

9 Noise and Vibration

9.1 Introduction

This chapter describes the likely significant noise and vibration effects resulting from the construction, operation and maintenance of the proposed development. Where necessary, mitigation measures are identified to reduce effects and the likely residual effects are described.

Chapter 4, *Description of the Proposed Scheme*, provides a description of the proposed development and **Chapter 5, *Construction Strategy***, describes the construction strategy. The following aspects are particularly relevant to the noise and vibration assessment:

- **Construction:**
 - Noise and vibration associated with construction activities at Arklow Bridge;
 - Noise associated with channel dredging;
 - Noise associated with the debris trap and gravel trap construction;
 - Noise and vibration associated with flood defence walls, drainage and embankment construction activities; and
 - Noise associated with construction traffic.
- **Design and operation:**
 - Noise associated with proposed pumping stations; and
 - Maintenance works associated with the proposed development.

9.2 Assessment Methodology

9.2.1 General

This assessment considers the potential for generating significant noise and vibration effects during the construction, operation and maintenance phases of the proposed development, and the likely significant effects of noise and vibration on noise sensitive properties (NSPs).

Construction phase NSPs are defined as “*any occupied premises outside a site used as a dwelling (including gardens), place of worship, educational establishment, hospital or similar institution, or any other property likely to be adversely affected by an increase in noise level*”¹.

Vibration has been considered during the construction phase only, as no potential for significant sources of vibration during the operation of the proposed development is expected.

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

Operational phase NSPs are defined as ‘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’.²

9.2.2 Guidance and Legislation

The noise and vibration assessment has been undertaken in accordance with the overarching EIA guidance identified in **Section 1.3.1 of Chapter 1, Introduction** and in accordance with:

- EPA (2016) *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)*²;
- Transport Infrastructure Ireland (TII, formerly NRA) (2014) *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes*³;
- TII (2004) *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*⁴; and
- British Standards Institution (BSI) (2014) 5228-1 and 2:2009+A1:2014. *Code of practice for noise and vibration control on construction and open sites. Noise and Vibration*⁵.
- Design Manual for Roads and Bridges, 2020. LA 111 Noise and Vibration⁶

The TII guidance documents, along with British Standard guidance documents, set out noise and vibration limits during construction which are generally applied by planning authorities to construction projects in Ireland.

9.2.3 Study Area

The proposed development is contained within the planning boundary as shown in Drawing No 1065 in Appendix 4.1 and replicated in **Figure 5.2 in Chapter 5, Construction Strategy**. The closest NSPs to the proposed development are along River Walk, South Quay, Ferrybank and North Quay with some within 15m of the proposed works.

² EPA (2016) *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)*;

³ TII (2014) *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes*. Available from: [http://www.tii.ie/technical-services/environment/planning/Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes.pdf](http://www.tii.ie/technical-services/environment/planning/Good_Practice_Guidance_for_the_Treatment_of_Noise_during_the_Planning_of_National_Road_Schemes.pdf) [Accessed 24 April 2018]

⁴ TII (2004) *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*.

⁵ British Standards Institution (BSI) (2014) 5228-1 and 2:2009+A1:2014. *Code of practice for noise and vibration control on construction and open sites. Noise and Vibration*.

⁶ DMRB, 2020. LA 111 Noise and Vibration
<https://www.standardsforhighways.co.uk/prod/attachments/cc8cfcf7-c235-4052-8d32-d5398796b364>

9.2.4 Site Visits

A site visit was undertaken on 10 November 2020 to conduct a survey of the baseline noise environment.

9.2.5 Categorisation of the Baseline Environment

9.2.5.1 Overview of the Surveys

The baseline noise environment was determined by conducting a survey on 10 November 2020 at NSPs in the vicinity of the proposed development. The surveys were undertaken in accordance with ISO 1996-1:2016⁷.

It is noted that the survey was undertaken during Level 5 of the Resilience and Recovery 2020-2021: Plan for Living with COVID-19, with likely reduced traffic volumes in the surrounding areas. The likely corresponding lower noise levels do not affect the robustness of this assessment, as lower baseline noise levels result in more stringent noise limits being assigned during the construction phase and greater effects levels assigned in the assessment (due to change over baseline). Therefore, a more conservative approach has been applied than if baseline noise levels were higher (i.e. during more normal traffic conditions). In addition, in comparison to the noise levels measured for the Irish Water Arklow Wastewater Treatment Plant Project⁸ no significant variations in measured noise levels is noted.

9.2.5.2 Noise Sensitive Properties

Attended noise measurements were conducted at seven no. locations in the vicinity of the proposed development. The co-ordinates and descriptions of each of the survey locations are presented in **Table 9.1** and illustrated in **Figure 9.1**.

Table 9.1: Description of Baseline Noise Monitoring Locations

Monitoring Location	Description	Coordinates	
		Easting (m)	Northing (m)
S01	Two storey residential dwelling located on the South Quay, adjacent to the Marina	325129	172995
S02	Two storey residential dwelling located on the South Quay	324945	173235
S03	Three storey residential dwelling located on the South Quay	324698	173450
S04	Three storey residential dwelling located on River Walk	324502	173575
S05	Four storey residential dwelling located on River Walk	324288	173540

⁷ ISO (2016) Acoustics – Description, measurement and assessment of environmental noise (Part 1 & Part 2).

⁸ Environmental Impact Assessment Report, Arklow Wastewater Treatment Plant Project, Table 10.3. Arup, 2019.

Monitoring Location	Description	Coordinates	
		Easting (m)	Northing (m)
S06	Two storey residential dwelling located adjacent to the roundabout to the northeast of Arklow bridge	324797	173626
S07	Two storey residential dwelling located on Brigg's Lane	324942	173907



Figure 9.1: Noise Monitoring Locations. Not to scale. Extracted from Drawing No 1003

9.2.5.3 Instrumentation

A Brüel & Kjær 2250 Light Class 1 Sound Level Meter was used to carry out the baseline noise surveys. This meter complies with applicable industry standards⁹. The noise meter was calibrated before and after each measurement at each survey location using a Brüel & Kjær 4231 Acoustic Calibrator. A windshield was used to provide the microphone with effective wind protection to ensure that local meteorological conditions did not impact on the monitoring.

9.2.5.4 Meteorological Conditions

Meteorological conditions over the monitoring period are set out in **Table 9.2**. Meteorological data has been taken from Johnstown Castle, Co. Wexford weather station data¹⁰ (the nearest weather station) for each day the surveys occurred.

Table 9.2: Meteorological Conditions for Survey Period

Date	Rainfall (mm)	Max Temp (°C)	Min Temp (°C)	Mean Wind Speed (m/s)
10 th November 2020	1.2	12.1	9.6	3.8

9.2.5.5 Measurement Parameters

The following parameters were recorded and reported as part of the baseline surveys:

- L_{Aeq} – this is the continuous steady sound level during the sample period and effectively represents an average value;
- L_{A10} – this is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise; and
- L_{A90} – this 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 are “A-weighted” in order to account for the non-linear nature of human hearing.

9.2.5.6 Survey Periods

Measurements were conducted at the survey locations between 3pm and 12am on 10th November 2020 to represent daytime, evening, night-time.

Section 5.5 of Chapter 5, Construction Strategy outlines the work packages (WPs) for the full construction phases. These are summarised in **Section 9.5.1.1**. As described, night-time monitoring was undertaken as night-time works may be required during Work Package 1, for both Bridge Grouting, and Option 3 (micro piling from bridge) for Work Package 1 and drainage works along Main Street

⁹ International Electro-Technical Commission (IEC) (2002) *Specification for Sound Level Meters*.

¹⁰ Met Eireann, 2020. Johnstown Castle Meteorological Station
<https://www.met.ie/climate/available-data/historical-data>

and Bridge Street for Work Package 4. It is anticipated that there may be other times due to exceptional circumstances that construction works will be necessary outside of the standard working hours.

The surveys were carried out on a week day and during time periods which were selected in order to provide a typical snapshot of the existing baseline noise environment in the vicinity of the NSPs. However, as noted in **Section 9.2.5.1**, the survey was undertaken during Level 5 of the Resilience and Recovery 2020-2021: Plan for Living with COVID-19.

The results were initially 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 also noted all primary noise sources contributing to the baseline noise environment.

9.2.6 Impact Assessment Methodology

9.2.6.1 Traffic Volumes (Construction and Operation)

The TII guidelines⁴ state that increases in Annual Average Daily Traffic (AADT) flows of less than 25% during the operational and construction phases are unlikely to result in significant noise and vibration effects. Likely significant effects on noise are therefore assessed when the AADT flows are projected to increase above these thresholds during construction and operation of the proposed development.

The traffic volumes (AADTs) as presented in **Chapter 7, Traffic and Transport**, show that predicted increases on affected roads are significantly less than 25% and unlikely to result in significant noise effects during construction, operation and cumulatively with the Arklow Wastewater Treatment Plant. Therefore, there is no requirement for a detailed assessment of construction and operational traffic noise.

9.2.6.2 Construction Noise – Assessment

BS 5228-1/2:2009+A1:2014 *Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise and Vibration*⁵ outlines guidance on prediction methodologies to estimate the effect of construction noise sources. BS5228 presents sound power levels for a range of construction plant and have been used in this assessment. The calculations undertaken have been done so in accordance with ISO1996-2:2007¹¹.

The calculations assume that plant in each phase are operating simultaneously. Construction plant is assumed operational for 66% of the time with the exception of the excavator breaker, hydraulic hammer rig and petrol concrete saw, which in reality will operate more intermittently, taken as 33% of the time. During night time works, the wheeled loader is predicted to be in operation 50% of the time.

¹¹ ISO 1996-2:2007/2017 Acoustics — Description, measurement and assessment of environmental noise — Part 2: Determination of environmental noise levels

Mitigation, in the form of a 2.4m hoarding, has been applied to the modelling scenarios resulting in a reduction of 10dB(A). This is due to the break in the line of sight from source to receiver side of the hoarding and its density which will be a minimum of 7kg/m², see **Section 9.6.1.1**. A 10dB reduction has been incorporated in the assessment of WP1. A portion of this reduction will be achieved due to the change in elevation from source to receptor.

It is accepted that during some work packages it may be difficult to effectively screen the construction works. In such areas, a more conservative assumption of partial screening has been applied, resulting in a reduction of 5dB(A). This has been applied to WP2, WP3, WP4 and WP5.

For the drainage works (excavation of trench and backfill) along; Bridge Street, Main Street, Condren's Lane Lower, Harbour Road and Dock Road, construction works will be undertaken at distances of 10m from sensitive receptors. Partial screening has been assumed resulting in a reduction of 5dB(A) for the daytime works. For night-time works (Bridge Street and Main Street) full screening has been assumed resulting in a reduction of 10dB(A). In practice, this will be in the form of movable screens/hoarding.

Due to the physical restraints in working in these areas, reduced operational times have been assumed for all construction plant.

While no sensitive receptors have been identified on Main Street or Bridge Street (both are primarily commercial streets), as a worst case, an assessment has been undertaken.

9.2.6.3 Construction Noise – Limits and Significance Criteria

BS 5228-1/2:2009+A1:2014 *Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise and Vibration*⁵ outlines guidance on construction noise criteria with reference to the existing noise environment, as well as prediction methodologies to estimate the effect. This guidance is considered the most appropriate to apply in this instance as it considers the existing baseline noise environment. BS 5228⁵ states that *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*. **Table 9.3** sets out the ABC method for establishing the impact criteria of construction noise as presented in BS 5228.

Table 9.3: BS5228 (Part 1) ABC Assessment Categories and Thresholds at Dwellings⁵

Assessment category and threshold value period $L_{Aeq, 1 \text{ hour}}$	Threshold value in decibels (dB)		
	A ^{A)}	B ^{B)}	C ^{C)}
Night (23:00-07:00hrs)	45	50	55
Evening and weekends ^{D)}	55	60	65
Day (07:00-19:00hrs) and Saturdays (08:00-14:00)	65	70	75

^{A)} Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than category A values.

- B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
- C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
- D) 19:00 – 23:00hrs weekdays, 14:00-23:00hrs Saturdays and 07:00-23:00hrs Sundays.

The construction noise criteria outlined in **Table 9.4** will be applied at the nearest NSP to the construction works based on the BS5228⁵ criteria. Based on the monitoring data, the noise limits presented in **Table 9.4** have been assigned.

Table 9.4: Noise Limits to be Applied Based on BS5228 Criteria

Assessment category and threshold value period L_{Aeq}	Proposed noise limits along South Quay and either side of Arklow Bridge works ($L_{Aeq, 1 \text{ hour}}$)	Proposed noise limits for all other locations ($L_{Aeq, 1 \text{ hour}}$)
Day (07:00-19:00hrs) (L_{Aeq} , dB)	70 (Cat B)	65 (Cat A)
Evening (19:00-23:00hrs) (L_{Aeq} , dB)	65 (Cat C)	55 (Cat A)
Night (23:00-07:00hrs) (L_{Aeq} , dB)	55 (Cat C)	45 (Cat A)

Where an exceedance of the construction noise criteria, as outlined in **Table 9.4**, is predicted, the effect associated with the noise increase is rated in accordance with **Table 9.5** and **Table 9.6**.

The construction impact magnitudes outlined in **Table 9.5**, are taken from the DMRB LA 111 Noise and Vibration¹². The impact ratings are based on the lowest observable adverse effect level (LOAEL), i.e. the baseline noise level, $L_{Aeq,T}$ and the significant observed adverse effect level (SOAEL), i.e. the threshold level outlined in **Table 9.4**.

Table 9.5: Construction Impact Magnitudes

Construction noise level	Magnitude of impact	EPA Impact Rating
Above or equal to SOAEL +5dB	Major	Significant
Above or equal to SOAEL and below SOAEL +5dB	Moderate	Moderate
Above or equal to LOAEL and below SOAEL	Minor	Slight
Below LOAEL	Negligible	Not significant

Table 9.6 outlines the duration and frequency of effect based on EPA guidance¹³.

¹² DMRB,2020. LA 111 Noise and Vibration

<https://www.standardsforhighways.co.uk/prod/attachments/cc8cfcf7-c235-4052-8d32-d5398796b364>

¹³ EPA (2017) Guidelines on the information to be contained in Environmental Impact Assessment Reports.

Table 9.6: Duration and Frequency of Effects

Effect Type	Duration
Momentary Effects	Effects lasting from seconds to minutes
Brief Effects	Effects lasting less than a day
Temporary Effects	Effects lasting less than a year
Short-term Effects	Effects lasting one to seven years.
Medium-term Effects	Effects lasting seven to fifteen years.
Long-term Effects	Effects lasting fifteen to sixty years.
Permanent Effects	Effects lasting over sixty years

9.2.6.4 Vibration

Guidance relevant to acceptable vibration in order to avoid damage to buildings is contained within both the TII guidance⁴ and BS 5228-2 (2014)¹⁴. These standards differentiate between transient and continuous vibration. Surface construction activities are considered to be transient in nature as they occur for a limited period of time at a given location. The standard notes that below a peak particle velocity (PPV) of 12.5 mm/s the risk of damage tends to zero. Typically, the most significant sources of transient vibration during the construction phase of the development are likely to be from the piling for foundations. Given the current traffic volumes crossing Arklow Bridge, vibration effects from the construction phases are not anticipated to be significant. **Table 9.7** outlines the vibration limits that will be applied to the nearest sensitive receptors for buildings and structurally sound structures.

Table 9.7: Vibration Limits at the Nearest Sensitive Receptor

Category of Building	Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of:		
	Less than 10Hz	10 to 50Hz	50 to 100 Hz (and above)
Structurally sound and non-protected buildings (TII Guidance)	8 mm/s	12.5 mm/s	20 mm/s

The main potential source of vibration during the construction programme is associated with sheet piling.

¹⁴ BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites –Vibration.

9.2.6.5 Sheet Piling

Sheet piling is proposed in the river channel along South Quay, River Walk and Ferrybank. The closest structures will be the buildings along South Quay and River Walk and the southern end of Arklow Bridge. Along South Quay and River Walk the sheet piled wall will be retaining approximately 2m of fill and supporting the flood defence walls and so will be driven to a greater depth. The sheet piling immediately upstream and downstream of the bridge will be to a shallower depth and as such vibrations from the sheet piling closest to the bridge will be significantly less.

A screening assessment, using empirical formula outlined in BS 5228-2⁴ to estimate groundborne vibration for vibratory sheet piling, has been undertaken for properties along South Quay and River Walk¹⁷.

9.2.7 Operation and Maintenance – Limits and Significance Criteria

The only operational noise source sources will be emergency water pumps and an emergency generator. As such, their impact on nearby receptors is not considered significant and no operational limits are required.

Maintenance works will be undertaken as required during the operational phase of the proposed development, see **Section 9.5.3** for more details.

9.3 Baseline Conditions

Table 9.8 presents the results of the baseline noise survey at each location. The results of the survey have indicated that baseline noise levels at all locations assessed are dominated by passing traffic on the local road network and shipping noise from Arklow Marina. No sources of vibration were noted during the surveys.

Table 9.8: Baseline Noise Survey Results

Survey date and time	Survey location	L _{Aeq} (dB)	L _{A10} (dB)	L _{A90} (dB)	Qualitative description	
Day – 10 November 2020	15:59 – 16:29	S01	60.2	61.9	52.9	The dominant noise source at this location was industrial and shipping noise from Arklow Marina. Other sources of noise included local traffic on South Quay, noise from pedestrians and birdsong.
	16:34 – 17:04	S02	57.3	59.0	45.7	The dominant noise source at this location was local traffic on South Quay. Other sources of noise included distant industrial and shipping noise from Arklow marina, noise from pedestrians and birdsong.
	17:11 – 17:41	S03	63.4	66.8	53.4	The dominant noise source at this location was local traffic on South Quay. Other sources of noise included

Survey date and time	Survey location	L _{Aeq} (dB)	L _{A10} (dB)	L _{A90} (dB)	Qualitative description	
					water flow under Arklow bridge, noise from pedestrians and birdsong.	
18:23 – 18:53	S04	47.6	49.7	42.5	The dominant noise source at this location was local traffic. Other sources of noise included distant traffic, noise from pedestrians and birdsong.	
17:46 – 18:16	S05	48.6	50.0	44.4	The dominant noise source at this location was noise from pedestrians. Other sources of noise included distant traffic and noise and birdsong.	
15:22 – 15:52	S06	66.0	68.4	59.3	The dominant noise source at this location was local traffic on the adjacent roundabout. Other sources of noise included distant traffic, water flow under Arklow bridge and noise from pedestrians.	
14:43 – 15:15	S07	50.8	53.6	45.6	The dominant noise source at this location was local traffic. Other sources of noise included distant traffic and birdsong.	
Evening - 10 November 2020	20:09 – 20:39	S01	57.9	59.9	51.9	The dominant noise source at this location was industrial and shipping noise from Arklow Marina. Other sources of noise included local traffic on South Quay, noise from pedestrians and birdsong.
	20:42 – 21:12	S02	53.1	54.0	42.6	The dominant noise source at this location was local traffic on South Quay. Other sources of noise included distant industrial and shipping noise from Arklow marina, noise from pedestrians and birdsong.
	21:15 – 21:45	S03	61.4	63.8	45.5	The dominant noise source at this location was local traffic on South Quay. Other sources of noise included water flow under Arklow bridge, noise from pedestrians and birdsong.
	19:33 – 20:02	S04	49.6	51.9	44.1	The dominant noise source at this location was noise from pedestrians. Other sources of noise included local traffic, distant traffic and birdsong.
	19:00 – 19:30	S05	50.0	51.7	46.4	The dominant noise source at this location was noise from pedestrians. Other sources of noise included distant traffic and noise and birdsong.
	22:28 – 22:58	S06	57.8	61.7	47.7	The dominant noise source at this location was local traffic on the adjacent roundabout. Other sources of noise included distant traffic, water flow under Arklow bridge and noise from pedestrians.

Survey date and time		Survey location	L _{Aeq} (dB)	L _{A10} (dB)	L _{A90} (dB)	Qualitative description
	21:50 – 22:20	S07	44.6	46.4	40.7	The dominant noise source at this location was local traffic. Other sources of noise included distant traffic and birdsong.
Night – 11 November 2020	23:42 – 23:57	S03	58.5	59.3	57.3	The dominant noise source at this location was water flow under Arklow bridge. Other sources of noise included local traffic on South Quay, noise from pedestrians and birdsong.
	23:22 – 23:37	S04	45.1	48.1	39.7	The dominant noise source at this location was noise from pedestrians. Other sources of noise included local traffic and distant traffic.
	23:01 – 23:16	S06	55.9	59.4	47.8	The dominant noise source at this location was local traffic on the adjacent roundabout. Other sources of noise included distant traffic, water flow under Arklow bridge and noise from pedestrians.

9.4 Description of Proposed Development

Chapter 4, *Description of the Proposed Scheme* provides a description of the proposed development. The construction of the proposed scheme can be divided into five Work Packages and is described in detail in **Chapter 5, *Construction Strategy***:

- **WP 1:** Lowering the floor of Arklow Bridge including Bridge underpinning, Bridge remedial works and scour protection works. Night-time works may be required during WP1, for both Bridge Grouting, and Option 3 (micro piling from bridge) for WP1.
- **WP 2:** Channel dredging upstream and downstream of Arklow Bridge. Works will include an extension of north riverbank with planting, installation of roosting platforms upstream of Arklow Bridge and local raising of river bed adjacent to the flood defence walls for bird refuges.
- **WP 3:** Construction of debris and gravel traps with associated maintenance access ramp. Bat tubes will also be installed on the downstream face of the debris trap piers.
- **WP 4:** Construction of flood defence walls (including sheet piling) along River Walk, South Quay and around the dock on the south (right) bank, upstream and downstream of Arklow Bridge including the adjacent stormwater drainage. Night time drainage works along Main Street and Bridge street. Public realm and landscape features including footpaths, terraces, planters and seating will be constructed along the working area.
- **WP 5:** Construction of flood defence earth embankment and flood defence wall on north (left) bank along eastern side of Arklow Town marsh

including stormwater drainage diversion works. Upon completion of the earth embankment, the green space on the dry side of embankment will be planted with trees. Landscaping will be carried out on the river side of the flood defence wall.

The proposed scheme requires a network of construction compounds as part of the works. A total of six site compounds have been identified. The site compounds will have a range of functions including the storage of materials, the stockpiling and archaeological monitoring of dredged material, construction offices and welfare facilities. Refer to Figure 5.3 in **Appendix 5.2** for further details and locations of the site compounds.

The following aspects are particularly relevant to the noise and vibration assessment:

- **Construction:**
 - Noise and vibration associated with construction activities at Arklow Bridge;
 - Noise associated with channel dredging;
 - Noise associated with the debris trap and gravel trap construction;
 - Noise and vibration associated with flood defence walls, drainage and embankment construction activities; and
- **Operation and Maintenance:**
 - New pumping stations associated with the operation of proposed development.

9.4.1 Do-nothing Scenario

In the scenario where the proposed development did not proceed as planned, none of the construction or operational impacts as set out in this chapter would occur. Under the ‘do nothing’ scenario, the noise and vibration baseline as presented in **Section 9.3** would continue.

9.4.2 Work Packages – Construction Plant Details

9.4.2.1 WP1

Table 9.9 outlines the number and type of equipment assumed to be in operation, along with the percentage time in operation, during WP1.

Table 9.9 Specification and Number of Equipment for Each Construction Phase of WP1

Plant included in assessment	BS 5228 5 reference	Number	Sound Power Level (Lw) dB	Percentage time in operation (%)
Enabling Works				
Water Pump (Diesel)	4-88	1	96	66
Tracked Excavator	2-7	2	98	66

Plant included in assessment	BS 5228 5 reference	Number	Sound Power Level (Lw) dB	Percentage time in operation (%)
Breaker Mounted on Excavator	1-9	1	118	33
Bridge Works Option 1 – Traditional Underpinning				
Phase 1				
Water Pump (Diesel)	4-88	1	96	66
Tracked Excavator	2-7	2	98	66
Dumper	4-3	1	104	66
Breaker Mounted on Excavator	1-9	1	118	66
Phase 2				
Concrete Pump + Cement Mixer Truck (Discharging)	4-24	1	96	66
Vibratory Tamper	4-35	1	91	66
Bridge Works Option 2 – Micro Piling from Riverbed				
Phase 1				
Water Pump (Diesel)	4-88	1	96	66
Tracked Excavator	2-7	2	98	66
Rotary Bored Piling - Cast in Situ Mini Piling Rig	3-18	1	96	66
Phase 2				
Concrete Pump + Cement Mixer Truck (Discharging)	4-24	1	96	66
Vibratory Tamper	4-35	1	91	66
Bridge Works Option 3 - Micro Piling from Bridge				
Phase 1				
Water Pump (Diesel)	4-88	1	96	66
Tracked Excavator	2-7	2	98	66
Rotary Bored Piling - Cast in Situ Mini Piling Rig	3-18	1	96	66
Phase 2				
Concrete Pump + Cement Mixer Truck (Discharging)	4-24	1	96	66
Vibratory Tamper	4-35	1	91	66
Bridge Works Option 4 – Extensive Formation Improvement				
Phase 1				
Tracked Excavator	2-7	2	98	66

Plant included in assessment	BS 5228 5 reference	Number	Sound Power Level (L _w) dB	Percentage time in operation (%)
Dumper	4-3	1	104	66
Breaker Mounted on Excavator	1-9	1	118	66
Rotary Bored Piling - Cast in Situ Mini Piling Rig	3-18	1	96	66
Phase 2				
Concrete Pump + Cement Mixer Truck (Discharging)	4-24	1	96	66
Vibratory Tamper	4-35	1	91	66
Bridge Grouting (night time)				
Mini Piling Rig	3-18	1	103	66
Diesel Generator	4-79	1	98	66
Lowering Arklow Bridge Floor				
Water Pump (Diesel)	4-88	1	96	66
Tracked Excavator	2-7	2	98	66
Dumper	4-3	1	104	66
Breaker Mounted on Excavator	1-9	1	118	66
Diesel Generator	4-79	1	98	66
Scour protection of Arklow Bridge				
Concrete Pump + Cement Mixer Truck (Discharging)	4-24	1	96	66
Diesel Generator	4-79	1	98	66
Vibratory Tamper	4-35	1	91	66

9.4.2.2 WP2

Table 9.10 outlines the number and type of equipment assumed to be in operation, along with the percentage time in operation, during WP2.

Table 9.10: Specification and Number of Equipment for Each Construction Phase of WP2

Plant included in assessment	BS 5228 ⁵ reference	Number	Sound Power Level (L _w) dB	Percentage time in operation (%)
Channel Dredging				
Water Pump (Diesel)	4-88	1	96	66
Tracked Excavator	2-7	1	98	66
Dumper	4-3	1	104	66

9.4.2.3 WP3

Table 9.11 outlines the number and type of equipment assumed to be in operation, along with the percentage time in operation, during WP3.

Table 9.11: Specification and Number of Equipment for Each Construction Phase of WP3

Plant included in assessment	BS 5228 ⁵ reference	Number	Sound Power Level (L _w) dB	Percentage time in operation (%)
Debris Trap				
Phase 1				
Water Pump (Diesel)	4-88	1	96	66
Tracked Excavator	2-7	2	98	66
Dumper	4-3	1	104	66
Hydraulic Hammer Rig	3-4	1	105	66
Phase 2				
Concrete Pump + Cement Mixer Truck (Discharging)	4-24	1	95	66
Gravel Trap				
Phase 1				
Water Pump (Diesel)	4-88	1	96	66
Tracked Excavator	2-7	2	98	66
Phase 2				
Concrete Pump + Cement Mixer Truck (Discharging)	4-24	1	95	66

9.4.2.4 WP4

Table 9.12 outlines the number and type of equipment assumed to be in operation, along with the percentage time in operation, during WP4.

Table 9.12: Specification and Number of Equipment for Each Construction Phase of WP4

Plant included in assessment	BS 5228 ⁵ reference	Number	Sound Power Level (L _w) dB	Percentage time in operation (%)
Construction of Temporary Causeway (assuming sheet pile method)				
Water Pump (Diesel)	4-88	1	96	66
Tracked Excavator	2-7	1	98	66
Dumper	4-3	1	104	66
Sheet Steel Piling	3-11	1	87	66
Hydraulic Hammer Rig	3-4	1	105	33
Construction of Sheet Piles including End Caps/ Reinforced concrete walls				

Plant included in assessment	BS 5228 ⁵ reference	Number	Sound Power Level (L _w) dB	Percentage time in operation (%)
Water Pump (Diesel)	4-88	1	96	66
Tracked Excavator	2-7	1	98	66
Dumper	4-3	1	104	66
Sheet Steel Piling	3-11	1	87	66
Hydraulic Hammer Rig	3-4	1	105	33
Construction of Reinforced Concrete Walls				
Water Pump (Diesel)	4-88	1	96	66
Tracked Excavator	2-7	1	98	66
Dumper	4-3	1	104	66
Concrete Pump + Cement Mixer Truck (Discharging)	4-24	1	95	66
Construction of Stormwater Drainage and Associated Works				
Water Pump (Diesel)	4-88	1	96	66
Tracked Excavator	2-7	1	98	66
Tracked Mobile Crane (Idling)	4-51	1	94	66
Concrete Pump + Cement Mixer Truck (Discharging)	4-24	1	95	66
Public Realm				
Tracked Excavator	2-7	1	98	66
Hand-held Circular Saw (Petrol-Cutting concrete blocks)	4-72	1	107	33
Concrete Pump + Cement Mixer Truck (Discharging)	4-24	1	95	66
Drainage Works				
Mini Excavator with Hydraulic Breaker	5-2	1	111	10
Wheeled Loader	4-14	1	95	50

9.4.2.5 WP5

Table 9.13 outlines the number and type of equipment assumed to be in operation, along with the percentage time in operation, during WP5.

Table 9.13: Specification and Number of Equipment for Each Construction Phase of WP5

Plant included in assessment	BS 5228 ⁵ reference	Number	Sound Power Level (L _w) dB	Percentage time in operation (%)
Enabling Works – Haul Road				
Tracked Excavator	2-7	2	98	66
Dumper	4-3	1	104	66

Plant included in assessment	BS 5228 ⁵ reference	Number	Sound Power Level (L _w) dB	Percentage time in operation (%)
Installation of Sheet Piles including Reinforced Concrete Retaining Wall				
Water Pump (Diesel)	4-88	1	96	66
Concrete Pump + Cement Mixer Truck (Discharging)	4-24	1	95	66
Sheet Steel Piling	3-11	1	87	66
Hydraulic Hammer Rig	3-4	1	105	66
Embankment Construction				
Tracked Excavator	2-7	3	98	66
Dumper	4-3	2	104	66
Foundation Preparation				
Sheet Steel Piling	3-11	1	87	66
Tracked Excavator	2-7	1	98	66

9.5 Likely Significant Effects

9.5.1 Assessment of Effects During Construction

9.5.1.1 Construction Phasing and Plant

The construction phase of the proposed development will involve; underpinning remedial and scour protection at Arklow Bridge, channel dredging, construction of a debris and gravel trap, flood defence walls, embankments and associated drainage.

It is not possible at this stage to predict the exact equipment and plant that will be chosen by the Contractor(s) and predicted calculations are indicative only and used for the purposes of comparison with the adopted criteria.

Based on the indicative construction program available, a reasonable worst-case assessment has been undertaken for each Works Package (WP). For the purposes of this assessment, the following construction phases are considered for the proposed development.

- **Arklow Bridge (WP1)**
 - Enabling works
 - Bridge works
 - Option 1 Traditional underpinning
 - Option 2 Micro piling from riverbed

- Option 3 Micro piling from bridge
- Option 4 Extensive formation improvement
- Bridge Grouting
- Lowering of Bridge Floor
- Concrete scour slab
- Channel dredging (**WP2**)
- Debris and gravel trap (**WP3**)
- Flood defence walls and drainage along South Bank (**WP4**)
 - Construction of Temporary Causeway
 - Construction of sheet piles including end caps/reinforced concrete walls
 - Construction of reinforced concrete walls
 - Construction of stormwater drainage and associated works
 - Public realm
- Flood defence walls, embankment and drainage along North Bank (**WP5**)
 - Enabling works and haul road construction
 - Installation of sheet piles including reinforced concrete retaining wall
 - Embankment construction
 - Foundation preparation

The calculations assume that plant items are operating simultaneously, as outlined in the following sections. Mitigation, in the form of a 2.4m hoarding, has been applied to WP1, resulting in a reduction of 10dB(A). This is due to the break in the line of sight from source to receiver side of the hoarding and its density which will be a minimum of 7kg/m², see **Section 9.6.1.1**.

As outlined in **Section 9.2.6.2**, it is accepted that during some work packages it may be difficult to effectively screen the construction works. In such areas, a more conservative assumption of partial screening has been applied, resulting in a reduction of 5dB(A). This has been applied to WP2, WP3, WP4 and WP5.

The calculations also assume that all plant items associated with the individual phases are operating simultaneously and at the distance specified for each phase.

Typically, construction will be from 7am to 7pm, Monday to Friday and 8am to 2pm on Saturday. The construction duration of work packages 1-5 is estimated at 54 months from 2023 (advance archaeological works and ESB diversions will take place in 2022) based on the reasonable worst case assessed herein. However, work will not be continuous over this period as the in-channel works are restricted to the summer months (approximately from May to September inclusive).

Figure 5.1 in **Chapter 5**, *Construction Strategy* outlines the sequence and duration of the WPs. These timelines are incorporated into the duration of effect for each WP assessment.

As outlined in **Section 9.2.5.6**, night-time works may be required during Work Package 1, for both bridge grouting, and Option 3 (micro piling from bridge). It is anticipated that there will be other times due to exceptional circumstances that construction works will be necessary outside of the standard hours. This will be

agreed in advance with Wicklow County Council (WCC) and communicated to local residents with an estimation of the timing and duration.

9.5.1.2 WP 1

Daytime Assessment

Table 9.14 outlines the predicted noise levels for WP1 at the three nearest sensitive receptors (refer to **Figure 9.2**).

Table 9.14: Predicted Sound Pressure Levels at the Nearest Sensitive Receptors to WP1

Phase	Receptor ID (see Fig 9.2)	Approx. distance to works (m)	Baseline Noise Level daytime (dBA)	Predicted Noise Level ($L_{Aeq, 1 hr}$) dB(A)	Exceed daytime noise limit of 70dB L_{Aeq}	Total predicted noise level dB(A)	Impact Rating (refer to Table 9.5)
Enabling Works	R01	30	63.4	66	No	68	Slight
	R02	20	63.4	69	No	70	Slight
	R03	40	66.0	63	No	68	Slight
Option 1 – Traditional Underpinning	R01	30	63.4	66	No	68	Slight
	R02	20	63.4	70	No	71	Slight
	R03	40	66.0	64	No	68	Slight
Option 2 – Micro Piling from Riverbed	R01	30	63.4	54	No	64	Slight
	R02	20	63.4	57	No	64	Slight
	R03	40	66.0	51	No	66	Slight
Option 3 - Micro Piling from Bridge	R01	30	63.4	54	No	64	Slight
	R02	20	63.4	57	No	65	Slight
	R03	40	66.0	51	No	66	Slight
Option 4 – Extensive Formation Improvement	R01	30	63.4	66	No	68	Slight
	R02	20	63.4	70	No	71	Slight
	R03	40	66.0	64	No	68	Slight
Concrete Pump + Cement Mixer Truck (Discharging)	R01	30	63.4	57	No	64	Slight
	R02	20	63.4	60	No	65	Slight
	R03	40	66.0	54	No	66	Slight
Lowering of Arklow Bridge Floor	R01	30	63.4	66	No	68	Slight
	R02	20	63.4	70	No	71	Slight
	R03	40	66.0	64	No	68	Slight
Scour protection of	R01	30	63.4	57	No	64	Slight
	R02	20	63.4	61	No	65	Slight

Phase	Receptor ID (see Fig 9.2)	Approx. distance to works (m)	Baseline Noise Level daytime (dBA)	Predicted Noise Level (L _{Aeq, 1 hr}) dB(A)	Exceed daytime noise limit of 70dB _{L_{Aeq}}	Total predicted noise level dB(A)	Impact Rating (refer to Table 9.5)
Arklow Bridge	R03	40	66.0	55	No	66	Slight

The results of the assessment indicate that for all phases of WP1 outlined in **Table 9.14**, the daytime noise limit of 70 dB L_{Aeq} can be complied with at the nearest sensitive receptors. The impact ratings associated with these works are short term (over three years), slight and negative.

The above calculations are indicative and are used for the purposes of comparison only with the adopted criteria.

9.5.1.3 Night-time Assessment – Bridge Grouting

As outlined in **Section 9.2.5.6**, night-time works are required for Bridge Grouting Works. As such, **Table 9.15** outlines the predicted noise levels for this works element at the three nearest sensitive receptors (refer to **Figure 9.2**).

Table 9.15: Night-time Assessment for Bridge Grouting Works

Phase	Receptor ID (see Fig 9.2)	Approx. distance to works (m)	Baseline Noise Level daytime (dBA)	Predicted Noise Level (L _{Aeq, 1 hr}) dB(A)	Exceed night time noise limit of 55 dB _{L_{Aeq}}	Total predicted noise level dB(A)	Impact Rating (refer to Table 9.5)
Bridge Grouting	R01	30	58.5	55	Yes	60	Slight to moderate
	R02	20	58.5	58	Yes	61	Slight to moderate
	R03	40	55.9	52	No	57	Slight to moderate

Night-time Assessment – Option 3

As outlined in **Section 9.2.5.6**, night-time works may be required if Option 3 (micro piling from bridge) is selected. As such, **Table 9.16** outlines the predicted noise levels for this works element at the three nearest sensitive receptors (refer to **Figure 9.2**).

Table 9.16: Night-time Assessment for Bridge Piling Works

Phase	Receptor ID (see Fig 9.2)	Approx. distance to works (m)	Baseline Noise Level daytime (dBA)	Predicted Noise Level ($L_{Aeq, 1 hr}$) dB(A)	Exceed night time noise limit of 55 dBL _{Aeq}	Total predicted noise level dB(A)	Impact Rating (refer to Table 9.5)
Option 3 - Micro Piling from Bridge	R01	30	58.5	54	Yes	60	Slight to moderate
	R02	20	58.5	57	No	61	Slight to moderate
	R03	40	55.9	51	No	57	Slight to moderate

The results of both assessments (**Table 9.15** and **Table 9.16**) indicate that for potential night time works for WP1, the night time noise limit of 55 dB L_{Aeq} can be complied with at R02 and R03. At R01, the night-time noise limit of 55 dB L_{Aeq} may be exceeded. The impact ratings associated with these works are slight to moderate, short term and negative. The impact ratings will reduce as the works move along the bridge, away from the receptors.

It is observed that baseline noise levels exceed the predicted noise levels, however, it is acknowledged that this could change during quieter periods during the night. For robustness, it has been assumed that noise levels during the night could be lower than those presented in **Table 9.16**. Hence, moderate, short term, negative impacts are predicted.

The above calculations are indicative and are used for the purposes of comparison only with the adopted criteria.

9.5.1.4 WP 2

Table 9.17 outlines the predicted noise levels for WP2 at the three nearest sensitive receptors (refer to **Figure 9.2**).

Table 9.17: Predicted Sound Pressure Levels at the Nearest Sensitive Receptors to WP2

Phase	Receptor ID (see Fig 9.2)	Approx. distance to works (m)	Baseline Noise Level daytime (dBA)	Predicted Noise Level ($L_{Aeq, 1 hr}$) dB(A)	Exceed daytime noise limit of 70 /65 dBL _{Aeq}	Total predicted noise level dB(A)	Impact Rating (refer to Table 9.5)
Channel Dredging	R04	15	63.4	67	No (70)	69	Slight
	R05	20	48.6	65	No (65)	65	Slight
	R06	25	47.6	63	No (65)	63	Slight

The results of the assessment indicate that for the construction phase of WP2 outlined in **Table 9.17**, the daytime noise limits of 65 and 70 dB L_{Aeq} can be

complied with. The impact ratings associated with these works are slight, temporary and negative.

The above calculations are indicative and are used for the purposes of comparison only with the adopted criteria.

Banded Assessment

Due to the transient nature of the channel dredging works,

Table 9.18 outlines the predicted noise levels for WP2 at banded distances.

Table 9.18: Predicted sound pressure levels at various distances to WP2

Phase	Predicted Noise Level ($L_{Aeq, 1 \text{ hr}}$) at various distances			
	15m	20m	25m	30m
Channel Dredging	67	65	63	61

The results of the assessment in **Table 9.18** indicate that for the channel dredging phase, the daytime noise limit of 65 dB L_{Aeq} can be complied with at distances of greater than 20m.

9.5.1.5 WP 3

Table 9.19 outlines the predicted noise levels for WP3 at the three nearest sensitive receptors (refer to **Figure 9.2**).

Table 9.19: Predicted Sound Pressure Levels at the Nearest Sensitive Receptors to WP3

Phase	Recept or ID (see Fig 9.2)	Approx. distance to works (m)	Baseline Noise Level daytime (dBA)	Predicted Noise Level ($L_{Aeq, 1 \text{ hr}}$) dB(A)	Exceed daytime noise limit of 65dB L_{Aeq}	Total predicted noise level dB(A)	Impact Rating (refer to Table 9.5)
Debris Trap - Phase 1	R06	20	48.6	68	Yes	68.0	Moderate
	R05	40	48.6	62	No	62.2	Slight
Gravel Trap - Phase 1	R06	20	48.6	61	No	61.2	Slight
	R05	40	48.6	55	No	55.9	Slight
Concrete Pump + Cement Mixer Truck (Discharging)	R06	20	48.6	54	No	55.4	Slight
	R05	40	48.6	48	No	51.3	Slight

The results of the assessment indicate that for daytime works for WP3 outlined in **Table 9.19**, the day time noise limit of 65 dB L_{Aeq} can be complied with at all receptors during all phases with the exception of debris trap works at R07. The impact ratings associated with these works are slight to moderate, temporary, negative. The above calculations are indicative and are used for the purposes of comparison only with the adopted criteria.

9.5.1.6 WP 4

Table 9.20 outlines the predicted noise levels for WP4 at the three nearest sensitive receptors (refer to **Figure 9.2**).

Table 9.20: Predicted Sound Pressure Levels at the Nearest Sensitive Receptors to WP4

Phase	Receptor ID (see Fig 9.2)	Approx. distance to works (m)	Baseline Noise Level daytime (dBA)	Predicted Noise Level ($L_{Aeq, 1 hr}$) dB(A)	Exceed predicted daytime noise limit of 70 / 65 dBL_{Aeq}	Total predicted noise level dB(A)	Impact Rating (refer to Table 9.5)
Construction of Temporary Causeway (assuming sheet pile method)	R02	16m	63.4	68	No (70)	70	Slight
	R08	19m	57.3	67	Yes (65)	67	Moderate
	R09	24m	57.3	65	Yes (65)	66	Moderate
Construction of Sheet Piles including End Caps/ Reinforced concrete walls	R02	12m	63.4	71	Yes (70)	72	Moderate
	R08	15m	57.3	69	Yes (65)	69	Moderate
	R09	20m	57.3	66	Yes (65)	67	Moderate
	R07	17m	47.6	68	Yes (65)	68	Moderate
Construction of Reinforced Concrete Walls	R02	12m	63.4	69	No (70)	71	Slight
	R08	15m	57.3	68	Yes (65)	68	Moderate
	R09	20m	57.3	65	No (65)	66	Slight
	R07	17m	47.6	66	Yes (65)	66	Moderate
Construction of Stormwater Drainage and Associated Works	R02	12m	63.4	66	No (70)	69	Slight
	R08	15m	57.3	64	No (65)	66	Slight
	R09	20m	57.3	61	No (65)	64	Slight
	R07	17m	47.6	63	No (65)	64	Moderate
Public Realm	R02	12m	63.4	69	No (70)	71	Slight
	R08	15m	57.3	67	Yes (65)	68	Moderate
	R09	20m	57.3	65	No (65)	67	Slight
	R07	17m	47.6	66	Yes (65)	67	Moderate

The results of the assessment indicate that for daytime works for WP4, the daytime noise limit can be complied with partially. The impact ratings associated with these works are slight to moderate, negative and short term.

The above calculations are indicative and are used for the purposes of comparison only with the adopted criteria.

Banded Assessment

Due to the transient nature of the works associated with WP4, a banded assessment has been carried out to predict noise levels at locations other than those presented in **Table 9.21** outlines the predicted noise levels for WP4 at banded distances.

Table 9.21: Predicted sound pressure levels at the nearest sensitive receptors to WP4

Phase	Predicted Noise Level ($L_{Aeq, 1 \text{ hr}}$) at various distances			
	15m	20m	25m	30m
Construction of Temporary Causeway (assuming sheet pile method)	69	66	64	63
Construction of Sheet Piles including End Caps/ Reinforced concrete walls	69	66	64	63
Construction of Reinforced Concrete Walls	68	65	63	62
Construction of Stormwater Drainage and Associated Works	64	61	59	58
Public Realm	67	65	63	61
Drainage Works	70	67	65	64

The results of the assessment in **Table 9.21** indicate that for WP4, the daytime noise limit of 70 dB L_{Aeq} can generally be complied with at distances of greater than 15m and limit of 65 dB L_{Aeq} can generally be complied with at distances of greater than 25m.

Night-time Assessment – Option 3

Due to the closer proximity of the drainage works along Main Street and Bridge Street, a separate banded assessment has been undertaken in **Table 9.22**. While no sensitive receptors have been identified on Main Street or Bridge Street (both are primarily commercial streets), as a worst case, an assessment is undertaken and presented in **Table 9.22**.

Table 9.22: Predicted sound pressure levels at the nearest sensitive receptors to WP4 (Drainage Works)

Phase	Predicted Noise Level ($L_{Aeq, 1 \text{ hr}}$) at various distances				
	10m	20m	30m	40m	50m
Drainage Works	68	62	59	56	54

The results of the assessment indicate that for night-time works for WP4, the night-time noise limit of 55 dB L_{Aeq} will be exceeded until at a distance of 45m. The impact ratings associated with these works are significant and negative. The duration will 1-2 weeks, categorised as temporary (see **Table 9.5**) but in practice, closer to brief.

The above calculations are indicative and are used for the purposes of comparison only with the adopted criteria.

9.5.1.7 WP 5

Table 9.23 outlines the predicted noise levels for WP5 at the three nearest sensitive receptors (refer to **Figure 9.2**).

Table 9.23: Predicted Sound Pressure Levels at the Nearest Sensitive Receptors to WP5

Phase	Receptor ID (see Fig 9.2)	Approx. distance to works (m)	Baseline noise level daytime (dBA)	Predicted noise level ($L_{Aeq, 1 hr}$) dB(A)	Exceed predicted daytime noise limit of 65 dBL_{Aeq}	Total predicted noise level dB(A)	Impact Rating (refer to Table 9.5)
Enabling Works – Haul Road	R10	60	50.8	55	No	56	Slight
	R03	25	66.0	63	No	68	Not significant
	R11	30	50.8	61	No	61	Not significant
Installation of Sheet Piles including Reinforced Concrete Retaining Wall	R10	60	50.8	51	No	54	Slight
	R03	25	66.0	59	No	67	Not significant
	R11	30	50.8	57	No	58	Not significant
Embankment Construction	R10	60	50.8	58	No	59	Not significant
	R03	25	66.0	66	Yes	69	Moderate
	R11	30	50.8	64	No	64	Not significant
Foundation Preparation	R03	25	66.0	57	No	67	Not significant

The results of the assessment indicate that for daytime works for WP5 outlined in **Table 9.23**, the daytime noise limit can be complied with.

The impact ratings associated with these works range from not significant to moderate, negative and temporary. Impacts will reduce at each of the receptors as the construction works progress.

The above calculations are indicative and are used for the purposes of comparison only with the adopted criteria.



Figure 9.2: Noise Receptors. Not to scale. Extracted from Drawing No 1003

9.5.1.8 Sheet Piling and Rotary Coring

As outlined in Section 9.2.6.5, sheet piling is proposed along South Quay and River Walk. A screening assessment, using empirical formula outlined in BS 5228-2⁴ to estimate groundborne vibration for vibratory sheet piling, has been undertaken where;

- v_{res} is the resultant PPV (peak particle velocity) in mm/s;
- k_v is a scaling factor (60 – 266 depending on probability of predicted values being exceeded. A value of 126 has been applied for screening relating to a 33% chance of exceedance);
- δ is an operations factor (assumed as 1.3, the average factor over both steady state and start up/rundown operations); and
- x is the distance measured along the ground surface in metres.

For structurally sound structures, a screening assessment has demonstrated that at distances of more than 8m, predicted results comply with the limits outlined in **Table 9.7** for the more restrictive limit (less than 10Hz). This distance decreases to 5m at higher frequencies. Vibration impacts from sheet piling at Arklow Bridge are considered not significant.

As outlined in **Table 9.9**, rotary coring through the piers for the underpinning for Arklow Bridge is a potential source of vibration. Given the current traffic volumes crossing Arklow Bridge, vibration effects from these construction phases are not predicted to be significant. Further detail on the mitigation and monitoring measures proposed are outlined in **Section 9.6**.

9.5.2 Operational

A surface water drainage network and pumping stations will be constructed on the dry side of the flood defence walls along River Walk, South Quay and the Dock to prevent flooding occurring from rainwater run-off from hardstanding areas in the flood zones when gravity discharge is prevented by flood events. In total, six non return valves are required at the pump stations outlet points. As the pumps will be in operation during emergency flooding events only, their impact on nearby receptors is not considered significant.

9.5.3 Maintenance

Regular maintenance activities will be required for the following elements of the Scheme: Stormwater drainage system including pumping stations and non-return valves; gravel and debris traps; river channel; riverbank vegetation.

In addition, regular inspection will be carried out on all other elements of the Scheme including; demountable flood defence barriers; flood gate; flood defence walls including glass panels; flood defence embankment; bridge piers and abutments and scour protection slab.

The impact of the maintenance phase is not considered significant.

9.6 Mitigation Measures and Monitoring

9.6.1 Mitigation

9.6.1.1 Mitigation During Construction

Management Plans and Method Statements

The information provided in the following sections will form part of the Construction Environmental Management Plan (CEMP), as outlined in **Appendix 5.1**. This included of the Construction Environmental Management Plan, detailed construction methodologies, phasing and equipment and, mitigation measures. The appointed Contractor(s) will revise these sections, as appropriate, prior to the commencement of works.

The CEMP will outline how the appointed Contractor(s) will comply with the noise criteria set out in this section and will deal specifically with construction activities in a strategic manner to remove or reduce significant noise and vibration impacts associated with the construction of the proposed development. The CEMP will detail the provision and installation of localised acoustic screens, the best practice noise measures that the appointed Contractor(s) will be required to adhere to for construction activities and the noise and vibration monitoring programme that the appointed Contractor(s) will be required to undertake during the construction works.

In addition, the appointed Contractor(s) will prepare detailed method statements addressing the likely noise and vibration levels that will be generated as a result of the construction activities once the specific details of the proposed plant items and construction methodologies are known.

Where considered necessary, structural surveys will be undertaken at sensitive receptors in close proximity to the works to establish their condition and tolerance for vibration impacts.

General

The following section describes measures to minimise the potential for noise and vibration disturbance to the surrounding area which will be employed by the contractor to ensure the construction noise and vibration criteria outlined in and are not exceeded.

The Contractor will take specific noise abatement measures and comply with the recommendations of BS 5228-1 and 2:2009+A1:2014⁵ *Code of practice for noise and vibration control on construction and open sites. Noise and vibration⁵* and the *European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001¹⁵*.

The following specific measures will be implemented during the construction

¹⁵ European Communities (2001) *European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001*

phase:

- A site representative shall be appointed to be responsible for matters relating to noise and vibration;
- Construction of temporary infrastructure (e.g. haul roads) will be with materials that minimise noise and vibration and design of haul roads will minimise reversing;
- Internal haul roads shall be well maintained;
- No unnecessary revving of engines, equipment should be switched off when not required;
- Rubber linings shall be used in chutes and dumpers etc. to reduce noise;
- Drop heights of materials shall be minimised;
- Water pumps and generators will be located away from sensitive receivers and will be enclosed;
- Selection of equipment, construction methods and programming with the objective of reducing noise and vibration where possible. Only equipment, including road vehicles, conforming to relevant national or international standards, directives and recommendations on noise and vibration emissions, will be used;
- Plant and vehicles shall be started sequentially rather than all together;
- Selecting electrically powered plant that is quieter than diesel or petrol-driven plant, if interchangeable;
- Fitting suitable anti-vibration mountings where practicable, to rotating and/or impacting equipment;
- Using noise-control equipment such as jackets, shrouds, hoods, and doors, and ensuring they are closed;
- Locate plant, as far as is reasonably practicable, away from receptors or as close as possible to noise barriers or hoardings where these are located between the source and receptor;
- Regular and effective maintenance by trained personnel shall be carried out to reduce noise and/or vibration from plant and machinery;
- Ensuring that all plant is maintained regularly to comply with relevant national or international standards and operation of plant and equipment that minimises noise emissions;
- Ensuring that plant is shut down when not in use;
- Ensuring that air lines are maintained and checked regularly to prevent leaks;
- Designing all audible warning systems and alarms to minimise noise. Non-audible warning systems can be used in preference, i.e. cab-mounted CCTV or the use of banksmen. If required, ensure that audible warning systems are switched to the minimum setting required by the Health and Safety Authority and where practicable use ‘white noise’ reversing alarms in place of the usual ‘siren’ style reversing alert

- A c. 2.4m hoarding of density of at least 7kg/m² shall be provided around construction works.
- Handling all materials, particularly steelwork, in a manner that minimises noise. For example, storing materials as far as possible away from sensitive receptors and using resilient mats around steel handling areas;
- During construction, regular inspections will be undertaken to ensure that the noise and vibration minimising methods, plant and mitigation identified in the specimen design stage are adopted on site and are working effectively. If applicable, it is proposed that construction method inspections be integrated into any health and safety or quality surveillance regime;
- Typically, site activities shall be limited to 7am – 7pm, Monday to Friday; and 8am – 2pm, Saturday. As outlined in **Section 9.2.5.6**, night-time works may be required if Option 3 (micro piling from bridge) for WP2 is selected. It is anticipated that there will be other times due to exceptional circumstances that construction works will be necessary outside of the standard hours. This will be agreed in advance with Wicklow County Council and communicated to local residents with an estimation of the timing and duration
- A Communications Management Plan shall be prepared to provide for effective community liaison to help ensure the smooth running of construction activities and to address any issues that may arise.

Night-time Works (WP1)

As outlined in **Section 9.5.1.2**, night-time works (for Bridge Grouting and Option 3 (micro piling from bridge)) are predicted to generate moderate, short term, negative impacts. As these impacts are during night-time more targeted mitigation measures are specified;

- A c. 2.4m hoarding of density of at least 7kg/m² shall be provided around construction works both at deck level and river level. This hoarding will be placed as close to the noise sources as possible and moved continuously as the works progress along the bridge.
- Using noise-control equipment such as jackets and shrouds around any pumps and engine, including excavators, at river level.

Effective implementation of these measures will reduce the impact during the quietest periods of night-time works from; moderate, short term, negative impacts to slight, short term, negative impacts.

Effective implementation of these measures will reduce the impact during the quietest periods of night-time works from; moderate, short term, negative impacts to slight, short term, negative impacts.

Drainage Works (WP4)

As outlined in Section 9.5.1.6, the impact ratings associated with these works at less than 10m are moderate, negative and temporary. As such, more targeted mitigation measures are specified.

- A c. 2.4m hoarding of density of at least 7kg/m² shall be provided around construction works. This hoarding will be placed as close to the noise sources as possible and moved continuously as the works progress along.

Effective implementation of these measures will reduce the from; moderate, short term, negative impacts to slight, short term, negative impacts.

9.6.1.2 Mitigation During Operation and Maintenance

No mitigation measures are proposed during the operational or maintenance phase of the proposed development.

9.6.2 Monitoring

9.6.2.1 Monitoring During Construction

The Main Contractor(s) shall be required to carry out continuous noise and vibration monitoring at the three closest sensitive receptors to the proposed development works during the construction phase. Environmental noise monitoring will be undertaken only by suitably trained and experienced staff.

Vibration monitoring will be undertaken on the piers of the bridge and measured against the TII guidance limits in **Table 9.7**. In the unlikely event of vibration limits being exceeded, works will cease, and alternative construction methods will be used.

Noise and vibration levels will be compared to the limit values outlined in **Table 9.4** and **Table 9.7**, respectively.

9.6.2.2 Monitoring During Operation and Maintenance

No monitoring is proposed during the operational or maintenance phase of the proposed development.

9.7 Cumulative

This section includes an assessment of the potential for likely significant direct and indirect cumulative effects of projects listed in **Table 20.1** in **Chapter 20, Cumulative and Interactive Effects** in combination with the proposed scheme and taken together in combination with the proposed scheme. As the proposed development has no operational noise impacts, only the construction phase has been examined cumulatively.

Projects that require detailed assessment are presented in **Section 9.8.3**. The following projects were not deemed necessary for detailed assessment.

Action Health Enterprises GP Limited The Former Boland's Builders Providers, Castle Park (181170)

This project relates to the development of a primary care facility at Castle Park.

Given the moderate scale of this project, in terms of both construction activities and construction traffic, there is minimal potential for cumulative noise and vibration effects to arise. As construction activities will be undertaken approximately 150m from the proposed development and will be screened by the line of properties on Mains Street, no significant negative cumulative effects are predicted at the receptors considered for the proposed development.

Circle K Safeway Service Station (20426)

This project relates to the demolition of the existing, and construction of a new, fuel forecourt at the existing Circle K service station, which is located immediately adjacent to Arklow Town Marsh and SC1 of the proposed scheme.

Given the minor scale of this project, in terms of both construction activities and construction traffic, there is minimal potential for cumulative noise and vibration effects to arise. As construction activities will be undertaken approximately 150m from the proposed development no significant negative cumulative effects are predicted.

No 7 and 8 Bridge Street & No 34 Main Street (19750)

The project relates to the demolition of two existing buildings and the construction of a new retail and commercial building on Main Street.

Given the minor scale of this project, in terms of both construction activities and construction traffic, there is minimal potential for cumulative noise and vibration effects to arise. As construction activities will be undertaken approximately 140m from the proposed development no significant negative cumulative effects are predicted.

Gaines Europe Ltd Unit 1A Lower Tinahask, South Quay (16248)

This project relates to the development of a new warehouse and distribution facility at Arklow Harbour.

Given the moderate scale of this project, in terms of both construction activities and construction traffic, there is potential for cumulative noise and vibration effects given that construction activities will be undertaken approximately 50m from the proposed development. However, the nearest sensitive receptor is located approximately 300m from the works. Therefore, no significant cumulative effects are predicted.

Gaines Europe Ltd Tinahask Lower, South Quay (16414)

This project relates to the demolition of an existing industrial building at Arklow Harbour.

Given the major scale of this project, in terms of both construction activities and construction traffic, there is potential for cumulative noise and vibration effects. However, given that construction activities will be undertaken approximately 50m from the proposed development, on the opposite side of the Arklow Harbour, no significant cumulative effects are predicted. In addition, construction works associated with the adjacent development will be monitored to ensure compliance with its noise and vibration limits.

Joby Developments North Quay, Arklow (15857)

This project relates to the demolition of existing structures and construction of retail and residential units at North Quay.

Given the moderate scale of this project, in terms of both construction activities and construction traffic, there is potential for cumulative noise and vibration effects. However, given that the main construction activities will be undertaken approximately 200m from the proposed development, on the opposite side of the Arklow River, no significant cumulative effects are predicted. In addition, construction works associated with the adjacent development will be monitored to ensure compliance with its noise and vibration limits.

Mill Sea Ltd North Quay, Arklow (18316)

Given the minor scale of this project, in terms of both construction activities and construction traffic, there is minimal potential for cumulative noise and vibration effects to arise. As the main construction activities will be undertaken approximately 140m from the proposed development on the opposite side of the Arklow Rive no significant negative cumulative effects are predicted.

Wicklow County Council Inner Harbour/Dock, Off South Quay (20469)

This project relates to the development of storage units at Arklow Harbour.

Given the minor scale of this project, in terms of both construction activities and construction traffic, there is minimal potential for cumulative noise and vibration effects to arise. As the construction activities will be undertaken approximately 150m from the main construction works proposed development on the opposite side of the Arklow River, no significant negative cumulative effects are predicted.

Crag Digital Avoca Limited (18940/201285)

This project relates to the development of data centre as the Avoca Rove Park industrial Estate. As the construction activities will be undertaken approximately 2.5km from the main construction works proposed development, no significant negative cumulative effects are predicted.

Arklow Bank Wind Park, Co. Wicklow - Pre-Application (306662)

This project relates to the development of onshore transmission connection infrastructure related to the Arklow Bank Wind Park offshore wind energy project.

As the construction activities will be undertaken approximately 2km from the main construction works proposed development, no significant negative cumulative effects are predicted.

Parade Ground- WCC Part 8

This project relates to public realm improvement works at Parade Ground, Arklow, which at its closest, is approximately 50m from the proposed development.

Given the minor scale of this project, in terms of both construction activities and construction traffic, there is minimal potential for cumulative noise and vibration effects to arise.

FORESHORE

FS007049 Sure Partners Site Investigations at Arklow Bank

Due to the offshore location and nature of this development, no negative likely significant cumulative effects are identified in relation to noise and vibration. .

All projects taken together in combination with the proposed scheme

Overall, taking all of the projects together in-combination with the proposed scheme, there is the potential for moderate, negative and short-term effects in combination with the proposed scheme. However, construction works associated with the adjacent developments will be monitored to ensure compliance with their own noise and vibration limits.

9.8 Residual Effects

9.8.1 Residual Effects During Construction

A noise assessment of the construction phase impacts has shown that compliance with noise limit values in can be achieved at the nearest sensitive receptors to the proposed works for WP1 (daytime) and WP2. For all other WPs, noise limits are predicted to be exceeded at the nearest sensitive receptors.

The implementation of the mitigation measures outlined in **Section 9.6** will assist in reducing the impact on nearby sensitive receptors. Residual short-term, slight to moderate negative impacts are predicted during the construction phase of the proposed development. **Table 9.24** summaries the residual impacts during the construction phase.

Table 9.24: Summary of Residual Impacts During Construction Phase

Construction phase	Summary of impact Post Mitigation
WP1 – daytime assessment	Short term, slight and negative.
WP1 – night-time assessment	Short term, slight to moderate and negative.
WP2 – daytime assessment	Temporary, slight and negative.
WP3 – daytime assessment	Temporary, slight to moderate, and negative.
WP4 – daytime assessment	Short term, slight to moderate, and negative.

Construction phase	Summary of impact Post Mitigation
WP5 – daytime assessment	Not significant to moderate, short term and negative.

9.8.2 Residual Effects During Operation

No residual impacts are predicted during the operation and maintenance phase of the proposed development.

9.8.3 Residual Effects During Cumulative

This section considers the potential for in combination construction impacts arising from the proposed development together with the Irish Water Arklow Wastewater Treatment Plant at the same time. In assessing the worst-case cumulative impact, the highest predicted sound levels for both schemes are examined, at the same receptor. **Table 9.25** outlines the results for this assessment.

As noted in **Section 2.6.1 of Chapter 2, *Background and Need for the Scheme***, the proposed WwTP will physically overlap with the Arklow Flood Relief Scheme (FRS) as there are common areas within the town where works for both the proposed WwTP and FRS developments will be undertaken. It has been agreed between OPW and Irish Water that the project that is first able to progress the directly overlapping construction works on site will do so. Refer to **Section 2.6.3 of Chapter 2, *Background and Need for the Scheme***, for further details on the interactions between the two schemes.

Taking that into consideration the construction works assessed cumulatively are sheet piled foundations for the flood defence walls and the construction of the TBM launch shaft for the WWTP on North Quay.

In practice, due to physical constraints, only limited works may be able to occur concurrently during the construction phase of the proposed development, limiting the potential for cumulative noise and vibration effects.

Table 9.25: Cumulative Noise Assessment with Proposed Development and Arklow WwTP

Arklow WwTP ¹⁶			Arklow FRS			Total Predicted Cumulative Noise Level (dB L _{Aeq,1hr})
Receptor Number	Phase	Predicted Noise (dB L _{Aeq,1hr})	Equivalent Receptor Number	Phase	Predicted Noise (dB L _{Aeq,1hr})	
S05	TBM shaft construction on North Quay	51	R02 (S03)	WP4 (Sheet pile construction)	71	71

Should the works outlined in **Table 9.25** occur simultaneously, the overall predicted impact would not be greater than the impact of the FRS works (71 dB L_{Aeq,1hr}). In accordance with **Table 9.5**, this impact is considered moderate, such that moderate, negative and short-term effects are predicted.

9.9 References

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¹⁶ Irish Water, 2018. Arklow Wastewater Treatment Plant Project. <https://www.water.ie/planning-sites/arklow-wastewater/docs/environmental-documents/volume-2/Arklow%20WWTP%20EIA%20-%20Chapter%2010%20Noise%20Vibration.pdf>

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