

12 NOISE AND VIBRATION

12.1 Introduction

This noise and vibration impact assessment has been prepared by AONA Environmental Consulting Ltd. to assess the existing noise and vibration levels in the area of the proposed River Poddle Flood Alleviation Scheme and to assess the potential impacts of construction of the Scheme from noise and vibration on the nearest sensitive receivers.

There are no mechanical elements such as removable flood defences proposed in the River Poddle Flood Alleviation Scheme. Therefore, there will be no operational noise impact.

The assessment and evaluation of the noise impact involved the following:

- Baseline Noise Survey – noise monitoring during daytime in proximity to the residential receivers in the vicinity of the development. The purpose of the noise monitoring survey was to evaluate the existing daytime noise climate in the area.
- Noise level predictions of the main likely noisy components of the construction of the proposed development at the nearest noise sensitive receivers.
- An assessment of the predicted noise and vibration impact on the nearest residential receivers against relevant noise and vibration guidelines and a review of the potential for noise and vibration nuisance and complaint. Appropriate construction noise and vibration limits have been outlined.
- A recommendation of appropriate noise and vibration mitigation measures, if required.

12.2 Statement of Authority

The Noise & Vibration Impact Assessment has been prepared by Mervyn Keegan. Mervyn Keegan is a Director of the environmental consultancy, AONA Environmental Consulting Ltd. Mervyn Keegan's areas of professional expertise includes Noise and Vibration & Air Quality and Climate impact assessment and mitigation design. Mervyn Keegan has over 20 years of environmental consultancy experience. Mervyn is a full member of the Institute of Acoustics, with a Bachelor of Science Degree (Applied Sciences), a Master of Science Degree (Environmental Science) and a Diploma in Acoustics in Noise Control. AONA Environmental Consulting Ltd. is an independent consultancy specialising in Environmental Impact Assessment and Licensing. Mervyn Keegan (AONA Environmental Consulting Ltd.) has prepared numerous Noise & Vibration impact assessments per annum for a wide range of development types in the Republic of Ireland, Northern Ireland and the UK in the last 15 years. Mervyn Keegan is an expert in the awareness and understanding of the relevant legislation and guidance that pertains to best practise in such assessments. Mervyn Keegan has appeared as an Expert Witness at oral hearings, public inquiries and legal proceedings. Mervyn Keegan has produced Noise and Vibration Impact Assessment reports to assess the impacts of a range of development types including roads, residential developments, industrial developments, quarries and mines and wind energy developments among others.

12.3 Methodology

12.3.1 Construction Noise Guidelines

There are no national construction noise limit guidelines. Instead, there are indicative levels of acceptability for construction noise, as contained in the National Roads Authority (now Transport Infrastructure Ireland or TII) "*Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes*" (March 2014) and outlined in **Table 12-1**.

Table 12-1: Maximum permissible noise levels at the façade of dwellings during construction

Days & Times	L _{Aeq} (1hr) dB	L _{AMax} dB
Monday to Friday - 07.00 to 19.00	70	80*
Monday to Friday - 19.00 to 22.00	60*	65*
Saturday - 08.00 to 16.30	65	75
Sundays and Bank Holidays - 08.00 to 16.30	60*	65*

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

(Ref. TII Guidelines)

12.3.2 Assessing Significance of Construction Noise Impacts

Annex E of BS5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*, provides guidance on assessing the potential significance of noise effects from construction activities. In relation to construction noise limits, BS 5228-1:2009+A1: 2014 *Noise and Vibration Control on Construction and Open Sites Part 1: Noise* details the 'ABC method', which recommends a construction noise limit based on the existing ambient noise level. General and short-term construction noise impacts that are deemed typical of any construction site noise sources, including activities such as ground preparation, site clearance, foundation earthworks, erection of new buildings, etc. are assessed in accordance with the 'ABC method' defined in BS 5228.

For the proposed River Poddle Flood Alleviation Scheme, the ambient noise levels have been determined through the baseline noise survey and then rounded to the nearest 5dB to determine the appropriate category (A, B or C) and subsequent threshold value. A potential significant effect is indicated if the construction noise level exceeds the appropriate category threshold value. If the existing ambient level exceeds the threshold category values, then a potential significant impact is indicated if the total noise level, including both the ambient noise and the various contributions of construction noise, is greater than the ambient noise level by more than 3dB. **Table 12-2**, reproduced from BS5228, demonstrates the criteria for selection of a noise limit for a specific receiver location.

Table 12-2: Construction noise threshold levels based on the BS 5228 'ABC' method

Assessment Category and Threshold value period (L _{Aeq})	Threshold value, in decibels (dB)		
	Category A (A)	Category B (B)	Category C (C)
Night time (23.00 to 07.00)	45	50	55
Evening and weekends ^(D)	55	60	65
Daytime (07.00 – 19.00) and Saturdays (07.00 - 13.00)	65	70	75

Notes:

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

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

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

19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.

12.3.3 Construction Vibration Guidelines

The relevant guidelines for vibration limits are the following:

- British Standards Institution. *British Standard 7385: Evaluation and measurement for vibration in buildings. Part 1: Guide for measurement of vibration and evaluation of their effects on buildings.* 1990.
- British Standards Institution. *British Standard 7385: Evaluation and measurement for vibration in buildings. Part 2: Guide for damage levels from ground borne vibration.* 1993.
- British Standards Institution. *British Standard 6472: Guide to evaluation of human exposure to vibration in buildings. Part 1: Vibration sources other than blasting.* 2008.
- National Roads Authority (now TII), *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes*, March 2014.

Relevant vibration limits and guidelines can be divided into two categories, those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. Higher levels of vibration are typically tolerated for single events or events of short duration such as during construction projects compared to permanent vibration from operational industrial sources. For example, blasting (an instantaneous activity) and piling (a repetitive/continuous activity), two of the primary sources of vibration during construction projects, are typically tolerated at vibration levels up to 12mm/s and 2.5mm/s, respectively.

The TII Guidelines (March 2014) identify limits for protection against cosmetic damage as a function of vibration frequency, and are:

- 8 mm/s (vibration frequency <10Hz)
- 12.5 mm/s (vibration frequency 10 to 50Hz)

- 20 mm/s (vibration frequency >50 Hz).

Guidance relevant to acceptable vibration at the foundation of buildings is contained within BS 7385 (1993): *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground-borne vibration*. This guidance states that there should typically be no cosmetic damage to buildings if transient vibration does not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz and above. These guidelines refer to relatively modern buildings.

12.3.4 Noise Survey Methodology Guidelines

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

In the EPA *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)* the steps to be followed in order to derive appropriate noise limit criteria are outlined as follows: Step 1 – Quiet Area Screening of the Development Location

- Step 2 – Baseline Environmental Noise Survey
- Step 3 – Screen for Areas of Low Background Noise
- Step 4 – Determine Appropriate Noise Criteria

The methodology in the EPA Guidance Note NG4 has been followed in order to screen for areas of low background noise and determine appropriate construction noise limits over the course of the project duration as described in **Figure 12-1**.

Table 12-3 outlines the noise limit criteria to be applied depending on the results of the screening processes in Steps 1 and 3, and the noise survey discussed in Step 2.

Table 12-3: The noise limit criteria to be applied depending on the results of the screening processes

Scenario	Daytime Noise Criterion, dB L _{Ar,T} (07:00 to 19:00hrs)	Evening Noise Criterion, dB L _{Ar,T} (19:00 to 23:00hrs)	Night-time Noise Criterion, dB L _{Aeq,T} (23:00 to 07:00hrs)
Quiet Area	Noise from the licensed site to be at least 10dB below the average daytime background noise level measured during the baseline noise survey.	Noise from the licensed site to be at least 10dB below the average evening background noise level measured during the baseline noise survey.	Noise from the licensed site to be at least 10dB below the average night-time background noise level measured during the baseline noise survey.
Areas of Low Background Noise	45dB	40dB	35dB
All other Areas	55dB	50dB	45dB

(Ref. EPA Guidance Note NG4)

12.3.5 Noise survey methodology

A daytime noise survey at the nearest residential properties to the main areas of construction activity was undertaken on Tuesday 14th May 2019. See **Figure 12-2** showing noise monitoring locations in relation to the works areas.

The noise monitoring survey was undertaken in accordance with ISO 1996 *Description and Measurement of Environmental Noise*. A Cirrus Optimus Green CR:171B sound level meter (Serial No. G068599 - Calibration Date - 09/01/2018) was used during the noise monitoring surveys. The sound level meter was placed at a height of approximately 1.5m and away from reflecting surfaces at each monitoring location. A wind shield was used on the microphone throughout the survey and the sound level meter was calibrated before and after the survey period.

The weather conditions recorded during the daytime noise monitoring surveys were sunny and dry with a temperature of approximately 16°C and a light breeze.

Sound level measurements were recorded over 15-minute intervals to allow for an assessment of fluctuating noise levels due to passing traffic on surrounding roads. All measurement data was downloaded, exported from the manufacturer's software and stored as Microsoft Excel spreadsheet files. The measurement parameters recorded during the noise surveys are defined as follows:

- L_{Aeq} is the A-weighted equivalent continuous steady sound level during the sample period and effectively represents an average value.
- L_{Amax} is the maximum A-weighted sound level measured during the sample period.
- L_{A10} is the A-weighted sound level that is exceeded for 10% of the sample period and is used to quantify traffic noise.
- L_{A90} is the A-weighted sound level that is exceeded for 90% of the sample period and is used to quantify background noise in the absence of the main noise source.

Subjective observations of the audible noise sources at each monitoring location were noted during the survey period. During the daytime monitoring periods it was noted that traffic noise from the adjacent heavily trafficked roads dominates the background noise level in the area of the proposed River Poddle Flood Alleviation Scheme.

12.3.6 Noise Prediction Methodology

As stated at the outset, the proposed River Poddle Flood Alleviation Scheme will have no operational noise impact, so this Chapter deals with the potential for daytime noise impacts during the construction phase only. The worst-case construction noise levels at specific locations in proximity to the expected main areas of construction activity have been predicted assuming specific operating 'on' times for typical equipment associated with such a construction project.

BS 5228-1:2009+A1:2014 sets out methods of predicting construction noise levels. Methods are presented for stationary and quasi-stationary activities and for mobile plant using a regular well-defined route (e.g. site haul roads). The predictions account for source-receiver distance, reflections and screening or soft ground attenuation and a percentage on-time.

The closest noise sensitive receivers to the expected main areas of construction activity and the construction compound have been selected to assess if there will be an exceedance of typical daytime construction noise limits at the noise sensitive receivers in the area.

12.4 Existing Environment

The results of the baseline noise monitoring survey are presented in **Table 12-4**. As stated previously, the background noise levels recorded were dominated by road traffic noise.

The results of the baseline noise monitoring data indicate that the noise levels at the sensitive receivers in the area of the proposed works are broadly in accordance with the World Health Organisation (WHO) *Guidelines for Community Noise*, recommended daytime levels of 50 – 55 dB(A) for outdoor living areas.

Some relatively high background noise levels of 50.2 – 52.7 dB(A) L_{90} were recorded at Limekiln Road, at Castletymon Road and in proximity to Ravensdale Park due to relatively constant traffic flows in these areas. L_{Amax} levels in excess of 65 dB(A) were frequently recorded due to noise from passing traffic. In the existing green area at the rear of the properties at Grosvenor Court and Whitehall Park along the existing River Poddle alignment, lower background noise levels of 38.1 – 43.5 dB(A) L_{90} were recorded. This is because this a relatively sheltered area with lower road traffic noise from Templeville Road.

Table 12-4: Noise monitoring data during the daytime period on Tuesday 14th May 2019

Location	Time	Duration	L_{Aeq} (dB)	L_{Amax} (dB)	L_{Amin} (dB)	L_{A10} (dB)	L_{A90} (dB)
NML 1 – Limekiln Road	09:47:48	00:15:00	56.7	68.3	49.9	59.8	52.7
	10:02:48	00:15:00	58.2	68.4	50.6	61.9	52.4
	10:17:48	00:15:00	57.1	67.2	50.1	61	51.8
	10:32:48	00:15:00	57.4	69	48.3	61.7	49.8
	10:47:48	00:15:00	56.9	68.6	48.9	61.3	50.2
	11:02:48	00:04:27	57.8	74.4	51.1	60.8	52.1
NML 2 – St. Aongus Grove	11:15:07	00:15:00	57.2	64.1	49.1	61.3	50.6
	11:30:07	00:15:00	57.3	64.6	50.1	60.3	51.9
	11:45:07	00:15:00	56.5	65.2	48.9	59.3	51.6
NML 3 – Grosvenor Court (Loc 1)	12:07:38	00:15:00	48.1	53.9	40	50.9	43.5
	12:22:38	00:15:00	49.2	58.3	39.4	51.9	43.1
	12:37:38	00:15:00	51.1	65.4	38.7	53.3	42
NML 3 – Grosvenor Court (Loc 2)	12:56:38	00:15:00	40.7	51.1	35.4	42.7	38.1
NML 4 – Poddle Park	13:13:17	00:15:00	55.5	73.3	46.3	58.5	50.1
	13:28:17	00:15:00	58.5	72.2	47.2	61.7	51.5
	13:43:17	00:04:23	60.1	76.3	46.1	63.2	50.8

When compared to the recommended noise limit criteria provided in the EPA *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)* and reproduced in **Table 12-3**, the noise measurement data obtained from the survey and reported in **Table 12-4** indicates that none of the areas could be described as 'Areas of Low Background Noise'.

12.5 Noise Impact Assessment

12.5.1 Summary of Proposed Works with potential for Noise Impact

A full description of all of the proposed works can be found in **EIAR Chapter 5The Proposed Development**. The main areas and works which are predicted to give rise to noise and vibration during construction of the River Poddle Flood Alleviation Scheme are described below. The drawings referred to are provided in **Part 2 Planning Drawings** of the planning documentation.

- 1) At Tymon North where embankments will be constructed [Site Layout Drawing Nos. 08132 & 08133] (Baseline Noise Survey Location – NML 2, ITT / St. Aongus Grove).
- 2) At Tymon Park where significant embankments with a flow control structure at Tymon Lake, and an Integrated Constructed Wetland will be constructed [Site Layout Drawing Nos. 08141, 08142, 08143, & 08146] (Baseline Noise Survey Location – NML 1, at front of No. 117 Limekiln Drive). The primary construction compound will be located within Tymon Park adjacent to the public carpark off Limekiln Road.
- 3) At green spaces at Whitehall Park and Wainsfort Manor Crescent where there is a channel diversion and flood walls planned [Site Layout Drawing Nos. 08151 & 08152]; (Baseline Noise Survey Location – NML 3, at rear of properties at Grosvenor Court and Whitehall Park). A temporary works / set down area will be established at Wainsfort Manor Crescent.
- 4) At Fortfield Road south of Kimmage Cross Roads and Ravensdale Park where there is a combination of replacing and reinforcing existing walls and new walls (to middle of park) [Site Layout Drawing No. 08155 & 08160] and at Poddle Park where manhole chambers are to be rehabilitated or replaced [Site Layout Drawing No. 08250]; (Baseline Noise Survey Location – NML 4, at side of No. 24 Ravensdale Drive). A temporary works / set down area will be established at Ravensdale Park.
- 5) The proposed works will include for construction of new flood defence walls at St. Martin's Drive, and Mount Argus, and the establishment of a secure storage area at St. Martin's Drive [Site Layout Drawing Nos. 08165 & 08170]. The construction of new flood defence walls will result in short-term construction noise impact which will not be significant at the nearest receivers. The existing background noise at these locations is represented by NML 4.
- 6) Manhole rehabilitation or replacement works will be carried out in the middle and lower reach of the River in public roads at Ravensdale Park in Kimmage, Poddle Park in Crumlin, and Saint Teresa's Garden in Merchant's Quay [Site Layout Drawing Nos. 08250 & 08251]. These works will take place predominantly within the existing public road network with works in proximity to St. Teresa's Gardens

and at the rear of the National Stadium. Construction noise impacts will be short-term at each works location and not significant in comparison to the existing background traffic noise.

- 7) Ancillary works and associated development will include rehabilitating culvert screens in locations as required; installing flap valves in all culverts draining to the River to prevent ingress of flood water to the drainage network; removal of trees where required for the proposed works; landscaping and landscape mitigation and public realm improvements in Tymon North, Tymon Park, Whitehall Park, and Ravensdale Park including replacing footbridges in Tymon Park and Ravensdale Park. These construction works will result in short-term construction noise impacts which will not be significant at the nearest receivers.

The nature of proposed construction works in each area and distance to nearest noise sensitive receivers are summarised in **Table 12-5**.

Section 12.6 describes the mitigation measures that are required relevant to the nature of the proposed works and proximity to noise sensitive receivers.

Table 12-5: Areas of proposed construction works and whether these are likely to result in a construction noise impact and require construction mitigation measures

Drawing No.	Location	Scheduled Works	Comments	Location of Nearest Sensitive Receivers	Potential Noise Impacts?
08132	Tymon North	Left bank embankment	<ul style="list-style-type: none"> Tree removal, temporary access road, excavating & saving topsoil, importing material, temporary crossing of river, piling, landscape mitigation works. 	St. Aongus Crescent – ~130m to SW	Yes
08133	Tymon North (adj to ESB substation)	Left bank embankment	<ul style="list-style-type: none"> Tree removal, temporary access road, excavating & saving topsoil, importing material, piling, landscape mitigation works 	St. Aongus Grove – ~190m to SW	Yes
08140	Tymon Park	Main site compound	<ul style="list-style-type: none"> Access off Limekiln Road Offices, carpark spaces, storage units Welfare facilities Water ESB and foul Temporary stockpile location in this area Pedestrian access management to prevent access to works area. 	Limekiln Road – ~25m to N.	Yes
08140	Tymon North and Tymon Park	Material stockpiling and landscape restoration & mitigation.	<ul style="list-style-type: none"> The aim is to reuse 50% of excavated material in landscape mitigation and restoration. The remainder to be removed from site. All topsoil excavated from the works areas (first 200mm depth) in Tymon North and Tymon Park will be reserved on site for reuse in final landscape mitigation and restoration. 	St. Aongus Crescent, St. Aongus Grove & Limekiln Road.	Yes
08141	Tymon Park	Left bank embankment	<ul style="list-style-type: none"> Tree removal, temporary access roads, excavating & saving topsoil, importing material, piling, landscape mitigation works 	Limekiln Road – ~150m to N.	Yes

Drawing No.	Location	Scheduled Works	Comments	Location of Nearest Sensitive Receivers	Potential Noise Impacts?
08142	Tymon Park	Left bank embankment	<ul style="list-style-type: none"> Tree removal, temporary access roads, excavating & saving topsoil, importing material, piling, landscape mitigation works 	Limekiln Road – ~100m to N.	Yes
08143	Tymon Lake	Main flood storage embankment and flow control structure	<ul style="list-style-type: none"> Tree removal, excavating & saving topsoil, importing material, temporary diversion, removal of existing weir and footbridge, temporary crossing of river, temporary access roads, piling, landscape mitigation works. For the embankment: Excavated top soil at foot of embankment and store for re use; Excavate central core; Fill with embankment material compacting in layers (consider use of remote control roller); construct embankment in 300mm layers, compact using 14T single drum vibrating roller; Surface of completed layer to be toothed with bucket to bond to next layer; Repeat; Embankment is overfilled and shaped to correct size and slope geometry. For flow control structure: Necessary to install channel diversion to dry out works area; fill in area of lake for works access; Design of structure to be passive with no mechanical electrical elements; Use of precast elements if possible; Reinstatement of diversion channel to All Reservoir Panel Engineer’s (ARPE) satisfaction. A new footbridge will be provided on top of embankment, landscape mitigation will incorporate new pedestrian path on top of embankment. 	Limekiln Road – ~165m to N.	Yes

Drawing No.	Location	Scheduled Works	Comments	Location of Nearest Sensitive Receivers	Potential Noise Impacts?
08146	Tymon Park	Integrated Constructed Wetland	<ul style="list-style-type: none"> Tree removal, temporary diversion of river, some instream works, excavating & saving topsoil, excavating to river level & removal of material, temporary access road, landscape mitigation works. 	Limekiln Road – ~45m to N.	Yes
08151	Whitehall Park	Channel re-alignment, re-grading, and reinforcing existing walls	<ul style="list-style-type: none"> Tree removal, temporary diversion, excavating & saving topsoil, excavation and landscape mitigation works. Access gate from Whitehall Park to be installed for SDCC Parks Maintenance General existing services to be brought to new channel and flapped Remove penstock at Lakelands overflow weir Access improvement works at weir. 	Whitehall Park, Whitehall Park & Grosvenor Court – ~15m to works.	Yes
08152	Wainsfort Manor Crescent	Reinforcing existing walls (Glendale Park and Terenure Badminton Club) & constructing new walls where none exist (at end of long gardens of houses on Limekiln Road) & temporary works / set down area with access off Wainsfort Manor Drive.	<ul style="list-style-type: none"> Tree removal, instream works, walls construction. 	Wainsfort Manor Green – ~15m to works. Wainsfort Manor Crescent– ~15m to works.	Yes
08155	Rear gardens at terrace of houses on Fortfield Road south of Kimmage Cross Roads	Replace existing walls	<ul style="list-style-type: none"> Tree removal, instream works, removing existing walls. walls pre-cast, Provide safe access for future clearance of inlet to culvert 	Fortfield Road - ~10m to works.	Yes
08160	Ravensdale Park & Poddle Park	Combination of reinforcing existing walls and new walls to middle of park; replacement footbridge; temporary works / set down area in Ravensdale	<ul style="list-style-type: none"> Tree removal, wall construction and manhole chamber replacement / rehabilitation 	Ravensdale Park & Poddle Park - ~15m to works.	Yes

Drawing No.	Location	Scheduled Works	Comments	Location of Nearest Sensitive Receivers	Potential Noise Impacts?
		Park; and sealed manholes in Poddle Park.	<ul style="list-style-type: none"> Manhole upgrades involves work in the public roads in mainly residential areas 		
08165	St Martin's Drive	New wall at end of St Martin's Drive and recladding existing wall along Poddle Park to match	<ul style="list-style-type: none"> Tree removal, wall construction 	Poddle Park - ~15m to works.	Yes
08170	Mount Argus	New walls at footbridge	<ul style="list-style-type: none"> Tree removal, wall construction 	Mount Argus Close - ~10m to works.	Yes
08250 & 08251	Within public roads in Ravensdale Park, Donore Avenue, and St. Teresa's Gardens, and at National Stadium off S. Circular Road	Manhole chamber replacement / rehabilitation	<ul style="list-style-type: none"> Involves work in the public roads in mainly residential areas 	Within the public roads at Donore Avenue & St. Teresa's Gdns. and at the National Stadium off S. Circular Road	Not significant

12.5.2 Predicted Construction Noise Levels at Sensitive Receivers

Noise impact as a result of the construction phase of the proposed development will be perceptible at nearby properties but this will be intermittent and temporary. Construction activities will not take place during night-time hours. The following construction practices have the potential to produce intermittent and temporary noise impacts:

- Site Clearance & Excavation - Rock hammers, dozers, tracked excavators & dump trucks;
- Infilling / Levelling / Piling - Excavators, wheeled loaders, and rollers;
- Wall removal & construction - Concrete mixer trucks, cranes & delivery vehicles;
- General Construction - Masonry construction, *etc.*

The proposed development will generate HGV movements throughout the duration of the construction period.

Construction noise can be assessed in terms of the equivalent continuous sound level and/or in terms of the maximum level. The level of sound in the neighbourhood that arises from a construction site depends on a number of factors and the estimation procedures need to take into account the following significant factors;

- the sound power outputs of processes and plant;
- the periods of operation of processes and plant;
- the distances from sources to receiver;
- the presence of screening by barriers;
- the reflection of sound;
- ground attenuation;
- meteorological conditions (particularly wind speed and direction), and
- atmospheric absorption.

Typical noise levels from construction works likely to take place during construction phase of proposed River Poddle Flood Alleviation Scheme are outlined in **Table 12-6**.

Table 12-6: Typical Noise Levels from Construction Works likely to take place during the construction of proposed development

Ref No.	Equipment	A-weighted sound pressure level, L_{Aeq} , dB @ 10m
Table C.2 Sound level data on site preparation		
Clearing Site & Ground excavation/earthworks		
1	Dozer ж (142 kW, 20T)	75 ж
3	Tracked excavator (102 kW, 22T)	78
12	Dozer (142 kW, 20T)	80
14	Tracked excavator (226 kW, 40T)	79
Loading lorries		
27	Wheeled loader (493 kW)	80
Distribution of material		
30	Dump truck (tipping fill) (306 kW, 29T)	79
31	Dump truck (empty) (306 kW, 29T)	87
Rolling and compaction		
37	Roller (rolling fill) ж	79 ж
Table C.3 Sound level data on piling and ancillary operations		
Pre-cast concrete piling – hydraulic hammer		
1	Hydraulic hammer rig	89
Table C.4 Sound level data on general site activities		
Distribution of materials		
1	Articulated dump truck ж	81 ж
Mixing & Pumping concrete		
20	Concrete mixer truck	80
Lifting		
38	Wheeled Mobile Telescopic Crane	78
Trenching		
63	Tracked excavator	77
Power for site cabins		
84	Diesel generator	74
Pumping water		
88	Water pump (diesel) (10 kW, 100Kg)	68
Sweeping and dust suppression		

Ref No.	Equipment	A-weighted sound pressure level, L_{Aeq} dB @ 10m
90	Road sweeper (70 kW)	76
91	Dust suppression unit trailer	78
Table C.5 Sound level data on road construction works		
Breaking road surface & concrete		
1	Backhoe mounted hydraulic breaker	88
6	Hand-held pneumatic breaker	95

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

(Ref: BS 5228 Noise on Construction and Open sites)

It is most likely that the above outlined construction activities will occur separately throughout periods of construction at each works location. The proposed construction works over the entire scheme are programmed over 24 months. Works will not be continuous over the 24-month period at any one location. By its nature, construction phases of such a proposed development are transient in terms of locations of precise activities on site from time to time. Therefore, the predicted worst-case $L_{Aeq,1 \text{ hour}}$ noise levels at specific locations have been outlined to present a worst-case range of noise levels that have the potential to occur at various stages throughout the 24-month construction period.

There will be four main works areas, namely Tymon North and Tymon Park; Whitehall Park and Wainsfort Manor Crescent; Fortfield Road, Ravensdale Park, St. Martin's Drive and Mount Argus; and at St. Teresa's Gardens. The expected construction duration for each area are summarised in Error! Reference source not found. **Table 12-7**.

Table 12-7: Estimated construction programme

Location	Main Flood Alleviation Scheme works	Estimated construction period (cumulative months)
Tymon North and Tymon Park	Establish & maintain main contractor's compound for Scheme duration	24 months
	Tree removal, excavations, demolition of flow control structure, stockpiling earth material, removal and import of earth material, embankments, demolition and replacement of flow control structure incorporating footbridge, ICW, site restoration, landscape mitigation/replacement tree planting, and biodiversity enhancements	4 months

Location	Main Flood Alleviation Scheme works	Estimated construction period (cumulative months)
Whitehall Park / Wainsfort Manor Crescent	Temporary works/set down area, excavations, removal and import of earth material, channel re-alignment and re-grading, flood protection walls, site restoration and biodiversity enhancements	2 months
Fortfield Road	Tree removal, demolition of existing boundary walls, erection of new flood protection walls, site restoration	1 month
Ravensdale Park / Poddle Park	Temporary works/set down area, tree removal, flood protection walls, demolition and replacement of footbridge, landscape mitigation/public realm improvements and replacement tree planting. Works to seal manholes.	2 months
St. Martin's Drive and Mount Argus	Establish secure works area, tree removal, flood protection walls, tree planting	1 month
St Teresa's Gardens/ Donore Avenue/ National Stadium	Temporary works area, traffic management, road works to rehabilitate or replace existing manholes	1 month

The predicted worst-case construction noise levels at specific locations in proximity to potential future construction works are summarised in **Table 12-8** below.

Table 12-8: Predicted worst-case construction noise levels at specific locations in proximity to potential future construction works.

Location	Likely Construction Noise Sources	Worst-case Predicted Noise Level $L_{Aeq, 1 \text{ Hour}}$ (dB)
At St Aongus Crescent during Embankment Construction in Tymon North (near NML 2)	1. Tracked excavator, Dump Trucks x 2 & Dozer	60 dB(A) (at 130m from works)
	2. Sheet piles driven using a Movax pile driver	65 dB(A) (at 130m from works)
	3. Tracked excavator, Dump Trucks x 2 & Dozer	56 dB(A) (at 190m from works)

Location	Likely Construction Noise Sources	Worst-case Predicted Noise Level $L_{Aeq, 1 \text{ Hour}}$ (dB)
At St Aongus Grove during Embankment Construction in Tymon North (near NML 2)	4. Sheet piles driven using a Movax pile driver	61 dB(A) (at 190m from works)
At nearest receivers on Limekiln Road during Embankment Construction in Tymon Park (near NML 1)	5. Tracked excavator, Dump Trucks x 2 & Dozer	63 dB(A) (at 100m from works)
	6. Sheet piles driven using a Movax pile driver	67 dB(A) (at 100m from works)
At nearest receivers on Limekiln Road to Construction Compound in Tymon Park (near NML 1)	7. Excavator, Dump Trucks, Lorry, Cement Mixer, Roller & 2 x Generators	70 dB(A) (at 25m from works)
At nearest receivers on Limekiln Road during Construction at Tymon Lake (near NML 1)	8. Tracked excavator, Dump Trucks x 2 & Dozer	58 dB(A) (at 165m from works)
At nearest receivers on Limekiln Road during Construction of ICW (near NML 1)	9. Tracked excavator, Dump Trucks x 2 & Dozer	72 dB(A) (at 45m from works)
At Whitehall Park (near NML 3)	10. Tracked excavator, Dump Truck, Water Pump & Place and vibrate concrete cycle	78 dB(A) (at 20m from works)
At Wainsfort Manor Crescent (near NML 3)	11. Tracked excavator, Dump Truck, Water Pump & Place and vibrate concrete cycle	78 dB(A) (at 20m from works)
	12. At receivers nearest to temporary works / set down area	72 dB(A) (at 20m from works)
At Rear gardens at terrace of houses on Fortfield Road (near NML 4)	13. Tracked excavator, Dump Truck, Water Pump & Place and vibrate concrete cycle	79 dB(A) (at 10m from works)
At Ravensdale Park & Poddle Park (near NML 4)	14. Tracked excavator, Dump Truck, Water Pump & Place and vibrate concrete cycle	80 dB(A) (at 15m from works)
	15. At receivers nearest to temporary works / set down area	72 dB(A) (at 20m from works)
At St Martin's Drive & Mount Argus	16. Tracked excavator, Dump Truck, Water Pump & Place and vibrate concrete cycle	79 dB(A) (at 10m from works)
Pedestrians and park users at Tymon North and in Tymon Park - @40m from works.	17. Tracked excavator, Dump Trucks x 2 & Dozer	73 dB(A) (at 40m from works)
	18. Sheet piles driven using a Movax pile driver	75 dB(A) (at 40m from works)

Location	Likely Construction Noise Sources	Worst-case Predicted Noise Level $L_{Aeq, 1 \text{ Hour}}$ (dB)
At Noise sensitive receivers @ 20m from manhole sealing and repair and stormwater upgrade works.	19. Tracked excavator, Dump Truck & Place and vibrate concrete cycle	76 dB(A) (at 20m from works)
At 20m from worst-case works when repairing flood defence walls	20. Tracked excavator, Dump Trucks, water pump & place and vibrate concrete cycle.	78 dB(A) (at 20m from works)

(Note: Calculations of the above worst-case construction noise levels are presented in **EIAR Volume 4, Appendix 12**)

12.5.3 Construction Noise Impact Significance

In accordance with the BS 5228-1:2009+A1: 2014 Noise and Vibration Control on Construction and Open Sites Part 1: Noise 'ABC method', the ambient noise levels (rounded to the nearest 5 dB) in the area of the proposed construction works are approximately 55 - 60 dB $L_{Aeq,T}$ during daytime. As a result, the noise sensitive receivers fall into Category A of the 'ABC' assessment methodology.

It is important to note that construction noise impacts will occur during daytime hours only and will be short-term at each area of construction along the River Poddle. Not all construction noise sources will operate at once and construction noise levels are likely to vary throughout the typical working day.

A pragmatic approach needs to be taken when assessing the significance of noise effects of any construction project. The significance of the construction noise from the project has been determined by considering the change in the ambient noise level with the construction noise on-going. BS5228 states that noise levels generated by construction activities are deemed to be significant if the total noise (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB L_{Aeq} , Period, from construction noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in significant impact. BS5228 also states that for public open space, impact might be deemed to be significant if the total noise (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise (L_{Aeq} , Period) by 5 dB or more for a period of one month or more.

Based on the BS5228 'ABC' assessment methodology, the contractor should aim to limit daytime construction noise to 65 dB $L_{Aeq,12 \text{ Hour}}$ at all works areas with the application of appropriate mitigation measures.

Based on the estimated duration of works at each location as outlined in **Table 12-7** there will be a short-term noise impact at the nearest sensitive receivers to the proposed works. In some of the works areas, the predicted worst-case 1-hour construction noise levels may be in excess of the recommended maximum noise level of 70 dB L_{Aeq} / 80 dB L_{AMax} at 1m from the façade of the nearest residential properties as outlined by the TII Guidelines (March 2014). Noise from construction works will fluctuate throughout the course of a typical working day as well as over the course of the construction works being undertaken in any one location. Therefore, the daytime construction noise limit of 65 dB $L_{Aeq,12 \text{ Hour}}$

should be achieved at the nearest residential properties. The construction noise impacts will be short-term and will not be significant.

Appropriate construction mitigation measures outlined below will be implemented as part of the Construction Environmental Management Plan (CEMP).

12.5.4 Construction Vibration at Sensitive Receivers

Construction vibration impacts have the potential to occur if piling works are undertaken in very close proximity to sensitive receivers. Piling works are proposed in Tymon Park where sheet piles will be driven to form part of the main embankment at Tymon Lake, and at Tymon North.

The nearest sensitive receivers to proposed piling works at Tymon North and Tymon Park will be at St. Aongus Crescent, St. Aongus Grove and Limekiln Road. Sheet piles will be approximately 6m long and will be driven using a Movax pile driver (Vibratory side grip pile driver) attached to a 25Te tracked excavator. This is a low noise and vibration method that is used in urban settings. At the distances to nearest sensitive receivers, vibration will not be discernible. A worst-case piling noise prediction has been used by assessing impacts with an assumed Pre-cast concrete piling – hydraulic hammer with a sound level of 89 dB(A) at 10m.

If after detailed design, sheet piling is required to construct the flood defence walls as part of the proposed scheme, vibration monitoring will need to be carried out at any requisite monitoring points in the vicinity of residential properties. The chosen locations will be agreed in advance with SDCC / DCC. This will help to ensure that any vibration generated by the construction of the proposed scheme would not give rise to nuisance in the vicinity of the proposed scheme.

It is proposed that vibration monitoring will be carried out for all properties in close proximity to construction works where piling is required. Precondition surveys will be carried out at properties in close proximity to the construction works. Survey and monitoring locations will be identified during detailed design and agreed with residents/owners as part of the CEMP in advance of the construction works. A programme of noise monitoring and 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 noise and 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.

The relevant vibration limits for the duration of the construction works are set out and represent the allowable vibration in order to minimise the risk of building damage. Specifically, Noise & Vibration levels shall be kept below the levels specified, or of limits which may be imposed by the Competent Authority. If vibration monitoring results indicate that levels are approaching the standard limits, appropriate mitigation measures will be put in place to ensure that vibration levels are reduced to acceptable levels.

The movement of construction vehicles to each of the proposed works areas will be *via* the existing road network. The resultant vibration levels will be no greater than is currently experienced when HGVs pass along the road network.

Accurate vibration level prediction is extremely difficult due to a significant number of variables that apply to such calculations, *e.g.* piling methods, ground conditions, etc. Therefore, the contractor will ensure that the TII Guidelines which identify limits for

protection against cosmetic damage as a function of vibration frequency are not exceeded through the use of the selected low vibration piling method and continuous monitoring of vibration levels during any piling that may have the potential to result in a vibration impact at nearby properties. However, as stated above, at distances of in excess of 100m from the nearest residences, vibration from the Movax pile driver will not be perceptible.

12.5.5 Predicted Operational Noise Levels at Sensitive Receivers

12.5.5.1 Predicted Operational Impact

There are no mechanical elements such as removable flood defences proposed in the River Poddle Flood Alleviation Scheme. Therefore, there will be no operational noise impact.

12.6 Mitigation Measures

12.6.1 Construction Mitigation

Appropriate mitigation measures have been identified to ensure the Construction Phase target noise limits are not exceeded. The contractor will be required to implement the control measures recommended in BS 5228 and apply the appropriate measures where applicable. Other measures will include:

- Working hours during site construction operations will be restricted to daytime hours from 07:30 hours to 16:30 hours (Monday to Friday) and, as may be required, from 08.00 hours to 13.00 hours (Saturdays). Evening and night-time work is not expected to take place although it is possible that limited 24 hours working may be required to take place on occasion. This will only take place with the prior agreement of SDCC and DCC.
- An on-site speed limit will be enforced for all traffic. Drivers of vehicles will be advised of the speed limits through the erection of signs *i.e.* a typically recommended on site speed limit is 10 km/hr.
- Where practicable, the use of quiet working methods and the most suitable plant will be selected for each activity having due regard to the need for noise control.
- Best practicable means will be employed to minimise noise emissions and will comply with the general recommendations of BS 5228. To this end operators will use “*noise reduced*” plant and/or will modify their construction methods so that noisy plant is unnecessary.
- By positioning potentially noisy plant as far as possible from noise sensitive receivers the transmission of sound can be minimised. Earth mounds and/or stockpiles of material or perimeter hoarding on site can be used as a physical barrier between the source and the receiver.
- Mechanical plant used on site will be fitted with effective exhaust silencers. Vehicle reverse alarms will be silenced appropriately in order to minimise noise breakout from the site while still maintaining their effectiveness.
- All plant will be maintained in good working order. Where practicable, machines will be operated at low speeds and will be shut down when not in use.
- Compressors will be of the “*noise reduced*” variety and fitted with properly lined and sealed acoustic covers.

- In all cases engine and/or machinery covers will be closed whenever the machines or engines are in use.
- All pneumatic percussive tools will be fitted with mufflers or silencers as recommended by the equipment manufactures. Where practicable, all mechanical static plant will be enclosed by acoustic sheds or screens.
- Employees working on the site will be informed about the requirement to minimise noise and will undergo training on the following aspects:
 - The proper use and maintenance of tools and equipment.
 - The positioning of machinery on-site to reduce the emission of noise to the noise sensitive receivers.
 - Avoidance of unnecessary noise when carrying out manual operations and when operating plant and equipment.
 - The use and maintenance of sound reduction equipment fitted to power pressure tools and machines.
- Cognisance will also be taken of the *Environmental good practice site guide 2005* compiled by CIRIA and the UK Environment Agency. This guide provides useful and practical information regarding the control of noise at construction sites.
- Where excessive noise levels are recorded, further mitigation measures will be employed which may include temporary wooden hoarding / acoustic screening to be installed to a height of no less than 2m around areas of construction where loud noise levels occur.
- The contractor will ensure that the TII Guidelines which identify limits for protection against cosmetic damage as a function of vibration frequency are not exceeded through the use of the selected low vibration piling method.
- Responsible Person –The Contractor will appoint a responsible and trained person who will be present on site and who will be willing to answer and act upon complaints and queries from the local public.
- Night-time Working - If there are items of plant (e.g. dewatering pumps and similar) in use during night-time hours they will be chosen, sited and enclosed such that levels at the nearest properties do not exceed the measured background noise levels.

12.6.2 Monitoring

- Where deemed necessary due to excessive impact or complaints received, noise monitoring will be undertaken during construction works to determine noise levels at noise sensitive receivers. On the basis of the findings of such noise monitoring, appropriate noise mitigation measures will be implemented to reduce noise impacts.
- The contractor will conduct continuous monitoring of vibration levels during any piling that may have the potential to result in a vibration impact at nearby properties.

12.6.3 Operational Mitigation

The proposed River Poddle Flood Alleviation Scheme will not result in an operational noise impact. Therefore, no operational mitigation measures are deemed necessary.

12.7 Residual impacts

The assessment of construction noise impacts from the proposed development has indicated that construction noise limit criteria may be exceeded at the nearest residential properties for short periods during daytime. This may occur on occasions when heavy construction activity occurs in close proximity to noise sensitive receivers. Noise from construction works will fluctuate throughout the course of a typical working day as well as over the course of the construction works being undertaken in any one location. Therefore, the daytime construction noise limit of 65 dB $L_{Aeq,12\text{ Hour}}$ should be achieved at the nearest residential properties. The construction noise impacts will be short-term and will not be significant. Also, while the overall construction activities for the River Poddle Flood Alleviation scheme will occur over 24 months, the nature of the proposed works and its duration will mean that noise sensitive receivers will not be exposed to continuous construction noise impact during this 24-month period.

Once the above mitigation measures have been implemented, the residual impacts from the development will not be significant.

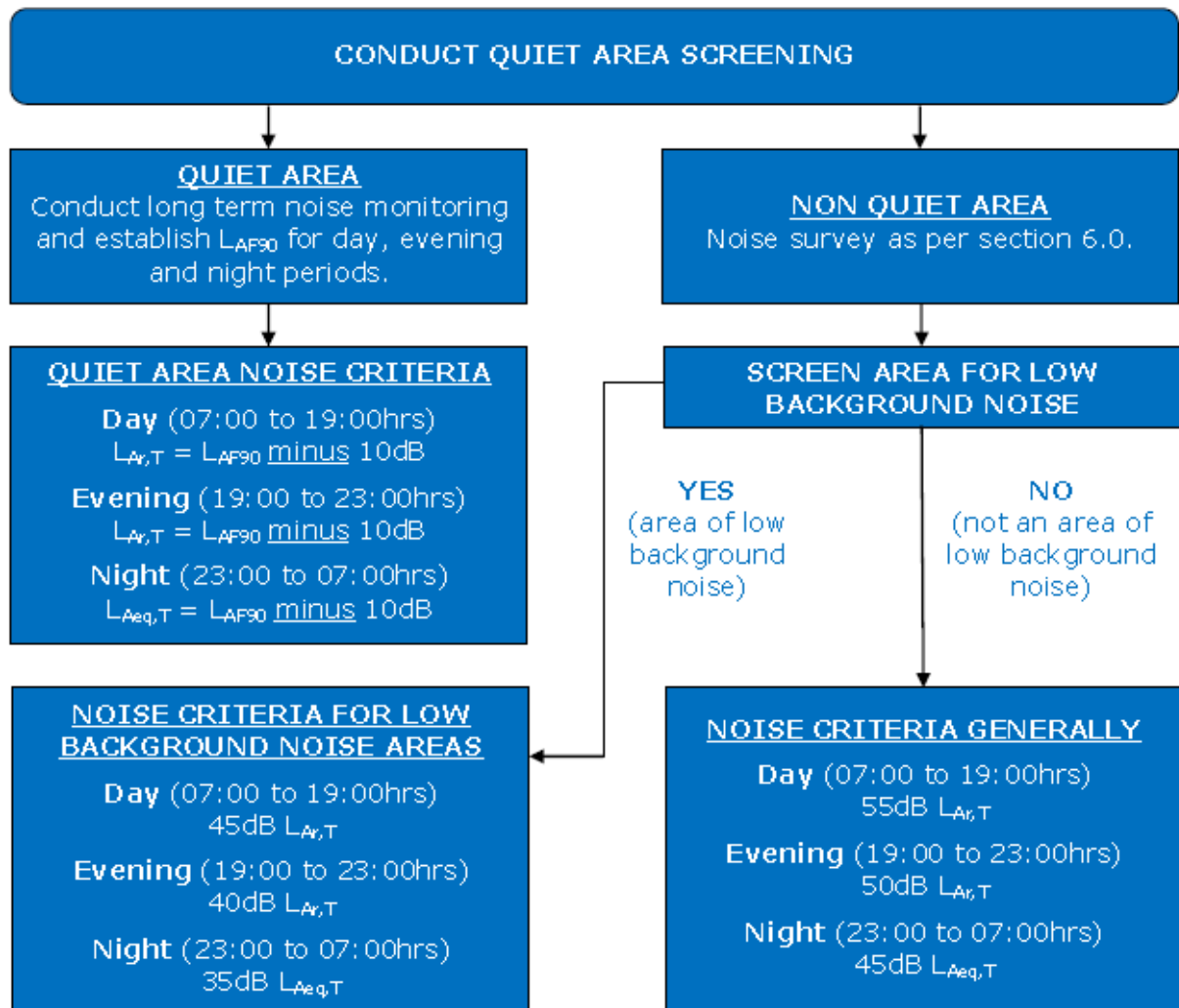


Figure 12-1: Flow Chart for the Identification of Appropriate Noise Criteria (Ref. EPA Guidance Note NG4).

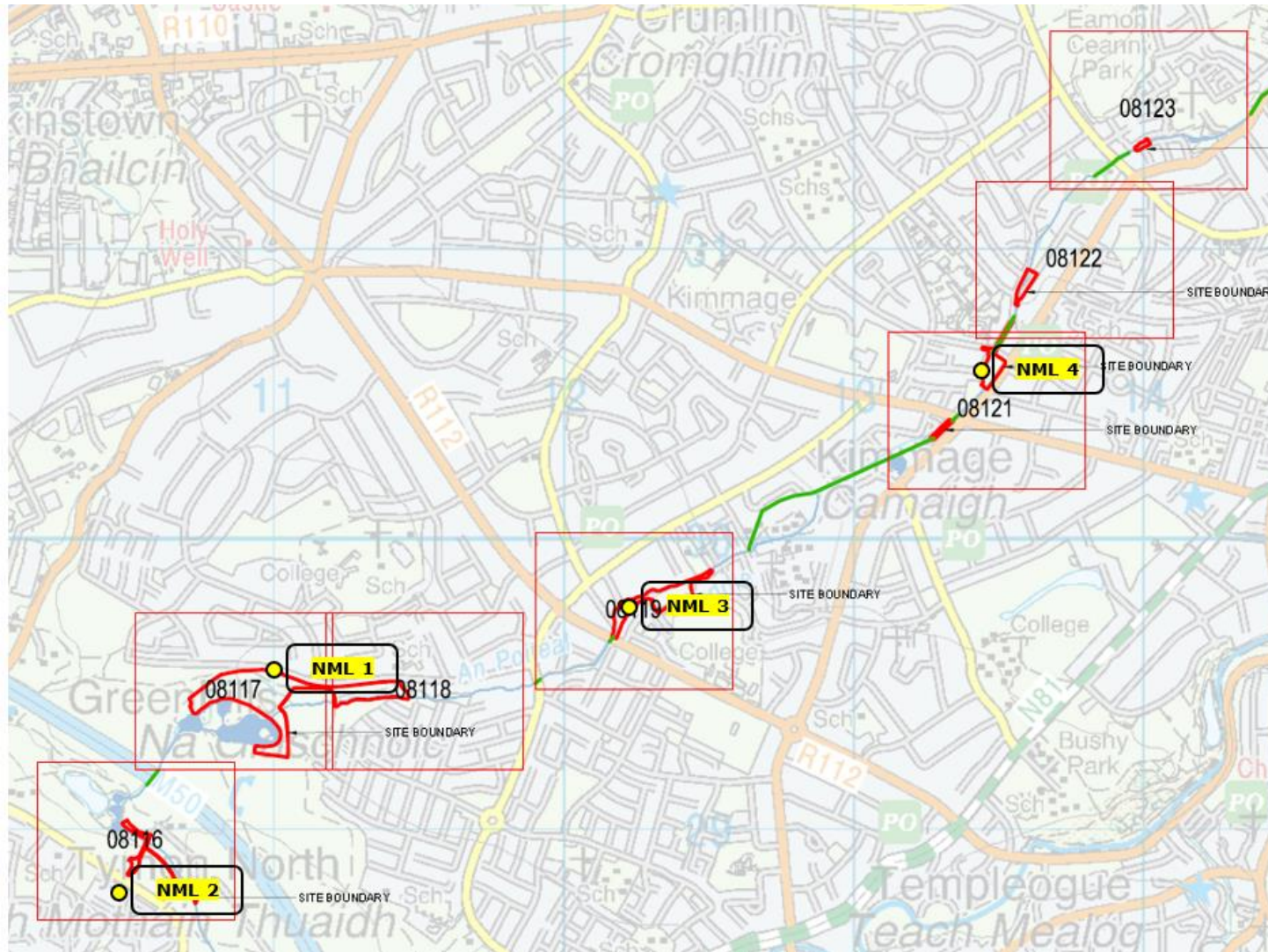


Figure 12-2: Baseline noise monitoring locations - Tuesday 14th May 2019