5. Survey Results

Survey results are provided below in **Table 3**

Table 3. Tree Survey Results

No.	Species	Age Class	Girth (mm)	Height (m)	Spread	Condition	Comments	Recommendation	Retention Category	RPA
1	Ash	M	700	15	12	Fair	In decline. Ivy	Low priority	C	8.4
2	Elm	SM	250	12	5	Poor	Surrounded by dead trees	Retain if possible but will succumb to elm disease.	U	3
3	Ash	M	350	11	7	Fair	Poor tree. Ivy	Low priority	U	4.2
4	Oak	M	1000	15	12	Good	Well proportioned, healthy	Retain	A	12
5	Ash	M	400	11	10	Good	2 trees on excavated soil heap - unstable	Retain	B	4.8
6	Ash	M	450	12	9	Fair	Ash dieback	Low priority	U	5.4
7	Ash	M	350	12	8	Fair	2 trees – Ash dieback	Low priority	U	4.2
8	Ash	M	400	14	8	Fair	Ash dieback	Low priority	U	4.8
9	Ash	M	480	13	9	Fair	Ash dieback	Low priority	U	5.7
10	Ash	M	400	10	8	Good		Retain	B	4.8
11	Ash	M	600	15	9	Good	(Probably in neighbouring land)	Retain	B	7.2

12	Ash	M	600	15	9	Good		Retain	B	7.2
13	Ash	M	450	8	6	Fair	Low tree	Retain	B	5.4
14	Ash	M	450	12	10	Good	2 stems	Retain	B	5.4
GROUPS										
G1	Elm	SM	250	10	30	Fair	Elm disease present (5 trees still alive)	Retain if possible but will succumb to Elm disease	U	12
G2	Elm	SM	230	9	35	Poor	Group of 5 trees (Surrounded by dead trees)	Retain if possible but will succumb to Elm disease	U	11.5
G3	Ash	M	450	11	40	Good	Group of 10 trees	Retain	B	10 (est.)

5. Discussion

A total of 14 individual trees and 3 tree groups are included in the survey schedule. The internal treeline/hedgerow, which includes tree numbers T1, T2, T3 and T4 as well as tree groups G1 and G2 will be removed.

All the trees are in field boundaries, which consist of overgrown, unmanaged hedgerows. Individual and tree groups are predominantly ash (*Fraxinus excelsior*) and Elm (*Ulmus spp.)* and one Oak (*Quercus robur*). The Oak tree (T4) is a fine, well-proportioned tree which will be removed as part of the proposed development. Ideally this tree would be retained for its landscape and ecological significance in any future development.

The Ash and Elm earmarked for removal (T1, T2 and T3) are both showing symptoms of disease – ash dieback (*Hymenoscyphus fraxinus*) and Dutch elm disease (*Ophiostoma ulmi)* respectively. It is unlikely that any Elm will survive beyond semi-maturity and a high proportion of ash will die in the short term. Consequently, neither species are given high values for retention.

It is proposed to remove approximately 170m of hedgerow, which includes two Ash trees (T and T3) and two groups of Elm (G1 and G2). In view of their poor long-term survival prospects their loss will be of low significance in a local context.

6. Mitigation

All works should be carried out to "BS 3998(2010) Tree Work – Recommendations by professional tree surgeons.

Significant root damage can be caused by ground works, excavation work and soil compaction. This can lead to tree damage and premature loss of important trees. Root Protection Area (R.P.A) barriers to be secured with a physical barrier, for example welded mesh barrier on scaffold frame.

If it is determined that limited, localised trench digging or other excavation works for services are required within the RPAs it will be supervised and approved by a qualified arborist. The supervising arborist will take account of the recommendations outlined in BS 5837:2012 *Trees in relation to design, demolition and construction*.

Wide or tall loads or items of plant coming into contact with retained trees can result in serious damage to them and might make their safe retention impossible. A risk assessment will be carried out to determine the size of loads in relation to the available distance between trees.

Soil contamination from cement or hydrocarbons will not be allowed to infiltrate the ground within 10 m of a tree stem.

Notice boards, fencing etc will not be affixed to trees.

Extensive planting of native trees is proposed as part a comprehensive landscape plan. Woodland planting will occupy areas along the western and south-western perimeter of the proposal site. Native trees of Irish origin including Pedunculate Oak, Scots Pine, Alder, Downy Birch, Wild Cherry etc will be utilised. Hedgerows are proposed along the northern and southern boundary of the site with a mix of native species including Blackthorn, Holly, Elder and Hazel. Further detail is provided in the report *Management, Maintenance and Boundary Treatment plan – New industrial units at Huntstown* (Macroworks, 2021)

7. Conclusions

The three Ash trees and two Elm groups which will be removed are considered of relatively low value as there are significant risks to the long-term viability of these trees due to disease. However, the Oak tree earmarked for removal has local ecological value. Taking into account the proposed mitigation measures, which includes establishment of extensive areas of native trees elsewhere on the site, impacts from the loss of hedgerow/trees will be negative, slight and local.

Appendix 1: Arboriculture Assessment

APPENDIX 8.2

N R A GUIDELINES

Appendix 8.2. NRA 2009 Guidelines

Examples of valuation at different geographical scales

Ecological valuation: Examples

International Importance:
 	
• 'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA) or proposed Special Area of Conservation and Proposed Special Protection Area (pSPA).
 	
• Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended).
• Features essential to maintaining the coherence of the Natura 2000 Network.[1]
• Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive.
• Resident or regularly occurring populations (assessed to be important at the national level) [2] of the following:
    o Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or
    o Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.
• Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971).
• World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972).
• Biosphere Reserve (UNESCO Man & The Biosphere Programme).
• Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979).
• Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979).
• Biogenetic Reserve under the Council of Europe.
• European Diploma Site under the Council of Europe.
• Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).[3]

National Importance:
 	
• Site designated or proposed as a Natural Heritage Area (NHA).
• Statutory Nature Reserve.
• Refuge for Fauna and Flora protected under the Wildlife Acts.
• National Park.
• Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park.
• Resident or regularly occurring populations (assessed to be important at the national level)[4] of the following:
    o Species protected under the Wildlife Acts; and/or
    o Species listed on the relevant Red Data list.
• Site containing 'viable areas'[5] of the habitat types listed in Annex I of the Habitats Directive.

County Importance:
 	
• Area of Special Amenity.[6]
• Area subject to a Tree Preservation Order.
• Area of High Amenity, or equivalent, designated under the County Development Plan.
• Resident or regularly occurring populations (assessed to be important at the County level)[7] of the following:
    o Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
    o Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;

- Species protected under the Wildlife Acts; and/or
- Species listed on the relevant Red Data list.

- **Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance.**
- **County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP, [8] if this has been prepared.**
- **Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county.**
- **Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.**

Local Importance (higher value):

- **Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;**
- **Resident or regularly occurring populations (assessed to be important at the Local level)[9] of the following:**
  - **Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;**
  - **Species of animal and plants listed in Annex II and/or IV of the Habitats Directive;**
  - **Species protected under the Wildlife Acts; and/or**
  - **Species listed on the relevant Red Data list.**
- **Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality;**
- **Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.**

Local Importance (lower value):

- **Sites containing small areas of semi-natural habitat that are of some local importance for wildlife;**
- **Sites or features containing non-native species that are of some importance in maintaining habitat links.**

1 See Articles 3 and 10 of the Habitats Directive.

2 It is suggested that, in general, 1% of the national population of such species qualifies as an internationally important population. However, a smaller population may qualify as internationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

3 Note that such waters are designated based on these waters' capabilities of supporting salmon (*Salmo salar*), trout (*Salmo trutta*), char (*Salvelinus*) and whitefish (*Coregonus*).

4It is suggested that, in general, 1% of the national population of such species qualifies as a nationally important population. However, a smaller population may qualify as nationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

5 A 'viable area' is defined as an area of a habitat that, given the particular characteristics of that habitat, was of a sufficient size and shape, such that its integrity (in terms of species composition, and ecological processes and function) would be maintained in the face of stochastic change (for example, as a result of climatic variation).

6 It should be noted that whilst areas such as Areas of Special Amenity, areas subject to a Tree Preservation Order and Areas of High Amenity are often designated on the basis of their ecological value, they may also be designated for other reasons, such as their amenity or recreational value. Therefore, it should not be automatically assumed that such sites are of County importance from an ecological perspective.

7 It is suggested that, in general, 1% of the County population of such species qualifies as a County important population. However, a smaller population may qualify as County important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

8 BAP: Biodiversity Action Plan

9 It is suggested that, in general, 1%of the local population of such species qualifies as a locally important population. However, a smaller population may qualify as locally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle

APPENDIX 9.1

AIR QUALITY

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Huntstown Materials Recovery Facility - Air Quality Appendix

Prepared for:

O'Callaghan Moran & Associates

April 2023

Final

Prepared by:

Katestone Environmental Pty Ltd
Office 5a, Portlaoise Enterprise Centre, Clonminam Industrial Estate, Portlaoise, Co Laois

www.katestone.global
admin@katestone.global
Ph +353 (87) 365 6879

katestone
www.katestone.global

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Prepared by:	Micheal Fogarty, Paddy McDowell
Reviewed by:	Simon Welchman
Approved by:	Simon Welchman 18/04/23

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Contents

Glossary

Term	Definition
g/s	gram per second
kg	kilogram
kg/m^3	Kilogram per cubic meter
km	kilometre
km/hr	kilometre per hour
m	metre
m/s	metres per second
m^2	square metres
m^3	cubic metres
m^3/s	cubic metres per second
m^3/hr	cubic metres per hour
mg	milligram
Z_0	roughness length
ou_E/m^3	European odour unit per cubic meter
ou_E/s	European odour unit per second
$\mu g/m^3$	micrograms per cubic meter
Abbreviations	**Definition**
AG4	Air Guidance 4
BAT	Best available techniques
EPA	Environmental Protection Agency
EF	Emission factor
EU	European Union

APPENDIX A METEOROLOGICAL MODELLING METHODOLOGY

A1 CALCULATION OF Z_0 AND THE ALBEDO AND BOWEN RATIO

According to the AERMET/AERMOD user guides, the Albedo and Bowen ratio should be determined from land use within a 10 km x 10 km rectangle centred on the meteorological station and roughness length, Z_0, should be determined based on land cover within a 1.0 km radius from the meteorological station. If the value of Z0varies significantly by direction, sector dependency should be used with sector width >= 30°. The meteorological data were recorded at Dublin Airport. Details of the meteorological station are listed in Table A.1.

Table A.1 Parameters describing the location of the meteorological station at Dublin Airport

Parameter	Value
Met. station name/identifier	Dublin Airport
Latitude (°)	53.428
Longitude (°)	-6.241
Easting (m)	683301
Northing (m)	5923429
UTM Zone	29 U
Altitude (m, AHD)	71

A1.1 Calculation of Z_0

From the aerial view in Figure A1, the land use within a 1 km radius is predominantly the airport with some cleared land (grassland) and industrial infrastructure (airport hangers, passenger terminals). The sector boundaries, land use, seasonal Z_0 values for each sector and individual sector weights are presented in Table A.2.

Table A.2 Sector boundaries and seasonal Z_o values

Sector	WDir-1	WDir-2	Summer	Autumn	Winter	Spring
A	29	94	0.112	0.112	0.112	0.112
B	94	138	0.070	0.070	0.070	0.070
C	138	225	0.083	0.027	0.009	0.059
D	225	276	0.070	0.070	0.070	0.070
E	276	306	0.082	0.030	0.011	0.061
F	306	338	0.173	0.130	0.097	0.159
G	338	29	0.070	0.070	0.070	0.070

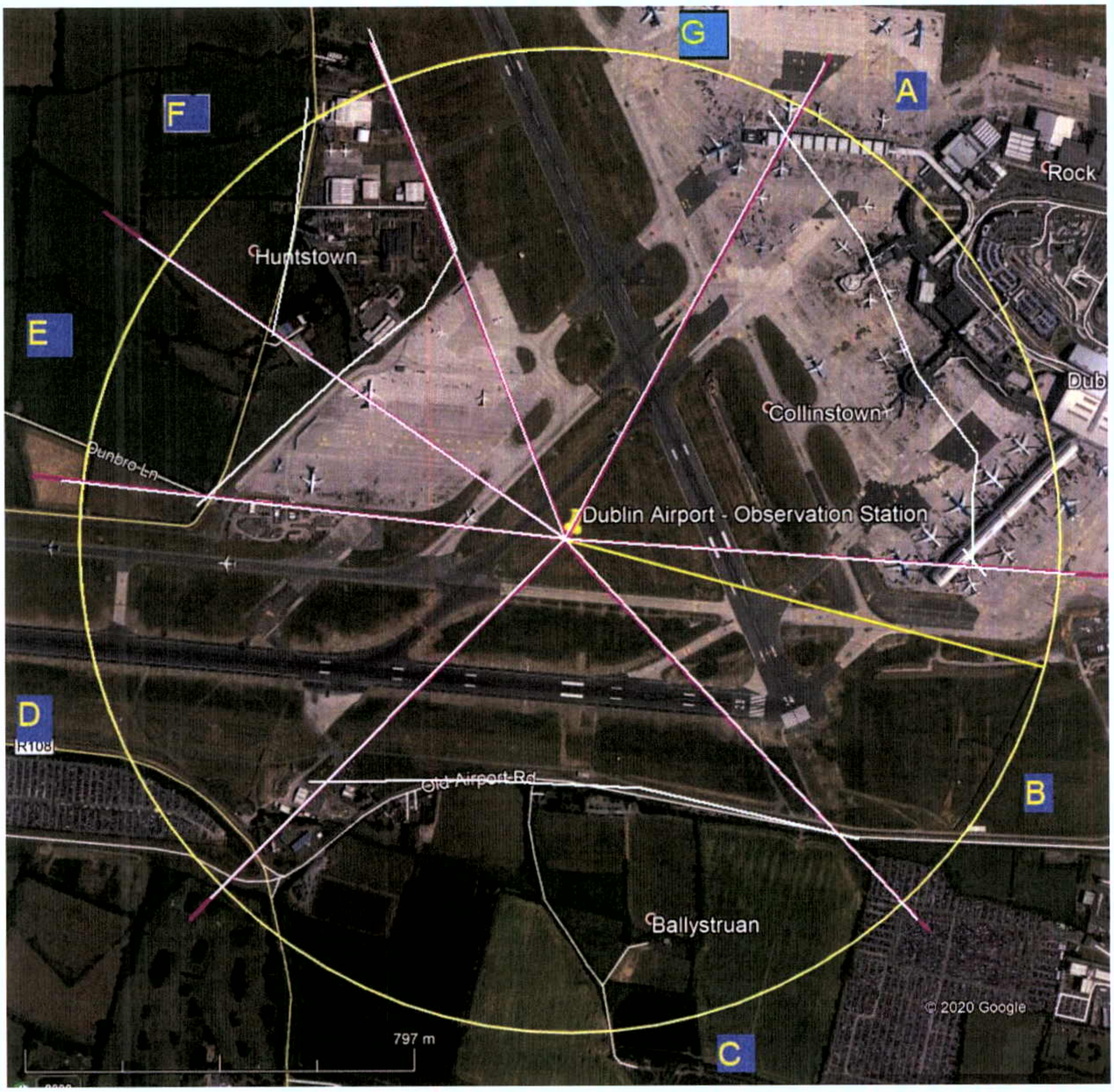


Figure A1 **Land use in the vicinity of the meteorological monitoring site at Dublin Airport**

A1.2 Calculation of Albedo and Bowen Ratio

These should be determined based on land cover within a 10km x 10km domain with no need for sector dependency. A weighted geometric mean should be used to determine the Bowen ratio and a weighted arithmetic mean for the albedo which is subsequently used to calculate the diurnal variation.

From the 10 km aerial view shown in Figure A2, it is evident that the main land use groups are low density residential, industrial/commercial and grass (cleared land). The land use fractions and seasonal Albedo and Bowen ratios are summarized in the Table A.3 and Table A.4.

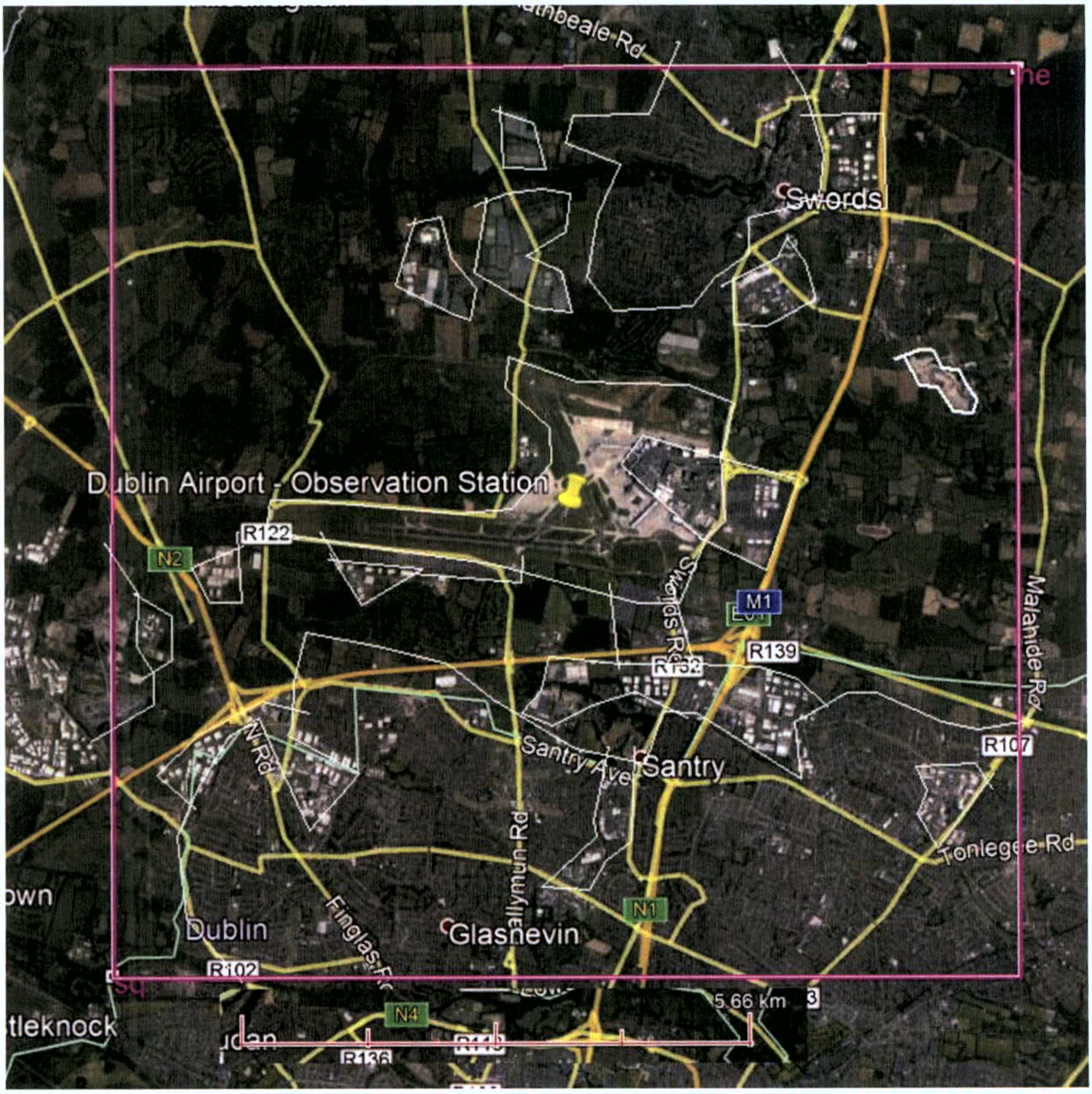


Figure A2 Land cover within a 10km x 10km domain of Dublin Airport monitoring location

Table A.3 Seasonal Albedo values

Land use	Fraction
Airports	0.062
Quarries/Strip mines, gravel	0.007
Low intensity residential	0.304
Industrial/commercial	0.088
Grassland	0.539

Table A.4 Seasonal Bowen Ratio values

Land use	Summer	Autumn	Winter	Spring
Albedo Arithmetic Weighted Average	0.174	0.174	0.191	0.174
Bowen Ratio Geometric Mean	0.883	1.066	1.066	0.608

APPENDIX 10.1

NOISE ASSESSMENT

dBA
damian brosnan acoustics

project

Noise & vibration impact assessment

Huntstown Circular Economy Hub – Stage 1

Proposed materials recovery facility & food container cleaning plant

where

Huntstown, Co. Dublin

when

February-March 2023

why

Planning application EIAR

client

Rathdrinagh Land Unlimited Company Huntstown Circular Economy Hub

prepared by

Damian Brosnan BSc MSc MIOA MIEI

report no.	date	no. of pages	status
398.1.1	**04.04.23**	**36 (0 appendices)**	**Issue to client**

086 813 1195

damianbrosnan@gmail.com

Summary

Damian Brosnan Acoustics carried out an assessment of potential noise and vibration impacts associated with a proposal to construct a materials recovery building and food tray cleaning building as part of stage 1 of the proposed Huntstown Circular Economy Hub at Huntstown, Co. Dublin. The proposed development will most likely require an industrial emissions licence from the EPA.

The proposed development site is located on the northwest side of the M50-N2 interchange. The site is accessed from North Road, a cul de sac which runs parallel to the N2, serving a number of dwellings and facilities in the Huntstown and Coldwinters area. The local soundscape is entirely dominated by road traffic noise 24/7. Despite the commercial character of the area, a number of residential dwellings lie in proximity to the development site.

While the loudest construction activity may be audible at the nearest receptors, noise levels will be lower than identified criteria. Construction noise impacts will be imperceptible to not significant, and will be temporary. No vibration impacts will arise. Once commissioned, residual noise impacts at surrounding receptors will be imperceptible. A BS 4142:2014 assessment indicates that no adverse impacts will arise. There will be no adverse noise impact on the local population or on human health. No cumulative impacts of significance will arise.

Contents

This report was prepared by Damian Brosnan, who has the following qualifications and experience:
•BSc (Honours) 1993 (University College Cork) •Postgraduate diploma in Acoustics & Noise Control 2009 (Institute of Acoustics) •MSc (Distinction) in Applied Acoustics 2015 (University of Derby) •Certificate of competence in workplace noise risk assessment (Institute of Acoustics) •Member of Institute of Acoustics (MIOA) & secretary of Irish IOA branch •Founding member of Association of Acoustic Consultants of Ireland (AACI) •Member of Engineers Ireland (MIEI) •Engaged with CPD through IOA & EI •Lead author of *Environmental noise guidance for local authority planning & enforcement departments* (AACI, 2019) •1996-2001: Noise Officer with Cork County Council •2001-2014: Partner with DixonBrosnan Environmental Consultants, specialising in EIA •Since 2015, principal at Damian Brosnan Acoustics

Glossary

Ambient	Total noise environment at a location, including all sounds present.
A-weighting	Weighting or adjustment applied to sound level to approximate non-linear frequency response of human ear. Denoted by suffix A in parameters such as $L_{Aeq\,T}$, $L_{AF10\,T}$, etc.
Background level	A-weighted sound pressure level of residual noise exceeded for 90 % of time interval T. Denoted $L_{AF90\,T}$.
Broadband	Noise which contains roughly equal energy across frequency spectrum. Does not contain tones, and is generally less annoying than tonal noise.
Decibel (dB)	Unit of noise measurement scale. Based on logarithmic scale so cannot be simply added or subtracted. 3 dB difference is smallest change perceptible to human ear. 10 dB difference is perceived as doubling or halving of sound level. Examples of decibel levels are as follows: 20 dB: very quiet room; 30-35 dB: night-time rural environment; 55-65 dB: conversation; 80 dB: busy pub; 100 dB: nightclub. **Throughout this report noise levels are presented as decibels relative to 20 μPa**.
Effect	Consequence of an impact.
Extraneous	Noise emissions unrelated to source under consideration.
Fast response	0.125 seconds response time of sound level meter to changing noise levels. Denoted by suffix F in parameters such as $L_{AF10\,T}$, $L_{AF90\,T}$, etc.
Frequency	Number of cycles per second of a sound or vibration wave. Low frequency noise may be perceived as hum, while whine represents higher frequency. Range of human hearing approaches 20-20,000 Hertz.
Hertz (Hz)	Unit of frequency measurement.
Impact	Change resulting from an action, such as implementation of a project.
Impulse	Noise which is of short duration, typically less than one second, sound pressure level of which is significantly higher than background.
Interval	Time period T over which noise parameters are measured at position. Denoted by T in $L_{Aeq\,T}$, $L_{AF90\,T}$, etc.
L_{AE}	A-weighted sound exposure level. Measure of noise level of an event, standardised to interval of one second, and containing same acoustic energy as actual event.
$L_{Aeq\,T}$	Equivalent continuous sound pressure level during interval T, effectively representing average A-weighted noise level of ambient noise environment.
$L_{AF10\,T}$	A-weighted sound pressure level exceeded for 10% of interval T, usually used to quantify traffic noise.
$L_{AF90\,T}$	A-weighted sound pressure level exceeded for 90% of interval T, usually used to quantify background noise. May also be used to describe noise level from continuous steady or almost-steady source, particularly where local noise environment fluctuates.
L_{day}	The A-weighted long term average incident sound pressure level determined over all the daytime periods of a year, where the daytime period is typically 0700-1900 h.
L_{den}	Day-evening-night noise level. Calculated from separate L_{day}, $L_{evening}$ and L_{night} levels using formula specified in *EU Directive 2002/49/EC*.
$L_{evening}$	The A-weighted long term average incident sound pressure level determined over all the evening periods of a year, where the evening period is typically 1900-2300 h.
L_{night}	The A-weighted long term average incident sound pressure level determined over all the night-time periods of a year, where the night-time period is typically 2300-0700 h.
L_{WA}	A-weighted sound power level generated by source due to conversion of work energy into noise energy.
Masking	Rendering inaudible of one noise source by another source(s) which may be louder, or may contain significant acoustic energy in same part of frequency spectrum. In latter case, any tone(s) in original source emissions may become inaudible.

Noise sensitive location Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or area of high amenity which for its proper enjoyment requires absence of noise at nuisance levels.

1/3 octave band Frequency spectrum may be divided into octave bands. Upper limit of each octave is twice lower limit. Each octave may be subdivided into thirds, allowing greater analysis of tones.

Peak particle velocity (PPV) Rate of change of displacement of particles in solid medium due to vibration, measured as mm/s. Usually used to assess vibration in relation to activities such as blasting as correlates well with human perception of vibration and property damage.

Residual level Noise level remaining when specific source is absent or does not contribute to ambient.

Reverberant level Sound pressure level in room where emitted acoustic energy is balanced by room surface absorption, resulting in steady noise level.

R_w Overall sound reduction index provided across a range of frequencies, determined from laboratory measured sound insulating properties of material or building element in each frequency band.

Sound pressure Deviation over ambient atmospheric pressure due to passing sound wave. Human ear is sound pressure detector, and thus acoustic parameters ultimately relate to sound pressure. Sound pressure level is ratio of measured sound pressure to reference value.

Soundscape Acoustic environment as perceived, experienced or understood by listeners, taking context into account.

Specific level $L_{Aeq\ T}$ level produced by specific noise source under consideration during interval T, measured directly or by estimation or calculation.

Tone Character of noise caused by dominance of one or more frequencies which may result in increased noise nuisance.

Z-weighting Standard weighting applied by sound level meters to represent linear scale. Denoted by suffix Z in parameters such as $L_{Zeq\ T}$, $L_{ZF90\ T}$, etc. Typically used to describe spectral band levels.

In this report units are generally presented using US National Institute Of Standards & Technology guidelines.

Uncertainty

u_i Standard uncertainty, related to instrumentation.

c_i Coefficient of sensitivity, specifically related to individual measurement factors listed below.

Residual factor c_i = 1 dB where source dominates, >20 dB where source becomes masked. u_i = 0.5 dB. c_iu_i range = 0.5 to >10 dB.

Weather factor c_iu_i = 2 dB in downwind and crosswind conditions, otherwise c_iu_i >2 dB. Levels representative of contemporaneous conditions only.

Anemometer factor 2 m anemometer height may increase meteorological uncertainty. 10 m height impractical during survey.

Precipitation factor Precipitation = 0 mm during reported intervals. c_iu_i = 0 dB.

Operations factor Levels representative of contemporaneous operating conditions only. c_iu_i <1 dB.

Location factor c_iu_i = 0 dB at free field positions. c_iu_i = 0.4 dB at near field and reflective field positions.

Instrument factor IEC 61672-1 class 1 specifications. u_i = 0.5 dB.

Combined uncertainty 3 dB to >10 dB, depending on position. Variation chiefly due to meteorology and residual noise intrusion.

Expanded uncertainty 6 dB to >10 dB, 95 % coverage.

All reasonable and practical efforts were applied to minimise uncertainty throughout survey.

1 Introduction

1.1 Overview

1.1.1 The applicant proposes to construct stage 1 of the Huntstown Circular Economy Hub at Huntstown, Co. Dublin. Stage 1 will consist of a materials recovery facility (**MRF**) and food container cleaning (**FCC**) plant. An application for planning permission, accompanied by an environmental impact assessment report (**EIAR**), will be submitted to Fingal County Council. Damian Brosnan Acoustics was instructed by O'Callaghan Moran & Associates, on behalf of the applicant, to carry out a noise and vibration impact assessment for inclusion as an appendix to the EIAR.

1.1.2 Potential noise and vibration impacts may be divided into the following categories:

- Construction phase noise impacts on surrounding receptors.
- Construction phase vibration impacts on surrounding receptors.
- Post-completion noise impacts on surrounding receptors.
- Post-completion vibration impacts on surrounding receptors.

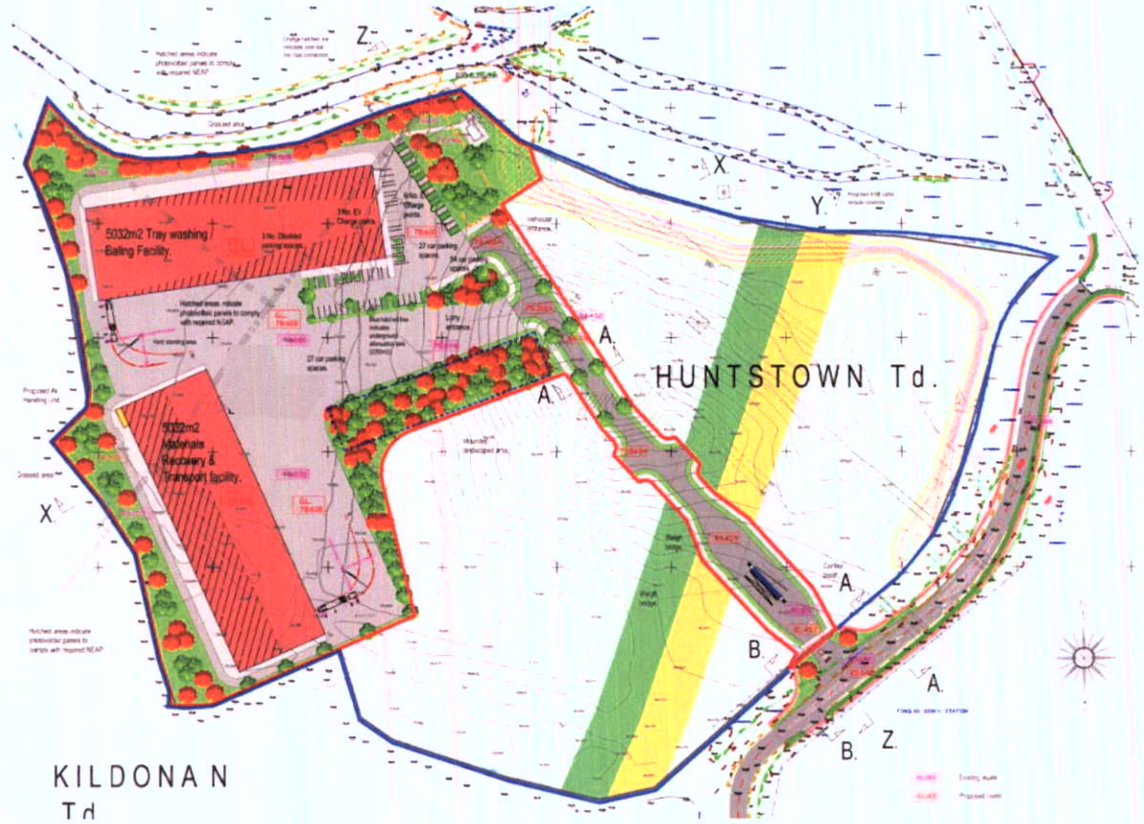
1.1.3 Following a preliminary scoping exercise, it was concluded that the proposed development will not give rise to any vibration impacts following commissioning, and this category has therefore been scoped out. The remaining three categories are assessed in this report.

1.2 Development summary

1.2.1 The proposed Circular Economy Hub will ultimately consist of several industrial buildings on a 21 ha greenfield site at Huntstown. The current application relates to stage 1, consisting of two buildings on a 9.3 ha plot (**figure 1**). One of these will house the MRF facility, while the second will house the FCC facility. The application will also include ancillary infrastructure such as drainage, and certain enabling works relating to subsequent stages of the hub project.

1.2.2 At the MRF, waste streams will be imported to the building by van and truck. Within the building, the various streams will be sorted into recoverable and recyclable streams for subsequent delivery to appropriate facilities. In due course, stages 2 and 3 are likely to include such facilities. Waste streams likely to be processed in the MRF building include residual municipal solid waste, organic waste, dry recyclables, and construction and demolition waste from a mixture of domestic and commercial sources. Processing will be undertaken using stationary processing lines which will variously incorporate a picking station, bag shredder, trommel, overband magnet, eddy current separator and wind sifter. Processed waste streams will be compacted, bale wrapped or stored loosely as appropriate. A mobile grab and front end loader will be used to manage the waste. All operations will be undertaken internally, apart from limited external storage of certain waste streams.

Figure 1: Stage 1 of Huntstown Circular Economy Hub.



1.2.3 At the FCC unit, food trays imported by vans and trucks will be washed, sanitised and dried using a mostly automated process. All operations will be undertaken internally.

1.2.4 Additional plant will include an odour control unit at the MRF, a switch room, back-up generator, and electrical substation. Waste management will be undertaken on a 24/7 basis. In this regard, it is noted that the proposed development site lies in an industrial area. The proposed development will require an industrial emissions licence from the Environmental Protection Agency (**EPA**).

1.3 Assessment methodology

1.3.1 Typical ambient noise levels across the local area were measured, and these used to identify appropriate construction phase noise criteria. Likely construction plant were identified, and their noise emissions data used to predict noise levels at surrounding receptors. Predicted levels were assessed in the context of identified criteria, and mitigation measures identified where required. Potential sources of vibration during the construction phase were also identified, and impacts assessed by reference to commonly applied criteria.

1.3.2 Noise sources associated with the commissioned development were reviewed, and potential impacts assessed in light of relevant criteria. Such impacts relate to operational noise emissions arising onsite, and road traffic. Appropriate mitigation measures were identified.

1.3.3 The assessment was undertaken having regard to guidance set out in *Guidelines on the information to be contained in environmental impact assessment reports* (Environmental Protection Agency, 2022). Several other documents consulted during the preparation of this report are listed in **section 8**, and referenced in the text as appropriate.

1.3.4 This report was prepared by Damian Brosnan (qualifications and experience listed on **page 2**). No difficulties were encountered in preparing the report.

2 Standards & guidance

2.1 Construction phase noise

2.1.1 There are no national mandatory noise limits relating to temporary construction works. In granting planning permission, a local authority may stipulate construction phase noise limits applicable to daytime, evening, night-time and weekend hours as appropriate. There are no national guidelines available regarding the selection of such limits. Many local authorities chose to apply a 65 dB $L_{Aeq\,T}$ limit.

2.1.2 The chief noise guidance document applied in Ireland and the UK in construction phase noise assessments is *British Standard BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise* (2014). Annex E of the document sets out several methods to draw up suitable noise criteria applicable to the construction phase of a project. The most appropriate method here is the 'ABC method', which provides for the selection of criteria based on existing ambient noise data. On the basis of noise data recorded at the study site, as discussed below, a daytime $L_{Aeq\,1\,h}$ criterion of 65 dB is recommended. This criterion is identical to that typically applied by local authorities, and is thus applied in this assessment. The $L_{Aeq\,1\,h}$ parameter describes the total noise emissions from all construction sources occurring during any 1 h period, averaged over that hour.

2.1.3 BS 5228:2009 states that the 65 dB criterion is applicable to the periods Monday-Friday 0700-1900 h and Saturday 0700-1300 h. Construction operations are unlikely to be undertaken during evening or night-time hours or on Sundays. This assessment therefore applies the 65 dB criterion in respect of all construction works.

2.1.4 The 65 dB criterion is considered applicable to surrounding receptors, in their immediate curtilage. In this regard, the Environmental Protection Agency (**EPA**) document *NG4 Guidance note for noise: Licence applications, surveys and assessments in relation to scheduled activities* (2016) defines a noise sensitive location as:

Any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or area of high amenity which for its proper enjoyment requires absence of noise at nuisance levels.

2.1.5 As construction projects tend to be relatively short, and as construction areas are usually localised and mobile, the 65 limit is typically not subject to any additional criteria such as tone and impulse restrictions.

2.2 Construction phase vibration

2.2.1 As with noise, there are no national limits relating to groundborne vibration, and reference is usually made to guidance set out in *British Standard BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration* (2014). **Table 1** presents guidance included in the document with respect to human perception of peak particle velocity (**PPV**), the most commonly applied descriptor of groundborne vibration.

Table 1: Human perception of vibration, from BS 5228-2:2009.

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.
10.0 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

2.2.2 During construction projects, reference is usually made to criteria relevant to buildings, in order to avoid potential cosmetic or structural damage. The National Roads Authority (**NRA**, now TII) document *Good practice guidance for the treatment of noise during the planning of national road schemes* (2014) has seen increasing application to non-road projects due to the absence of any other Irish guidance. NRA criteria, listed in **table 2**, are informed by documents such as *British Standard BS 7385-2:1993 Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration* (1993). The criteria apply at the closest part of any relevant building or structure.

Table 2: Building vibration criteria, from NRA (2014).

Frequency	<10 Hz	10-50 Hz	>50 Hz
PPV	8 mm/s	12.5 mm/s	20 mm/s

2.2.3 NRA limits set out above are considerably lower than criteria recommended by two international authorities, as presented in **table 3**. The criteria presented are those below which cosmetic damage (hairline cracking, etc.) to buildings is unlikely to occur. Limits relating to structural damage are significantly higher.

Table 3: Recommended vibration limits.

Structure	Lower frequencies	Higher frequencies	Source*
Modern dwellings	<40 Hz: 19 mm/s	>40 Hz: 51 mm/s	1
Older dwellings	<40 Hz: 12.7 mm/s	>40 Hz: 51 mm/s	1
Industrial & heavy commercial	4-15 Hz: 50 mm/s	>15 Hz: 50 mm/s	2 & 3
Residential & light commercial	4-15 Hz: 15-20 mm/s	>15 Hz: 20-50 mm/s	2 & 3

*Sources:

1 *US Bureau of Mines Report RI 8507: Structural response and damage produced by ground vibration from surface mines blasting* (1980).

2 *British Standard BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration* (2014).

3 *British Standard BS 7385-2:1993 Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration* (1993).

2.3 Operational phase noise - Absolute

2.3.1 There are no national mandatory noise limits applicable to commissioned developments. With respect to commercial noise emissions, most environmental noise guidance documents issued across Europe ultimately derive limits from guidance issued by the World Health Organisation (**WHO**). The WHO document *Guidelines on community noise* (1999) sets out guideline values considered necessary to protect communities from environmental noise. With respect to residential settings, the document notes that an outdoor $L_{Aeq\ 16\ h}$ level of 55 dB is an indicator of serious annoyance during daytime and evening hours, with 50 dB being an indicator of moderate annoyance.

2.3.2 The 55 dB criterion has become the de facto daytime limit applied by most Irish regulatory authorities to commercial and industrial operators. Although the WHO criterion applies to daytime periods of 16 hours, authorities typically specify shorter periods, and thus limits such as $L_{Aeq\ 15\ min}$, $L_{Aeq\ 30\ min}$ and $L_{Aeq\ 1\ h}$ are variously applied. In issuing licences to industrial and waste management facilities, the EPA typically specifies a daytime $L_{Aeq\ T}$ limit of 55 dB at receptors. The EPA considers daytime to be 0700-1900 h. A similar daytime limit is usually included in noise conditions attached to planning permission issued by local authorities.

2.3.3 The WHO's 1999 guidance document recommends an external night-time criterion of 45 dB to prevent sleep disturbance. Although the WHO document *Night noise guidelines for Europe* (2009) makes reference to a 40 dB night-time criterion, this relates to the $L_{night,outside}$ parameter, which is the long term average measured throughout a whole year. The 45 dB criterion is considered more appropriate for short term measurement intervals. As before, $L_{Aeq\ 15\ min}$, $L_{Aeq\ 30\ min}$ and $L_{Aeq\ 1\ h}$ night-time intervals are variously applied by regulatory authorities, rather than the 8 hour period to which the WHO's 45 dB criterion applies. The EPA considers that night-time refers to 2300-0700 h.

2.3.4 Neither of the WHO documents identified above makes reference to evening periods, and indeed their 1999 document assumes that daytime extends to 2300 h. However, a trend towards the separate assessment of evening impacts is currently evident, partly driven by the EPA's NG4 document. The original 2012 version of the document introduced the evening period 1900-2300 h. The NG4 document recommends an evening criterion of 50 dB, applicable externally at receptors.

2.3.5 Many authorities require that a penalty be added to measured noise levels where emissions are tonal and/or impulsive. NG4 specifies the addition of a 5 dB penalty to site specific $L_{Aeq\ T}$ levels measured during daytime or evening hours. During night-time hours, the EPA prohibits tones and impulses entirely, stating that such characteristics should not be 'clearly audible or measurable'.

2.3.6 The proposed development will require an industrial emissions licence from the EPA. In assessing the licence application, the EPA is likely to have regard to their NG4 document. NG4 criteria are set out in **table 4**. The criteria are considered relevant to noise sources at the proposed development. Rather than allowing daytime and evening levels to be rated for tonal or impulsive features, the table assumes that such features are avoided at all times. Criteria apply externally at receptors.

Table 4: Noise criteria recommended by the EPA.

Period	Parameter	Limit
0700-1900 h	$L_{Aeq\ T}$	55 dB
1900-2300 h	$L_{Aeq\ T}$	50 dB
2300-0700 h	$L_{Aeq\ T}$	45 dB

2.3.7 The NG4 document includes a methodology to derive lower limits where a site is located in a 'quiet area' or an 'area of low background noise'. The proposed development site is not located in a quiet area, being situated in proximity to several major roads, and a number of industrial and infrastructural facilities. Noise levels measured in the local area, as discussed below, indicate that the development site is also not located in an area of low background noise. Thus lower criteria are not warranted, and **table 4** criteria are considered relevant to this assessment.

2.4 Operational phase noise - Relative

2.4.1 In addition to the absolute criteria set out in **table 4**, the impact of noise emissions from commercial sources may be assessed by reference to relative criteria. The most commonly applied standard here is *British Standard BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound* (2019) which provides for the comparison of specific $L_{Aeq\ T}$ levels (i.e. noise levels attributable to the source in question) with background levels, and provides an indication of impact depending on the difference. Specific levels may be rated to take tonal, impulsive and other characteristics into account. The standard notes that the background noise environment may include existing industrial emissions unrelated to the specific source.

2.4.2 BS 4142:2014 states that a difference of 10 dB or more between specific and background levels indicates a significant adverse impact. A difference of 5 dB suggests an adverse impact, with lower differences suggesting reduced impacts. The standard adds that the perception of impact will be increased or reduced depending on local context.

2.4.3 Noise impacts may also be assessed by reference to *Guidelines for environmental noise impact assessment* (Institute of Environmental Management & Assessment, 2014) (**IEMA**) which sets out guidance on impacts by comparison with ambient levels. **Table 5** sets out a scale adapted from IEMA and EPA guidance. The table is considered relevant to total ambient $L_{Aeq\ T}$ levels i.e. $L_{Aeq\ T}$ levels attributable to the proposed development may be compared to existing $L_{Aeq\ T}$ levels.

Table 5: Assessment of impact by reference to increase over existing noise levels.

Change	Impact	Effect
<2 dB	Imperceptible	Capable of measurement, but without significant consequences
2-4 dB	Not significant	Causes noticeable changes to soundscape, but without significant consequences
4-6 dB	Slight	Causes noticeable changes to soundscape without affecting its sensitivities
6-10 dB	Moderate	Alters soundscape in manner consistent with existing and emerging baseline trends
10-15 dB	Significant	Alters soundscape due to source character, magnitude, duration or intensity
15-20 dB	Very significant	Significantly alters soundscape due to source character, magnitude, duration or intensity
>20 dB	Profound	Obliterates soundscape

2.4.4 Local offsite receptors are currently subject to existing traffic noise levels on the surrounding road network. The proposed development will increase traffic volumes locally, with a consequent increase in traffic noise levels. The *Design manual for roads and bridges* (UK Highway Agency, 2011) (**DMRB**) notes that the resulting noise impact is linked to the magnitude of the noise increase. **Table 6** sets out the DMRB guidance. Included in the table are impact categories listed by the EPA in their 2022 EIAR guidance document.

Table 6: DMRB assessment guidance.

Increase	Subjective rection	DMRB impact	EPA impact
0 dB	None	No change	Neutral
0-3 dB	Imperceptible	Negligible	Imperceptible to not significant
3-5 dB	Perceptible	Minor	Not significant to slight
5-10 dB	Up to a doubling of loudness	Moderate	Slight to moderate
>10 dB	Doubling of loudness or greater	Major	Significant to profound

2.5 Noise action plan

2.5.1 The *Draft noise action plan for Fingal County 2019-2023* (Fingal County Council, 2018) describes a strategic plan based on noise mapping undertaken in 2017 ('round 3' mapping). Preparation of the plan is a requirement of *Directive 2002/49/EC of the European Parliament and of the Council relating to the assessment and management of environmental noise* (2002), transposed into Irish law by the *European Communities (environmental noise) Regulations 2018* (SI No. 549/2018). The directive requires preparation of noise plans for all roads with annual traffic volumes over 3 million vehicles. The nearest major roads are the M50 motorway and national route N2 which run to the south and east of the site respectively, within several hundred metres. A number of other roads to the north (L3125), east (North Road and R122), and west (L3120 and Cappagh Road) are also subject to mapping.

2.5.2 The noise action plan proposes the following limits:

- Desirable low noise levels are defined as areas with a daytime level below 55 dB and/or a night-time level below 50 dB.
- Undesirable high noise levels are defined as areas where daytime and night-time levels exceed 70 and 55 dB respectively.
- Absolute daytime and night-time values below 55 and 45 dB define a 'quiet area'.
- Perceived or 'relatively quiet' areas are those which provide a perceived sense of tranquillity despite their proximity to areas of high noise.

2.5.3 While larger rail lines are subject to mapping, there are no lines in proximity. However, Dublin Airport, which lies within 2 km of the development site, is subject to a separate noise action plan, titled *Draft noise action plan for Dublin Airport 2019-2023* (Fingal County Council, 2018). Planning policy guidance in the plan relates chiefly to encroachment of sensitive development towards the airport. The proposed development does not constitute sensitive development.

3 Baseline

3.1 Location

3.1.1 The proposed development site is located on the northwest side of the M50-N2 interchange. The stage 1 plot, to which to which this application refers, lies at the western end of the proposed Circular Economy Hub site. The overall hub site is shown in **figure 2**. The 9.3 ha stage 1 site is positioned 290 m from the N2, and 480 m from the M50. The site topography is level, and is currently under grass.

3.1.2 The site is accessed from North Road, a cul de sac which runs parallel to the N2, serving a number of dwellings and facilities in the Huntstown and Coldwinters area. Facilities located in this area include a large electrical transformer station situated immediately adjacent to the interchange. Access to the proposed development site will be provided from a private roadway serving the transformer station and a residential dwelling. Other facilities in the local area include a bioenergy facility 130 m from the site's northwest corner, and Huntstown power station further northwest. The access road serving these also serves a large active quarry and soil recovery facility. A number of commercial premises lie along North Road, including the Dog's Trust complex.

Figure 2: Proposed stage 1 site delineated yellow.

N

3.2 Receptors

3.2.1 There are no receptors on the proposed development site. Despite the commercial character of the area, a number of residential dwellings lie in proximity to the development site (**figure 3**). The nearest receptors are as follows:

- A cluster of three dwellings lies 220 m east of the site on North Road, representing the nearest receptors. One of these houses a veterinary clinic.
- Scattered dwellings lie further north, including the Ravenswood Estate community housing project at 830 m.
- An isolated farmhouse 280 m southwest of the site (Kildonan House) is accessed from the private road serving the transformer station. It is unclear if the dwelling is currently occupied.

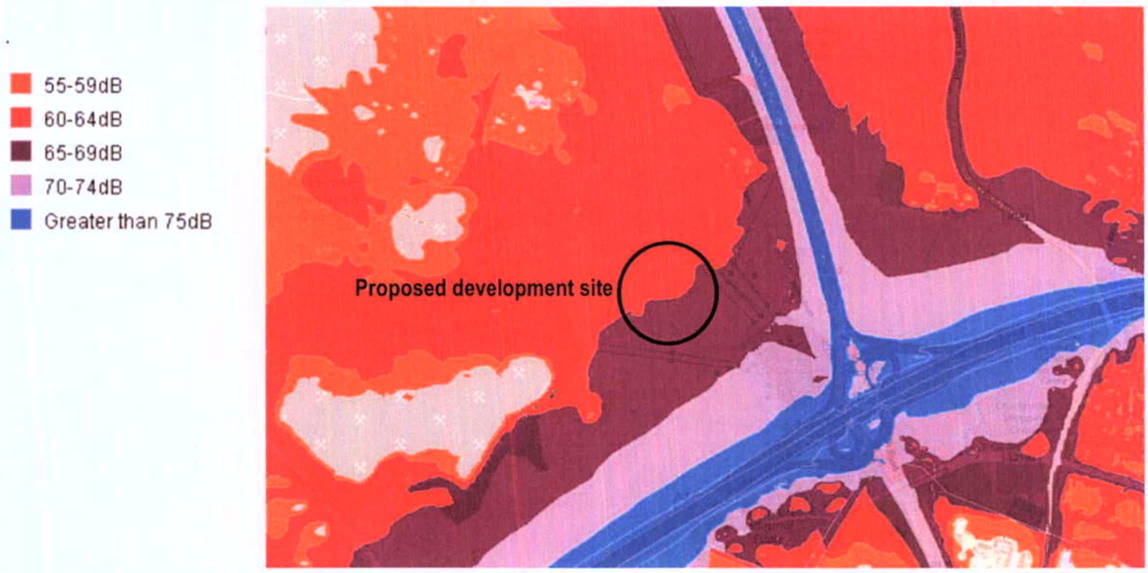
3.2.2 Other receptors are scattered in several directions, all of which lie over 700 m from the site. A number of residential estates lie to the south and southeast, in addition to apartment complexes at Charlestown. Given the elevated ambient noise levels across the study area, as discussed below, receptors beyond 500 m are highly likely to be outside audible range of the proposed project.

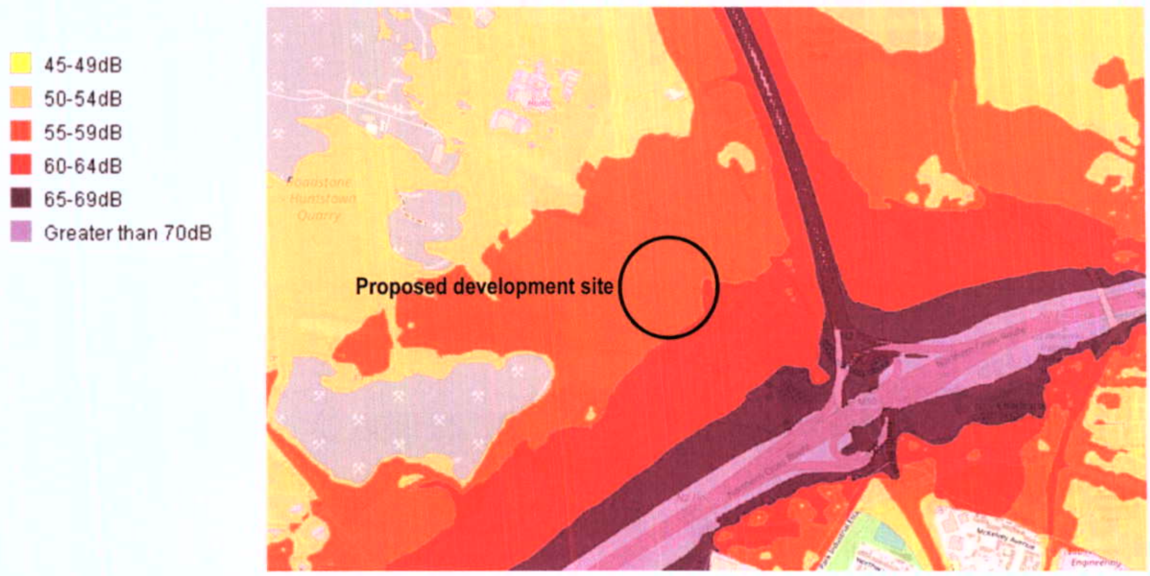
Figure 3: Nearest residential receptors, delineated white. The Ravenswood Estate community housing project is delineated yellow, and the Baleskin reception centre orange. N

3.2.3 All receptors in proximity to the site are residential. There are no particularly vulnerable receptors such as hospitals or nursing homes within 500 m. Commercial and power-related facilities, including their offices, are not considered noise sensitive. The dog's trust facility to the north is also not considered a noise sensitive location.

3.3 Noise mapping

3.3.1 The *Draft noise action plan for Fingal County 2019-2023* includes maps relating to the road network in the vicinity of the site, as required by Directive 2002/49/EC. Relevant traffic mapping is shown in **figures 4 & 5**. L_{den} levels at the proposed development site reach 65 dB, and exceed 65 dB at the nearest dwelling cluster on North Road as well as at Kildonan House to the southwest. L_{night} levels are also elevated, exceeding 55 dB across the local area. These levels are high, reflecting the 24 h dominance of road traffic, and approach the 'undesirable high' noise level thresholds set out in the noise action plan. On this basis, it is evident that the proposed development site is unlikely to be suitable for residential development without considerable mitigation measures. The site is, however, suitable for a proposed waste management facility.





3.3.2 Noise mapping presented in the *Draft noise action plan for Dublin Airport 2019-2023* (**figures 6 & 7**) indicates that the proposed development site and nearest receptors lie immediately outside mapped noise contours.

Figure 6 ⇨

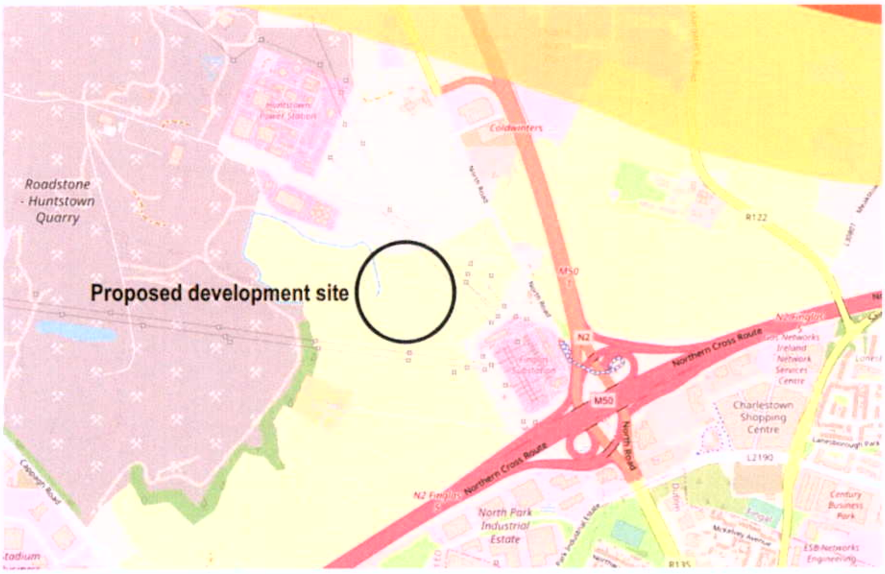
Air traffic L_{den} contours.

- 55-59dB
- 60-64dB
- 65-69dB
- 70-74dB
- Greater than 75dB

Figure 7 ⇨

Air traffic L_{night} contours.

- 45-49dB
- 50-54dB
- 55-59dB
- 60-64dB
- 65-69dB
- Greater than 70dB



3.4 Noise survey

3.4.1 In order to quantify the local noise environment, a baseline noise survey was undertaken 23.02.23—24.02.23. Monitoring was carried out at three positions described in **table 7**, and shown in **figure 8** and **photographs 1-3**. Survey methodology, equipment specifications and weather conditions are listed in **table 8**. Recorded time history profiles are shown in **figures 9-11**. Noise data are presented in **table 9** and summarised in **table 10**.

Table 7: Baseline noise stations.

Ref.	ITM NGR	Description	Purpose
N1	711650 740917	SW corner of site	To represent farmhouse to SW (access to farmhouse not possible)
N2	711992 741125	Adjacent to North Road, 200 m E of site boundary	To represent 3 dwellings nearby
N3	711893 741310	Field NW of site, 190 m from site boundary	To represent 3 dwellings nearby

Photograph 1 ⇨
N1, looking SW towards distant farmhouse.

Photograph 2 ⇨
N2, looking SE towards dwelling on North Road.

Photograph 3 ⇨
N3, looking N towards dwellings on North Road.

Figure 8: Baseline noise stations.

N

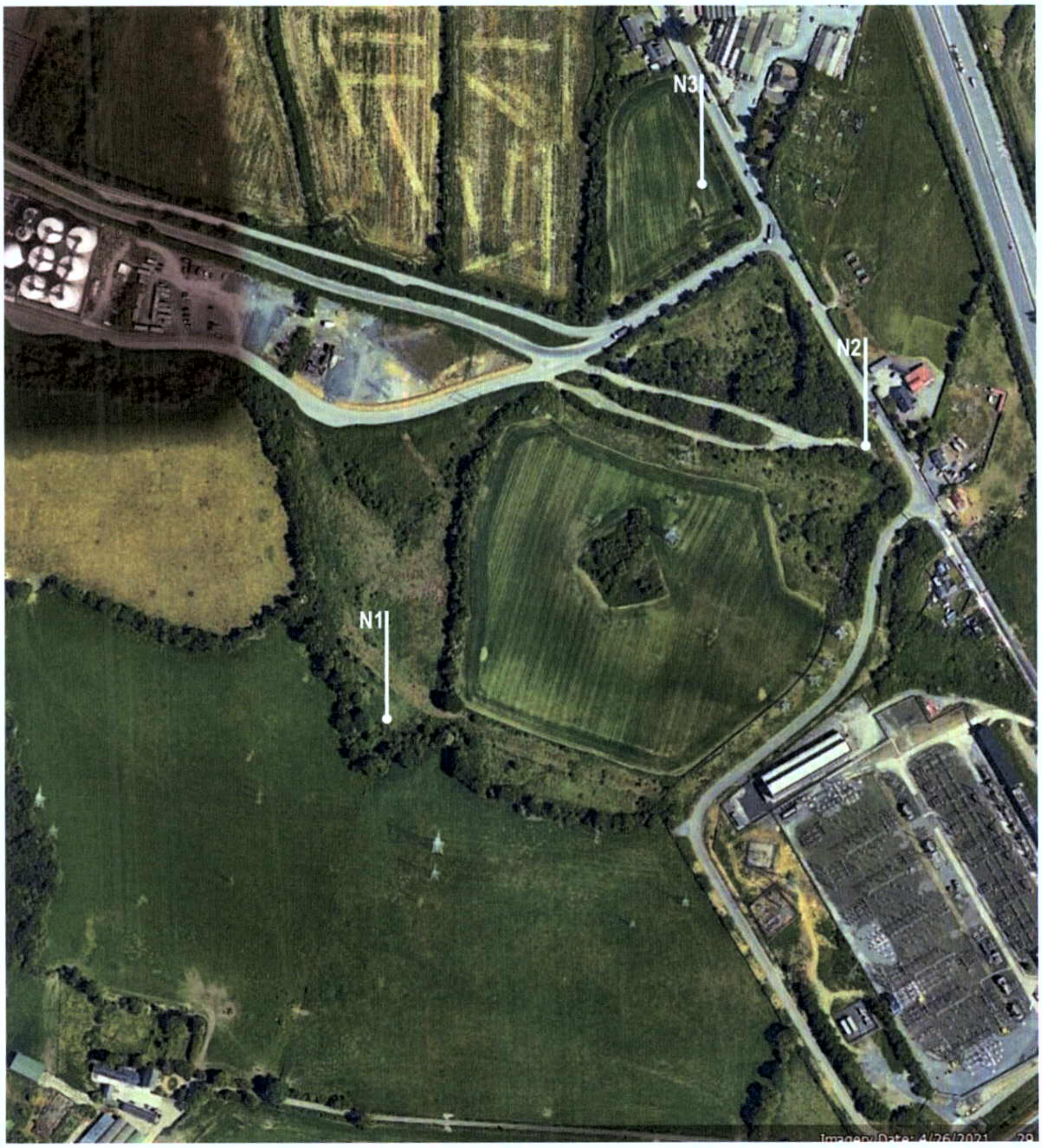


Figure 9: $L_{Aeq\ 1\ s}$ profile at N1.

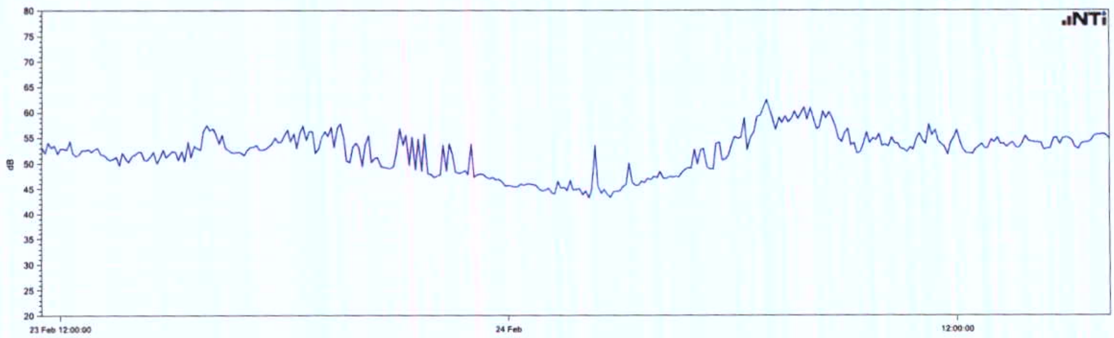


Figure 10: $L_{Aeq\ 1\ s}$ profile at N2.

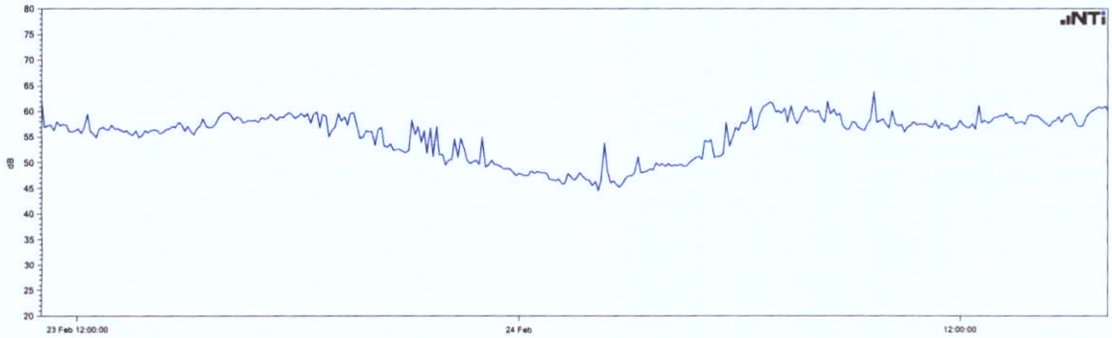


Figure 11: $L_{Aeq\ 1\ s}$ profile at N3.

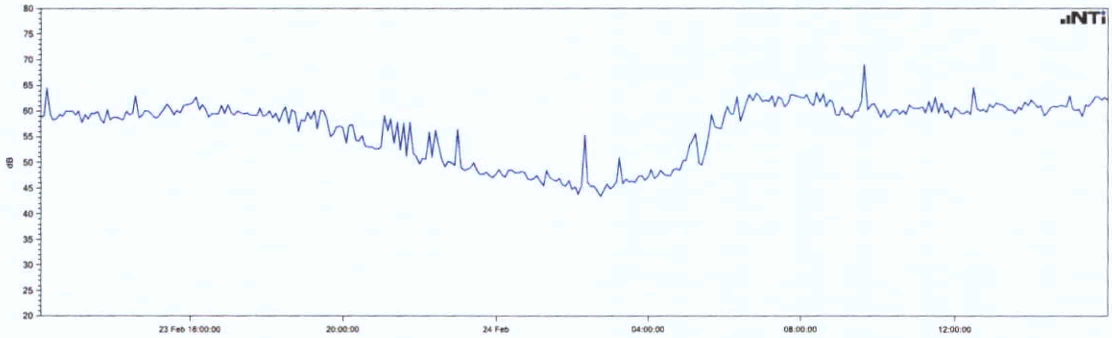


Table 8: Baseline survey details.

Weather	
Cloud cover	20 % at set up, increasing to 100 % overnight, clearing to 30 % on 24.02.23
Precipitation	0 mm
Temperature	9 °C at set up, falling to 8 °C overnight, rising to 10 °C on 24.02.23
Wind direction	NE on 23.02.23, veering NW overnight, and remaining at NW on 24.02.23
Wind speed	0-3 m/s throughout
WS measurement	Anemo anemometer 2 m above ground level
Field details	
DB1 calibration	Station N2 23.02.23 1050 @ 39.3 mV/Pa
DB4 calibration	Station N3 23.02.23 1143 @ 39.8 mV/Pa
DB5 calibration	Station N1 23.02.23 1117 @ 41.9 mV/Pa
Acoustic field	Free field
Microphone height	1.5 m above ground level
Standard	ISO 1996 (2016 & 2017)
Survey operator	Damian Brosnan BSc MSc MIOA MIEI
Instruments	
Calibrator	Bruel & Kjaer Type 4231 Serial: 3017723 Verification: 16.02.22
SLM DB1	NTi Audio XL2 Serial A2A-13658-E0 Microphone A14735 Pre-amp 7066 Verification 13.05.21
SLM DB4	NTi Audio XL2 Serial A2A-15429-E0 Microphone A16329 Pre-amp 7945 Verification 16.02.22
SLM DB5	NTi Audio XL2 Serial A2A-17932-E0 Microphone A18747 Pre-amp 9220 Verification 17.02.22
Certificates	Available on request

Table 9: Noise data (dB).

Station ⇨	N1			N2			N3		
Interval ⇩	$L_{Aeq\,T}$	$L_{AF10\,T}$	$L_{AF90\,T}$	$L_{Aeq\,T}$	$L_{AF10\,T}$	$L_{AF90\,T}$	$L_{Aeq\,T}$	$L_{AF10\,T}$	$L_{AF90\,T}$
1100-1130	-	-	-	57	59	55	-	-	-
1130-1200	53	54	50	57	59	55	-	-	-
1200-1230	53	54	50	57	58	54	60	62	56
1230-1300	53	54	50	57	58	55	60	62	56
1300-1330	51	53	49	56	58	54	59	62	56
1330-1400	51	53	49	56	57	54	59	61	55
1400-1430	52	53	49	56	58	54	59	62	55
1430-1500	52	53	49	57	58	55	60	63	56
1500-1530	52	54	49	57	59	55	60	63	56
1530-1600	55	59	50	58	61	56	61	63	57
1600-1630	55	57	52	59	60	57	61	63	58
1630-1700	52	53	51	58	59	57	60	62	58
1700-1730	53	54	51	59	60	57	60	61	58
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1800-1830	56	59	52	59	61	56	60	62	56
1830-1900	55	56	51	58	59	54	59	61	55
1900-1930	56	60	51	59	61	55	59	63	55
1930-2000	53	56	49	56	58	53	57	59	53
2000-2030	52	52	49	55	55	52	56	57	52
2030-2100	50	50	48	52	54	51	53	55	51
2100-2130	54	58	48	56	59	51	57	60	51
2130-2200	52	51	47	54	54	49	55	54	49
2200-2230	51	51	47	53	53	50	54	53	49
2230-2300	50	49	47	51	51	49	52	52	48
2300-2330	48	49	46	50	51	48	49	51	47
2330-0000	46	48	45	48	50	47	48	49	46
0000-0030	46	47	44	48	49	47	48	50	46
0030-0100	45	47	43	47	49	46	47	49	45
0100-0130	45	47	43	47	48	45	47	49	44
0130-0200	45	47	43	47	49	44	46	48	43
0200-0230	48	47	42	49	49	44	49	47	43
0230-0300	44	46	42	46	48	44	45	46	43
0300-0330	47	47	44	49	50	46	47	48	44
0330-0400	47	48	45	49	51	47	47	48	45
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1330-1400	54	56	52	59	60	56	61	63	58
1400-1430	54	55	51	58	60	56	60	63	57
1430-1500	55	56	52	59	61	57	61	63	58
1500-1530	54	56	52	58	60	56	60	62	57
1530-1600	55	57	53	61	62	58	62	64	60

Table 10: Noise data summary (dB). Data for the period 1100-1600 h used in the L_{den} calculation are taken from 23.02.23. Averages are arithmetic.

Period ⇩	Station ⇨	N1		N2		N3	
		Range	Average	Range	Average	Range	Average
0700-1900 h	$L_{Aeq\ 30\ min}$	51-60	54	56-61	58	59-64	61
	$L_{AF10\ 30\ min}$	53-63	56	57-63	60	61-65	63
	$L_{AF90\ 30\ min}$	49-54	51	54-58	56	55-60	57
1900-2300 h	$L_{Aeq\ 30\ min}$	50-56	52	51-59	55	52-59	55
	$L_{AF10\ 30\ min}$	49-60	53	51-61	56	52-63	57
	$L_{AF90\ 30\ min}$	47-51	48	49-55	51	48-55	51
2300-0700 h	$L_{Aeq\ 30\ min}$	44-60	49	46-61	51	45-63	50
	$L_{AF10\ 30\ min}$	46-63	50	48-64	52	46-66	52
	$L_{AF90\ 30\ min}$	42-53	46	44-57	48	43-57	47
24 h	L_{den}	59		61		62	
2300-0700	L_{night}	52		53		54	

3.4.2 The soundscape at all three stations was entirely dominated by distant road traffic, with traffic on national route N2 being more intrusive than M50 traffic. Intermittent North Road traffic was also significant at station N3, chiefly associated with truck movements related to the nearby Roadstone quarry. All three stations were influenced by local bird song/calls and aircraft movements. Noise emissions from quarry plant were slightly audible at N1.

3.4.3 The dominance of distant traffic is reflected in the relatively high noise levels measured, and in particular the elevated $L_{AF90\ 30\ min}$ levels. Daytime and evening $L_{AF90\ 30\ min}$ levels exhibit a narrow range, suggesting little or no break in distant traffic. Night-time levels show a wider range, attributable to occasional lulls in traffic. L_{den} and L_{night} levels measured across all three stations are relatively high.

3.4.4 **Table 11** presents a comparison of measured and mapped road traffic L_{den} and L_{night} levels at the three baseline stations. Mapped levels are estimated from mapping contours. At all three stations, measured levels are lower than mapped levels. Relatively large discrepancies were observed at N1 and N2, being greater than the 1-4 dB discrepancy typically observed in most projects. The most likely explanation here is that the northeast and northwest breezes prevailing during the survey significantly minimised M50 traffic noise levels, and indeed it was noted during the survey that N2 traffic noise masked M50 traffic noise. In contrast, traffic noise mapping indicates that M50 noise contours ordinarily exhibit a considerably wider corridor than N2 contours.

Table 11: Comparison of measured and mapped road traffic L_{den} and L_{night} levels (dB).

Station ⇨	N1		N2		N3	
Parameter ⇨	L_{den}	L_{night}	L_{den}	L_{night}	L_{den}	L_{night}
Measured	59	52	61	53	62	54
Mapped	66	58	68	60	64	58
Discrepancy	7	6	7	7	2	4

3.5 Future trends

3.5.1 EPA EIAR guidance recommends that a noise impact assessment should include a description of the likely evolution of the future receiving acoustic environment in the absence of the proposed development. The local noise environment is urban in character, being dominated by road traffic noise on a 24/7 basis. Traffic volumes are likely to continue to increase into the future, resulting in gradually increasing noise levels. While engine noise emissions will reduce due to increasing take-up of electric vehicles, it is noted that traffic noise above 50 km/h arises chiefly from tyre noise, and such tyre noise is unlikely to be less in electric vehicles. Thus the increasing proportion of electric vehicles in the national car fleet is unlikely to result in a decrease in traffic noise levels across the study site.

3.5.2 With respect to the development site itself, it is expected that, should the proposed development not proceed (the 'do nothing' scenario), no noise emissions are expected to arise other than those from land management practices, depending on how the site is used into the future.

4 Construction phase impacts

4.1 Construction noise

4.1.1 Construction will commence within six months of grant of planning permission, and will be managed from a temporary onsite compound. The overall construction project is expected to last 14 months. Construction hours will generally be 0700-1900 Monday-Friday and 0800 to 1400 on Saturday, but may vary. Construction works will include the following activities, undertaken variously throughout the construction phase and in different areas of the site:

- Soil stripping and temporary stockpiling.
- Installation of a temporary site compound.
- Provision of hardcore stone on yard areas.
- Excavation of foundations and services trenches.
- Installation of services.
- Steel frame erection.
- Pouring and floating of floor slabs.
- Block work, cladding and roof work.
- Building fit out and installation of plant.
- Laying of yard surfaces.
- Site landscaping.

4.1.2 During the construction phase, the chief source of noise emissions will be plant used onsite. Construction plant required onsite at various stages of the project is listed in **table 12**. The table includes details of typical sound pressure levels, taken from BS 5228-1:2009.

Table 12: Expected construction plant required across site (band $L_{Zeq\,T}$ dB at 10 m, and total $L_{Aeq\,T}$).

Plant	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Total $L_{Aeq\,T}$
Discharging concrete mixer truck	80	69	66	70	71	69	64	58	75
Tracked excavator (22 t)	80	83	76	73	72	70	69	66	78
Wheeled backhoe loader (9 t)	68	67	63	62	62	61	54	47	67
Lifting platform	78	76	62	63	60	59	58	49	67
Mobile generator	78	71	66	62	59	55	56	49	65
Dumper	84	81	74	73	72	68	61	53	76
6x6 dump truck	88	90	80	79	76	71	65	61	81
Vibro-roller	88	83	69	68	67	65	62	59	74
Telescopic handler	85	79	69	67	64	62	56	47	71
Truck (driving)	73	78	78	78	74	73	68	66	80

4.1.3 Noise emissions arising during the construction phase of the proposed development will vary considerably due to several reasons:

- Throughout the construction phase, plant associated with different activities will relocate around the site as required.
- Different plant will be required at different times, and construction operations will vary on a daily basis.
- Each machine may operate under different loading conditions or be in varying states of repair.
- Construction works may be concentrated for certain periods, followed by periods of inactivity. Localised works may require several hours of intense activity.
- During later stages of the construction phase, emissions from some operations will be screened by previously completed structures.

4.1.4 From the foregoing, it is clear that construction phase noise emissions will vary, and it is not possible or practical to calculate a single sound power output figure for the entire site. With respect to surrounding noise sensitive receptors, worst case scenario emissions will arise when localised works are undertaken close to their respective boundaries. An extreme worst case scenario consists of construction activity simultaneously occurring at the nearest points to offsite receptors, involving plant with the greatest noise output. In this scenario, operations may occur simultaneously in two zones:

- Zone 1: Construction works near the northeast corner.
- Zone 2: Construction works near the southwest corner.

4.1.5 For the purposes of modelling, it is assumed that operations in both zones will involve a tracked excavator, discharging mixer truck, 6x6 dump truck and telescopic handler in simultaneous use at the nearest point of the works zone. Such a scenario is unlikely to arise, but is applied here to represent an extreme worst case scenario. Noise emissions from these were modelled using DGMR iNoise Pro v2022 software. Input parameters were as follows:

- Model algorithm: *International Standard ISO 9613-2:1996 Acoustics: Attenuation of sound during propagation outdoors – Part 2 General method of calculation* (1996).

- Ground cover: Bare and compacted ground assumed in work areas, otherwise ground under grass.
- Screening: None.
- Conditions: 10 °C and 70 % RH.
- Receiver height: 4 m.
- Plant output data taken from **table 12**. 31.5 Hz levels (not provided in BS 5228) assumed to be same as 63 Hz levels.

4.1.6 The model output is shown in **figure 12**. $L_{Aeq\ 1\ h}$ levels predicted at receptors are listed in **table 13**. Levels will be considerably lower than the 65 dB criterion discussed in **section 2.1**.

Figure 12: Predicted construction phase $L_{Aeq\ 1\ h}$ levels.

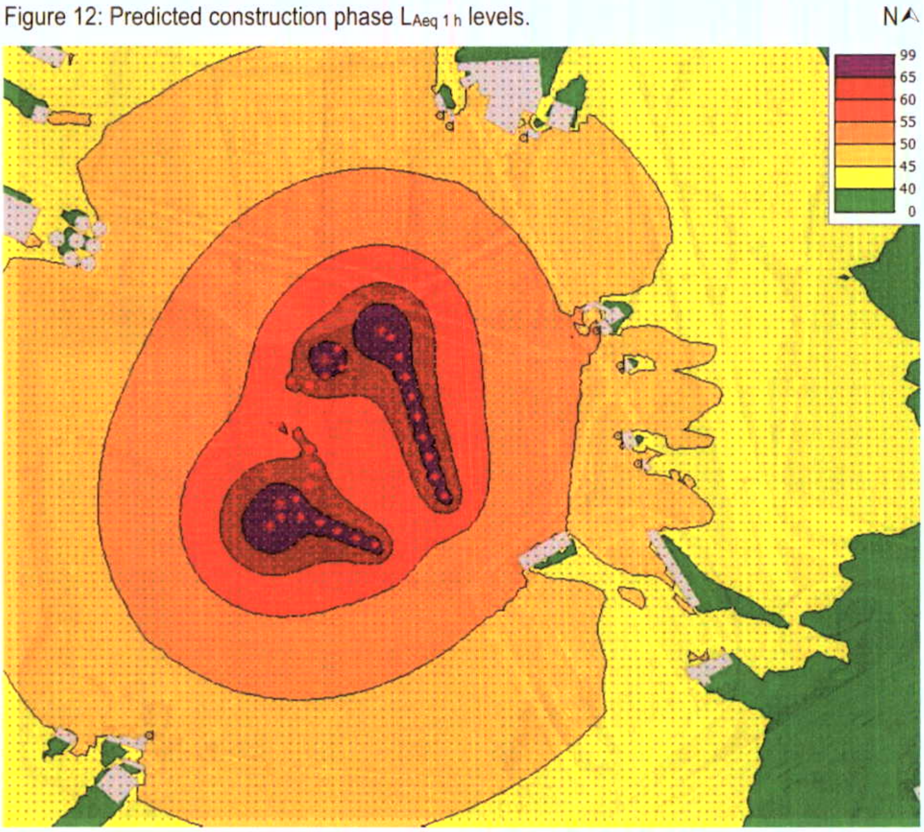


Table 13: Worst case scenario construction phase $L_{Aeq\ 1\ h}$ levels predicted at receptors (dB).

Receptor	$L_{Aeq\ 1\ h}$
Kildonan House to SW	48
Dwelling E of site, S of access road entrance	48
Dwelling opposite access road entrance	50
Veterinary clinic dwelling	51
2 dwellings opposite commercial park to N	48-49
Dwelling at commercial park to N	48

4.2 Construction traffic

4.2.1 During the construction phase, vehicles will arrive at, and depart from, the site during the working day. Vehicle movements will be associated with workers' arrival and departure, and delivery of materials. The approximate numbers of workers employed onsite over the entire construction period will fluctuate depending on schedule. Numbers are unlikely to exceed 60 at any time. Construction traffic volumes will be inconsequential in the context of existing truck traffic associated with a number of existing commercial facilities, particularly a substantial quarry and soil recovery facility at Huntstown. Thus construction phase traffic noise impacts are expected to be imperceptible.

4.3 Construction vibration

4.3.1 Potential sources of groundborne vibration during the construction phase are as follows:

- Delivery truck movements: Trucks may give rise to vibration at positions adjacent to the road. However, such emissions are typically imperceptible beyond 10 m, and are highly unlikely to be perceptible at dwellings alongside site access routes. North Road is currently subject to a large number of daily truck movements.
- Plant movements: The movement of plant onsite is not considered to constitute a source of groundborne vibration, and is not listed in typical vibration documents such as BS 5228-2:2009. In addition, plant machinery used onsite is likely to be small to mid-sized, and similar to those used on other urban construction projects.
- Ground works: Excavation of trenches and pits for foundation and services will be required. These activities are not typically associated with offsite groundborne vibration impacts. Piling is not proposed. In addition, rock breaking is unlikely to be required.
- Vibro-rolling: While the vibro-roller will generate high levels of vibration at the point of operation, experience at other sites indicates that such vibration is typically immeasurable beyond 50 m.

4.3.2 On the basis of the foregoing, PPV levels at all receptors are expected to be considerably lower than criteria listed in **tables 1-3**, and indeed are expected to be below measurement threshold. It follows that construction operations are unlikely to be perceptible offsite, or to cause cosmetic or structural damage to buildings.

4.4 Overall construction phase impacts

4.4.1 Construction phase noise levels at all receptors will be markedly lower than the 65 dB criterion recommended by BS 5228:2009. BS 5228:2009 source noise data suggest that construction phase emissions will not be tonal. Apart from hammering, emissions are also unlikely to be impulsive. Hammering will be sporadic. Associated noise emissions will be brief and localized.

4.4.2 It is reiterated here that the above predictions are based on an entirely worst case scenario, with simultaneous operation of several plant items at the nearest respective points of the site. These activities are highly unlikely to be undertaken at the same time due to project phasing and working logistics. Typically, most operations at a particular location onsite require just 1-2 machines. Thus, throughout the entire construction phase, $L_{Aeq\ 1\ h}$ levels at receptors are expected to be considerably lower than the 65 dB criterion. On this basis, construction phase noise impacts will be temporary and not significant.

4.4.3 No impacts are expected in relation to construction traffic. In addition, no vibration impacts are expected.

5 Operational phase impacts

5.1 Noise emissions

5.1.1 The proposed development is summarised in **section 1.2**. The development will consist of two similarly sized buildings, at the northwest and southwest corners of the site (see **figure 1** above). The former will house the FTC operation, while the latter will house the MRF facility. At both units, waste streams will be imported by vans and trucks.

5.1.2 Within the MRF, noise emissions will arise from the following sources:

- Stationary processing lines which will variously include trommels, shredders, optical separators, magnets, eddy current separators, wind sifters, picking lines, compactor units and bale wrapping units.
- The C&D processing line will additionally include crushing and screening equipment.
- A mobile grab and front end loader will be used to manage waste.
- A telescopic loader will be used to manage bulky items, and to load baled waste onto trucks for offsite delivery.
- Negative air pressure will be maintained in the building using an air management system which will also include an odour control unit. This system will be installed at the rear of the building, and will discharge through a 16 m stack.

5.1.3 In the FCC building, the following sources will generate noise emissions:

- Trays, crates, and similar items used in the food industry will be washed and sanitised by an automated cleaning line. The line will be managed by several employees.
- Up to two electric forklift trucks will be used to move tray and crate stacks within the building, upstream and downstream of the cleaning line, including loading/unloading of vans and trucks.

5.1.4 All MRF and FCC operations will be confined to the respective buildings. Access to the buildings will be provided by roller shutter doors. In the MRF building, these doors will be fast-acting in order to assist in maintenance of negative air pressure and odour control. No external activities will be undertaken, apart from vehicle movements on yards, and limited external storage of certain baled MRF waste streams pending removal offsite. Management of the latter will require occasional telescopic loader activity in the external yard.

5.1.5 Additional noise sources will include a switch room and electrical room. Noise emissions from these will be negligible. A proposed back-up generator will be used only during power outages, and will not constitute a routine noise source.

5.1.6 The site will be accessed at intervals throughout the day by vans and trucks. The number of truck movements is expected to average 162 during the daytime (i.e. 81 inward and 81 outward trips), with a typical hourly maximum of 19 movements during peak hours. A small number of movements may occur during the evening and night-time, falling to an expected average of two movements per hour. All vehicles will enter and exit the site via a gate on the southern boundary. Employees will park in a carpark near the proposed FTC building. In the context of existing traffic noise in the local area, noise emissions from employee car movements will be negligible.

5.1.7 It is proposed to undertake waste management operations on a 24/7 basis. Thus operations in both buildings will be carried out through the evening and night-time. Vehicle movements will also arise on a 24/7 basis, subject to permission, although traffic movements during the evening and night-time will be sporadic.

5.1.8 Expected noise emissions associated with the above sources are listed in **table 14**. Noise data previously measured by Damian Brosnan Acoustics at several facilities indicate that noise emissions from electric forklift trucks in the FCC unit will be entirely negligible in the context of emissions from the washing line, and forklift truck emissions may therefore be discounted.

Table 14: Operational plant noise emissions (dB, band levels Z-weighted).

Plant	31.5 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Total $L_{Aeq\,T}$
MRF internal operations[1]	79	82	84	83	80	76	78	73	68	84
Mobile grab[2]	64	64	60	63	64	62	57	51	45	66
Telescopic loader[3]	85	85	79	69	67	64	62	56	47	71
Air management & odour plant[4]	89	75	72	71	71	67	65	61	61	73
FTC washing line[5]	73	74	84	80	78	75	68	66	62	80
Truck[6]	111	104	100	101	101	101	96	90	85	104

Data source:

[1]Reverberant $L_{Zeq\,T}$ levels measured in building at similar facility (processing lines and front end loader) in Dublin measured 2021 by Damian Brosnan Acoustics.

[2]Wheeled excavator $L_{Zeq\,T}$ at 10 m, from BS 5228:2009. 31.5 Hz value assumed to be same as 63 Hz value.

[3]$L_{Zeq\,T}$ at 10 m, from BS 5228:2009. 31.5 Hz value assumed to be same as 63 Hz value.

[4]Noise emissions data are currently unavailable for the proposed odour control unit. Data measured at other sites suggest a typical A-weighted sound power level of 72-74 dB. Spectral data are unavailable, and data from a cooling tower are applied pro rata here, given that both sources generate a similar broadband spectrum.

[5]Noise data are currently available. Noise data measured 2018 by Damian Brosnan Acoustics at an IBC washing facility in Dublin indicate a reverberant $L_{Aeq\,T}$ level of 81 dB. On the assumption that the applicant will be required to achieve occupational health noise criteria, a reverberant $L_{Aeq\,T}$ level of 80 dB is applied here. Spectral data are taken from the 2018 measurement, adjusted pro rata.

[7]Sound power level taken from the DGMR iNoise database.

5.1.9 For the purposes of predictive modelling, three scenarios were identified:

- Daytime: All processing operations underway in both buildings, including stationary processing lines, grab and loader activity in the MRF building, with both forklift trucks in use in the FCC building. In addition, telescopic loader activity on the external yard near the MRF building. MRF air management plant and odour control unit operating continuously. 19 truck and 10 van movements per hour assumed.
- Evening: As during the daytime, with truck and van movements each reducing to four movements per hour.
- Night-time: As during the evening, with movements further reducing to two per hour.

5.1.10 Noise levels associated with the three scenarios were modelled using DGMR iNoise Pro v2022 software. Input parameters were as follows:

- Model algorithm: *International Standard ISO 9613-2:1996 Acoustics: Attenuation of sound during propagation outdoors – Part 2 General method of calculation* (1996).
- Receiver height: 4 m.
- Plant output data: Sound power levels or sound pressure levels as appropriate taken from **table 14**.
- Building envelope: Insulated 50 mm Kingspan cladding is assumed (facades and roof), over a mass concrete wall. Sound reduction index values taken from Kingspan specifications sheet.
- Doors: One open roller shutter door assumed (MRF east façade and FCC south façade).

5.1.11 The model output is shown in **figures 13-15**. Predicted $L_{Aeq\ 30\ min}$ levels at the nearest dwellings are presented in **table 15**.

Figure 13.8 Predicted operational phase $L_{Aeq\ 30\ min}$ levels – Daytime.

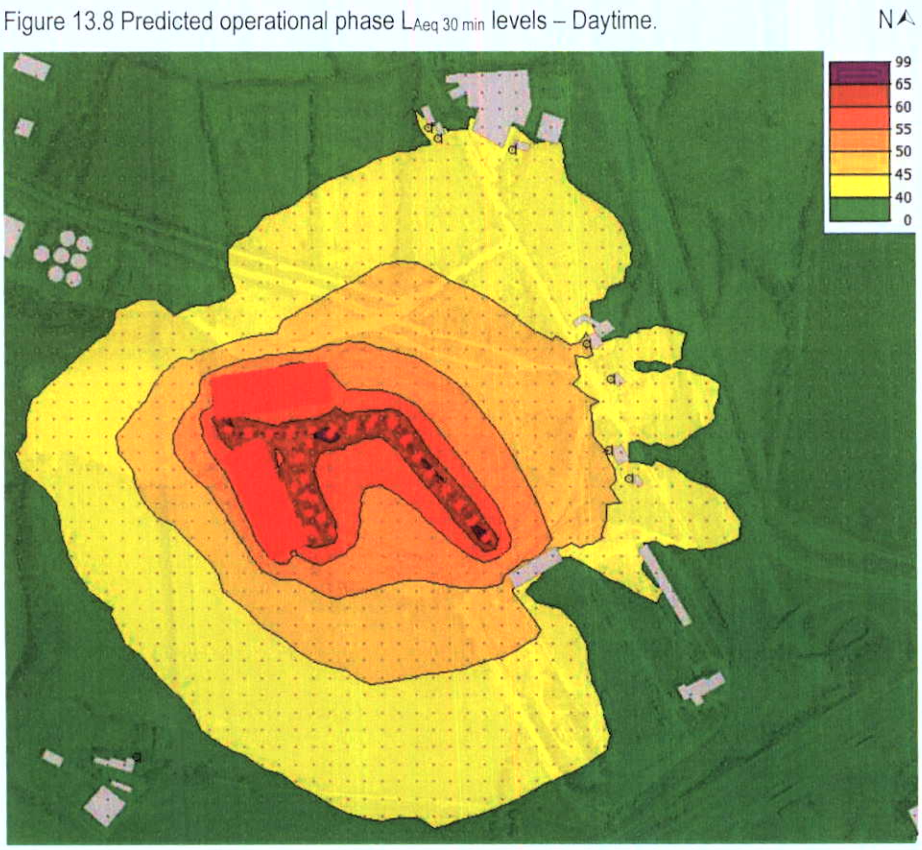


Figure 13.9 Predicted operational phase $L_{Aeq\ 30\ min}$ levels – Evening.

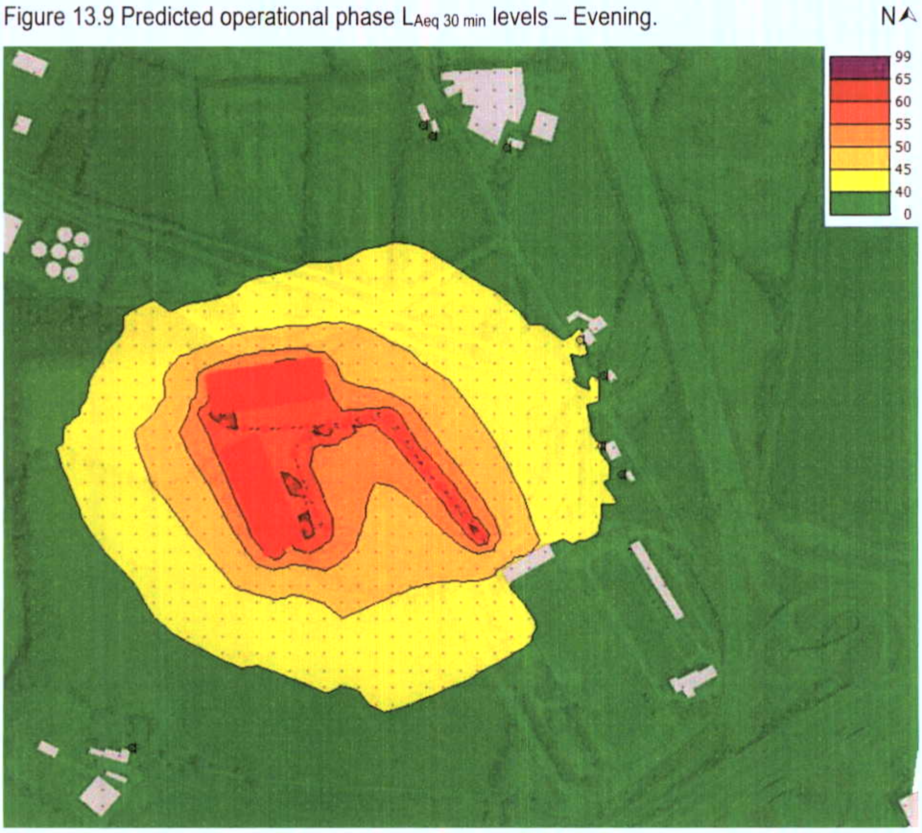


Figure 13.10 Predicted operational phase $L_{Aeq\ 30\ min}$ levels – Night-time.

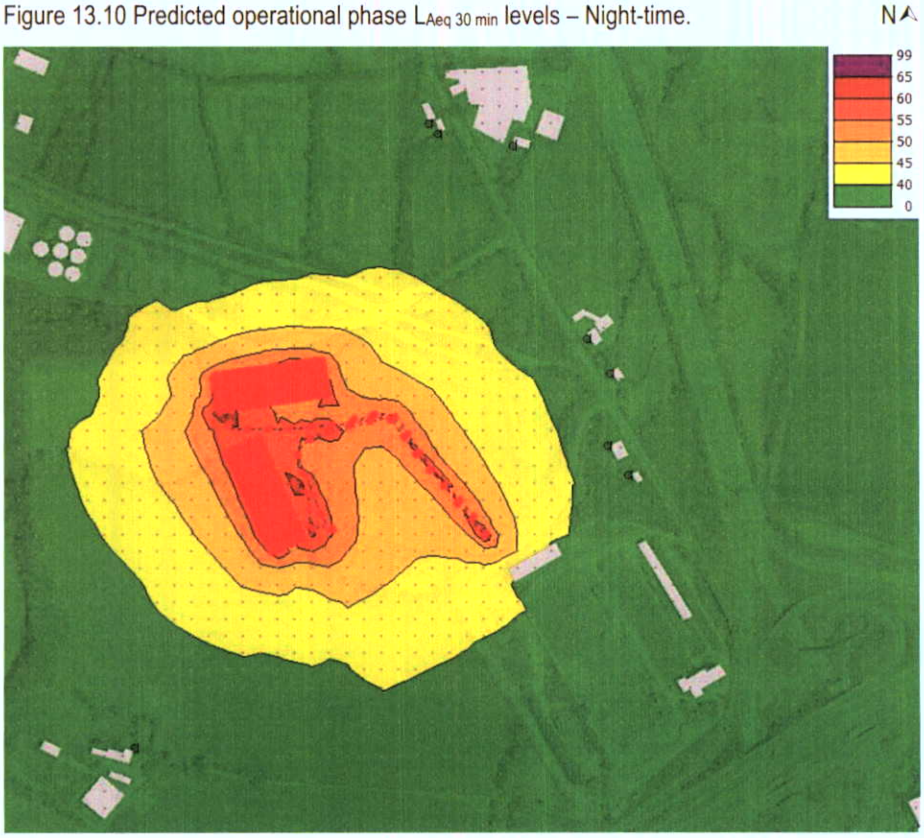


Table 15: Predicted operational phase $L_{Aeq\ 30\ min}$ levels.

Receptor	Daytime	Evening	Night-time
Kildonan House to SW	38	36	36
Dwelling E of site, S of access road entrance	44-45	39-40	38
Dwelling opposite access road entrance	46	41	40
Veterinary clinic dwelling	46	41	39
2 dwellings opposite commercial park to N	40-41	36-37	35-36
Dwelling at commercial park to N	42	37	36

5.2 Operational phase traffic

5.2.1 All vehicles accessing the site will use North Road. Existing daytime traffic movements, including HGV movements, are elevated on North Road due to traffic associated with several surrounding facilities, particularly a large quarry at Huntstown. A road traffic assessment undertaken in 2022 indicates that the number of vehicle movements to the immediate north of the quarry entrance is 2610 during the period 0700-1900 h, with 1514 HGV movements. In this context, daytime traffic volumes associated with the proposed development will be entirely negligible.

5.2.2 The road traffic assessment indicates that, south of the quarry entrance, the number of daytime movements reduces to 292, with 58 HGV movements. The proposed development will significantly increase traffic volumes on a 200 m road segment here. There are two dwellings adjacent to this segment, one of which includes a veterinary clinic. During daytime hours, the development will increase the number of HGV movements on this segment from 58 to 162, with a similar increase expected in car and van movements. The resulting increase in road traffic noise level at these dwellings will be 4 dB. With reference to **table 6**, this represents a not significant to slight adverse impact.

5.2.3 The proposed development will give rise to sporadic vehicle movements during evening and night-time hours, with approximately two truck movements per hour expected between 2300 and 0700 h. $L_{Aeq\ 30\ min}$ levels at dwellings adjacent to North Road resulting from these movements may be calculated using:

$$L_{Aeq\ 30\ min} = L_{AE} + 10\log N - 10\log T$$

where the L_{AE} describes the sound exposure level during a typical truck pass, N is the number of passes, and T is the time interval. A passing truck will typically generate a sound exposure level of 80 dB at 10 m, the typical separation distance to local roadside dwellings. On this basis, $L_{Aeq\ 30\ min}$ levels associated with up to two movements per hour will be 48 dB at 10 m. It follows that $L_{Aeq\ 30\ min}$ levels associated with HGV movements on North Road during evening and night-time hours will be lower than existing baseline levels as described in **section 3.4**.

5.3 Operational phase impacts

5.3.1 Predicted operational phase $L_{Aeq\ 30\ min}$ levels may be assessed in light of three sets of criteria. The first of these relates to criteria recommended by the EPA, based on WHO guidance, as set out in **table 4** above. An assessment of compliance with these criteria is presented in **table 16**. The assessment indicates that the proposed development will comply with EPA criteria at the nearest dwellings. Levels will also comply at more distant dwellings.

5.3.2 The second assessment method relates to BS 4142:2014 which provides for the comparison of specific $L_{Aeq\ T}$ levels (i.e. noise levels attributable to the source in question) with background levels. **Table 17** presents this assessment. Background levels are taken from **table 10**. In all cases, operational noise levels will be lower than background $L_{AF90\ 30\ min}$ levels, which at all receptors are dominated by road traffic. It follows that no adverse impacts will arise. It should be noted that BS 4142:2014 does not differentiate a separate evening period, and the assessment of a separate evening period here is applied in order to adopt an overly rigorous assessment.

5.3.3 Finally, the increase in $L_{Aeq\ 30\ min}$ levels arising from the proposed development may be assessed in light of IEMA guidance. This assessment is presented in **table 18**. Baseline $L_{Aeq\ 30\ min}$ levels are again taken from **table 10**. In all cases, impacts will be imperceptible, again due to high existing baseline noise levels resulting from road traffic.

Table 16: Operational phase $L_{Aeq\ 30\ min}$ levels v EPA criteria.

Receptor	Period	Predicted $L_{Aeq\ 30\ min}$ dB	Criterion $L_{Aeq\ 30\ min}$ dB	Compliance
Kildonan House to SW	0700-1900 h	38	55	✓
	1900-2300 h	36	50	✓
	2300-0700 h	36	45	✓
Dwelling E of site, S of access road entrance	0700-1900 h	44-45	55	✓
	1900-2300 h	39-40	50	✓
	2300-0700 h	38	45	✓
Dwelling opposite access road entrance	0700-1900 h	46	55	✓
	1900-2300 h	41	50	✓
	2300-0700 h	40	45	✓
Veterinary clinic dwelling	0700-1900 h	46	55	✓
	1900-2300 h	41	50	✓
	2300-0700 h	39	45	✓
2 dwellings opposite commercial park to N	0700-1900 h	40-41	55	✓
	1900-2300 h	36-37	50	✓
	2300-0700 h	35-36	45	✓
Dwelling at commercial park to N	0700-1900 h	42	55	✓
	1900-2300 h	37	50	✓
	2300-0700 h	36	45	✓

Table 17: Operational phase $L_{Aeq\ 30\ min}$ levels v BS 4142:2014.

Receptor	Period	Predicted $L_{Aeq\ 30\ min}$ dB	Background $L_{AF90\ 30\ min}$ dB	Impact
Kildonan House to SW	0700-1900 h	38	51	No impact
	1900-2300 h	36	48	No impact
	2300-0700 h	36	46	No impact
Dwelling E of site, S of access road entrance	0700-1900 h	44-45	56	No impact
	1900-2300 h	39-40	51	No impact
	2300-0700 h	38	48	No impact
Dwelling opposite access road entrance	0700-1900 h	46	56	No impact
	1900-2300 h	41	51	No impact
	2300-0700 h	40	48	No impact
Veterinary clinic dwelling	0700-1900 h	46	56	No impact
	1900-2300 h	41	51	No impact
	2300-0700 h	39	48	No impact
2 dwellings opposite commercial park to N	0700-1900 h	40-41	57	No impact
	1900-2300 h	36-37	51	No impact
	2300-0700 h	35-36	47	No impact
Dwelling at commercial park to N	0700-1900 h	42	57	No impact
	1900-2300 h	37	51	No impact
	2300-0700 h	36	47	No impact

Table 18: Operational phase $L_{Aeq\ 30\ min}$ levels v IEMA guidance.

Receptor	Period	Predicted $L_{Aeq\ 30\ min}$ dB	Baseline $L_{Aeq\ 30\ min}$ dB	Combined $L_{Aeq\ 30\ min}$ dB	Increase dB	Impact
Kildonan House to SW	0700-1900 h	38	54	54	0	Imperceptible
	1900-2300 h	36	52	52	0	Imperceptible
	2300-0700 h	36	49	49	0	Imperceptible
Dwelling E of site, S of access road entrance	0700-1900 h	44-45	58	58	0	Imperceptible
	1900-2300 h	39-40	55	55	0	Imperceptible
	2300-0700 h	38	51	51	0	Imperceptible
Dwelling opposite access road entrance	0700-1900 h	46	58	58	0	Imperceptible
	1900-2300 h	41	55	55	0	Imperceptible
	2300-0700 h	40	51	51	0	Imperceptible
Veterinary clinic dwelling	0700-1900 h	46	58	58	0	Imperceptible
	1900-2300 h	41	55	55	0	Imperceptible
	2300-0700 h	39	51	51	0	Imperceptible
2 dwellings opposite commercial park to N	0700-1900 h	40-41	61	61	0	Imperceptible
	1900-2300 h	36-37	55	55	0	Imperceptible
	2300-0700 h	35-36	50	50	0	Imperceptible
Dwelling at commercial park to N	0700-1900 h	42	61	61	0	Imperceptible
	1900-2300 h	37	55	55	0	Imperceptible
	2300-0700 h	36	50	50	0	Imperceptible

5.4 Cumulative impacts

5.4.1 Site inspections and baseline noise monitoring indicate that the local soundscape is entirely dominated by road traffic noise. Although a number of commercial and industrial noise sources are located in the surrounding area, noise emissions from these do not contribute to the soundscape at receptors. The only exception here is Kildonan House to the southwest of the site, where quarry operations are audible during the daytime.

5.4.2 Predictive noise modelling indicates that noise emissions from the proposed development will be lower than baseline noise levels at receptors, and thus cumulative impacts will not arise. While cumulative impacts will arise in relation to an increase in North Road traffic, increases will be negligible north of the quarry entrance. South of the entrance, the proposed development will generate an increase in traffic noise levels of 4 dB, resulting in a not significant to slight impact. It follows that the proposed development will not give rise to any cumulative noise impacts of significance.

6 Mitigation

6.1 Construction stage

6.1.1 Construction phase $L_{Aeq\ 1\ h}$ levels at all receptors will be lower than the 65 dB criterion recommended by BS 5228:2009. No vibration impacts will arise. Although construction phase noise emissions will be short term, and will not exceed construction phase criteria, the applicant nonetheless proposes to apply the following mitigation measures throughout the construction phase:

- Construction operations will in general be confined to the periods Monday-Friday 0800-1800 h and Saturday 0800-1800 h.
- Hooting will be prohibited onsite. Drivers of plant and vehicles will be instructed to avoiding hooting at all times.
- Plant used onsite during the construction phase will be maintained in a satisfactory condition and in accordance with manufacturer recommendations. In particular, exhaust silencers will be fitted and operating correctly at all times. Defective silencers will be immediately replaced.
- Queuing of trucks on North Road will be prohibited.
- Machinery not in active use will be shut down.
- A site representative will be appointed as a liaison officer with the local community.
- All complaints of noise received during the construction phase will be logged in a register, and investigated immediately. Details of follow-up action will be included in the register.
- Where it is proposed to import potentially noisy plant to the site, the potential impact of noise emissions will be assessed in advance.
- Guidance set out in British Standard BS 5228:2009 with respect to noise control will be applied throughout the construction phase.

6.2 Operational stage

6.2.1 No specific mitigation measures are warranted, as impacts at offsite receptors will be imperceptible. The applicant, however, proposes to apply the following general measures:

- Both the MRF and FCC buildings shall be constructed so as to avoid any gaps at cladding joints.
- Prior to selection of the air management system and odour control unit, noise emissions data shall be assessed to ensure that emissions are entirely broadband in character.
- All mobile plant shall be fitted with flat spectrum reversing alarms.
- Hooting will be prohibited onsite. Drivers of plant and vehicles will be instructed to avoiding hooting at all times.
- Plant used onsite will be maintained in a satisfactory condition and in accordance with manufacturer recommendations.
- A site representative will be appointed as a liaison officer with the local community.
- All complaints of noise received will be logged in a register, and investigated immediately. Details of follow-up action will be included in the register.

6.3 Monitoring

6.3.1 Given that baseline noise levels are elevated, construction phase noise monitoring is not warranted. Once operational, the facility will require a licence from the EPA. Any licence granted is likely to include noise limits and noise monitoring requirements. A monitoring programme will be commissioned by the operator in compliance with the licence conditions.

7 Summary of effects

7.1 While the loudest construction activity may be audible at the nearest receptors, noise levels will be lower than identified criteria. There will be extended periods when little or no emissions arise. Construction noise impacts will be imperceptible to not significant, and will be temporary. No vibration impacts will arise.

7.2 Once commissioned, residual noise impacts at surrounding receptors will be imperceptible. A BS 4142:2014 assessment indicates that no adverse impacts will arise. No indirect impacts or interactive effects have been identified. There will be no adverse noise impact on the local population or on human health. No cumulative impacts of significance will arise.

7.3 The assessment of impacts on human health is typically undertaken by reference to WHO guidance, which has been revised over the last four decades according as noise and health studies have been published. The WHO currently recommends the following:

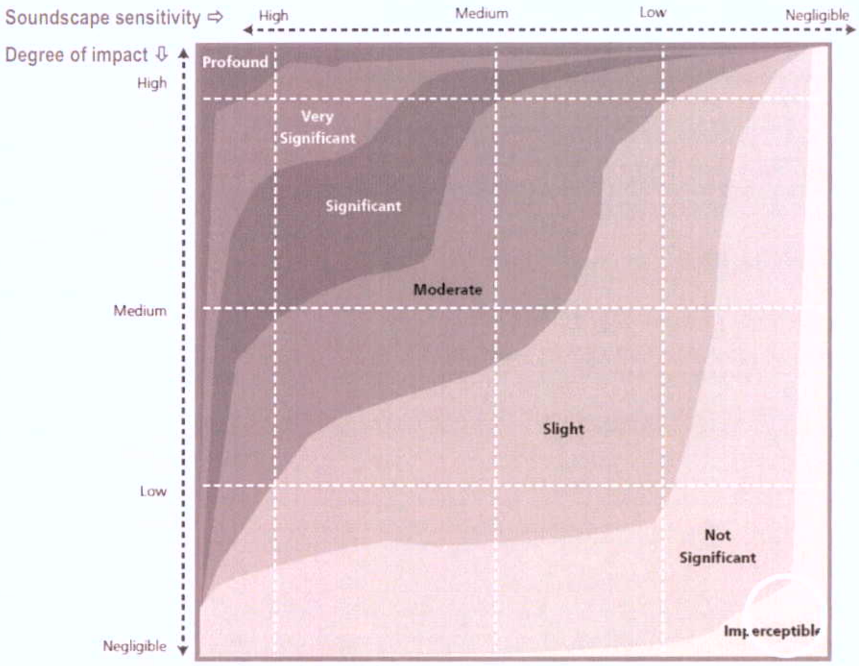
- In residential settings, a daytime/evening $L_{Aeq\ 16\ h}$ level of 50 dB is an indicator of moderate annoyance.
- A night-time $L_{Aeq\ 8\ h}$ level of 45 dB is recommended to prevent sleep disturbance.

7.4 The proposed development will not result in any breach of the above criteria. On this basis, it is considered that there will be no adverse noise impact on the local population or on human health. Impacts and effects are summarised in **table 19**.

Table 19: Assessment of impacts & effects.

Informed by EPA 2022 & IEMA 2014 guidance regarding impact (noise level change) & effect (consequence of impact)
Impact Imperceptible at all receptors; Truck movements on North Road will give rise to impacts at two dwellings south of the quarry entrance which will be not significant to slight ***imperceptible*** *(<2 dB change);* ***not significant*** *(2-4 dB change);* ***slight*** *(4-6 dB change);* ***moderate*** *(6-10 dB change);* ***significant*** *(10-15 dB change);* ***very significant*** *(15-20 dB change);* ***profound*** *(>20 dB change)*
Extent Site is located in a commercial/industrial area dominated by road traffic noise, with a small number of local residential receptors *development area size, receiving area affected, number of receptors affected, proportion of population affected*
Context Local area is commercial/industrial in character, and proposed development will conform with soundscape *conformity or contrast with existing & emerging soundscape*
Probability Effects are unlikely ***likely*** *(reasonably expected to occur);* ***unlikely*** *(reasonably expected not to occur)*
Duration Long term ***momentary*** *(seconds or minutes);* ***brief*** *(<1 day);* ***temporary*** *(<1 year);* ***short term*** *(1-7 years);* ***medium term*** *(7-15 years);* ***long term*** *(15-60 years);* ***permanent*** *(>60 years)*
Frequency Noise emissions will arise daily 24/7 *occurrence*
Reversibility Impacts are entirely reversible ***reversible*** *(may be undone in the future);* ***irreversible*** *(cannot be undone following onset, thus permanent)*
Indirect impact No indirect impacts identified *secondary impacts not directly attributable to development, often removed from site*
Cumulative impact Cumulative impacts are unlikely due to masking of existing commercial/industrial sources by road traffic noise *combined impacts with other projects or sources*
Worst case impact Impact determination is not dependent on mitigation measures, and thus mitigation failure will not affect outcome *where mitigation measures substantially fail*
Indeterminable impact Indeterminable impacts are unlikely *where full consequences of change in soundscape cannot be described*
Quality of effect Neutral impacts are expected at all receptors; Traffic movements on North Road south of the quarry entrance are likely to result in slightly adverse impacts at two dwellings ***positive*** *(improves soundscape);* ***neutral*** *(no perceptible changes);* ***adverse*** *(reduces quality of soundscape)*

Table 19 continued.

Informed by EPA 2022 & IEMA 2014 guidance regarding impact (noise level change) & effect (consequence of impact)
Significance of effect Site impacts imperceptible at all receptors; Traffic impacts increasing to not significant to slight at two receptors on North Road south of the quarry entrance ***imperceptible*** *(capable of measurement, but without significant consequences);* ***not significant*** *(causes noticeable changes to soundscape, but without significant consequences);* ***slight*** *(causes noticeable changes to soundscape without affecting its sensitivities);* ***moderate*** *(alters soundscape in manner consistent with existing and emerging baseline trends);* ***significant*** *(alters soundscape due to source character, magnitude, duration or intensity);* ***very significant*** *(significantly alters soundscape due to source character, magnitude, duration or intensity);* ***profound*** *(obliterates soundscape)*
Overall residual effect On the basis of the foregoing, the overall residual effect is circled white in the diagram. 

8 References

Report RI 8507: Structural response and damage produced by ground vibration from surface mines blasting (US Bureau of Mines, 1980).

British Standard BS 7385-2:1993 Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration (1993).

International Standard ISO 9613-2:1996 Acoustics: Attenuation of sound during propagation outdoors – Part 2 General method of calculation (1996)

Guidelines on community noise (World Health Organisation, 1999).

Directive 2002/49/EC of the European Parliament and of the Council relating to the assessment and management of environmental noise (2002), transposed into Irish law by the *European Communities (environmental noise) Regulations 2018 (SI no. 549/2018).*

Night noise guidelines for Europe (World Health Organisation, 2009).

Design manual for roads and bridges (UK Highways Agency, 2011).

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

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

Good practice guidance for the treatment of noise during the planning of national road schemes (National Roads Authority (now Transport Infrastructure Ireland), 2014).

Guidelines for environmental noise impact assessment (Institute of Environmental Management & Assessment, 2014).

NG4 Guidance note for noise: Licence applications, surveys and assessments in relation to scheduled activities (EPA, 2016).

International Standard ISO 1996-2:2017 Acoustics – Description, measurement and assessment of environmental noise, Part 2: Determination of environmental noise levels (2017).

Draft noise action plan for Fingal County 2019-2023 (Fingal County Council, 2018).

Draft noise action plan for Dublin Airport 2019-2023 (Fingal County Council, 2018).

British Standard BS 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound (2019).

Guidelines on the information to be contained in environmental impact assessment reports (EPA, 2022).

APPENDIX 10.3

GLINT & GLARE

GLINT AND GLARE ASSESSMENT

macroworks

Industrial Units,
Huntstown,
Co. Dublin.

ILI Registered Landscape Architect

April 2023

GLINT AND GLARE ASSESSMENT

Executive Summary

The proposal is for a roof mounted photovoltaic solar panel installation on the roof of the proposed industrial units in Huntstown townland, County Dublin. The proposed solar arrays wer assessed to determine whether they will have the potential to cause any glint or glare impacts upon specific aviation receptors at Dublin Airport – notably the air traffic control tower and the runway approaches.

An in-depth analysis of the proposed photovoltaic panel installation with regard to the indicated aviation receptors has predicted that there is the potential for glare effects upon aircraft approaching all the runways at Dublin Airport, however, it is of a lower-level of intensity, that is deemed by the Federal Aviation Authority (FAA) to be of low risk to this category of receptor, thus deemed an acceptable level of glare. The analysis also indicated the potential for a level of glare at the new, taller Air Traffic Control Tower which is considered unacceptable by the FAA. However, a detailed visibility analysis determined that the design and orientation of the proposed buildings upon which the array is proposed, affords the panels additional screening, preventing any potential glint or glare at the Air Traffic Control Tower as a result of the proposed roof mounted installation of photovoltaic panels.

1 INTRODUCTION

Macro Works Ltd. was commissioned to undertake a glint and glare assessment report for a proposed roof mounted photovoltaic (PV) panel installation on the roofs of two proposed industrial units in Huntstown townland, County Dublin (Figure 1 and Figure 2 refer). The proposed development is located approximately 500m west of the N2 national primary road and approximately 600m north of the M50 motorway. The PV panels will remain in a fixed position throughout the day and year (i.e. they will not rotate to track the movement of the sun).

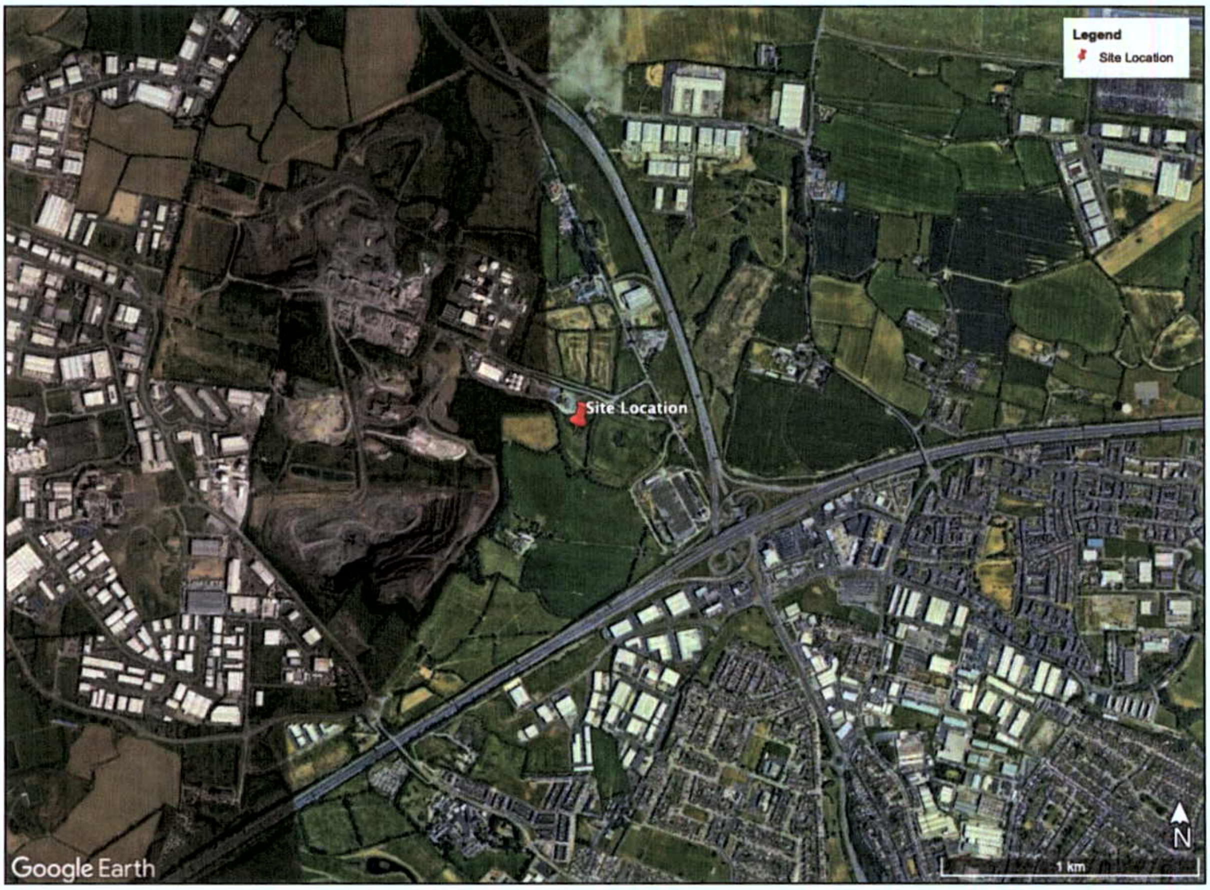


Figure 1: Aerial view (Google Earth Pro) showing the location of the proposed PV panels (red pin).

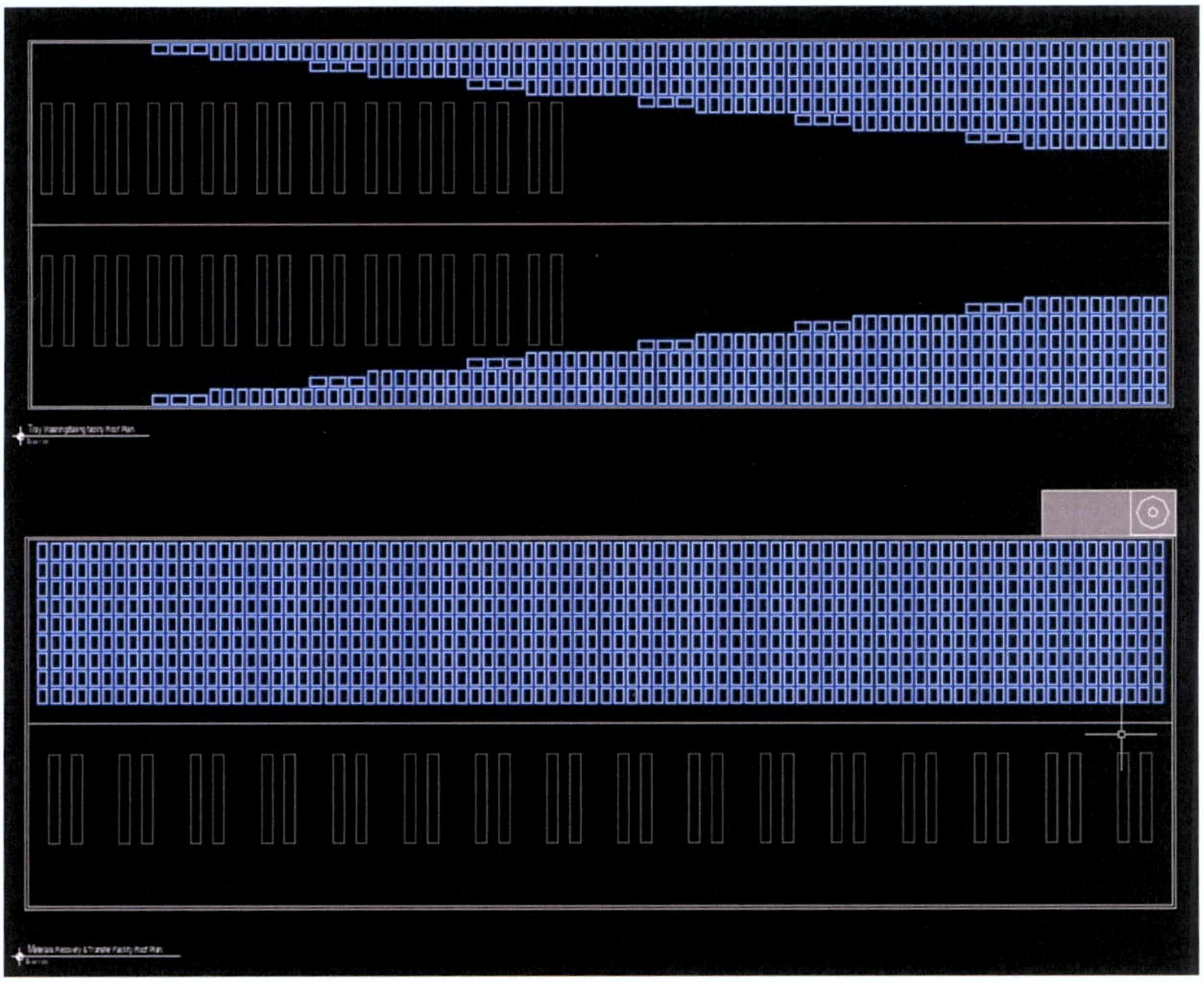


Figure 2: Extract from drawing "22-039 S Industrial units REV E.dwg" showing the proposed roof layouts of with the proposed PV panels (blue).

2 STATEMENT OF AUTHORITY

Macro Works' relevant experience includes nineteen years of analysing the visual effects of a wide range of infrastructural and commercial development types. This experience includes numerous domestic and international wind and solar energy developments. Macro Works has assessed the effects of glint and glare for many solar development sites throughout Ireland to date.

3 METHODOLOGY

The process for dealing with aviation receptors is as follows:

1. The Federal Aviation Administration (FAA) approved Solar Glare Hazard Analysis Tool (SGHAT) is used to determine if any of these aviation receptors has the potential to theoretically experience glint or glare. This tool also calculates the intensity of such reflectance and whether it is acceptable by FAA standards.

2. SGHAT does not account for terrain screening or screening provided by surface elements such as existing vegetation or buildings, therefore the results of the SGHAT may need to be considered, in conjunction with an assessment of existing intervening screening that may be present, to establish if reflectance can actually be experienced at the receptors.
3. Finally, if necessary, additional assessment is undertaken using Macro Works' bespoke model which would into account any screening provided by any proposed mitigation measures.

4 GUIDANCE

Guidance has been prepared by the Federal Aviation Authority[1] to address the potential hazards that solar developments may pose to aviation activities, and this has been adopted for use by the Irish Aviation Authority. SGHAT was developed in conjunction with the FAA in harmony with this guidance and is commonly regarded as the accepted industry standard by aviation authorities internationally when considering the glint and glare effects upon aviation related receptors.

4.1 FEDERAL AVIATION AUTHORITY

Within the FAA's interim policy, a 'Review of Solar Energy System Projects on Federally Obligated Airports'[2] it states:

> *"To obtain FAA approval to revise an airport layout plan to depict a solar installation and/or a "no objection" to a Notice of Proposed Construction Form 7460–1, the airport sponsor will be required to demonstrate that the proposed solar energy system meets the following standards:*
>
> - *No potential for glint or glare in the existing or planned Airport Traffic Control Tower (ATCT) cab, and*
> - *No potential for glare or "low potential for after-image" (shown in green in Figure 1* [Figure 3 refers]*) along the final approach path for any existing landing threshold or future landing thresholds (including any planned interim phases of the landing thresholds) as shown on the current FAA-approved Airport Layout Plan (ALP). The final approach path is defined as two (2) miles from fifty (50) feet above the landing threshold using a standard three (3) degree glidepath."*

<u>In summary, glare at an ATCT is not acceptable but glare with a *"low potential for after-image"* is acceptable along final approach paths to runways</u>.

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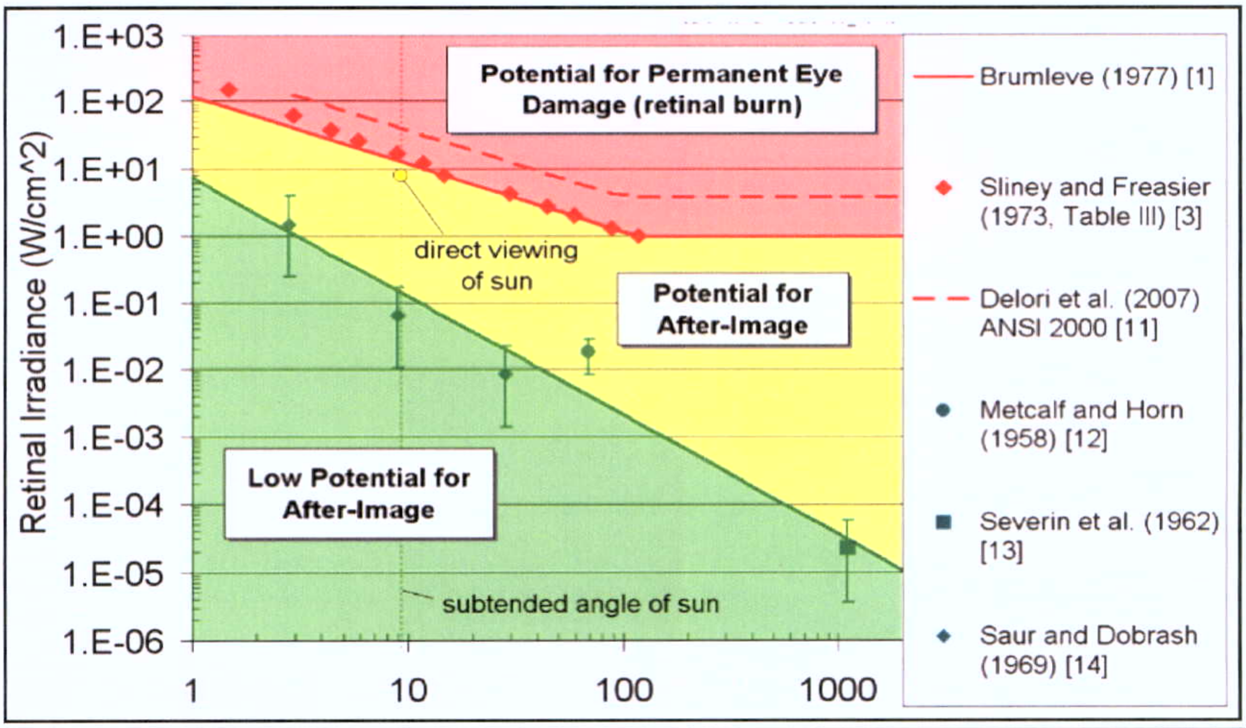
[1] Harris, Miller, Miller & Hanson Inc.. (November 2010). Technical Guidance for Evaluating Selected Solar Technologies on Airports; 3.1.2 Reflectivity. *Technical Guidance for Evaluating Selected Solar Technologies on Airports*. Available at: https://www.faa.gov/airports/environmental/policy_guidance/media/airport-solar-guide.pdf

[2] Federal Aviation Administration (FAA). (2013). Department of Transportation - Federal Aviation Administration. *Interim Policy, FAA Review of Solar Energy System Projects on Federally Obligated Airports*. Vol 78 (No 205), 63276-63279.

4.2 SOLAR GLARE HAZARD ANALYSIS TOOL

The SGHAT was designed to determine whether a proposed solar energy project would result in the potential for ocular impact as depicted on the Solar Glare Hazard Analysis Plot (Figure 3 refers). SGHAT analyses ocular impact over the entire calendar year in one minute intervals from when the sun rises above the horizon until the sun sets below the horizon. One of the principal outputs from the SGHAT report is a glare plot per receptor that indicates the time of day and days per year that glare has the potential to occur. SGHAT plot classifies the intensity of ocular impact as either Green Glare, Yellow Glare or Red Glare. These colour classifications are equivalent to the FAA's definitions regarding the level of ocular impact e.g. 'Green Glare' in the SGHAT is synonymous to the FAA's *"low potential for after-image',*' and so forth. The various correlations are illustrated on the Solar Glare Hazard Analysis Plot.



Solar Glare Ocular Hazard Plot: The potential ocular hazard from solar glare is a function of retinal irradiance and the subtended angle (size/distance) of the glare source. It should be noted that the ratio of spectrally weighted solar illuminance to solar irradiance at the earth's surface yields a conversion factor of ~100 lumens/W. Plot adapted from Ho et al., 2011.

Chart References: Ho, C.K., C.M. Ghanbari, and R.B. Diver, 2011, Methodology to Assess Potential Glint and Glare Hazards from Concentrating Solar Power Plants: Analytical Models and Experimental Validation, J. Solar Energy Engineering, August 2011, Vol. 133, 031021-1 – 031021-9.

Figure 3: Figure 1 from the FAA Interim Policy, FAA Review of Solar Energy System Projects on Federally Obligated Airports

5 IDENTIFICATION OF RELEVANT RECEPTORS

5.1 RUNWAY APPROACHES

Dublin Airport is an international airport operated by the Dublin Airport Authority. Dublin Airport currently hosts 3 operational runways 10/28 and 16/34 and 10L/28R which was recently constructed and commenced operations in August 2022. 10L/28R was constructed to the north of the Airport to help accommodate increasing passenger numbers and runs parallel to runway 10/28, to the south. It is envisaged that this will eventually render the 16/34 runway as a purely taxiing runway (**Error! Reference source not found.**6 refers). All 6 runway approaches will be assessed.

Figure 4: Aerial view (Google Earth Pro) showing 2 mile approach lines to runways at Dublin Airport (at ¼ mile intervals) as assessed by SGHAT. Includes the newly opened northern runway (10L and 28R.)

5.2 AIR TRAFFIC CONTROL TOWERS

Dublin Airport has two Air Traffic Control Towers (ATCT). The older ATCT has a viewing height of 21.9m Above Ground Level (AGL) (Ref: '1-ATCT' in SGHAT) and is located to the west of the main terminal buildings (Figure 5 refers). The second, newer ATCT has a viewing height of 75.6m Above Ground Level (AGL) (Ref: '2-ATCT' in SGHAT) and is also located to the west of the main terminal buildings (Figure 5 refers). Both ATCTs will be assessed.

Figure 5: Location of the Air Traffic Control Towers at Dublin Airport (red centre icons).

6 RESULTS

6.1 RUNWAY APPROACHES

The SGHAT results are contained in Appendix A and show that of the six runway approaches analysed, all six have the theoretical potential to receive glare (10L, 10, 16, 28R, 28 and 34). In all instances SGHAT calculated the potential glare to be *'Green Glare'*. SGHATs *'Green Glare'* classification regarding the intensity of the potential glare is synonymous with FAA's *'low potential for temporary after image'*. *'Green Glare'* / glare with a *'low potential for temporary after image,'* regardless of the number of minutes per year, is considered by the FAA to be an **acceptable level of reflectance effect for runway approaches.**

6.2 AIR TRAFFIC CONTROL TOWERS

The SGHAT results contained in Appendix A also show the theoretical potential for glare at both of the ATCT's at Dublin Airport (1-ATCT and 2-ATCT). SGHAT calculated this potential glare to be *'Green Glare'*. SGHATs *'Green Glare'* classification regarding the intensity of the potential glare is synonymous with FAA's *'low potential for temporary after image'*. *'Green Glare'* / glare with a *'low* *potential for temporary after image,'* regardless of the number of minutes per year, is considered by the FAA to be an **unacceptable intensity of reflectance effect for an ATCT**.

These results are not unexpected or uncommon as the SGHAT software does not account for screening as a result of intervening terrain, buildings or vegetation, therefore a 3D visibility analysis was undertaken from the new, taller ATCT at Dublin Airport. Furthermore, it should also be noted that visibility of panels is not a precursor for glare impacts as panels may be visible but not cause any glare, depending on a number of factors i.e. panel orientation.

6.2.1 Visibility Analysis

A viewshed analysis was carried out for the taller Air Traffic Control Tower at Dublin Airport (2-ATCT) to identify what portions of the proposed development are theoretically visible. In the case of Dublin Airport where there are two ATCTs, if there is no potential for visibility from the taller ATCT (worst-case scenario), there will be no potential for visibility from the smaller ATCT, thus a visibility analysis from the smaller ATCT (1-ATCT) is not required. This analysis was undertaken with the aid of a high resolution digital surface model (DSM) to produce a Zone of Theoretical Visibility (ZTV) map (Figure 6 refers). The proposed buildings and PV panels were incorporated into the DSM model. The result of this analysis shows that there is no potential for inter-visibility between the ATCT (2-ATCT) and the areas of PV panels at the proposed development – potentially visible area are indicated in yellow on Figure 6. Thus, there will be **no potential for glint or glare to occur at either of the ATCTs**.

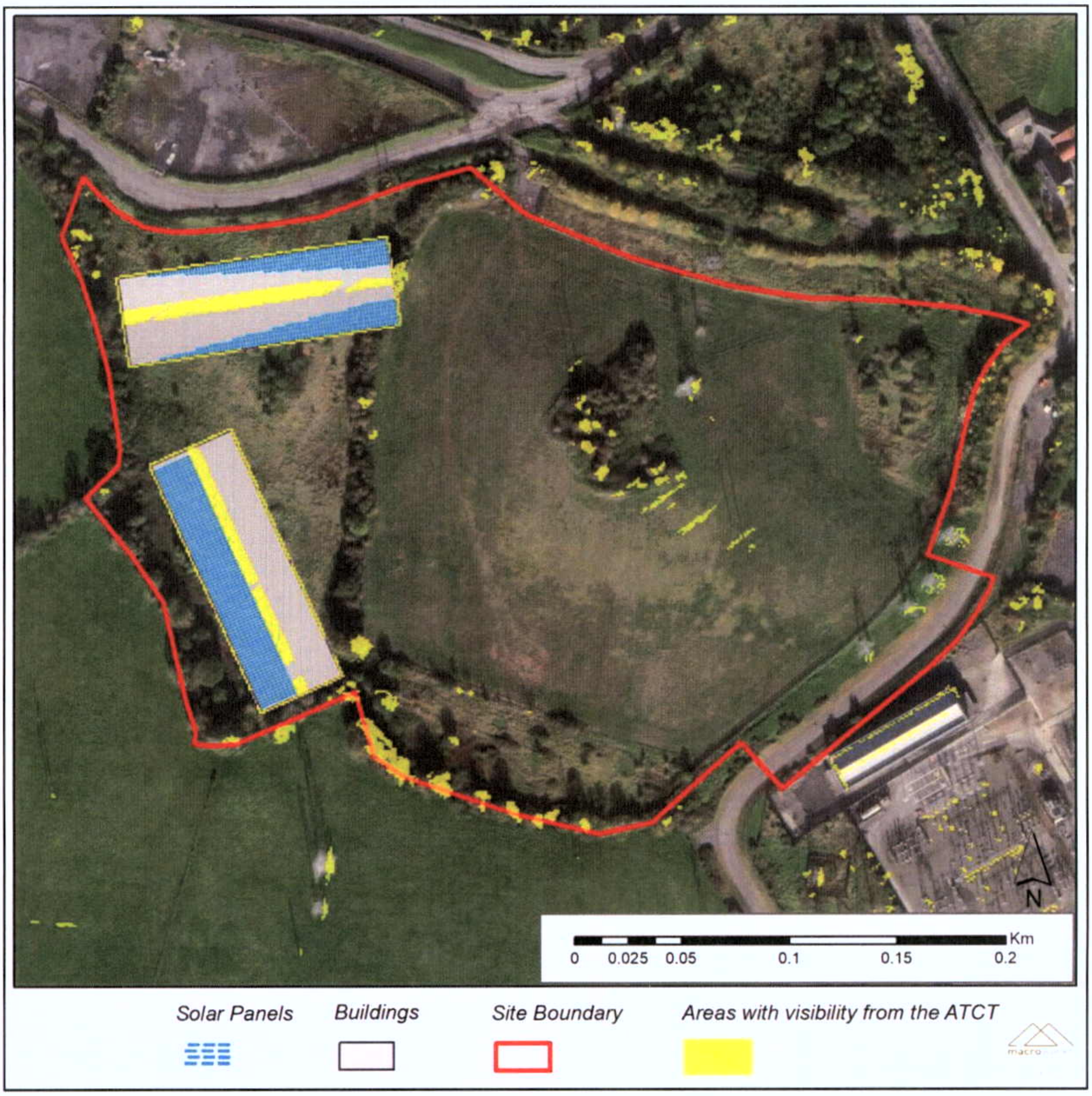


Figure 6: Viewshed / Zone of Theoretical Visibility (ZTV) map, showing the areas within the application site that are potentially visible (yellow pattern) from the taller air traffic control tower (2-ATCT) at Dublin Airport.

6.3 OVERALL CONCLUSION

From the analysis and discussions contained herein, it is considered that there will not be any hazardous glint and glare effects upon the Dublin Airport aviation receptors identified as a result of the proposed roof mounted solar PV panels.

APPENDIX A:

SGHAT RESULTS

RUNWAYS APPROACHES AND AIR TRAFFIC CONTROL TOWERS (ATCT)

FORGESOLAR GLARE ANALYSIS

Project: **Dublin Airport SGHAT**
Site configuration: **Hunststown Td**
Analysis conducted by Luis Dominguez (luis@macroworks.ie) at 09:29 on 21 Mar, 2023.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	PASS	Flight path receptor(s) do not receive yellow glare
ATCT(s)	FAIL	Receptor(s) marked as ATCT receive green and/or yellow glare

Default glare analysis parameters and observer eye characteristics (for reference only):

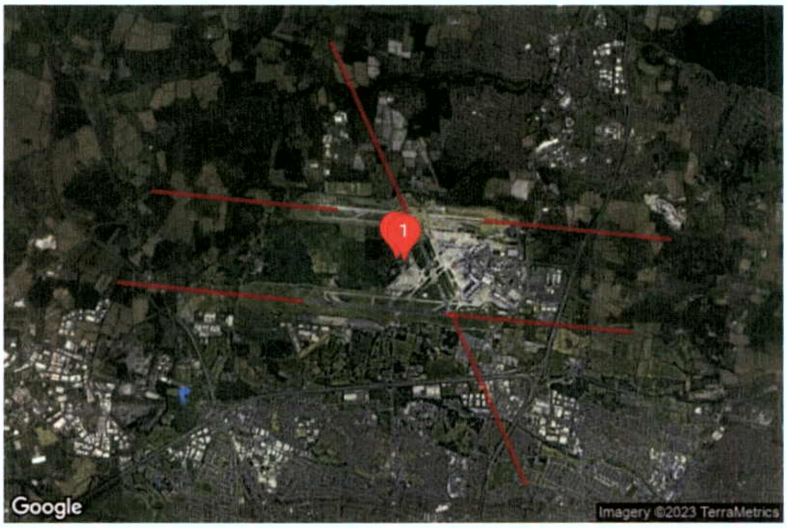
- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 86659.12200
Methodology: V2



PV Array(s)

Name: Array 1
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 352.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.408324	-6.319673	78.70	13.19	91.89
2	53.408306	-6.319904	78.70	13.19	91.89
3	53.408312	-6.319912	78.70	13.12	91.82
4	53.408305	-6.320002	78.70	13.12	91.82
5	53.408316	-6.320016	78.70	12.99	91.69
6	53.408303	-6.320189	78.70	12.99	91.69
7	53.408308	-6.320197	78.70	12.93	91.63
8	53.408302	-6.320287	78.70	12.93	91.63
9	53.408312	-6.320301	78.70	12.80	91.50
10	53.408301	-6.320453	78.70	12.80	91.50
11	53.408307	-6.320461	78.70	12.73	91.43
12	53.408300	-6.320550	78.70	12.73	91.43
13	53.408310	-6.320571	78.70	12.60	91.30
14	53.408297	-6.320738	78.70	12.60	91.30
15	53.408303	-6.320746	78.70	12.53	91.23
16	53.408296	-6.320835	78.70	12.53	91.23
17	53.408307	-6.320850	78.70	12.41	91.11
18	53.408296	-6.321001	78.70	12.41	91.11
19	53.408301	-6.321009	78.70	12.34	91.04
20	53.408295	-6.321099	78.70	12.34	91.04
21	53.408305	-6.321113	78.70	12.21	90.91
22	53.408294	-6.321264	78.70	12.21	90.91
23	53.408299	-6.321273	78.70	12.14	90.84
24	53.408293	-6.321362	78.70	12.14	90.84
25	53.408302	-6.321364	78.70	12.04	90.74
26	53.408428	-6.319695	78.70	12.04	90.74
27	53.408324	-6.319673	78.70	13.19	91.89

Name: Array 2
Axis tracking: Fixed (no rotation)
Tilt: 5.0°
Orientation: 172.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.408176	-6.319642	78.70	13.19	91.89
2	53.408072	-6.319619	78.70	12.04	90.74
3	53.407946	-6.321289	78.70	12.04	90.74
4	53.407955	-6.321290	78.70	12.14	90.84
5	53.407961	-6.321201	78.70	12.14	90.84
6	53.407968	-6.321196	78.70	12.21	90.91
7	53.407979	-6.321044	78.70	12.21	90.91
8	53.407983	-6.321033	78.70	12.24	90.94
9	53.407992	-6.321035	78.70	12.34	91.04
10	53.407999	-6.320945	78.70	12.34	91.04
11	53.408005	-6.320940	78.70	12.41	91.11
12	53.408017	-6.320788	78.70	12.41	91.11
13	53.408029	-6.320779	78.70	12.53	91.23
14	53.408036	-6.320689	78.70	12.53	91.23
15	53.408043	-6.320684	78.70	12.60	91.30
16	53.408056	-6.320511	78.70	12.60	91.30
17	53.408069	-6.320501	78.70	12.73	91.43
18	53.408075	-6.320412	78.70	12.73	91.43
19	53.408082	-6.320406	78.70	12.80	91.50
20	53.408094	-6.320255	78.70	12.80	91.50
21	53.408106	-6.320245	78.70	12.93	91.63
22	53.408113	-6.320156	78.70	12.93	91.63
23	53.408120	-6.320150	78.70	12.99	91.69
24	53.408133	-6.319977	78.70	12.99	91.69
25	53.408145	-6.319968	78.70	13.12	91.82
26	53.408152	-6.319878	78.70	13.12	91.82
27	53.408159	-6.319873	78.70	13.19	91.89
28	53.408176	-6.319642	78.70	13.19	91.89

Name: Array 3
Axis tracking: Fixed (no rotation)
Tilt: 4.0°
Orientation: 248.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
1	53.407488	-6.321343	78.70	13.60	92.30
2	53.407555	-6.321073	78.70	15.08	93.78
3	53.406540	-6.320362	78.70	15.08	93.78
4	53.406473	-6.320632	78.70	13.60	92.30
5	53.407488	-6.321343	78.70	13.60	92.30

Flight Path Receptor(s)

Name: 10L Runway
Description: None
Threshold height: 15 m
Direction: 95.8°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 120.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	53.436880	-6.280253	71.90	15.20	87.10
Two-mile	53.439822	-6.328592	74.90	180.90	255.80

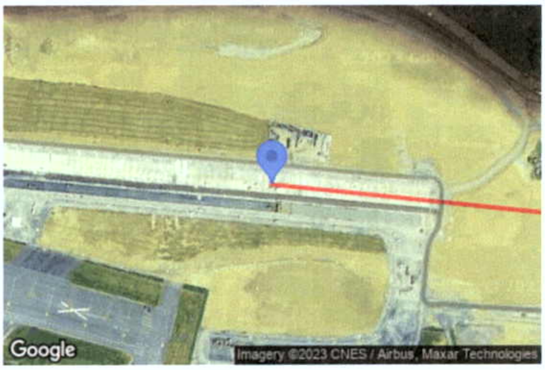
Name: 10 Runway
Description: None
Threshold height: 15 m
Direction: 95.8°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 120.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	53.422405	-6.289520	74.00	15.30	89.30
Two-mile	53.425327	-6.337846	80.30	177.60	257.90

Name: 16 Runway
Description: None
Threshold height: 15 m
Direction: 156.1°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 120.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	53.436699	-6.261764	66.50	15.20	81.70
Two-mile	53.463138	-6.281428	69.70	180.70	250.40

Name: 28R Runway
Description: None
Threshold height: 15 m
Direction: 275.9°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 120.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	53.435084	-6.240975	65.50	15.30	80.80
Two-mile	53.432097	-6.192645	34.00	215.50	249.50

Name: 28 Runway
Description: None
Threshold height: 15 m
Direction: 275.5°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 120.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	53.420299	-6.251111	62.00	15.20	77.20
Two-mile	53.417517	-6.202763	41.90	204.00	245.90

Name: 34 Runway
Description: None
Threshold height: 15 m
Direction: 336.6°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 120.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (m)	Height above ground (m)	Total elevation (m)
Threshold	53.420211	-6.249810	62.20	15.30	77.50
Two-mile	53.393680	-6.230504	49.00	197.10	246.10

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (m)	Height (m)
1-ATCT	1	53.428489	-6.262201	65.90	21.90
2-ATCT	2	53.428937	-6.264259	65.60	75.60

Map image of 1-ATCT

Map image of 2-ATCT