

---

## **Appendix 6A**

# **Noise and Vibration Report**

---

**ANV Technology**

**Report 25369**

**Cork Lower Harbour Main Drainage Scheme  
Noise and Vibration Impact Assessment**

**August 2007**

## Cork Lower Harbour Main Drainage Scheme Noise and Vibration Impact Assessment

<b>1</b>	<b>INTRODUCTION.....</b>	<b>1</b>
1.1	NOISE SENSITIVE LOCATIONS .....	1
1.2	METHODOLOGY.....	2
<b>2</b>	<b>EXISTING ENVIRONMENT.....</b>	<b>6</b>
2.1	RECEIVING NOISE ENVIRONMENT .....	6
2.2	BASELINE NOISE SURVEYS.....	6
2.2.1	<i>Description of measurement locations.....</i>	6
2.2.2	<i>Weather Conditions:.....</i>	7
2.2.3	<i>Personnel.....</i>	7
2.2.4	<i>Instrumentation.....</i>	8
2.3	MEASURED EXISTING NOISE LEVELS .....	8
2.3.1	<i>Existing Noise Environment in Vicinity of WWTP Site.....</i>	9
2.3.2	<i>Existing Noise Environment at Sites of Proposed Major Pumping Stations.....</i>	10
2.3.3	<i>Existing Noise Environment at Sites of Minor Pumping Stations.....</i>	10
2.4	DO-MINIMUM SCENARIO.....	19
<b>3</b>	<b>NOISE IMPACTS OF THE DEVELOPMENT .....</b>	<b>19</b>
3.1	ASSESSMENT CRITERIA .....	19
3.1.1	<i>Construction Noise Criteria.....</i>	19
3.1.2	<i>Operational Phase Noise Impact Criteria .....</i>	21
3.1.3	<i>Proposed Boundary Noise Design Criteria .....</i>	23
3.2	CONSTRUCTION NOISE IMPACT .....	25
3.2.1	<i>Construction of Waste Water Treatment Plant .....</i>	25
3.2.2	<i>Construction Works at Pumping Stations .....</i>	26
3.2.3	<i>Excavation Works for Sewer Lines .....</i>	27
3.2.4	<i>Vibration.....</i>	29
3.2.5	<i>Construction Traffic.....</i>	29
3.3	OPERATIONAL PHASE NOISE IMPACT .....	30
3.3.1	<i>Noise Propagation Model.....</i>	30
3.3.2	<i>Noise Emissions From WWTP .....</i>	30
3.3.3	<i>Ground Vibration Due to WWTP.....</i>	33
3.3.4	<i>Noise and Vibration Emissions From Pumping Stations.....</i>	33
3.3.5	<i>Impact of Operational Phase Traffic .....</i>	37
<b>4</b>	<b>MITIGATION.....</b>	<b>38</b>
4.1	NOISE MITIGATION DURING CONSTRUCTION PHASE.....	38
4.2	NOISE MITIGATION FOR OPERATIONAL PHASE.....	39
<b>5</b>	<b>RESIDUAL NOISE IMPACT .....</b>	<b>39</b>
<b>6</b>	<b>NON TECHNICAL SUMMARY .....</b>	<b>40</b>

## Cork Lower Harbour Main Drainage Scheme Noise and Vibration Impact Assessment

### 1 INTRODUCTION

The noise and vibration impact of the proposed Cork Lower Harbour Drainage scheme was assessed. The proposed scheme will include construction of a new wastewater treatment plant (WWTP) at Shanbally, including access roads, installation of a network of sewerage lines serving the lower harbour area, with associated pumping stations.

The proposed WWTP site is located in lands zoned for this purpose in the Shanbally area, to the northwest of Carrigaline. The current use of these lands is agricultural.

The potential noise impacts during the construction phase, and during the operational phase were considered.

During the construction phase there will be noise emissions from activities at the WWTP site, including earthmoving, excavations, and construction of facilities, with associated construction traffic on routes to the site.

There will also be noise impacts along the routes of the proposed sewer lines, and at the construction sites of the proposed pumping stations.

During the operational phase of the WWTP, there will be continuous process noise emissions during both daytime and nighttime. There are minor potential impacts in terms of noise from pumping stations, which are also considered in the report.

#### 1.1 NOISE SENSITIVE LOCATIONS

The proposed WWTP site is in a rural area, with few dwellings visible from the site. The nearest existing noise-sensitive locations to the site are the houses at Upper Shanbally, approximately 260m to the east of the site boundary. There are also lands zoned for residential use approximately 130m to the east of the site, which are treated in this assessment as noise sensitive locations.

The nearest houses to the north are approximately 430m distant. The intervening lands

are agricultural. The sports ground located 80m from the north-eastern corner of the site is moderately noise sensitive, as it is an outdoor recreational area.

The nearest house to the south is at a distance of approximately 570m.

There are no noise sensitive locations immediately to the west of the site. The ESB compound is located 160m to the west. A Bord Gáis facility is located 65m from the south-western corner of the site. There are commercial units located on the southern side of the entrance road to the site from Cogan's Road.

Houses in the vicinity of the proposed major pumping stations at Raffeen, Monkstown, Carrigaloe and West Beach Cobh, are also treated as noise sensitive locations. For houses in the vicinity of the minor pumping stations, there is lower potential for noise impact. However potential impacts at these locations are also considered.

Pipe laying will occur along the routes of the proposed new sewer lines. The associated construction works will therefore affect many houses in different areas, for limited periods during the construction phase. All of the houses along the proposed sewer routes are therefore considered as being noise sensitive locations during the construction phase.

## **1.2 METHODOLOGY**

The existing noise environment was determined by means of baseline noise surveys at the site of the proposed WWTP and pumping stations in accordance with ISO 1996 "Description and measurement of environmental noise". The surveys were carried out in June 2007.

Noise propagation calculations in this report were made according to ISO 9613 "Attenuation of sound during propagation outdoors".

Calculation of noise due to construction plant and equipment was in accordance with BS 5228 "Noise and vibration control on open and construction sites", using standardised noise emission data for typical construction site equipment likely to be used for this development, and heavy vehicle noise levels.

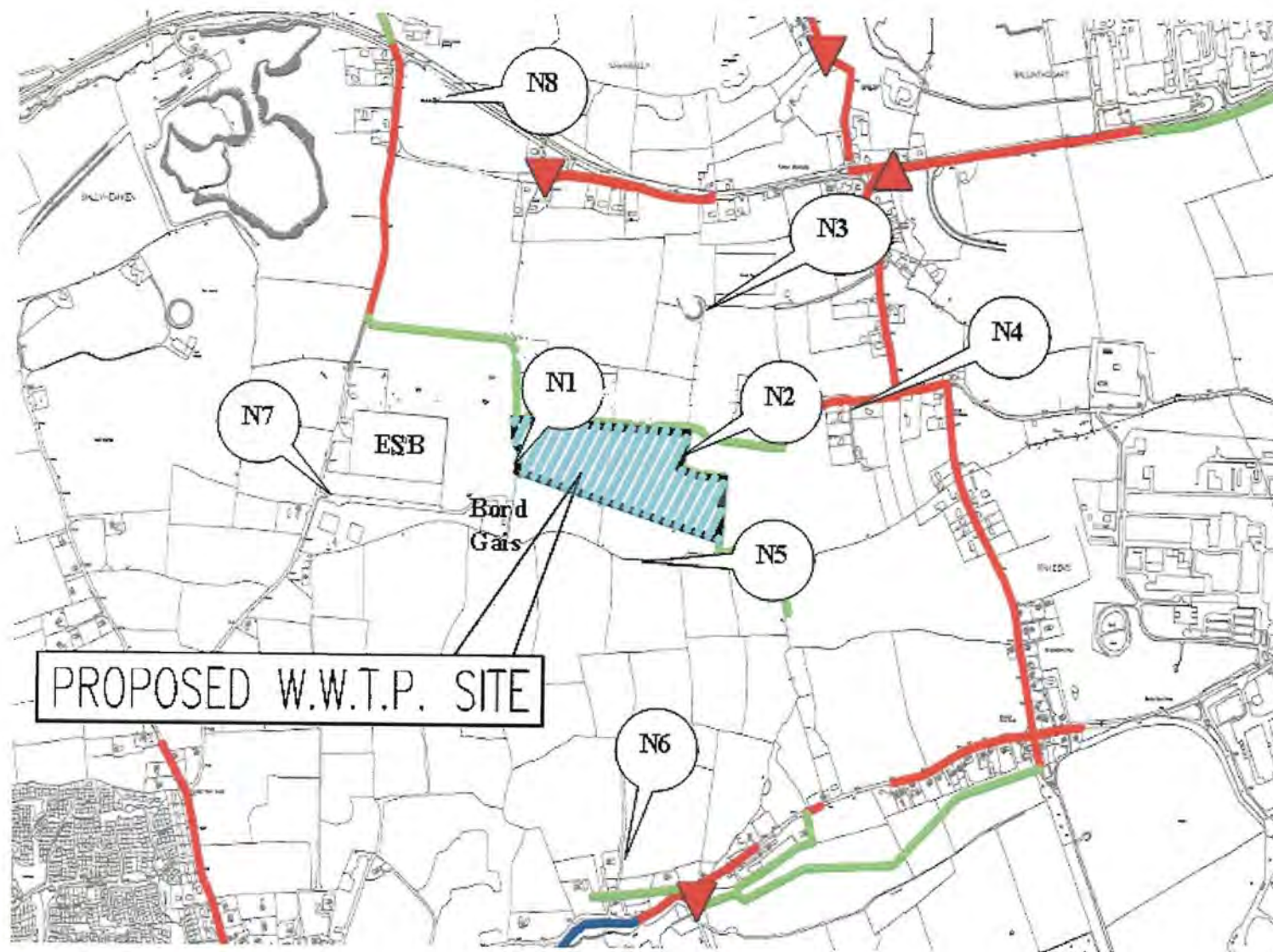
Traffic noise was calculated based on the U.K. Calculation of Road Traffic Noise (CRTN), with results converted to daytime average noise levels ( $L_{Aeq}$ ).

The WWTP is a Design-Build-Operate (DBO) project. One of the environmental parameters to be met by a successful bidder will be a maximum noise emission specification at the boundary of the WWTP site, and at a reference distance from the pumping stations. In this assessment report, an appropriate boundary noise criterion is proposed for the WWTP and the pumping stations. This was arrived at by first determining an appropriate noise assessment criterion at the nearest houses which would ensure negligible adverse impact. This assessment criterion noise level at the nearest house was then used to calculate back to the plant boundaries, to establish the

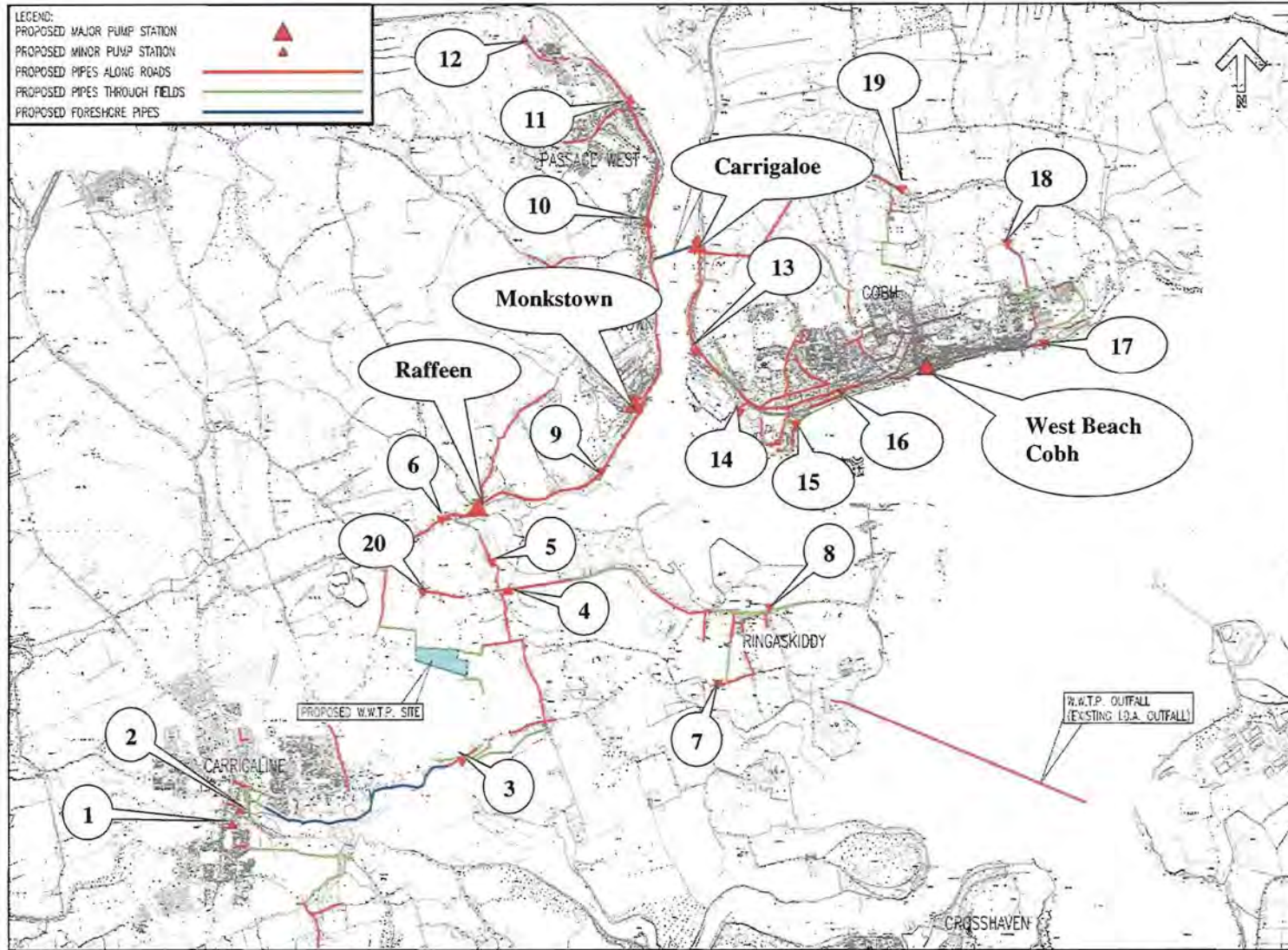
appropriate design noise criterion at the boundaries. The validity of the noise impact assessment relies on the proposed design noise criteria being incorporated into the contracts for the projects, and implemented through appropriate equipment specifications during the detailed design stage.

The noise assessment criterion at the nearest noise sensitive locations was determined with reference to the EPA guideline noise limits, and also by considering the change in noise environment brought about by the development, based on the methodology of British Standard BS 4142 "Rating industrial noise affecting mixed residential and industrial areas", and the potential audibility of the noise.

All noise levels presented in the text of the report represent time-averaged noise levels over the appropriate reference periods ( $L_{Aeq}$ ), unless otherwise indicated. An explanation of acoustics terminology is provided in Appendix A.



**Figure 1.** Location of proposed WWTP site, and baseline noise survey locations N1 to N8



**Figure 2.** Layout of Cork Lower Harbour Main Drainage Scheme, showing sewerage network, and major pumping station locations at Raffeen, Monkstown, Carrigaloe, and West Beach where detailed noise surveys were carried out. Also shown are the minor pumping station locations 1 to 20, where short-duration noise surveys were carried out



## **2 EXISTING ENVIRONMENT**

### **2.1 RECEIVING NOISE ENVIRONMENT**

The proposed WWTP site is located within a predominantly rural area, with a low density of housing.

The main contribution to the existing ambient noise level is from the distant traffic noise on the N28, located 490m to the north of the site. There is a lower component of noise from distant agricultural machinery, aircraft, and natural noise sources such as wind noise, birds and animals. Along the entrance road to the site from Cogan's Road, there is audible electrical hum from the ESB compound, and occasional work activity noise from the Brown & Gilmer premises at the entrance from Cogan's Road.

The overall noise environment in the vicinity of the proposed WWTP site can be described as quiet rural.

### **2.2 BASELINE NOISE SURVEYS**

#### **2.2.1 DESCRIPTION OF MEASUREMENT LOCATIONS**

Noise surveys over 24-hour periods were carried out at three locations in the vicinity of the WWTP site, denoted N1, N2 and N3 in Figure 1.

Surveys of three hours duration during daytime and nighttime were conducted at five additional representative positions, including nearest noise sensitive locations, in the Carrigaline East/Shanbally areas, denoted N4 to N8 in Figure 1.

- N1: Western boundary of proposed site, beside electricity pylon
- N2: Eastern boundary of proposed site, adjacent gate
- N3: 200 m to the north of site, southwest corner of sports ground
- N4: Upper Shanbally, at entrance to playing field
- N5: 70 m south of proposed site
- N6: Nearest house to south of site, at approximately 570m
- N7: Entrance to Bord Gais, 20m from roadway
- N8: At 12 m from N28 Ringaskiddy Road

Surveys of three hours duration during daytime and nighttime were also conducted at the proposed sites of the four major pumping stations at Raffeen, Monkstown, Carrigaloe, and West Beach Cobh, the locations of which are shown in Figure 2.

Short orientation noise measurements were carried out during daytime and nighttime at the sites of twenty proposed minor pumping stations, as indicated in Figure 2.

### 2.2.2 WEATHER CONDITIONS:

Date	Measurement Period	Description of weather conditions
25/06/2007	Daytime	Light SW breeze, overcast, showers.
	Nighttime	Showers, light SW breeze.
26/06/2007	Daytime	Moderate SW breeze, overcast, warm, dry.
	Nighttime	Moderate breeze - calm, cool, clear night.
27/06/2007	Daytime	Light SW Breeze, dry, overcast, warm.
	Nighttime	Calm, clear, cool.
28/06/2007	Daytime	Heavy showers, moderate SW with gusts, warm.
	Nighttime	Showery, moderate SW breeze, cool.
29/06/2007	Daytime	Showers, light SW breeze

**Table 1.** Summary of weather conditions during noise surveys

### 2.2.3 PERSONNEL

The baseline surveys were carried out by Kevin Downes B.Sc, and Alan Hanley B.Sc. of ANV Technology. The assessment was undertaken by Colin Doyle M.Sc. MIOA of ANV Technology.

## 2.2.4 INSTRUMENTATION

Manufacturer	Instrument	Calibrated Laboratory	Calibration reference	Last Laboratory Calibration
Brüel & Kjær	SLM 2260 (Type 1) serial no.1875380	Pennine Instruments	07062-1	20/01/06
Brüel & Kjær	SLM 2250-L Class1 serial no. 2579999	Bruel & Kjaer	Certificate of conformance 2579999	19/3/2007
Svantek	SLM 949 (Type 1)	Svantek	No. 8183	27/09/05
Brüel & Kjær	Calibrator 4231 serial no. 1859044	AV Calibration	0611490	7/11/06
Castle	Calibrator GA 607 serial no. 040520	Castle Group	40520/ 45338	27/10/05

**Table 2.** Noise measurement instrumentation used during the surveys. Calibration checks were carried out before and after each survey period.

## 2.3 MEASURED EXISTING NOISE LEVELS

The results of the noise survey for the measurements positions in the vicinity of the WWTP site are presented in Table 3. At locations N1, N2, N3, the mean measured noise levels are averaged over continuous 24 hours measurement. At locations N4 to N8, the mean measured noise levels are derived from noise levels measured during a 3 hour period in daytime and in nighttime.

Time plots of the 24-hour measurements at N1, N2 and N3 are shown in Figure 3. The measured hourly noise levels for measurement positions N4 to N8 are presented in Tables 4 and 5 for daytime and nighttime periods respectively.

The results of the noise surveys at the sites of the proposed major pumping stations are presented in Tables 6 and 7 for daytime and nighttime periods respectively.

The results of the short-term orientation surveys at the sites of the proposed minor pumping stations are presented in Tables 8 and 9 for daytime and nighttime periods respectively.

### 2.3.1 EXISTING NOISE ENVIRONMENT IN VICINITY OF WWTP SITE

The noise environment in this area was determined primarily by distant traffic, agricultural machinery, wind noise, birds/ animals, with a contribution from aircraft noise during daytime.

Referring to Table 3, at the measurement locations N1 and N2 at the proposed WWTP site boundaries, the average daytime noise level was 44 and 47 dB(A)  $L_{Aeq}$  respectively. This reduced to 36 and 38 dB(A)  $L_{Aeq}$  respectively at nighttime. At N3, 230m to the north of the proposed site boundary, the mean daytime noise level was 47 dB(A)  $L_{Aeq}$ , reducing to 39 dB(A)  $L_{Aeq}$  at nighttime. The noise measurements at locations N2 and N3 represent the noise environment in the lands zoned residential to the east of the proposed site.

The  $L_{A90}$  parameter is the noise level exceeded for 90% of the measurement period. This represents the steady component of the underlying background noise. At locations N1 to N3, the mean  $L_{A90}$  value for the day/evening periods ranged from 39 to 41 dB(A). At nighttime this reduced to 30 to 31 dB(A)  $L_{A90}$ .

Measurements location N4 was at the nearest house to the proposed site, at a distance of 280m from the eastern site boundary. At this position, the average daytime noise level was 55 dB(A)  $L_{Aeq}$  due to local traffic, reducing to 50 dB(A)  $L_{Aeq}$  at nighttime. The steady underlying background noise at this location was 48 dB(A)  $L_{A90}$  during daytime, and 40 dB(A)  $L_{A90}$  at nighttime.

At location N5, 100m to the south of the site, the average daytime noise level was 45 dB(A)  $L_{Aeq}$ , reducing to 43 dB(A)  $L_{Aeq}$  at nighttime. The steady underlying background noise at this location was 41 dB(A)  $L_{A90}$  during daytime, and 39 dB(A)  $L_{A90}$  at nighttime.

Measurement location N6 was at the nearest house to the south of the proposed site, which is at a distance of approximately 600m. The average daytime noise level was 55dB(A)  $L_{Aeq}$ , reducing to 48 dB(A)  $L_{Aeq}$  at nighttime. The steady underlying background noise at this location was 42 dB(A)  $L_{A90}$  during daytime, and 31 dB(A)  $L_{A90}$  at nighttime.

Measurement location N7 was at Cogan's Road, and measurements from this position represent the existing noise exposures of houses along this road. The average daytime noise level was 54dB(A)  $L_{Aeq}$ , reducing to 46 dB(A)  $L_{Aeq}$  at nighttime. The steady underlying background noise at this location was 46 dB(A)  $L_{A90}$  during daytime, and 38 dB(A)  $L_{A90}$  at nighttime.

Measurement location N8 was at the N28, and measurements from this position represent the existing noise exposures of houses along this road. The average daytime noise level was 62dB(A)  $L_{Aeq}$ , reducing by 13 dB, to a level of 49 dB(A)  $L_{Aeq}$  at nighttime. The steady underlying background noise at this location was 53 dB(A)  $L_{A90}$  during daytime, and 35 dB(A)  $L_{A90}$  at nighttime.

### 2.3.2 EXISTING NOISE ENVIRONMENT AT SITES OF PROPOSED MAJOR PUMPING STATIONS

Referring to Tables 6 and 7, at Raffeen, the average daytime noise level was 57 dB(A)  $L_{Aeq}$ , due to local traffic, reducing to 46 dB(A) at nighttime. The steady underlying background noise at this location was 50 dB(A)  $L_{A90}$  during daytime, and 40 dB(A)  $L_{A90}$  at nighttime.

At Monkstown, the average daytime noise level was 55 dB(A)  $L_{Aeq}$ , due to local traffic and local activity noise, reducing to 42 dB(A) at nighttime. The steady underlying background noise at this location was 43 dB(A)  $L_{A90}$  during daytime, and 38 dB(A)  $L_{A90}$  at nighttime.

At West Beach Cobh, the average daytime noise level was 58 dB(A)  $L_{Aeq}$ , due to local traffic and local activity noise, and 57 dB(A) at nighttime, due to noise from a docked boat and local activity noise. The steady underlying background noise at this location was 50 dB(A)  $L_{A90}$  during daytime, and 47 dB(A)  $L_{A90}$  at nighttime.

At Carrigaloe, the average daytime noise level was 63dB(A)  $L_{Aeq}$ , due to local road traffic, ferry traffic, and noise from the ferry, and reduced to 57 dB(A) at nighttime. The steady underlying background noise at this location was 49 dB(A)  $L_{A90}$  during daytime, and 39 dB(A)  $L_{A90}$  at nighttime.

### 2.3.3 EXISTING NOISE ENVIRONMENT AT SITES OF MINOR PUMPING STATIONS

Referring to Tables 8 and 9, daytime noise levels at the sites of the proposed minor pumping stations ranged from 44 to 69 dB(A)  $L_{Aeq}$ , depending on the local traffic flows. The underlying background noise levels during daytime ranged from 38 to 53 dB(A)  $L_{A90}$ .

Nighttime noise levels ranged from 44 to 64 dB(A)  $L_{Aeq}$ , depending on the local traffic flows. The underlying background noise levels ranged from 27 to 49 dB(A)  $L_{A90}$ .

Location	Measured Noise Levels dB(A) (mean of measured values at 15-minute intervals)				Comment
	L <sub>Aeq,15mins</sub>	L <sub>A90</sub>	L <sub>A50</sub>	L <sub>A10</sub>	
<b>Day/Evening (07.00 -23.00)</b>					
N1	44	39	41	45	Distant traffic, tractors, aircraft, wind noise
N2	47	41	44	48	
N3	47	41	45	49	
N4	55	48	50	56	
N5	45	41	43	47	
N6	55	42	50	59	Light traffic, tractors, wind noise
N7	54	46	49	55	Noise from commercial unit, light traffic
N8	62	53	60	65	Traffic, wind noise
<b>Night (23.00 -07.00)</b>					
N1	36	31	34	37	Low-level distant traffic, aircraft, animals, wind noise
N2	38	30	33	40	
N3	39	30	34	42	
N4	50	40	44	51	
N5	43	39	41	42	
N6	48	31	34	44	Aircraft, occasional traffic
N7	46	38	39	42	Low-level noise from commercial unit, distant traffic
N8	49	35	39	49	Occasional traffic, wind noise
EU <sup>1</sup> noise descriptors for 24-hr locations N1 to N3 (power averaged noise levels)					
Location	L <sub>day</sub> L <sub>Aeq,</sub> 07.00-19.00	L <sub>evening</sub> L <sub>Aeq,</sub> 19.00-23.00	L <sub>night</sub> L <sub>Aeq,</sub> 23.00-07.00	L <sub>den</sub>	
N1	45	46	39	48	
N2	50	44	42	50	
N3	48	44	48	54	

**Table 3.** Overview of measured noise levels.(see also plots of measured noise levels over 24 hrs at N1, N2 N3 Further details in Figure 3, and measured noise levels at N4 to N8 in Tables 4 and 5)

<sup>1</sup> The standard EU noise descriptors are L<sub>Aeq</sub> values over the daytime, evening and nighttime periods. However in low noise areas such as this, the noise environment is more reliably described by the arithmetic mean of the measured noise levels at 15-minute intervals. In low noise areas, the EU noise descriptors are biased by short duration noise events, which may be of no significance (eg. animal/bird sounds near the meter). The description of noise environment is therefore based on the mean values rather than the EU descriptors.

Location	Date	Time	$L_{Aeq, 15mins}$	$L_{A90}$	$L_{A50}$	$L_{A10}$	Comment
<b>Daytime Survey</b>							
N4	25/06/2007	16.58	53	49	51	55	Very little Traffic. Wind moderate. Aircraft
		17.59	58	46	49	58	Church bells. Moderate breeze
		18.58	54	48	51	56	Gentle breeze
		mean	55	48	50	56	
N5	26/06/2007	14.56	44	40	42	47	Airplane. Moderate breeze
		17.2	45	42	44	47	Cattle in crush. Gentle breeze
		17.36	45	42	43	46	Moderate wind. Traffic.
		mean	45	41	43	47	
N6	26/06/2007	14.27	51	39	46	55	Moderate Breeze. Rustling of hedges and leaves. Very little traffic on road.
		16.25	57	44	53	62	Tractors
		17	57	45	52	60	Traffic
		mean	55	42	50	59	
N7	25/06/2007	16.13	56	49	52	58	Work at Brown & Gilmer Ltd. Very traffic on road.
		17.18	53	45	48	55	Door closing at Brown & Gilmer Ltd. Very little traffic on road.
		18.21	51	44	47	53	Dogs barking
		mean	54	46	49	55	20m from road edge
N8	25/06/2007	16.37	63	56	61	65	Traffic. Light breeze.
		17.41	61	51	59	64	Rustling of trees and hedges.
		18.4	61	51	59	65	Little traffic. Light breeze.
		mean	62	53	60	65	At 12m road edge

**Table 4.** Expanded details of daytime noise surveys at WWTP survey locations N4 to N8

Location	Date	Time	L <sub>Aeq</sub> , 15mins	L <sub>A90</sub>	L <sub>A50</sub>	L <sub>A10</sub>	Comment
<b>Night Time Survey</b>							
N4	25/06/2007	22.51	52	46	50	55	Moderate breeze. Rustling from leaves.
		23.51	54	38	43	50	Moderate breeze
		00.48	44	35	38	47	Light breeze
		mean	50	40	44	51	
N5	26/06/2007	00.09	45	40	41	43	Aircraft, cattle
		00.52	43	40	41	43	Distant traffic
		01.32	41	38	39	41	Distant traffic
		mean	43	39	41	42	
N6	26/06/2007	23.49	53	32	37	51	Aircraft
		00.32	51	31	34	45	Aircraft
		01.13	41	29	31	37	Very little traffic.
		mean	48	31	34	44	
N7	25/06/2007	23.30	44	41	43	47	Very little traffic. Rustling of leaves.
		00.30	45	38	39	43	Gentle hum coming from Brown & Gilmer Ltd.
		01.27	49	35	36	37	Gentle hum coming from Brown & Gilmer Ltd.
		mean	46	38	39	42	20m from road edge
N8	25/06/2007	23.12	53	42	47	55	Very little traffic
		00.11	46	32	35	43	Rustling leaves
		01.09	48	31	36	49	Calm
		mean	49	35	39	49	12m road edge

**Table 5.** Expanded details of nighttime noise surveys at WWTP survey locations N4 to N8

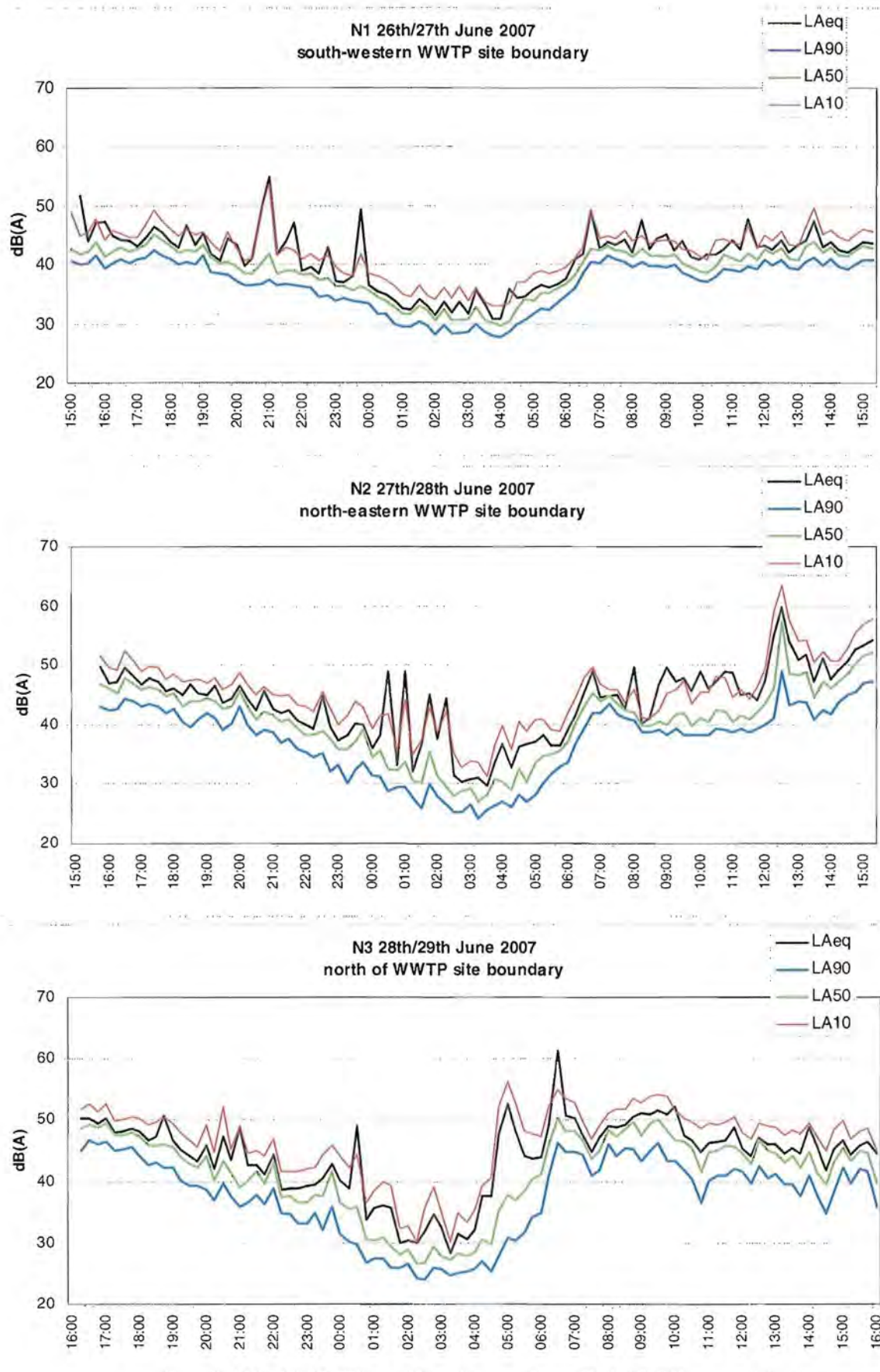


Location	Date	Time	L <sub>Aeq</sub> , 15mins	L <sub>A90</sub>	L <sub>A50</sub>	L <sub>A10</sub>	Comment
Daytime							
Raffeen	26/06/2007	16:24	56	50	54	59	Local traffic, distant construction noise from nearby reservoir site, flowing stream barely audible.
		17:10	57	51	55	60	Noise from local traffic, stream barely audible, distant intermittent construction works.
		mean	57	50	55	60	
Monkstown	26/06/2007	15:46	57	43	48	59	Noise from children in adjacent playground, intermittent local and distant traffic, tree movement in breeze, stream flowing barely audible (roadside position)
		16:45	52	41	46	54	Local traffic noise, children in playground, birdsong, distant traffic noise, tree movement in breeze.
		17:55	55	45	51	58	Local traffic noise, children playing, dogs barking, nearby lawnmower.
		mean	55	43	49	57	
West Beach	27/06/2007	13.15	57	49	55	60	People walking by. Traffic
		14.16	60	52	58	63	People walking by. Jetski's in water. Church bells ringing. Construction noise.
		15.05	58	50	55	60	Lots of people walking by. Church bells ringing. Construction noise
		mean	58	50	56	61	
Carrigaloe	27/07/2006	12.32	63	49	55	67	Traffic
		13.55	62	49	54	66	Traffic. Ferry crossing. Aircraft
		14.38	63	49	57	66	Traffic, wind freshening
		mean	63	49	56	67	

**Table 6.** Daytime noise surveys at the sites of the proposed major pumping stations

Location	Date	Time	L <sub>Aeq</sub> , 15mins	L <sub>A90</sub>	L <sub>A50</sub>	L <sub>A10</sub>	Comment
Nighttime							
Raffeen	26/06/2007	23:24	48	52	39	37	Trees in breeze, intermittent local traffic.
		00:30	47	34	37	47	Intermittent distant and local traffic (light), noise from trees in breeze and nearby stream.
		01:15	42	34	35	39	Noise from nearby stream, very quiet, occasional local car/distant car.
		mean	46	40	37	41	
Monkstown	26/06/2007	23:45	45	37	39	44	Noise from water flowing in nearby stream, distant and intermittent traffic noise, very calm, clear.
		00:53	40	38	38	40	Steady noise from nearby stream.
		00:00	41	39	39	42	Noise from running stream, light breeze, light tree movement, very quiet.
		mean	42	38	39	42	
West Beach Cobh	27/07/2006	23.27	56	48	50	58	Boat docked. Voices
		0.09	56	48	50	59	Boat docked.
		0.51	60	47	49	55	Boat Docked. Voices
		mean	57	47	50	57	
Carrigaloe	27/06/2007	22.3	57	43	49	62	Very Little traffic. Ferry crossing
		23.48	57	41	49	62	Ferry Crossing. Little traffic. No wind
		0.29	57	32	36	56	Ferry has stopped crossing
		mean	57	39	45	60	

**Table 7.** Nighttime noise surveys at the sites of the proposed major pumping stations



**Figure 3** Plot of measured noise levels at 24-hour measurements positions at WWTP site

Daytime	Date	Time	L <sub>Aeq</sub> , 15mins	L <sub>A90</sub>	L <sub>A50</sub>	L <sub>A10</sub>	Comment
1	26/06/2007	15:47	58	51	55	60	Significant traffic.
2	26/06/2007	16:05	64	53	60	67	Traffic, voices, horns beeping.
3	26/07/2007	16:42	57	44	52	61	Tractors.
4	26/06/2007	12:44	63	47	57	66	Local and distant traffic noise, distant motor noise on main road, nearby silage machinery, high % HGV's on road.
5	26/06/2007	13:43	44	38	42	45	Distant and local traffic noise, golf course mowers.
6	26/06/2007	18:15	61	44	55	65	Heavy local traffic noise, trees in breeze
7	27/06/2007	12:15	55	45	49	55	Local and distant traffic, tree movement in wind.
8	27/06/2007	11:32	62	47	51	61	Noise from nearby vehicle distribution centre, intermittent local traffic, distant trucks audible.
9	27/06/2007	17:33	64	41	53	67	Local traffic noise, trees in breeze.
10	27/06/2007	14:58	63	47	53	67	Noise from local and distant traffic, birds, water lapping against sea wall.
11	27/06/2007	16:55	62	49	55	61	Heavy local traffic, distant traffic noise, cars in car park, children playing in nearby playground.
12	27/06/2007	16:25	69	53	65	73	Heavy local traffic, roadside position 3-4 meters, trees moving in breeze.
13	27/06/2007	12.5	69	50	61	72	Traffic
14	28/06/2007	12:57	55	48	52	58	Noise from local traffic, trees in breeze, distant traffic. ~ 20m from roadside and water front.
15	28/06/2007	13:30	49	44	47	51	Distant traffic noise, birdsong, light rain, construction noise from island across the water, distant boat noise.
16	27/06/2007	13:36	66	46	58	71	Traffic
17	28/06/2007	13:55	58	50	52	57	Wind & water lapping against seashore (20m below), trees in breeze, distant traffic barely audible, light rain.
18	28/06/2007	14:24	47	41	44	50	Noise from nearby construction site, trees in breeze.
19	28/06/2007	14:46	54	40	43	54	Intermittent local traffic, birdsong - stopped due to rain after 10 minutes.
20	26/06/2007	13:15	59	49	55	62	Local traffic noise, high % HGV's on road, distant and local traffic.

**Table 8.** Short-term orientation noise surveys at the sites of the proposed minor pumping during daytime

Nighttime	Date	Time	$L_{Aeq, 15mins}$	$L_{A90}$	$L_{A50}$	$L_{A10}$	Comment
1	26/06/2007	22.5	53	47	48	56	Dry night. Little traffic on road. River running close to site.
2	26/06/2007	23.12	63	49	52	65	Road works being carried out 75m away
3	26/07/2007	23.33	47	33	36	45	Aircraft
4	26/06/2007	23:50	57	35	44	62	Intermittent local and distant traffic, low level distant plant noise audible in lulls. Calm & Clear
5	26/06/2007	00:35	45	29	31	38	Noise from airplanes, water flowing in nearby stream barely audible, distant low level plant noise barely audible.
6	26/06/2007	23:00	55	38	42	56	Distant traffic barely audible, intermittent local traffic, stream flowing nearby barely audible
7	27/06/2007	23:25	44	42	43	46	Low level distant plant noise, and distant traffic, trees in breeze.
8	27/06/2007	23:05	51	37	40	46	Intermittent traffic and distant traffic noise, low level rumble, boat?, tree movement in breeze.
9	27/06/2007	00:10	54	34	36	52	Intermittent local and distant traffic, low level plant noise across water from Pfizer barely audible, hedge growth/trees in breeze.
10	27/06/2007	00:57	54	27	34	51	Distant traffic barely audible, occasional car pass by.
12	27/06/2007	01:38	53	33	35	42	Intermittent distant and local traffic, low level plant noise across water audible. Calm, clear, cold night. Stream barely audible.
13	27/06/2007	22.5	64	38	53	70	Little traffic. Little or no breeze
16	27/06/2007	23.09	64	38	50	66	Traffic
20	28/06/2007	00:10	49	32	41	53	Intermittent local and distant traffic.

**Table 9.** Short-term orientation noise surveys at the sites of the proposed minor pumping stations during nighttime

## 2.4 DO-MINIMUM SCENARIO

In the do-minimum scenario, with no development at the site, it is expected that the environmental noise sources will remain essentially unchanged in terms of noise emission. However, the proposed realignment of the N28 will result in a change in noise environment at the proposed WWTP site.

The realigned road will be 100m from the northern boundary of the site at its closest approach. Based on published NRA traffic flow data for this road, it is calculated to generate a daytime traffic noise level of 52 dB(A)  $L_{Aeq}$  at the northern site boundary. The additional nighttime traffic noise level is expected to be approximately 39 dB(A)  $L_{Aeq}$  (calculated based on a 13 dB difference between daytime and nighttime noise levels as measured at the N28, measurement position N8). When added to the existing nighttime noise, of level 36 to 39 dB(A), this will increase the nighttime ambient noise to approximately 40 to 42 dB(A)  $L_{Aeq}$ .

As the steady underlying background noise is determined mainly by the distant traffic noise component, the realignment of the N28 is not expected to significantly alter the steady underlying background noise levels ( $L_{A90}$ ) in the vicinity of the site, and is consequently not a consideration in setting design noise criteria for the WWTP site.

The noise environment is expected to remain unchanged at the locations of the proposed pumping stations.

## 3 NOISE IMPACTS OF THE DEVELOPMENT

### 3.1 ASSESSMENT CRITERIA

#### 3.1.1 CONSTRUCTION NOISE CRITERIA

Criteria for daytime construction noise are generally set at a level higher than for other permanent intrusive noise sources, because it is recognised that it is a short-term activity. For prolonged exposures above 70dB(A), the level of noise intrusion into houses may however prove unacceptable.

A level of 70 dB(A) is the construction noise limit proposed in the National Roads Authority guidelines for road construction projects, during normal daytime working hours, as shown in Table 10. (Guidelines for Treatment of Noise and Vibration in National Roads Schemes, published draft, NRA, 2004).

The National Road Authority guidelines for road construction projects do not include limits for works between the hours of 22:00 hrs. and 07:00 hrs. However for any

essential nighttime works it would be reasonable to assign a limit of 45 dB(A)  $L_{Aeq,1hr}$ , which is the EPA guideline industrial nighttime noise limit.

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
Vibration Limits: For protection of buildings 8 mm/s (vibration frequency <10Hz) 12.5mm/s (vibration frequency 10 to 50Hz) 20 mm/s (vibration frequency >50 Hz)  Continuous piling: 2.5mm/s (tolerable level)		

$L_{Aeq(1hr)}$  is the one hour average noise level.

$L_{Amax}$  is the measured maximum noise level.

**Table10** Maximum permissible noise levels at the façade of dwellings during construction. Source: "Guidelines for the Treatment of Noise & Vibration in National Road Schemes", NRA, 2004

The NRA construction noise limits represent a reasonable compromise between the practical limitations of a construction project, and the need to ensure an acceptable ambient noise level for the residents. The degree of adverse impact depends on the construction noise level, and the duration of the construction project. The descriptive scale of adverse construction noise impacts used in this report is presented in Table 11.

Approximate Duration of Exposure	Construction Noise Level $L_{Aeq}$ dB					
	<55	55-60	60-70	70-75	75-80	>80
Days	Negligible	Negligible	Negligible	Slight	Moderate	Significant
Weeks	Negligible	Negligible	Slight	Moderate	Significant	Severe
Months	Negligible	Slight	Moderate	Significant	Severe	Severe
Year	Negligible	moderate	Significant	Severe	Severe	Severe

**Table 11.** Gradation of adverse noise impact as function of construction noise level, and duration of noise exposure

### 3.1.2 OPERATIONAL PHASE NOISE IMPACT CRITERIA

As this is a Design-Build-Operate (DBO) project, there are no details at this planning stage on the exact equipment to be installed in the Waste Water Treatment Plant.

The project management team has requested that design noise criteria be specified at the plant boundary, in order to accommodate the contractual requirements of the DBO project. Since equipment at the plant will operate continuously, equipment noise emissions would need to be controlled to ensure that acceptable night-time noise levels are achieved at the nearest noise sensitive locations.

The approach taken in this report is to determine a suitably low assessment noise criterion at the nearest houses, such that the resulting noise impact of the proposed development will be negligible, and comfortably within acceptable guideline levels. This assessment noise criterion is then used to calculate back to the plant boundaries, to establish the appropriate design criteria at the plant boundaries.

The validity of the noise impact assessment relies on the final design noise criteria being incorporated into the contracts for the projects, and implemented through appropriate equipment specifications during the detailed design stage.

#### 3.1.2.1 EPA NOISE LIMITS

The EPA (Environmental Protection Agency) guidelines, which set a nighttime limit of 45dB(A), and a daytime noise limit of 55 dB(A), at noise sensitive locations. The EPA guidelines should however be viewed as maximum tolerable levels rather than levels of negligible impact. Where existing background noise levels are low, a lower noise criterion would be required, as described below.



### 3.1.2.2 CONSIDERATION OF CHANGE IN NOISE ENVIRONMENT

In assessing the scale of an adverse noise impact, consideration is given to the change in noise environment brought about by a development. There are two aspects to be considered. The first is the increase in total noise level ( $L_{Aeq}$ ) due to the development, which is termed the “sound emergence”. The second is the degree to which the industrial noise exceeds the pre-existing background noise. In this context the background noise, which is quantified by the  $L_{A90}$  parameter, is the steady underlying component of the ambient noise.

BS 4142 provides guidelines on potential noise impacts by consideration of the level of the industrial noise relative to the background noise. An exceedence of 10 dB indicates clear audibility, with potential for complaints, and the impact needs to be carefully assessed. An increase of 5 dB is considered to be a marginal situation. When the industrial noise is equal to or less than the background noise, it is unlikely to be noticeable, and there is a low probability of complaint.

The mean daytime background noise level at measurement locations N1 to N3 in the vicinity of the proposed WWTP site were in the range 39 to 41 dB(A)  $L_{A90}$ , due to distant traffic noise. At the nearest house to the east, at position N4, the daytime background noise level was 48 dB(A)  $L_{A90}$ .

The mean nighttime background noise level at measurement locations N1 to N3 in the vicinity of the proposed WWTP site was in the range 30 to 31 dB(A)  $L_{A90}$ . During the quietest periods of the night from 02.00 to 05.00, background noise levels ranged between 24 and 30 dB(A)  $L_{A90}$ . At the nearest house to the east of the site at N4, the lowest background noise level detected was 35 dB(A)  $L_{A90}$ .

#### **Noise Impact Descriptors**

Neither EPA guidelines, nor BS 4142 provide criteria for assigning noise impact descriptors such as “negligible, slight, moderate, significant”. However the principles of BS 4142 can be used in conjunction with the EPA guideline noise limits to arrive at a set of descriptors.

In the case where noise from a development is 10 dB higher than the existing background noise, and if the EPA guideline limit is also approached or exceeded, the adverse noise impact can be described as “significant”.

If the noise from a development exceeds the background noise by 5 dB, the adverse impact can be described as: “slight” if the noise level is less than the EPA limit; “moderate” if the noise level is close to the EPA limit; and “significant” if the EPA limit is exceeded by more than 2 dB.

For “negligible” or “slight” impact, the additional noise from the development should be less than, or broadly comparable with the existing background noise. In these cases, if the absolute noise level is close to the EPA limit, , the impact can be described as “slight”. If the absolute noise level is significantly less (10 dB less) than the EPA

limit, the impact can be described as “negligible”. When the noise from the development is significantly lower than the background noise (for example 10 dB lower), it is unlikely to be audible, and the noise impact can be described as negligible.

### **3.1.2.3 CONSIDERATION OF INDOOR NOISE LEVELS AT NIGHTTIME**

It should be noted that BS 4142 was devised for mixed residential and industrial areas, already subject to a detectable level of industrial noise. It does not specifically address noise impacts in quiet rural areas where the background noise is less than 30 dB(A), as occurs on occasion in this area at nighttime.

In these cases of very low background noise, any new noise sources will always be in excess of the background noise level at certain times, especially at nighttime. In these cases, the level of the new noise source relative to the background noise is not the determining factor. Rather, the level of noise transmitted inside a house needs to be considered.

Acceptable indoor noise criteria are specified in British Standard 8233 “ Sound insulation and noise reduction for buildings – Code of practice” (1999). BS 8233 specifies 30 to 40 dB(A)  $L_{Aeq}$  as representing a “good” to “reasonable” indoor noise environment for living rooms, and 30 to 35 dB(A)  $L_{Aeq}$  for bedrooms. In addition, noise maxima inside bedrooms should not normally exceed 45 dB(A)  $L_{AFmax}$  at nighttime. This is to ensure acceptable resting/sleeping conditions. These guidelines are also consistent with recommendations of the World Health Organisation. However from experience measuring indoor noise levels in Irish residences in rural areas, it is found that indoor noise levels at nighttime are generally below 30 dB(A), and would more typically be in the range 20 to 25 dB(A).

An external noise source of level 35 dB(A) would be attenuated by approximately 15 dB when transmitted into a house, through a partially opened window, or through an open ventilation grille. The resulting indoor noise level would therefore be approximately 20 dB(A). This would be at the lower range of typical indoor background noise levels, and provided the sound contains no tonal or impulsive components is unlikely to be noticeable. An indoor noise level of 20 dB(A) would be very comfortably within BS 8233 and WHO guideline levels. Noise impact at this level would be negligible.

### **3.1.3 PROPOSED BOUNDARY NOISE DESIGN CRITERIA**

#### **Criterion for Continuous Plant and Process Noise Emissions**

Taking account of the EPA guideline limits, and the existing low background noise levels, and also the requirement that the WWTP noise should not be noticeable indoors at nighttime, it is considered that a design criterion of 35 dB(A) at nighttime at the nearest noise sensitive location is appropriate for this development. This

would constitute a “negligible” noise impact, based on the noise impact criteria discussed in section 3.1.2 above. The nearest noise sensitive location is the land zoned residential, approximately 130m to the east of the proposed site boundary. There is currently no development on these lands. The nearest existing house is approximately 260m to the east.

The noise design criterion is best specified at a reference distance from the proposed boundary, rather than at the precise WWTP boundary. Specification at a position beyond the site boundary would take proper account of any noise screening which may be incorporated at the WWTP plant boundary, which would also have a benefit at the nearest noise sensitive receptor locations. A reasonable reference position would be at 20m from the boundary to the north, south, and east. The western boundary is not especially noise sensitive, due to the proximity of the ESB compound. It is therefore not necessary to apply a noise design criterion for the western boundary.

An ISO 9613 noise propagation model was developed for the proposed site. This was used to calculate the design criterion at the plant boundary, which would ensure that the resulting noise level at the zoned residential lands 130m to the east was less than 35 dB(A), which is the criterion for negligible noise impact in this rural area. The calculated design noise criterion is a noise level of 45 dB(A) at 20m from the plant boundaries. Based on experience measuring noise levels at existing wastewater treatment plants, this is considered to be technically achievable using current equipment technology, and through incorporation of boundary noise screening where required.

### **Criterion for Daytime Work Activity Noise Emissions**

It should be noted that the above engineering design noise criterion applies to items of equipment and processes at the WWTP which operate on a 24-hour basis. The criterion was devised to ensure that there would be negligible noise impact at nighttime, which is the most sensitive period with respect to noise impact.

During normal operation of the WWTP there will also be daytime work activities, and movement of vehicles during daytime within the site, which would not be subject to the same criterion. The existing underlying background noise in the vicinity of the site was determined to be at least 10 dB higher than at nighttime. Consequently, a daytime design noise criterion 10dB higher than the nighttime criterion, i.e. 55 dB(A) at 20 m for the site boundary, would be considered appropriate to ensure negligible daytime noise impact at the nearest noise sensitive receptors. For a daytime noise criterion of 55 dB(A) at 20m from the boundary, the resulting noise level at the nearest noise sensitive location, approximately 130m to the east is calculated to be 45 dB(A).

## **3.2 CONSTRUCTION NOISE IMPACT**

### **3.2.1 CONSTRUCTION OF WASTE WATER TREATMENT PLANT**

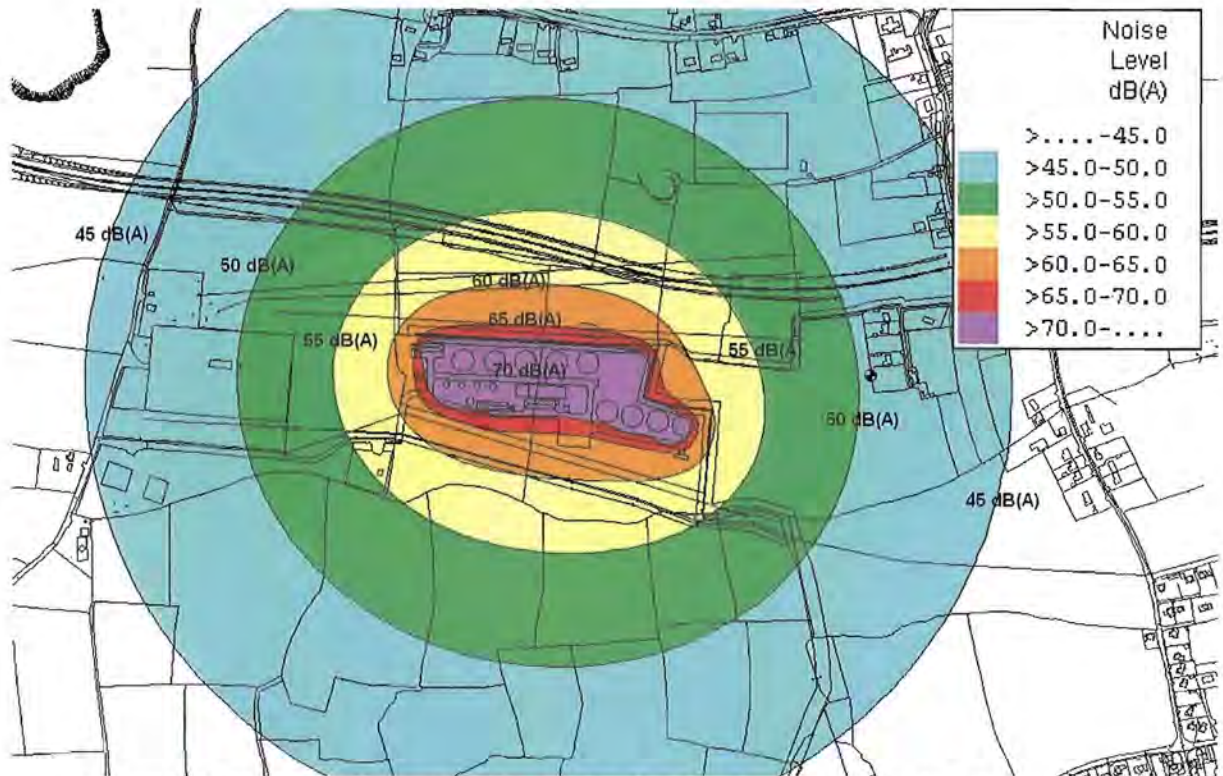
The assessment in this report is based on general information available at the planning stage of the project. The analysis presented is considered indicative of the scale of potential noise impacts during the construction phase, based on noise emission data for construction equipment from BS 5228, and experience at similar sites. However this does not constitute a definitive estimate of construction noise levels. The detailed noise analysis can only be carried out when precise details of works are formulated in terms of equipment, processes, and exact timings of works. This detailed analysis will be the responsibility of contacting companies undertaking the work, in accordance with the applicable standards.

During construction of the treatment plant itself, the highest noise levels will be generated during the site clearance and excavation phase of the works. During the actual construction of the plant facilities and equipment installation, noise emissions will be considerably lower.

For site clearance activities, involving heavy earth moving and excavation equipment, the calculated construction noise level at the nearest house to the east is 51 dB(A)  $L_{Aeq}$  (based on an assumed sound power emission of 120 dB  $L_{WA}$  from plant and equipment operating on the site). This calculated noise level is very comfortably below the NRA construction noise criterion of 70 dB(A). It would be just noticeable above the existing ambient noise outdoors, but would not be intrusive. There would be no noticeable noise impact indoors. The resulting noise impact at the houses is negligible.

The construction noise level in the sports field to the northeast is expected to be in the range 50 to 55 dB(A), and will have negligible impact on outdoor activities in this area.

A noise map representing construction noise levels during the early construction phase of the WWTP is shown in Figure 4.



**Figure 4.** Calculated construction noise levels, during the early site excavation and preparation phase when noise emissions are expected to be highest. The calculation are based on a total site sound power emission of 120 dB(A)  $L_{WA}$ , which is a reasonable allowance for a project of this scale

### 3.2.2 CONSTRUCTION WORKS AT PUMPING STATIONS

The construction works at the major pumping stations will be of a significantly reduced scale compared with the construction of the WWTP. The highest noise emissions will be produced during the site preparation and excavation phase. Based on a site equipment sound power emissions of 115 dB(A)  $L_{WA}$ , the resulting construction noise levels at the nearest houses are calculated to be approximately 70 dB(A) at the nearest houses at the Monkstown and West Beach sites, where it is considered that the standard guideline noise limit of 70 dB(A) can be complied with, subject to appropriate mitigation. There will be a slight adverse noise impact at these houses. At the Raffeen and Carrigaloe sites, the calculated noise levels are 58 and 57 dB(A) respectively, which are comfortably within the standard 70 dB(A) criterion, and noise impact will be negligible.

Construction noise levels at the minor pumping stations will be of a lower level and shorter duration than for the major pumping stations, and the adverse noise impact will be negligible to slight.

<b>Location of Proposed Pumping Station</b>	<b>Calculated Construction Phase Noise Level at Nearest House to Pumping Station dB(A)</b>
Rafeen	58
Monkstown	70
Carrigaloe	57
West Beach Cobh	69

**Table 12.** Calculated highest construction noise levels, during the early site preparation and excavation phases for the proposed major pumping stations (BS 5228 calculation based on site sound power emissions of 115 dB(A)  $L_{WA}$ , with allowance for noise screening by standard timber site hoardings).

### 3.2.3 EXCAVATION WORKS FOR SEWER LINES

The proposed sewer network will involve laying of sewer lines through populated areas of Cobh, Monkstown, Ringaskiddy, and Carrigaline, and in the vicinity of houses along rural sections of the network. The noise level at houses along the proposed sewer routes will vary depending on the proximity of the works, and the set-back distance of the houses from the line of the sewer. The expected construction noise levels at the houses along the routes of the sewer pipelines were calculated in accordance with BS 5228. The calculations are based on typical equipment noise emissions data (for excavator/breaker and truck) and allow for distance attenuation, and marginal screening at the house boundaries.

The highest expected noise level at any given house along the sewer route will be generated when excavations are in progress immediately adjacent to the house in question. The noise level at the house will depend on the distance of the house from the excavation works. Table 13 shows the calculated noise levels for houses at various distances from the line of the sewer line excavation works.

For houses set back 10 metres from the sewer line, the noise levels may exceed the 70 dB(A) construction noise criterion for the short period while works are in progress immediately adjacent to the house.

As works progress along the route, the noise level at any given house will vary depending on the location of the works along the road. The expected variation in noise level is shown in Figure 5. This shows that in general noise levels will be less than 65 dB(A). However, noise levels may exceed 70 dB(A) while works are in progress in the 20m stretch immediately in front of the houses. As works progress away from the house, the noise level falls off rapidly. Beyond 50 metres, the noise level would be less than 60 dB(A), and beyond 100 metres the noise levels would be less than 54 dB(A).

This construction noise will be audible above the existing ambient noise, but would

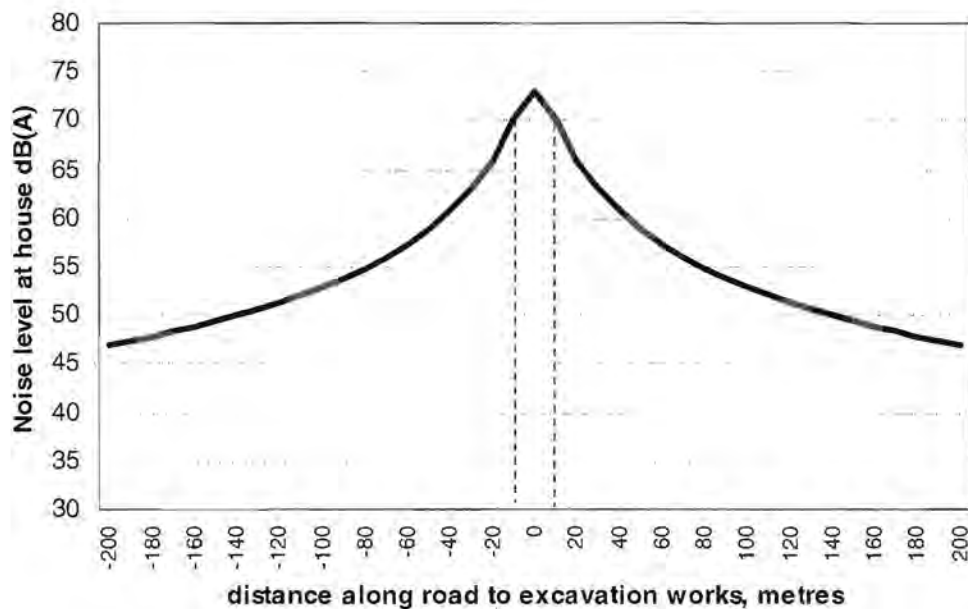
not be considered intrusive in the context of the limited duration of the works.

Set-back distance of house from line of sewer excavations, metres	10	20	30	40	50
Noise level dB(A) $L_{Aeq,1hr}$	73	67	63	61	59

**Table 13.** Calculated noise levels at a house, due to excavation works at roadside adjacent to the house

(based on data from BS 5228, with an assumed sound power emission of 110 dB(A) from an excavation works, with average on-time of 50%, and assumed nominal screening allowance of 6 dB for boundary walls.)

### Noise due to road excavation



**Figure 5.** Variation of noise level at a given house, depending on distance of excavation works along the road from the house entrance. In the situation depicted, the house is 10m from the road. The 70dB(A) NRA criterion may be exceeded while works are in progress on the 20m stretch immediately in front of the house.

### Channel Crossing at Carrigaloe

At this planning stage, final details are not available on the works on the channel crossing at Carrigaloe. The possible options include open cut and tunnelling. In either case, it can be assumed that there will be shore-based works, which will generate noise. In the case of the open cut option there would also be noise emitted from the works on floating platforms in the channel. An additional consideration is the question of tidal restrictions, which may require works to be carried out outside the normal daytime construction periods on occasions. Noise emissions from these works will be subject to the construction noise limits set out in section 3.1.1.

### **3.2.4 VIBRATION**

In carrying out this assessment, it is assumed that there will be no blasting carried out.

Taking account of the nature of the likely excavation works for the sewerage pipes, such as excavation and rock breaking, it is expected that the resulting vibration levels at nearby properties will be comfortably within the vibration limits for protection against cosmetic damage (set out in Table 10), and in terms of nuisance, are likely to be imperceptible.

### **3.2.5 CONSTRUCTION TRAFFIC**

At this planning stage, precise details are not available on construction traffic volumes. Additional traffic noise can however be expected on haul routes to the treatment plant site, and along the sewer pipeline routes.

Based on a nominal assumption of 10 vehicles per hour travelling to/from the work sites, the additional traffic noise generated at a house at 10m from the road is expected to be approximately 55 dB(A). This is a relatively low level of traffic noise, and would have only a slight impact.



### **3.3 OPERATIONAL PHASE NOISE IMPACT**

#### **3.3.1 NOISE PROPAGATION MODEL**

A computer noise propagation model was developed for the proposed waste water treatment plant. The model is based on the calculation procedures of ISO 9613. For noise modelling purposes the overall continuous plant and process noise emissions from the new plant are assumed to be limited at source and/or screened, such that the resulting noise level at a reference distance of 20m from the plant boundary is at the proposed design noise criterion of 45 dB(A). For additional work activities and vehicles operating within the site during daytime, the overall noise emissions are assumed to be limited to the daytime noise criterion of 55 dB(A) at 20m from the boundary.

#### **3.3.2 NOISE EMISSIONS FROM WWTP**

The calculated operational noise levels, and noise impact assessment for the daytime and nighttime periods, are presented in Table 14. The calculated noise levels for the operational WWTP are illustrated as a noise map in Figures 6 and 7 for nighttime and daytime operation respectively.

##### **Daytime Noise Impact**

For daytime operation of the WWTP, including daytime work activities and vehicle movements within the site, the projected additional noise levels due to the WWTP are in the range 34 dB(A) to 45 dB(A) at the noise sensitive locations considered. These additional noise levels are all comfortably below the EPA daytime noise limit of 55 dB(A).

At the nearest lands zoned residential to the east of the site, the ambient noise level is calculated to increase by 2 dB. This increase is not likely to be perceptible. The daytime activity noise and vehicle movement noise within the site is calculated to exceed the background noise by 4 dB. The noise may therefore be just audible, but is unlikely to be clearly distinguishable from the existing distant traffic noise. The component of continuous noise from the plant and processes at the WWTP (excluding vehicles and daytime works activities) would be in the range 27 to 35dB(A) and would be inaudible. The noise impact at this location is considered to be negligible.

At the other noise sensitive locations, the additional noise from the WWTP, including daytime work activities and vehicle movements within the site, would not result in any change in the existing total ambient noise at the nearest noise sensitive locations, and would be lower than the existing background noise levels. There would be no adverse noise impact at these locations.

At the existing houses to the east, north, south and west, the calculated additional WWTP noise will be 8 to 14 dB lower than the existing steady background noise level, and will be inaudible.

In the sports field to the north east of the site, the daytime noise level is expected to be in the range 40 to 45 dB(A), and will have no noise impact on the amenity of this area.

### **Nighttime Noise Impact**

For nighttime operations, noise emissions from the WWTP are the same as modelled for daytime conditions, and the calculated noise levels at the noise sensitive locations are in the range 24 to 35 dB(A).

These additional noise levels are all in comfortable compliance with the EPA nighttime noise limit of 45 dB(A).

The additional noise at the noise sensitive locations would result in an increase of at most 1 dB in nighttime noise level at the nearest noise sensitive location, which is the land zoned residential 140m to the east. At this location, the WWTP noise would exceed the existing steady background noise by 5 dB, and consequently the noise would be audible at a low level outdoors. Allowing for an attenuation of approximately 15 dB through a partially opened window, the resulting indoor noise level would be 20 dB(A). This is comfortably within the BS 8233 guidelines, and represents an extremely low noise level which is unlikely to be noticeable indoors. The adverse noise impact at this location is considered to be negligible.

At the existing houses to the east, north, south and west, the projected WWTP noise is very low, and in the range 24 to 30 dB(A). The WWTP noise would be between 6 and 11 dB lower than the existing background noise, and would not be audible outdoors or indoors. There would be no adverse noise impact at these houses.

House Locations	Projected WWTP Plant Noise Level L <sub>Aeq</sub> dB(A)	Existing Noise L <sub>Aeq</sub> dB(A)	Projected Total Future Noise L <sub>Aeq</sub> dB(A)	Projected Change, dB (Sound emergence)	Within EPA Limits (55/45 dB(A) day/night)	Comparison with mean background noise L <sub>A90</sub> <sup>1</sup>	Likely Audibility	Overall Adverse Noise Impact
<b>Daytime</b>								
Lands to east (zoned residential)	45	47	49	+2	yes	+ 4 dB	Daytime activities possibly audible at low level outdoors, inaudible indoors	Negligible
Houses to east	40	55	55	0	yes	-8 dB	Inaudible outdoors and indoors	None
Houses to north	39	62	62	0	yes	-14 dB		
Houses to south	34	55	55	0	yes	-8 dB		
Houses to west	37	54	54	0	yes	-9 dB		
<b>Nighttime</b>								
Lands to east (zoned residential)	35	38	40	+2	yes	+5 dB	Audible at low level outdoors, not noticeable indoors	Negligible
Houses to east	30	50	50	0	yes	-10 dB	Inaudible outdoors and indoors	None
Houses to north	29	49	49	0	yes	-6 dB		
Houses to south	24	48	48	0	yes	-7 dB		
Houses to west	27	46	46	0	yes	-11 dB		

**Table 14.** Predicted noise levels from proposed WWTP, and noise impact assessment

<sup>1</sup> difference between projected WWTP noise, and the background noise at the assessment location, as given in Table 3

### **3.3.3 GROUND VIBRATION DUE TO WWTP**

From visits to other waste water treatment plants (including Limerick, Ennis, Kilkenny, Athy, Greystones), it has been found that there is no perceptible ground vibration beyond the site boundaries associated with the operating equipment. At the proposed WWTP site, the nearest sensitive location is 140m to the east. There is unlikely to be any significant potential for audible ground-borne vibration over this distance.

### **3.3.4 NOISE AND VIBRATION EMISSIONS FROM PUMPING STATIONS**

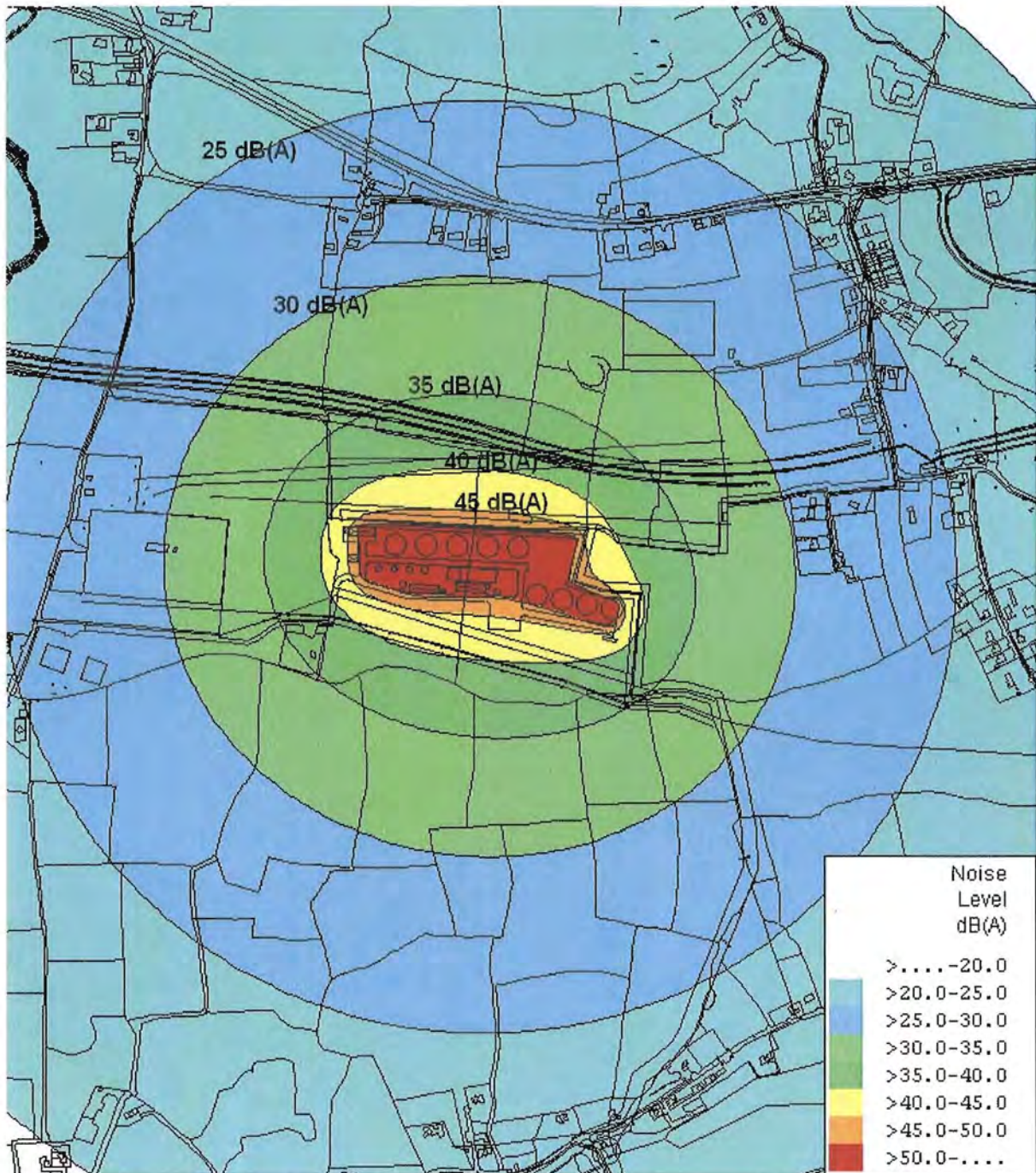
As the pumps and equipment in the major pumping stations will be enclosed within buildings, or located below ground level at the minor pumping stations, the noise sources will be effectively enclosed. In principle any desired degree of sound attenuation can be achieved.

Nighttime background noise levels at the sites of the proposed pumping stations ranged from 32 to 47 dB(A)  $L_{A90}$ . A reasonable criterion would be to ensure a noise level of less than 35 dB(A) at the nearest houses, as was proposed for the noise sensitive locations near the WWTP site itself. For noise sensitive locations closest to the pumping stations at Monkstown and West Beach Cobh, this would correspond to a design noise criterion of 45 dB(A) at 5m from the pumping stations.

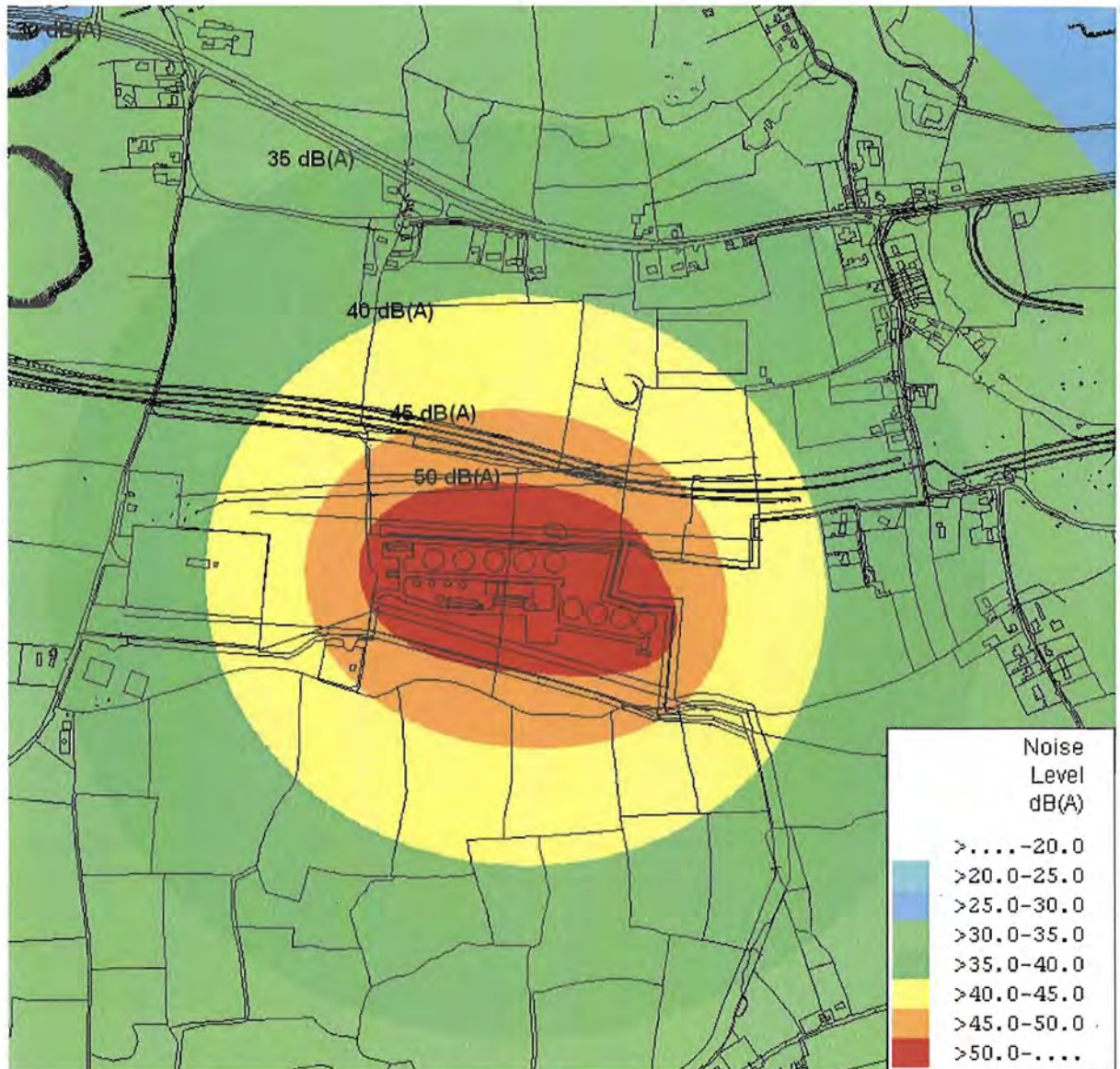
Given the proximity of nearby residences to the pumping station at Monkstown and West Beach Cobh, it is prudent to consider the potential for generation of ground-borne vibration, in the audio frequency range, which could potentially give rise to a low pitched audible sound inside the nearby residences.

Such ground-borne hums could be generated by motors, pumps and any other equipment which is in mechanical contact with the ground near a building. Audible ground-borne vibration is readily prevented through incorporation of suitable vibration isolators in the equipment mountings.

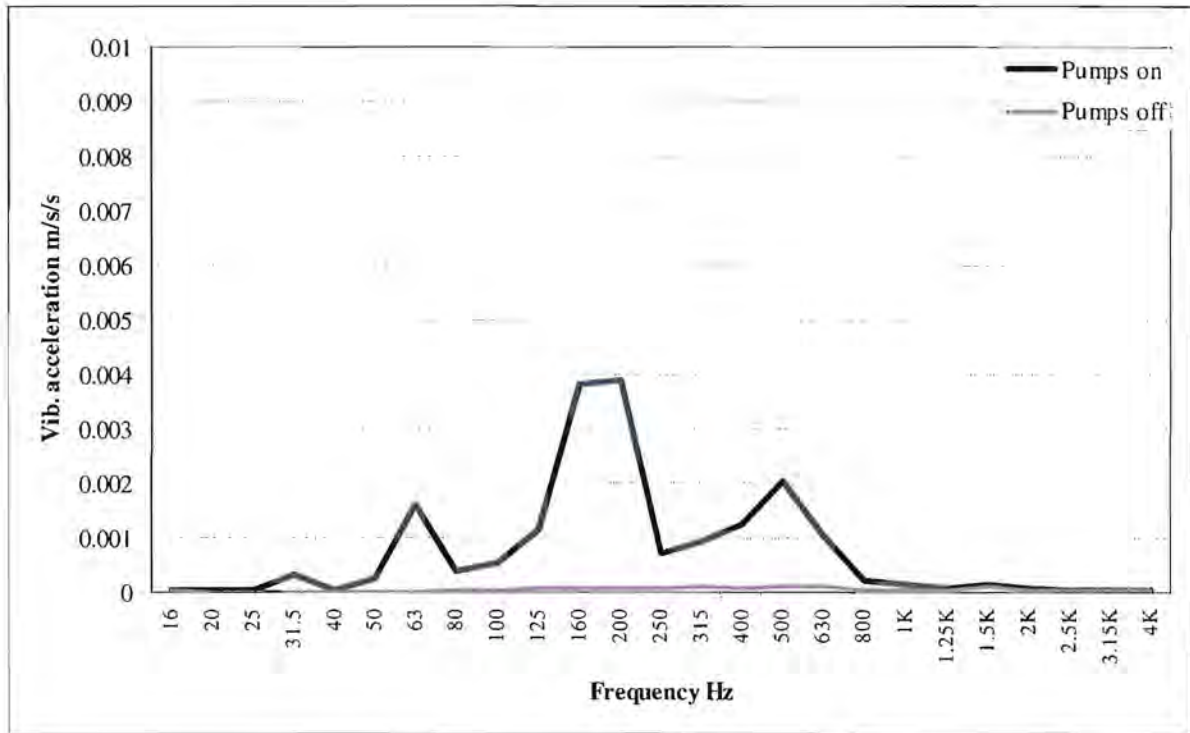
Measurements at the existing Church Street pumping station in Carrigaline found that ground vibration levels at 1m from the wall of the pumping station were extremely low, and there was negligible potential for transmission of audible ground-borne vibration to nearby residences. The measured vibration level is presented in Figure 8.



**Figure 6.** Calculated nighttime noise levels due to the operating WWTP. This noise map was generated using an ISO 9613 noise propagation model, based on a nighttime design noise criterion of 45 dB(A) at 20m from the WWTP boundary. This noise map represents the continuous plant and process noise emissions from the operating WWTP.



**Figure 7.** Calculated noise levels due to operating WWTP, during daytime. This noise map was generated using an ISO 9613 noise propagation model, based on a design noise criterion of 55 dB(A) at 20m from the WWTP boundary during daytime. This noise map represents the continuous plant and process noise emissions from the operating WWTP, and includes daytime work activities and traffic on site.



**Figure 8.** Measured ground vibration level at 1m from existing Church Street pumping station in Carrigaline, which demonstrate very low ground vibration levels, with no potential for transmission of audible sound beyond the immediate vicinity of the station

### **3.3.5 IMPACT OF OPERATIONAL PHASE TRAFFIC**

Detailed operational traffic forecasts were not available at time of preparation of this report. However the estimates of likely site traffic are relatively low, at approximately 10 heavy vehicle movements per day along Cogan's Road to the site, and light staff traffic, which will have negligible impact.

The calculated traffic noise level due to the heavy vehicle movements is 40 dB(A)  $L_{Aeq}$  at a distance of 20m from the road. The existing measured traffic noise level was 54 dB(A)  $L_{Aeq}$  . The additional traffic noise would not add detectibly to the average traffic noise level.

The noise generated by vehicles moving within the site is calculated to result in a noise level of less than 50 dB(A) at 20m from the site boundary, and will be comfortably within the proposed daytime noise criterion of 55 dB(A) at 20m from the site boundary.



## 4 MITIGATION

### 4.1 NOISE MITIGATION DURING CONSTRUCTION PHASE

During the construction phase of the actual WWTP, the potential noise impact during daytime is slight, and no special mitigation measures are likely to be required.

During construction of the pumping stations and during excavation works for the sewer lines, there is potential for exceedence of the standard construction noise criterion of 70 dB(A) on occasions. In accordance with best practice, the noise issues at the sites should be managed in accordance with the recommendations in BS 5228, which should be incorporated into the construction environmental management plan.

- General guidelines for limiting the disturbance which may be applicable for these works are outlined below:
- Limit noisy construction works to 07.00 to 19.00 weekdays with Saturday working from 08.00 – 13.00 hours (relatively quiet construction activities could be carried out outside these hours, subject to strict controls).
- Essential nighttime works, should be subject to a noise limit of 45 dB(A), and carefully assessed and controlled to minimise impact
- Utilise solid timber site hoardings where required to screen sensitive properties.
- Use modern, silenced and well-maintained equipment conforming to applicable EU directives.
- Shut down equipment when not in use, where practicable.
- Site semi-static equipment such as generators, mixers, and compressors as far away as possible from sensitive locations and ensure that the orientation is the optimum for low noise.
- Ensure that all workers are given training with respect to minimising noise and disturbance.
- Noise exposure aspects within the worksites will be managed in accordance with the requirements of Safety, Health and Welfare at Work (General Application) Regulations 2007, SI 299 of 2007.

## 4.2 NOISE MITIGATION FOR OPERATIONAL PHASE

The assessment of noise impact during the operational phase of the development was based on a nighttime design noise criterion of 45 dB(A) at 20m from the northern, eastern and southern boundaries of the WWTP, and a design criterion of 45 dB(A) at 5m from the pumping stations.

In addition, for the WWTP site, a daytime design noise criterion of less than 55 dB(A) at 20m from the boundary is proposed to ensure negligible noise impact due to daytime work activities and vehicles operating within the site. These design noise criteria represent the specific noise emissions from continuous plant and processes, excluding residual noise from other sources such as traffic.

The achievement of these noise criteria will depend on the appropriate noise specifications and noise controls being incorporated into the detailed acoustic design of the plant. The principal mitigation measures required for the development therefore concern selection of equipment, sound containment, acoustic attenuators, and noise screening, in order to achieve the required design noise criteria.

Any mechanical equipment (such as motors) at the pumping stations, which is considered capable of transmitting significant ground borne vibration in the audio frequency range, should be adequately vibration isolated to ensure that they do not give rise to audible sound at the nearest houses.

Achieving the design criteria will be the responsibility of the developer's design team. The predicted noise levels, as outlined in this report are considered to be readily technically achievable using standard technology and noise control methods. The contractor will be required to demonstrate in advance of construction, using an appropriate methodology, that the design noise criteria will be achieved.

The design noise criteria referred to above, are for engineering design purposes only, and should not be confused with any noise conditions which may be set by the relevant authorities, which would typically be 55 dB(A) during daytime, and 45 dB(A) during nighttime at noise sensitive locations (as opposed to boundaries).

## 5 RESIDUAL NOISE IMPACT

The WWTP development with associated pumping stations is expected to have a negligible residual noise impact at the nearest houses during daytime and nighttime operations. Noise will be comfortably within the EPA limits at all houses.

## 6 NON TECHNICAL SUMMARY

The environmental noise impact of the proposed Cork Lower Harbour Drainage Scheme and Waste Water Treatment Plant has been assessed both during the construction phase, and during the operational phase.

The existing daytime noise environment in the vicinity of the proposed WWTP site was found to be relatively quiet, with a mean ambient noise level in the range 44 to 47 dB(A)  $L_{Aeq}$ , and with steady underlying background noise levels of 39 to 41 dB(A)  $L_{A90}$ . The noise environment is determined by distant traffic noise, agricultural machinery, with a contribution from aircraft noise.

At nighttime the mean ambient noise level was in the range 36 to 43 dB(A)  $L_{Aeq}$  with a steady underlying background noise component of 30 to 39 dB(A)  $L_{A90}$ .

The future realignment of the N28 will alter the noise environment at the site of the WWTP. The calculated future ambient noise level at the northern boundary is 52 dB(A) during daytime, and 39 dB(A) at nighttime. The realignment of the road is not expected to alter the steady underlying component of background noise at the WWTP site, as this is due to distant noise sources.

At the sites of the proposed major pumping stations at Rafeen, Monkstown, West Beach Cobh, and Carrigaloe, the noise environment was determined mainly by local traffic.

During the construction phase of the proposed WWTP the resulting noise levels at the nearest existing houses to the east and north is 51 dB(A). This is a very low noise level, and is comfortably within the standard construction noise criterion of 70 dB(A). The noise impact will be negligible.

During construction of the major pumping stations at Rafeen, Monkstown, West Beach Cobh, and Carrigaloe, the construction noise levels are expected to range from 57 to 70 dB(A) at the nearest houses. The highest noise levels will be experienced at the houses closest to the Monkstown and West Beach sites. Subject to appropriate mitigation, it is expected that the NRA 70 dB(A) criterion will be achievable at these locations, and that the resulting adverse impact will be slight.

The proposed scheme will involve extensive excavation works for laying new sewer lines. When these works are in progress adjacent to houses along the routes, noise may exceed the 70 dB(A) National Roads Authority construction noise criterion for short periods. In general however, construction noise levels at houses along the sewer routes will be typically less than 65 dB(A), with minimal impact.

When the treatment plant is operational, and provided it is designed to the specified noise criteria, noise emissions are calculated to result in a nighttime noise level of 30 dB(A)  $L_{Aeq}$ , and a daytime noise level of 40 dB(A)  $L_{Aeq}$  at the nearest existing houses to the east, with no adverse noise impact. At the lands zoned residential, 140m to the east of the site, the expected noise level is 35 dB(A) at nighttime, and 45 dB(A) during daytime. The resulting noise impact is considered to be negligible.

Airborne noise emission from the pumping stations will be negligible. However, where a pumping station is located close to a residence, there is a small risk of structure borne vibration being transmitted into the residence, and being audible indoors. This can be avoided through incorporation of suitable vibration isolation as appropriate.

### **Summary of Main Mitigation Measures for This Project**

- The Waste Water Treatment Plant should be designed such that the operational noise level due to the continuously operating WWTP plant and processes at a distance of 20m from the plant boundaries is less than 45 dB(A)  $L_{Aeq}$ .

This criterion excludes daytime work activities and daytime vehicle movements within the site. The appropriate criterion for these daytime work activities and vehicle movements is a noise level of less than 55 dB(A) at a distance of 20m from the boundaries

- The pumping stations should be designed such that the operational noise level at a distance of 5m from the stations is less than 45 dB(A)  $L_{Aeq}$
- Any equipment at the pumping stations capable of transmitting audible ground borne vibration to nearby houses should be adequately vibration isolated
- A daytime construction noise limit of 70 dB(A) is considered appropriate for this project. Construction noise aspects should be managed in accordance with BS 5228 “Noise and vibration control on construction and open sites”.

## References

ISO 1996 “Description and Measurement of Environmental Noise”

ISO 9613 “Attenuation of sound during propagation outdoors”

BS 5228 “Noise and Vibration Control on Construction and Open Sites”.

BS 4142, “Rating Industrial Noise Affecting Mixed Residential and Industrial Areas”.

U.K. Design Manual for Roads and Bridges / Calculation of Road Traffic Noise

BS 8233 “Sound insulation and noise reduction for buildings – A code of practice”.

National Road Authority “Guidelines for Treatment of Noise and Vibration in National roads Schemes”

World Health Organisation: “Guidelines for Community Noise”

## APPENDIX A - TERMINOLOGY

**dB(A)** a logarithmic noise scale (decibel). The "A" indicates that a frequency weighting has been applied to take account of the variation in the sensitivity of the human ear as a function of frequency.

**L<sub>Aeq</sub>** the average noise level during the measurement period, which includes all noise events. The L<sub>Aeq</sub> value has been found to correlate well with human tolerance of noise, and is the value normally used in setting and monitoring industrial noise limits.

**L<sub>A90</sub>** the noise level exceeded for 90% of the time. It is generally taken as being representative of the steady background noise at a location. It tends to exclude short events such as cars passing, dogs barking, aircraft flyovers etc.

**L<sub>A50</sub>** the noise level exceeded for 50% of the time.

**L<sub>A10</sub>** the noise level exceeded for 10% of the time. It is a measure of the higher noise levels present in the ambient noise. The L<sub>A10</sub> parameter is generally used to describe traffic noise.

**L<sub>WA</sub>** the total sound power emitted by a source (in dB re 1 picoWatt)

### Free-field

Noise measurements made away from reflecting surfaces (apart from the ground) are termed free-field measurements. Measurements at the façade of a building are typically 3 dB higher, due to reflection from the façade. All data in this report are free-field

### Total Noise Level

The total noise level due to all noise sources (also called ambient noise).

### Specific Noise Level

A component of the ambient noise that can be attributed to a specific source, e.g. industrial source

### Residual Noise Level

The component of the total noise that exists in the absence of the specific noise

### Sound Emergence

The increase in the total noise due to the addition of a specific noise source

### Background Noise

The steady underlying component of the measured noise (normally measured using the L<sub>A90</sub> parameter)