IRWIN CARR
CONSULTING



AIR QUALITY IMPACT ASSESSMENT
BLAKISTON HOUSTON DIGESTATE BUILDING

Rp001AQ 2024199 (Blakiston Houston Digestate Building)
25 April 2025

PROJECT: AIR QUALITY IMPACT ASSESSMENT

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1.0 INTRODUCTION

Irwin Carr Consulting Ltd have been commissioned to undertake a detailed air quality impact assessment for a proposed industrial building to be used for anaerobic digestate management on lands approximately 120m southwest of No. 28 Carrowreagh Road, Dundonald BT16 1TS.

In this report, the following impacts have been assessed:

- Pollutant impacts (NO_2 and ammonia) from the extract stack.
- Odour impact from the associated carbon filter.

It is understood that this assessment will be submitted to the Planning Section of Lisburn and Castlereagh City Council (LCCC) in support of a future planning application and will be assessed by the Environmental Health Service (EHS) of the Council.

The application seeks full planning permission.

1.1 Development Description

The proposal seeks permission for a building that facilitates the management of anaerobic digestate by way of blending with mineral fertiliser and additives to produce a pelletised product..

The proposed development site is situated on existing agricultural land, adjacent to the boundary of the Carrowreagh Business Park and Dundonald Enterprise Park.

There are a number of residential properties in the vicinity of the proposed site. The closest third-party receptor property (i.e. 40 Millreagh Grove) is located approximately 180m to the east of the proposed building.

From an air quality perspective, the primary emissions associated with the proposed development will be ammonia and odour from the proposed extract stack and odour from the proposed extract stack once air has passed through the carbon filter.

For the purposes of this assessment, it is assumed that the development will operate 24 hours a day, 7 days a week.

The location of the site and nearby residential properties is shown in Appendix A.

1.2 Process Description

The proposed facility will accept 15,000tpa of solid, or dried, fraction of digestate produced from eight AD plants currently in operation throughout Northern Ireland. The digestate is delivered via HGVs and unloaded by reversing into an available top loader/delivery bay within the proposed building. An additional 15,000tpa of mineral fertiliser additives will be delivered by road tanker for tanker blown loading into the silos located within the proposed building.

The digestate is removed at a controlled rate by way of conveyors and combined with additives from each silo in turn to a mixing process to produce a “blend mix”. A stabilising element is additionally dosed into the blend mix. The blending process stabilises the nitrogen, ammonia and phosphate contained within the feedstock and helps to achieve a formula required for future use as a fertiliser.

Post mixing, the blend mix undergoes a conditioning process where moisture, heat and other nutrient additives are introduced. The conditioned blend mix is fed into a pelletising line where the pellets are then cooled, cleaned and passed to storage.

Pellets are passed to an interim storage capacity prior to bagging into 1,000kg Flexible Intermediate Bulk Container (“FIBC”) units. The facility will produce up to 30,000tpa of mineral fertiliser product.

The blending process will operate continuously 24 hours per day, Monday to Sunday. Deliveries to the site will be limited to day-time hours where possible.

2.0 LEGISLATIVE POLICY AND GUIDANCE

2.1 Statutory Nuisance

2.1.1 CLEAN NEIGHBOURHOODS AND ENVIRONMENT ACT (NORTHERN IRELAND)

The Clean Neighbourhoods and Environment Act (Northern Ireland)[1] has been produced to improve the quality of the local environment by giving the Local Authority additional powers to deal with litter, nuisance alleys, graffiti, and fly posting, abandoned and nuisance vehicles, dogs, noise and statutory nuisance.

Part 7 makes provision to constitute *"statutory nuisances"* for the purposes of the Act[1]. Specifically, Section 63 gives the following definitions of statutory nuisance relevant to dust, odour, and particles:

- *"Any dust, steam, smell or other effluvia arising from industrial, trade or business premises or smoke, fumes or gases emitted from premises to be prejudicial to health or a nuisance".*
- *"Any accumulation or deposit which is prejudicial to health or a nuisance".*

Following this, Section 65 says that where a statutory nuisance is shown to exist, the Local Authority must serve an abatement notice. The abatement notice would impose either all or any of the following requirements:

- Requiring the abatement of the nuisance or prohibiting or restricting its occurrence or recurrence; or,
- Requiring the execution of such works, and the taking of such other steps, as may be necessary for any of those purposes.

Nuisance is a subjective concept, and its perception is highly dependent upon the existing conditions and the change which has occurred.

2.2 Strategic Planning Policy

2.2.1 STRATEGIC PLANNING POLICY FOR NORTHERN IRELAND

The Strategic Planning Policy Statement for Northern Ireland (SPPS)[2] sets out how planning policies should be applied.

Annex A of the SPPS[2] relates to the management of air quality. Annex A states the following key points:

- The planning system can also positively contribute to the improvement of air quality and in minimising its harmful impacts on health and well-being.
- In managing development, planning authorities should recognise that air quality can be a material consideration in the determination of planning applications.
- Where a proposed development is likely to have a significant air quality impact or add to a cumulative impact in an area, applications should be supported by sufficient information to allow full consideration of the impact on local air quality.
- Adequate consultation between the planning authority and those with responsibility for air quality and pollution control will be essential.
- The impact on ambient air quality is likely to be particularly important for development proposals located within or close to a designated AQMA.

Nuisance is referenced throughout the SPPS[2] whereby, *"other amenity considerations arising from development, that may have potential health and well-being implications, include design considerations, impacts relating to visual intrusion, general nuisance..."* and *"development proposals should not result in environmental problems such as noise, nuisance or disturbance."*

1 Acts of the Northern Ireland Assembly (2011) Clean Neighbourhoods and Environment Act (Northern Ireland) 2011, Part 7 Statutory Nuisances 2011 c.23 [online] http://www.legislation.gov.uk/nia/2011/23/part/7

2 Department of the Environment (2015) Strategic Planning Policy Statement for Northern Ireland [online] https://www.planningni.gov.uk/index/policy/spps_28_september_2015-3.pdf

2.3 Best Practice Guidance

The following best practice guidance documents have been used in the production of this odour impact assessment:

- Environment Agency - H4 Odour Management[3].
- Institute of Air Quality Management (IAQM) - Guidance on the Assessment of Odour for Planning[4].

[3] Environment Agency (2011) H4 Odour Management: How to comply with your environment permit [online] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/296737/geho0411btqm-e-e.pdf

[4] Institute of Air Quality Management (IAQM) (Version 1.1 Updated 2018) Guidance on the assessment of odour for planning [online] https://iaqm.co.uk/text/guidance/odour-guidance-2014.pdf

3.0 ODOUR ASSESSMENT METHODOLOGY

The Proposed Development has the potential to cause nuisance from increased odour emissions stemming from the operation of the industrial building.

The following method has therefore been derived to present an assessment of the potential impact of odour releases during the operation of the Development for the local Council's considerations.

3.1 Method

An impact assessment of odour releases from the Existing Development has been carried out using the AERMOD dispersion modelling package (Version 10.2.1), as developed by the American Meteorological Society, in conjunction with the US Environmental Protection Agency (US EPA) and consideration of best practice guidance documents (see Section 2.3).

AERMOD is the current US EPA regulatory model used to predict pollutant concentrations from a wide range of sources that are present at typical industrial facilities. AERMOD is classified as a Gaussian (steady state) plume dispersion model.

The model accepts hourly meteorological data to define the conditions for plume rise, transport, diffusion, and deposition and give due consideration to the surrounding terrain. AERMOD estimates the concentration or deposition value for each source and receptor combination for each hour of input meteorology and calculates user-selected short-term averages. Since most air quality standards are stipulated as averages or percentiles, AERMOD allows further analysis of the results for comparison purposes.

Percentile analysis for emissions is calculated for the maximum averages using the AERMOD-percent post-processing utility. This utility calculates the maximum concentration of a pollutant from all receptors at a specific percentile, for a specific period. Employing the percentile facilitates the omission of unusual short-term meteorological events that may cause elevated pollutant concentrations and hence a more accurate representation of the likely average pollutant concentrations over an averaging period.

3.2 Odour Impact Assessment

3.2.1 SCOPE OF ASSESSMENT

The scope of the odour impact assessment has been determined by the following:

- Desktop study to identify receptor locations e.g., residential dwellings that may be susceptible to an adverse effect on amenity from odorous releases made from the Site.
- Review of emissions parameters for the Development and completion of an atmospheric dispersion modelling exercise with application of the AERMOD modelling software to predict the 98th percentile of hourly mean, ground-level odour concentrations at those identified sensitive receptor locations for each considered assessment year.

3.2.2 DEFINITION OF ODOUR

DEFRA issued a guidance document[5] for Local authorities around odour investigation and control. Page 8 of the DEFRA Odour guidance[5] states that,

"An odour is the organoleptic attribute perceptible by the olfactory organ on sniffing certain volatile substances. It is a property of odorous substances that make them perceptible to our sense of smell.

The term odour refers to the stimuli from a chemical compound that is volatilised in air. Odour is our perception of that sensation, and we interpret what the odour means. Odours may be perceived as pleasant or unpleasant."

Odour concentration is expressed as European Odour Units (ou_E) and the emission rate can be determined as European odour units per cubic metre of air (ou_E/m^3) or in $ou_E/m^2/s$ depending on the source of emission.

5 DEFRA (2010) *Odour Guidance for Local Authorities* [online] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/645286/pb13554-local-auth-guidance-100326.pdf

3.2.3 EFFECT OF ODOUR

Before an adverse effect (such as loss of amenity, annoyance, nuisance, or complaints) can occur, there must be odour exposure. For odour exposure to occur all three links in the source – pathway – receptor chain must be present:

A) An emission source – a means for the odour to get into the atmosphere

B) A pathway – for the odour to travel through the air to locations off site, noting that:

Anything that increases dilution and dispersion of an odorous pollutant plume as it travels from source to receptor will reduce the concentration at the receptor, and hence reduce exposure. Increasing the length of the pathway (e.g., by releasing the emissions from a high stack) will – all other things being equal – increase the dilution and dispersion.

C) The presence of receptors (people) that could experience an adverse effect, noting that people vary in their sensitivities to odour.

The scale of exposure (the impact) is determined by the parameters collectively known as the FIDOL[6] factors (Frequency, Intensity, Duration, Offensiveness and Location); these are described in Table 1.

The magnitude of the effect experienced is determined by the scale of exposure (FIDO) and the sensitivity of the receptor (L, denoting the location, which is often taken to be a surrogate for the sensitivity and incorporates the social and psychological factors that can be expected for a given community).

According to the IAQM[4], *"Different combinations of the FIDO factors can result in different exposures at a location. For example, odours may occur as a one-off, as frequent short bursts, or for longer, less-frequent periods, and may be said to give 'acute' or 'chronic' exposures, respectively."*

Table 1: Description of FIDOL Factors

Frequency	How often an individual is exposed to odour
Intensity	The individual's perception of the strength of the odour
Duration	The overall duration that individuals are exposed to an odour over time
Offensiveness	Odour unpleasantness describes the character of an odour as it relates to the hedonic tone' (which may be pleasant, neutral, or unpleasant) at a given odour concentration/intensity. This can be measured in the laboratory as the hedonic tone, and when measured by the standard method and expressed on a standard nine-point scale it is termed the hedonic score.
Location	The type of land use and nature of human activities in the vicinity of an odour source. Tolerance and expectation of the receptor. The 'location factor can be considered to encompass the receptor characteristics, receptor sensitivity, and socio-economic factors.

The IAQM[4] guidance provides definitions of how 'impact' is characterised in an odour impact assessment to inform the judgement on significance of 'effect'.

The following definitions have been applied, as per Box 1 of the IAQM[4] guidance document.

- Impacts – These are changes to the environment attributable to the development proposal.
- Effects – These are the results of the changes on specific receptors.
- Receptors – Are the users of the adjacent land, which may vary in their sensitivity to odour.

[6] The term FIDOR is sometimes used in place of FIDOL, whereby 'R' represents the 'Receptor' (location(s))

3.2.4 DEFINITION OF ODOUR

To inform an odour impact assessment, an air quality practitioner must incorporate one assessment method that gives due consideration to the FIDOL factors (see Table 1).

The IAQM[4] offers the air quality practitioner best practice guidance to complete an appropriate odour impact assessment. The document is not anticipated to replace existing guidance produced by the Environment Agency[3] or where a specific assessment method is already presented within existing guidance.

For the sensitivity of people to odour, the IAQM recommends that professional judgement is applied to identify where on the spectrum between high and low sensitivity a receptor lies, considering the general principles within Table 2.

Table 2: Receptor Sensitivity to Odours

High Sensitivity Receptor	Surrounding land where: • Users can reasonably expect enjoyment of a high level of amenity; and • People would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land.
Examples may include residential dwellings, hospitals, schools / education and tourist / cultural.	
Medium Sensitivity Receptor	Surrounding land where: • Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or • People would not reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.
Examples may include places of work, commercial / retail premises, and playing / recreation fields.	
Low Sensitivity Receptor	Surrounding land where: • The enjoyment of amenity would not reasonably be expected; or • There is transient exposure, where the people would reasonably be expected to be present. Only for limited periods of time as part of the normal pattern of use of the land.
Examples may include industrial use, farms, footpaths, and roads.	

For odour assessments, the probability is the likelihood of exposure (impact), and the consequence can be the effect on the receptor if that exposure (impact) took place. These two components are brought together by the Source-Pathway-Receptor (S-P-R) concept, as outlined within the IAQM guidance on odour for planning[4].

3.2.5 ASSESSMENT CRITERIA

According to the IAQM odour guidance[4], an odour impact assessment may be required to reach a conclusion as to the likely significance of any predicted odour impacts for planning purposes. The significance can be therefore assessed with regard to the magnitude of the impact and the sensitivity of considered receptors.

Section 5 of the IAQM odour guidance[4] presents a review of odour benchmarks (see Section 3.2.6) and illustrates two tables with respect to impact descriptors based on the 'moderately offensive' and 'most offensive' odour categories, as referenced with the Environment Agency's H4[3] and IAQM's odour guidance[4] documents. The corresponding magnitude scale for this assessment has been derived based on the suggested benchmark for 'moderately offensive' odours.

The significance of impacts has been determined through the interaction of the predicted 98th percentile of hourly mean odour concentrations (i.e., the magnitude) and receptor sensitivity (see Table 2). The relevant assessment matrix is summarised in Table 3.

Although the matrix acts as a guide, professional judgement is required to take into account various factors such as a community's tolerance of existing odours. *The IAQM[4] note that "It is incumbent on the responsible practitioner to exercise good professional judgement in selecting an appropriate odour assessment criterion for any particular case and providing justification for that selection. Practitioners are also recommended to exercise such judgement in appreciating other factors which govern human responses to odour."*

Table 3: Matrix for Assessing the Significance of Impacts predicted from Dispersion Modelling of Moderately Offensive Odour

Odour Exposure Level as 98th %ile of Hourly Mean (ou_E/m^3)	Receptor Sensitivity		
	Low	Medium	High
Less than 0.5	Negligible	Negligible	Negligible
0.5 – 1.5	Negligible	Negligible	Negligible
1.5 – 3.0	Negligible	Negligible	Slight
3.0 – 5.0	Negligible	Slight	Moderate
5.0 – 10.0	Slight	Moderate	Moderate
More than 10.0	Moderate	Substantial	Substantial

It should be noted that Table 3 applies equally to cases where there are increases and decreases in odour exposure as a consequence of development, in which case the informative terms 'adverse' and 'beneficial' have been respectively applied to the corresponding descriptors.

The IAQM odour guidance[4] surmises that, *"Where the overall effect is deemed 'moderate' or 'substantial', it is likely to be considered as significant, whilst if the effect is termed as 'negligible' or 'slight' then it is likely to be adjudged as not significant. It is acknowledged that this is a binary judgement of either it is significant or not significant."*

This has been considered to determine the overall significance of potential odour impacts associated with the Site.

3.2.6 ODOUR BENCHMARKS

The Environmental Agency for England and Wales, in consultation with the Northern Ireland Environment Agency (NIEA) published guidance[7] providing guidelines for dispersion modelling as well as identifying target odour levels at the nearest sensitive locations in the vicinity of operations such as the existing site.

Table 4 below shows how different types of processes are categorised and the appropriate odour benchmark values.

Table 4: Odour Benchmark levels

Relative Offensiveness of Odour	Benchmark level (ou/s)
Most Offensive odours; • Processes involving decaying animals or fish • Processes involving septic effluent or sludge • Biological landfill odours	1.5
Moderately Offensive Odours • Intensive livestock rearing • Fat frying (food processing) • Sugar beet processing • Well aerated green waste composting	3.0
Less offensive odours; • Brewery • Confectionery • Coffee roasting • Bakery	6.0

For the purposes of assessing odorous emissions from the industrial building, the odour target value of C_{98}, 1-Hour ≤3 ou/m^3 will be adopted at the nearest sensitive receptor.

To put these guidelines into context, an odour threshold of 1ou/m^3 is the level at which an odour is detectable by 50% of screened panellists. The recognition threshold is about 5 times this concentration i.e. 5ou/m^3. Furthermore, odour concentration of between 5 and 10 ou/m^3 above background will give rise to a faint odour and concentrations greater than 10ou/m^3 constitutes a distinct odour and are likely to give rise to nuisance complaints.

Odour assessments are commonly compared to the 98th percentile of hourly averages. For a typical meteorological year, the dispersion model predicts 8,760 hourly concentrations for each receptor location. The 98th percentile is part of the statistical distribution, where 98% of the results fall below this value and 2% of the results fall above this value.

[7] H4 Odour Management: How to comply with your environment permit; Environment Agency March 2011

4.0 AIR QUALITY

The proposed target levels and method of assessment is described in this section.

4.1 Ecological Impacts

This assessment relates to the ecologically sensitive sites within the remit of NIEA.

4.1.1 AMMONIA

Information was provided by the NIEA advising that there are limitations on emissions of ammonia from such installations for both the protection of human health and for the protection of vegetation. They are referenced from *Cape, J.N.; van der Eerden, L.J.; Sheppard, L.J.; Leith, I.D.; Sutton, M.A.. 2009. Evidence for changing the critical level for ammonia. Environmental Pollution, 157 (3). 1033-1037.*

Where the limits are applied to general vegetation such as herbaceous species or forest trees the limit is set at 3 ± 1 µg/m^3 of ammonia (ie. 2-4 µg/m^3) as a long-term (several year) concentration.

For particularly sensitive plants such as lichens and bryophytes, the limit of 1 µg/m^3 is applied to ammonia as a long-term (several year) concentration

Table 5 shows the target levels for both the protection of human health and protection of vegetation.

Table 5: Ammonia limit values

Pollutant	Reason	Guideline Value	Measured as
Ammonia	Protection of Human Health	180 µg/m^3	Annual Mean
		2,500 µg/m^3	Max 1-Hr
	Protection of Vegetation	1-3 µg/m^3	Annual Mean

5.0 DISPERSION MODELLING DATA

The inputs for the air quality dispersion modelling assessment are described in detail in this Section.

5.1 AERMOD Dispersion Modelling Package Description

The AMS/EPA Regulatory Model (AERMOD) is the current US EPA regulatory model used to predict pollutant concentrations from a wide range of sources that are present at typical industrial facilities.

AERMOD is also identified in the Environment Agencies H4 Guidance as an appropriate dispersion model to meet its requirements.

The model accepts hourly meteorological data to define the conditions for plume rise, transport, diffusion and deposition. It estimates the concentration or deposition value for each source and receptor combination for each hour of input meteorology and calculates user-selected short term averages. The model also takes into account the local terrain surrounding the facility. Since most air quality standards are stipulated as averages or percentiles, AERMOD allows further analysis of the results for comparison purposes.

Percentile analysis for emissions is calculated for the maximum averages using the AERMOD-percent post-processing utility. This utility calculates the maximum concentration of a pollutant from all receptors at a specific percentile, for a specific period. Employing the percentile facilitates the omission of unusual short-term meteorological events that may cause elevated pollutant concentrations and hence a more accurate representation of the likely average pollutant concentrations over an averaging period.

The following information was input into the model for the prediction of maximum ground level ambient air quality concentrations from the proposed development.

5.2 Input Parameters

The site layout map, building plans and elevations were used as a template for all sources, relevant structures and the boundary of the facility

5.2.1 AMMONIA EMISSIONS

The building has the potential to emit ammonia from the releases associated with the storage/management of digestate.

Table 6 details the normalised volume flow (Nm^3/s) for the emission point associated with the site.

Table 6: Normalised Flow Rates from Stack

Source	Actual Volume Flow (m^3/hr)	Normalised Volume Flow (Nm^3/hr)*	Normalised Volume Flow (Nm^3/s)
Extract Stack	11,166	9,740	2.71

**Actual volume flow is based on 313.15K, 101.3kPa and 5% O_2.*

Table 7 below relates to the emission concentrations values associated with the proposed extract stack on the site, which take account of the air **after** UV carbon filter treatment.

Table 7: Emission Concentrations from Extract Stack

Source	Pollutant	Normalised Volume Flow (Nm^3/s)	Emission Concentration Values (mg/Nm^3)	Emission Rate per Stack (g/s)
Extract Stack	Ammonia	2.71	2.2*	**0.006**

**This is the maximum emission concentration from the air after it has passed through the UV treatment and carbon filter, which has been provided by the manufacturer.*

5.2.2 ODOUR EMISSIONS

The main source of emissions from the proposed site are from the building itself.

Several abatement systems are incorporated into the design of the facility to minimise potential adverse impacts on the environment and human health.

These include the indoor delivery, handling and blending of the digestate and mineral additives with fast acting roller shutter doors located on the proposed building.

A Local Exhaust Ventilation ("LEV") system will be installed within the building to capture odour emissions for Ultra-Violet ("UV") treatment prior to passing through a carbon filter. The treated and abated odour emission airflow will be discharged to the atmosphere via a single emission point, the proposed stack.

The total odour emissions from the LEV are based on the maximum odour concentration from the system, as well as the total volume of air passing through the carbon filter, as summarised below:

- The maximum odour concentration from the proposed treatment is $1,000ou/m^3$.
- The total volume of air that will pass through the stack is approx. $13,325m^3$.

The total odour from the LEV is detailed in the Table below.

Table 8: Odour Emission Rate from Odour Treatment System

Source	Odour Concentration (ou/m^3)	Total Volume ($m^3/hour$)	Total Volume ($m^3/second$)	Total Odour Emission Rate (ou/s)
LEV	1,000	13,325	3.70	**3,700**

It can be seen from the table above that the total odour emission rate from the building, after passing through the UV treatment and carbon filter, is 3,600ou/s, which has been included as part of the odour model.

5.2.3 STACK EMISSION VELOCITY

Table 9 below shows the ventilation rate of the stacks relied upon in the assessment.

Table 9: Ventilation rates from stack

Parameter	Extract Stack
X-Coordinate	343344
Y-Coordinate	374541
Temperature (^{o}C)	40
Stack Height AGL (m)	16.9
Stack tip Diameter (m)	0.51
Actual Volume Flow (m^3/hr)	11,116
Flue Gas Temp (K)	313.15
Efflux Velocity (m/s)	15.01

5.3 Meteorological Data

The AERMOD dispersion model requires the use of meteorological data (such as wind speed and direction) as pollutant concentrations can vary in time and space depending on the distribution of pollution sources and topography.

The Environment Agency's Permitting: Air Dispersion Modelling Reports[8] Guidance recommends that *"to represent conditions for an 'average year' hourly meteorological data for a period of at least three, preferably five years should be used"* to assess inter-year variations.

For this assessment, five years of hourly sequential meteorological data has been acquired from the Belfast International Airport, Aldergrove site for the years between 2018 and 2022 and incorporated into the AERMOD dispersion modelling exercise. This allowed for the determination of the predicted impact of emissions of ammonia from the site.

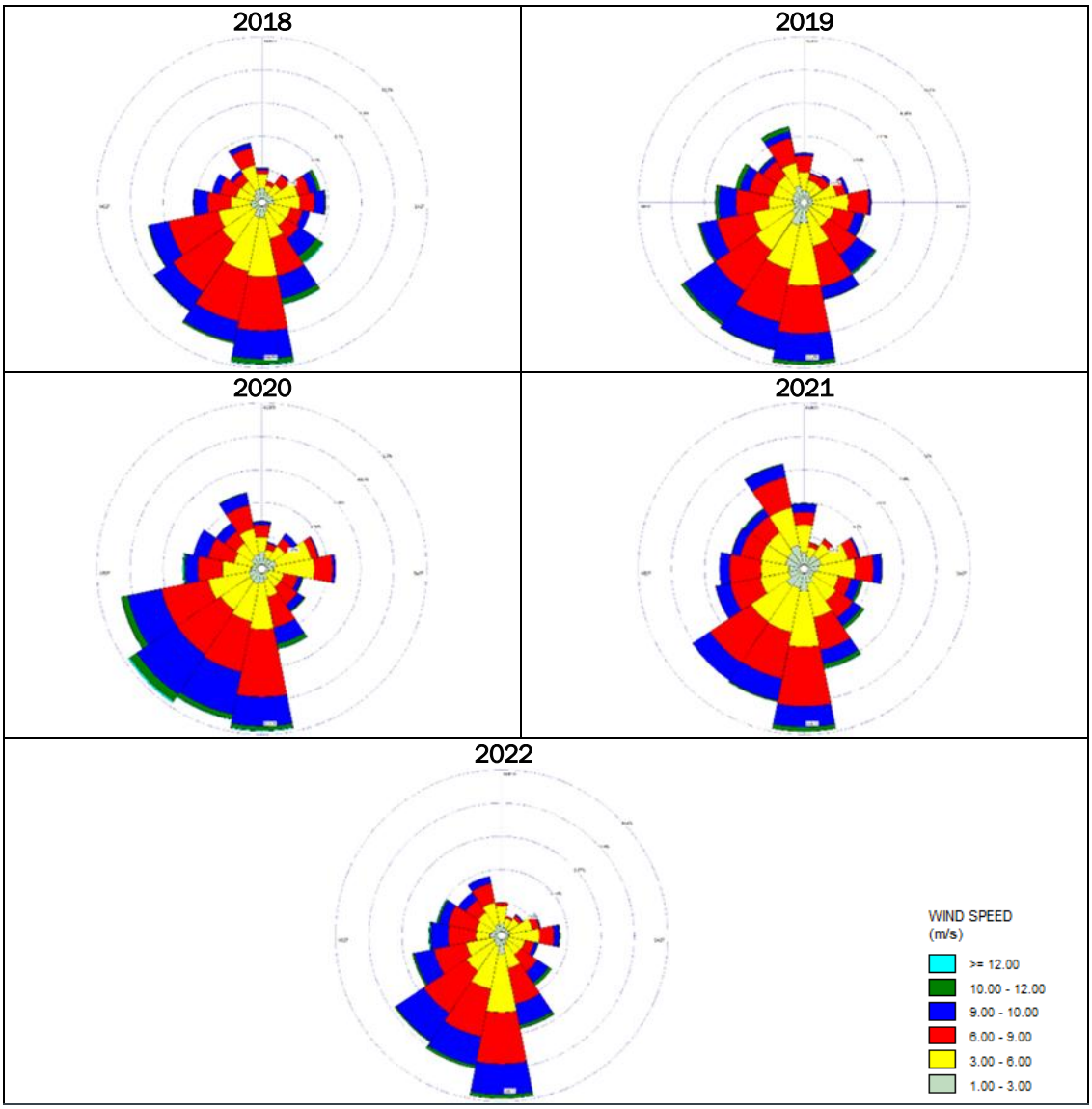
The corresponding meteorological datasets for the assessment have been acquired from Lakes Environmental who utilise the Weather Research and Forecasting (WRF) model, a mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting applications to generate a representative, high resolution meteorological dataset suitable for use within the AERMOD dispersion modelling package. The WRF model is used globally to simulate weather and air quality conditions by drawing from observations and archived meteorological model data and objective analysis to generate gridded meteorological parameters horizontally and vertically for a region.

Lake Environmental then employ the Mesoscale Model Interface Program (MMIF) to convert the prognostic WRF meteorological model output to AERMET pre-processor data input format prior to use within the AERMOD dispersion modelling package. During technical meetings held with the NIEA, it has been confirmed that a surface roughness factor of 0.2 should be applied to the respective meteorological dataset within AERMET before use in any AERMOD dispersion modelling exercises. The results in this report reflect the use of this factor.

The associated wind rose plots for each individual year are presented in Figure 1.

[8] *Environment Agency & DEFRA. Environmental permitting: air dispersion modelling reports. 19 January 2021. Available* at: *https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports*

Figure 1: Annual Windrose Data



5.4 Building Downwash

When one or more buildings in the vicinity of a point source interrupt wind flow, an area of turbulence known as a building wake is created. Pollutants emitted from a relatively low level can be caught in this turbulence, affecting their dispersion. This phenomenon is called building downwash. In order to conduct an analysis of downwash effects of the sources created to mimic the release of emissions from the site, the dimensions (including heights) of the existing buildings on-site was obtained from drawings.

5.5 Digital Terrain Data

AERMOD contains a terrain data pre-processor called AERMAP. Receptor and source elevation data from AERMAP output is formatted for direct insertion into an AERMOD control file. The elevation data are used by AERMOD when calculating air pollutant concentrations.

Regulatory dispersion models applicable for simple to complex terrain situations require information about the surrounding terrain. With the assumption that terrain will affect air quality concentrations at individual receptors, AERMAP first determines the base elevation at each receptor and source. For complex terrain situations, AERMOD captures the essential physics of dispersion in complex terrain and therefore needs elevation data that convey the features of the surrounding terrain. In response to this need, AERMAP searches for the terrain height and location that has the greatest influence on dispersion for each individual receptor. This height is the referred to as the hill height scale. Both the base elevation and hill height scale data are produced by AERMAP as a file or files which can be directly inserted into an AERMOD input control file.

6.0 RESULTS

The fifteen closest sensitive receptors are shown in Table 10 below. It should be noted that these receptors are not limited to third party dwellings, and also include the industrial premises, workplaces & properties within the applicant's ownership.

Table 10: Nearest Residential Properties

	Location	Grid Coordinate (X,Y)	Approx. Distance to Extract Stack (m)*
H1	32 Carrowreagh Road	343513, 374671	213
H2	30 Carrowreagh Road	343528, 374665	222
H3	28 – 28A Carrowreagh Road	343530, 374620	201
H4	27 Carrowreagh Road	343601, 374569	258
H5	40 Millreagh Grove	343569, 374467	237
H6	21 Millreagh Grove	343561, 374433	242
H7	25 Millreagh Grove	343552, 374407	247
H8	1 Millreagh Grove	343527, 374378	246
H9	2 Millreagh Grove	343511, 374353	252
H10	Dundonald Enterprise Park	343402, 374447	111
H11	Dundonald Enterprise Park	343365, 374457	87
H12	Dundonald Enterprise Park	343332, 374460	82
H13	Dundonald Enterprise Park	343296, 374474	82
H14	Dundonald Enterprise Park	343292, 374489	73
H15	Government Training Centre	343100, 374459	257

**The co-ordinates of the extract stack are approximately 343344, 374541. The distances shown above are from this point to the receptor co-ordinates as identified.*

The tabulated results for the odour and ammonia modelling are shown in the relevant Sections below.

6.1 Odour

The activities within the building are carries out in a contained environment, with the only emissions to air being expected after the gases have passed through the carbon filter.

Odour modelling was carried out for each individual year with the results at the nearest sensitive locations presented in Table 12 below.

All results are the odour concentration in (ou_E/m^3).

Table 11: 98th Percentile of the Max 1-hr odour levels at nearest Receptors

	2018	2019	2020	2021	2022	Average
H1	0.21	0.22	0.22	0.22	0.21	0.22
H2	0.20	0.22	0.20	0.21	0.20	0.21
H3	0.21	0.24	0.23	0.23	0.21	0.22
H4	0.15	0.17	0.17	0.16	0.14	0.16
H5	0.16	0.18	0.17	0.18	0.16	0.17
H6	0.14	0.16	0.17	0.17	0.16	0.16
H7	0.13	0.17	0.16	0.16	0.17	0.16
H8	0.14	0.17	0.16	0.17	0.17	0.16
H9	0.13	0.17	0.16	0.18	0.17	0.16
H10	0.37	0.39	0.38	0.42	0.39	0.39
H11	0.58	0.57	0.55	0.60	0.56	0.57
H12	0.26	0.29	0.27	0.30	0.29	0.28
H13	0.17	0.20	0.21	0.16	0.16	0.18
H14	0.19	0.20	0.20	0.16	0.17	0.18
H15	0.15	0.13	0.17	0.15	0.15	0.15

The results show that all existing dwellings are below the $3ou_E/m^3$ when considered as individual years and as a 5-year average of the 98th percentile.

It should be noted that there are no receptors in the vicinity of the site that will experience odour levels higher than those predicted in the Table above.

6.2 Odour Significance

An assessment of the significance of the odour impact at each receptor using the specified criterion within the IAQM odour guidance (see Table 3) and dispersion modelling results (see Table 23) has been made in Table 24 below.

Table 12: Significance of Estimated Odour Emissions at Considered Receptors

	Receptor ID	Maximum Annual 98th Percentile Hourly Mean Concentration (ou_E/m^3)		Receptor Sensitivity	Impact Descriptor
H1	32 Carrowreagh Road	0.22	2019	High	Negligible
H2	30 Carrowreagh Road	0.22	2019	High	Negligible
H3	28 – 28A Carrowreagh Road	0.24	2019	High	Negligible
H4	27 Carrowreagh Road	0.17	2019	High	Negligible
H5	40 Millreagh Grove	0.18	2019	High	Negligible
H6	21 Millreagh Grove	0.17	2020	High	Negligible
H7	25 Millreagh Grove	0.17	2019	High	Negligible
H8	1 Millreagh Grove	0.17	2019	High	Negligible
H9	2 Millreagh Grove	0.18	2021	High	Negligible
H10	Dundonald Enterprise Park	0.42	2021	Medium	Negligible
H11	Dundonald Enterprise Park	0.60	2021	Medium	Negligible
H12	Dundonald Enterprise Park	0.30	2021	Medium	Negligible
H13	Dundonald Enterprise Park	0.21	2020	Medium	Negligible
H14	Dundonald Enterprise Park	0.20	2019	Medium	Negligible
H15	Government Training Centre	0.17	2020	Medium	Negligible

As indicated in Table 13, the significance of odour impacts has been predicted to be 'Negligible' at all receptors.

The IAQM guidance states that only if the impact is greater than slight, the effect is considered significant. As such, the maximum impact of 'negligible' at the worst affected receptors is considered **not significant**, in accordance with the stated methodology.

7.0 Ecological Sites

The ammonia levels were assessed in areas of specific interest in relation to vegetation.

All areas within approximately 7.5km of the proposed development were searched on the NIEA website for the eight types of designated areas listed below:

- **RAMSAR**

  These are wetlands of international importance designated under the RAMSAR convention.

- **Special Areas of Conservation (SAC)**

  These areas are given special protection under the European Union's Habitats Directive to protect some of the most seriously threatened habitats and species across Europe.

- **Special Protection Areas (SPA)**

  Areas designated under the European Commission on the conservation of wild birds (the Birds Directive). All EU member states are required to identify internationally important areas for breeding, over-wintering and migrating birds and designate them as SPA's.

- **National Nature Reserve (NNR)**

  An area of importance for flora, fauna and geological features of special interest, which are reserved and managed for conservation and to provide special opportunities for study or research.

- **Areas of Special Scientific Interest (ASSI)**

  These have been identified as being Northern Ireland's very best wildlife and geological sites.

- **Areas of Outstanding Natural Beauty (AONB)**

  Areas designated to protect and enhance their distinctive landscapes and scenic beauty and to promote their enjoyment by the public.

- **Marine Nature Reserves (MNR)**

  The purpose of the MNR's is to conserve marine flora and fauna and geological features of special interest, while providing opportunities for study of marine systems. Strangford Lough is NI's only MNR

- **World Heritage Site**

  Designated for their globally important cultural or natural interest and require appropriate management and protection measures. Giant's Causeway and Causeway Coast is NI's

There are seven designated sites located within 7.5km, and one priority habitat within 2km of the building, as detailed in the Table below.

Table 13: Designated and Priority Sites in vicinity of Building

Location	Description	Distance (km)	Designation	NI Grid Co-ordinates	
E1	Craigantlet Woods*	0.33	ASSI	343166	374815
E2	Scrabo	4.20	ASSI	347309	373159
E3	Belfast Lough (Outer Belfast Lough ASSI)	5.97	SPA	340160	379596
E4	Inner Belfast Lough	6.02	ASSI	338615	378261
E5	Belfast Lough Open Water	6.13	SPA	339342	379177
E6	Whitespots	6.15	ASSI	349248	376279
E7	Strangford Lough (Part 1 ASSI)	6.24	SAC, SPA	349186	372337
E8	Craigantlet Woods*	0.15	SLNCI	343323	374685

**It should be noted that the receptor locations differ for the closest point of Craigantlet Woods ASSI (E1) and Craigantlet Woods SLNCI (E8).*

The predicted ammonia impacts are presented in Table 14 below, which show the impacts from the building.

Table 14: Annual Average Ammonia from proposed development

Location	2018	2019	2020	2021	2022	Average
H1	0.04	0.04	0.04	0.04	0.04	0.04
H2	0.04	0.04	0.04	0.03	0.04	0.04
H3	0.04	0.04	0.04	0.04	0.04	0.04
H4	0.02	0.02	0.03	0.02	0.02	0.02
H5	0.02	0.02	0.02	0.02	0.02	0.02
H6	0.02	0.02	0.02	0.02	0.02	0.02
H7	0.02	0.02	0.02	0.02	0.02	0.02
H8	0.02	0.02	0.02	0.03	0.02	0.02
H9	0.02	0.02	0.02	0.03	0.02	0.02
H10	0.05	0.06	0.06	0.08	0.06	0.06
H11	0.07	0.08	0.08	0.11	0.08	0.08
H12	0.03	0.04	0.03	0.04	0.03	0.03
H13	0.02	0.02	0.02	0.02	0.02	0.02
H14	0.02	0.02	0.02	0.02	0.02	0.02
H15	0.02	0.02	0.02	0.02	0.02	0.02
E1	0.0152	0.0150	0.0110	0.0154	0.0143	0.0142
E2	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
E3	0.0002	0.0002	0.0001	0.0002	0.0001	0.0001
E4	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001
E5	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001
E6	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001
E7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
E8	0.0656	0.0609	0.0533	0.0628	0.0675	0.0620

All of the predicted Ground Level Concentrations of Ammonia are significantly below the limit values as provided in Table 5 in relation to the protection of human health and vegetation.

Table 15 below compares the highest annual average predicted levels at the designated area where:

- The Process contribution (PC), the maximum modelled concentration of the substance due to process emissions alone
- Predicted Environmental Concentration (PEC) – that is, the maximum modelled concentration (of ammonia) due to process emissions combined with estimated baseline concentrations.
- PC and PEC as a percentage of the objective or guideline.

In accordance with A3.195 of Part IV of the Environment Act 1995 Environment (Northern Ireland) Order 2002 Part III Local Air Quality Management Technical Guidance LAQM.TG(09) February 2009, *"For the assessment of annual mean concentrations the annual mean contribution of the process can be added to the annual mean estimate for background."*

Table 15: Ammonia Concentrations from proposed development

	Location	Guideline (µg/m³)	Background (µg/m³)	Highest PC (µg/m³)	PEC (µg/m³)	PC/ Guideline level (%)	PEC/ Guideline level (%)
E1	Craigantlet Woods ASSI	3	1.71	0.0154	1.7254	**0.51**	58
E2	Scrabo ASSI	3	1.75	0.0002	1.7502	**0.01**	58
E3	Belfast Lough (Outer Belfast Lough ASSI) SPA	3	1.6	0.0002	1.6002	**0.01**	53
E4	Inner Belfast Lough ASSI	3	1.60	0.0002	1.6002	**0.01**	53
E5	Belfast Lough Open Water SPA	3	1.6	0.0002	1.6002	**0.01**	53
E6	Whitespots ASSI	3	1.77	0.0002	1.7702	**0.01**	59
E7	Strangford Lough (Part 1 ASSI) SAC, SPA	3	1.67	0.0001	1.6701	**0.00**	56
E8	Craigantlet Woods SLNCI	3	1.71	0.0675	1.7775	**2.25**	59

Ammonia concentrations at these sites are dominated by the background concentrations, which are approximately 53 - 59% of the air quality guidelines for ammonia.

The maximum process contribution from the proposed development is:

- 0.51% (Craigantlet Woods ASSI) at any designated site.
- 2.25% (Craigantlet Woods SLNCI) at any Priority Habitat.

As detailed above, the receptor locations differ for the closest point of Craigantlet Woods ASSI and Craigantlet Woods SLNCI.

7.1 NITROGEN DEPOSITION

The Critical Load specifies the annual amount of ammonia that can be deposited for a given area per year. Below this level, sensitive habitat should not be affected.

The dry deposition flux (µg/m^{2}/s of ammonia) was calculated using AQTAG06[9] where the predicted ground level of ammonia (in µg/m^{3}) was multiplied by the relevant deposition velocity.

The dry deposition was then multiplied by the conversion factor provided in the guidance to convert to the levels of kgN/ha/yr. The conversion factors are provided in Table 8.1 and 8.2 of the AQTAG06 as presented in the Table 16 below.

Table 16: Conversion Factors

Pollutant	NH_3 Deposition Velocity (m/s)	Conversion Factor
NH_3 to N	0.02 (Grassland)	260

Table 17 below converts the highest Process Contribution in µg/m^{-3} to kg.N/ha/yr, using the conversion factors detailed in Table 16 above.

Table 17: Conversion of Highest NH_3 Results

Location	Pollutant	Highest PC (µg/m^{-3})	NH_3 Deposition Velocity (m/s)	Conversion Factor	Highest PC (kg.N/ha/yr)
E1		0.0154	0.03 (Forest)		0.120
E2		0.0002	0.02 (Grassland)		0.001
E3		0.0002	0.02 (Grassland)		0.001
E4	NH_3 to N	0.0002	0.02 (Grassland)	260	0.001
E5		0.0002	0.02 (Grassland)		0.001
E6		0.0002	0.02 (Grassland)		0.001
E7		0.0001	0.02 (Grassland)		0.001

The max PC at the designated site is 0.012 kg.N/ha/yr.

[9] Technical Guidance on Detailed Modelling Approach for an Appropriate Assessment for Emissions to Air, AQTAG06

8.0 ASSESSMENT OF IMPACT

The NIEA have provided detail on their updated ammonia strategy, which is now based on an interim 'case-by-case' approach, using the Decision-Making Threshold (DMT) project reports published by the JNCC.

A DMT is a quantifiable contribution from an individual source which can properly be ignored for the purpose of decision-making as the combined effects of proposals excluded by it will not undermine the achievement of the conservation objectives. Further assessment would not change the outcome of the decision to be taken.

Ammonia

A summary of the steps outlined in the case-by-case approach are detailed below:

- Where the PC at a designated site is at or below 0.08%, it is considered de minimis and no further air quality assessment is required.
- If the application contributes at impact more than 0.08%, a Site Relevant Threshold (SRT) is applied. The SRT has been calculated as 0.75%, and additional information is provided in Appendix C.
- If the application contributes more than the SRT, further assessment is necessary by way of an in-combination assessment.

Taking into account the predicted impacts included in Table 15 above, the following is a summary of the proposed building:

- A total of 7x designated sites were identified within 7.5km of the proposed development.
- The impact at 6 of the 7 designated sites was below the DMT of 0.08%. These contributions are considered de minimus and no further assessment is required.
- The maximum predicted PC was 0.51% at Location E1 (Craigantlet Woods ASSI), which is below the SRT of 0.75%. This contribution is also considered de minimus and no further assessment is required.

At all designated sites included as part of the assessment, the proposal contributed less than the DMT (0.08%) or SRT (0.75%).

Nitrogen Deposition

As noted in the NIEA response, the approach is based on the Decision-Making Threshold project reports published by the JNCC. The relevant SRT for both ammonia and nitrogen deposition are included in these reports.

The SRT for annual mean nitrogen deposition is confirmed as the following for the application site:

- 0.13 kg.N/ha/yr for woodland
- 0.088 kg.N/ha/yr for grassland

The results in Table 17 show that the maximum deposition at any designated site is 0.12 kg.N/ha/yr at Craigantlet Woods ASSI, which complies with the SRT for woodland. All other impacts are below the SRT associated with grassland.

Summary

In can be seen from the information above that the contribution from the proposed building under consideration, is below the SRT for both ammonia and nitrogen deposition at all designated sites in the vicinity.

As detailed above in the JNCC reports, the cumulative effects of proposals excluded by the DMT will not undermine the achievement of the conservation objectives for the relevant designated sites, and the impact is therefore considered to be **not significant**.

9.0 CONCLUSION

An air quality assessment has been undertaken for a proposed industrial building to be used for anaerobic digestate management on lands approximately 120m southwest of No. 28 Carrowreagh Road, Dundonald BT16 1TS.

Odour

The potential sources of odour associated with the proposed development have been assessed, and the maximum ground level odour concentration is predicted to be primarily confined to the immediate environs of the site.

Under the layout, the maximum 98th percentile of 1-hour ground level odour concentration at the worst effected residential property with no interest in the operation of the site, is in accordance with the target limit value for of $\leq 3ou_E/m^3$ when taken as an average of the 5-year period or within any individual 1-year period. The odour impact is considered to be not significant.

Ammonia & Nitrogen

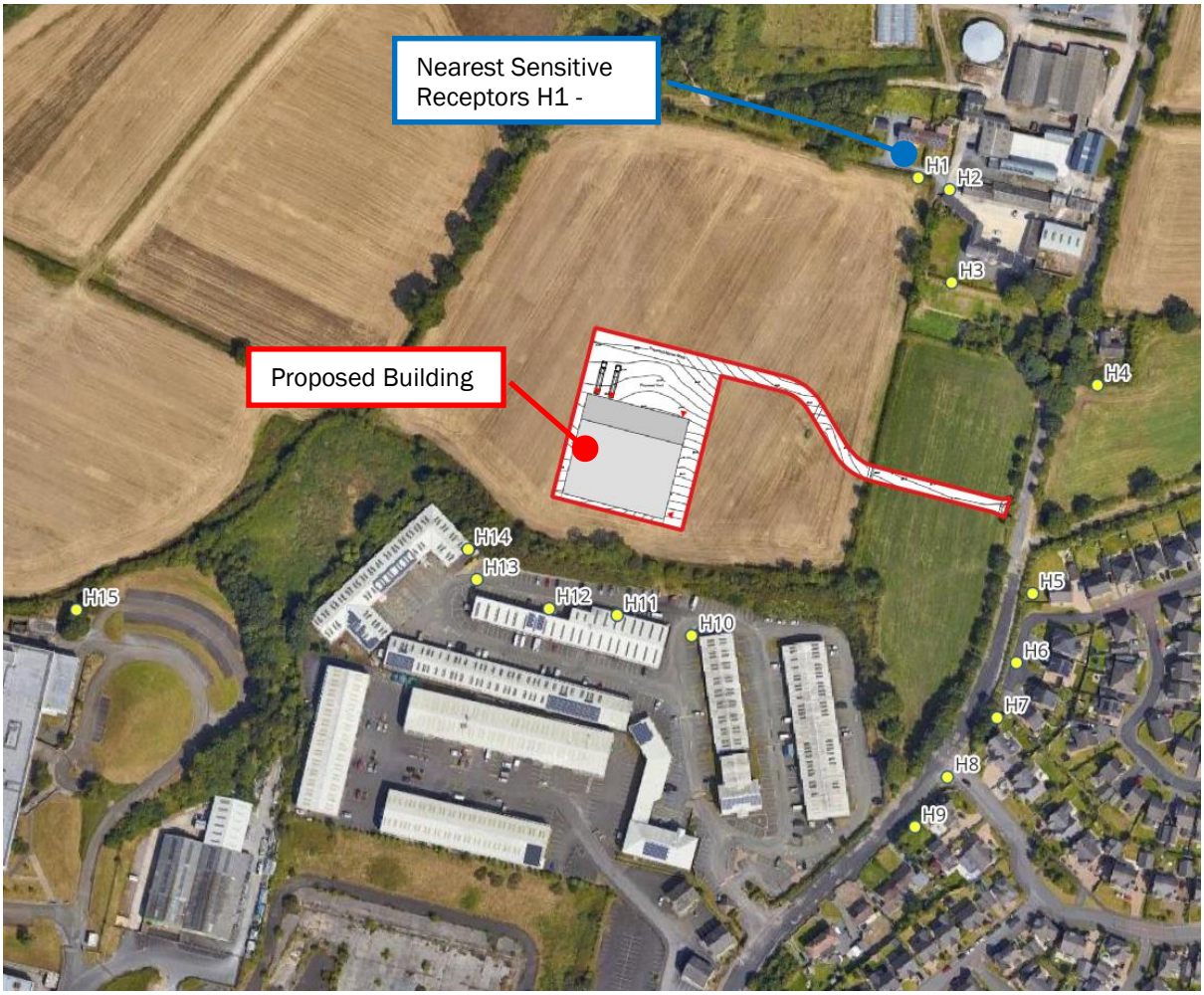
For air quality, it can be seen that the contribution from the proposal is below either the SRT for both ammonia and nitrogen deposition at all designated sites in the vicinity of the proposed development.

As detailed in the JNCC reports, the cumulative effects of proposals excluded by the SRT will not undermine the achievement of the conservation objectives for the relevant designated sites, and the impact is therefore considered to be not significant.

Appendix D indicates the predicted odour and ammonia plumes for the proposed development.

APPENDIX A SITE LOCATION

The Figure below show the location of the proposed development as well as the closest sensitive receptors.



**Note- The above diagram is not to scale and is for illustrative purposes only

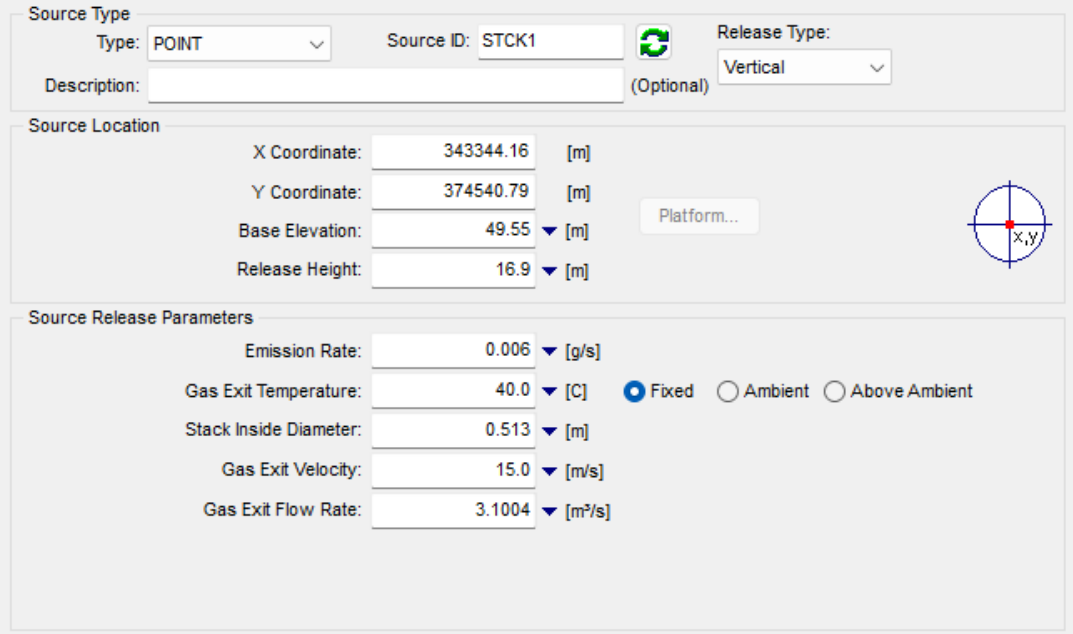
APPENDIX B AERMOD INPUTS

This Section details all of the AERMOD model inputs that were included in the model to calculate the predicted impacts.

Sources

The following Figures include the details of the proposed source and exact location, as it was input into the AERMOD model.

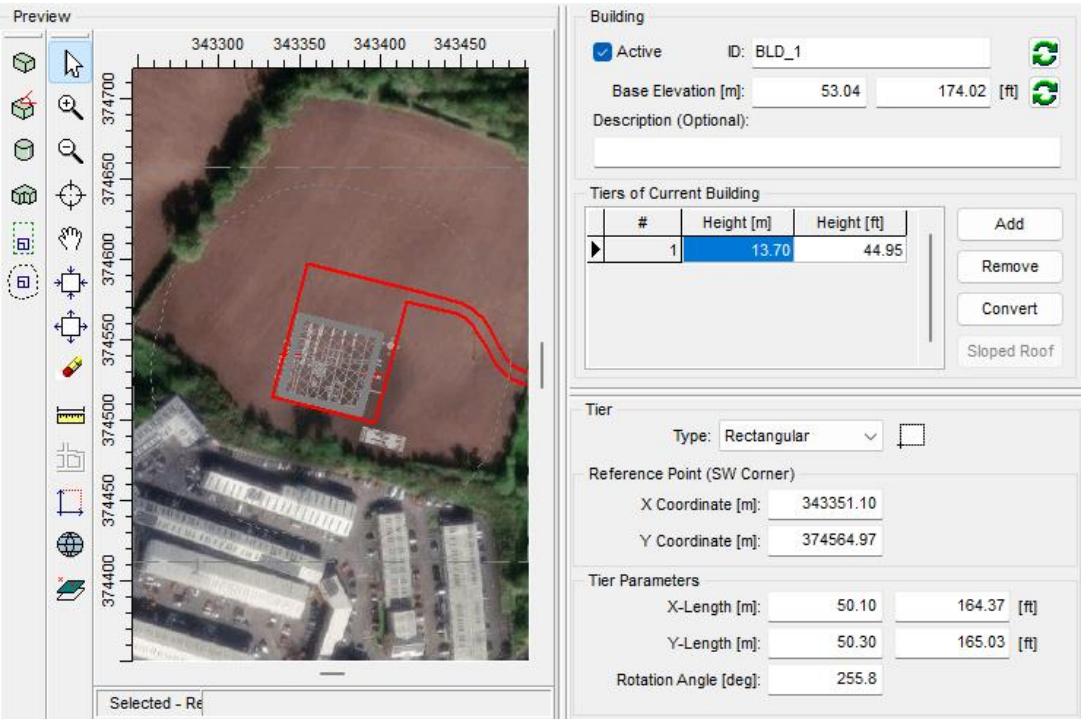
Figure 2: Proposed Shed AERMOD Inputs



Buildings

The exact input of the proposed building and location is shown in the Figure below.

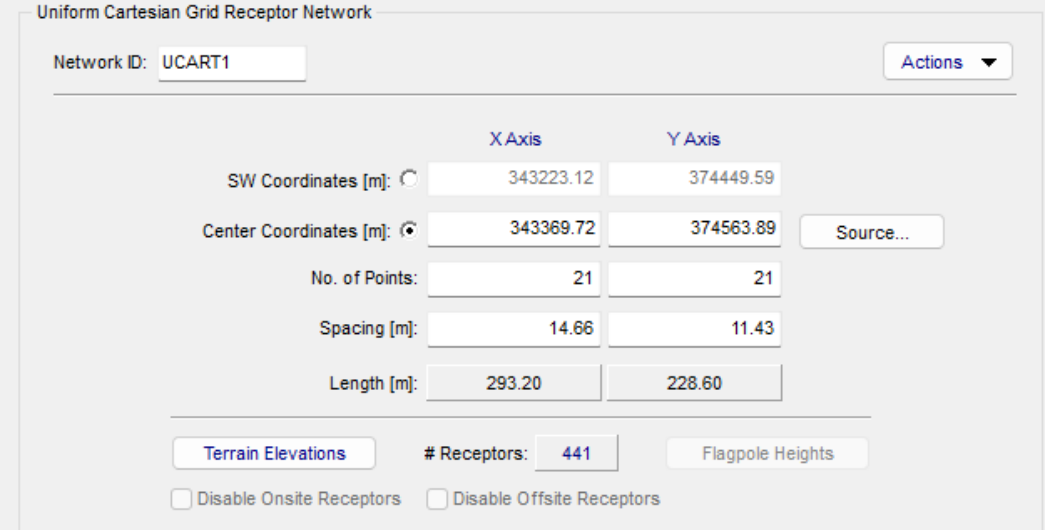
Figure 3: Proposed Building Inputs



Receptors

The information below shows the co-ordinates of the 'Uniform Cartesian Grid Receptors' that was input in the model to generate the ammonia plume.

Figure 4: Details of Uniform Cartesian Grid Receptors



Modelling Results

The Table below details the maximum 1-hour concentration at each of the sensitive receptors for the MET data 2018-2022.

Table 18: Ammonia concentrations at residential locations

Location	Maximum 1-Hour Concentration (µg/m³)
H1	1.51
H2	1.52
H3	1.74
H4	1.89
H5	1.75
H6	1.55
H7	2.44
H8	1.76
H9	1.97
H10	2.05
H11	4.49
H12	1.61
H13	0.79
H14	0.81
H15	3.14

All the predicted Ground Level Concentrations of Ammonia are significantly below the maximum 1-hour limit value as provided in Table 5 in relation to the protection of human health.

The Figure below details the ammonia plume for 2022 for the proposed site, created using the Uniform Cartesian Grid in Figure 4.

APPENDIX C SITE RELEVANT THRESHOLD

As detailed in the report, the updated NIEA strategy relies on a 'Site Relevant Threshold' (SRT) for the assessment of ammonia and Nitrogen impacts.

The SRT is calculated depending on the number of additional new projects below the DMT within 5km of the development over 13 years. The current applicable 13-year period is from 2017 – 2030. It is therefore necessary to estimate how many projects might be developed over this 13-year period.

Irwin Carr have completed a search of all relevant planning applications and IPPC permit applications/ variations within 5km of the development, and they are summarised in the Table below. As per the JNCC Technical Report, only those applications which are below the DMT have to be included as part of the calculation.

Table 19 : Number of additional new projects below the DMT within 5km of Development

Application	Proposal	Does Max PC Exceed DMT (0.08%)?	Include as Relevant Application?
LA05/2018/0655/F	Agricultural shed for purposes of agriculture plant and livestock	Application Withdrawn	No
	Total Applications from 2017 – 2023		**0**

In addition, there were no IPPC permits identified within 5km of the proposed development:

Based on the information above the identified applications/ permits, it can be seen that there are no relevant applications between 2017 – 2022 to be considered when calculating the DMT. Based on a consistent rate of development, it has therefore been assumed that there will be no additional new projects below the DMT within 5km of the development over the 13-year period.

Based on the Figure below, taken from the JNCC report, this results in a 'Very Low' Development Density, with the associated SRTs provided for each emission type.

Figure 5: Site Relevant Thresholds for Application to Individual Plans and Projects.

Development Density	Very Low	Low	Medium	High
Description	Remote area which sees very little development	Area which sees small amounts of development	Typical agriculture / industrial area	Area experiencing intensive growth (e.g. Powys or Immingham docks)
Example Number of additional new projects below the DMT within 5 km of proposed development over 13 yrs [a]	1	5	10	30
Site-Relevant Thresholds for On-site Emissions				
Annual Mean NH_3 (lichens/bryophytes) ($\mu g/m^3$)	0.0075	0.0034	0.0020	0.00079
Annual Mean NH_3 (higher plants) ($\mu g/m^3$)	0.022	0.010	0.0060	0.0024
Annual Mean NOx ($\mu g/m^3$)	0.087	0.046	0.030	0.014
Annual Mean N dep (woodland (kg-N/ha/yr)	0.13	0.057	0.034	0.013
Annual Mean N dep (grassland) (kg-N/ha/yr)	0.088	0.040	0.024	0.0093

APPENDIX D MODELLING RESULTS

The Figures below show the plumes associated with the proposed building.

PROJECT TITLE:

BH Estates- Carrowreagh

98th %tile of 1-Hour Ground Level Odour Concentration (ou/m3) (2022)





COMMENTS:

SOURCES:

1

RECEPTORS:

456

OUTPUT TYPE:

Concentration

MAX:

1.0 OU/M3**

MODELER:

Christy Carr

DATE:

27/03/2025

SCALE: 1:3,798

0 0.1 km

IRWIN CARR CONSULTANTS

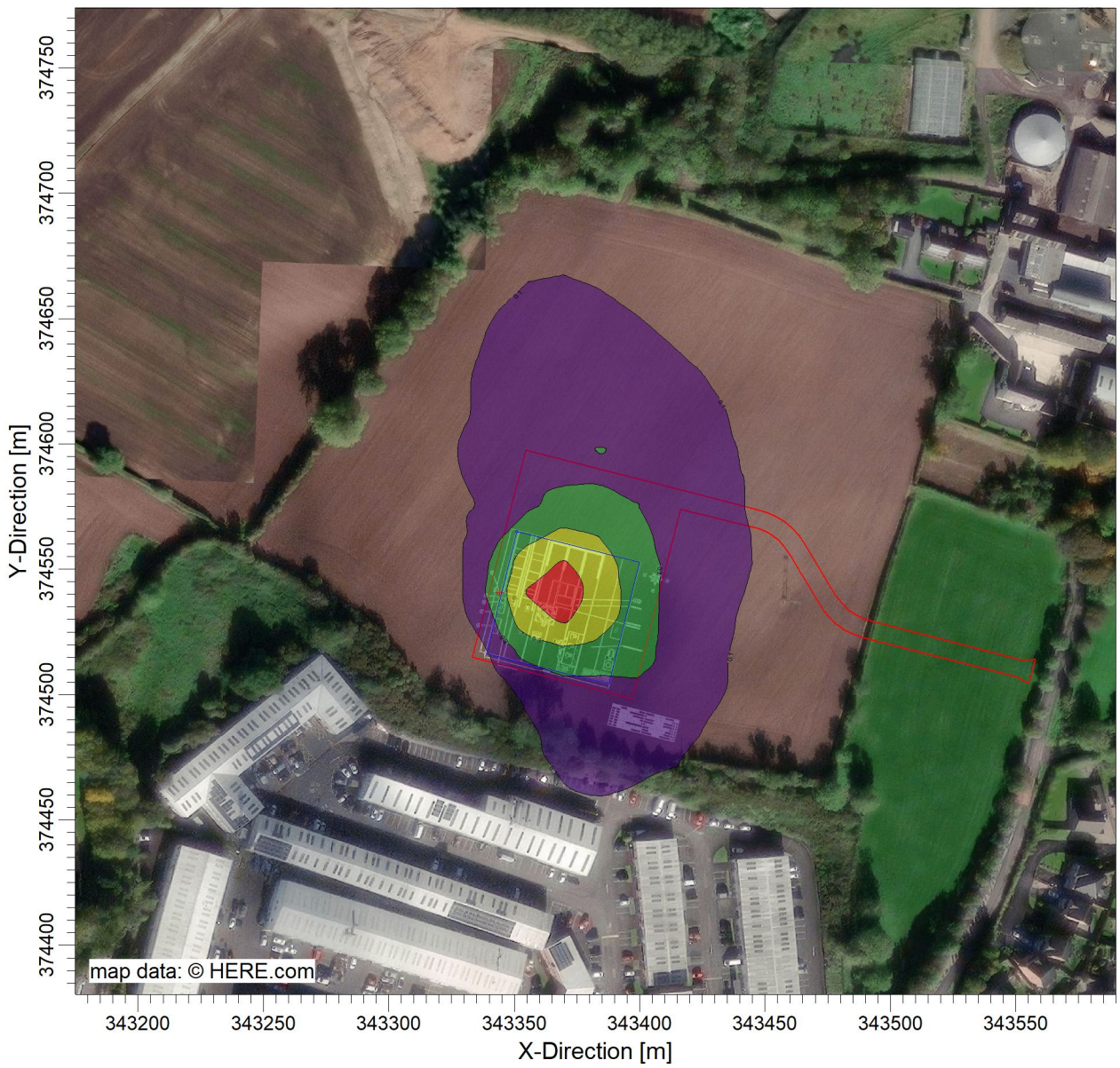
PROJECT NO.:

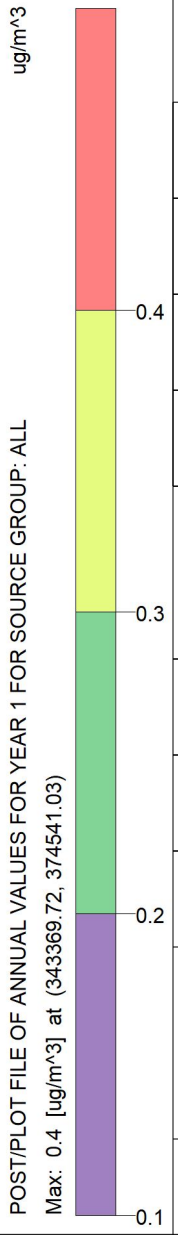
2024199

PROJECT TITLE:

BH Estates- Carrowreagh

Annual Average Ground Level Ammonia Concentration (ug/m3) (2022)





COMMENTS:

SOURCES:

1

RECEPTORS:

464

OUTPUT TYPE:

Concentration

MAX:

0.4 ug/m^3

MODELER:

Christy Carr

DATE:

27/03/2025

SCALE: 1:2,678

0 0.05 km

IRWIN CARR CONSULTANTS

PROJECT NO.:

2024199

AERMOD View - Lakes Environmental Software