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# Environmental Impact Assessment Report Development at Waterford Airport

## Volume 2 – Chapter 11 – Noise and Vibration

**Prepared for: Waterford City & County Council in Partnership with Waterford Regional Airport PLC**

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# 11. INTRODUCTION

## 11.1 Introduction

Waterford Airport was granted planning permission (Planning Reference 14/89) for a 350m extension of the southern section of runway. Waterford Airport is proposing to extend the northern section of the runway by 491m, including addition of a new hammerhead at the northern extent. The southern extension of 363m extension is proposed, which will supersede the existing planning permission. The proposal includes widening the entire runway by 7.5m either side as well as the provision of services, new cark park, navigation lighting, an extension of the terminal building and drainage works. The works include the demolition of 2 no. houses adjacent to the northern runway (R303 and R304).

## 11.2 Methodology

The methodology adopted for this noise assessment is as follows:

- Review of appropriate guidance, planning conditions applicable to other sites and specification of suitable construction and operational noise criteria;
- Characterisation of the receiving noise environment;
- Characterisation of the proposed development;
- Prediction of the noise impact associated with the proposed development, and;
- Evaluation of noise impacts.

### 11.2.1 Study Area

Waterford Airport is located c. 7.4 km southeast of Waterford city and c. 5.6 km northwest of Tramore town. The airport is on the R708 road, which can be accessed from the R710 outer ring road in Waterford. The surrounding area is characterised by one off housing development, commercial/industrial facilities[1] adjacent to the airport and agricultural land. The Airport Business Park is located on Light Industrial zoned lands to the immediate south of Waterford Airport.

Within 1 km of the airport there are 62 no. residential receptors and 13 receptors which are classed as both residential and commercial receptors[2]. 35 no. commercial receptors including various enterprises are located within the airport area and airport business park. The closest residential dwellings are located adjacent to the northern and southern boundaries.

There are three types of noise sources associated with the operation of the proposed development: air traffic noise, ground noise and traffic noise. Air traffic noise has potential to impact receptor further away from the airport and receptors within the 48 dB $L_{Aeq,16h}$ noise contour were assessed. For ground noise, receptors within 1km were assessed and for traffic noise receptors adjacent to R708 main access route to the airport up to 1km from the airport entrance were assessed.

[1] Many of the commercial/industrial facilities are airport related.
[2] ***Source:*** Eircode Postcodes database (2020)

Construction activities were assessed against noise limit criteria in BS 5228-1:2009+A1:2014 at the nearest noise sensitive locations to construction activities. If compliance can be demonstrated at the nearest noise sensitive locations, compliance can be inferred at more distant noise sensitive locations.

Details on the noise sensitive locations assessed as part of this noise impact assessment are provided in Appendix 11.1.

### 11.2.2 Relevant Guidance

A list of relevant guidance documents used in the preparation of this assessment are provided below. These have been referred to where appropriate.

**EIAR/EIA Guidance:**

The EPA draft guidance documents 2015 and 2017 relating to the preparation of EIAR have been considered in the preparation of this EIAR.

- Guidelines on Information to be contained in Environmental Impact Assessment Reports, Draft EPA, 2017
- Advice Notes for Preparing Environmental Impact Statements, Draft, EPA, 2015

**Noise Standards and Technical Advice:**

- International Standard ISO 9613-2:1996, Attenuation of sound during propagation outdoors, Part 2: General method of calculation
- International Standards Organisation, ISO 1996-1:2016, Acoustics -- Description, measurement and assessment of environmental noise -- Part 1: Basic quantities and assessment procedures
- International Standards Organisation, ISO 1996-2:2017, Acoustics -- Description, measurement and assessment of environmental noise -- Part 2: Determination of environmental noise levels
- British Standard BS 5228 Part 1:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites - Part 1: Noise
- British Standard BS 5228 Part 2:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites - Part 2: Vibration
- Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4), Environmental Protection Agency, January 2016
- Calculation of Road Traffic Noise (CRTN), Department of Transport Welsh Office, HMSO 1988
- Integrated Noise Model (INM) - Federal Aviation Administration, United States
- Guidelines for the Treatment of Noise and Vibration in National Road Schemes, 2004, Transport Infrastructure Ireland
- Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes, 2014, Transport Infrastructure Ireland
- Highways Agency, Design Manual for Roads and Bridges, LA111 – Noise and Vibration Rev 2 (May 2020)

### Guideline Noise Levels

- British Standard BS 5228 Part 1:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites - Part 1: Noise
- British Standard BS 5228 Part 2:2009+A1:2014, Code of practice for noise and vibration control on construction and open sites - Part 2: Vibration
- Highways Agency, Design Manual for Roads and Bridges, LA111 – Noise and Vibration Rev 2 (May 2020)
- Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4), Environmental Protection Agency, January 2016
- British Standard BS 8233:2014, Guidance on sound insulation and noise reduction for buildings
- Guidelines for the Treatment of Noise and Vibration in National Road Schemes, 2004, Transport Infrastructure Ireland
- Department for Transport (UK) – 57 dB $L_{Aeq,16h}$ onset of annoyance was adopted in 1990 on foot of the following research:
  - Directorate of Operational Research and Analysis "The Noise and Number Index" DORA Communication 7907, Second Edition, September 1981
  - Brooker, P et al "United Kingdom Aircraft Noise Index Study: Final Report" Civil Aviation Authority DR Report 8402, January 1985
  - Critchley, JB and Ollerhead, JB "The Use of Leq as an Aircraft Noise Index" Civil Aviation Authority DORA Report 9023, September 1990.
- UK airspace policy consultation: executive summary, Department for Transport (UK)
- UK airspace policy consultation: a framework for balanced decisions on the design and use of airspace, Department for Transport (UK)
- Air navigation guidance on airspace and noise management and environmental objectives, Department for Transport (UK)
- Consultation Response on UK Airspace Policy: A framework for balanced decisions on the design and use of airspace, Department for Transport (UK)

## 11.2.3 Evaluation Criteria

### *11.2.3.1 Construction Noise Criteria*

There is no statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. In the absence of specific noise limits, appropriate emission criteria relating to permissible construction noise levels for a development of this scale may be found in the British Standard *BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise.*

*BS 5228-1:2009+A1:2014* contains a number of methods for the assessment of the significance of noise effects. The *ABC Method* from BS 5228-1:2009+A1:2014 is used to derive appropriate noise limits for the proposed development. The threshold limits as defined in Table 11.1 based on existing ambient levels, which if exceeded, signify a potential significant effect.

**Table 11.1: Threshold of Potential Significant Effect at Dwellings**

| Assessment category and threshold value period ($L_{Aeq}$) | Threshold Value, in decibels (dB) | | |
|---|---|---|---|
| | Category A [A)] | Category B [B)] | Category C [C)] |
| Night-time (23:00 to 07:00hrs) | 45 | 50 | 55 |
| Evenings and weekends [D)] | 55 | 60 | 65 |
| Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00) | 65 | 70 | 75 |

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

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

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

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

For the appropriate period (e.g. daytime) the ambient noise level is determined and rounded to the nearest 5dB. The noise environment at the three baseline monitoring locations varied throughout the noise survey with ambient (free-field) noise levels within the range 30.8dB – 66.5dB $L_{Aeq}$, 39.4dB – 62.0dB $L_{Aeq}$, and 31.3dB – 61.2dB $L_{Aeq}$ at monitoring locations N1, N2 and N3, respectively. (See Section 11.4 for further details on baseline noise survey). However, the maximum ambient noise levels measured at monitoring location N1 is likely to be higher than would be expected at the nearest residential dwelling c. 170m further away from Waterford Airport. Hence, noise data from monitoring location N1 was not used to determine suitable construction noise limits.

A correction of +3dB was added to the noise levels measured at monitoring locations N2 and N3 to convert free-field noise levels to façade noise levels. The ambient façade noise level when rounded to the nearest 5 dB ranged between 35 and 65 dB $L_{Aeq}$ at these monitoring locations. However, the number of occurrences at the higher ambient noise levels was low and the typical ambient façade noise level when rounded to the nearest 5 dB was 60 dB $L_{Aeq}$. This was used to determine the construction noise limits for nearby residential dwellings. Hence, the nearest residential dwellings adjacent to Waterford Airport are afforded Category A designation (65 dB $L_{Aeq,1hr}$ during daytime periods).

Section 11.5 provides the detailed appraisal in relation to this site. If the site noise exceeds the appropriate category value then a potential significant effect is deemed to occur.

#### *11.2.3.2 Construction Vibration Criteria*

There is no published statutory Irish guidance relating to the maximum permissible vibration level that may be generated during the construction phase of a project. In the absence of specific vibration limits, appropriate criteria relating to permissible construction vibration levels for a development of this scale may be found in British standards. When vibration is discussed in terms of the effect on the environment, it is in the context of the effect on human comfort and cosmetic or structural damage to buildings.

Guidance relevant to acceptable vibration within buildings is contained in the following standards:

- *BS 7385-2:1993, Evaluation and measurement for vibration in buildings: Guide to damage levels from groundborne vibration*
- *BS 6472-1:2008, Guide to evaluation of human exposure to vibration in buildings: Vibration sources other than blasting*
- *BS 5228-2:2009+A1:2014, Code of Practice for Noise and Vibration Control on Construction and Open Sites – Vibration*

### Human Comfort

Human beings are known to be very sensitive to vibration, the threshold of perception being typically in the peak particle velocity (PPV) range of 0.14 mm/s to 0.3 mm/s. BS 6472-2:2008 recommends using vibration dose value (VDV) as the appropriate measure to evaluate human exposure to vibration in residential and other types of buildings. The likelihood of adverse comment from building occupants is used to evaluate the likely severity of the effect, and VDVs and probabilities of adverse comment within residential buildings are presented in BS 6472.

However, BS 5228-2:2009+A1:2014 states, "*Whilst the assessment of the response to vibration in BS 6472 is based on the VDV and weighted acceleration, for construction it is considered more appropriate to provide guidance in terms of the PPV, since this parameter is likely to be more routinely measured based upon the more usual concern over potential building damage. Furthermore, since many of the empirical vibration predictors yield a result in terms of PPV, it is necessary to understand what the consequences might be of any predicted levels in terms of human perception and disturbance*." Table 11.2 presents guidance on the effects of vibration levels extracted from BS 5228.

**Table 11.2: Guidance on Effects of Vibration Levels**

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

### Cosmetic or structural damage to buildings

The PPV is the simplest indicator of both perceptibility and the risk of damage to structures. BS 7385-1:1990 and BS 7385-2:1993 provide guidance on measurement, evaluation of effects on buildings and damage levels, and are based on the use of PPV. Table 11.3 shows the transient vibration guide values for cosmetic damage extracted from BS 7385-2:1993. *BS 5228-2:2009+A1:2014* also applies the damage threshold criteria presented in BS 7385-2:1993.

**Table 11.3: Transient Vibration Guide Values for Cosmetic Damage**

| Category | Type of Building | Peak component particle velocity in the frequency range of predominant pulse | |
|---|---|---|---|
| | | 4 Hz to 15Hz | 15 Hz and above |
| 1 | Reinforced or framed structures<br>Industrial and heavy commercial buildings | 50 mm/s at 4 Hz and above | 50 mm/s at 4 Hz and above |
| 2 | Unreinforced or light framed structures<br>Residential or light commercial buildings | 15 mm/s at 4 Hz and increasing to 20 mm/s at 15 Hz | 20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above |
| Note 1: Values referred to are at the base of the building.<br>Note 2: For Category 2, at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) is not to be exceeded.<br>These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings. | | | |

For the purposes of assessing construction vibration impacts, the range of relevant criteria used for human comfort and building protection is expressed in terms of PPV in mm/s.

### *11.2.3.3 Operational Noise Criteria*

During the operational phase of the proposed development noise will be generated from air traffic, ground operations and road traffic noise. The operational noise criteria vary depending on the noise source type. The operational noise criteria are outlined in the following paragraphs.

#### ***Air Traffic Noise Criteria***

There is no statutory Irish guidance relating to aircraft noise exposure levels. In the absence of such guidance, reference is made to UK guidance. The UK government (See Section 11.2.2 for details) defined three threshold levels for policy consideration: 57, 63 and 69dB $L_{Aeq,16h}$ representing, low, moderate and high annoyance. The reference time period is an average summer day, from June 16th to September 15th inclusive and from 07:00 to 23:00 hrs[3].

The findings of the Survey of Noise Attitudes study (SoNA 2014) commissioned by the Department for Transport (UK) which indicated that the degree of annoyance (based on % of respondents highly annoyed) previously occurring at 57 dB $L_{Aeq,16h}$, now occurs at 54 dB $L_{Aeq,16h}$. The research also showed that some adverse effects of annoyance can be seen to occur down to 51dB $L_{Aeq,16h}$.

[3] The summer day period dates back to the recommendations in the 1963 Wilson Committee report on aircraft noise, which recommended measuring noise exposure during the summer months because people were more likely to have windows open, be outdoors, and aviation activity is at its most intense.

The UK National aviation policy is currently under review and on 2nd February 2017 the Government published a number of policy consultation documents. Those directly relevant to noise are:

- UK airspace policy consultation: executive summary;
- UK airspace policy consultation: a framework for balanced decisions on the design and use of airspace; and
- Air navigation guidance on airspace and noise management and environmental objectives.

On 20th October 2017, the Government published a Consultation Response on UK Airspace Policy. In the executive summary of the Air Navigation Guidance it states that the policies set out within the Consultation Response document should be viewed as current Government policy for airspace change[4].

The latest policy outlines a risk based approach proposed in line with latest evidence and current guidance from the World Health Organisation (WHO). The new guidance sets 51dB $L_{Aeq,16h}$ for daytime and 45dB $L_{Aeq,8h}$ for night-time as the Lowest Observed Adverse Effect Level (LOAEL) for assessing the health impacts from air traffic noise. It also states that if noise levels are above 63dB $L_{Aeq,16h}$ financial assistance should be provided by the airport for sound insulation. If noise levels are above 69dB $L_{Aeq,16h}$ an offer of full insulation to be paid for by the airport where the home owners do not want to move. These levels of noise exposure for which mitigation has been discussed in the UK are rather higher and higher than the noise levels that than would be experienced at Waterford, and essentially refer to noise impact mitigation for persons exposed to prolonged noise levels of 63dBA and 69dBA or more, for 16 hours or more. Prolonged exposure to such higher levels of noise is not anticipated from the relatively low levels of commercial aircraft activity likely to take place at Waterford Airport, where an anticipated level of only 6 medium jet aircraft movements have been forecast for the busy day. The purpose of mentioning this UK viewpoint is to put the Waterford Airport aircraft noise impacts in context, and to illustrate that the aircraft noise impacts anticipated for residents living beneath flight paths near to Waterford Airport would be significantly less than has triggered land use controls and noise mitigation in the UK.

The Waterford Regional Airport & Business Park Masterplan is appended to the WCDP 2011-2017. The document sets out the planning objectives and strategies for the future of the regional airport in line with the objectives of the Development Plan, Regional Planning Guidelines and National Planning Policy. Section 1.1 of Appendix 1: Airport Control Zones of the Waterford Regional Airport & Business Park Masterplan states "*To protect the public from adverse effects of aircraft noise, it is important to control development of certain land uses within those lands that potentially would be subject to various levels of aircraft noise.*" Table 11.4 presents the typical land uses permitted within specific noise contour levels.

[4] Consultation Response on UK Airspace Policy: A framework for balanced decisions on the design and use of airspace – extract from executive summary… *'The Government's current aviation policy is set out in the Aviation Policy Framework (APF). The policies set out within this document provide an update to some of the policies on aviation noise contained within the APF, and should be viewed as the current government policy.'*

**Table 11.4: Typical Land Uses Permitted within Specific Noise Contour Levels**

| Aircraft Noise Contour | Permitted Uses and Development |
|---|---|
| <57 dBA | Residential<br>Outdoor Recreational Facilities<br>Commercial<br>Public Facilities<br>Municipal Utilities<br>Industrial<br>Transportation<br>Agriculture |
| 57 – 63 dBA | Limited Outdoor Recreational Facilities<br>Commercial<br>Limited Public Facilities<br>Municipal Utilities<br>Industrial<br>Transportation<br>Agriculture |
| 63 – 69 dBA | Limited Outdoor Recreational Facilities<br>Commercial<br>Municipal Utilities<br>Industrial<br>Transportation<br>Agriculture |
| >69 dBA | Limited Outdoor Recreational Facilities<br>Commercial<br>Municipal Utilities<br>Industrial<br>Transportation<br>Agriculture |

Guidance on aircraft noise and land uses within lands around an airport that prevail in the UK specifies that development should not occur in a noise contour band where predicted noise levels could be greater than 72 dBA.

The airport is typically open between the hours of 07:00 – 23:00 and is operational all year round. However, the airport has previously facilitated ad hoc requests from individual operators which can occur outside of the hours above so there is potential for flight operations during night-time periods (e.g. Irish Coastguard requirement to support 24 hours emergency operations). If this was the case the frequency would be very low.

The impact from the proposed airport extension has been assessed against noise limits set out in 'Consultation Response on UK Airspace Policy: A framework for balanced decisions on the design and use of airspace' (current UK Government policy) and aircraft noise contours from the Waterford Regional Airport & Business Park Masterplan (Table 11.4).

### *Ground Operations Noise Criteria*

In the absence of specific noise limits, appropriate emission criteria was derived with respect to the Environmental Protection Agency (EPA) *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)* (Environmental Protection Agency, 2016) provides noise guidance to operator's subject to IPPC or waste licences. While the proposed development does not fall under the remit of the EPA, the EPA's NG4 guidelines are considered the most appropriate noise assessment criteria as they follow best practice principles.

The World Health Organisation (WHO) Guidelines for Community Noise and BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings* also specify noise limits for daytime and night-time periods.

#### Noise Guidance (NG4) Compliance

*Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)* (Environmental Protection Agency, 2016) requires that sites are screened to determine whether they are a 'quiet area' in accordance to the EPA publication *Environmental Quality Objectives – Noise in Quiet Areas* (2003) (Step 1 of NG4 Screening) or areas of low background noise (Step 2/3 of the screening). This screening is required to determine the most applicable noise limits for sites.

Step 1 of the screening is shown in Table 11.5 below. For the site to be in a 'Quiet Area', the criteria listed in Table 11.5 must be satisfied. In the case of this site, it does not meet any of the criteria in Table 11.5 and it is not considered to be a 'Quiet Area'.

### Table 11.5: Quiet Area Screening Step 1

| Criteria | Response |
|---|---|
| Is the site >3km away from urban areas with a population >1,000 people? | Yes |
| Is the site >10km away from urban areas with a population >5,000 people? | Yes |
| Is the site >15km away from urban areas with a population >10,000 people? | No, c.14 km from Waterford City with a population of 53,504 [Census 2016] |
| Is the site >3km away from any local industry? | No, Airport Business Park adjacent to the development |
| Is the site >10km away from any major industry centre? | No, Airport Business Park adjacent to the development |
| Is the site >5km away from any national primary route? | Yes |
| Is the site >7.5km away from any motorway or dual carriageway? | Yes |

Since it is not in a 'Quiet Area', NG4 requires the site to be screened to determine if the site is in an 'area of low background noise' (NG4 Step 3). Background noise levels are examined to see if they satisfy the following criteria:

- Average Daytime Background Noise Level ≤40dB $L_{AF90}$, and;
- Average Evening Background Noise Level ≤35dB $L_{AF90}$, and;
- Average Night-time Background Noise Level ≤30dB $L_{AF90}$.

In order for a site to be considered an 'area of low background noise', all three criteria above must be satisfied. A baseline noise survey was undertaken at three locations in close proximity to the site. The data was analysed and monitoring location N2 is not considered an 'area of low background noise'. Monitoring locations N1 and N3 generally have background noise levels less than low background noise criteria, however, there are occasions when the background noise is above the low background noise criteria. The ambient noise levels are also significantly higher. Given the existing ground operation activities at the airport and the fact that land immediate south of Waterford Airport is zoned as Light Industrial, the typical EPA noise limits as presented in Table 11.6 over are most appropriate.

### Table 11.6: Guidance Note NG4 Recommended Noise Emission Limits

| Period | Noise Limit |
|---|---|
| Daytime (07:00 to 19:00 Hrs) | 55 dB(A) $L_{Ar,T}$ |
| Evening-time (19:00 to 23:00 Hrs) | 50 dB(A) $L_{Ar,T}$ |
| Night-time (23:00 to 07:00 Hrs) | 45 dB(A) $L_{Aeq,T}$ |

In addition to the numerical limit, the NG4 guidance note states that during the daytime and evening periods, rigorous efforts should be made to avoid clearly audible tones and impulsive noise at all noise sensitive locations. A penalty of 5 dB for tonal and/or impulsive elements is applied to the daytime and evening measured $L_{Aeq,T}$ values to determine the appropriate rating level $L_{Ar,T}$. During night-time no tonal or impulsive noise from the facility should be audible at any noise sensitive location.

However, when considering effects at the community level as opposed to the individual level, the WHO Guidelines for Community Noise and BS8233:2014 can be taken to indicate that 55 dB $L_{Aeq,16h}$ and 45 dB $L_{Aeq,8h}$ are suitable thresholds applicable to community annoyance as a whole for daytime and night-time periods, respectively. The noise limits in EPAs NG4 guidelines, WHO guidelines and BS8233:2014 are similar. However, the definition of daytime periods varies. For the purpose of assessing the noise impact of ground operations the following noise limits and time periods were used:

- Daytime (07:00 – 23:00): 55 dB $L_{Aeq,16h}$
- Night-time (23:00 – 07:00): 45 dB $L_{Aeq,8h}$

### *Traffic Noise Criteria*

The proposed runway extension and ancillary works has potential to result in increased traffic to and from the airport. The TII *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (TII 2004) document provides guidance on the treatment of noise and vibration during the planning and design of national road schemes including a design goal of 60 dB $L_{den}$.

The TII *Guidelines for the Treatment of Noise and Vibration in National Road Schemes* (TII 2004) are for new road schemes but also states that routes should be considered for further assessment where traffic flow is likely to increase or decrease by 25% or more in both the construction and operational phases. This statement is with respect to increased traffic flow on an arterial route as a result the new road scheme. The proposed runway extension does not include for the provision of a new road development but there will be an increased number of vehicle movements on the R708 regional road which serves the airport.

TII state that the design goal is applicable to new road schemes only. As the proposed runway extension is not a new road but associated increase in traffic has potential to impact on residences, it is important to assess any potential impact and reference is made to the Highways Agency in the UK who published the Design manual for roads and bridges LA111 Rev 2 – Noise and vibration (May 2020). This document presents details on the classification of magnitude of noise impacts in the short term (e.g. when a project is opened) and long term (typically 15 years after project opening). A change in road traffic noise of 1 dB in the short term is the smallest that is considered perceptible. In the long term, a 3 dB change us considered perceptible. The significance that can be attached to changes in noise levels (perceptible to human beings) applies to traffic noise is shown in Table 11.7. However, the changes are subjective and will vary among individuals.

**Table 11.7: Classification of Magnitude of Noise Impacts (Highways Agency, UK)**

| Magnitude of Impact | Noise Change, $L_{A10\ (18\ hour)}$ | |
|---|---|---|
| | Short Term | Long Term |
| Negligible | Less than 1.0 | Less than 3.0 |
| Minor | 1.0 to 2.9 | 3.0 to 4.9 |
| Moderate | 3.0 to 4.9 | 5.0 to 9.9 |
| Major | Greater than or equal to 5.0 | Greater than or equal to 10.0 |

The potential traffic noise impacts have been assessed with respect to the Highways Agency's guidance document.

### 11.2.4 Significance of Impact

The criteria for determining the significance of impacts and the effects are in line with the EPA Guidelines (Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports 2017) .

The EPA guidelines do not quantify the impacts in decibel terms. In absence of such information, reference is made to "Guidelines for Environmental Noise Impact Assessment" (IEMA, 2014). Table 11.8 presents the degree of effect matrix from the IEMA guidelines and Table 11.9 presents the effect descriptions.

**Table 11.8: Degree of Effect Matrix (IMEA, 2014)**

| | | Sensitivity of Receptor | | | |
|---|---|---|---|---|---|
| | | High | Medium | Low | Negligible |
| Magnitude / Scale of Change | Large | Very Substantial | Substantial | Moderate | None |
| | Medium | Substantial | Substantial | Moderate | None |
| | Small | Moderate | Moderate | Slight | None |
| | Negligible | None | None | None | None |

**Table 11.9: Effect Descriptions (IMEA, 2014)**

| Effect | Description |
|---|---|
| Very Substantial | Greater than 10 dB LAeq change in sound level perceived at a receptor of great sensitivity to noise |
| Substantial | Greater than 5 dB LAeq change in sound level at a noise-sensitive receptor, or a 5 to 9.9 dB LAeq change in sound level at a receptor of great sensitivity to noise |
| Moderate | A 3 to 4.9 dB LAeq change in sound level at a sensitive or highly sensitive noise receptor, or a greater than 5 dB LAeq change in sound level at a receptor of some sensitivity |
| Slight | A 3 to 4.9 dB LAeq change in sound level at a receptor of some sensitivity |
| None/Not Significant | Less than 2.9 dB LAeq change in sound level and/or all receptors are of negligible sensitivity to noise or marginal to the zone of influence of the proposals |

For this assessment, it has been assumed that dwellings have a high sensitivity. Table 11.10 presents the impact scale adopted in this assessment as well as the corresponding significance of impact based on definitions presented in the "Revised Guidelines on the Information to be contained in Environmental Impact Assessment Reports" (EPA, 2017).

**Table 11.10: Effect Descriptions (IMEA, 2014and EPA, 2017)**

| Noise Level Change dB(A) | IEMA Guidelines | EPAs Significance of Effects |
|---|---|---|
| Less than 2.9 | None/Not Significant | Imperceptible |
| | | Not Significant |
| 3.0 - 4.9 | Slight | Slight Effects |
| | Moderate | Moderate Effects |
| 5.0 – 9.9 | Substantial | Significant Effects |
| Greater than 10.0 | Very Substantial | Very Significant |
| | | Profound Effects |

## 11.3 Existing Environment

### 11.3.1 Baseline Noise Survey

A baseline noise survey was conducted to quantify the background and ambient noise levels in the vicinity of the proposed development. The noise survey was conducted from the 5$^{th}$ to 11$^{th}$ July 2018 and the procedure followed was in accordance with ISO 1996-2:2017 Acoustics – Description, measurement and assessment of environmental noise.

#### *11.3.1.1 Methodology*

The noise survey consisted of unattended measurements at three noise sensitive receivers. The noise parameters recorded during the noise survey were:

**$L_{Aeq}$** is the A-weighted equivalent continuous sound level measured during the sample period. It is an average of the fluctuating noise level over the sample period.

**$L_{AFMax}$** The maximum RMS A-weighted sound level during a stated time period (Fast Time weighting).

**$L_{AFMin}$** The minimum RMS A-weighted sound level during a stated time period (Fast Time weighting).

**$L_{A10}$** is the A-weighted sound level, which is exceeded for 10% of the sample period (Fast Time weighting).

**$L_{A90}$** is the A-weighted sound level, which is exceeded for 90% of the sample period (Fast Time weighting).

$L_{Aeq}$ is the most commonly used parameter for assessment of noise impact and is a good measure of ambient noise levels. $L_{A90}$ indicator is considered a good measure of background noise levels. In this report, $L_{Aeq}$ and $L_{A90}$ measurement parameters are used to describe the noise environment.

All measurements were free-field measurements positioned at least 3.5m from any reflecting facades. The microphone was mounted at a height of 1.5m above ground level. Measurements were logged every 10 minutes.

### 11.3.2 Monitoring Locations

For the current case three noise sensitive locations were identified for obtaining a detailed representation of the ambient and background noise levels in the vicinity of the proposed runway extension. The chosen noise monitoring locations are representative of nearest occupied dwellings to the proposed development.

Details of the noise monitoring locations are provided in Table 11.11 below and a figure of the positions is presented in Figure 11.1.

**Table 11.11: Noise Monitoring Location Details**

| Monitoring Location | Easting | Northing | Location | Photograph |
|---|---|---|---|---|
| N1 | 662755 | 605518 | Located adjacent to airport northern site boundary. The nearest dwelling is c. 170m northeast of this location. | Plate 4.1 |
| N2 | 661909 | 603323 | Located adjacent to the airport southern site boundary. The nearest dwelling is located c. 50m northwest of this location. | Plate 4.2 |
| N3 | 663088 | 604396 | Located adjacent to airport approach road and c. 30m from R708 regional road. The nearest dwelling is c. 110m east of this location. | Plate 4.3 |
| Weather Station | 662743 | 605521 | Located beside NML 1 | Plate 4.4 |

Path: R:\Map Production\2020\P20-004\Workspace\EIAR\P20-004_GIS_Fig11-1_NoiseMonitoringAndWeatherStationLocations_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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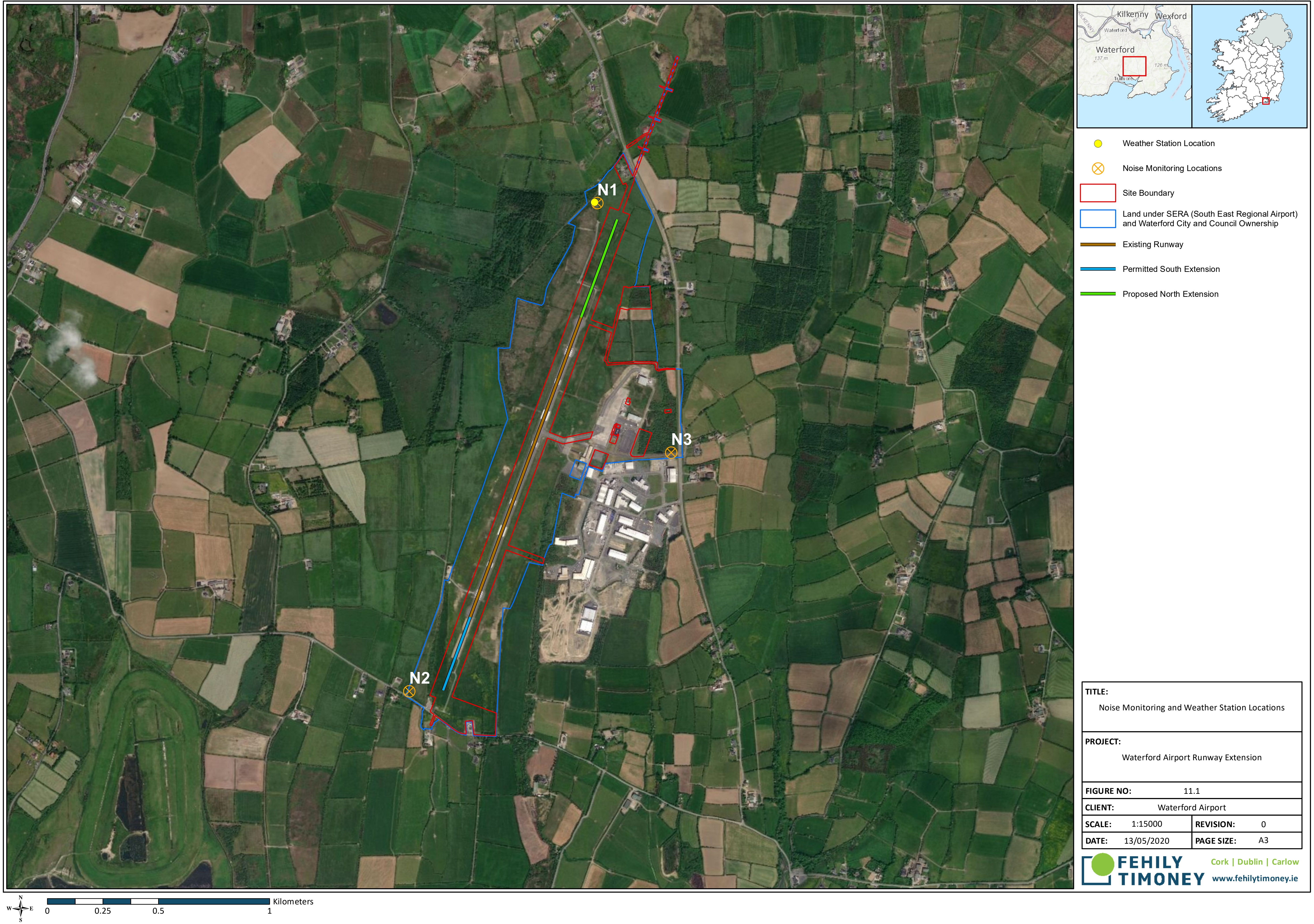


| | |
|---|---|
| **TITLE:** Noise Monitoring and Weather Station Locations | |
| **PROJECT:** Waterford Airport Runway Extension | |
| **FIGURE NO:** 11.1 | |
| **CLIENT:** Waterford Airport | |
| **SCALE:** 1:15000 | **REVISION:** 0 |
| **DATE:** 13/05/2020 | **PAGE SIZE:** A3 |

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**Plate 11-1: Monitoring Location N1**

**Plate 11-2: Monitoring Location N2**

**Plate 11-3: Monitoring Location N3**

**Plate 11-4: Weather Station**

### 11.3.3 Monitoring Equipment

Baseline noise monitoring was carried out using three Bruel & Kjaer 2250L Class 1 sound level meters. The meters were fitted with 1/2" microphones. The microphones were fitted with windshields. The microphones were mounted on a tripod at a height of 1.5 m. Details of the noise monitoring equipment are presented in Table 11.12 and calibration certificates for each meter are provided in Appendix 11.2.

**Table 11.12: Equipment Details**

| Description | N1 | N2 | N3 |
|---|---|---|---|
| Instrument Type: | B&K 2250L | B&K 2250L | B&K 2250L |
| Instrument Serial Number: | 3001350 | 2654662 | 2602763 |
| Calibration Time: | 14:50 05-07-2018 | 15:20 05-07-2018 | 16:20 05-07-2018 |
| Calibration Level: | 94.0 dB | 94.0 dB | 94.0 dB |
| Calibration Drift: | -0.1dB | 0.1dB | 0.0dB |

A NRG SymphoniePLUS3 data logger was used to record wind speed and wind direction (#40C Anemometer and #200P Wind Vane, respectively). This data was acquired every 15 minutes simultaneously with noise data.

### 11.3.4 Monitoring Protocol

The monitoring equipment (noise level meters and weather station) was installed for 7 days from the 5th to 11th July 2018.

The following monitoring protocol was carried out at each of the monitoring locations:

1. The sound level meters were calibrated on-site and set to log a range of noise parameters discussed in Section 11.3.1 every 15 minutes.
2. Each sound level meter microphone was mounted at 1.5 m above ground level and fitted with a windshield. The microphone was placed at least 3.5 m from reflecting surfaces to obtain 'free field' conditions.
3. A weather station was installed at N1 and wind speed/ direction measurements were logged every 15 minutes.
4. After the monitoring was completed, the noise meters were re-tested using the calibration noise source to ensure that the meters had not drifted.

### 11.3.5 Survey Results

#### *11.3.5.1 Meteorological Conditions*

The proposed runway extension is located at Waterford Airport. Typical weather at this location would not be considered 'neutral' and it very rare that there would be a situation where the wind is 'absent or no more than 1m/s'.

The weather conditions during the noise survey period were dry; with temperatures ranging from 11 to 22°C. There was no precipitation during the noise survey. Figure 11.2 presents the wind speed and direction for the noise survey.

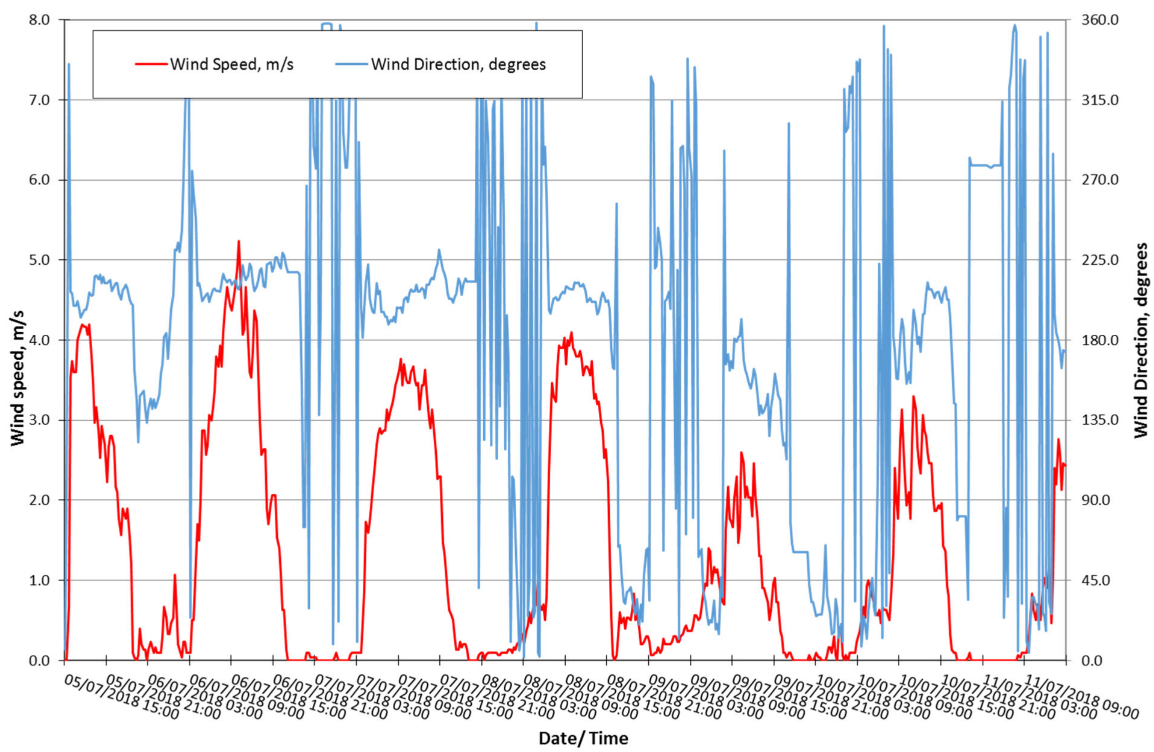


**Figure 11.2: Prevailing Wind Speed and Direction for the duration of the noise survey**

### *11.3.5.2 Noise Survey Results*

Figures 11.3 – 11.5 present the measured noise level $L_{Aeq}$ and $L_{A90}$ for N1, N2 and N3, respectively, as well as wind speed recording during the noise survey.

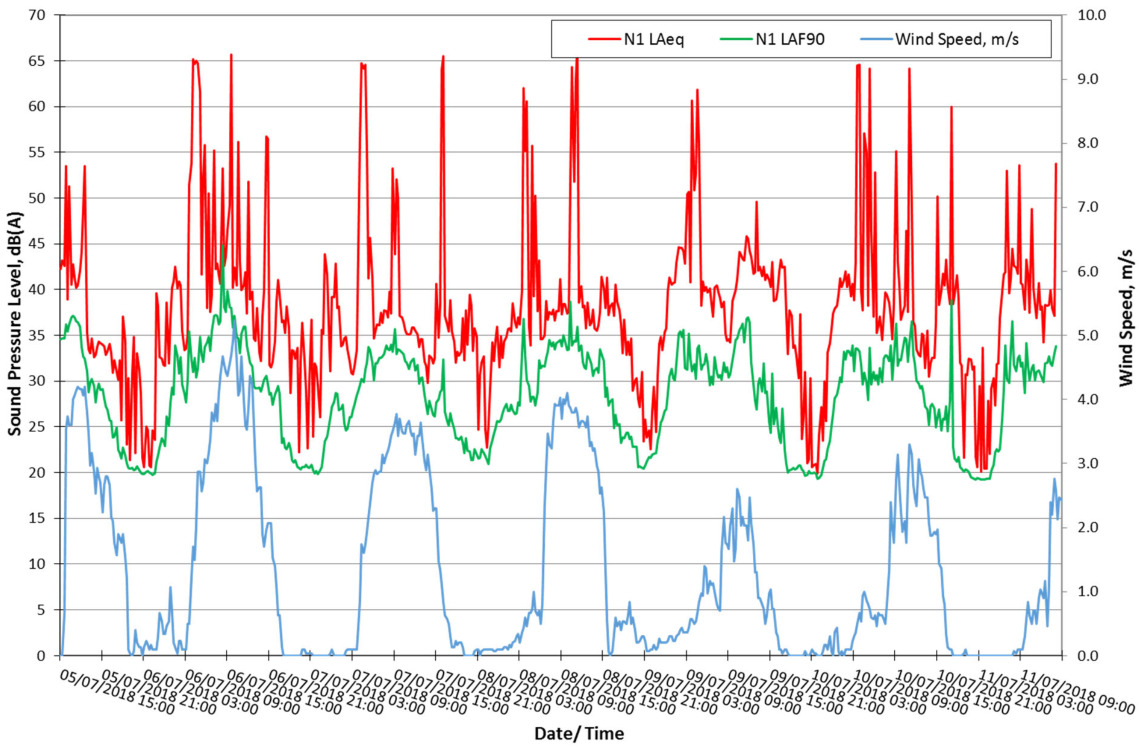


**Figure 11.3: Prevailing Noise levels at N1**

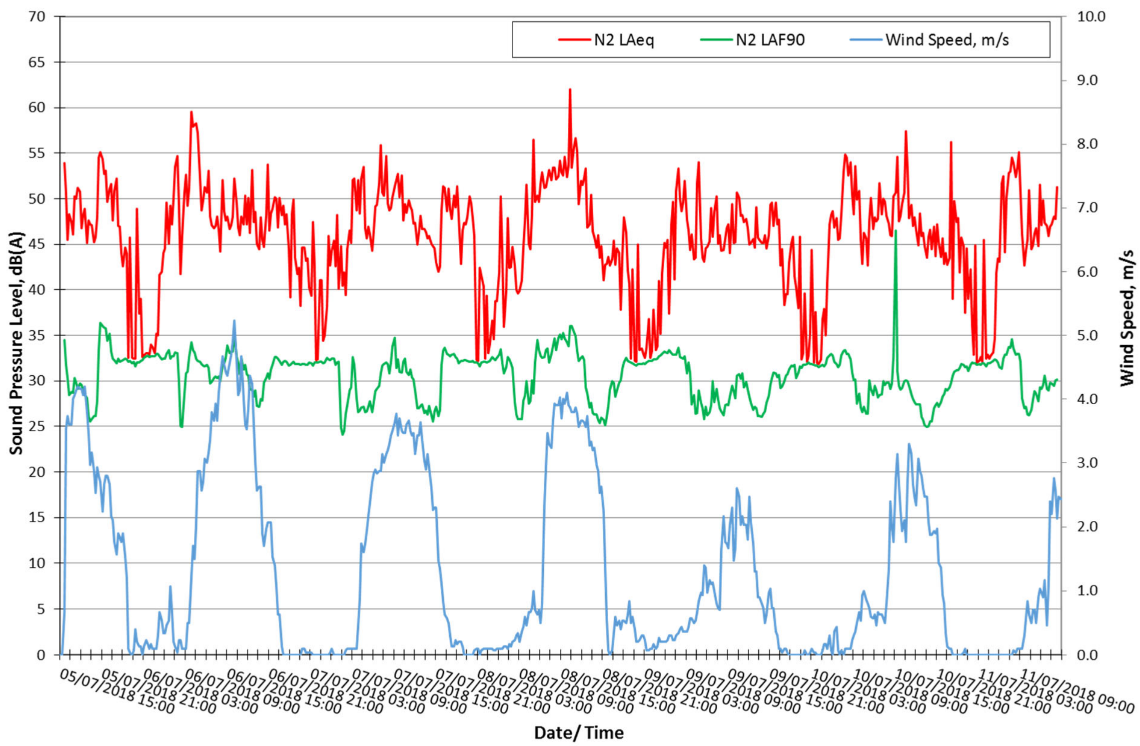


**Figure 11.4: Prevailing Noise levels at N2**

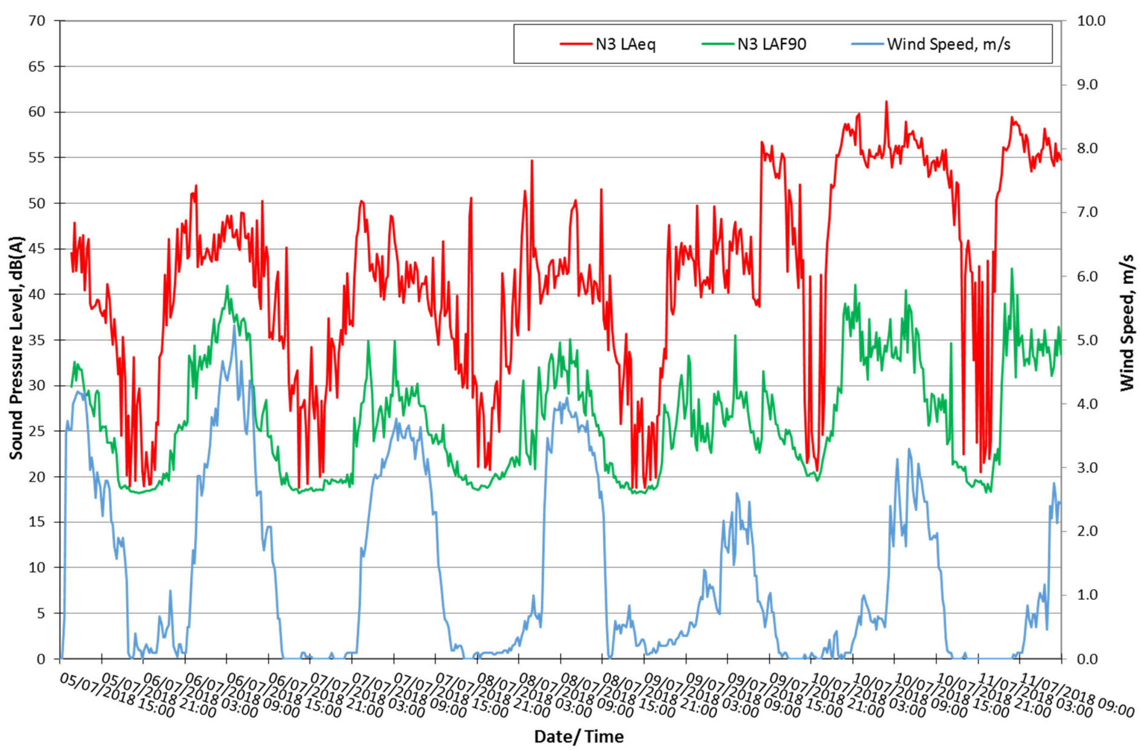


**Figure 11.5: Prevailing Noise levels at N3**

The ambient noise levels at N1 ranged between 19.9dB – 66.5dB $L_{Aeq}$ and the background noise levels ranged between 19.2dB – 44.8dB $L_{A90}$. The ambient noise levels at N2 ranged between 31.8dB – 62.0dB $L_{Aeq}$ and the background noise levels ranged between 24.1dB – 46.5dB $L_{A90}$. The ambient noise levels at N3 ranged between 18.8dB – 61.2dB $L_{Aeq}$ and the background noise levels ranged between 18.2dB – 42.8dB $L_{A90}$.

The airport will typically operate during daytime (07:00 – 19:00 hrs) and evening (19:00 – 23:00 hrs) periods. However, there is potential for the occasional flight to occur during the night-time (23:00 -07:00) as is currently the case at Waterford Airport. Therefore, the noise levels were assessed in the context of daytime, evening time and night-time periods.

Figures 11.6 – 11.8 present statistical analyses during daytime, evening and night-time periods for the noise data measured at monitoring locations N1, N2 and N3, respectively.

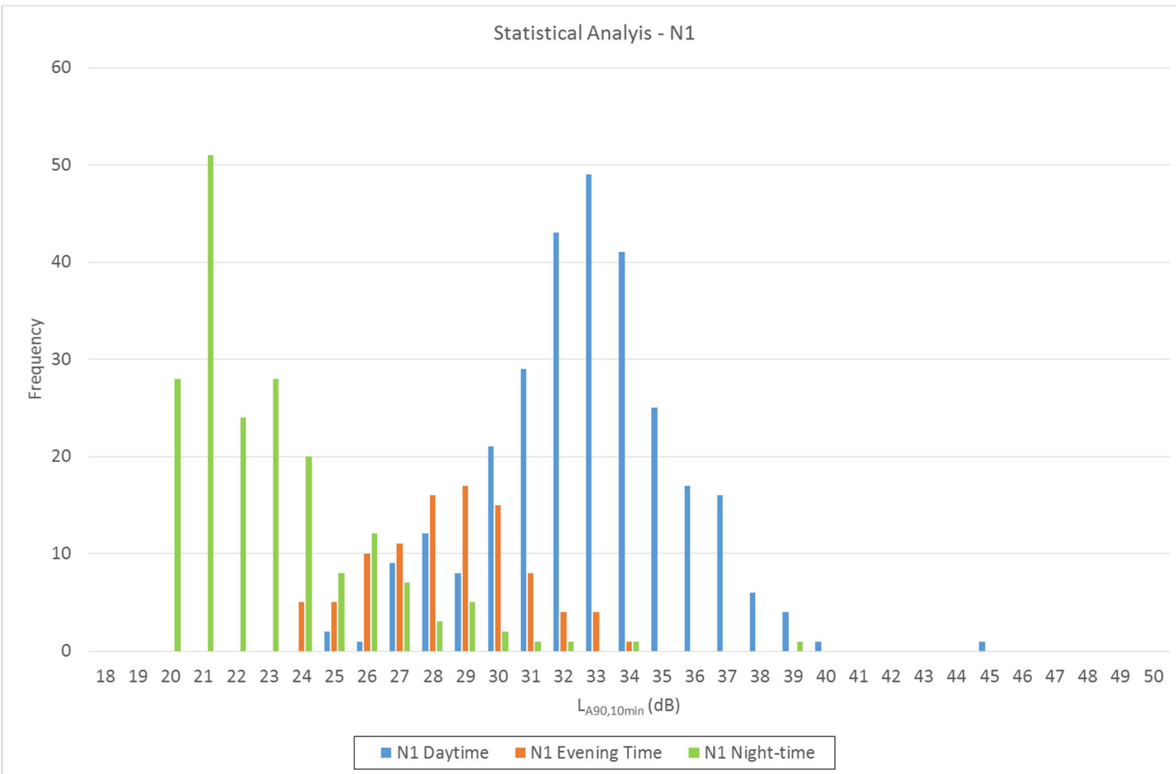


**Figure 11.6: Statistical Analysis N1**

At monitoring location N1 a background noise level ($L_{A90,10min}$) of 33dB was considered representative for daytime periods whilst background noise of 29 dB and 21 dB were considered representative of evening and night-time periods, respectively.

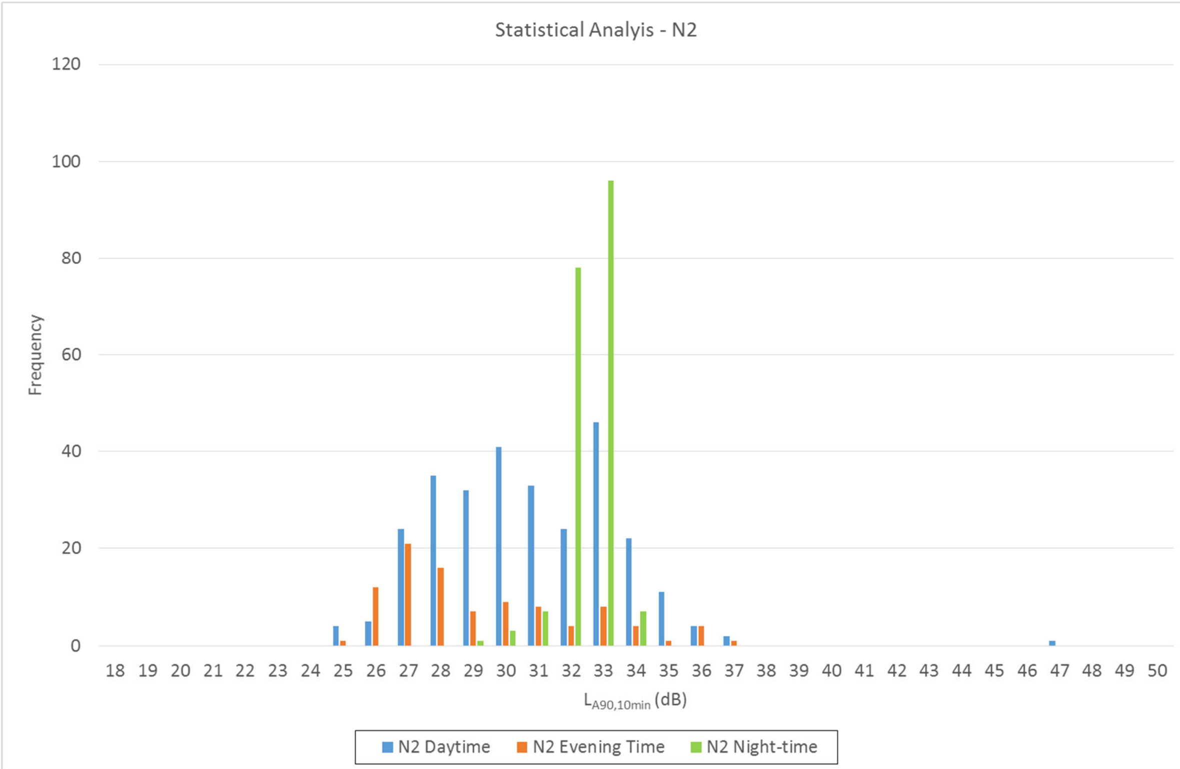


**Figure 11.7: Statistical Analysis N2**

At monitoring location N2 a background noise level ($L_{A90,10min}$) of 33dB was considered representative for daytime and night-time whilst a background noise level of 27 dB was considered representative of the evening. It is not apparent why there is a drop off in background noise during the evening period.

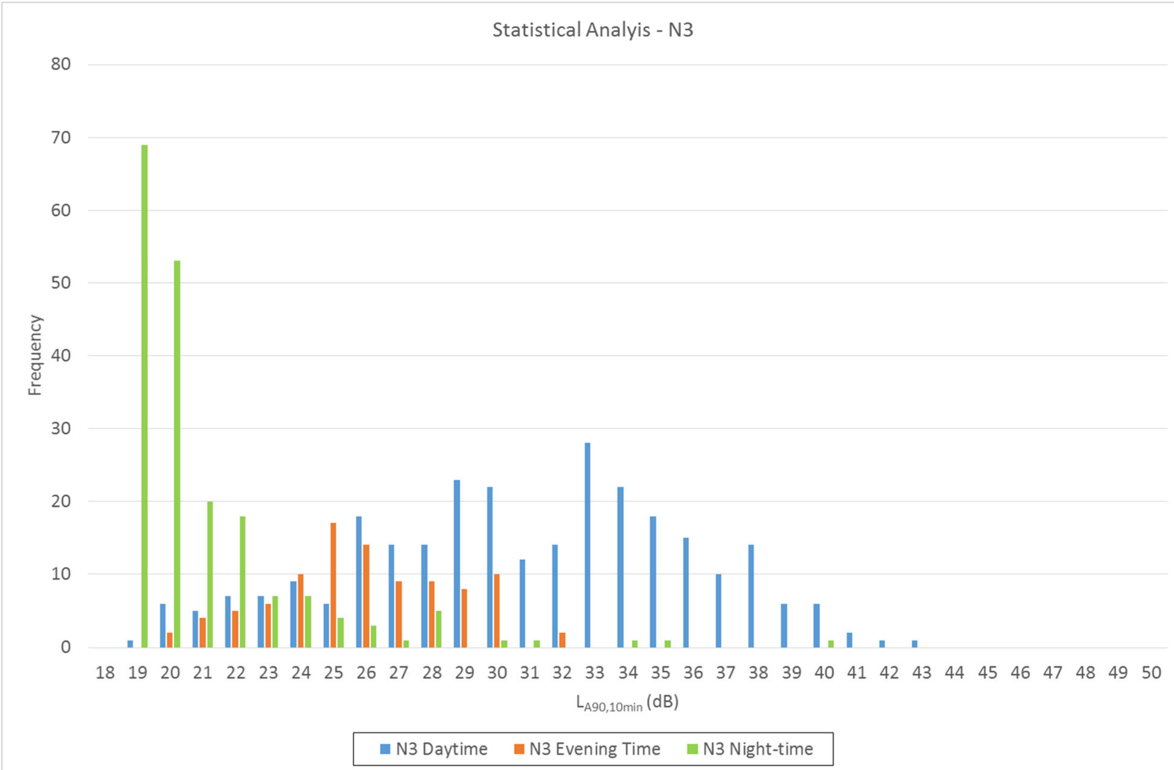


**Figure 11.8: Statistical Analysis N3**

At monitoring location N3 a background noise level ($L_{A90,10min}$) of 33dB was considered representative for daytime periods whilst background noise of 25 dB and 19 dB were considered representative of evening and night-time periods, respectively.

The data was analysed with respect to the EPA 'area of low background noise' criteria. Monitoring location N2 is not considered an 'area of low background noise'. Monitoring locations N1 and N3 generally have background noise levels less than low background noise criteria, however, there are occasions when the background noise is above the low background noise criteria. The ambient noise levels are also significantly higher. Given the existing ground operation activities at the airport and the fact that land immediate south of Waterford Airport is zoned as Light Industrial, the typical EPA noise limits as presented in Table 11.6 and noise limits in WHO guidelines and BS8233:2014 are deemed to be the most appropriate noise limit criteria for the ground operations.

## 11.4 Do Nothing Scenario

The airport is open between the hours of 07:00 – 23:00 and is operational all year round. The majority of the total number of movements now is made up of single engine training aircraft (PA28, C172 types). The estimated level of activity at the airport in terms of flights is presented in Table 11.13.

**Table 11.13: Estimated Current Flight Activity (per annum)**

| Medium Passenger Jet | Business Jet Eg. Citation 525 | Multi Engine Piston / Turbine Eg. PA44 / C441 | Single Engine Training Aircraft Eg. PA28 | Helicopter Eg. S91 – EC135 |
|---|---|---|---|---|
| 0 | 70 | 1,146 | 10,714 | 1,477 |

No commercial flights have been operational for the last year and if the proposed runway extension and ancillary development is not permitted and constructed, it is likely that the general noise level in the vicinity of the study area would increase slightly assuming modest growth in flight activity (see Do Nothing Scenario 2025 in section 11.7.1). However, the airport opened in 1981 and in 2008 there were ca. 144,000 passengers/annum (ca. 4,000 flights). If the throughput through the airport reached the numbers of flights in 2008 the noise environment would increase beyond the levels resulting from the proposed runway extension.

## 11.5 Potential Impacts – Construction Noise

The predicted construction noise levels at the nearest noise sensitive locations were calculated using data sourced from BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1 Noise. The standard sets out sound power levels and $L_{Aeq}$ noise levels of plant items normally encountered on construction sites, which in turn enables the prediction of noise levels at selected locations.

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

The construction activities have been established in outline form only. In order to evaluate noise during the construction phase of the development, it is necessary to define the various activities that will be undertaken.

The proposed runway extension and ancillary works will generally consist of the following works:

- Earthworks
- Pavement works
- Draining works
- Utility works
- Installation of Navigation Lighting
- Provision of a new car park
- Delivery and removal of material

While not part of the current planning application, it is intended to extend the terminal building and apply for separate planning permission. The construction of the terminal building extension is considered as part of this chapter.

For the purpose of this assessment, it has been conservatively assumed that mobile plant will be operating simultaneously and for a percentage on-time[5] of 80%, except for the tipper trucks tipping material where a percentage on-time of 40% is modelled due to shorter duration of this activity. The reality is that some of the plant will only operate intermittently. The ground cover between the facility and noise sensitive locations is acoustically soft ground (G=1). However, a conservative ground cover of G=0.85 was used in the construction noise model. Roads, hardstands, existing runway and other acoustically hard or reflective surfaces were modelled with a ground cover of G=0. For each construction activity, the location of mobile plant was selected such that the distance between the mobile plant and the nearest receptor was at a minimum. The parameters outlined above are conservative making the noise modelling assessment a conservative exercise. Construction activities were assessed against noise limit criteria in BS 5228-1:2009+A1:2014[6] at the nearest noise sensitive locations. If compliance can be demonstrated at the nearest noise sensitive locations, compliance can be inferred at more distant noise sensitive locations.

### Earthworks

The existing runway comprises bituminous pavement with much of the area adjacent to the runway currently turfed. The existing runway will remain and runway extension will require the excavation of the turfed area. The contractor will strip the topsoil, with surplus topsoil disposed of off-site.

After the topsoil has been stripped, the excavation works will continue to a level suitable for new pavement construction. The majority of this excavated material will be directly loaded into dump trucks and taken off-site for disposal.

Table 11.14 presents the assumed plant to be used during the earthworks. The predicted noise level at the nearest noise sensitive dwelling c. 155m to the south of the southern runway extension is 60 dB $L_{Aeq,1hr}$. It is expected that the actual noise levels will be lower, as the noise model has assumed that all plant will be operating simultaneously at the runway boundary. In practice, not all plant will be operating simultaneously and the distance to the nearest noise sensitive location will be greater. Nonetheless, the predicted noise level is below the noise limit of 65 dB $L_{Aeq,1hr}$.

**Table 11.14: Assumed Plant for Earthworks**

| Plant item BS 5228-1 | Activity | A-weighted sound pressure level, $L_{Aeq}$, dB at 10 m | Percentage on time | Predicted noise level at nearest residential receptor (dB $L_{Aeq,1hr}$) |
|---|---|---|---|---|
| Tracked excavator (C.2.3) | Clearing site | 78 | 80% | 60 |
| Tracked excavator (C.2.24) | Earthworks | 73 | 80% | |
| Tracked excavator (C.2.29) | Loading Material | 79 | 80% | |

[5] Percentage on-time - percentage of the assessment period for which the activity takes place.

[6] Predicted construction noise levels are façade noise levels as per BS5228-1:2009+A1:2014. Façade noise levels include reflection from the building façade. Façade noise level = Free-field noise level + 3dB

| Plant item BS 5228-1 | Activity | A-weighted sound pressure level, $L_{Aeq}$, dB at 10 m | Percentage on time | Predicted noise level at nearest residential receptor (dB $L_{Aeq,1hr}$) |
|---|---|---|---|---|
| Lorry / truck * (C.11.9) | Distribution of Material | 82 | 4 two-way trips per hour | |
| * Drive-by maximum sound pressure level in $L_{max}$ (octave bands) and $L_{Amax}$ (overall level) | | | | |

## Pavement Works

Following the completion of the excavation works, work will commence on the construction of the pavement. Granular fill material (e.g. crushed aggregate subbase) will be laid and compacted in layers according to the specifications. The material will be brought to site in open trucks, unloaded and distributed with an excavator or paver. A roller will compact it and water will be sprayed on the layer if necessary.

Table 11.15 presents the assumed plant to be used during the subsurface pavement works. The predicted noise level at the nearest noise-sensitive dwelling c. 155m to the south of the southern runway extension is 63 dB $L_{Aeq,1hr}$, which is below the noise limit of 65 dB $L_{Aeq,1hr}$.

**Table 11.15: Assumed Plant for Pavement Works Laying Granular Fill**

| Plant item BS 5228-1 | Activity | A-weighted sound pressure level, $L_{Aeq}$, dB at 10 m | Percentage on time | Predicted noise level at nearest residential receptor (dB $L_{Aeq,1hr}$) |
|---|---|---|---|---|
| Lorry / truck (C.11.9) | Transport of Material | 82 | 4 two-way trips per hour | 63 |
| Dump Truck (Tipping Fill) (C.2.30) | Tipping Fill | 79 | 40% | |
| Tracked Excavator (C.4.17) | Distribution of Material | 71 | 80% | |
| Dozer (C5.12) | Spreading Chip and Fill | 77 | 80% | |
| Vibratory roller (C.5.21) | Rolling and Compaction | 80 | 80% | |
| Water bowsers (discharging) (C.6.37) | Dust Suppression | 81 | 80% | |

### Bituminous Pavement

The finish surface of the runway is a bituminous surface. The bituminous material will be batched off-site and delivered to site in open back trucks covered with tarpaulin. The granular base or cement treated base might be primed before laying the bituminous materials with a coating in order to avoid debris and to ensure proper adhesion.

The bituminous layers will be laid with a road paver, potentially with a feeder in front to secure an even temperature and mix of the material. Each layer will be compacted by a suitable roller, with the type of roller differing depending on the layer of bituminous material. A thin tack coat layer will be laid between each bituminous layer by a customized tanker that will spray the tack coat directly onto the pavement. The final bituminous pavement layer will be swept upon completion by a suction sweeper to ensure that debris and loose traces of bituminous material are removed from the bituminous surface.

Table 11.16 presents the assumed plant to be used in laying the bituminous pavement. The predicted noise level at the nearest noise-sensitive dwelling c. 155m to the south of the southern runway extension is 64 dB $L_{Aeq,1hr}$, which is below the noise limit of 65 dB $L_{Aeq,1hr}$.

**Table 11.16: Assumed Plant for Pavement Works Laying Bituminous Pavement**

| Plant item<br>BS 5228-1 | Activity | A-weighted sound pressure level, $L_{Aeq}$, dB at 10m | Percentage on time | Predicted noise level at nearest residential receptor (dB $L_{Aeq,1hr}$) |
|---|---|---|---|---|
| Lorry / truck * (C.11.9) | Delivery of Material | 82 | 4 two-way trips per hour | 64 |
| Asphalt paver (+ tipper lorry) (C.5.31) | Paving | 77 | 80% | |
| Vibratory roller * (C.5.21) | Rolling and Compaction | 80 | 80% | |
| Road roller * (C.5.19) | Rolling and Compaction | 80 | 80% | |
| Tack truck §* | Tanker for applying Coating | 76 | 80% | |
| Road sweeper (C.4.90) | Removal of Debris | 76 | 80% | |

* Drive-by maximum sound pressure level in $L_{max}$ (octave bands) and $L_{Amax}$ (overall level)

§ - Assumed similar noise emissions to road sweeper BS 5228 Ref C.4.90

### Drainage Works

Drainage works include trenching, laying of pipes and removal of material. The nearest noise sensitive location to the drainage works is c. 155m to the south of the proposed southern runway extension. Table 11.17 presents the assumed plant to be used in the drainage works. The predicted noise level from all plant involved in drainage works is 62 dB $L_{Aeq,1hr}$, which is below the noise limit of 65 dB $L_{Aeq,1hr}$.

**Table 11.17: Assumed Plant during Drainage Works**

| Plant item BS 5228-1 | Activity | A-weighted sound pressure level, $L_{Aeq}$, dB at 10m | Percentage on time | Predicted noise level at nearest residential receptor (dB $L_{Aeq,1hr}$) |
|---|---|---|---|---|
| Diesel water pump (C.6.41) | Pumping Water | 78 | 100% | 62 |
| Tracked excavator (C.4.64) | Trenching | 75 | 80% | |
| Tracked excavator (C.2.29) | Loading Material | 79 | 80% | |
| Lorry / truck * (C.11.9) | Delivery and removal of Material | 82 | Maximum 4 two-way trips per hour | |
| Dump Truck (Tipping Fill) (C.2.30) | Tipping Fill | 79 | 40% | |
| * Drive-by maximum sound pressure level in $L_{max}$ (octave bands) and $L_{Amax}$ (overall level) | | | | |

### Utilities Works

Utilities works will include the installation of airfield ground lighting (AGL). The AGL bases with a blank plate will be installed. The bases are installed by drilling an oversized core over the ducts underneath, placing the base and fixing it with an epoxy material. The drilling operation requires water, and detritus material will be collected by a suction sweeper immediately after drilling.

Ducts will be installed to provide power/communication. In aircraft trafficked areas, the ducts will comprise HDPE pipes embedded in concrete or steel pipes without concrete. A channel for the ducts will be cut with a road saw. The concrete will be cast in forms with a low viscosity, self-levelling concrete. In turfed areas, the ducts will comprise HDPE pipes without concrete surrounding them.

The noisiest of the activities were modelled. Table 11.18 presents the assumed plant involved in the installation of utilities in aircraft trafficked areas. The predicted noise level from all plant involved in installation of utilities is 67 dB $L_{Aeq,1hr}$, which is above the noise limit of 65 dB $L_{Aeq,1hr}$. However, it is assumed that all plant will be operating simultaneously. In practice, not all plant will be operating simultaneously at the closest location to the dwelling and it is expected that the actual noise levels will be below the noise limit.

**Table 11.18: Assumed Plant for the Installation of Utilities**

| Plant item<br>BS 5228-1 Ref | Activity | A-weighted sound pressure level, $L_{Aeq}$, dB at 10 m | Percentage on time | Predicted noise level at nearest residential receptor (dB $L_{Aeq,1hr}$) |
|---|---|---|---|---|
| Core drill (electric) (C.4.69) | Drilling | 85 | 80% | 67 |
| Road sweeper (C.4.90) | Removal of Debris | 76 | 80% | |
| Hand-held circular saw (5.36) | Cutting Pavement | 87 | 80% | |

### Car Park

It is proposed to develop a new car park to the east of the terminal building. The works will involve the excavation of new drainage channels, removal of subsoil and transport of material off site, delivery of sub-base material for distribution with an excavator, backfill material to be rolled and compacted. There are a number of backfill stages requiring similar plant. Once the compacted sub-base material is at the design level, a surface course of tarmacadam will be laid using a paver and this will be rolled and compacted. The typical plant involved in the construction of the car park is presented in Table 11.19. The predicted noise level at the nearest noise-sensitive dwelling c. 225m to the east of proposed car park is 61 dB $L_{Aeq,1hr}$, which is below the noise limit of 65 dB $L_{Aeq,1hr}$.

**Table 11.19: Car Park Works – Assumed Plant**

| Plant item<br>BS 5228-1 Ref | Activity | A-weighted sound pressure level, $L_{Aeq}$, dB at 10 m | Percentage on-time (%) | Predicted noise level at nearest residential receptor (dB $L_{Aeq,1hr}$) |
|---|---|---|---|---|
| Excavator (C.2.24) | Earthworks / Distribution Material | 73 | 80% | 61 |
| Excavator (C.10.9) | Loading of Material | 75 | 80% | |

| Plant item<br>BS 5228-1 Ref | Activity | A-weighted sound pressure level, $L_{Aeq}$, dB at 10 m | Percentage on-time (%) | Predicted noise level at nearest residential receptor (dB $L_{Aeq,1hr}$) |
|---|---|---|---|---|
| Dump Truck / Dumper (C.2.30) | Tipping fill | 79 | 40% | |
| Vibratory roller (C.5.21) | Rolling and compaction | 80 | 80% | |
| Dozer (C5.12) | Spreading Chip and Fill | 77 | 80% | |
| Road roller * (C.5.19) | Rolling and compaction | 80 | 80% | |
| Excavator (C.4.64) | Trenching | 75 | 80% | |
| Asphalt Paver + tipper lorry (C.5.31) | Laying asphalt | 77 | 80% | |
| Lorry* (C.11.9) | Delivery / Removal of Material | 82 | 4 two-way trips per hour | |
| * - Drive-by maximum sound pressure level in $L_{max}$ (octave bands) and $L_{Amax}$ (overall level) | | | | |

### Construction of Extension to Terminal Building

Foundations for the terminal building will consist of reinforced cast in-situ concrete. Concrete will be delivered on-site in a concrete mixing truck. For the purposes of this assessment it has been assumed that concrete is delivered on-site, given the smaller quantities and different mixture compared to the laying of concrete pavement.

The typical plant involved in the construction of the extension of the terminal building is presented in Table 11.20. The predicted noise level at the nearest noise-sensitive dwelling c. 360m to the east of proposed car park is 58 dB $L_{Aeq,1hr}$, which is below the noise limit of 65 dB $L_{Aeq,1hr}$.

### Table 11.20: Assumed Plant for the Construction of Extension to Terminal Building

| Plant item BS 5228-1 Ref | Activity | A-weighted sound pressure level, $L_{Aeq}$, dB at 10 m | Percentage on-time (%) | Predicted noise level at nearest residential receptor (dB $L_{Aeq,1hr}$) |
|---|---|---|---|---|
| Tracked excavator (C.2.3) | Clearing site | 78 | 80% | 58 |
| Excavator (C.4.64) | Trenching | 75 | 80% | |
| Tracked excavator (C.2.29) | Loading Material | 79 | 80% | |
| Concrete mixer truck & concrete pump (C.4.28) | Pumping Concrete | 75 | 80% | |
| Poker vibrator (C.4.33) | Concrete Compaction | 78 | 80% | |
| Wheeled Mobile Crane (C.4.41) | Lifting | 71 | 80% | |
| Angle grinder (grinding steel) (C.4.93) | Grinding Steel | 80 | 80% | |
| Lorry* (C.11.9) | Delivery / Removal of Material | 82 | 4 two-way trips per hour | |
| Telescopic Handler (C.4.54) | Lifting and Distribution of Material | 79 | 80% | |
| Lifting Platform (C.4.57) | Lifting Construction Personnel | 67 | 80% | |
| * - Drive-by maximum sound pressure level in $L_{max}$ (octave bands) and $L_{Amax}$ (overall level) | | | | |

### Navigation Lighting

It is proposed to install navigation lighting to the north and south of the runway. The lighting will be provided on steel frames, mounted on concrete plinths. Material will be excavated, and the plinths will be lifted into position and set in the ground. The excavated material will be back filled around them and grass seed set. The works will also involve trenching for laying ducting. The typical plant involved in the installation of the navigation lighting is presented in Table 11.21. The predicted cumulative noise level at the nearest noise-sensitive dwelling c. 25m is 74 dB $L_{Aeq,1hr}$ which is above the noise limit. The duration of this activity is expected to brief, and mitigation measures will be employed to minimise the impact. These are discussed in section 11.9.1. The predicted noise levels at the next nearest dwelling is 57 dB $L_{Aeq,1hr}$ which is below the noise limit of 65 dB $L_{Aeq,1hr}$.

**Table 11.21: Navigation Lighting – Assumed Plant**

| Plant item BS 5228-1 Ref | Activity | A-weighted sound pressure level, $L_{Aeq}$, dB at 10 m | Percentage on-time (%) | A-Weighted Sound Pressure Level, $L_{Aeq}$, dB at a distance of | |
|---|---|---|---|---|---|
| | | | | 25 m | 128 m |
| Excavator (C.4.64) | Trenching | 75 | 80% | 74 | 57 |
| Excavator (C.2.24) | Earthworks / Distribution Material | 73 | 80% | | |
| Lorry with boom (C4.53) | Lifting Concrete Plinths | 77 | 80% | | |

The predicted noise levels from construction activities are generally expected to be below 65 dB $L_{Aeq,1hr}$ with the expectation of the installation of navigational lighting close a dwelling south of the southern navigational lighting installation.

The noise predictions are predicted maximum expected noise levels and in practice the actual levels are expected to be lower due to the fact that the distance between the construction activities and the nearest noise sensitive locations will be greater than the minimum distances modelled and activities will not occur simultaneously. The predicted maximum noise levels are expected to occur for only short periods of time at a very limited number of dwellings. Although the predicted noise levels are generally expected to be below the noise limit, best practice mitigation measures will be employed to minimise the noise impact at the nearest noise sensitive locations.

*Construction Traffic*

Detailed information on construction traffic is presented in Chapter 8. To summarise, additional light goods vehicles travelling to and from the site during the construction phase would be expected to peak during the morning (arrival of contractors at the site) and evening (departure of contractors from the site), and are envisaged not be a continuous source of noise emissions from the site during a typical working day. The impact from construction personnel movements to and from the site is expected to be low.

It is proposed to access the site from three locations. The main compound is adjacent to the terminal building and will be accessed from the public access road. The contactor will also have a compound at the northern runway extension and southern runway extension accessed from an existing haulage road from the R708 and R685, respectively. The combined HGV and LGV average daily increase is 42 trips per day over the course of the construction period. During peak construction period, HGV traffic is expected to peak at 78 trips per day. The peak construction traffic flow have been modelled and the predicted noise level will be below the noise limit of 65 dB $L_{Aeq,1hr}$. The increase in traffic noise levels on the R685 and R708 as a result of the construction traffic is expected to be less than 1dB resulting in a negligible impact.

The noise impact for construction works traffic would be mitigated by generally restricting movements along access routes to the standard working hours and exclude Sundays, unless specifically agreed otherwise. If deliveries are required at night it would be ensured that vehicles on local roads do not wait outside residential properties with their engines idling, and that the local residents will be informed of any activities likely to occur outside of normal working hours.

## 11.6 Potential Impacts – Construction Vibration

The potential for vibration at neighbouring sensitive locations during construction is typically limited to excavation works and lorry movements on uneven road surfaces. Vibration from construction activities will be controlled to ensure there is no likelihood of structural or even cosmetic damage to existing neighbouring dwellings. Considering the distances proposed from the majority of works and the nearest sensitive locations, vibration will be localised and vibration from construction activities will not have a significant impact on the nearest sensitive locations.

## 11.7 Potential Impacts – Operation

The noise from the operational phase of the proposed development can be considered under three different categories comprising:

- Air traffic noise
- Ground operations noise; and
- Road traffic noise.

### 11.7.1 Air Traffic Noise

The airport is typically open between the hours of 07:00 – 23:00 and is operational all year round, with the exception of Christmas day. However, the airport has previously facilitated ad hoc requests from individual operators which can occur outside of the hours above. The majority of the total number of movements now and in the future will be made up of single engine training aircraft (PA28, C172 types). The estimated level of activity at the airport in terms of flights is as presented in Table 11.13 in Section 11.4.

The proposed runway extension will facilitate the landing and departure of medium jet aircraft such as Boeing 737/800 and Airbus 320. With the proposed runway extension, it is anticipated that the airport will achieve approximately 2,240 flights per annum by year five of operations. Breakdown of air traffic is anticipated to consist of scheduled flights of medium jet aircraft and non-schedule flights such as business jets, multi and single-engine general aviation and helicopter operations. Passenger numbers are anticipated to reach up to 345,000 by year five of operations as a result of the proposed runway development.

Scheduled operations are expected to take place on a drop-in basis meaning it is unlikely that scheduled passenger aircraft will be based at Waterford Airport.

#### *11.7.1.1 Air Traffic Noise Prediction Modelling - Overview*

Leading Edge Aviation Planning Professionals (LEAPP) prepared the air traffic noise prediction model. Air traffic noise contours were output from the noise model. The noise contours information was used by Fehily Timoney & Company to assess the potential impact from this element of the development. Details on the noise sensitive locations was obtained from Eircode data. Four hundred and five noise sensitive locations were identified within the 48 dB $L_{Aeq,16h}$ noise contour. The noise impact at the 405 noise sensitive locations were assessed.

LEAPP used the Integrated Noise Model (INM) to model the air traffic noise. INM is the primary noise simulation tool that has been in use worldwide. It was developed by, and distributed by, the U.S Federal Aviation Administration. In 2015 the INM was replaced by the FAA with the "Aviation Environmental Design Tool" (AEDT), which is a more sophisticated and broader analytical tool which was developed to enable assessment of aircraft fuel consumption, aircraft emissions, air quality impacts, as well as aircraft noise. However, as the INM had been adopted by several other countries, and incorporated into their own national aircraft noise and land use regulation standards, the INM is still used by many, especially outside the US, as the preferred tool for aircraft noise impact modelling.

For the assessment of aircraft noise at Waterford Airport the FAA Integrated Noise Model 7.0 has been used to generate contours of expected aircraft noise impact around the Waterford Airport runway.

The overall forecast of air traffic activity at Waterford Airport developed for the purposes of estimating future aircraft noise once the extended runway becomes operational is provided in Table 11.22. This forecast assumes that the extended runway would be completed in 2021, with an initial jet service operating later in the year. It is also assumed is that there would be little or no traffic growth experienced in 2020 and early 2021 while the runway construction is underway as well as impacts from the COVID-19 pandemic.

**Table 11.22: Five Year Forecast of Air Traffic Activity 2019 to 2013**

| Year | Forecast of Air Traffic Activity | | | | | |
|---|---|---|---|---|---|---|
| | Medium Jet | Business Jet | Multi Engine GA | Single Engine GA | Helicopter | Total |
| 2020 | 0 | 44 | 1,528 | 14,286 | 1,448 | 17,306 |
| 2021 | 594 | 70 | 1,146 | 10,714 | 1,477 | 14,001 |
| 2022 | 1,058 | 73 | 1,260 | 11,785 | 1,506 | 15,682 |
| 2023 | 1,538 | 77 | 1,386 | 12,963 | 1,536 | 17,500 |
| 2024 | 1,946 | 81 | 1,524 | 14,259 | 1,567 | 19,377 |
| 2025 | 2,240 | 85 | 1,676 | 15,684 | 1,598 | 21,283 |

Projections Provided by Waterford Regional Airport PLC

### Noise Modelling Assumptions

The following assumption have been made in the noise model:

1. The Integrated Noise Model 7.0 developed by the US Federal Aviation Administration has been used model air traffic noise.
2. The noise model uses the profiles of air traffic expected to use the runway on peak days in 2020 and 2025 without the runway extension and in 2025 with the proposed runway extension.
3. Three air traffic profiles have been modelled:
   - 2020 Do Nothing;
   - 2025 Do Nothing; and
   - 2025 Do Something.
4. For each air traffic profile, three scenarios were modelled giving a total of 9 scenarios:
   - Assignment of all aircraft operations to Runway 03;
   - Assignment of all operations to Runway 21; and
   - A split of operations between Runway 03 and Runway 21 (which would occur where a shift in wind direction might occur during the busy day).

   A summary of the nine scenarios are presented in Table 11.23 overleaf.
5. Noise modelling for Waterford Airport has assumed that all air traffic operations would occur during the daytime hours and that there are no late night operations expected (except under emergency situations).
6. The noise assessment metric applied for modelling aircraft noise has been the $L_{Aeq,16h}$

## Table 11.23: Aircraft Traffic Data

| Scenario | Runway Operating Direction | Runway Status | Traffic Basis | Peak Day Aircraft Movements on Runway | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Medium Passenger Jet | Passenger Turboprop | Small Jets | Multi Engine GA | Single Engine GA | Helicopters | Total Peak Day Movements |
| 1 | 03 | Extended | 2025 | 7.5 | 0 | 0.3 | 5.6 | 52.28 | 5.33 | 70.94 |
| 2 | 21 | Extended | 2025 | 7.5 | 0 | 0.3 | 5.6 | 52.28 | 5.33 | 70.94 |
| 3 | 03/21 | Extended | 2025 | 7.5 | 0 | 0.3 | 5.6 | 52.28 | 5.33 | 70.94 |
| 4 | 03 | Existing | 2020 | 0 | 0 | 0.147 | 5.1 | 47.62 | 4.83 | 57.69 |
| 5 | 21 | Existing | 2020 | 0 | 0 | 0.147 | 5.1 | 47.62 | 4.83 | 57.69 |
| 6 | 03/21 | Existing | 2020 | 0 | 0 | 0.147 | 5.1 | 47.62 | 4.83 | 57.69 |
| 7 | 03 | Existing | 2025 | 0 | 0 | 0.3 | 5.6 | 52.28 | 5.33 | 63.48 |
| 8 | 21 | Existing | 2025 | 0 | 0 | 0.3 | 5.6 | 52.28 | 5.33 | 63.48 |
| 9 | 03/21 | Existing | 2025 | 0 | 0 | 0.3 | 5.6 | 52.28 | 5.33 | 63.48 |

Notes: Scenarios 1, 2, 3 represent traffic forecast for 2025 and including medium passenger jet aircraft using an extended runway (Do Something)
Scenarios 4, 5, 6 represent current traffic for 2020 with no jet or turboprop passenger traffic, using the existing runway (Do Nothing)
Scenarios 7, 8, 9 represent traffic forecast for 2025, with no jet or turboprop passenger traffic, using the existing runway (Do nothing)

### *11.7.1.2 Noise Prediction Modelling - Results*

Noise sensitive locations within the 48 dB $L_{Aeq,16h}$ noise contour were assessed. The two dwellings to be CPO'd as part of the proposed development are not included in the noise contour assessment. Table 11.24 presents noise contours and the number of residential dwellings that are greater than the specified noise contour. Noise contours of 51, 54, 57, 60, 63 and 66 dB $L_{Aeq,16h}$ were assessed.

**Table 11.24: Aircraft Noise Contours**

| Scenario | Runway Operating Direction | Runway Status | Traffic Basis | Noise Contours ($L_{Aeq,16h}$ – dB) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 51 | 54 | 57 | 60 | 63 | 66 |
| 1 | 03 | Extended | 2025 | 71 | 31 | 20 | 8 | 2 | 0 |
| 2 | 21 | Extended | 2025 | 23 | 17 | 13 | 5 | 0 | 0 |
| 3 | 03/21 | Extended | 2025 | 41 | 24 | 16 | 7 | 2 | 0 |
| 4 | 03 | Existing | 2020 | 61 | 13 | 7 | 1 | 0 | 0 |
| 5 | 21 | Existing | 2020 | 15 | 10 | 8 | 5 | 1 | 0 |
| 6 | 03/21 | Existing | 2020 | 26 | 18 | 6 | 1 | 0 | 0 |
| 7 | 03 | Existing | 2025 | 75 | 16 | 9 | 2 | 0 | 0 |
| 8 | 21 | Existing | 2025 | 18 | 11 | 8 | 5 | 1 | 0 |
| 9 | 03/21 | Existing | 2025 | 31 | 20 | 7 | 1 | 0 | 0 |

The impact of proposed runway extension is dependent on what runway is utilised. Three scenarios were assessed:

- All Air Traffic Assigned to Runway 03
- All Air Traffic Assigned to Runway 21
- Air Traffic Split between Runway 03 and 21

*All Air Traffic Assigned to Runway 03*

With all air traffic assigned to runway 03, the predicted noise impact for current air traffic (2020) and future air traffic (2025) determine that there are no dwellings with noise levels above 63 dB, the proposed runway extension (2025) will result in two dwellings with noise levels above 63 dB. The proposed runway extension will result in an increase in the number of dwellings above the 54 dB, 57 dB and 60 dB noise contours as shown in Table 11.24. There will be a small increase in the number of dwellings above the 51 dB noise contour.

The impact from the proposed runway extension has been assessed against the UK guidance which sets 51dB $L_{Aeq,16h}$ for daytime and 45dB $L_{Aeq,8h}$ for night-time as the Lowest Observed Adverse Effect Level (LOAEL) for assessing the health impacts from air traffic noise. The impact from the proposed runway extension was also assessed against the land use criteria in the Waterford Regional Airport & Business Park Masterplan which sets residential land use as <57 dB $L_{Aeq,16h}$.

The predicted impact from the current operations with no proposed development show that there are 61 dwellings exposed to noise levels greater than 51 dB(A). This increases to 75 dwellings in 2025 (no development). With the proposed runway extension (2025) the number of dwellings exposed to noise levels greater than 51 dB(A) is 71 which is a decrease of 4 dwellings exposed to noise levels above 51 dB(A).

The predicted impact from the current operations with no proposed development show that there are 7 dwellings exposed to noise levels greater than 57 dB(A). This increases to 9 dwellings in 2025 (no development). With the proposed runway extension (2025) the number dwellings exposed to noise levels greater than 57 dB(A) is 20 which is an increase of 11 dwellings exposed to noise levels above 57 dB(A).

*All Air Traffic Assigned to Runway 21*

With all air traffic assigned to runway 21, the predicted noise impact for current air traffic (2020) and future air traffic (2025) shows one dwelling exposed to noise levels above 63 dB. The proposed runway extension (2025) will result in no dwellings with predicted noise levels greater than 63 dB(A). The 2025 air traffic shows 5 dwellings with noise levels greater than 60 dB(A). This number does not increase with the proposed runway extension (2025). The proposed runway extension will result in increases in the number of dwellings above the 51 dB, 54 dB and 57 dB contours as shown in Table 11.24.

The predicted impact from the with future air traffic (2025) with no proposed development show that there are 18 dwellings exposed to noise levels greater than 51 dB(A). With the proposed runway extension, the number dwellings exposed to noise levels greater than 51 dB(A) is 23 which is an increase in 5 dwellings exposed to noise levels above 51 dB(A).

The predicted impact from the current operations with no proposed development show that there are 8 dwellings exposed to noise levels greater than 57 dB(A) in 2020 and 2025. With the proposed runway extension (2025) the number dwellings exposed to noise levels greater than 57 dB(A) is 13 which is an increase of 5 dwellings exposed to noise levels above 57 dB(A).

*Air Traffic Split between Runway 03 and 21*

With air traffic split between runway 03 to runway 21, the predicted noise impact for current air traffic (2020) and future air traffic (2025) shows no dwellings exposed to noise levels above 63 dB. The proposed runway extension (2025) will result in two dwellings with predicted noise levels greater than 63 dB(A). The proposed runway extension will also result in increases in the number of dwellings above the 51 dB, 54 dB, 57 dB and 60 dB contours as shown in Table 11.24.

The predicted impact from the current operations with no proposed development show that there are 26 dwellings exposed to noise levels greater than 51 dB(A). This increases to 31 dwellings in 2025 (no development). With the proposed runway extension (2025) the number dwellings exposed to noise levels greater than 51 dB(A) is 41 which is an increase of 10 dwellings exposed to noise levels above 51 dB(A).

The predicted impact from the current operations with no proposed development show that there are 6 dwellings exposed to noise levels greater than 57 dB(A) in 2020 and 7 dwellings exposed to noise levels greater than 57 dB(A) in 2025. With the proposed runway extension (2025) the number dwellings exposed to noise levels greater than 57 dB(A) is 16 which is an increase 9 dwellings exposed to noise levels above 57 dB(A).

*Summary*

The greatest aircraft noise impact is predicted to occur when aircraft operations are assigned to Runway 03 and, to a lesser extent, when runway operations are split between Runway 03 and Runway 21. The preferred operational runway is Runway 21 as noise impacts on nearby dwellings is at its lowest as the air traffic is assigned to operate towards the south where the number of dwellings is lower.

Runway 21 is the primary runway at the airport and the runway favoured by prevailing winds during the peak air traffic time of the year whereas Runway 03 is used when the winds are from the north and northeast. Therefore, normal operation of the airport would affect no more than 24 dwellings (noise levels greater than 51 dB(A)) when passenger jet aircraft are using the airport.

*Land Use*

The Waterford Regional Airport & Business Park Masterplan is appended to the WCDP 2011-2017. The document sets out the planning objectives and strategies for the future of the regional airport in line with the objectives of the Development Plan, Regional Planning Guidelines and National Planning Policy. Section 1.1 of Appendix 1: Airport Control Zones of the Waterford Regional Airport & Business Park Masterplan states "*To protect the public from adverse effects of aircraft noise, it is important to control development of certain land uses within those lands that potentially would be subject to various levels of aircraft noise.*" Table 11.4 in section 11.2.3 presents the typical land uses permitted within specific noise contour levels.

An aircraft noise contour of less than 57 dB(A) is defined as suitable for residential developments. As noted earlier, there is no general statutory limitation on land use due to aircraft noise exposure in Ireland and judgement must be applied as to what noise level should be regarded as intolerable for specific land uses involving human activity. Certainly, from practice elsewhere it would appear that residential uses should not be permitted where prolonged long-term noise exposure exceeds, or is predicted to exceed, 69dBA, and discouraged where noise exposure is predicted to exceed 63 dBA for periods of 16 hours or more. Based on such limits, the impact of aircraft noise from an extended runway with modest use by medium jet aircraft, on the lands surrounding Waterford Airport, and on dwellings under the flight paths of the runway, would be deemed to be moderate.

*Significance of Impact*

The operational noise from the proposed development will be audible at the nearest noise sensitive locations and dwellings further away from the airport. In terms of the significance of impact, Table 11.25 presents the significance of impact at dwellings with noise levels above 51 dB $L_{Aeq,16hr}$. The use of Runway 21 is the preferred runway and results in the least impact. However, there will be occasions when Runway 21 or a combination of Runway 03 and 21 will be in operation and the significance of impact will increase. When Runway 03 is used solely, there a very significant increase in noise levels at 7 dwellings. However, Runway 21 is the primary runway at the airport and the runway favoured by prevailing winds during the peak air traffic time of the year. The use of Runway 21 will result in a moderate impact at 6 dwellings and a significant impact at 3 dwellings.

**Table 11.25: Air Traffic Noise - Significance of Impact**

| Scenario | Runway Operating Direction | Runway Status | Positive | | | | Imperceptible | Negative | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Very Significant | Significant | Moderate | Not Significant | | Not Significant | Moderate | Significant | Very Significant |
| 1 / 7 | 03 | Extended / Existing | 0 | 0 | 0 | 13 | 52 | 4 | 6 | 2 | 7 |
| 2 / 8 | 21 | Extended / Existing | 0 | 0 | 2 | 0 | 10 | 2 | 6 | 3 | 0 |
| 3 / 9 | 03/21 | Extended / Existing | 0 | 0 | 0 | 1 | 9 | 15 | 13 | 4 | 0 |

Several mitigation measures are outlined in Section 11.9.3 to reduce the noise impact.

### 11.7.2 Ground Operations Noise

Ground noise is more of a localised issue than noise from air traffic noise. Ground noise consist of taxiing aircraft, engine testing, aircraft auxiliary power units, building services, generators and ground vehicles used at the airport. All these activities have occurred at some stage in the past when commercial flights operated at this airport. Commercial flights ceased in 2016 and this coincided with a reduction in some of these activities. The following are a list of equipment/plant and activities that will operate at the airport:

- Taxiing Aircraft
- Engine Testing
- Six Air Conditioning Units - Sanyo PACi DC Inverter (R410A)
- Two Jumbo Electric Tugs J 6E (Baggage and General Purpose)
- TUG 660 Baggage Loader
- Two Ground Power Units - Houchin 690 DV T1 (Cummins Engine)
- Two Operations Jeeps (Nissan Navara)
- Two Scammel Refueller Trucks

There is also a number of other items of plant and equipment that will operate occasionally at the airport:

- TN 550 New Holland Tractor – Site Maintenance
- Emergency Generators - VISA 400kva and SDMO 110kva
- Iveco 85E15 – Aircraft De-icing Unit
- Aircraft Tug – Reliance Mercury

The tractor is used for site maintenance and it is used occasionally for maintenance of the airport grounds. The emergency generators are not typically in use and will only be deployed in the event of mains power failure.

De-icing is considered uncommon at Waterford airport. Historic de-icing of aircraft at the airport has been associated with early morning flights. The anticipated drop-in schedule of flights may eliminate the need for aircraft de-icing. In the event that de-icing is required it will occur while the planes are on stand and the noise impact will not be significant.

All aircraft are expected to taxi under their own power between the runway and the designated stand when arriving or departing. In the event an aircraft cannot taxi under its own power, there is a Reliance Mercury aircraft tug on standby to tow the aircraft. The usage of the aircraft tug is expected to be low and movements of the tug is not considered significant noise sources when compared to the noise associated with aircraft engines and power units when taxiing. The noise emissions from the aircraft tug has not been modelled.

There is also equipment associated with rescue firefighting at the airport but this will only be deployed in an emergency and the noise impact from this activity has not been considered as it is not considered to be part of day to day operations and it would be hoped that such a requirement never occurs.

For the purpose of this assessment all equipment and plant which operate occasionally have been reviewed and it has been concluded that the noise emissions from these operations will not result in a significant noise impact and have not been included in the noise model.

#### *11.7.2.1 Ground Operations Noise Prediction Modelling - Overview*

The predicted noise levels associated with stationary or minimal movement sources, as well as on-site traffic movements, at the site were predicted according to the International Standard ISO 9313-2: 1996 *Acoustics - Attenuation of sound outdoors - Part 2: General Method of Calculation* (ISO, 1996) using Brüel & Kjær Predictor software.

This noise propagation model allows for octave band calculation of noise from multiple sources, including diffraction and reflection around buildings, terrain and ground effects. This allows all significant noise sources and propagation effects to be accounted for in the model. Noise sensitive locations within 1 km of airport were appraised.

The modelling conservatively assumes that all noise sources will be operating simultaneously for a given time period. The reality is that many of the sources will only operate intermittently.

The geographical features of the area, including existing buildings and all significant noise sources and propagation effects were accounted for in the model. This includes site structures and neighbouring structures. Roads, runway and stands were modelled as acoustically hard surfaces (G=0). The remainder of ground cover is acoustically soft (G=1) i.e. uncompacted loose ground (turf, grass, loose soil). For the purpose of this assessment a ground type of G=0.75, representing a mixture between hard and soft ground was used. Atmospheric conditions of 10 ˚C and 70 % humidity were used as they represent a reasonably low level of air absorption. Receiver heights of 1.5 m and 4.0 m were modelled.

#### *11.7.2.2 Noise Prediction Modelling – Site Noise Sources*

Each of the major potential noise sources on the site were identified and reference sound power data assigned. The data has been sourced from literature and manufacturers datasheets.

A significant source of noise is from taxiing. This activity already takes place for non-commercial aircraft. Noise emission data for taxiing Boeing 737 aircraft was sourced from 'Enhanced Modelling of Aircraft Taxiway Noise, Airport Cooperative Research Program (2009)'. The directivity angle for a taxiing aircraft is important as the noise emissions vary significantly as a function of angle. For the purpose of this assessment maximum sound pressure level of 95 dB at 150ft was used. An un-weighted broadband spectrum, corrected using the A-weighted profile was used to estimate octave band data for this activity. It has been assumed that aircraft will taxi at a speed of 15 km/hr.

Another source of noise is engine testing. Again, this currently takes place at Waterford Airport prior to take off of flights currently departing the airport. The noise emissions from this activity depend on the type of aircraft. The proposed runway extension will facilitate the commercial aircraft such as a Boeing 737. The Boeing 737 does not require engine testing in the same manner as the other aircraft currently operating at the airport. The engine management system carries out checks without the need to physically test the engine by increasing the trust or power to the engine. Therefore, the proposed runway extension will not increase the noise impact from this activity.

Two air conditioning units are installed to regulate temperature in the departures lounge and four air conditioning units are installed to regulate temperature in the control tower. The air conditioning units will operate mainly during daytime and evening periods. Operation during night-time periods was also assessed. Octave band sound power level data for the air conditioning units (Sanyo PAC I DC Inverter) was not available from the manufacturers' datasheet. However, octave band sound power level data was obtained from a similar air conditioning unit (Mitsubishi Electric PUHY-P200YKB-A1).

Two Jumbo Electric Tugs J6E are used for the transportation of baggage and other miscellaneous activities. These are battery powered and the tugs travel at a maximum speed of 15 km/hr. The main source of noise from the Tug is tyre noise and the noise emissions from the Tug are low and have not been predicted.

TUG 660 Baggage Loader is used to load and unload baggage into the aircraft hold. No noise emission data was available for the baggage loader, hence, it was assumed that the baggage load had similar noise emissions to a conveyor drive unit (BS 5228 Ref C.10.20).

Two Ground Power Units - Houchin 690 DV T1 (Cummins Engine) are used to provide power to aircraft on stand. The overall sound pressure level @ 3m was available from the manufacturers' datasheet. This was converter to an overall sound power level and octave band data by normalised overall sound power level using plant item – BS 5228-1 C4.84 (Diesel generator). It has also been assumed that noise emissions from the ground power units are similar to the Auxiliary Power Units.

Two operations jeeps are located at the airport. For the purpose of this assessment it has been assumed that they travel at a maximum of 30 km/hr. The noise emissions are low and have not been considered.

Aircraft fuel is stored at the airport; however, it is not anticipated that commercial aircraft will uplift fuel at Waterford Airport for UK and near-Europe destinations. This is due to the comparative high cost of refuelling at this location. It is expected that an airline serving Waterford will plan for sufficient fuel for return journeys. Smaller aircraft currently uplift fuel and it is expected that this will continue. Aircraft requiring refuelling will be serviced by 2 Scammel refueller trucks.

The reference sound power levels and octave band sound power levels used in the model are shown in Table 11.26 and 11.27, respectively.

**Table 11.26: Site Noise Sources (Overall Sound Power Level)**

| Equipment description | Sound Power, $L_{WA}$ (dB) | Comments |
|---|---|---|
| Aircraft Taxiing | 136 | 95 dB at 150ft |
| Ground Power Units - Houchin 690 DV T1 (Cummins Engine) | 101.5 | 84 dB $L_{Aeq}$ @ 3m<br>Octave band data obtained by normalising manufactures LwA using plant item – BS 5228-1 C4.84 (Diesel generator)<br>Noise emissions from Auxiliary Power Units are assumed to be similar to Ground Power Units |
| Jumbo Electric Tugs JT 6E | - | Noise emissions are low. The main source of noise is tyre noise and the Tugs travel at a maximum speed of 15 km/hr and tyre noise is low at this speed. |

**Table 11.27: Site Noise Sources (Octave Band Sound Power Level)**

| Equipment Description | A-Weighted Octave Band Sound Power Level $L_{WA}$ (dB) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | Total |
| Mitsubishi Electric PUHY-P200YKB-A1 | 66.9 | 68 | 72.5 | 72.9 | 69.6 | 66.3 | 60.6 | 53 | 78 |
| TUG 660 Baggage Loader § | 72.8 | 80.9 | 87.4 | 95.8 | 103 | 96.2 | 92 | 83.9 | 104.8 |
| Fuel tanker lorry * (BS 5228-1 C.4.15) | 80.8 | 84.9 | 90.4 | 99.8 | 100 | 96.2 | 88 | 76.9 | 104.1 |
| Fuel tanker pumping (BS 5228-1 C.4.16) | 76.8 | 81.9 | 86.4 | 91.8 | 97 | 95.2 | 89 | 79.9 | 100.6 |
| Diesel Generator (BS 5228-1 C.4.84) Ω | 76.8 | 83.9 | 95.4 | 94.8 | 97 | 94.2 | 85 | 73.9 | 101.7 |

* Drive-by maximum sound pressure level in $L_{max}$ (octave bands) and $L_{Amax}$ (overall level)
§ - Assumed that noise emissions are similar to a conveyor drive unit BS 5228 Ref C.10.20
Ω - Used to normalise octave band data for Cummins Engine

The airport is typically open between the hours of 08:30 – 22:00, however, the airport has previously facilitated ad hoc requests from individual operators which can occur outside of the hours above. The proposed runway extension will result in scheduled commercial operations. Scheduled operations are expected to take place on a drop-in basis meaning it is unlikely that scheduled passenger aircraft will be based at Waterford Airport. Commercial operations in the airport are therefore likely to be serviced by second rotation onwards scheduled activity.

For the purpose of the assessment, predicted operational noise levels were calculated at the closest noise sensitive locations to the airport. Standard operations with 8 commercial flight movements between 07:00 and 23:00 hrs was modelled.

### *11.7.2.3 Noise Prediction Modelling - Results*

Fifty-one residential receptors and 13 residential and commercial receptors within 1km of the airport were assessed. The co-ordinates of the receptor locations are presented in Appendix 1.

For the purposes of assessing the noise impact from the proposed runway extension, predicted noise levels were assessed against the daytime noise limit of 55 dB $L_{Aeq,16h}$. Table 11.28 presents the predicted noise levels at ground floor and first floor levels. The noise impact from proposed runway extension is below the daytime noise limit at all locations.

The noise model did not predict the noise from engine testing as the noise emissions vary depending on the type of aircraft, age of aircraft and duration of the test. Engine testing currently takes place at Waterford Airport prior to take-off of flights currently departing the airport and it is expected that the noise impact will not increase should the proposed runway extension be built. The proposed runway extension will facilitate the commercial aircraft such as a Boeing 737. The Boeing 737 does not require engine testing in the same manner as the other aircraft currently operating at the airport. The engine management system carries out checks without the need to physically test the engine by increasing the trust or power to the engine. Therefore, the proposed runway extension will not increase the noise impact from this activity.

The predicted noise level from ground operations resulting from the proposed development is below daytime noise limit. However, this result is without the inclusion of engine testing. If it was found that if the impact from the airport needs to be reduced, mitigation measures could be implemented.

The predicted noise levels are also below the baseline ambient noise levels measured at the three noise monitoring locations. Therefore, it is likely that traffic noise and aircraft noise will mask the noise from the ground operations. In terms of the significance of impact, as the existing ambient noise levels are above the predicted noise for the proposed development, the potential impact from ground operational noise levels is not significant.

**Table 11.28: Operational Noise Impact Assessment – Ground Sources**

| Receptor ID | Ground Floor | | First Floor | |
|---|---|---|---|---|
| | Predicted $L_{Aeq,16h}$ Noise Level | Daytime[7] limit of 55dB $L_{Aeq,16h}$ Met | Predicted $L_{Aeq,16h}$ Noise Level | Daytime limit of 55dB $L_{Aeq,16h}$ Met |
| R1 | 39.4 | Y | 41.4 | Y |
| R2 | 41.3 | Y | 43.3 | Y |
| R3 | 35.8 | Y | 37.1 | Y |
| R4 | 37.9 | Y | 38.9 | Y |
| R5 | 40.8 | Y | 43.1 | Y |
| R6 | 47.9 | Y | 49.3 | Y |
| R7 | 33.7 | Y | 37.1 | Y |
| R8 | 43.5 | Y | 47.3 | Y |
| R9 | 48.5 | Y | 49.8 | Y |
| R10 | 36.7 | Y | 38.2 | Y |
| R11 | 33.9 | Y | 34.8 | Y |
| R15 | 35.9 | Y | 37.2 | Y |
| R143 | 34.1 | Y | 36.7 | Y |
| R144 | 35.6 | Y | 36.2 | Y |
| R145 | 47.7 | Y | 49.1 | Y |
| R298 | 48.7 | Y | 49.9 | Y |
| R299 | 36.3 | Y | 37.8 | Y |
| R300 | 37.6 | Y | 39 | Y |
| R301 | 41.7 | Y | 44 | Y |
| R302 | 47.4 | Y | 48.6 | Y |
| R305 | 49.5 | Y | 50.6 | Y |
| R306 | 48.2 | Y | 49.5 | Y |
| R307 | 47.7 | Y | 49 | Y |
| R308 | 37.8 | Y | 41 | Y |
| R309 | 46.9 | Y | 50 | Y |
| R310 | 43.8 | Y | 47.3 | Y |
| R311 | 41.3 | Y | 43 | Y |

[7] Daytime 07:00 to 23:00 hrs and Night-time 23:00 to 07:00 hrs

| Receptor ID | Ground Floor | | First Floor | |
|---|---|---|---|---|
| | Predicted $L_{Aeq,16h}$ Noise Level | Daytime[7] limit of 55dB $L_{Aeq,16h}$ Met | Predicted $L_{Aeq, 16h}$ Noise Level | Daytime limit of 55dB $L_{Aeq,16h}$ Met |
| R312 | 43.6 | Y | 46.6 | Y |
| R313 | 42.4 | Y | 44.8 | Y |
| R314 | 42.4 | Y | 44.6 | Y |
| R315 | 39.3 | Y | 40.3 | Y |
| R316 | 35.8 | Y | 37 | Y |
| R317 | 35.1 | Y | 37.5 | Y |
| R318 | 38.4 | Y | 39.7 | Y |
| R319 | 34.7 | Y | 37.1 | Y |
| R326 | 34.1 | Y | 35.7 | Y |
| R327 | 34.1 | Y | 35.3 | Y |
| R335 | 35.1 | Y | 37.2 | Y |
| R715 | 50.5 | Y | 51.6 | Y |
| R716 | 50.4 | Y | 51.5 | Y |
| R717 | 50 | Y | 51.1 | Y |
| R718 | 45 | Y | 46.5 | Y |
| R719 | 39.6 | Y | 43.4 | Y |
| R720 | 38.6 | Y | 39.3 | Y |
| R721 | 38.5 | Y | 40.8 | Y |
| R722 | 38.1 | Y | 38.7 | Y |
| R723 | 38.2 | Y | 39.7 | Y |
| R724 | 37.7 | Y | 38.3 | Y |
| R725 | 37.9 | Y | 38.7 | Y |
| R726 | 39.1 | Y | 40.6 | Y |
| R727 | 39.1 | Y | 40.7 | Y |
| R728 | 35.6 | Y | 37.2 | Y |
| R729 | 37.7 | Y | 38.5 | Y |
| R730 | 37 | Y | 38.1 | Y |
| R731 | 37.1 | Y | 38.8 | Y |
| R732 | 41.7 | Y | 42.8 | Y |
| R733 | 37.5 | Y | 38.6 | Y |
| R734 | 39.1 | Y | 40.4 | Y |
| R735 | 39.3 | Y | 40.3 | Y |
| R736 | 40 | Y | 40.8 | Y |
| R737 | 39.2 | Y | 39.8 | Y |
| R738 | 39.4 | Y | 39.9 | Y |
| R739 | 33.9 | Y | 34.7 | Y |
| R740 | 37 | Y | 39.4 | Y |

### 11.7.3 Traffic Noise

The proposed development will result in an increase in passenger throughput at Waterford Airport with projected passenger movements of 345,000. Passengers starting or ending their journeys at Waterford Airport will mostly arrive at the airport by road so will generate increased road traffic.

#### *11.7.3.1 Traffic Noise Prediction Modelling - Overview*

Traffic noise is predicted using the Calculation of Road Traffic Noise (CRTN)[8] with the application of the relevant conversion factors as detailed in the TII guidance document.

The CRTN method of predicting noise from a road Scheme consists of the following five elements:

(i) divide the road Scheme into segments so that the variation of noise within this segment is small;
(ii) calculate the basic noise level at a reference distance of 10 metres from the nearside carriageway edge for each segment;
(iii) assess for each segment the noise level at the reception point taking into account distance attenuation and screening of the source line;
(iv) correct the noise level at the reception point to take account of site layout features including reflections from buildings and facades, and the size of source segment;
(v) combine the contributions from all segments to give the predicted noise level at the receiver location for the whole road Scheme.

CRTN calculates traffic noise levels in terms of noise parameter LA10 (18hour). However, the design goal set out in the TII guidelines is in terms of Lden (EU noise indicator for day-evening-night). LA10 (18hour) results can be converted to Lden using the conversion procedure outlined in the TII guidelines is:

$$L_{den} = 0.86 \text{ x } L_{A10(18hour)} + 9.86 \text{ dB}$$

**Inputs to the Traffic Noise Model**

The prediction method takes the following factors into account: traffic flow rates, mean traffic speed, percentage of heavy vehicles. Other information required for the calculation includes: road surface and gradient; ground type; height of noise source; shielding of barriers and cuttings; reflections at facades and from nearby buildings; and angle of view of the road.

The noise model was prepared using road alignments, topographical data and Ordnance Survey mapping. The mean traffic speed on the R708 regional route and airport access road was modelled as 80 km/hr and 50 km/hr, respectively. Existing traffic volumes on the airport access road and R708 were obtained from a traffic survey undertaken by Nationwide Data Collection between 14 June 2018 and 21 June 2018. A detailed assessment of the existing traffic volumes on the road network in the vicinity of the site and future traffic growth figures for the do nothing and do something scenarios were obtained from Chapter 8 'Traffic & Transportation'. A summary of traffic volumes used in the preparation of the traffic noise model are presented in Table 11.29.

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[8] Department of Transport Welsh Office, HMSO 1988.

**Table 11.29: Operational Noise Impact Assessment – Traffic Volumes**

| Link | 2020 AADT (non-construction) | | 2021 AADT Do Minimum Scenario | | 2021 AADT Do Something Scenario | | 2025 AADT Do Minimum Scenario | | 2025 AADT Do Something Scenario | |
|---|---|---|---|---|---|---|---|---|---|---|
| Airport Approach Road | 190 | | 147 | | 391 | | 209 | | 1,123 | |
| | % HGV | 0.17 | % HGV | 0.17 | % HGV | 14.5 | % HGV | 0.15 | % HGV | 14.5 |
| R708 | 2,588 | | 2,577 | | 2,784 | | 2,688 | | 3,659 | |
| | % HGV | 1.48 | % HGV | 1.50 | % HGV | 3.4 | % HGV | 1.33 | % HGV | 5.39 |

### *11.7.3.2 Traffic Noise Prediction Results*

Dwellings along the R708 and up to 1 km away from the junction of R708 and the airport access road were assessed. These represent a worst-case scenario with regards to noise impacts and are considered representative of dwellings within the vicinity of the airport that may potentially be impacted by the proposed development. Receptor heights of 1.5m and at 4m were modelled.

The following noise scenarios were modelled for the proposed development:

- Base Year 2020
- Opening Year 2021; Do-Minimum and Do-Something scenarios
- Design Year 2025; Do-Minimum and Do-Something scenarios

Table 11.30 and 11.31 presents the predicted noise levels for the scenarios detailed above.

**Table 11.30: Predicted $L_{den}$ Noise Levels – Ground Floor Level for the "Do-Minimum" and "Do-Something Scenarios for 2021 and 2025 and Base year 2020**

| Receptor ID | Base Year 2020 | Opening Year 2021 Predicted Noise Levels | | 5 Years after Opening 2025 Predicted Noise Levels | |
|---|---|---|---|---|---|
| | | Do-Minimum | Do-Something | Do-Minimum | Do-Something |
| R3 | 56.5 | 56.7 | 57.2 | 56.7 | 58.8 |
| R6 | 54.2 | 54.4 | 54.9 | 54.4 | 56.4 |
| R9 | 58.2 | 58.5 | 59 | 58.5 | 60.6 |
| R15 | 54.7 | 54.9 | 55.5 | 54.9 | 57 |
| R145 | 53.6 | 53.9 | 54.4 | 53.8 | 55.9 |
| R298 | 60.7 | 60.9 | 61.4 | 60.9 | 63.1 |
| R299 | 53.1 | 53.3 | 53.9 | 53.3 | 55.4 |
| R300 | 53.1 | 53.3 | 53.8 | 53.3 | 55.4 |

| Receptor ID | Base Year 2020 | Opening Year 2021 Predicted Noise Levels | | 5 Years after Opening 2025 Predicted Noise Levels | |
|---|---|---|---|---|---|
| | | Do-Minimum | Do-Something | Do-Minimum | Do-Something |
| R302 | 54.9 | 55.2 | 55.7 | 55.1 | 57.2 |
| R305 | 56.2 | 56.5 | 57 | 56.4 | 58.5 |
| R306 | 57 | 57.2 | 57.7 | 57.2 | 59.3 |
| R307 | 56.9 | 57.1 | 57.7 | 57.1 | 59.3 |
| R315 | 53.7 | 53.9 | 54.4 | 53.9 | 55.9 |
| R317 | 58.1 | 58.4 | 58.9 | 58.3 | 60.4 |
| R318 | 51.7 | 52 | 52.5 | 51.9 | 54 |
| R319 | 57.2 | 57.4 | 57.9 | 57.4 | 59.5 |
| R335 | 53.1 | 53.4 | 53.9 | 53.3 | 55.4 |
| R715 | 52.1 | 52.3 | 53 | 52.3 | 54.7 |
| R716 | 51.9 | 52.1 | 52.7 | 52.1 | 54.5 |
| R717 | 52.3 | 52.5 | 53.1 | 52.5 | 54.7 |
| R718 | 52.4 | 52.6 | 53.1 | 52.6 | 54.7 |
| R719 | 57.2 | 57.4 | 57.9 | 57.4 | 59.5 |
| R720 | 59.1 | 59.4 | 59.9 | 59.4 | 61.5 |
| R721 | 56.8 | 57.1 | 57.6 | 57 | 59.1 |
| R722 | 61.8 | 62 | 62.6 | 62 | 64.3 |
| R723 | 58.9 | 59.1 | 59.7 | 59.1 | 61.3 |
| R724 | 55.2 | 55.4 | 55.9 | 55.4 | 57.5 |
| R725 | 58 | 58.2 | 58.7 | 58.2 | 60.3 |
| R740 | 54.2 | 54.4 | 55 | 54.4 | 56.5 |

**Table 11.31: Predicted $L_{den}$ Noise Levels – First Floor Level for the "Do-Minimum" and "Do-Something Scenarios for 2021 and 2025 and Base year 2020**

| Receptor ID | Base Year 2020 | Opening Year 2021 | | Design Year 2025 | |
|---|---|---|---|---|---|
| | | Predicted Noise Levels | | Predicted Noise Levels | |
| | | Do-Minimum | Do-Something | Do-Minimum | Do-Something |
| R3 | 58.4 | 58.6 | 59.1 | 58.6 | 60.7 |
| R6 | 55.7 | 55.9 | 56.4 | 55.9 | 58 |
| R9 | 60.3 | 60.5 | 61 | 60.5 | 62.6 |
| R15 | 56.5 | 56.7 | 57.2 | 56.7 | 58.8 |
| R145 | 54.8 | 55.1 | 55.6 | 55 | 57.1 |
| R298 | 62.6 | 62.8 | 63.4 | 62.8 | 65 |
| R299 | 54.3 | 54.5 | 55 | 54.5 | 56.6 |
| R300 | 54.4 | 54.6 | 55.1 | 54.5 | 56.6 |
| R302 | 56.8 | 57.1 | 57.6 | 57 | 59.1 |
| R305 | 58.1 | 58.3 | 58.8 | 58.3 | 60.4 |
| R306 | 58.8 | 59.1 | 59.6 | 59 | 61.1 |
| R307 | 58.7 | 59 | 59.5 | 58.9 | 61 |
| R315 | 55.2 | 55.5 | 56 | 55.4 | 57.5 |
| R317 | 59.9 | 60.1 | 60.6 | 60.1 | 62.2 |
| R318 | 52.9 | 53.1 | 53.7 | 53.1 | 55.2 |
| R319 | 59.1 | 59.3 | 59.8 | 59.2 | 61.4 |
| R335 | 54.4 | 54.6 | 55.1 | 54.6 | 56.6 |
| R715 | 53.3 | 53.6 | 54.3 | 53.5 | 55.9 |
| R716 | 53.2 | 53.5 | 54 | 53.4 | 55.8 |
| R717 | 53.5 | 53.7 | 54.4 | 53.7 | 56 |
| R718 | 53.7 | 53.9 | 54.4 | 53.9 | 56 |
| R719 | 59 | 59.2 | 59.8 | 59.2 | 61.3 |
| R720 | 60.9 | 61.1 | 61.7 | 61.1 | 63.2 |
| R721 | 58.7 | 58.9 | 59.4 | 58.9 | 61 |
| R722 | 63.3 | 63.5 | 64.1 | 63.5 | 65.7 |
| R723 | 60.7 | 60.9 | 61.4 | 60.9 | 63 |
| R724 | 56.8 | 57 | 57.5 | 57 | 59 |
| R725 | 59.8 | 60 | 60.6 | 60 | 62.1 |
| R740 | 55.4 | 55.7 | 56.2 | 55.6 | 57.7 |

*Year 2020*

The base noise prediction shows that the expected traffic noise from the R708 satisfy the 60dB Lden at most locations. Receptors locations R9, R298, R720, R722 and R723 are above the 60dB $L_{den}$ TII design goal.

*Year 2021*

The Do-minimum scenario shows an increase in noise levels compared to the base year. When the traffic noise effects from the proposed runway extension are included i.e. Do-Something scenario, traffic noise levels in the vicinity of the proposed development increase by a maximum of 0.7 dB in the short term. The magnitude of impact is classified as negligible.

*Year 2025*

The Do-Minimum scenario shows an increase in noise levels compared to the base year. When the traffic noise effects from the proposed runway extension are included i.e. Do-Something scenario, traffic noise levels in the vicinity of the proposed development increase by 2.0 - 2.4 dB in the long term. The increase of 2.4 dB again is classified as negligible.

Although the proposed runway extension will result in increased traffic volumes, the magnitude of impact is negligible in the short term and long term.

## 11.8 Cumulative Impacts

*Construction Cumulative Impacts*

There are no anticipated cumulative construction noise impacts.

*Operational Cumulative Impacts*

The noise from the operational phase of the proposed development can be considered under three different categories comprising air traffic noise, ground operations noise and road traffic noise. Each of the main noise sources associated with operations at an airport is assessed according to its character, with specific methodologies and assessment criteria applied. Hence, each of the noise sources are dealt with separately and it is not possible to derive a ‘cumulative noise impact’.

When considering cumulative impacts, each main noise sources associated with the airport was assessed. There are no other developments proposed in the vicinity of the airport which could generate noise levels requiring consideration in conjunction with aircraft air noise to derive a cumulative effect.

## 11.9 Mitigation Measures

### 11.9.1 Mitigation Measures during Construction

The noise impact assessment indicates that predicted noise levels are below the 65 dB $L_{Aeq,1hr}$ noise limit for majority of the construction activities. There is potential exceedance during the installation of navigation lighting and utilities. However, these exceedances are limited to one dwelling and the duration of the impact is expected to be brief. To mitigate the noise at this receptor, where practicable, only one item of plant will operate at a given time. BS 5228-1:2009+A1:2014 provides a detailed list of mitigation measures to minimise the noise impact from construction activities and these recommendations should be implemented.

- While the noise from these activities is likely to be minimal (in most cases) and transient in nature, there is potential for greater impacts at a limit number of dwellings and it is recommended that construction activities shall be carried out during normal working hours.
- A site representative responsible for matters relating to noise should be appointed.
- Establishing communication channels between the contractor and the local authority and residents.
- Noise monitoring at noise sensitive receivers should be performed during critical periods.

There are many general measures that can reduce noise levels:

- Avoid unnecessary revving of engines and switch off equipment when not required.
- Keep internal haul routes well maintained and avoid steep gradients.
- Select equipment conforming to international standards on noise and vibration.
- Select equipment with quiet and low vibration emissions, and ensure equipment is regularly maintained ensuring it operates in an efficient manner. If possible all mechanical plant will be fitted with effective exhaust silencers.
- Compressors will be of the “sound reduced” models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all pneumatic tools shall be fitted with suitable silencers.
- Locate equipment as far away as noise sensitive receivers as possible within constraints of the site.
- Erection of hoardings or temporary noise barriers, where practicable and necessary, to provide acoustic screening.
- Ensure road surfaces on-site and in the vicinity of the site are well-maintained and smooth. If this is the case, truck movements will be unlikely to cause perceptible structural vibration in nearby properties.
- Plant and/or methods of work causing significant levels of vibration at sensitive premises will be replaced by other, less intrusive, plant and/or methods of working where practicable.

The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 07:00 hours and 19:00 hours Monday to Saturday. However, to ensure that optimal use is made of fair weather windows, or at critical periods within the programme, it could occasionally be necessary to work outside these hours. Any such out of hours working would be agreed in advance with the local planning authority.

The noise impact for construction works traffic would be mitigated by generally restricting movements along access routes to the standard working hours and exclude Sundays, unless specifically agreed otherwise.

### 11.9.2 Vibration Mitigation Measures during Construction

There are no significant vibration impact from on-site given the distance between the works and the nearest receptors.

There is potential for vibration from construction traffic. However, if road surfaces/haul route surfaces on-site and in the vicinity are well-maintained and smooth road surfaces, there will be no significant adverse effects from vibration due to construction traffic.

All roads upon completion of the construction works, will be expeditiously reinstated to their pre-works condition or better and to the satisfaction of the relevant roads authority. If, during the course of the construction works, some of the roads used in connection with the development are damaged, these roads will be made good to the satisfaction of the roads authority. Hence, there should be no significant adverse effects from vibration due to construction traffic.

### 11.9.3 Noise Mitigation Measures during Operation

The following mitigation measures are recommended to minimise the impact from the proposed runway extension:

- It is recommended that Runway 21 be utilised where possible as its use is the most favourable mode of operation as it is lessens the impact of aircraft noise on the local community.
- Control the frequency of night flights at the airport so as to protect residential amenity
- Undertaken noise monitoring and track flights. The results of the noise and flight track monitoring shall be used to re-evaluate noise impacts and the application of mitigation measures. This data will be reviewed annually. This information will also be used to assess and address noise complainants should they arise.
- Where practicable, the airport will implement a variety of noise abatement procedures such as requiring aircraft to operate along pre-determined departure routes (noise preferential routes or NPR's) and to climb in a manner to minimise noise on communities on the ground. Approaching aircraft are required to ensure they do not encroach below the 3 degree glide slope operating at the airport. On touchdown, aircraft are required to avoid the use of reverse thrust during the hours of 23:00 to 07:00 except where operational or safety reasons dictate otherwise.

The predicted noise level from ground operations resulting from the proposed development is below daytime noise limit. However, this result is without the inclusion of engine testing. If it was found that if the impact from the airport needs to be reduced, installation of earth bunds at specific locations could help mitigate the noise impact from ground operations.

## 11.10 Residual Impacts

In general, the construction noise impacts are expected to be below the noise limits of 65 dB $L_{Aeq,1hr}$. There is potential for construction noise levels to exceed 65 dB $L_{Aeq,1hr}$ but this is expected to be brief and at one dwelling. The construction noise levels are expected to be at a similar level to the ambient noise level but there may also be instances when the construction noise levels is above the ambient noise levels and the construction activity is expected to result in a moderate temporary residual impact.

It is envisaged that proposed development will result in additional residual air traffic impacts over and above the current operations at the airport. However, where these impacts are deemed unacceptable, mitigation measures are proposed to minimise the impacts.

Ground operations noise is expected to increase but the noise levels are below the noise limit and will be masked by air traffic noise and road traffic noise and under this criterion, there will be no residual impact.

Although the proposed runway extension will result in increased traffic volumes, the magnitude of traffic noise impact is negligible in the short term and long term. Under this criterion, there will be no residual impact.

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