 Guidance on sound insulation and noise reduction for buildings

Guidance Note for Noise: License Applications, Surveys and Assessments in Relation to Scheduled Activities (EPA, 2016).

ISO 1996: 2017: Acoustics – Description, measurement, and assessment of environmental noise.

Appendix A

Equipment Calibration Certificates



NSAI

National Metrology Laboratory

Certificate of Calibration

Issued to

Malachy Walsh & Partners
Reen Point
Blennerville
Tralee
Co. Kerry

Certificate Number	**232454**
Item Calibrated	Larson Davis CAL200 Sound Level Calibrator
Serial Number	11262
ID Number	None
Order Number	29155
Date Received	07 Jun 2023
NML Procedure Number	AP-NM-13
Method	The above calibrator was allowed to stabilize for a suitable period in laboratory conditions. It was then calibrated by measuring the sound pressure level generated in its measuring cavity (half-inch configuration). The calibrator's operating frequency was also measured.
Calibration Standards	Norsonic 1504A Calibration System incorporating: Agilent 34401A Digital Multimeter, File No. 0736 [Cal due: 16 Aug 2023] B & K 4134 Measuring Microphone, File No. 0744 [Cal due: 10 Jul 2023] B & K 4228 Pistonphone, File No. 0740 [Cal due: 10 Jul 2023]

Calibrated by David Fleming — **Approved by** Paul Hetherington

Date of Calibration 14 Jun 2023 — **Date of Issue** 14 Jun 2023

CIPM MRA

This certificate is consistent with Calibration and Measurement Capabilities (CMC's) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures. Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for quantities, ranges and measurement uncertainties specified in Appendix C (for details see www.bipm.org).

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NSAI

National Metrology Laboratory

Certificate of Calibration

Issued to

Malachy Walsh & Partners
Reen Point
Blennerville
Tralee
Co. Kerry

Certificate Number	**221922**
Item Calibrated	Larson Davis Sound Level Meter with PCB PCB377B02 Microphone
Serial Number	0003826 (SLM) and 150020 (Microphone)
ID Number	None
Order Number	27026
Date Received	10 May 2022
NML Procedure Number	AP-NM-09
Method	The above sound level meter was allowed to stabilise for a suitable period in laboratory conditions. It was then calibrated by carrying out the verification tests detailed in IEC 61672-3 (2006), *Periodic tests, specification for the verification of sound level meters*. This standard specifies a procedure for the periodic verification of conformance of a sound level meter or integrating-averaging meter to IEC 61672-1 (2003).
Calibration Standards	Norsonic 1504A Calibration System incorporating: SR DS360 Signal Generator, No. 0735 [Cal Due Date: 10 Jun 2022] Agilent 34401A Digital Multimeter, No. 0736 [Cal Due Date: 10 Jun 2022] B&K 4134 Measuring Microphone, No. 0744 [Cal Due Date: 03 Jun 2023] B&K 4228 Pistonphone, No. 0740 [Cal Due Date: 04 Jun 2023] B&K 4226 Acoustical Calibrator, No. 0150 [Cal Due Date: 07 Oct 2022]

Calibrated by	David Fleming	**Approved by**	PP Paul Hetherington
Date of Calibration	31 May 2022	**Date of Issue**	31 May 2022

CIPM MRA

This certificate is consistent with Calibration and Measurement Capabilities (CMC's) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures. Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for quantities, ranges and measurement uncertainties specified in Appendix C (for details see www.bipm.org)

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Appendix B

Glossary of Noise Related Terminology

Terminology	Description
A-weighting	a filter that down-weights low frequency and high frequency sound to better represent the frequency response of the human ear when assessing the likely effects of noise on humans
acoustic character	one or more distinctive features of a sound (e.g. tones, whines, whistles, impulses) that set it apart from the background noise against which it is being judged, possibly leading to a greater subjective effect than the level of the sound alone might suggest
acoustic screening	the presence of a solid barrier (natural landform or manmade) between a source of sound and a receiver that interrupts the direct line of sight between the two, thus reducing the sound level at the receiver compared to that in the absence of the barrier
ambient noise	All-encompassing noise associated with a given environment, usually a composite of sounds from many sources both far and near, often with no particular sound being dominant
annoyance	a feeling of displeasure in this case evoked by noise
attenuation	the reduction in level of a sound between the source and a receiver due to any combination of effects including: distance, atmospheric absorption, acoustic screening, the presence of a building façade, etc.
audio frequency	any frequency of a sound wave that lies within the frequency limits of audibility of a healthy human ear, generally accepted as being from 20 Hz to 20,000 Hz
background noise	the noise level rarely fallen below in any given location over any given time period, often classed according to day-time, evening or night-time periods (for the majority of the population of the UK the lower limiting noise level is usually controlled by noise emanating from distant road, rail or air traffic)
dB	abbreviation for 'decibel'
dB(A)	abbreviation for the decibel level of a sound that has been A-weighted
decibel	the unit normally employed to measure the magnitude of sound
directivity	the property of a sound source that causes more sound to be radiated in one direction than another
equivalent continuous sound pressure level	the steady sound level which has the same energy as a time varying sound signal when averaged over the same time interval, T, denoted by $L_{Aeq,T}$
external noise level	the noise level, in decibels, measured outside a building
filter	a device for separating components of an acoustic signal on the basis of their frequencies
frequency	the number of acoustic pressure fluctuations per second occurring about the atmospheric mean pressure (also known as the 'pitch' of a sound)
frequency analysis	the analysis of a sound into its frequency components
ground effects	the modification of sound at a receiver location due to the interaction of the sound wave with the ground along its propagation path from source to receiver

Terminology	Description
hertz	the unit normally employed to measure the frequency of a sound, equal to cycles per second of acoustic pressure fluctuations about the atmospheric mean pressure
impulsive sound	a sound having all its energy concentrated in a very short time period
instantaneous sound pressure	at a given point in space and at a given instant in time, the difference between the instantaneous pressure and the mean atmospheric pressure
internal noise level	the noise level, in decibels, measured inside a building
L_{Aeq}	the abbreviation of the A-weighted equivalent continuous sound pressure level
L_{A10}	the abbreviation of the 10 percentile noise indicator, often used for the measurement of road traffic noise
L_{A90}	the abbreviation of the 90 percentile noise indicator, often used for the measurement of background noise
level	the general term used to describe a sound once it has been converted into decibels
loudness	the attribute of human auditory response in which sound may be ordered on a subjective scale that typically extends from barely audible to painfully loud
noise	physically: a regular and ordered oscillation of air molecules that travels away from the source of vibration and creates fluctuating positive and negative acoustic pressure above and below atmospheric pressure. Subjectively: sound that evokes a feeling of displeasure in the environment in which it is heard, and is therefore unwelcomed by the receiver
noise emission	the noise emitted by a source of sound
noise immission	the noise to which a receiver is exposed
noise nuisance	an unlawful interference with a person's use or enjoyment of land, or of some right over, or in connection with it
octave band frequency analysis	a frequency analysis using a filter that is an octave wide (the upper limit of the filter's frequency band is exactly twice that of its lower frequency limit)
percentile exceeded sound level	the noise level exceeded for n% of the time over a given time period, T, denoted by $L_{An,T}$
receiver	a person or property exposed to the noise being considered
residual noise	the ambient noise that remains in the absence of the specific noise whose effects are being assessed
sound	physically: a regular and ordered oscillation of air molecules that travels away from the source of vibration and creates fluctuating positive and negative acoustic pressure above and below atmospheric pressure subjectively: the sensation of hearing excited by the acoustic oscillations described above (see also 'noise')
sound level meter	an instrument for measuring sound pressure level
sound pressure amplitude	the root mean square of the amplitude of the acoustic pressure fluctuations in a sound wave around the atmospheric mean pressure, usually measured in Pascals (Pa)
sound pressure level	a measure of the sound pressure at a point, in decibels

Terminology	Description
sound power level	the total sound power radiated by a source, in decibels
spectrum	a description of the amplitude of a sound as a function of frequency
Standardised wind speed	Values of wind speed at hub height corrected to a standardised height of ten metres using the same procedure as used in wind turbine emission testing
threshold of hearing	the lowest amplitude sound capable of evoking the sensation of hearing in the average healthy human ear (0.00002 Pa)
tone	the concentration of acoustic energy into a very narrow frequency range

Appendix C

Noise Monitoring Location Photos

NML1

NML2

NML3

NML4

NML5

NML6