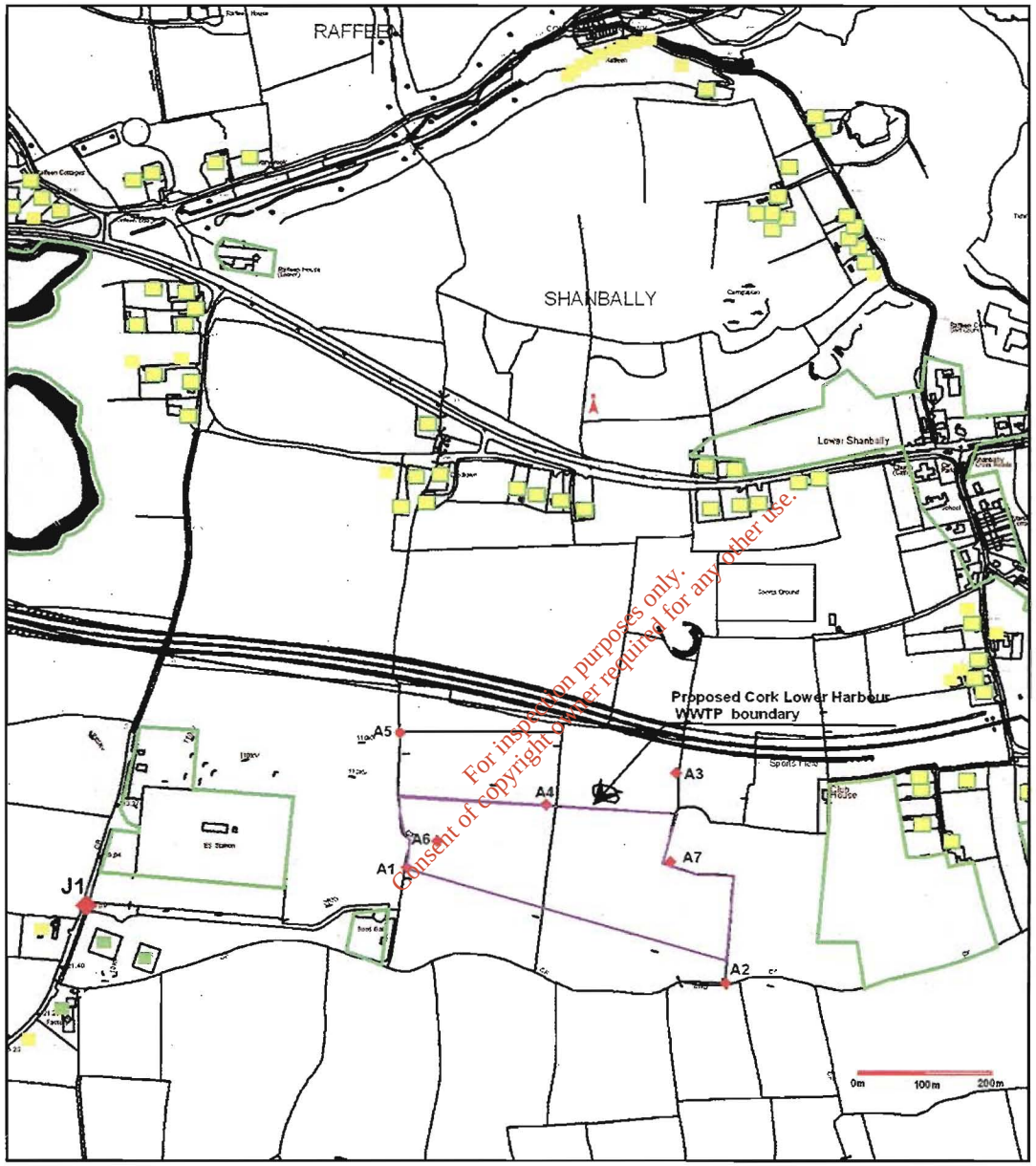


NOTE:
RECEPTOR LOCATION J1 WAS USED FOR ASSESSING THE MAXIMUM PREDICTED EMISSIONS ASSOCIATED WITH TRAFFIC GENERATION AS A RESULT OF THE WWTP OPERATION PHASE.

Mott MacDonald

FIGURE 3.6.1 OVERVIEW OF MONITORING LOCATIONS A1 TO A7 AND RECEPTOR LOCATION J1 (SEE NOTE) IN THE VICINITY OF THE PROPOSED CORK HARBOUR MAIN DRAINAGE SCHEME WWTP

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG178

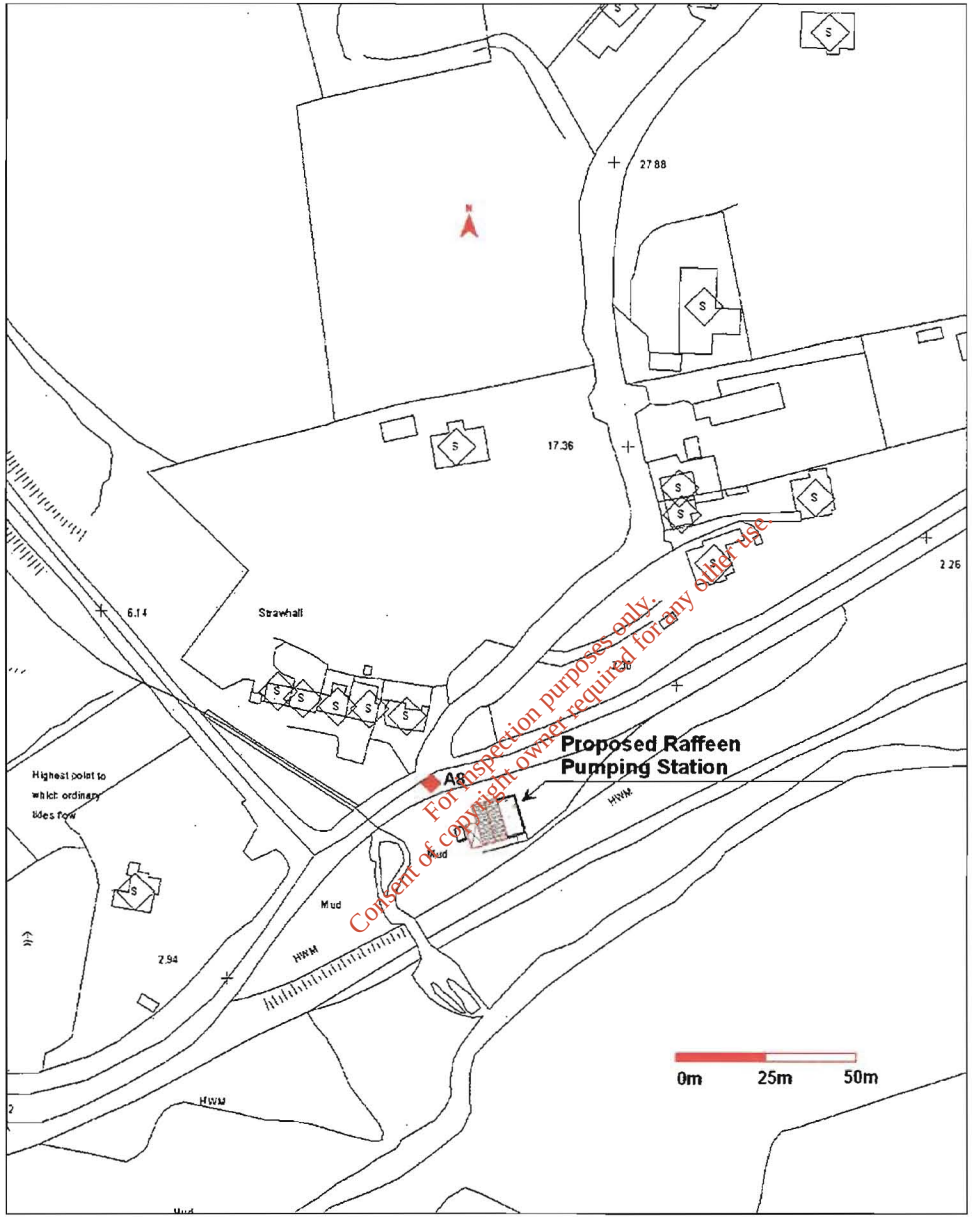


FIGURE 3.6.2 OVERVIEW OF MONITORING LOCATION A8 IN THE VICINITY OF THE PROPOSED RAFFEEN PUMPING STATION

Mott MacDonald

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG173

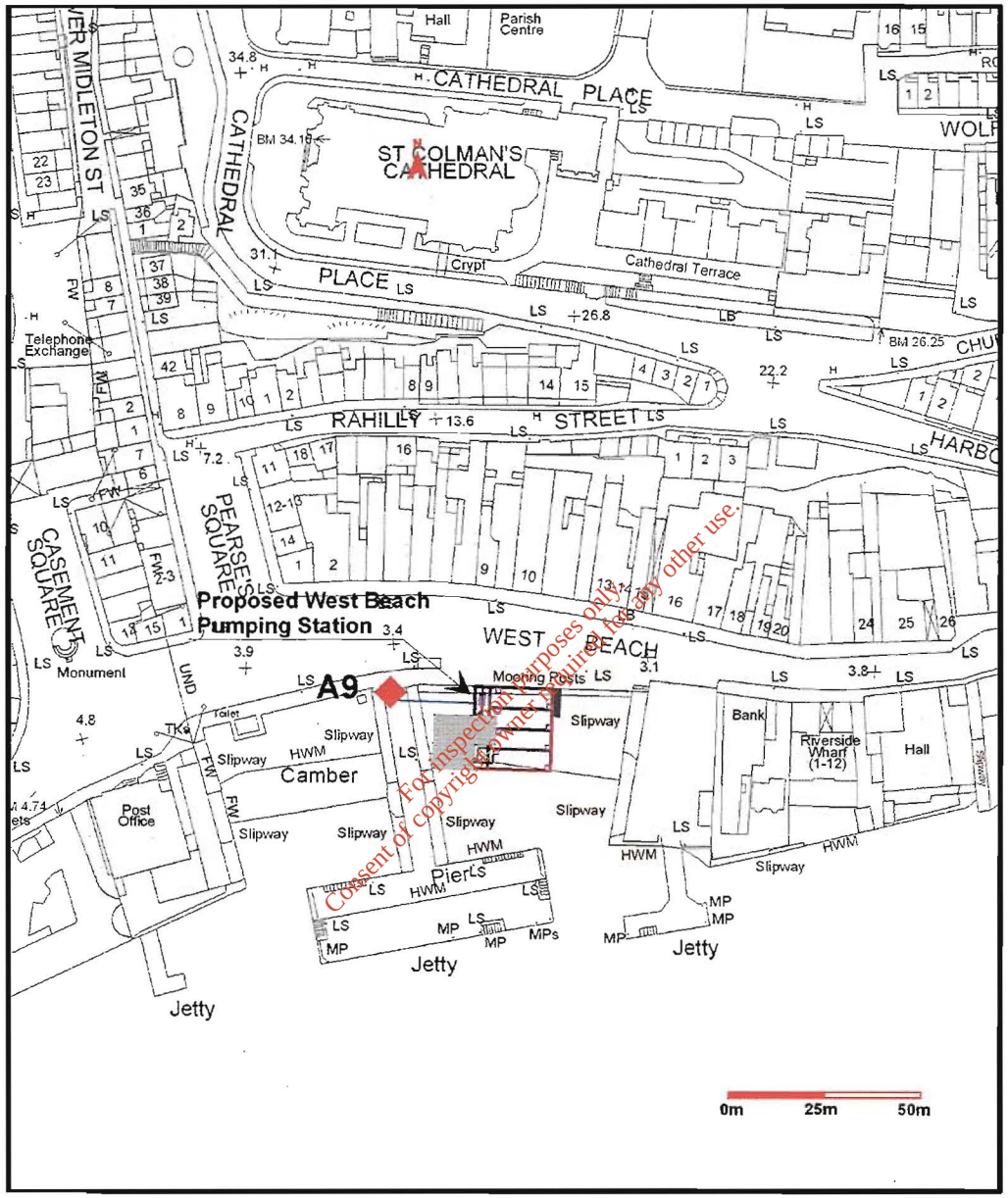


FIGURE 3.6.3 OVERVIEW OF MONITORING LOCATION A9 IN THE VICINITY OF THE PROPOSED WEST BEACH PUMPING STATION

Mott MacDonald

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG174

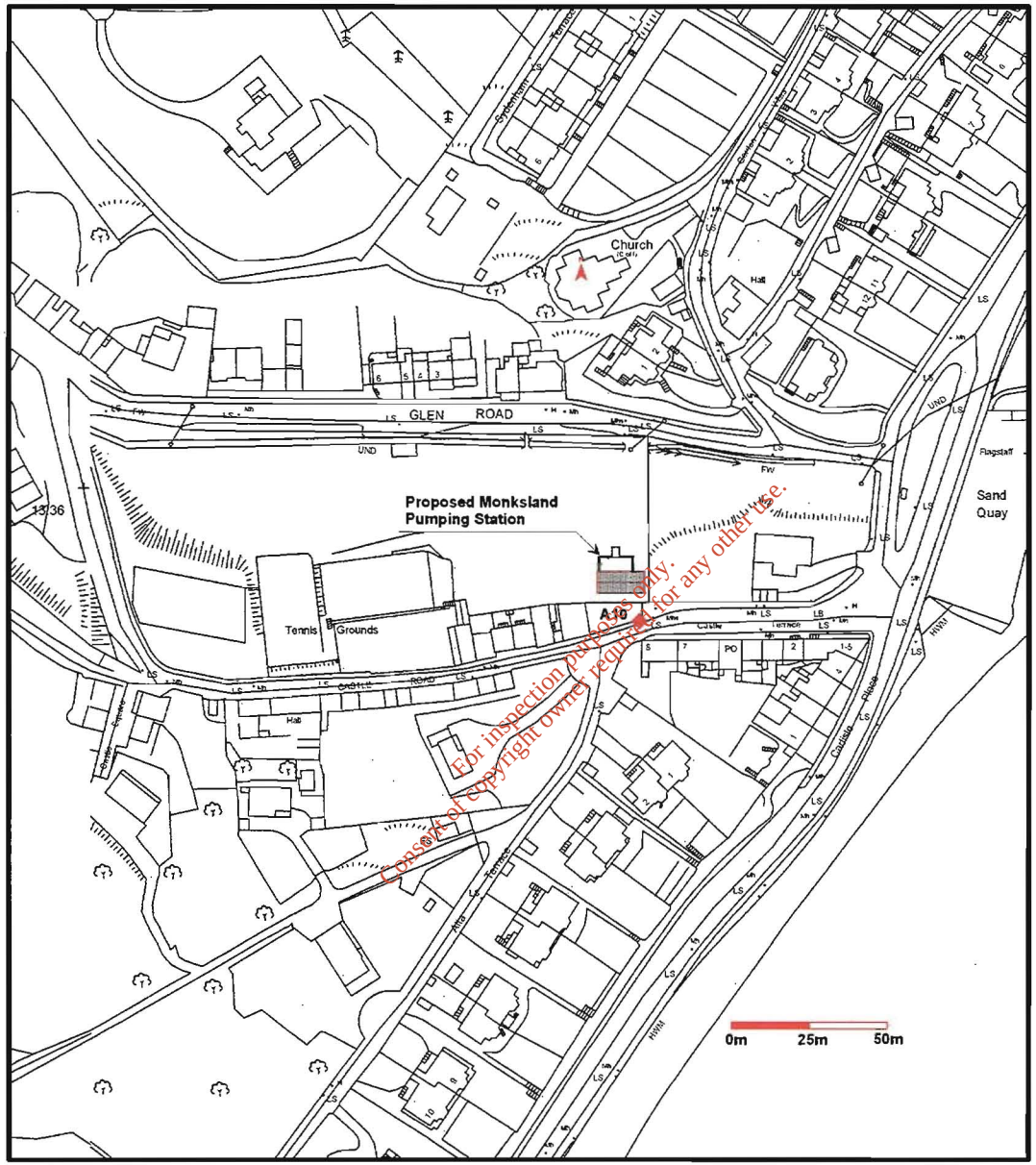


FIGURE 3.6.4 OVERVIEW OF MONITORING LOCATION A10 IN THE VICINITY OF THE PROPOSED MONKSTOWN PUMPING STATION

Mott MacDonald

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG175

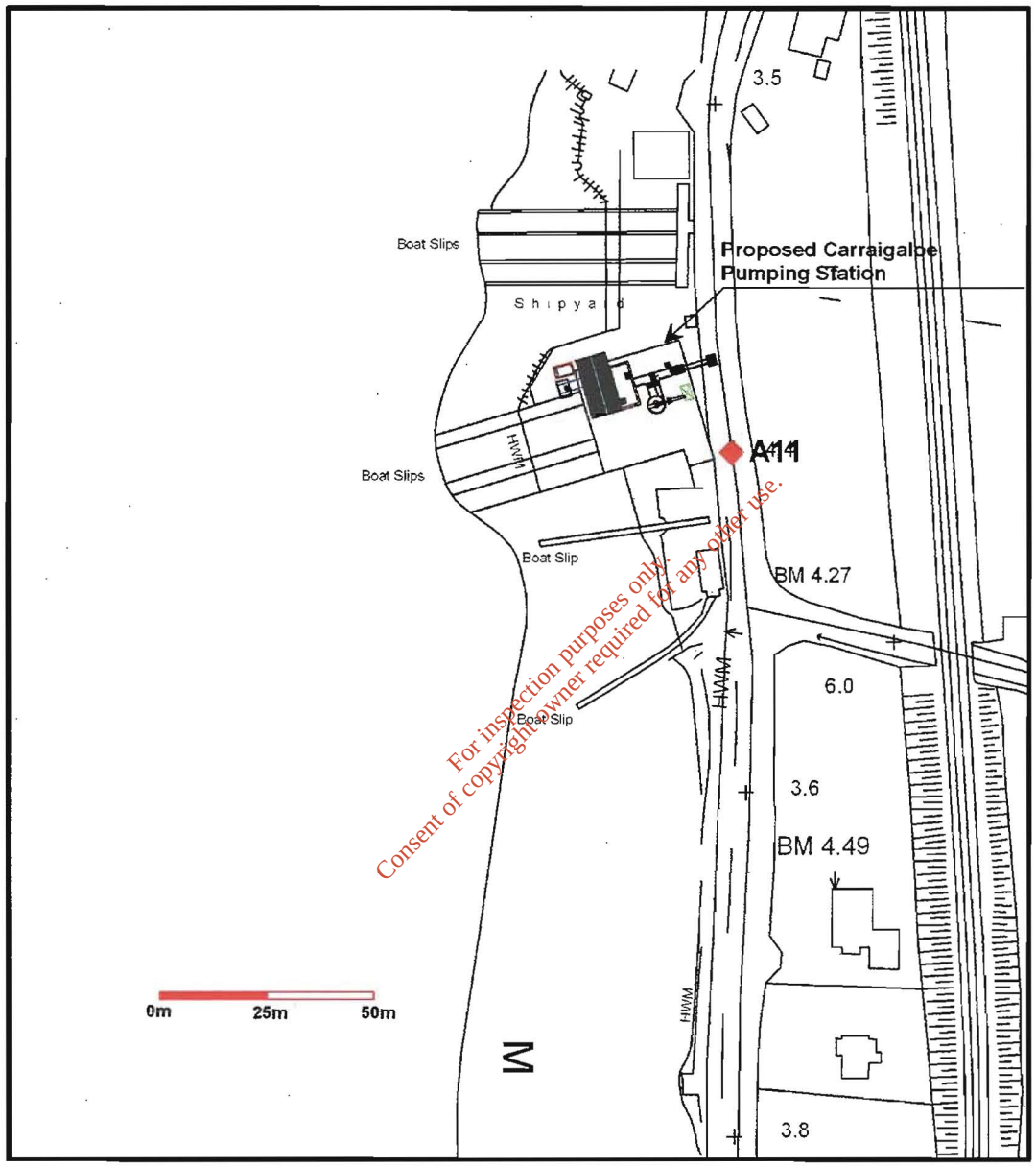


FIGURE 3.6.5 OVERVIEW OF MONITORING LOCATION A11 IN THE VICINITY OF THE PROPOSED CARRIGALOE PUMPING STATION

Mott MacDonald

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG176

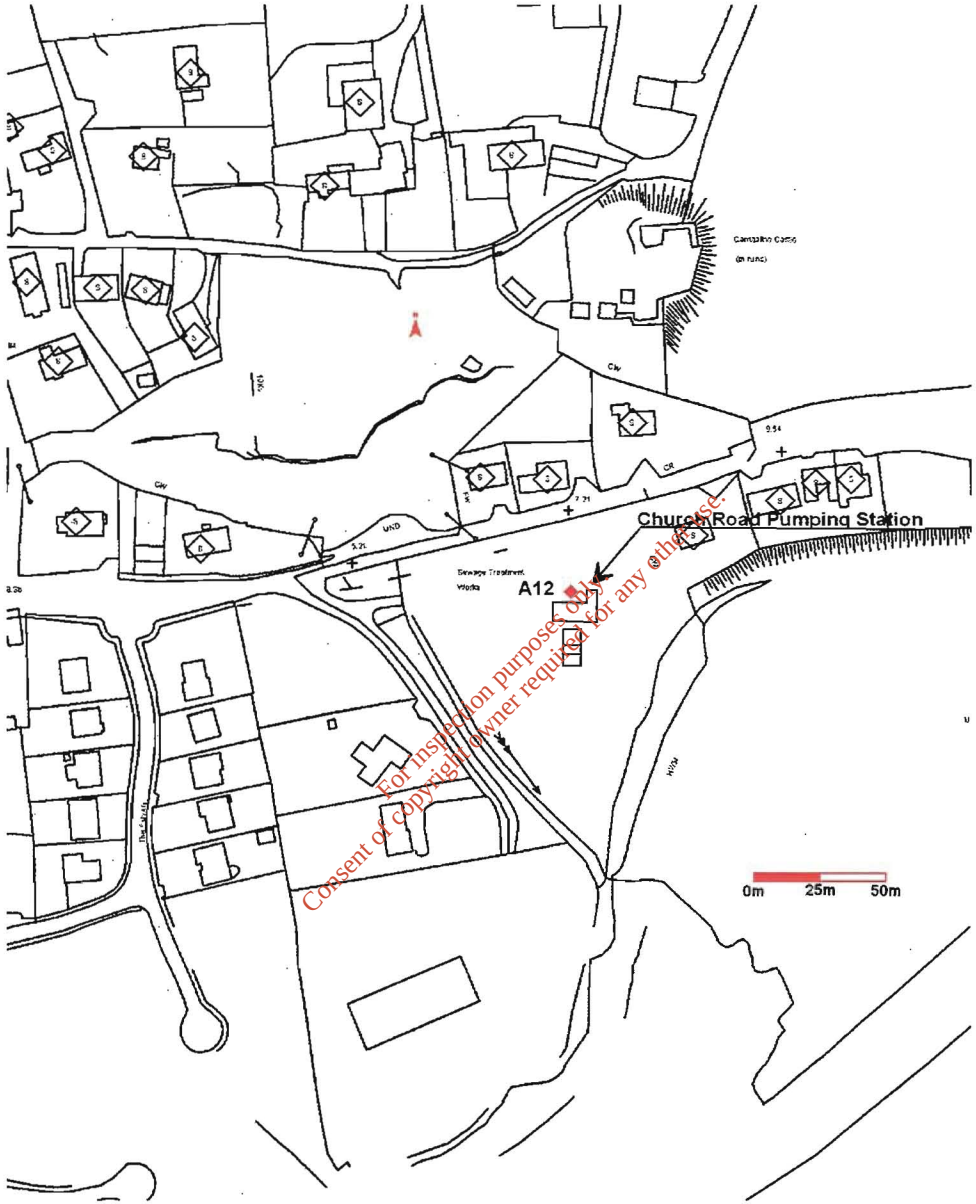


FIGURE 3.6.6 OVERVIEW OF MONITORING LOCATION A12 IN THE VICINITY OF THE PROPOSED CHURCH ROAD PUMPING STATION

Mott MacDonald

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG177

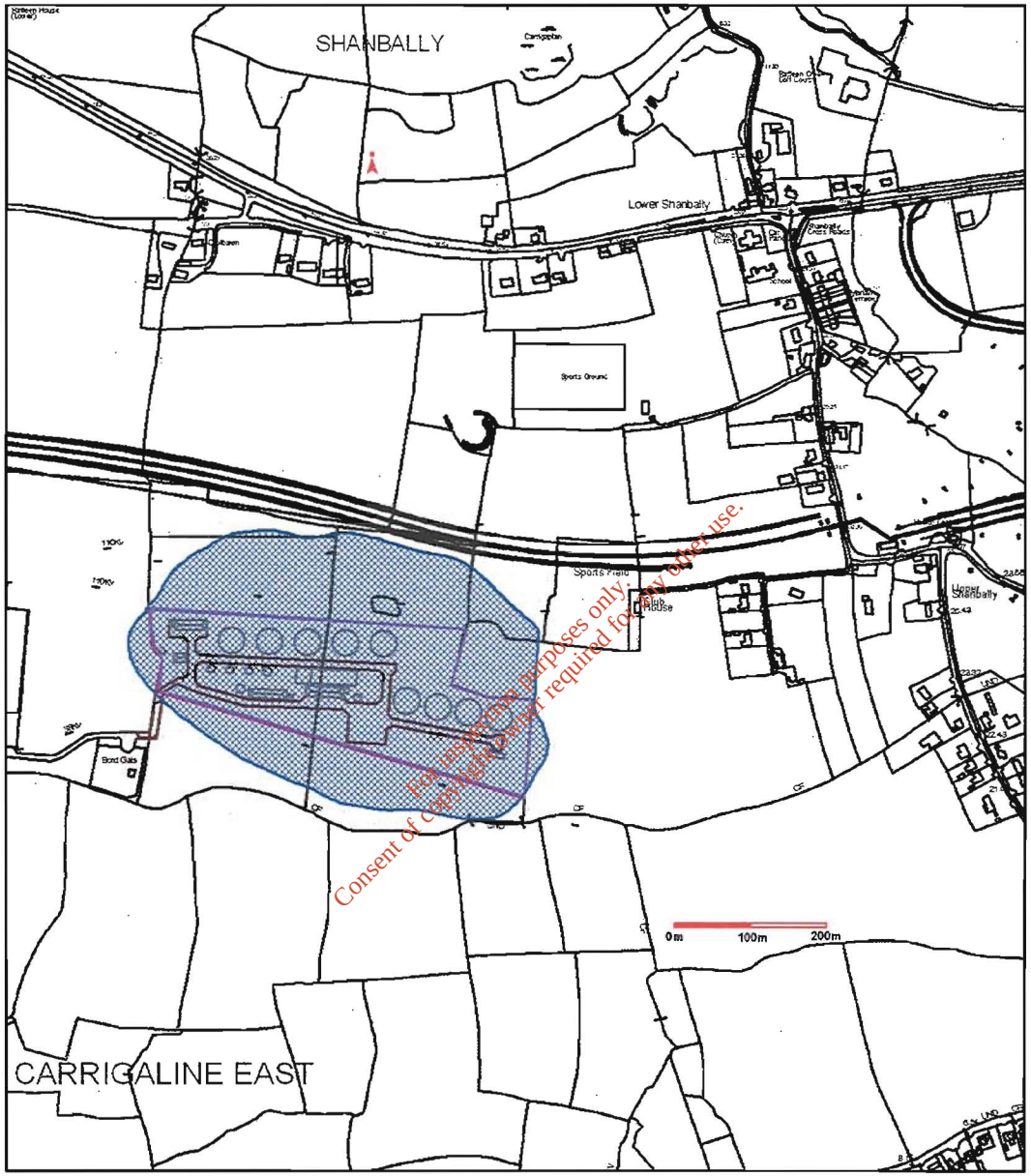


FIGURE 3.6.7 PREDICTED ODOUR EMISSION CONTRIBUTION WITH ODOUR ABATEMENT PROTOCOLS IMPLEMENTED AT THE 98th PERCENTILE FOR ODOUR CONCENTRATIONS ≤ 1.5 $O_{UE}\,m^{-3}$

Mott MacDonald

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG144

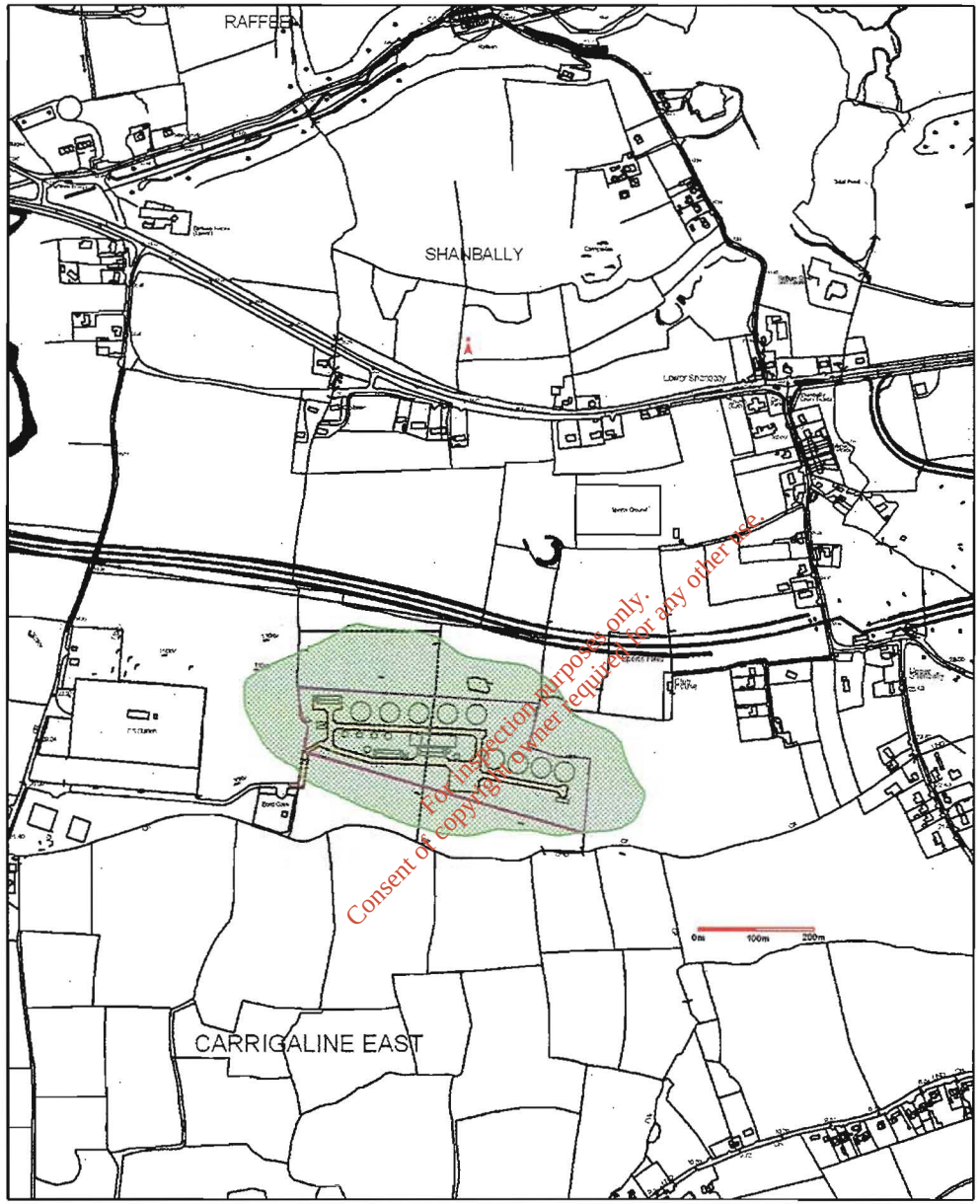
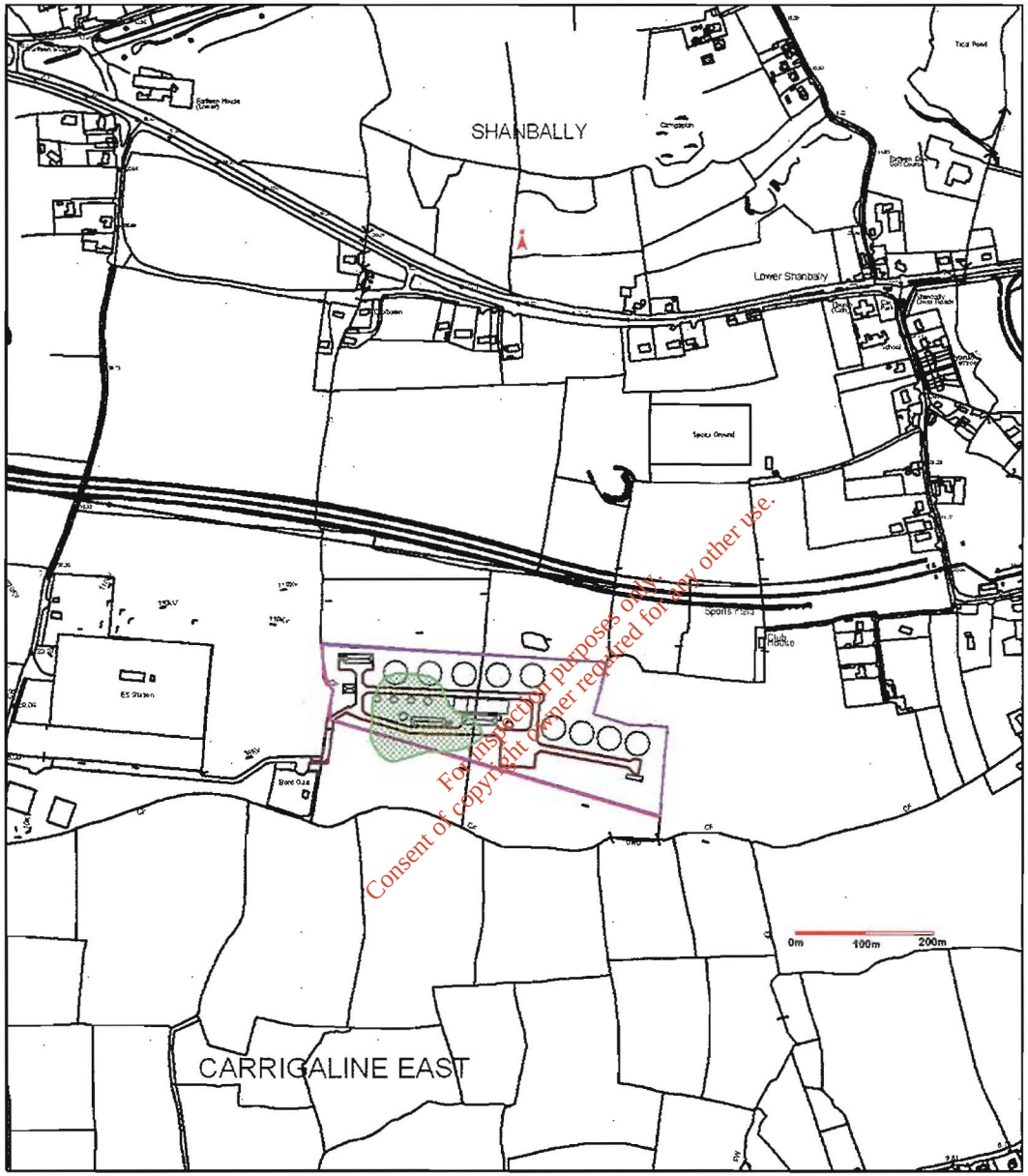


FIGURE 3.6.8 PREDICTED ODOUR EMISSION CONTRIBUTION WITH ODOUR ABATEMENT PROTOCOLS IMPLEMENTED AT THE 99.5th PERCENTILE FOR ODOUR CONCENTRATIONS ≤ 3.0 $Ou_E\ m^{-3}$

Mott MacDonald

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG145



NOTE:
TOTAL OCUs – INDIVIDUAL GROUPED ODOUR CONTROL UNIT SOURCES.

FIGURE 3.6.9 PREDICTED ODOUR EMISSION CONTRIBUTION OF TOTAL OCUs (SEE NOTE) TO ODOUR PLUME DISPERSAL. ODOUR CONCENTRATION ≤ 0.3 $Ou_E\ m^{-3}$ AT THE 98th PERCENTILE

Mott MacDonald

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG146

NOTE:
THIS INCLUDES ODOUR CONTRIBUTIONS FROM THE AERATION TANKAGE, SECONDARY SETTLEMENT AND STORM WATER TANKAGE.

FIGURE 3.6.10 PREDICTED ODOUR EMISSION CONTRIBUTION (EXCLUDING OCUs) TO ODOUR PLUME DISPERSAL (SEE NOTE). ODOUR CONCENTRATION ≤ 1.5 $O_{UE}\,m^{-3}$ AT THE 98th PERCENTILE

Mott MacDonald

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG147

3.7 Noise and Vibration

3.7.1 Introduction

This noise and vibration assessment was completed by ANV Technology Limited on behalf of Mott MacDonald Pettit.

The purpose of this study is to evaluate the noise and vibration impacts associated with the proposed Cork Lower Harbour WWTP (Cork Harbour Main Drainage Scheme) at Shanbally, Co. Cork. In doing so, assessments are made regarding the likely impacts, the appropriate mitigation measure and any residual impacts associated with the development. A copy of the specialist report is included in *Volume III, Appendix 6A* of this statement.

3.7.2 Methodology

(i) Existing Environment

A baseline noise survey was carried out in June 2007 at the WWTP site and pumping station sites to establish the existing noise environment. This serves as a baseline against which the operational noise emissions during daytime and night-time from the WWTP and pumping stations can be assessed. The surveys were undertaken in accordance with ISO 1996 *Description and Measurement of Environmental Noise*.

Noise surveys over 24-hour periods were carried out at three locations in the vicinity of the WWTP site (N1, N2 and N3). Surveys of three hours duration during daytime and night-time were conducted at five additional representative positions, including nearest noise sensitive locations, in the Carrigaline East/Shanbally areas (N4 to N8). Surveys of three hours duration during daytime and night-time were also conducted at the proposed sites of the four major pumping stations at Raffeen, Monkstown, Carrigaloe, and West Beach, Cobh. Short orientation noise measurements were carried out during daytime and night-time at twenty of the proposed minor pumping stations. These measurements of daytime noise levels were also carried out to represent locations along the proposed sewer lines, to serve as a baseline for the assessment of construction noise impact. Refer to Figure 3.7.1 *Location of Proposed WWTP Site and Baseline Noise Survey Locations N1 to N8* and Figure 3.7.2 *Layout of Cork Harbour Main Drainage Scheme, Pumping Station Locations* for noise survey measurement locations.

Instrumentation used was Brüel & Kjær and Svantek Type 1 sound level meters. The calibration of the instrument was checked before and during the survey with a Brüel & Kjær and Castle calibrator.

(ii) Impact Assessment Methodology

Construction Phase

Noise propagation calculations 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}).

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 70dB(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 3.7.1. *Maximum Permissible Construction Noise Levels at the Façade of Dwellings during Construction (NRA, 2004).*

The NRA 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 night-time works it would be reasonable to assign a limit of 45dB(A) L_{Aeq},1hr , which is the EPA guideline industrial night-time noise limit.

Table 3.7.1: Maximum Permissible Construction Noise Levels at the Façade of Dwellings during Construction (NRA 2004)

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.

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

Table 3.7.2: Gradation of adverse noise impact as function of construction noise level, and duration of noise exposure

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

Operational Phase

The WWTP is a Design-Build-Operate (DBO) project. One of the environmental parameters to be met by the Contractor 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 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 potential noise impact during the operational phase was assessed with reference to the EPA guideline noise limits, and the assessment procedures of BS 4142, *Rating Industrial Noise Affecting Mixed Residential and Industrial Areas.* The potential audibility of sound at night-time was also considered.

A computer noise propagation model was developed for the proposed waste WWTP. The model is based on the calculation procedures of ISO 9613.

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.

EPA Noise Limits

The EPA guidelines set a night-time limit of 45dB(A), and a daytime noise limit of 55dB(A), at noise sensitive locations. However these should be viewed as maximum tolerable levels rather than levels of negligible impact.

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 LA90 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 exceedance of 10dB indicates clear audibility, with potential for complaints, and the impact needs to be carefully assessed. An increase of 5dB 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.

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 5dB, 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 2dB.

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 (10dB 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 10dB lower), it is unlikely to be audible, and the noise impact can be described as negligible.

Consideration of Indoor Noise Levels at Night-time

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 30dB(A), as occurs on occasion in this area at night-time.

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 night-time. In these cases, the level of the new noise source relative to the background noise is not the determining factor. Instead 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 40dB(A) L_{Aeq} as representing a "good" to "reasonable" indoor noise environment for living rooms, and 30 to 35dB(A) L_{Aeq} for bedrooms. In addition, noise maxima inside bedrooms should not normally exceed 45dB(A) L_{AFmax} at night-time. This is to ensure acceptable resting/sleeping conditions. These guidelines are also consistent with recommendations of the World Health Organisation. However based on ANV's experience measuring indoor noise levels in Irish residences in rural areas, it was found that indoor noise levels at night-time are generally below 30 dB(A), and would more typically be in the range 20 to 25dB(A).

An external noise source of level 35dB(A) would be attenuated by approximately 15dB 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 20dB(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 20dB(A) would be very comfortably within BS 8233 and WHO guideline levels. Noise impact at this level would be negligible.

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 night-time, it is considered that a design criterion of 35dB(A) at night-time at the nearest noise sensitive location is appropriate for this development. This would constitute a "negligible" noise impact, based on the noise impact criteria. The nearest noise sensitive location is the land zoned residential, approximately 134m 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 35dB(A), which is the criterion for negligible noise impact in this rural area. The calculated design noise criterion is a noise level of 45dB(A) at 20m from the plant boundaries.

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 night-time, 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 10dB higher than at night-time. Consequently, a daytime design noise criterion 10dB higher than the night-time criterion, i.e. 55dB(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 55dB(A) at 20m from the boundary, the resulting noise level at the nearest noise sensitive location, approximately 134m to the east is calculated to be 45dB(A).

3.7.3 Existing Environment

WWTP Site

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

Referring to Table 3.7.3 *Overview of measured noise levels at N1 to N8*, at the measurement locations N1 and N2 at the proposed WWTP site boundaries, the average daytime noise level was 44 and 47dB(A) L_{Aeq} respectively. This reduced to 36 and 38dB(A) L_{Aeq} respectively at night-time. At N3, 230m to the north of the proposed site boundary, the mean daytime noise level was 47 dB(A) L_{Aeq}, reducing to 39dB(A) L_{Aeq} at night-time. The noise measurements at locations N2 and N3 represent the noise environment in the lands zoned residential to the east of the proposed site. Plots of measured noise levels over the 24hr period at N1 to N3 are detailed in Figure 3.7.3 *Plot of measured noise levels at 24hr measurements, positioned at WWTP 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 41dB(A). At night-time this reduced to 30 to 31dB(A) L_{A90}.

Measurements location N4 was at the nearest house to the proposed site, at a distance of 260m from the eastern site boundary. At this position, the average daytime noise level was 55dB(A) L_{Aeq} due to local traffic, reducing to 50dB(A) L_{Aeq} at night-time. The steady underlying background noise at this location was 48dB(A) L_{A90} during daytime, and 40dB(A) L_{A90} at night-time.

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

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 night-time. The steady underlying background noise at this location was 42 dB(A) L_{A90} during daytime, and 31 dB(A) L_{A90} at night-time.

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 46dB(A) L_{Aeq} at night-time. The steady underlying background noise at this location was 46dB(A) L_{A90} during daytime, and 38dB(A) L_{A90} at night-time.

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 13dB, to a level of 49dB(A) L_{Aeq} at night-time. The steady underlying background noise at this location was 53dB(A) L_{A90} during daytime, and 35dB(A) L_{A90} at night-time.

Table 3.7.3: Overview of measured noise levels at N1 to N8.

Location	Measured Noise Levels dB(A) (mean of measured values at 15-minute intervals)				Comment
	L_{Aeq},15mins	L_{A90}	L_{A50}	L_{A10}	
Day/Evening (07.00 -23.00)					
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 form commercial unit, light traffic
N8	62	53	60	65	Traffic, wind noise
Night (23.00 -07.00)					
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 1 noise descriptors for 24-hr locations N1 to N3 (power averaged noise levels)					
Location	L_{day} L_{Aeq}, 07.00-19.00	$L_{evening}$ L_{Aeq}, 19.00-23.00	L_{night} L_{Aeq}, 23.00-07.00	L_{den}	
N1	45	46	39	48	
N2	50	44	42	50	
N3	48	44	48	54	

Major Pumping Stations

Referring to Tables 3.7.4 *Daytime and night-time noise surveys at the sites of the proposed major pumping stations* at Raffeen, the average daytime noise level was 57dB(A) L_{Aeq}, due to local traffic, reducing to 46dB(A) at night-time. The steady underlying background noise at this location was 50dB(A) L_{A90} during daytime, and 40dB(A) L_{A90} at night-time.

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

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

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 57dB(A) at night-time. The steady underlying background noise at this location was 49dB(A) L_{A90} during daytime, and 39dB(A) L_{A90} at night-time.

Table 3.7.4: Daytime and night-time noise surveys at the sites of the proposed major pumping stations

Location	Date	Time	L_{AEQ} 15 Mins	L_{A90}	L_{A50}	L_{A10}
Daytime						
Raffeen	26/06/2007	mean	57	50	55	60
Monkstown	26/06/2007	mean	55	43	49	57
West Beach	27/06/2007	mean	58	50	56	61
Carrigaloe	27/07/2006	mean	63	49	56	67
Night-time						
Raffeen	26/06/2007	mean	46	40	37	41
Monkstown	26/06/2007	mean	42	38	39	42
West Beach Cobh	27/07/2006	mean	57	47	50	57
Carrigaloe	27/06/2007	mean	57	39	45	60

Minor Pumping Stations

Daytime noise levels at the sites of the proposed minor pumping stations ranged from 44 to 69dB(A) L_{Aeq}, depending on the local traffic flows. The steady underlying background noise levels during daytime ranged from 38 to 53dB(A) L_{A90} (refer to Table 3.7.5 *Daytime short-term orientation noise surveys at 20 proposed minor pumping stations*).

Night-time noise levels ranged from 44 to 64dB(A) L_{Aeq}, depending on the local traffic flows. The steady underlying background noise levels ranged from 27 to 49dB(A) L_{A90} (refer to Table 3.7.6 *Night-time short-term orientation noise surveys at 20 minor pumping stations*).

Table 3.7.5: Daytime short-term orientation noise surveys at 20 proposed minor pumping stations

Day time	Date	Time	L_{Aeq} 15mins	L_{A90}	L_{A50}	L_{A10}	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 % HGVs 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 % HGVs on road, distant and local traffic.

Table 3.7.6: Night-time short-term orientation noise surveys at 20 minor pumping stations

Night-time	Date	Time	L_{Aeq}, 15 mins	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.

3.7.4 Impact Assessment

(i) Construction Phase Impacts

WWTP

During construction of the WWTP 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 51dB(A) L_{Aeq} (based on an assumed sound power emission of 120dB LWA from plant and equipment operating on the site). This calculated noise level is very comfortably below the NRA construction noise criterion of 70dB(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 55dB(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 3.7.4 *Calculated construction noise levels, during early site investigation and preparation phase when noise emissions are expected to be highest.*

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 3.7.7 *Calculated noise levels at a house, due to excavation works at roadside adjacent to the house* shows the calculated noise levels for houses at various distances from the line of the sewer line excavation works.

For houses set back 10m from the sewer line, the noise levels may exceed the 70dB(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 3.7.5 *Variation of noise levels at a given house, depending on distance of excavation works along the road from the house entrance.* This shows that in general noise levels will be less than 65dB(A). However, noise levels may exceed 70dB(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 50m, the noise level would be less than 60dB(A), and beyond 100 metres the noise levels would be less than 54dB(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.

Table 3.7.7: Calculated noise levels at a house, due to excavation works at roadside adjacent to the house

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

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

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 form these works will be subject to the construction noise limits set out in Table 3.7.1 *Maximum Permissible Construction Noise Levels at the Façade of Dwellings during Construction (NRA 2004)* and the EPA guidelines.

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 115dB(A) LWA, the resulting construction noise levels at the nearest houses (refer to Table 3.7.8 *Calculated highest construction noise levels, during the early site preparation and excavation phases for the proposed major pumping stations*) are calculated to be approximately 70dB(A) at the nearest houses at the Monkstown and West Beach sites, where it is considered that the standard guideline noise limit of 70dB(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 57dB(A) respectively, which are comfortably within the standard 70dB(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.

Table 3.7.8: Calculated highest construction noise levels, during the early site preparation and excavation phases for the proposed major pumping stations.

Location of Proposed Pumping Station	Calculated Construction Phase Noise Level At Nearest House To Pumping Station DB(A)
Raffeen	58
Monkstown	70
Carrigaloe	57
West Beach Cobh	69

(BS 5228 calculation based on site sound power emissions of 115dB(A) LWA, with allowance for noise screening by standard timber site hoardings).

Vibration

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 (as set out in Table 3.7.1 *Maximum Permissible Construction Noise Levels at the Façade of Dwellings during Construction (NRA 2004)*, and in terms of nuisance, are likely to be imperceptible.

Construction Traffic

Additional traffic noise can 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 55dB(A). This is a relatively low level of traffic noise, and would have only a slight impact.

(ii) Operational Phase Impacts

Noise Emissions from the WWTP

The calculated operational noise levels, and noise impact assessment for the daytime and night-time periods, are presented in Table 3.7.9 *Predicted noise levels from proposed WWTP, and noise impact assessment*. The calculated noise levels for the operational WWTP are illustrated as a noise map in Figures 3.7.6 *Calculated night-time noise levels due to operating WWTP* and 3.7.7 *Calculated daytime noise levels due to operating WWTP* for night-time 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 34dB(A) to 45dB(A) at the noise sensitive locations considered. These additional noise levels are all comfortably below the EPA daytime noise limit of 55dB(A).

At the nearest lands zoned residential to the east of the site, the ambient noise level is calculated to increase by 2dB. 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 4dB. 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 14dB 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 45dB(A), and will have no noise impact on the amenity of this area.

Night-time Noise Impact

For night-time 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 35dB(A).

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

The additional noise at the noise sensitive locations would result in an increase of at most 1dB in night-time 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 5dB, and consequently the noise would be audible at a low level outdoors. Allowing for an attenuation of approximately 15dB through a partially opened window, the resulting indoor noise level would be 20dB(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 30dB(A). The WWTP noise would be between 6 and 11dB lower than the existing background noise, and would not be audible outdoors or indoors. There would be no adverse noise impact at these houses.

Table 3.7.9: Predicted noise levels from proposed WWTP, and noise impact assessment

House Locations	Projected WWTP Plant Noise Level L_{AEQ} DB(A)	Existing Noise L_{AEQ} DB(A)	Projected Total Future Noise L_{AEQ} DB(A)	Projected Change, DB (Sound Emergence)	Within Epa Limits (55/45 DB(A) Day/Night)	Comparison With Mean Background Noise L_{A90} (Note 1)	Likely Audibility	Overall Adverse Noise Impact
Daytime								
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		
Night-time								
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		

Note 1-differrence between projected WWTP noise, and the background noise at the assessment location (as given on Table 3.7.3).

Ground Vibration due to Operation of WWTP

Based on noise surveys carried out by ANV Technology Limited at other WWTPs (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 134m to the east. There is unlikely to be any significant potential for audible ground-borne vibration over this distance.

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.

Night-time background noise levels at the sites of the proposed pumping stations ranged from 32 to 47dB(A) L_{A90}. A reasonable criterion would be to ensure a noise level of less than 35dB(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 45dB(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 3.7.8 *Measured ground vibration at 1m from existing Church Road Pumping Station.*

Traffic Impact

Operational phase estimates of likely site traffic are relatively low. Using a nominal figure of 10 HGV movements per day along Cogan's Road to the site and light staff traffic, the operational phase will have negligible impact (Note - the number of HGV sludge movements used for this assessment is over estimated by a factor of approximately 2.5 for Indicative Design Nr.2 (2 HGVs daily for dewatered sludge) and a factor of 10 for Indicative Design Nr.1 (2-3 HGVs weekly for dried sludge)).

The calculated traffic noise level due to the heavy vehicle movements is 40dB(A) L_{Aeq} at a distance of 20m from the road. The existing measured traffic noise level was 54dB(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 50dB(A) at 20m from the site boundary, and will be comfortably within the proposed daytime noise criterion of 55dB(A) at 20m from the site boundary.

(iii) 'Worst-Case Scenario' Impact

It is considered that the "Worst-Case Scenario" impact would arise from ineffective traffic and construction management and consequently the plant and equipment involved in haulage and construction activities causing a significant noise impact.

(iv) 'Do-Nothing' Impact

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 52dB(A) L_{Aeq} at the northern site boundary. The additional night-time traffic noise level is expected to be approximately 39dB(A) L_{Aeq} (calculated based on a 13 dB difference between daytime and night-time noise levels as measured at the N28, measurement position N8). When added to the existing night-time noise, of level 36 to 39dB(A), this will increase the night-time ambient noise to approximately 40 to 42dB(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.

3.7.5 Mitigation Measures

(i) 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 exceedance of the standard construction noise criterion of 70dB(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 night-time works, should be subject to a noise limit of 45dB(A), and carefully assessed and controlled to minimise impact
- Utilise solid timber site hoardings where required to screen sensitive properties; particularly where noise levels are anticipated to exceed 70dB(A).
- 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, S.I. No. 299 of 2007.

(ii) Operational Phase

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

In addition, for the WWTP site, a daytime design noise criterion of less than 55dB(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.

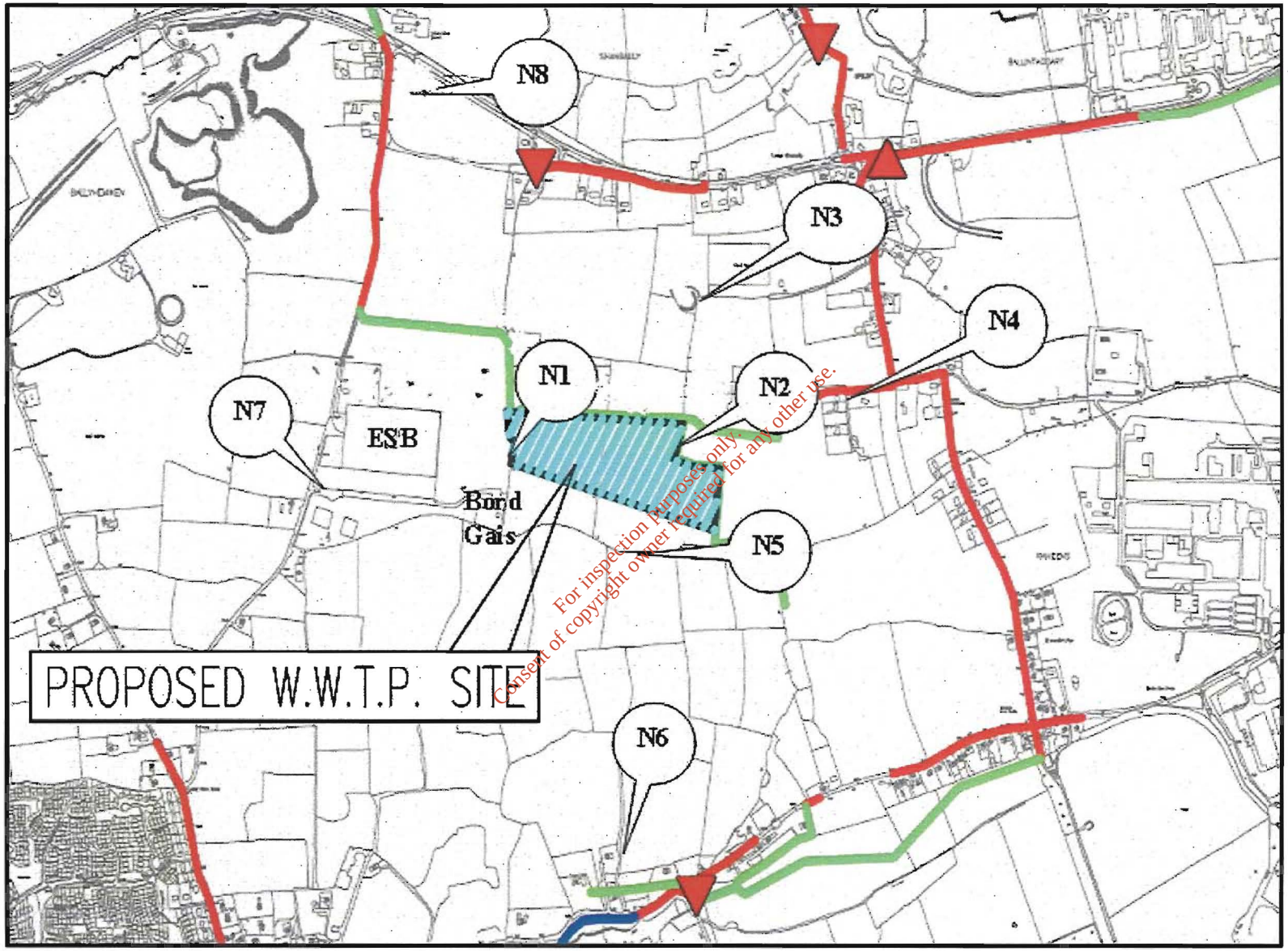
Achieving the design criteria will be the responsibility of the developer's design team. The predicted noise levels, as outlined in this report are considered to be readily technically achievable using standard technology and noise control methods. The contractor will be required to demonstrate in advance 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 55dB(A) during daytime, and 45dB(A) during night-time at noise sensitive locations (as opposed to boundaries).

3.7.6 Residual Impacts

On effective implementation of the specified mitigation measures, no significant residual impacts are envisaged.

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



Mott MacDonald

FIGURE 3.7.1 LOCATION OF PROPOSED WWTP SITE, AND BASELINE NOISE SURVEY LOCATIONS N1 TO N8

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG126

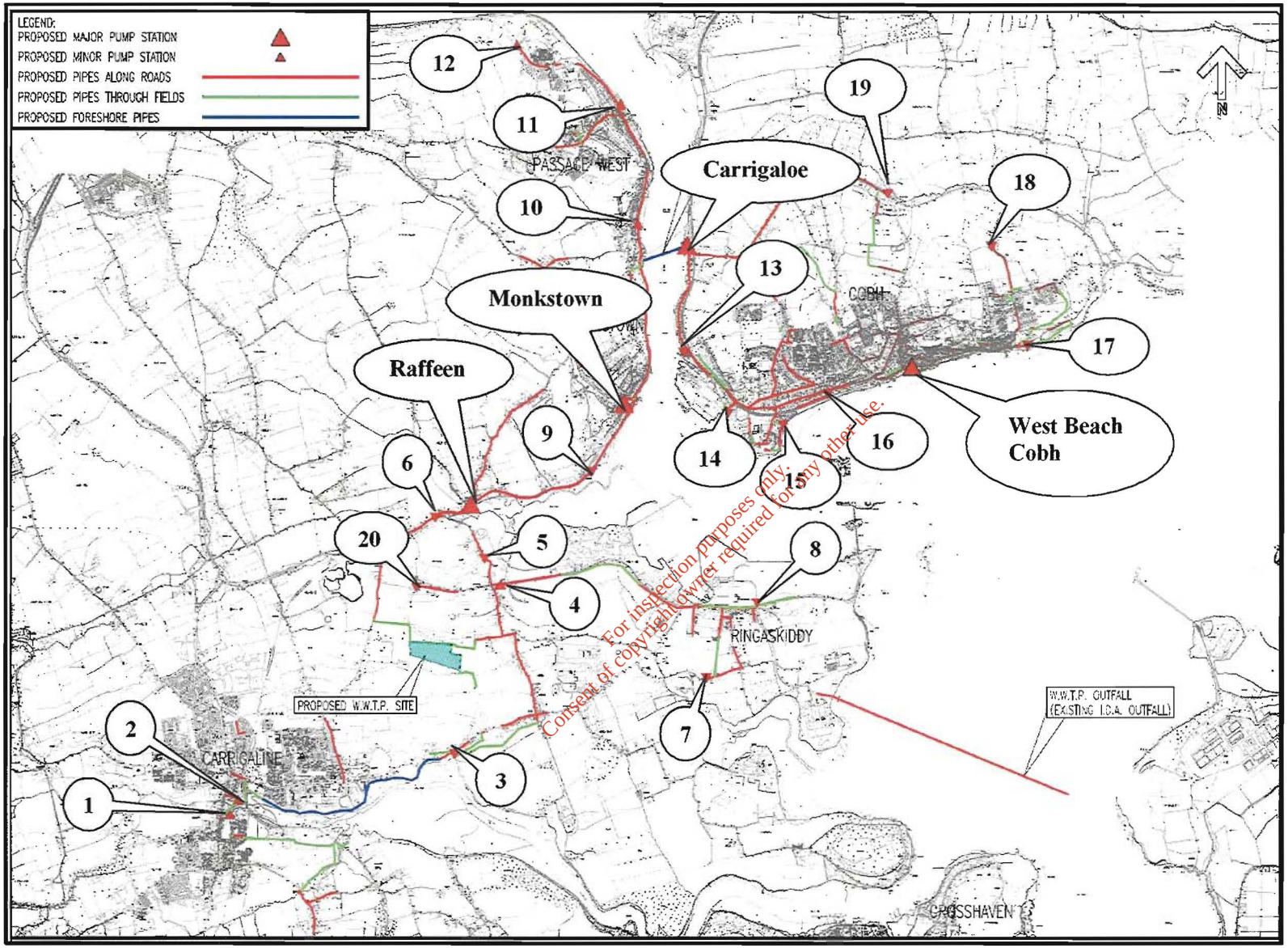
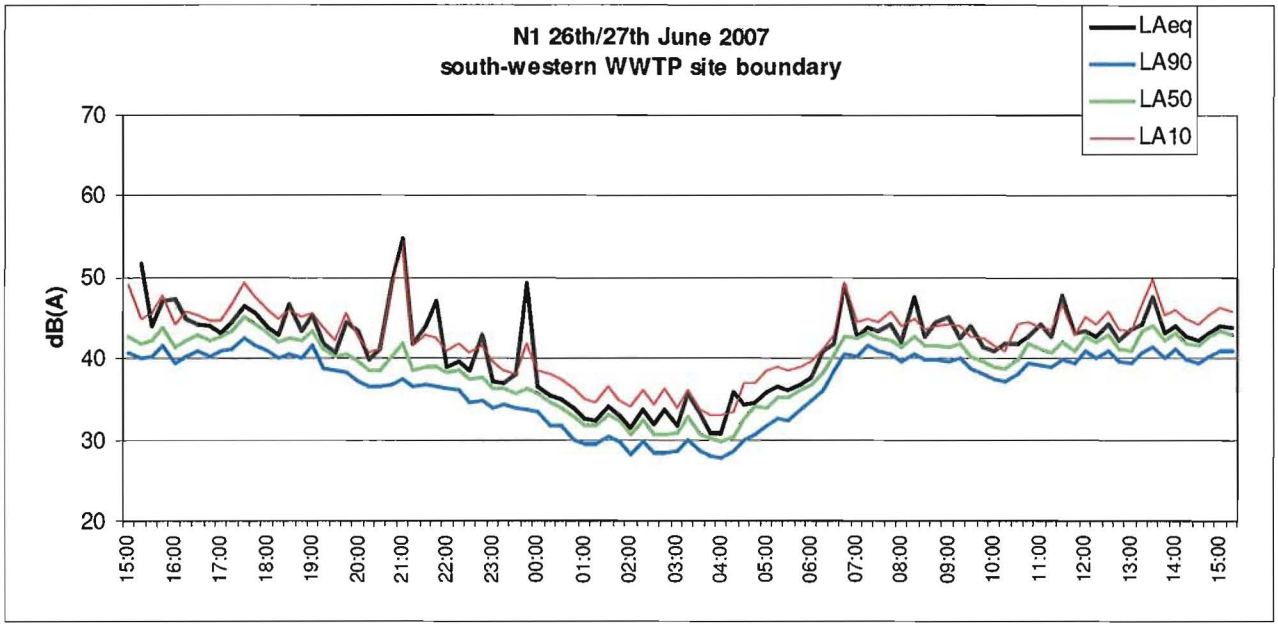
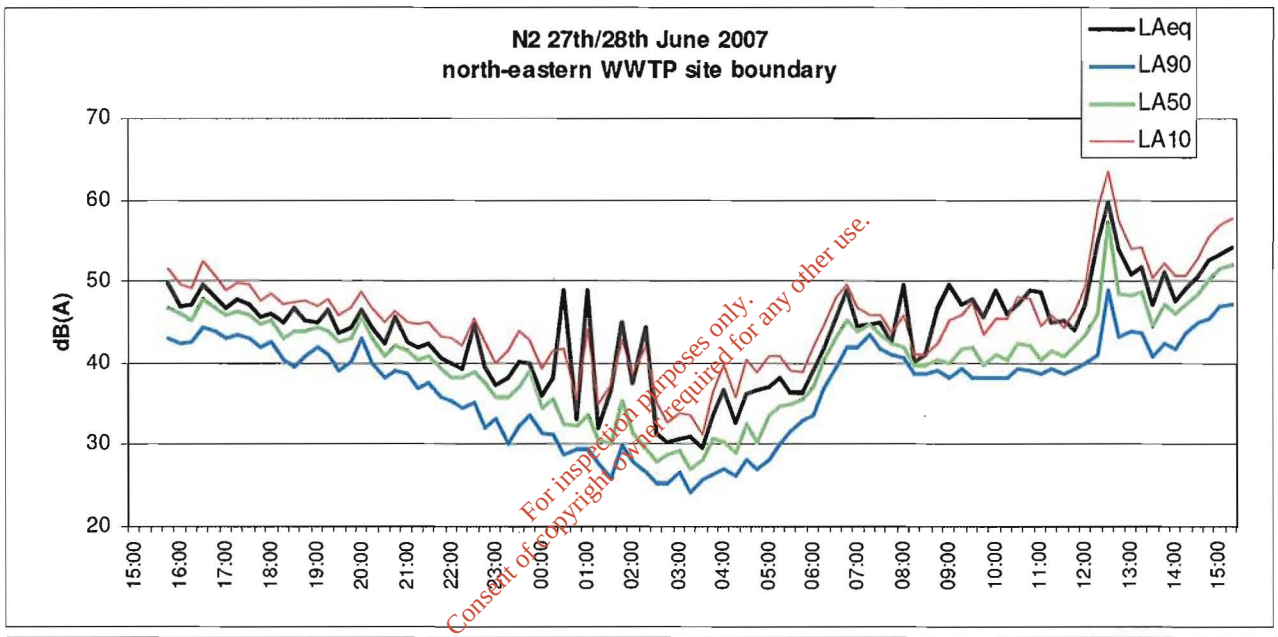


FIGURE 3.7.2 LAYOUT OF CORK HARBOUR MAIN DRAINAGE SCHEME, PUMPING STATION LOCATIONS

Mott MacDonald

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG127





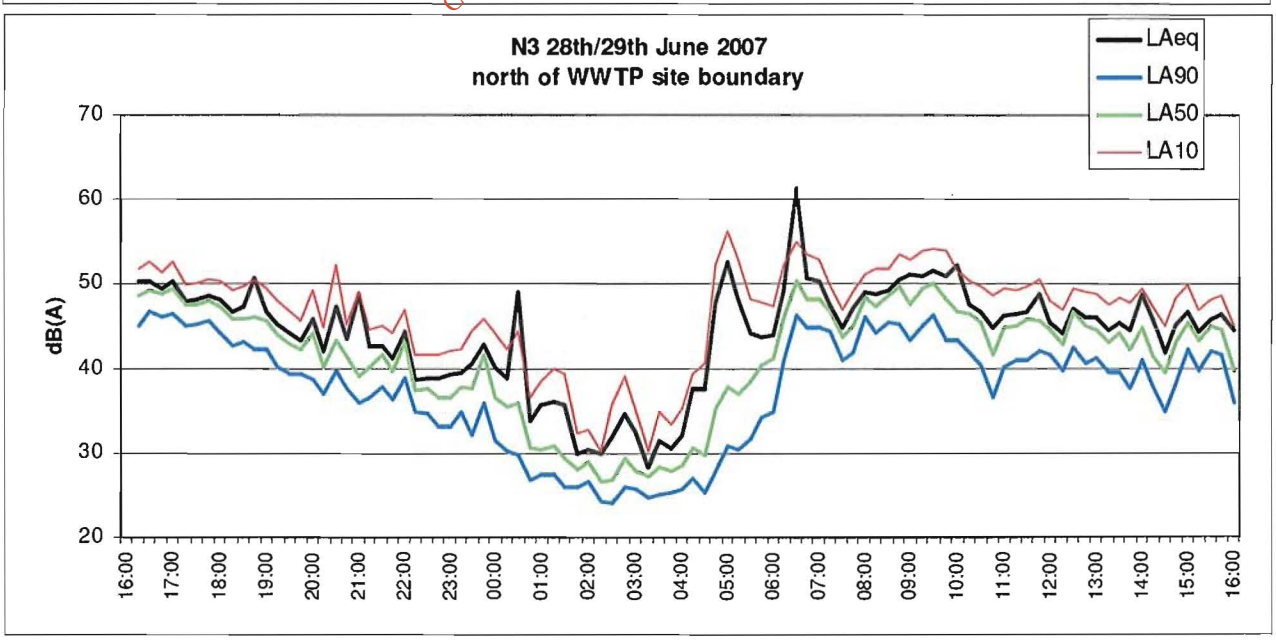
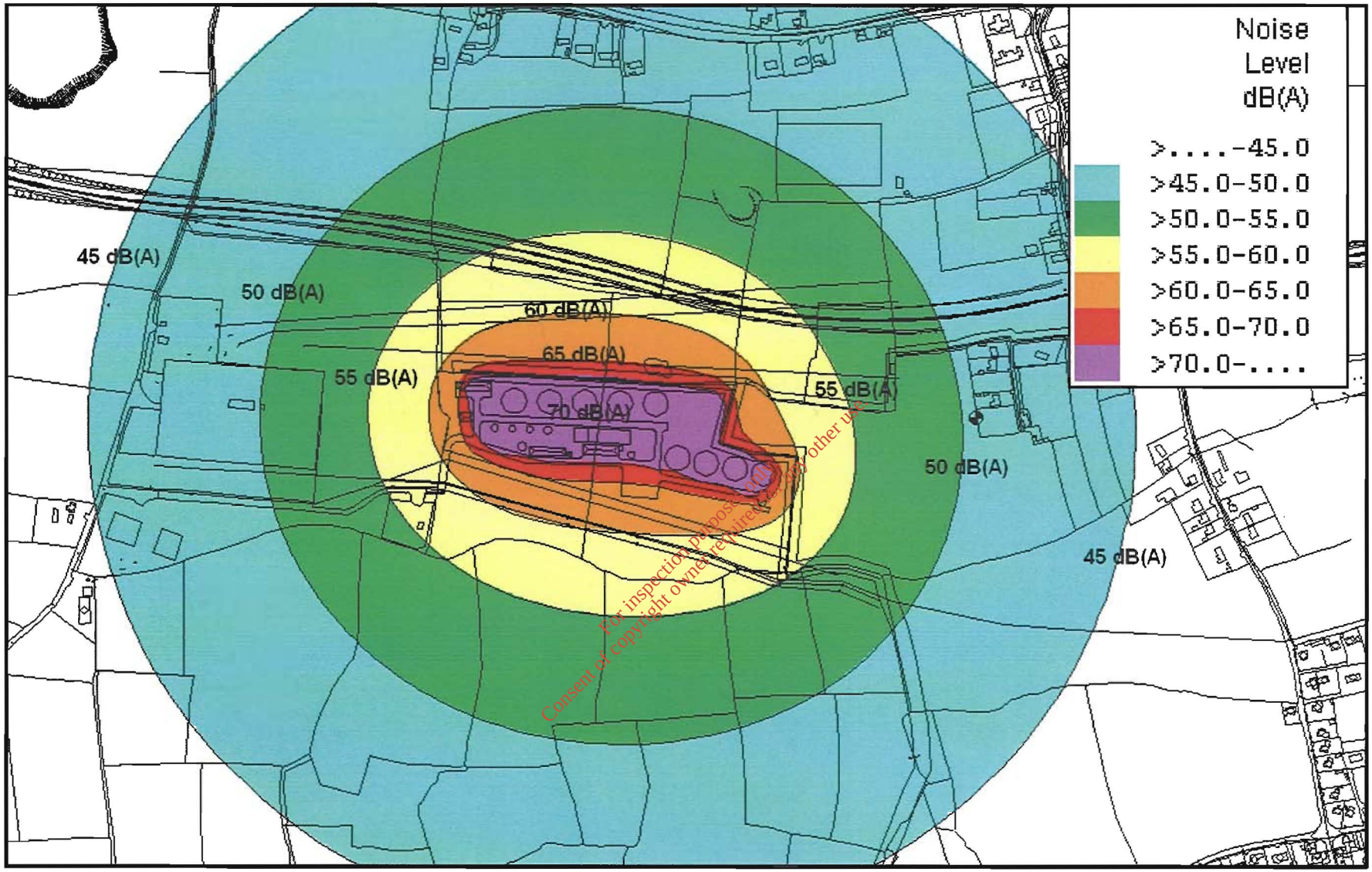


FIGURE 3.7.3 PLOT OF MEASURED NOISE LEVELS AT 24-HOUR MEASUREMENTS, POSITIONED AT WWTP SITE

Mott MacDonald

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG139

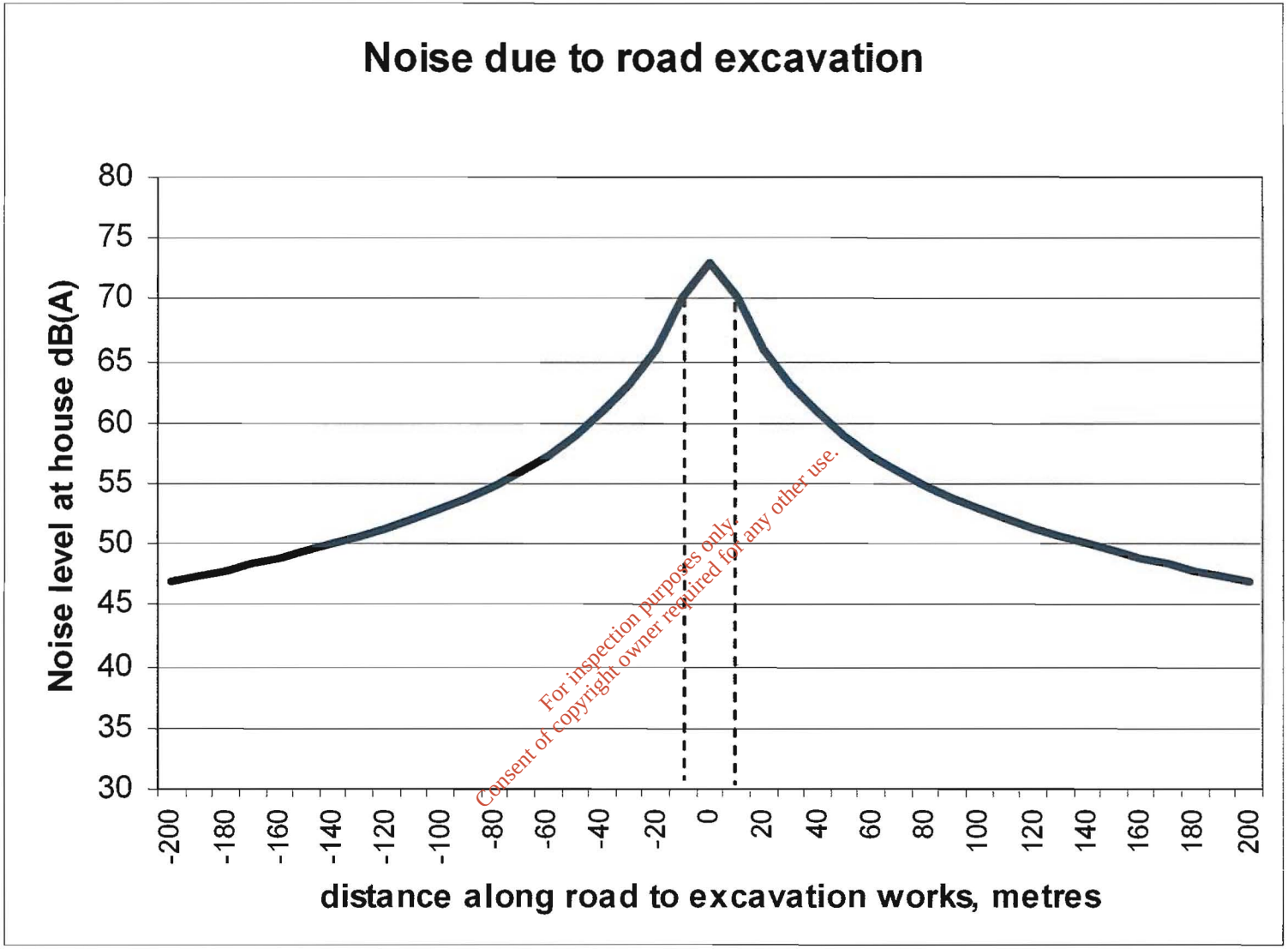


(The calculation are based on a total site sound power emission of 120 dB(A) LWA, which is a reasonable allowance for a project of this scale)

FIGURE 3.7.4 CALCULATED CONSTRUCTION NOISE LEVELS, DURING EARLY SITE EXCAVATION AND PREPARATION PHASE WHEN NOISE EMISSIONS ARE EXPECTED TO BE HIGHTEST

Mott MacDonald

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG128

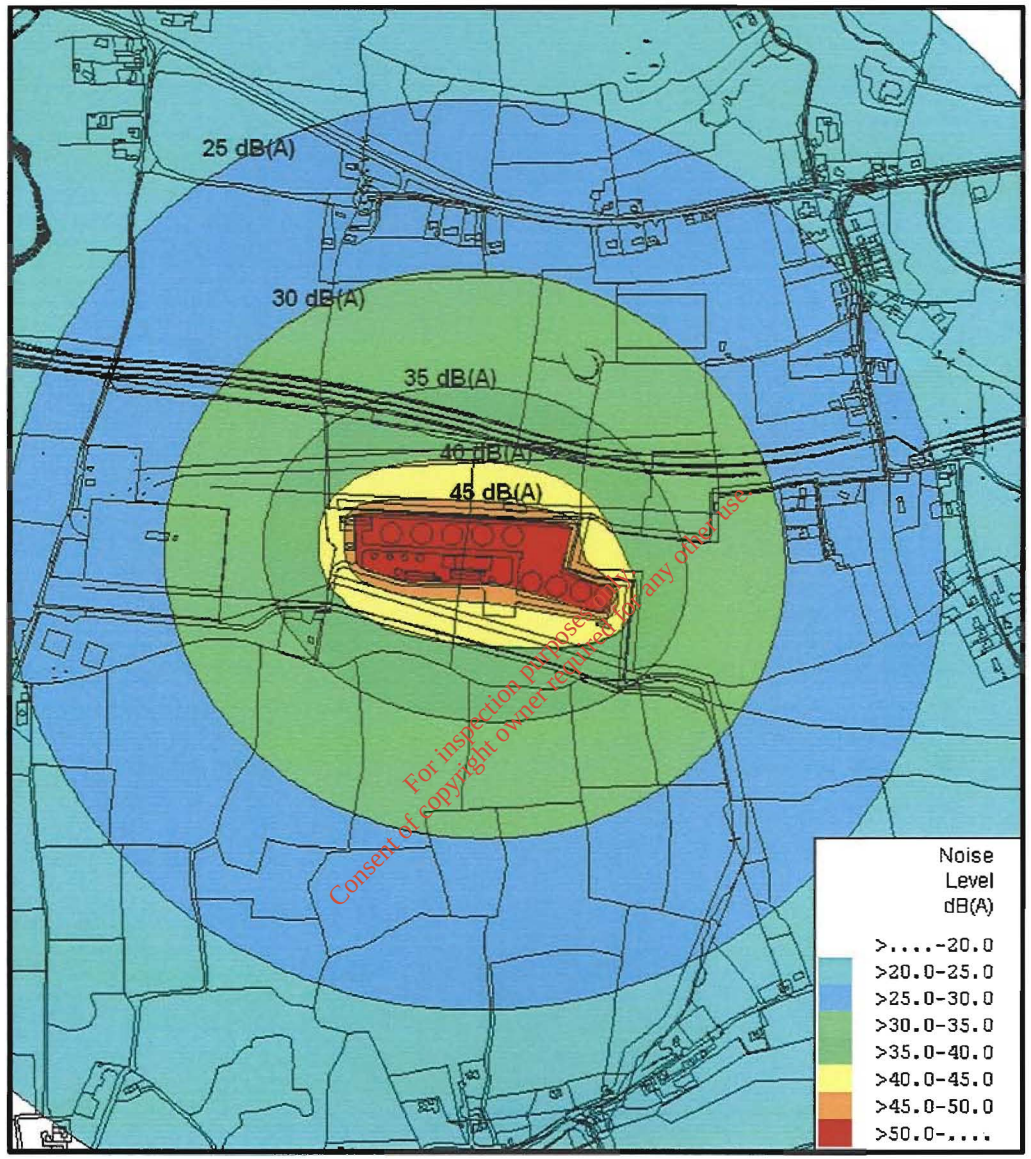


(In the situation depicted, the house is 10m from the road. The 70dB(A) NRA criterion may be exceeded while works are in progress on the 20m stretch immediately in front of the house).

FIGURE 3.7.5 VARIATION OF NOISE LEVEL AT A GIVEN HOUSE, DEPENDING ON DISTANCE OF EXCAVATION WORKS ALONG THE ROAD FROM THE HOUSE ENTRANCE

Mott MacDonald

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG138

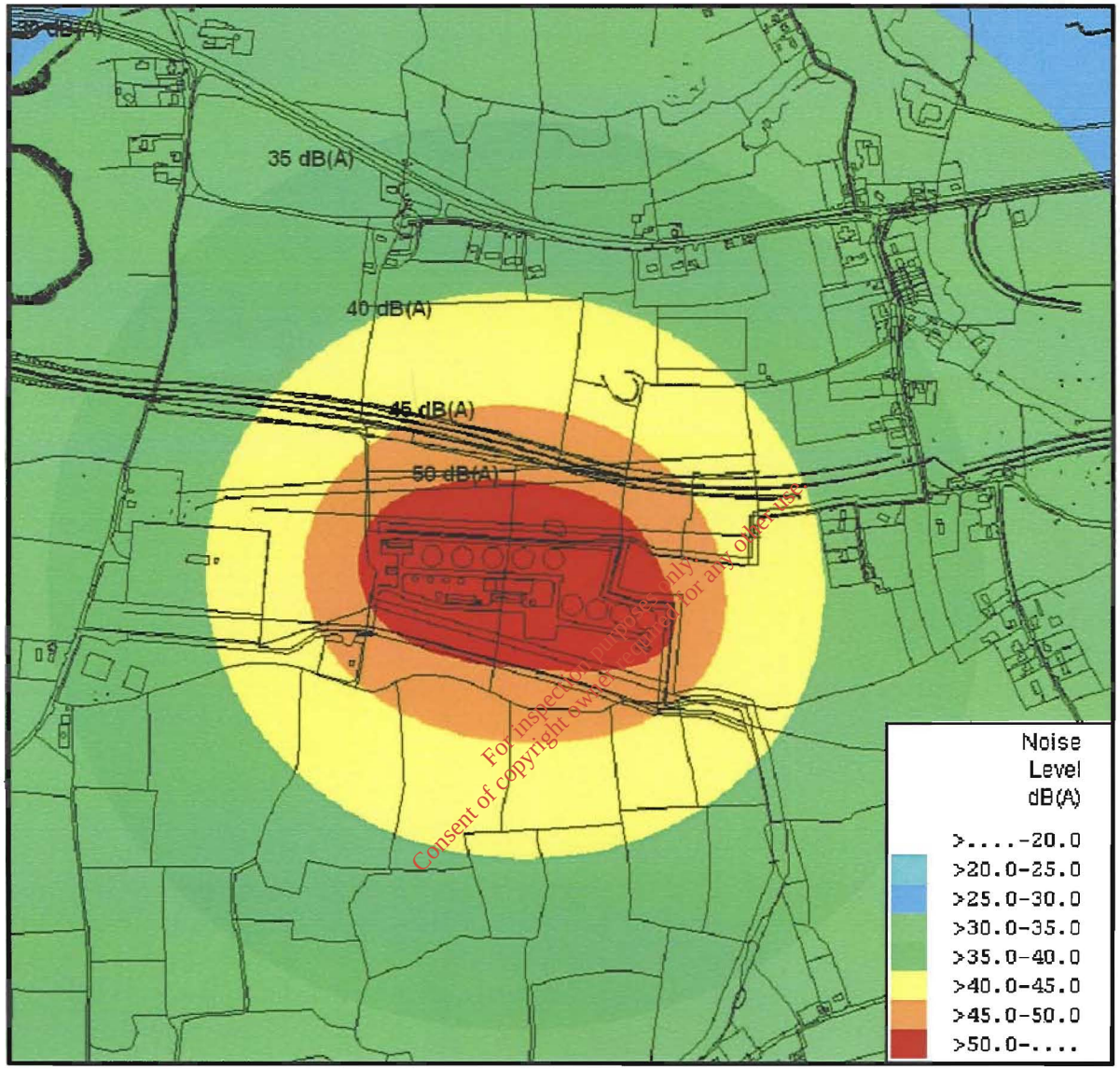


(This noise map was generated using an ISO 9613 noise propagation model, based on a nighttime design noise criterion of 45 dB(A) at 20m from the WWTP boundary. This noise map represents the continuous plant and process noise emissions from the operating WWTP)

Mott MacDonald

FIGURE 3.7.6 CALCULATED NIGHT-TIME NOISE LEVELS DUE TO OPERATING WWTP

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG129

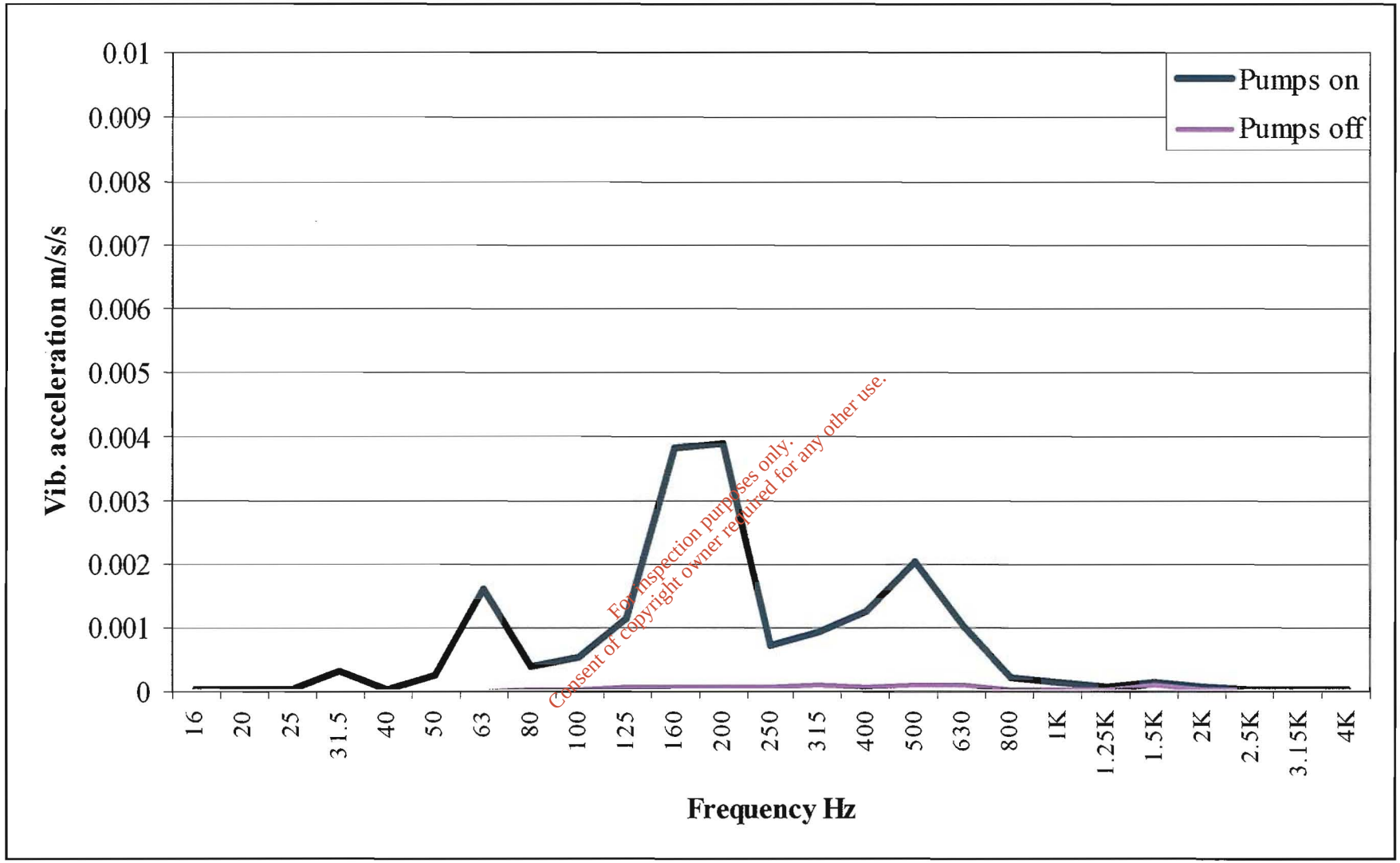


(This noise map was generated using an ISO 9613 noise propagation model, based on a design noise criterion of 55 dB(A) at 20m from the WWTP boundary during daytime. This noise map represents the continuous plant and process noise emissions from the operating WWTP, and includes daytime work activities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

Mott MacDonald

FIGURE 3.7.7 CALCULATED DAYTIME NOISE LEVELS DUE TO OPERATING WWTP

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG130



Mott MacDonald

FIGURE 3.7.8 MEASURED GROUND VIBRATION AT 1m FROM EXISTING CHURCH ROAD PUMPING STATION

CORK HARBOUR MAIN DRAINAGE SCHEME
ENVIRONMENTAL IMPACT STATEMENT
JOB NR. 234541
DRG NR. 5670FG160

3.8 Cultural Heritage

3.8.1 Introduction

This chapter of the EIS describes the Cultural Heritage in the existing environment surrounding the proposed development.

ÆGIS Archaeology Limited was commissioned to conduct a Cultural Heritage Assessment as part of the EIS for the proposed development in Cork Lower Harbour. The Archaeological Diving Company Limited was appointed by ÆGIS Archaeology to undertake the off-shore/inter-tidal assessment. The study included both the proposed development area and the collection system environs (on-shore and offshore). The objective of the assessment was to examine the potential impact on the archaeological, architectural and cultural heritage due to the proposed development and to identify mitigation measures where necessary. A copy of the specialist report is included in *Volume III, Appendix 7A* of this statement.

3.8.2 Methodology

General

The cultural heritage assessment comprised of a desk based study and a field assessment of the study area of the on-shore and off-shore elements of the proposed development.

On-Shore Assessment

The desk based study comprised of:

- A comprehensive review of published archaeological and cultural heritage work undertaken in the vicinity of the study area was undertaken (including Excavations Bulletins, searched on the online research database www.excavations.ie)
- The National Museum topographical files were consulted
- The Record of Monuments and Places (RMP) constraint maps and list were consulted
- The published archaeological inventory for the study area was consulted (*Archaeological Inventory of County Cork- Volume II: East and South Cork* (Power *et al.*, 1994)). This is an important resource for the archaeological heritage of Co. Cork
- *Cork County Development Plan* (Cork County Council, 2003), *Cobh Town Development Plan* (Cobh Town Council, 2005) and applicable local area plans were consulted for the locations of possible Protected Structures in the vicinity of the proposed development
- The National Inventory for Architectural Heritage (NIAH) was consulted. The NIAH has not yet undertaken the inventory for this area of Cork, but are beginning fieldwork presently
- A wide range of local historical and archaeological records relevant to the study area were consulted, including the OS First Edition six-inch map (c.1840)
- Suitable aerial photos, analysed for archaeological purposes were used in the study

The information from these sources has been tabularised as per the NRA published guidelines on constraints studies for both archaeological and architectural heritage.

The Archaeological Inventory of County Cork VOL II: East and South Cork (Power *et al.,* 1994), which is a publication of information held in the files of the Archaeological Survey of Ireland, held by the National Monuments Section, DEHLG (also known as the SMR) were also consulted. This inventory also records field work.

The National Museum of Ireland files, known as the Topographical Files were also checked to identify archaeological artefact sites that may be within the pipeline vicinity.

The yearly Excavations Bulletin, which summarises licensed archaeological work in the country, by county (Bennett, various dates) was checked for up-to-date information on recent archaeological discoveries the location of the study area. Excavation summaries for the years 1996-2003 inclusive were included.

The on-shore field assessment was carried out on 27th June, 10th July and the 16th September 2007 comprised of:

- An inspection of the proposed WWTP site
- Where the proposed pipeline corresponded with roadway or public areas these were visited and/or a windscreen survey was undertaken
- Where the proposed pipelines were on private lands aerial photos were used as a substitute and the areas were viewed from the roadsides or gateways

Off-Shore Assessment

An underwater dive assessment, including metal-detection survey, across the River Lee at Monkstown (c.390m wide crossing-point) and field-walking of the intertidal section of the proposed pipeline route (c.2.4km long corridor, Owenboy River near Carrigaline) was carried out on the 24th and 25th September 2007 (refer to Figures 3.8.1 *Location of Underwater and Intertidal Survey Areas*).

Marine Crossing

Visual inspection and magnetometry survey by hand-held metal-detection was employed to assess the archaeological potential of the seabed over an area that extended 12m upstream and 50m downstream of the proposed marine pipeline. The upstream survey area was restricted due to the presence of an active ferry service between Cobh and Passage West. Detailed descriptions were made of the seabed topography and bottom composition. Where possible, metal-detected anomalies were inspected and logged. A finds retrieval strategy dealing with conservation issues, cataloguing, and locational recording was in place to deal with any artefacts recovered during the survey. Maximum seabed coverage was obtained using a diver-towed survey methodology.

A very strong current of 5+ knots was noted during both the filing and the ebb tides. As such, the dive survey was undertaken during the tide-change, at which time the current fell to around 2 knots; the interaction between river and sea meant no 'slack-water' period was evident at this site. Due to the diving conditions present it was not possible to undertake a metal-detection survey across the central channel or the eastern side of the river. However, a band of reduced current was noted along the western limit of the survey and a metal-detection survey was undertaken across this area. A maximum water depth of 16.68m was recorded for the central channel. Visibility ranged between 1m-2m, depending on location within the channel. Diving operations were carried out to HSA/HSE standard using surface supplied equipment, supported with suitable boat cover and VHF communications to the relevant authorities.

Intertidal/Foreshore Pipelines

The proposed intertidal/ foreshore locations were field-walked to assess their archaeological potential and a photographic record was made. This was undertaken at low water to maximise survey coverage. A metal-detection survey was undertaken along a 50m stretch of foreshore to provide a sample target-ratio that would be representative of the rest of the foreshore survey area. A hand-held GPS unit was used to log any items of interest encountered as part of the survey.

3.8.3 Existing Environment

Historical Overview – Cork and the Lower Harbour

The following is a synopsis of the study area as it relates to the archaeology and history of the Lower Cork Harbour region. All Cultural Heritage (CH) features identified in this section are detailed in Tables 3.8.4 *Archaeological constraints Inventory of Recorded Monuments,* 3.8.5 Architectural *constraints inventory of Recorded Structures within study area* and 3.8.6 *Further potential Architectural Constraints within study area.*

Prehistory (Early Mesolithic 8000-5500BC, Later Mesolithic 5500-4000BC, Neolithic 4000-2500BC, Bronze Age 2500-500BC, Iron Age 500BC-AD500)

The earliest evidence for human settlement in Co. Cork now dates to the Early Mesolithic period (Woodman 1984, 1-11; 1989, 116-124). People living in the Mesolithic period ("middle stone age") were gatherers, hunters and fishers. It is thought they lived near the coastlines and along rivers, using flint and other suitable stones to make sharp tools (Anderson 1991, 35-8). Shell middens are refuse mounds or spreads of discarded sea-shells and can date from the Late Mesolithic, although the Cork Harbour oyster middens are quite recent (Power *et al.,* 1994). In addition Mesolithic people are found in the archaeological record by the material they left behind, usually in the form of stone tool-making waste ("debitage") and the tools themselves, and more rarely by habitation evidence such as house structures, pits and hearths. Burial evidence for this period is exceedingly rare with the latest evidence being located along the River Shannon, Co. Limerick (Collins and Coyne 2003; 2006). The Later Mesolithic period could be represented by the midden at Ringaskiddy CH12, although without datable material from this feature it is impossible to estimate its precise date of use (CO087-054---).

The Neolithic ("new stone age") saw the introduction of farming into Ireland. This change is seen in the archaeological evidence through domesticated plant and animal remains and a more sedentary lifestyle, although it is now thought that a certain amount of hunting and gathering would have continued (Waddell 1998). An important development in the Neolithic is the appearance of community burial places, megalithic tombs (of which there are 4 types), which took much time, effort and planning to construct (Twohig 1990). Evidence for Neolithic life in the archaeological record of Munster includes rectangular houses, farmsteads, pottery and megalithic tombs.

The Bronze Age marks the first introduction of widespread metal use into Ireland, firstly copper and then bronze. It is thought that society in this period became more hierarchical, with stress in community evidenced in the archaeological record by the disproportionate amount of weapons, particularly those which appear to be ritually deposited in watery places. Farming continued with houses being characterised in this period by circular structures, some in unenclosed or enclosed farmsteads. Burial at this time moves from the community rite of the Neolithic to singular burial in much smaller burial monuments such as barrows, ring ditches, cists and pits, sometimes grouped together into "cemeteries" (Waddell 1990; 1998). Pottery continues to be used in a domestic context and also new pottery shapes are seen, which are made especially for funerary purposes. Of the most common monument types in the archaeological record in Ireland, the burnt mound, or fulacht fiadh tends to date to this period (although both earlier and later dated examples have been found) (Buckley 1990; Monk 2007). Although no surface trace survives of CH19 is such an example. Ritual stone monuments such as standing stones, pairs, rows and circles, as well as rock art tend to date to the Bronze Age, which are particularly common in the Munster region, especially west Cork and Kerry (Ó Nualláin 1984).

An archaeological site dating to the Neolithic and Bronze Ages was excavated in advance of a golf course on Foaty Island excavated in 1992 (outside the study area), revealed a prehistoric complex of human occupation and possible burial pits.

The Iron Age in Ireland is more elusive than the previous periods, with no definite site type or burial tradition attributable to the period. The Iron Age has been discovered in Co. Cork, however, most recently at excavations at Cashel Hill and on the Beara peninsula by Prof. William O'Brien of UCC (O'Brien 2006).

Medieval (Early Medieval AD400-1100, Later Medieval AD1100-1600, Post Medieval AD1600-1700)

The early medieval period in Ireland is characterised by the introduction to Christianity to the country and history (i.e. writing, Edwards 1990; Sheehan and Monk 1998). Archaeological monuments attributable to this period include ringforts, cashels, (enclosed farmsteads) some hut sites, souterrains (underground chambers) and many monastic and ecclesiastical sites. These sites may occur in association in the landscape (Stout 1997). There are two ringforts located in the vicinity of the pipeline route CH1 & CH16, a ringfort and souterrain) and CH3 a ringfort in Parkgarriff. CH9 and CH10 are other probable examples of ringforts situated near the proposed location of the WWTP site. The end of the early medieval period in Ireland is marked by the arrival of the Vikings in AD795, firstly through raiding and later through trade and settlement. The Vikings are credited with establishing the first true towns in Ireland, at Cork, Dublin, Waterford and Limerick and smaller centres such as Wicklow and Arklow (Edwards 1990). There are no known early medieval archaeological remains in the immediate vicinity of the pipeline route. Other monuments represented within the study area which may be dated to the Medieval period are holy wells. The use of holy wells has continued from at least Early Medieval times until the present day (O'Sullivan and Sheehan 1996) and has its origins in pre-Christian Ireland although many of the sites are more recent in origin. The wells were usually visited for penitential purposes on saint's days and these pilgrimages followed a set pattern. During 19th century the Church became more and more disapproving of the trouble the patterns caused and the superstitious nature of the ritual associated with them, which has led to a decline in numbers in the recent past. Although CH2 in Ballywilliam is extant, the holy well at Ballyfouloo (CH4) has not been located.

The later medieval period begins historically with the invasion of the Anglo-Normans in AD1169 (Barry 1987; O'Keeffe 2002). Their presence can be seen in the archaeological record through the towns they established and re-organised. Archaeological monuments dating to this period include ringworks, hall houses, moated sites and tower houses.

The beginning of the post-medieval period was a turbulent time in Irish history. A new system of lordships emerged which eclipsed many of the earlier Anglo-Norman settlements. Irish lords came into conflict with the monarchy of England particularly Elizabeth I, when they tried to re-assert their control over the country, by establishing plantations, populated by settlers and by other means (Duffy *et al.* 2001; Robinson 1984). This resulted in the wars from 1560-1603.

Early Modern (AD1700-1900)

The 18th century was a time of general prosperity for the newly established protestant gentry. From 1691 until 1798 (the Rebellion) Ireland witnessed few dramatic events. By the end of the 18th century Cork Harbour was the lynch-pin of British naval operations in Ireland (Rynne 1993, 68). Defence was always a consideration, and with political changes on Continental Europe, and the threat of a French invasion of British-controlled lands, a series of defensive features, such as barracks, forts, batteries and Martello towers were built. The fort of Cove or Carrignafoy fort (CH18) was built between 1743 and 1749 and in 1804 it had three batteries (*ibid.* 70). Martello towers (so named after Mortello in Corsica where a similar type of gun tower had been used with success in 1794) and were built in Cork Harbour in 1813 and 1815 (Rynne 1993, 74; Rynne 2006, 204). The Cork Martello towers were placed strategically around the harbour on Haulbowline Island, at Monning, Belvelly and Rossleague on Great Island and Ringaskiddy (Rynne 1993, 74). None of the Martello towers or their zone of archaeological potential (ZAP) is predicted to be impacted, so they have not been included as CH features in this study.

Industrialisation occurred in Ireland in this period with many industries being established throughout the country. The limekilns at Monkstown and Shanbally, CH5 & CH8 are located within the pipeline route. The primary use of lime was agricultural but it was also used in the manufacture of mortar (Rynne 2006; 197). In addition, in Irish coastal towns and ports limekilns were also used for refining salt, which was imported as rock salt and used in the manufacture of butter (Rynne 1999, 29; 2006, 159). Cork was internationally famous for its butter and the trade in rock salt created the largest urban salt processing industry in Ireland (Rynne 2006, 302). CH22 is an unusual occurrence of a previously unrecorded limekiln. It is clearly an excellent example of the type and its location is marked on the OS six-inch first edition map with the characteristic "ring and dot" symbol which indicates a kiln.

Other features of industry dating to this period are mills (CH6 at Carrigaline). Running water was the main power source for the majority of flour mills built within the harbour area (Rynne 1993, 87). Traditional small-scale mills were gradually replaced by larger mills as mechanisation developed. Large scale milling could be undertaken on the quay sides where grain could be unloaded, reduced to flour and loaded to outgoing ships (Rynne 1999, 74). A similar mill complex was established in the eighteenth century at Raffeen. This is no longer extant and no trace of it could be found during the walkover. As the proposed development is only in its general vicinity it was not allocated a CH number on this occasion.

As part of this industrialisation the development of roads and railways became important in this part of Cork. Marked on the earlier OS maps as the Great Southern Railway the railway line that skirts the study area is also known as the Cork, Blackrock, and Passage Light Railway. It passed through the study area from Cork City through Passage West, Glenbrook, Monkstown, Raffeen, Carrigaline and onward to Crosshaven. The Great Southern and Western Railway travelled from Cork to Cobh (it is still operational) CH26. The railway servicing Crosshaven through Passage West to Carrigaline ceased functioning by the 30s (Rynne 2005, 196). Two remnants of this line are the embankments and small bridges which allow outflows of smaller creeks to the harbour and are CH features of the study area: CH23 near Raffeen in the townland of Ballyfouloo and CH25 in the townland of Kilnaglery. The latter now forms part of an amenity walk from Carrigaline to Crosshaven.

Townland and Barony Boundaries

Townland and barony boundaries may be the remnants of much earlier (early medieval or perhaps earlier) cultural divisions of the landscape, which have been maintained overtime, many to the present day. Boundaries in the vicinity of the Scheme are identified on Figures 3.8.2 to 3.8.6.

Current Townlands

The study area covers portions of 30Nr. existing townlands. These are detailed in Table 3.8.1 *Detail of Townlands within Study Area.*

Table 3.8.1: Detail of Townlands within Study Area

Townland	OS 6" Sheet No.	Parish	Barony
Ardmore	87	Marmullane	Kerrycurrihy
Ballybricken	87	Barnahely	Kerrycurrihy
Ballyfouloo	87	Monkstown	Kerrycurrihy
Ballyleary	87	Clonmel	Barrymore
Ballynoe	87	Clonmel	Barrymore
Ballintaggart	87	Carrigaline	Kerrycurrihy
Ballywilliam	87	Templerobin	Barrymore
Ballyvoloon	87	Clonmel	Barrymore
Barnahely	87	Barnahely	Kerrycurrihy
Carrigaline	87, 99	Carrigaline	Kerrycurrihy
Carrigaline Middle	87	Carrigaline	Kerrycurrihy
Carrigaline East	87	Carrigaline	Kerrycurrihy
Carrignafoy	87	Templerobin	Barrymore
Commeen	99	Carrigaline	Kerrycurrihy
Cuskinny	87	Templerobin	Barrymore
Dean & Chapter: Land of Cloyne	87	Clonmel	Barrymore
Kilgarvan	87	Templerobin	Barrymore
Lackaroe	87	Monkstown	Kerrycurrihy
Loughbeg	87	Barnahely	Kerrycurrihy
Maulbaun	75, 87	Monkstown	Kerrycurrihy
Monkstown	87	Monkstown	Kerrycurrihy
Raheens	87	Carrigaline	Kerrycurrihy
Rathanker	87	Monkstown	Kerrycurrihy
Ringaskiddy	87	Barnahely	Kerrycurrihy
Ringacoltig	87	Clonmel	Barrymore
Ringmeen	87	Clonmel	Barrymore
Shanbally	87	Carrigaline	Kerrycurrihy
Parkgarriff	87	Monkstown	Kerrycurrihy
Pembroke	75, 87	Marmullane	Kerrycurrihy
Passage West	75, 87	Marmullane & Monkstown	Kerrycurrihy

On-Shore Assessment

Field Assessment

An archaeological inspection was carried out on the study area. For ease of description the footprint was sub divided into 5Nr. Sections.

1. Passage West, Monkstown, Raffeen/Strawhill
2. Carrigaline
3. Shanbally (WWTP)
4. Ringaskiddy

5. Cobh and environs

These are described in terms of a) pipeline routes along existing roads, b) pipeline routes through 'green field' areas, c) pumping stations, and d) cultural heritage features. Full details of this assessment are included in *Volume III, Appendix 7A*.

The proposed WWTP site was inspected and field walked. Nothing new of an archaeological nature was noted as being present during the inspection. The proposed site is adjacent to two recorded archaeological monuments (CH9 & CH10, detailed on Table 3.8.4 *Archaeological constraints Inventory of Recorded Monuments*).

A number of the proposed pipelines in green field locations were located on private lands. Where these occurred, aerial photos (orthophotos) were consulted or, where possible, stretches were viewed from roads or gateways. Nothing of an archaeological nature was noted during this field assessment. However, there remains the potential for archaeological features to be present at a very low above ground register, which may not manifest on aerial photos. There remains the possibility that subsurface unrecorded archaeological remains may be impacted during the positioning of these pipes.

Desk-Based Assessment

The five sections of the study area (identified above) are described in terms of their archaeological and historical background. This is included in the specialist report in *Volume III, Appendix 7A*. A summary of archaeological monuments, architectural structures and further potential archaeological & architectural features which could be impacted by the Scheme are detailed on Tables 3.8.4 *Archaeological constraints Inventory of Recorded Monuments,* 3.5.8 *Architectural constraints inventory of Recorded Structures within study area* and 3.8.6 *Further potential Architectural Constraints within study area*.

A list of finds recovered from the townlands within and adjacent to the study area as per the National Museum of Ireland Topographical finds is detailed in Table 3.8.2 *List of finds from Townlands along the pipeline (National Museum of Ireland Topographical Files)*.

Table 3.8.2: List of finds from Townlands along the pipeline (National Museum of Ireland Topographical Files)

Townland	Find Description
Carrigaline	• Stone ball 1.5 inch diameter with projecting knob on one side • 2 amber beads
Near Carrigaline	• 1 polished stone axe-head: 6.3cm long width at cutting edge 4.25cm; width at butt 3.1cm
Carrigaline (Ravenswood)	• 1 stone axe-head • 6 bronze pins; 1 amber ball; 1 bronze armlet; 1 flat copper axe head
Pembroke	• Dug-out canoe, 1.70m long x 0.45m wide, round bottomed with pointed stem; sides damaged, washed ashore in the townland of Pembroke in 1964

Off-Shore/Intertidal Assessment

There are no archaeological sites listed in the Record of Monuments and Places for the immediate vicinity of the Marine Pipeline Crossing, the nearest sites lying 900m to the southeast of the proposed impact area; CO087:008: Possible Ringfort, and CO087:009: Graveyard(Figure 3.8.7 *RMP Sites within the Vicinity of the proposed Marine Crossing*). However, the history of maritime activity within this area is well established; an activity that is further attested to by the number of vessels listed in the Shipwreck Inventory for this stretch of coastline (refer to *Volume III, Appendix 7A*).

The proposed crossing lies within an extremely active stretch of waterway, approximately 800m from the mouth of the River Lee and the greater expanse of Cork Harbour (Plate 3.8.1 *North-facing view of the estuary mounth, River Lee survey area in distance,* Figure 3.8.8 *Survey Area and Seabed Observations at Site of Proposed Marine Pipeline Crossing*). The east side of the river is occupied by the site of a disused boatyard, currently under development, and a series of boat-moorings are located immediately upstream of the pipeline crossing (Plate 3.8.2 *East-facing view across Marine Pipeline Survey Area, River Lee Estuary*). The Cobh to Monkstown Car Ferry operates in close proximity to the pipeline crossing; leaving from a slipway 190m upstream of the eastern limit of the pipeline, and arriving at a slipway 60m upstream on the western limit of the pipeline.

The R610 roadway runs along the western side of the river, behind which, a series detached houses are located. A steep, wooded hill is located behind these residences (Plate 3.8.3 *West-facing view across Marine Pipeline Survey Area, River Lee Estuary*). The remains of the Royal Victoria Baths are located upon the waterfront, to the east of the roadway. The site is impacted by the pipeline corridor along its northern (upstream) side. The baths consisted of two wings, with an interlinking corridor, and provided separate bathing areas for both male and female patrons. A plunge pool and 150ft swimming area was located on the eastern side of this interlinking corridor, at the river's edge. The southern wing was one storey, while the northern wing was three stories high. The baths were extended in 1858 to include an entertainment area and Turkish bath. The northern wing was destroyed by a fire in 1859 and the baths were extensively refurbishment. The baths underwent a decline in popularity during the latter part of the nineteenth-century and by 1929 they were left in a derelict state. Shortly after the upstanding elements of the structure were demolished, the rubble being used to in-fill the swimming area. The foundations of both the north and south wings are still visible today and rise *c.*2.5m from the waters edge at Low Water (Plates 3.8.4 *West-facing view of downstream (southern wing) masonry façade from the remains of the Royal Victoria Baths* and 3.8.5 *North-west facing view of western side of survey area, adjacent to the remains of the Swimming area of Royal Victoria Baths*).

The Owenboy River rises in near Adamstown and runs eastwards, passing thorough Carrigaline to exit at Crosshaven. To the east of Carrigaline town, the river becomes tidal in nature and extensive mudflats flank the river at Low water. The remains of fish-traps, fish-weirs, wooden jetties/causeways, trackways, and submerged seasonal habitation sites are included among the more frequent archaeological sites/structures encountered within the intertidal zone. In addition, the possibility remains that mudflat sediments will retain isolated archaeological features, such as log boats (dug-out canoes) or other river/sea craft.

There are no known sites of archaeological or architectural interest located within the immediate vicinity of pipeline route (Figure 3.8.9 *RMP Sites within the Vicinity of the proposed Foreshore Pipeline Route)*. However, it is important to remember the high recovery potential for portable archaeological artefacts from riverine environments. The National Museum of Ireland's (NMI) topographic files attest to the large amount of archaeological material recovered from Ireland's waterways. No artefacts are listed in the National Museum of Ireland's Topographical Files for Owenboy River.

The Record of Monuments and Places lists six sites for the townlands surrounding the proposed foreshore pipeline corridor and these are tabulated below (Table 3.8.3 *List of RMP for the Foreshore Pipeline Corridor*).

Table 3.8.3: List of RMP for the Foreshore Pipeline Corridor

Rmp Number:	National Grid Reference:	Townland:	Site Type:	Distance From Pipeline:
CO087:036-01	17414E, 06259N	Carrigaline Middle	Graveyard	300m north
CO087:036-02	17414E, 06259N	Carrigaline Middle	Church	300m north
CO087:036-03	17414E, 06259N	Carrigaline Middle	Church of Ireland	300m north
CO087:037	17446E, 06275N	Carrigaline East	Castle	200m north
CO099:001	17543E, 06147N	Kilnaglery	Fulacht Fiadh	500m south
CO099:001-02	17542E, 06149N	Kilnaglery	Fulacht Fiadh	500m south

The underwater and intertidal assessments were comprehensive and extended beyond the site boundaries. The compact nature of the riverbed/seabed, coupled with high water velocities across of the central-channel and the eastern side of the river, provides an extremely poor holding content for archaeological material. A moderate to poor holding content can be ascribed to the western side of the river, where current is reduced and some sediment deposition is taking place. No archaeologically significant materials/structures were observed during the in-water assessment of the pipeline route. While the presence of masonry and other building material located along the western limit of the underwater survey area is of interest, most likely associated with the nineteenth century Royal Victoria Baths, it retains an historic rather than archaeological significance. However, whilst no surface archaeological material has been encountered, there always remains the possibility of buried, *in situ*, archaeology remains.

Likewise, a poor archaeological potential has been observed for the pipeline corridor at Owenboy River. It is evident that extensive modern alteration has taken place with the construction of flood protection measures and the presence of an existing pipeline running along the upper foreshore. This pipeline runs along approximately 70% of the survey area. In contrast, a good archaeological holding content can be ascribed to the inter-tidal mudflats, where the deep build up of silt and clay sediments provide ideal conditions for the preservation of archaeological material. No archaeologically significant material/structures were observed during the inter-tidal assessment of the pipeline route. Only two structures of note were encountered as part of the survey. These included the remains of two iron-trackways with associated boat-trolleys. However, while these structures provide a useful insight into the river-use in the early 1900s, they hold no inherent archaeological value.

3.8.4 Environmental Impacts

(i) Construction and Operational Phase Impacts

On-shore Impacts

All elements of the proposed WWTP will involve ground disturbance. Trenches will need to be dug for pipe-laying purposes, the construction of the pumping stations may require some excavation, while, construction of the WWTP itself will require that earth be removed from the area and reused on site where possible. There exists the potential to negatively impact upon any sub-surface archaeological features and/or artefacts that may as of yet be unidentified in the area. There are recorded archaeological monuments in the immediate vicinity of the WWTP. During the construction of the WWTP and collection system, vibration from nearby machinery may have a negative impact on nearby extant archaeological features, however, the impact will be imperceptible following the implementation of mitigation measures.

The proposed pipeline follows for the most part existing roadways and so will not impact on any townland or barony boundaries in those areas (excepting where the road may form this boundary). However, areas where there is green field piping will impact a number of townland and barony boundaries. Figures 3.8.2 to 3.8.6 show the townland boundaries, which will be impacted by the green-field routes for the piping. Townland boundaries, while not recorded archaeological monuments, do possess the potential to yield archaeological information on the enclosing of the landscape in the past.

Impacts to known sites of archaeological value are as follows:

- The digging of trenches within or adjacent to zones of archaeological potential (ZAP) for the RMP sites within the study area have the potential to cause a negative impact. Zones of archaeological potential which are predicted to be directly impacted by the development are CH9 and CH18. These are indicated on the map by a circle (this is for indication purposes only and may not actually delimit the site on the ground). The locations of these monuments are depicted on the aerial photo figures (Figures 3.8.10 to 3.8.14 *Aerial Photo showing CH Locations*). 17 Nr. sites and their ZAPs may be indirectly impacted by the proposed pipeline (as stated above the ZAP is indicative only). The impact on these sites is predicted to be significant and permanent in nature; where the pipelines are routed along existing roadways, which have already caused disturbance the predicted impact has a low certainty.

- The digging of trenches for the proposed development in greenfield areas where no recorded archaeology is located could potentially result in the permanent destruction of subsurface archaeological features and/or artefacts which might as of yet be un-recorded in the area. This would be a significantly negative impact.

Should no archaeological mitigation be put in place for the duration of these works, it is likely that unrecorded archaeological deposits and/or artefacts may be destroyed without proper archaeological recording taking place.

Landscape

It is clear from this study that the landscape of the proposed development is rich in cultural heritage elements from the earliest times to the present. Perhaps the most important of those is that of Cobh Town itself CH26. Due to its historic past and its protected structures (which are seen as individual elements) it was decided that in the case of this study it should be seen as a cohesive entity. This ethos is echoed in the town's Development Plan (Cobh Town Council 2005). Most of the proposed development is underground pipe work, so while it is predicted to be visible when construction is taking place, in the long term, the visual impact should not be permanent. Major pumping stations will have a visual impact, particularly the one proposed for West Beach Cobh. This should be designed sensitively with its central location borne in mind, among all the historic structures. The other stations might also be suitably screened and their construction either/or archaeologically test trenched or monitored.

Inventory of Recorded Monuments

The following are the archaeological monuments in the vicinity of the study area, which are likely to be impacted by the proposed development. There is a description of each monument as they appear in the *Archaeological Inventory of County Cork- Volume II: East and South Cork* (Power *et al.* 1994). Where possible these sites were visited in the field. Due to the scale of the development, only those recorded monuments whose ZAP are predicted to be impacted by the development have been included as CH sites. The recorded archaeological monuments predicted to be impacted by the proposed development are detailed below on Table 3.8.4 *Archaeological Constraints Inventory of Recorded Monuments.*

Architectural Inventory

The following features listed in Table 3.8.5 *Architectural constraints inventory of Recorded Structures within study area* are the list of all known recorded protected structures (RPS) within the study area (with the exception of Cobh Town; its elements have been grouped under CH26 see below due to its complexity). This study's code (Cultural Heritage, CH, features) is provided as well as the RPS county code for the structure. The importance/legal status of the structure is provided along with the name of the address in which the structure is situated. The site type is the classification designated to the structure in the list of Protected Structure in the *Cork County Development Plan* (2003). The source of the information provided in the table is given, along with the pertinent points of that source in the final column. The National Inventory of Architectural Heritage (NIAH) was contacted. They informed Aegis Archaeology that they have yet to survey the study area and its vicinity and as such have no records for the study area at present. It is important to point out that the NIAH's future work may have a bearing on this study.

Further Potential Archaeological & Architectural Constraints

Some wayside monuments were noted during the inspection of the study area (refer to Table 3.8.6 *Further potential Architectural Constraints within study area*). These are not formally protected. They might be regarded as being of local interest and so it is suggested that they be protected from inadvertent damage during the construction of the development. The potential architectural constraints have been included here (although they are not recorded structures at present). Potential architectural features were identified from the walkover inspection only. One "new" unrecorded existing archaeological monument was noted during the walkover CH22, a limekiln.