Appendix 7A

Air Quality Assessment

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Proposed OCGT Development

Environmental Impact Assessment Report

Volume II – Appendices

Appendix 7A: Air Quality Impact Assessment

DOCUMENT HISTORY

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GLOSSARY

Abbreviation	**Description**
CO	Carbon monoxide
DMRB	Design Manual for Roads and Bridges
EFT	Emission Factor database Tool
ELV	Emission Limit Values
Env Std	Environmental Standard
EPA	Environmental Protection Agency
HRA	Habitats Regulations Assessment
IAQM	Institute of Air Quality Management
IED	Industrial Emissions Directive
IPPC	Integrated Pollution Prevention and Control
NO_X	Oxides of nitrogen
NO_2	Nitrogen dioxide
PC	Process Contribution
PEC	Predicted Environmental Concentration (PC + Background)
PM_{10}	Particulate Matter of 10 µm diameter
$PM_{2.5}$	Particulate Matter of 5 µm diameter
SAC	Special Area of Conservation
SO_2	Sulphur Dioxide
SPA	Special Protection Area
NHA	National Heritage Area
TOC	Total Organic Carbon
VOC	Volatile organic compounds

CONTENTS

TABLES

ANNEXES

1.0 OVERVIEW

1.1.1 This air quality dispersion modelling report quantifies the potential impact of the operation of a new Open Cycle Gas Turbine (OCGT) plant ('the Proposed Development') at Tynagh Power Station in Derryfrench, Loughrea, Co. Galway, Republic of Ireland.

1.1.2 Emissions to air from the Proposed Development have the potential to adversely affect human health and sensitive ecosystems. This report details the results of a dispersion modelling assessment of emissions from the process and associated road traffic.

1.1.3 The magnitude of air quality impacts at sensitive human receptors are quantified for pollutants emitted from the stack of the Proposed Development. The impact of emissions on sensitive ecological receptors is considered in the context of relevant Critical Loads (deposition to ground) or Critical Levels (atmospheric pollutant concentrations) for designated nature sites.

1.1.4 The assessment considers emissions from the Proposed Development during normal operational conditions and during the use of back-up fuel. Non routine emissions, such as those which may occur during the commissioning process or other short-term events typically only occur on an infrequent basis, are detected by the process control system and rectified within a short time period and are tightly regulated by the Environmental Protection Agency (EPA). For this reason, no detailed consideration of impacts associated with non-routine or emergency events is included within this assessment.

2.0 SCOPE

2.1 Combustion Plant Emissions

2.1.1 The assessment considers the impact of process emissions on local air quality, under normal operating conditions, from the emissions stack ('the stack') serving the combustion process. The assessment considers impacts in the year in which the Proposed Development is due to commence operation, 2027.

2.1.2 The dispersion of emissions is predicted using the dispersion model ADMS 5. The results are presented in both tabular format and as contours of predicted ground level process contributions overlaid on mapping of the surrounding area.

2.1.3 Emissions to air from combustion facilities are currently governed by Directive 2010/75/EU, the Industrial Emissions Directive (IED) (European Commission, 2010), which was transposed into Irish law in April 2013 (Environmental Protection Agency (Industrial Emissions) (Licensing) Regulations 2013, S.I. No. 138/2013). This Directive amends, consolidates and replaces seven Directives on pollution from industrial installations, including those relating to Integrated Pollution Prevention and Control (IPPC).

2.1.4 The IED contains measures relating to the control of emissions, including emissions to air, for example by specifying minimum standards for gas temperature and the residence time of combustion gases within the combustion chamber. The Directive sets limits on emissions of a wide range of air pollutants and requires operators to monitor and report emissions to air as well as to other environmental media.

2.1.5 The Proposed Development would be regulated under the Industrial Emissions Directive (IED) and in accordance with the Large Combustion Plants BREF. This BREF was updated, and the final version was published in 2017 and was formally adopted by the EU soon after. For the purposes of the IED and Permitting, the conclusions from the updated BREF should be regarded as enforceable through Environmental Permits and it is assumed that the Environmental Protection Agency (EPA) would set specific limits on the Environmental Permit based on the BAT-associated emission levels (BAT-AELs).

2.1.6 The design of the flue gas treatment system needs to be fully compliant with current legislation, meeting the requirements of BAT as well as the EPA Act and the IED. In accordance with Article 15, paragraph 2, of the IED, the emission limits that the Proposed Development plant will be designed to meet will be based on BAT. BAT-AELs are included in the Large Combustion Plants BREF that has now been published and these have been applied in the air impact assessment accordingly.

2.1.7 The pollutants considered within this assessment from the Proposed Development stack are:

- oxides of nitrogen (NO_X), as Nitrogen Dioxide (NO_2);
- particulate matter (as PM_{10} and $PM_{2.5}$ size fractions); and
- carbon monoxide (CO).

2.1.8 A comparison has been made between predicted model output concentrations, and short-term and long-term Environmental Standards (Env Std), set out within EPA's Air Dispersion Modelling from Industrial Installations Guidance Note (AG4) (EPA, 2019).

2.2 Cumulative Impacts

2.2.1 Impacts from existing sources of pollution in the area have been accounted for in the adoption of site-specific background pollutant concentrations from archive sources and a programme of project-specific baseline air quality monitoring in close proximity to the Proposed Development.

2.2.2 The other developments specifically modelled in the cumulative impact assessment are the existing CCGT Power Station unit and Tynagh 1 OCGT Approved Development (Ref 21/2192).

2.2.3 The assessment of cumulative impacts is contained in Section 8 of this Report.

2.3 Sources of Information

2.3.1 The information used within this air quality assessment includes:

- data on emission concentrations to atmosphere from the process, taken from limit values in the IED and BAT-AEL values, or in the case of stack flow parameters, data provided by EP Energy Development Ltd and Fichtner Consulting Engineers;
- details on the development layout provided by EP Energy Development Ltd and Fichtner Consulting Engineers;
- OSi (Ordnance Survey Ireland) mapping;
- OSi terrain data;
- baseline air quality data from project specific monitoring, published sources and Local Authorities;
- Information on the construction plans;
- meteorological data supplied by ADM Ltd; and
- road traffic flow data from the AECOM traffic team.

2.4 Assessment Structure

2.4.1 The remainder of this Appendix is set out as follows:

- Section 3: Assessment criteria;
- Section 4: Assessment methodology;
- Section 5: Summary of baseline air quality;
- Section 6: Construction Dispersion Modelling Results;
- Section 7: Operation Dispersion Modelling Results;

- Section 8: Cumulative Impacts;
- Section 9: Assessment limitations and assumptions; and
- Section 10: Conclusions.

3.0 ASSESSMENT CRITERIA

3.1 Environmental Standards for the Protection of Human Health

3.1.1 The Environmental Standards criteria for the protection of human health, against which impacts from the Proposed Development and road traffic are evaluated, are set out within Table 7A.1. The criteria are taken from the Environmental Standards contained within EPA's Air Dispersion Modelling from Industrial Installations Guidance Note (AG4) (EPA, 2019).

3.1.2 The Clean Air for Europe (CAFE) programme revisited the management of Air Quality within the EU and replaced the EU Framework Directive 96/62/EC (Council of European Communities, 1996), its associated Daughter Directives 1999/30/EC (Council of European Communities, 1999), 2000/69/EC (Council of European Communities, 2000), 2002/3/EC (Council of European Communities, 2002), and the Council Decision 97/101/EC (Council of European Communities, 1997) with a single legal act, the Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC (Council of European Communities, 2008).

3.1.3 The Air Quality Directive is currently transposed into Irish legislation by the Air Quality Standards Regulations (S.I. 180 of 2011). These Limit Values are binding in the Republic of Ireland and have been set with the aim of avoiding, preventing or reducing harmful effects on human health and on the environment as a whole. The Directive also lists a number of Target Values.

Table 7A.1: Environmental Standards for Air (for the Protection of Human Health)

POLLUTANT	SOURCE	CONCENTRATION (µG/M^3)	MEASURED AS
NO_2	EU Air Quality Limit Values	40	Annual Mean
		200	1-hour mean, not to be exceeded more than 18 times per year
PM_{10}	EU Air Quality Limit Values	40	Annual Mean
		50	24-hour mean, not to be exceeded more than 35 times a year
$PM_{2.5}$	EU Air Quality Limit Values	25	Annual Mean
CO	EU Air Quality Limit Values	10,000	Maximum daily running 8-hour mean

3.2 Assessment Criteria for Sensitive Ecological Receptors

3.2.1 The Republic of Ireland is bound by the terms of the European Birds and Habitats Directives and the Ramsar Convention. The Conservation of Habitats and Species Regulations 2010 provides for the protection of European sites created under these polices, i.e. Special Areas of Conservation (SACs) designated under the Habitats Directive, Special Protection Areas (SPAs) designated under the Birds Directive, and Ramsar Sites designated as wetlands of international importance under the Ramsar Convention. The 2010 Regulations apply specific provisions of the European Directives to SACs, SPAs, candidate SACs (cSACs) and proposed SPAs (pSPAs), which require them to be given special consideration and further assessment by any development which is likely to lead to a significant effect upon them.

3.2.2 The legislation concerning the protection and management of designated sites and protected species within the Republic of Ireland is set out within the provisions of the Wildlife Acts 1976 to 2021.

3.2.3 The impact of emissions from the Proposed Development on sensitive ecological receptors are quantified within this assessment in two ways:

- as direct impacts arising due to increases in atmospheric pollutant concentrations; and
- indirect impacts arising through deposition of acids and nutrient nitrogen to the ground surface.

3.2.4 The Critical Levels for the protection of vegetation and ecosystems are set out in Table 7A.2, and apply regardless of habitat type. These values have been adopted as the assessment criteria for the impact of the process on designated nature sites.

Table 7A.2: Critical Level (CLe) Environmental Assessment Levels for Air (for the Protection of Designated Habitat Sites)

POLLU-TANT	SOURCE	CONCENTRATION (μG/M^3)	MEASURED AS	NOTES
NO_X (as NO_2)	EU Air Quality Limit Values	30	Annual mean	-

3.2.5 Critical Load criteria for the deposition of acids and nutrient nitrogen are dependent on the habitat type and species present and are specific to the sensitive receptors considered within the assessment. The Critical Loads are set out on the Air Pollution Information System website (Centre for Ecology and Hydrology (CEH), 2022). Although this website is UK based, the AG4 Guidance stipulates that Critical Loads for the equivalent type of habitats should be used.

3.2.6 The Critical Load criteria adopted for the sensitive ecological receptors considered by the assessment are presented in the model results section of this report.

4.0 METHODOLOGY

4.1 Overview

4.1.1 This section describes the approach taken to the assessment of emissions associated with the operation of the Proposed Development. This has been broken down into four sub-sections.

- Qualitative assessment of construction dust;
- Modelling of combustion emissions from the stack; and
- Modelling of construction phase road traffic emissions on local roads.

4.1.2 The outputs from the modelling of combustion emissions from the stack and road traffic have been used to determine the combined change in concentrations of NO_2, PM_{10} and $PM_{2.5}$ at a number of receptors located in close proximity to local roads. The approach taken to the prediction of impacts is determined later within this section of the report.

4.2 Construction Dust Assessment

4.2.1 While the majority of the Site is existing hard standing, the movement and handling of soils and spoil during the Proposed Development construction activities is anticipated to lead to the generation of some short-term airborne dust. The occurrence and significance of dust generated by earth moving operations is difficult to estimate and depends heavily upon the meteorological and ground conditions at the time and location of the work within the Site, and the nature of the actual activity being carried out.

4.2.2 At present, there are no statutory Irish standards relating to the assessment or control of construction dust. Dust (including PM_{10}) from construction will be considered using a risk-based screening assessment (IAQM, 2014).

4.2.3 The emphasis of the regulation and control of construction dust is therefore through the adoption of good working practice on Site. It is intended that significant adverse environmental effects are avoided at the design stage and through embedded mitigation where possible, including the use of good working practices to minimise dust formation.

4.2.4 The IAQM provides guidance for good practice qualitative assessment of risk of dust emissions from construction and demolition activities (IAQM, 2014). The guidance considers the risk of dust emissions from unmitigated activities to cause human health (PM_{10}) impacts, dust soiling impacts, and ecological impacts (such as physical smothering, and chemical impacts for example from deposition of alkaline materials). The appraisal of risk is based on the scale and nature of activities and on the sensitivity of receptors, and the outcome of the appraisal is used to determine the level of good practice mitigation required for adequate control of dust.

4.2.5 The following four potential activities have been screened as potentially significant, based on the nature of construction activities proposed as part of the Proposed Development (Institute of Air Quality Management, 2014):

- demolition (of buildings, roads or site clearance);
- earthworks (spoil movement and stockpiling);
- construction; and
- track-out (HGV movements on unpaved roads and offsite mud on the highway).

Magnitude Definitions

4.2.6 The potential magnitude of dust emissions is categorised through consideration of the scale, duration and location of construction activities being carried out and is classified as Small, Medium or Large;

4.2.7 The magnitude of each activities is determined by professional judgment, but examples given in the IAQM guidance can help to make that judgment. These examples are as detailed in Table 7A.3 below.

Table 7A.3: IAQM Examples of Definition of Magnitude of Construction Activities

MAGNITUDE	EARTHWORKS	CONSTRUCTION	TRACKOUT
Large	Site area >1 ha potentially dusty soil type (e.g. clay). >10 heavy earth moving vehicles at once, bunds >8 m high, total material moved >100,000 tonnes	Total building volume >100,000 m^3, on-site concrete batching, sandblasting	>50 Heavy Duty Vehicle (HDV) (>3.5 tonne) peak outward movements per day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m
Medium	Site area 0.25 – 1 ha, moderately dusty soil type (e.g. silt), 5 – 10 heavy earth moving vehicles at once, bunds 4-8 metres high, total material moved 20,000 – 100,000 tonnes	Total building volume 25,000 – 100,000 m^3, potentially dusty materials e.g. concrete, on-site concrete batching	10 – 50 HDV peak outward movements per day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 – 100 metres
Small	Site area <0.25 ha, large grain soil type (e.g. sand), <5 heavy earth moving vehicles at once, bunds <4 metre high, total material moved <20,000 tonnes	Total building volume <25,000 m^3, low dust potential construction materials e.g. metal/timber	<10 HDV peak outward movements per day, surface material low dust potential, unpaved road length <50 metres

Receptor Sensitivity Definitions

4.2.8 The Study Area for the assessment of construction dust has been applied, using criteria proposed within with IAQM guidance (IAQM, 2014), and extends:

- up to 350m beyond the Site boundary and 50m from the construction traffic route (up to 500m from the Site entrances), for human health receptors; and
- up to 50m from the Site boundary and/ or construction traffic route (up to 500m from the Site entrances) for ecological receptors.

4.2.9 The assessment of construction dust has been made with respect to the receptor and area sensitivity definitions as outlined in Table 7A.4 to Table 7A.7 below. Sensitivity definitions have been made with reference to the IAQM guidance; receptors beyond 100 metres are defined as low sensitivity; ecological receptors (including statutory designations, and non-statutory ecological receptors of location importance such as county wildlife sites, national and local nature reserves) have not been included as there are no such sites within this 500 metres screening distance.

Table 7A.4: Receptor Sensitivity to Construction Dust Effects

POTENTIAL DUST EFFECT	HUMAN PERCEPTION OF DUST DEPOSITION EFFECTS	PM_{10} HEALTH EFFECTS	ECOLOGICAL EFFECTS
High sensitivity	Enjoy a high level of amenity; appearance/ aesthetics/ value of property would be diminished by soiling; receptor expected to be present continuously	Public present for 8 hours per day or more, e.g. residential, schools, care homes	Locations with an international or national designation and the designated features may be affected by dust deposition
Moderate sensitivity	Enjoy a reasonable level of amenity; appearance/ aesthetics/ value of property could be diminished by soiling; receptor not expected to be present continuously	Only workforce present (no residential or high sensitivity receptors) 8 hours per day or more	Locations where there is a particularly important plant species, where dust sensitivity is uncertain or unknown or locations with a national designation where the features may be affected by dust deposition
Low sensitivity	Enjoyment of amenity not reasonably expected; appearance/ aesthetics/ value of property not diminished by soiling; receptors are transient / present for limited period of time; e.g. playing	Transient human exposure, e.g. footpaths, playing fields, parks	Locations with a local designation which may be affected by dust deposition

POTENTIAL DUST EFFECT	HUMAN PERCEPTION OF DUST DEPOSITION EFFECTS	PM_{10} HEALTH EFFECTS	ECOLOGICAL EFFECTS
	fields, farmland, footpaths, short term car parks		

4.2.10 Distances are measured from source to receptor in bands of less than 20 metres, less than 50 metres, less than 100 metres and less than 350 metres for demolition, earthworks and construction. For trackout the receptor distance measured from receptor to trackout route (up to 50 metres) and up to 500 metres from the Site exit. These distances bands have been applied in Table 7A.5 and Table 7A.6. For ecological impacts the distance bands are as set out in Table 7A.7.

Table 7A.5: Sensitivity of the Area to Dust Deposition Effects on People and Property, With Less than 100 Properties Present

RECEPTOR SENSITIVITY	DISTANCE FROM THE SOURCE (M)			
	<20	<50	<100	<350
High	High	Medium	Low	Low
Moderate	Medium	Low	Low	Low
Low	Low	Low	Low	Low

Table 7A.6: Sensitivity of the Area to Human Health Impacts, with Less than 100 Properties Present, where the Annual Mean PM_{10} Concentration is less than 24 µg/m^3

RECEPTOR SENSITIVITY	DISTANCE FROM THE SOURCE (M)			
	<20	<50	<100	<350
High (where the annual mean PM_{10} concentration <24 µg/m^3)	Low	Low	Low	Low
Medium (where the annual mean PM_{10} concentration <24 µg/m^3)	Low	Low	Low	Low
Low	Low	Low	Low	Low

Table 7A.7: Sensitivity of the Area to Ecological Impacts

RECEPTOR SENSITIVITY	DISTANCE FROM SOURCE (M)	
	<20	<50
High	High	Medium
Medium	Medium	Low

RECEPTOR SENSITIVITY	DISTANCE FROM SOURCE (M)	
	<20	<50
Low	Low	Low

Risk Definitions

4.2.11 The potential risks from emissions from unmitigated construction activities have been defined with reference to the magnitude of the potential emission and the sensitivity of the highest receptor(s) within the effect area, as summarised in Table 7A.8 below.

Table 7A.8: Classification of Risk of Unmitigated Impacts

AREA OF SENSITIVITY TO ACTIVITY	MAGNITUDE		
	LARGE	MEDIUM	SMALL
Earthworks			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible
Construction			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible
Trackout			
High	High risk	Medium risk	Low risk
Medium	Medium risk	Low risk	Negligible
Low	Low risk	Low risk	Negligible
Demolition			
High	High risk	Medium risk	Medium risk
Medium	High risk	Medium risk	Low risk
Low	Medium risk	Low risk	Negligible

4.3 Assessment of Construction Dust

Magnitude Assessment

4.3.1 From a review of the proposals estimates of the likely scale of activities based on the type of building and structures being relocated and built, with reference to the guidance magnitude definitions, have been made for the purposes of mitigation definition:

- there could potentially be some demolition activities to complete prior to the construction of the Proposed Development, therefore the dust emissions magnitude from demolition has been considered medium; and
- the potential for dust emissions from earthwork, construction and track out from the Proposed Development is considered medium because of the size of the project but for this assessment to be conservative, they will be considered large.

Receptor Identification

4.3.2 Potential dust impacts (pre-mitigation) have been assessed based on the receptor sensitivity and distance criteria outlined above and using professional judgment. The only human health and amenity receptors falling into those screening distances are two residential properties approximately 330-380m to the south-west from the Proposed Development (R1 and R16 as shown in Figure 7A.1) and the adjacent Sperrin Galvanising Ltd. business, an Integrated Pollution Prevention and Control (IPPC) licensed facility. However, due to the nature of the work undertaken in the galvanising process, dust soiling would not have any significant environmental impacts at that industrial site, so this receptor is not considered "sensitive". The Site access is approximately 250m away from the LP4310 Gortymadden to Tynagh Road, with only two residential receptors along that road and proposed construction traffic route and within 500m of the Site entrance. The sensitivity of the area can be considered "low" both for dust soiling impacts and for human health impacts from PM_{10} releases from all activities, on account of the distance from the activity source to the receptors, and the existing low background concentration particulates (<24 µg/m^3).

4.3.3 All local Ramsar sites, SPAs and SACs are further than 50m from the construction works associated with the Proposed Development, the closest being 5.9km away.. Deposition of nutrient nitrogen and acid to waterbodies and watercourses has not been considered as these types of receptors are not considered to be at risk from such emissions. The lagoon and tailing ponds are industrial in nature and would not be considered to be sensitive ecological receptors. Due to this nature, these industrial waterbodies, whilst they may support a limited species range of plant and animal, are considered to be a sub-optimal habitat for both and therefore not significant in EIA terms.

4.3.4 Other watercourses such as rivers are bodies of water which are constantly moving systems, with fresh water flushing out any dissolved air quality contaminants even if they were present in high concentrations, which is not the case for the Proposed Development. On that basis, it is not possible for any air quality contaminants to become dissolved and accumulate in the water to elicit a response from the aquatic habitat.

Area Sensitivity Assessment

4.3.5 The receptor sensitivity to the effects of dust deposition and PM10 (human health) impacts has been determined for all activities, based on the closest distance from the identified receptors to those activities, as summarised in Table 7A.9 below. The overall area sensitivity to dust deposition and PM10 (human health), based on the area sensitivity for each activity listed in Table 7A.10 below, is considered to be 'low'.

Table 7A.9: Area Sensitivity for Receptors of Construction Dust

ACTIVITY	POTENTIAL IMPACT	RECEPTOR SENSITIVITY AND DISTANCE TO ACTIVITY	OVERALL AREA SENSITIVITY
Demolition	Dust deposition	High <350 m	Low
	Health PM_{10}	High <350 m	Low
Earthworks	Dust deposition	High <350 m	Low
	Health PM_{10}	High <350 m	Low
Construction	Dust deposition	High <350 m	Low
	Health PM_{10}	High <350 m	Low
Trackout	Dust deposition	High <350 m	Low
	Health PM_{10}	High <350 m	Low

4.3.6 The risk of impacts from unmitigated activities has been determined through a combination of the potential dust emission magnitude and the sensitivity of the area, for each activity to determine the level of mitigation that should be applied. The risk of impacts from unmitigated activities are summarised in

4.3.7 Table 7A.10 below.

Table 7A.10: Risk of Impacts from Unmitigated Activities

POTENTIAL IMPACT	RISK OF IMPACT FROM ACTIVITY			
	PRE-CONSTRUC-TION DEMOLITION	EARTHWORKS	CONSTRUCTION	TRACKOUT
Dust Soiling	Low risk	Low risk	Low risk	Low risk
Human Health PM_{10}	Low risk	Low risk	Low risk	Low risk
Ecology	Not applicable	Not applicable	Not applicable	Not applicable

4.3.8 Whilst the assessment has identified a “low risk” of impact from construction activities and the IAQM “low risk” mitigation measures would be adequate to reduce dust and particulates enough to avoid significant impacts, there are high risk receptors within 350m and it might be beneficial for both parties if measures from the “medium” level were applied.

4.3.9 Mitigation measures to be embedded within the Proposed Development will therefore be defined as listed in the ‘medium risk’ schedule of measures listed in section 8.2 of the IAQM guidance and Annex F of this report. Additional site-specific measures will be identified in the Construction Environmental Management Plan (CEMP) if necessary.

4.4 Modelling of Combustion Emissions from the Stack

Dispersion Model Selection

4.4.1 The assessment of emissions from the Proposed Development stack has been undertaken using the latest version of ADMS 5 (V5.2.4). ADMS is a modern dispersion model that has an extensive published validation history. This model has been extensively used throughout Ireland to demonstrate regulatory compliance and is listed as a suitable model in the AG4 guidance.

4.4.2 The assessment of emissions from road traffic associated with the Proposed Development has used the latest version of ADMS-Roads (V5.0) to quantify pollution levels at selected receptors. ADMS-Roads is a modern dispersion model that has a published track record of use for the assessment of local air quality impacts, including model validation and verification studies.

Modelled Scenarios

4.4.3 Six emissions scenarios have been modelled, as outlined below:

- Full Load continuous operation, running on natural gas fuel;
- Backup operation, running on backup fuel (emergency full load operation);
- Augmented Power, running on natural gas fuel (short-term augmented power mode);
- Low Load, running on natural gas fuel;
- A cumulative impact assessment including the Proposed Development, the existing CCGT unit and Tynagh 1 OCGT Approved Development Ref 21/2192 all running on natural gas fuel; and
- A backup cumulative impact assessment including the Proposed Development, the existing CCGT unit and Tynagh 1 OCGT Approved Development Ref 21/2192 all running on backup fuel.

4.4.4 The dispersion modelling undertaken in the assessment of emissions from the above scenarios are:

- modelling of maximum ground-level impacts from the Augmented Power scenarios at a range of release heights, between 34m and 70m above ground level, in order to evaluate the effect of increasing effective release height on dispersion;
- modelling of impacts on a variable resolution receptor grid and at discrete sensitive human receptors for all pollutants, at a release height of 40m above ground level; and
- modelling of impacts at selected sensitive ecological receptors, at a release height of 40m above ground level.

Model Inputs

4.4.5 The general model conditions used in the assessment are summarised in Table 7A.11. Other more detailed data used to model the dispersion of emissions is considered below. All coordinates are displayed in the ITM coordinate system.

Table 7A.11: General ADMS 5 Model Conditions

VARIABLE	INPUT
Surface roughness at source	0.3
Surface roughness at meteorological site	0.3
Receptors	Selected discrete receptors
	Nested receptor grid, variable spacing
Receptor location	X,Y co-ordinates determined by GIS
	z = 1.5 m for residential receptors and AQMAs
	z = 0 m for ecological receptors
Source location	X,Y co-ordinates given by Fichtner
Emissions	IED emission limits, BAT-AEL values
Sources	Proposed Development –[350MWturbine emitting through 1 Stack. Cumulative – includes the Proposed Development, Tynagh 1 and existing CCGT units.
Meteorological data	5 years of meteorological data, Gurteen Meteorological Station (2016 – 2020)
Terrain data	Flat terrain
Buildings that may cause building downwash effects	The main buildings on site in the immediate vicinity of the stack were modelled, as shown in Table 7A. 20

Emissions Data

4.4.6 The Proposed Development emissions stack would be the only source of combustion emissions from the Proposed Development. There would be one stack, and the height considered to represent BAT for the Proposed Development stack based on the range of stack heights assessed is 40 metres above ground level, with an internal diameter of 7.7 metres.

4.4.7 The physical properties of the combustion emission source, as represented within the model, are presented in Table 7A.12.

4.4.8 The position of the stack within the modelled domain is illustrated in Figure A7.1 of Annex A to this report.

Table 7A.12: Source Properties – Proposed Development Combustion Sources

PARAMETER	UNIT	FULL LOAD	BACKUP	AUGMENTED POWER	LOW LOAD
Fuel		Gas	Backup Fuel	Gas	Gas
Stack position	(ITM) m	574480, 713202	574480, 713202	574480, 713202	574480, 713202
Stack release height	M	40	40	40	40

PARAMETER	UNIT	FULL LOAD	BACKUP	AUGMENTED POWER	LOW LOAD
Effective internal stack diameter	M	7.7	7.7	7.7	7.7
Flue temperature	°C	600.8	500	600.8	590
Flue O_2 content (dry)	%	12.06	14.03	12.06	13.507
Stack flow (actual)	kg/h	2,614,284	2,815,200	2,702,736	1,544,400
Stack flow at reference conditions (NTP, dry, 11% O_2)	Nm^3/h	2,472,510	2,163,095	2,556,165	1,206,654

* m^3/h

Table 7A.13: Source Properties –Cumulative Developments Combustion Sources

PARAMETER	UNIT	TYNAGH 1	TYNAGH 1	EXISTING CCGT	EXISTING CCGT
Fuel		Gas	Backup Fuel	Gas	Backup Fuel
Stack position	(ITM) m	574335, 712876	574335, 712876	574407, 712848	574407, 712848
Stack release height	M	40	40	55	55
Effective internal stack diameter	M	8	8	6.87	6.87
Flue temperature	°C	596.4	597.9	110	150
Flue O_2 content (dry)	%	12.28	12.57	13.52	-
Stack flow (actual)	kg/h	2,491,800	2,397,200	2,406,632*	3,016,440*
Stack flow at reference conditions (NTP, dry, 11% O_2)	Nm^3/h	1,965,074	1,861,456	1,911,490	2,460,749.4

* m^3/h

4.4.9 The modelled pollutant emission rates (in g/s) are determined by the daily average BAT-AEL values set out within the BREF or Emission Limit Values (ELVs) set out within the IED. The emissions limits assumed to apply to the Proposed Development are shown in Table 7A.14.

4.4.10 Pollutant mass emission rates from the waste combustion process associated with the Proposed Development (in g/s) have been calculated by multiplying the daily average and half hour average ELVs by the volumetric flow rate at reference conditions. The pollutant mass emission rates from the stack, as used within the dispersion modelling assessment, are presented in Table 7A.15.

4.4.11 This assessment assumes that the Proposed Development would operate at continuous design load (8,760 hours per year). No time-based variation in stack emissions has therefore been accounted for within the model. For the assessment of short-term impacts, emissions have been modelled at the maximum emission rate, reflecting the assumption that it is not possible to predict when the operational hours may be.

Table 7A.14: Air Emission Limit Values (ELVs) as Specified in the Industrial Emission Directive (IED, 2010/75/EU) and the BAT-AELs (Official Journal of the European Union, 2019)

ITEM	EMISSION LIMIT (mg/m^3)	EMISSION LIMIT (mg/m^3)	
		HALF-HOUR AVERAGE (BASED ON IED)	DAILY AVERAGE (BASED ON BAT-AEL)
OCGT (new)	NO_X (as NO_2)	50	35
	CO	40	NA
CCGT (existing)	NO_X (as NO_2)	50	50
	CO	25	NA

Table 7A.15: Pollutant Emission Rates for natural gas sources

POLLUTANT	UNIT	FULL LOAD	AUGMENTED POWER	LOW LOAD	TYNAGH 1	EXISTING CCGT
NOx Long-term	g/s	24.04	N/A	N/A	19.105	26.548
NOx Short-term	g/s	34.34	36.21	16.76	27.293	26.548
CO Short-term	g/s	27.47	28.40	13.41	21.834	13.274

Table 7A.16: Pollutant Emission Rates for Backup Fuel sources

POLLUTANT	UNIT	BACKUP	TYNAGH 1	EXISTING CCGT
NOx Long-term	g/s	N/A	N/A	N/A
NOx Short-term	g/s	86.186	25.854	61.9
CO Short-term	g/s	24.034	20.683	68.8

Modelled Domain – Discrete Sensitive Human Receptors

4.4.12 Ground-level concentrations of the modelled pollutants relevant to human health have been predicted at discrete air quality sensitive receptors, as listed in Table 7A.17. The locations of these sensitive human receptors are also shown in Figure 7A.1 of Annex A to this Appendix. The residential receptors have been selected to be representative of residential dwellings in the area around the Proposed Development.

4.4.13 A number of the sensitive human receptors are also in close proximity to traffic routes which would experience changes to vehicle flows during the construction of the Proposed Development. The residential receptors which are located in close proximity to traffic routes have been specified in the table below. At these locations, an assessment has been made of the effect of emissions from construction traffic on local concentrations of NO_2, PM_{10} and $PM_{2.5}$.

4.4.14 The flagpole height of all of the sensitive human receptors listed in Table 7A.17 has been set within the model at 1.5m above ground level.

Table 7A.17: Modelled Domain - Selected Discrete Human Receptor Locations

ID	RECEPTOR NAME	RECEPTOR TYPE	GRID REFERENCE		DIST FROM STACK (M)	ASSESSED FOR IMPACTS FROM:
			X	Y		
R1	Residential Property on LP4310 Gortmadden to Tynagh Road	Residential	574021	712888	330	Emissions Stack, Construction Dust and Construction Traffic
R2	Residential Property near LP4310 Gortmadden to Tynagh Road	Residential	574004	712716	490	Emissions Stack, Construction Dust and Construction Traffic
R3	Residential Property on LP4310 Gortmadden to Tynagh Road	Residential	573809	713366	507	Stack and Construction Traffic
R4	Equestrian Centre	Residential	574967	713581	260	Stack
R5	Residential Houses behind the Equestrian Centre	Residential	575018	713658	525	Stack
R6	Residential Property South of Site	Residential	574495	712384	690	Stack
R7	Residential Property South of Site	Residential	575054	712367	965	Stack
R8	Residential Property on LP4310 Gortmadden to Tynagh Road	Residential	574067	712515	320	Stack and Construction Traffic
R9	Residential Property East of Site	Residential	576301	712529	1903	Stack
R10	Residential Property East-North-East of Site	Residential	576540	713339	1876	Stack
R11	Residential Property in Tynagh	Residential	574692	711428	1667	Stack
R12	Residential Property in Killimor - N65	Residential	580483	712843	5934	Stack and Construction Traffic
R13	Residential Property in Ramore - N65	Residential	577517	713960	3003	Stack and Construction Traffic
R14	Residential Porperty North of site - N65	Residential	576007	714800	2013	Stack and Construction Traffic

ID	RECEPTOR NAME	RECEPTOR TYPE	GRID REFERENCE X	GRID REFERENCE Y	DIST FROM STACK (M)	ASSESSED FOR IMPACTS FROM:
R15	Residential Property near N65/ LP4310 Gortmadden to Tynagh Road	Residential	573443	716332	3191	Stack and Construction Traffic
R16	Residential Property on LP4310 Gurtymadden to Tynagh Road	Human Health	573896	713001	380	Emissions Stack, Construction Dust and Construction Traffic
S1	Kilcooley National School - N65	School	569492	716821	6000	Stack and Construction Traffic
S2	St Brendans National School	School	572153	710861	3082	Stack

<u>Modelled Domain – Discrete Sensitive Ecological Receptors</u>

4.4.15 In accordance with the EPA's AG4 guidance, the impacts associated with emissions from the combustion process on statutory sensitive ecological sites have been quantified. The assessment has considered National Heritage Areas (NHAs) and European designated sites within 15 km of the Proposed Development, as recommended by the risk assessment guidance.

4.4.16 Ground-level concentrations of the modelled pollutants relevant to sensitive ecological receptors have been predicted at locations listed in Table 7A.16. The locations of these receptors are also shown in Figure A7.2 of Annex A to this Appendix.

4.4.17 For sensitive ecological receptors, the flagpole height has been set within the model at ground level (z=0m).

Table 7A.18: Modelled Domain – Ecological Receptor Locations

ID	RECEPTOR NAME	RECEPTOR TYPE	GRID REFERENCE X	GRID REFERENCE Y	DIST FROM STACK (M)	ASSESSED FOR IMPACTS FROM:
E5	Capira/Derrew Bog NHA	Ecological	584129	709281	10378	Stack
E6	Lough Derg SAC and SPA	Ecological	585019	703862	14008	Stack
E7	Lough Derg SAC	Ecological	582874	703155	13019	Stack
E8	Barroughter Bog SAC	Ecological	579212	703971	10276	Stack
E9	Slieve Aughty Mountains SPA	Ecological	574730	704267	8812	Stack
E10	Slieve Aughty Mountains SPA	Ecological	568679	710645	6104	Stack
E11	Lough Rea SPA	Ecological	562874	714553	11468	Stack

ID	RECEPTOR NAME	RECEPTOR TYPE	GRID REFERENCE		DIST FROM STACK (M)	ASSESSED FOR IMPACTS FROM:
			X	Y		
E1	Eskerboy Bog NHA	Ecological	578200	716741	4946	Stack
E2	Cloonoolish Bog NHA	Ecological	581722	714969	7327	Stack
E3	Moorfield Bog NHA	Ecological	584925	716025	10687	Stack
E4	Ardgraigue Bog SAC	Ecological	582855	713655	8279	Stack
E12	Middle Shannon Callows SPA/SAC	Ecological	587053	705893	14488	Stack
E13	Middle Shannon Callows SPA/SAC	Ecological	589198	709514	15142	Stack
E14	Meeneen Bog NHA	Ecological	588815	712112	14302	Stack
E15	Cloonmoylan Bog SAC	Ecological	578068	701982	11688	Stack
E16	Rosturra Wood SAC	Ecological	576628	702144	11157	Stack
E17	Pollnaknockaun Wood Nature Reserve SAC	Ecological	574463	702012	11059	Stack
E18	Derrycrag Wood Nature Reserve SAC	Ecological	574242	699813	13259	Stack
E19	Slieve Aughty Bog NHA	Ecological	572798	702067	1118	Stack
E20	Slieve Aughty Bog NHA	Ecological	564847	707282	11075	Stack
E21	Slieve Aughty Bog NHA	Ecological	567985	701970	12811	Stack
E22	Ancient Woodland: Bog Wood	Ecological	545530	709177	4074	Stack
E23	Ancient Woodland: Rinmaher Wood	Ecological	582379	704756	11493	Stack
E24	Ancient Woodland: Derryvunlam	Ecological	575473	702904	10226	Stack

Modelled Domain – Receptor Grid

4.4.18 Emissions from the stack have also been modelled on a receptor grid of variable spacing, in order to:

- determine the location and magnitude of maximum ground level impacts; and
- enable the generation of pollutant isopleth plots.

4.4.19 The dispersion model output is reported at specific receptors and as a nested grid of values. The inner grid extends 2 km from the stack at a resolution of 20m, the middle grid 5 km at a resolution of 100m, and the outer grid 15 km at a resolution of 500m. Details of the receptor grid are summarised in Table 7A.17. All gridded model outputs are reported at 1.5m above ground level (z=1.5m).

Table 7A. 19: Modelled Domain - Receptor Grid

GRID SPACING (M)	DIMENSIONS (M)	ITM REFERENCE OF THE CENTRE OF THE SQUARES
20	4000 x 4000	574335, 712876
100	10,000 x 10,000	
500	30,000 x 30,000	

Terrain

4.4.20 The Proposed Development is situated 1.5km from Tynagh village. The area in general is undulating with some small gradients and changes in ground height. The AG4 Guidance states that "Terrain downwash is defined by the USEPA as occurring when terrain features are greater than 40 % of the Good Engineering Practice (GEP) stack height within 800m of the stack". This criterion allows the need to include terrain in the model to be screened out. Despite this, however, the sensitivity of the model to terrain effects has been evaluated and the results are presented in Annex E.

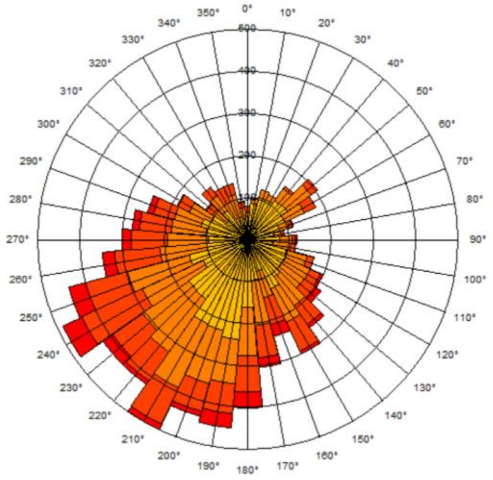
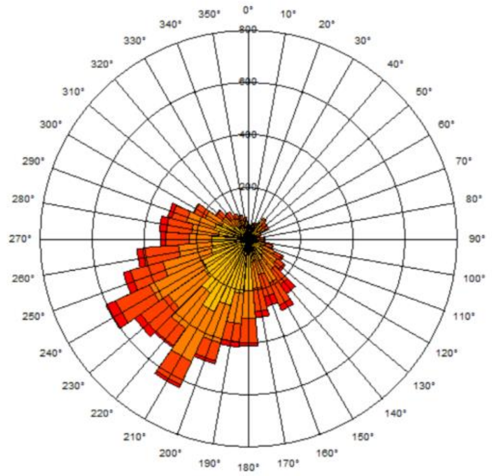
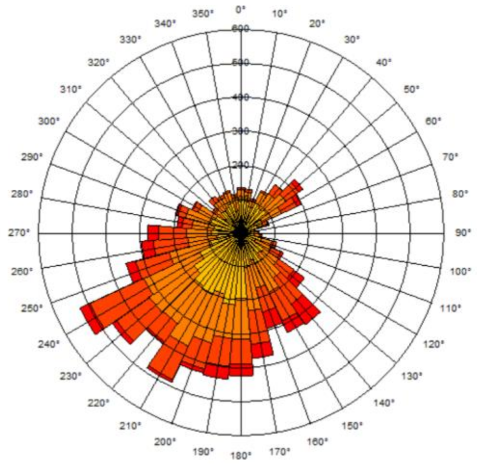
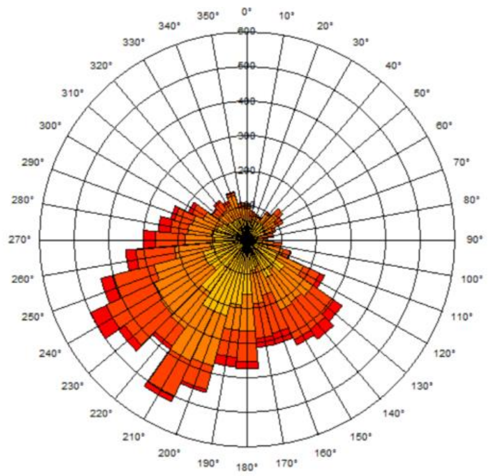
Meteorological Data

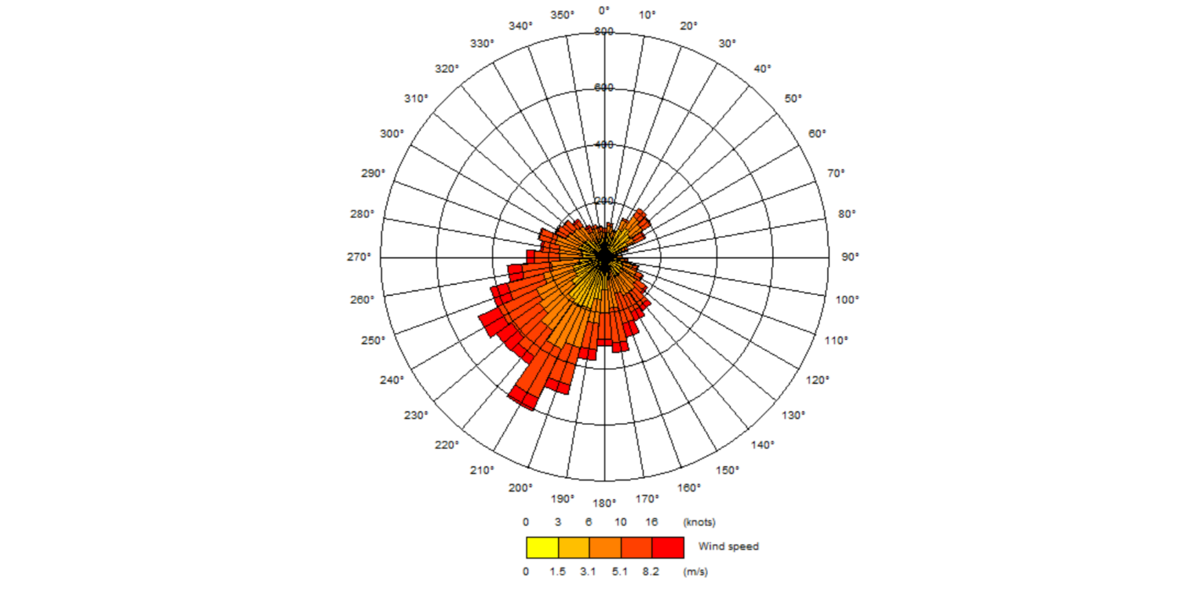
4.4.21 Actual measured hourly-sequential meteorological data is available for input into dispersion models, and it is important to select data as representative as possible for the development modelled. This is usually achieved by selecting a meteorological station as close to the Site as possible, although other stations may be used if the local terrain and conditions vary considerably, or if the station does not provide sufficient data.

4.4.22 The meteorological site that was selected for the assessment is Gurteen Meteorological Station, located approximately 30 km south-east of the Site, at a flat field in a principally agricultural area, and therefore a surface roughness of 0.3m (representative of an agricultural area) has been selected for the meteorological site.

4.4.23 The modelling for this assessment has utilised 5 years of meteorological data for the period 2016 – 2020. Wind roses for each of the years within this period are shown in Figure 7A.8.

Figure 7A. 8: Wind roses for Gurteen, 2016 to 2020

2016	2017
	
2018	2019
	
2020	



Building Downwash Effects

4.4.24 The buildings and structures that make up the Proposed Development and the existing CCGT Power Station have the potential to affect the dispersion of emissions from the stacks. The ADMS building effects module has therefore been used to incorporate building downwash effects as part of the modelling. Buildings greater than one third of the range of stack heights modelled have been included within the modelling assessment.

4.4.25 Structures associated with the Proposed Development that are considered to be of sufficient height and volume to potentially impact on the dispersion of emissions from the Proposed Development stacks include the OCGT air intake, the OCGT and CCGT structures, various tanks and existing buildings within CCGT Power Station Site. The heights for these buildings were calculated from cross sections produced by Fichtner Consulting on behalf of EP Energy Developments Limited. Some buildings have a sloping roof but, as ADMS software is unable take that into account, the highest point of each roofs has been used as a most conservative option, as it increases the downwash effect.

4.4.26 As the only additional scheme modelled in the cumulative scenario is also part of the power station, no extra buildings needed to be included. Parameters for these structures are displayed in Table 7A. 20.

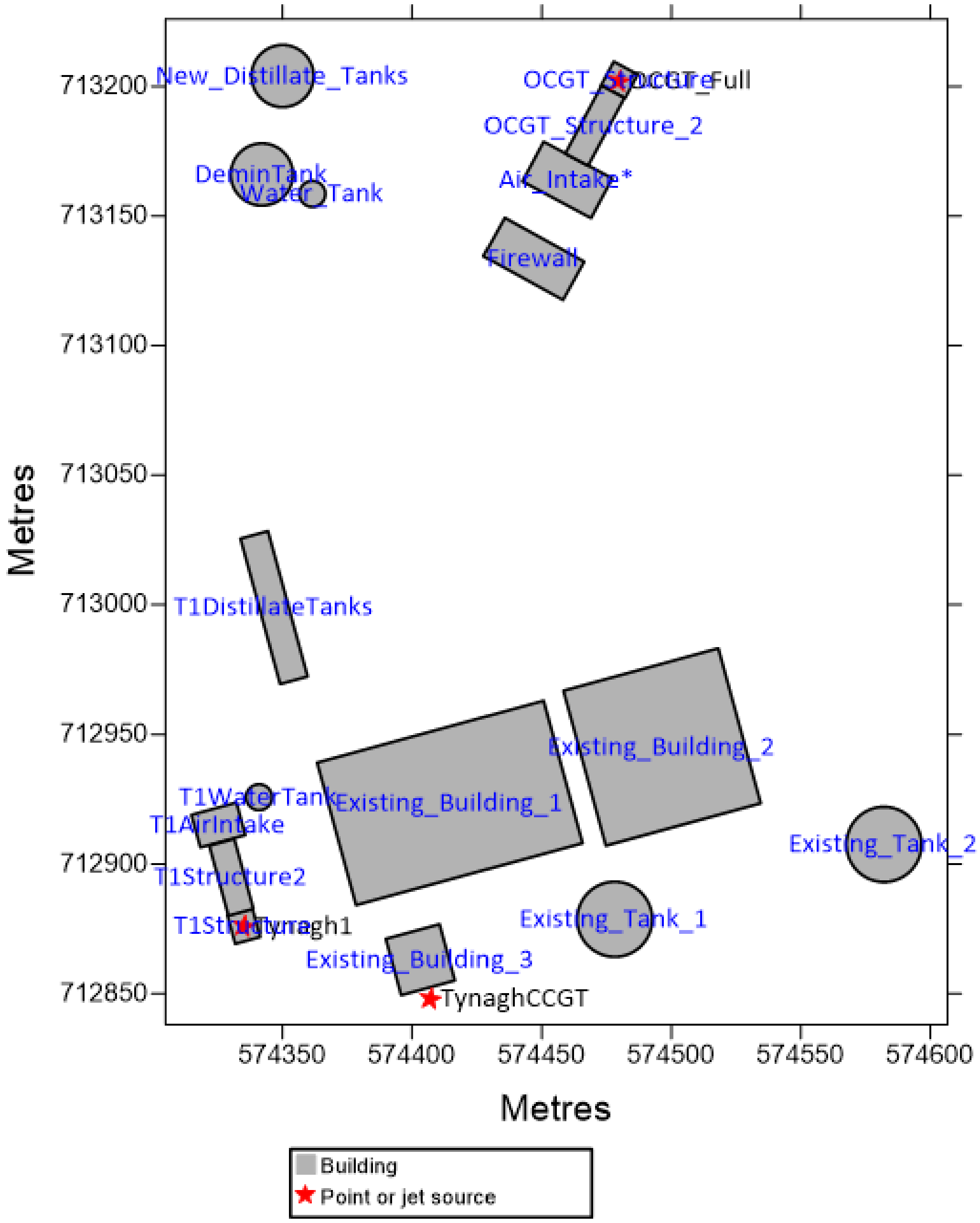
Table 7A. 20: Structures Incorporated into the Modelling Assessment

MAIN STRUCTURE FOR	STRUCTURE	SHAPE	GRID RE NIOS (M)	HEIGHT (M)	LENGTH/DIAM (M)	WIDTH (M)	ANGLE (O)
OCGT	Air Intake	Polygon	574459.8, 713163.9	33	30	17.4	118.1
	OCGT Structure	Polygon	574479.9, 713202.5	15	10.5	10.4	118.1
	New Distillate Tanks	Circle	574350, 713204	25	24	NA	NA
	Firewall	Polygon	574446.9, 713133.4	12	35	16.8	118.9

	OCGT Structure 2	Polygon	574470.4, 713184.8	8	10	29.7	118.1
	Water Tank	Circle	574361.5, 713158.5	15	10	NA	NA
	Demin Tank	Circle	574342, 713166	25	24	NA	NA
Tynagh 1	Air Intake	Polygon	574325.2, 712915.1	33.6	18	13	74.7
	OCGT Structure	Polygon	574335, 712876.1	19	10	11.5	74.7
	Distillate Tanks	Polygon	574346.7, 712998.9	19.1	11	58	74.7
	Water Tank	Circle	574340.9, 712925.8	15	10	NA	NA
	OCGT Structure 2	Polygon	574330.2, 712894.9	10	10	28	74.7
CCGT	Existing Tank 1	Circle	574478.1, 712878.7	21	29	NA	NA
	Existing Tank 2	Circle	574582.1, 712907.6	21	29	NA	NA
	Existing Building 1	Polygon	574414.5, 712923.6	24.5	90.5	57	74.7
	Existing Building 2	Polygon	574496.4, 712945.2	24	62	62	74.7
	Existing Building 3	Polygon	574403.2, 712863.1	31.5	21.5	22.5	74.7

4.4.27 The local area upwind and downwind of the site is relatively flat, predominantly agricultural in all directions. A surface roughness of 0.3m, corresponding to the maximum value associated with agricultural areas, has therefore been selected to represent the local terrain.

Plot 7A.1: Proposed Development Building Layout Modelled by ADMS 5



<u>NO_X to NO_2 Conversion</u>

4.4.28 Emissions of nitrogen oxides from industrial point sources are typically dominated by nitric oxide (NO), with emissions from combustion sources typically in the ratio of nitric oxide to nitrogen dioxide of 9:1. However, it is nitrogen dioxide that has specified Environmental Standards due to its potential impact on human health. In the ambient air, nitric oxide is oxidised to nitrogen dioxide by the ozone present, and the rate of oxidation is dependent on the relative concentrations of nitric oxide and ozone in the ambient air.

4.4.29 For the purposes of detailed modelling, and in accordance with AG4 Guidance it is assumed that 100% of nitric oxide emitted from stacks is oxidised to nitrogen dioxide in the long term and 50% of the emitted nitric oxide is oxidised to nitrogen dioxide in the local vicinity of the Proposed Development in the short-term.

Calculation of Deposition at Sensitive Ecological Receptors

4.4.30 The deposition of nutrient nitrogen and acid at sensitive ecological receptors is calculated, using the modelled process contribution predicted at the receptor points. The deposition rates are determined using conversion rates and factors contained within AG4 Guidance, which account for variations deposition mechanisms in different types of habitat.

4.4.31 The conversion rates and factors used in the assessment are detailed in Table 7A.21 and Table 7A.22.

Table 7A.21: Conversion Factors – Calculation of Nutrient Nitrogen Deposition

POLLUTANT	DEPOSITION VELOCITY GRASSLANDS (M/S)	DEPOSITION VELOCITY FORESTS (M/S)	CONVERSION FACTOR (µG/M^3/S TO KG/HA/YR)
NO_X as NO_2	0.0015	0.003	96

Table 7A.22: Conversion Factors – Calculation of Acid Deposition

POLLUTANT	DEPOSITION VELOCITY GRASSLANDS (M/S)	DEPOSI-TION VELOCITY FORESTS (M/S)	CONVER-SION FACTOR (µG/M^3/S TO KG/HA/YR)	CONVER-SION FACTOR (KG/HA/YR TO KEQ/HA/YR)
NO_2	0.0015	0.003	96	0.0714

Specialised Model Treatments

4.4.32 Emissions have been modelled such that they are not subject to dry and wet deposition or depleted through chemical reactions. The assumption of continuity of mass is likely to result in an over-estimation of impacts at receptors.

4.5 Modelling of Emissions from Road Traffic

Modelled Scenarios

4.5.1 Quantitative assessment of the impact of exhaust emissions from additional road traffic has been undertaken, in order to assess the change in air quality statistics at sensitive receptors in close proximity to the designated access routes to the Proposed Development. The latest version of ‘ADMS-Roads’ (V5.0) has been used to model the dispersion of road traffic emissions, allowing the quantification of pollution levels at selected receptors.

4.5.2 The approach taken to the assessment of road traffic emissions is outlined further within the remainder of this section.

Model Inputs

4.5.3 The general model conditions used in the assessment of road traffic emissions are summarised in Table 7A.23. Other more detailed data used to model the dispersion of emissions is considered below.

Table 7A.23: General ADMS Roads Model Conditions

VARIABLE	INPUT
Surface Roughness at source	0.3 m
Receptors	Selected discrete receptors
Receptor location	X,Y co-ordinates determined by GIS. The height of residential receptors were set at 1.5 metres
Emissions	NO_X, PM_{10} and $PM_{2.5}$
Emission Factors	Emission Factor Toolkit version 11.0 for 2018 for baseline (2019) and construction year (2024) scenarios
Meteorological Data	1 year of hourly sequential data, Gurteen (2019)
Emission Profiles	None used
Terrain Types	Flat terrain
Model Output	Long-term annual mean NO_X concentration (µg/m^3)
	Long-term annual mean PM_{10} concentration (µg/m^3)
	Long-term annual mean $PM_{2.5}$ concentration (µg/m^3)

<u>Traffic Data</u>

4.5.4 Predicted vehicle movements during the construction phase of the Proposed Development are detailed in EIAR Volume I, Chapter 14: Traffic.

4.5.5 The change in vehicle movements is predicted to peak at 266 80 one-way LGV (light goods vehicles) movements and 60 128 one-way HGV (heavy goods vehicles) movements accessing the Site via Tynagh Road and the N65. There are several identified sensitive receptors within 200m of affected links, and therefore a detailed assessment of construction traffic impacts has been conducted.

4.5.6 The derivation of the traffic data used in this assessment is set out in EIAR Chapter 14: Traffic. The data used in the road traffic dispersion modelling has been provided for the following scenarios:

- 2021 baseline traffic (for model verification process);
- 2024 baseline traffic (uplifted to reflect pre-covid flows) + committed development traffic (the total future baseline traffic flows for the Construction assessment); and
- 2024 baseline traffic (uplifted to reflect pre-covid flows) + committed development traffic + peak construction traffic from the Proposed Development (the total traffic flows with the Proposed Development for the Construction assessment).

4.5.7 The traffic data used in the modelling of road traffic emissions are presented in Annex B to this report.

Emissions Data

4.5.8 The magnitude of road traffic emissions for the baseline and with development scenarios are calculated from traffic flow data using the Defra's current emission factor database tool EFT 11.0, updated in November 2021 (Defra, 2021). The assessment considers the operational phase impact of road traffic emissions at receptors adjacent to roads in the vicinity of the Proposed Development. As the EFT has been built for the UK, the choice of regions to define the vehicle fleet is limited to the four UK countries. As Northern Ireland is the closest one and the one with the highest traffic exchange rates, it has been deemed the most representative vehicle fleet. The emission rates for the road fleet has used data at 2018 values the EFT for all scenarios. This is the oldest year available in the EFT and ensures a conservative approach as it does not include year on year improvements in average emissions from vehicles.

Modelled Domain – Discrete Receptors

4.5.9 The receptors for which the impacts of road traffic emissions have been predicted are listed in Table 7A.17. At these locations, an assessment has also been made of the combined effect of emissions from the Proposed Development stack.

Meteorological Data

4.5.10 As for the model runs carried out for the Proposed Development, hourly sequential data from Gurteen Meteorological Station has been used for 2019, consistent with the year chosen to verify the performance of the model against measured nitrogen dioxide concentrations.

Consideration of Terrain

4.5.11 Emissions from road traffic make the greatest contribution to pollutant concentrations at sensitive receptors adjacent to the source (i.e. at the roadside). For this reason, there is not normally a large variation in height between the emission source and residential properties next to the roads included in the model. Therefore, terrain has not been included in the road traffic modelling assessment.

NO_X to NO_2 Conversion

4.5.12 To accompany the publication of the guidance document LAQM.TG(16) (Defra, 2016), a NO_X to NO_2 converter was made available as a tool to calculate the road NO_2 contribution from modelled road NO_X contributions. The tool comes in the form of an MS Excel spreadsheet and uses borough specific data to calculate annual mean concentrations of NO_2 from dispersion model output values of annual mean concentrations of NO_X. Version 8.1 (April 2020) (Defra, 2020) of this tool was used to calculate the total NO_2 concentrations at receptors from the modelled road NO_X contribution and associated background concentration. Due to the location of the Proposed Development, the Transport Infrastructure Ireland (TII) Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes states to "assume that regional concentrations in Ireland are characterised by a local authority in Northern Ireland (Craigavon)". The 'All other non-urban UK traffic' mix was selected, and the 2018 year was selected to stay consistent with the year used in the EfT (Emissions inventory, see paragraph 4.5.8).

Bias Adjustment of Road Contribution NO_X, PM_{10} and $PM_{2.5}$

4.5.13 The modelled road NO_X contributions from the ADMS-Roads model have been adjusted for bias following the method described in LAQM.TG(16).

4.5.14 In order to inform model verification, a NO_2 diffusion tube monitoring survey was undertaken in the study area. The monitoring used in this assessment tool place between the 25th June 2021 and the 14th of January 2022. The locations of the diffusion tubes are presented in Table 7A.17 and in Figure 7A-1 of Annex A of this report.

4.5.15 A direct comparison can be made between concentrations modelled at the roadside diffusion tube locations and measured concentrations. Table 7A.24 provides a summary of the bias adjustment process. The year 2019 has been used for annualization to correct any exceptional results (due to Covid-19 impacts) that would not be representative of the normal situation. Of the full survey, six tubes have been selected to be used for verification as they are the only ones on the side of modelled roads. As monitoring locations are all close to the kerb, the concentrations have also been adjusted for calibration (verification) purposes to a virtual receptor location at the same distance back from the carriageway as the nearest sensitive receptor to the road link.

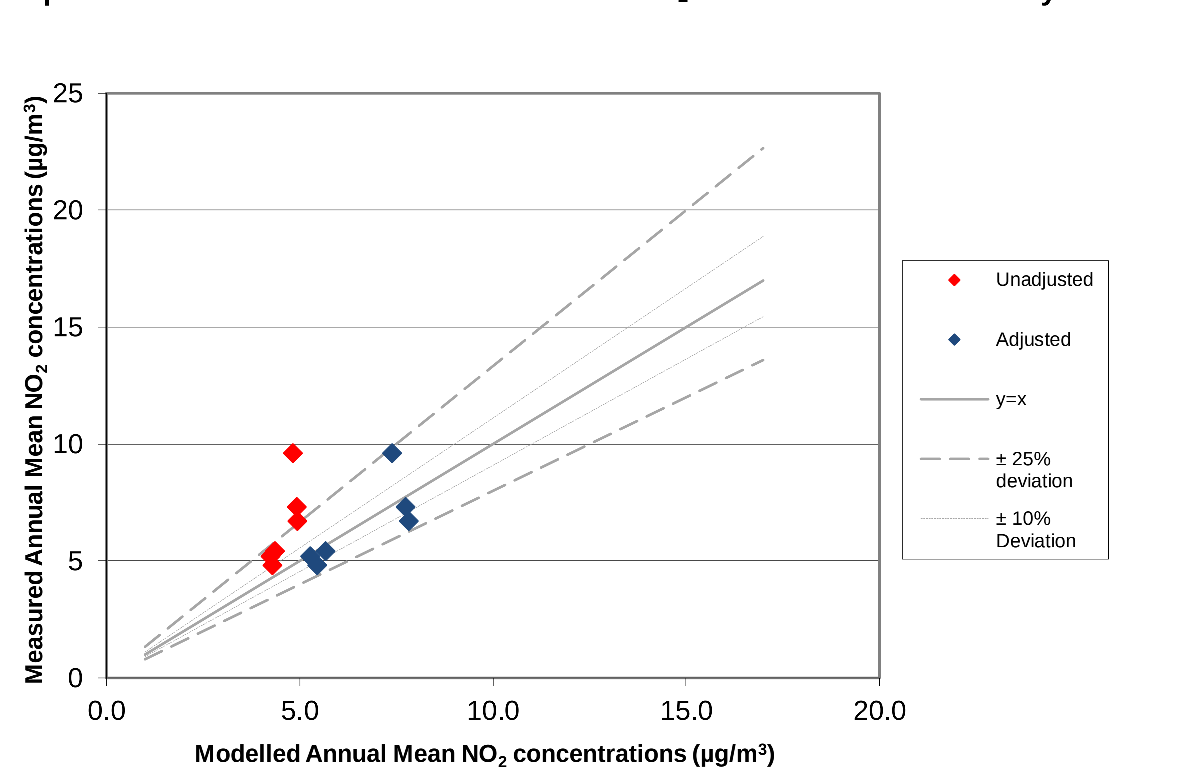
Table 7A.24: Summary of Bias Adjustment Process

TUBE ID	MONITORING LOCATION DISTANCE TO KERB (m)	SENSITIVE RECEPTOR DISTANCE TO KERB (m)	2019 ANNUALISED AND ADJUSTED MONITORED ROAD NO_X (µg/m³)	2019 ANNUAL MEAN MODELLED ROAD NO_X (µg/m³) *BEFORE ADJUST-MENT*	2019 ANNUAL MEAN MODELLED ROAD NO_X (µg/m³) *AFTER ADJUST-MENT*	VERIFICATION FACTOR FOR ROAD NO_X ADJUSTMENT
DT1	1.5	7.0	5.0	1.9	7.0	3.77
DT2	2.4	6.0	6.0	1.8	6.8	
DT3	2.5	6.0	10.2	1.7	6.2	
DT4	3.0	24.0	2.7	0.8	3.1	
DT5	1.2	13.0	2.3	0.6	2.4	
DT6	1.4	6.0	1.6	0.7	2.8	

4.5.16 The red dots on the graph below) show the variation of the unadjusted modelled concentration of total annual mean NO_2 at the measurement locations in the whole traffic study area. The blue dots show the adjusted modelled concentration at the total annual mean at the measurement locations. The comparison of measured and modelled concentrations here suggests that the model over-predicted and under-predicted at various locations in the study area. Therefore, a bias adjustment factor was required; the factor of 3. 77 was applied to the modelled road NO_X.

4.5.17 The uncertainty in the model has been assessed by comparing the adjusted modelled predictions to the measured concentrations of NO_2 and calculating the RMSE. LAQM TG(16) (Defra, 2016) identifies a standard of model uncertainty expressed as an RMSE value that is within 10% of the objective value as the idea for annual mean nitrogen dioxide 10% of the objective value is 4 µg/m^3. A RMSE value for the whole study area of 1.1 µg/m^3 was obtained for the adjusted model predictions, which being below 4 µg/m^3, is evidence of a robust level of performance from the model.

Graph 7A. 1: Modelled NO2 Versus Monitored NO_2 for the Road Traffic Study Area



4.5.18 The same bias adjustment factor derived for the modelled contributions of the primary pollutant NO_X has been applied to the modelled road PM_{10} and $PM_{2.5}$ contributions, as recommended in LAQM.TG(16).

<u>Predicting the Number of Days in which the Particulate Matter 24-hour Mean Objective is Exceeded</u>

4.5.19 The guidance document LAQM.TG(03) (Defra, 2003) sets out the method by which the number of days in which the particulate matter 24 hr objective is exceeded can be obtained based on a relationship with the predicted particulate matter annual mean concentration. The most recent guidance LAQM.TG(16) suggests no change to this method. As such, the formula used within this assessment is:

$$No. of\ Exceedances = 0.0014 * C^3 + \frac{206}{C} - 18.5$$

4.5.20 Where C is the annual mean concentration of PM_{10}.

Predicting the Number of Days in which the Nitrogen Dioxide Hourly Mean Objective is Exceeded

4.5.21 Research projects completed on behalf of Defra and the Devolved Administrations (Laxen and Marner, 2003; AEAT, 2008), have concluded that the hourly mean nitrogen dioxide objective is unlikely to be exceeded if annual mean concentrations are predicted to be less the 60 µg/m^3.

4.5.22 In 2003, Laxen and Marner concluded:

"…local authorities could reliably base decisions on likely exceedances of the 1-hour objective for nitrogen dioxide alongside busy streets using an annual mean of 60 µg/m^3 and above."

4.5.23 The findings presented by Laxen and Marner (2003) are further supported by AEAT (2008) who revisited the investigation to complete an updated analysis including new monitoring results and additional monitoring sites. The recommendations of this report are:

"Local authorities should continue to use the threshold of 60 µg/m^3 NO_2 as the trigger for considering a likely exceedance of the hourly mean nitrogen dioxide objective."

4.5.24 Therefore, this assessment will evaluate the likelihood of exceeding the hourly mean nitrogen dioxide objective by comparing predicted annual mean nitrogen dioxide concentrations at all receptors to an annual mean equivalent threshold of 60 µg/m^3 nitrogen dioxide. Where predicted concentrations are below this value, it can be concluded that the hourly mean nitrogen dioxide objective (200 µg/m^3 NO_2 not to be exceeded more than 18 times per year) will be achieved.

Specialised Model Treatments

4.5.25 No specialised model treatments have been used in the assessment of road traffic emissions.

5.0 BASELINE AIR QUALITY

5.1 Overview

5.1.1 This section presents the information used to evaluate the background and baseline ambient air quality in the area surrounding the Site (see Figures 7A.1 and 7A.2 in Annex A). The following steps have been taken in the determination of background values. Where appropriate, the study focuses on data gathered in the vicinity of the Site:

- review of local and national ambient monitoring data;
- review of other monitoring undertaken in the area around the Site; and
- review of background data and Site relevant Critical Loads from the APIS website.

5.2 Ambient Monitoring Data

Existing Air Quality

5.2.1 The existing environment has been described with reference to the most recently published EPA Air Quality Report and supplementary data (EPA, 2020b).

5.2.2 The EPA manages the national ambient air quality network, which consists of 116 monitoring stations as of 2022, located across the country that monitor a range of pollutants, including some of those of relevance to this assessment. The most recent EPA Air Quality Report available was published in 2022 and refers to monitoring data gathered in 2021 and earlier.

5.2.3 EU legislation on air quality requires that Member States divide their territory into zones for the assessment and management of air quality. The zones in place in Ireland during the most recently available report of monitoring (EPA, 2020b) are:

- Zone A – Dublin conurbation.
- Zone B – Cork conurbation;
- Zone C – large towns with a population >15,000; and
- Zone D – the remaining area of Ireland.

5.2.4 The EPA operate a network of air quality monitoring across the country. Data gathered by the nearest air quality monitoring undertaken to the Proposed Development Site is summarised in Table 7A. 25. Data is also presented as the average across the representative Zone D sites.

Table 7A. 25 Air Quality Monitoring Data

MONITORING STATION		POLLUTANT	REPORTED CONCENTRATION (µg/m³)[1]				AIR QUALITY STANDARD (µg/m³)
			2018	2019	2020	2021	
Zone D Average[5]		NO_2	4.7	5.7	4.0	7.3	40[2]
		NO_X	6.7	7.8	5.4	14.5	30[3]
		PM_{10}	10.7	12.3	11.9	11.6	40[2]
		$PM_{2.5}$	7.5	9.3	8.3	7.9	25[2]
		CO[4]	400 (0)[6]	100 (0)	400 (0)[6]	300 (0)	10,000[2]

Notes:
1 Values as reported by the EPA in the Supplementary Tables to Support the annual Air Quality in Ireland reports.
2 For the protection of human health.
3 For the protection of ecosystems (nature conservation receptors).
4 Rolling 8-hour average – number of exceedances of the rolling 8-hour maximum Air Quality Standard provided in parenthesis).
5 Zone D average data discounts sites with data capture of <50%.
6 Average for Zone C – no Zone D data available.

5.2.5 The EPA data summarised in Table 7A. 25 above demonstrates that the existing airshed in the vicinity of the Proposed Development is unlikely to be constrained and concentrations are generally well below the respective Air Quality Standards and Environmental Assessment Levels for the protection of human health and ecosystems.

5.2.6 Monitored annual mean NO_X concentrations reported by the EPA for Zone D suggest that nature conservation sites considered in this assessment are not currently constrained by the pollutants associated with harm to ecosystems.

AECOM Project Specific Monitoring

5.2.7 To provide further detail on the variation in background NO_2 concentrations throughout the study area, a project specific diffusion tube survey was undertaken. Although the survey was conducted during a period when road traffic volumes were reduced by the Coronavirus pandemic, it still provides useful information on the range of conditions in the area around the Proposed Development site.

5.2.8 Results presented below are based on measurements realised between the 25th June 2021 and the 14th of January 2022. The results from the survey were annualised to 2019 in line with the methodology set out in LAQM.TG (16) (Defra, 2016). The year 2019 has been used to correct any exceptional results (due to Covid-19 impacts) that would not be representative of the normal situation. The results of the survey are shown in Table 7A. 26. The raw monitoring data is located in Annex C. Monitoring data was annualised using data from the Emo Court, Castlebar and Kilkitt rural monitoring stations. Data for these sites was sourced from the airquality.ie website, operated by the EPA.

Table 7A. 26 AECOM NO2 Diffusion Tube Concentrations Monitored in 2021 and Annualised to 2019

SITE ID	GRID REF NIOS (M)	SITE TYPE	PERIOD MEAN CONCENTRATION (µg/m³)						BIAS ADJUSTED ANNUALISED MEAN (µg/m³)
			July	August	September	October	November	December	
DT1	572752, 716320	Roadside	7.8	2.3	9.0	5.6	7.6	4.5	8.1
DT2	575589, 715309	Roadside	7.7	6.4	7.7	4.2	5.7	6.2	8.3
DT3	577150, 714268	Roadside	8.9	8.0	11.5	6.7	8.0	7.5	11.1
DT4	580211, 712950	Roadside	5.7	5.3	7.2	4.4	4.9	5.2	7.2
DT5	573545, 716127	Roadside	5.0	4.9	6.8	4.1	2.9	5.8	6.5
DT6	573974, 715285	Roadside	3.7	4.1	4.5	4.2	4.1	3.4	5.3
DT7	574725, 711292	Background	2.2	2.6	2.9	2.5	4.6	2.6	3.8
DT8	576238, 712536	Background	2.0	2.5	2.5	2.3	2.2	I/S	3.2
DT9	574164, 712370	Background	Missing	2.8	3.1	I/S	I/S	2.8	3.6
DT10	575645, 714495	Background	2.5	3.1	3.0	2.8	3.8	2.6	3.9

5.2.9 The project specific NO_2 measurement results are all well below the annual mean NO_2 objectives. The annual mean NO_2 concentrations measured along the N65 (DT1 to DT4) are low at one third or less of the air quality standard value. Concentrations at other less busy roads are markedly lower.

5.3 Summary of Background Air Quality

5.3.1 The background pollutant concentrations used to inform this assessment have been obtained from the most recent Air Quality in Ireland report published by the EPA (2020) and diffusion tube measurements. With the 6 months survey complete, the highest annualised nitrogen dioxide concentration measured at a background location (DT10) has been used as a conservative but representative of the local background option. The nitrogen oxide concentration has been calculated assuming a 70% NOx to NO_2 conversation rate, as this is a value commonly agreed in the UK for long-term averaging periods. All other pollutant were sourced from publicly available data.

5.3.2 The background pollutant concentration data is listed in Table 7.8. For pollutants with averaging periods of less than the annual mean, it is standard practice to assume the background concentration is the annual mean (long-term) value doubled, which is in line with EPA guidance (2020). Background nitrogen deposition values were sourced from EPA Research Report No. 323 (EPA, 2020). No ambient background data could be found for acid deposition rates and a proxy background value has been used as an alternative, as described in Table 7A. 27. Due to the use of this proxy value, there remains some uncertainty in the annual mean acid deposition rates reported in this chapter. The latest version of the EPA report has been used and values for zone D for 2019 were selected as the most representative year.

Table 7A. 27 Background Pollutant Concentrations

Pollutant	Averaging Period	Rural Concentration ($\mu g/m^3$ unless stated)
Nitrogen dioxide (NO_2)	Annual mean	3.9
	Hourly mean	7.8
Carbon monoxide (CO)	Rolling 8-hour mean	100
Particulate matter (PM_{10})	Annual mean	12.3
	Daily mean	24.6
Fine particulate matter ($PM_{2.5}$)	Annual mean	9.3
Oxides of nitrogen (NO_X) – for the protection of ecosystems	Annual mean	5.6
Nitrogen deposition	Annual mean	12 kg N/ha/yr
Acid deposition	Annual mean	0.5 (N: 0.4 / S: 0.1) keq/ha/yr[1]

[1] No acid deposition data for Ireland obtained. Instead, a representative value has been used and obtained from APIS, based on modelled acid deposition rates at a rural location in the west of Wales, at British National Grid reference 214675,325608. However, Predicted Environmental Concentrations of acid deposition reported in this chapter should be treated with caution.

5.4 Predicted Baseline Pollutant Concentrations of NO_2, PM_{10} and $PM_{2.5}$ at Discrete Receptors Close to Roads

Baseline

5.4.1 Baseline annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$, and the number of expected exceedances of the 24-hour 50 µg/m3 PM_{10} air quality objectives at the receptors sensitive to changes in road traffic emissions during the current 2019 baseline scenario are listed in Table 7A. 28 below.

Table 7A. 28 Air Quality Statistics Predicted for Baseline Scenario in 2019

ID	RECEPTOR NAME	ANNUAL MEAN POLLUTANT CONCENTRATION (µg/m^3)			NUMBER OF DAYS OF EXCEEDANCE OF 24-HOUR MEAN OF 50 µg/m^3 (DAYS)
		NO_2	PM_{10}	$PM_{2.5}$	
R1	Property on LP4310 Gurtymadden	4.5	12.4	9.4	1
R2	Property on LP4310 Gurtymadden	4.0	12.3	9.3	1
R3	Property on LP4310 Gurtymadden	4.9	12.5	9.4	1
R8	Property on LP4310 Gurtymadden	4.0	12.3	9.3	1
R12	Property in Killimor - N65	9.8	13.1	9.8	0
R13	Property in Ramore - N65	6.4	12.7	9.5	1
R14	Porperty North of site - N65	7.6	12.9	9.7	1
R15	Property near N65/ LP4310 Gurtymadden junction	10.8	13.4	10.0	0
R16	Property on LP4310 Gurtymadden	4.4	12.4	9.3	1
S1	Kilcooley National School - N65	9.6	13.2	9.9	0

5.4.2 In the Baseline scenario the annual mean concentrations of all pollutants near to main roads in the vicinity of the Site are well below the environmental standards, indicating that air quality in the area around the Proposed Development is of a very good standard.

Future Construction Baseline

5.4.3 Predicted annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$, and the number of exceedances of the 24-hour 50 µg/m3 PM_{10} air quality objective, at the selected receptors during the future 2022 baseline scenario for the Proposed Development are listed in Table 7A. 29. As described at paragraph 4.5.6 the traffic flows used for the future baseline scenario include other committed developments.

Table 7A. 29 Air quality baseline statistics predicted for 2024 baseline scenario (including other committed developments)

ID	RECEPTOR NAME	ANNUAL MEAN POLLUTANT CONCENTRATION (µg/m^3)			NUMBER OF DAYS OF EXCEEDANCE OF 24-HOUR MEAN OF 50 µg/m^3 (DAYS)
		NO_2	PM_{10}	$PM_{2.5}$	
R1	Property on LP4310 Gurtymadden	4.6	12.4	9.4	1

ID	RECEPTOR NAME	ANNUAL MEAN POLLUTANT CONCENTRATION (µg/m³)			NUMBER OF DAYS OF EXCEEDANCE OF 24-HOUR MEAN OF 50 µg/m³ (DAYS)
		NO_2	PM_{10}	$PM_{2.5}$	
R2	Property on LP4310 Gurtymadden	4.1	12.3	9.3	1
R3	Property on LP4310 Gurtymadden	5.1	12.5	9.4	1
R8	Property on LP4310 Gurtymadden	4.0	12.3	9.3	1
R12	Property in Killimor - N65	11.0	13.3	9.9	0
R13	Property in Ramore - N65	6.9	12.8	9.6	1
R14	Porperty North of site - N65	8.4	13.0	9.7	1
R15	Property near N65/ LP4310 Gurtymadden junction	12.2	13.6	10.1	0
R16	Property on LP4310 Gurtymadden	4.5	12.4	9.4	1
S1	Kilcooley National School - N65	10.7	13.4	10.0	0

5.4.4 The predicted future baseline scenario for the construction year pollutant concentrations are well below all AQS values for all pollutants, indicating that air quality in the vicinity of the Proposed Development will continue to be of a very good standard. Compared to 2019, slightly higher concentrations of NO_2 are predicted alongside the N65, though still within the AQS objective values.

5.5 Point Source Emissions Background Concentrations for Different Averaging Times

5.5.1 In accordance with EPA's AG4 guidance, the annual mean background pollutant concentrations have been obtained from the EPA as described above and the short-term background concentration is assumed to be twice the long-term concentration for NO_2 and CO and one and a half times the long-term background concentration for PM_{10}.

6.0 CONSTRUCTION DISPERSION MODELLING RESULTS

6.1 Modelling Results for NO_2

6.1.1 The predicted change in annual mean NO_2 concentrations that would occur during the traffic associated with construction works for the Proposed Development, at the selected sensitive receptors (being the residential receptors specified in Table 7A.17), are presented in Table 7A. 30. Any errors in the addition of PC to the baseline concentrations are due to rounding only.

6.1.2 The maximum predicted change in annual mean NO_2 concentrations at the selected sensitive receptors is +0.8 µg/m^3, and this would occur in the vicinity of receptors near the N65/ LP4310 Gurtymadden junction. The reported change in concentration at this location is predominantly due to the impact of emissions from construction road traffic. The annual mean NO_2 PEC at all of the receptors would remain below the annual mean NO_2 Environmental Standard, therefore the change is not predicted to lead to a risk of the annual mean air quality standard being exceeded.

6.1.3 The receptor with the highest PEC is also receptor R15, near the N65/ LP4310 Gurtymadden junction. At this location annual mean NO_2 concentrations are predicted to be 13.0 µg/m^3. With the Proposed Development being constructed, annual mean concentrations would remain below the annual mean Environmental Standard for NO_2.

6.1.4 The significance of the predicted change in annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations during construction in planning terms is discussed in Chapter 7: Air Quality (refer to ES Volume I).

Table 7A. 30:Predicted change in annual mean NO_2 concentrations at discrete receptors (µg/m^3) due to construction road traffic emissions, with comparison against Environmental Standard criteria

RECEPTOR	2024 BASELINE	CHANGE DUE TO ROAD	PC % ENV STD	PEC	PEC % ENV STD
R1	4.6	0.3	0.7	4.9	12.3
R2	4.1	0.1	0.1	4.1	10.3
R3	5.1	0.5	1.2	5.6	13.9
R8	4.0	<0.1	<0.1	4.0	10.1
R12	11.0	0.7	1.7	11.7	29.3
R13	6.9	0.3	0.6	7.1	17.8
R14	8.4	0.4	1.0	8.7	21.9
R15	12.2	0.8	2.1	13.0	32.6
R16	4.5	0.2	0.5	4.7	11.7
S1	10.7	0.6	1.4	11.3	28.1

6.2 Modelling Results for PM_{10} and $PM_{2.5}$ Particulates

6.2.1 Change in annual mean PM_{10} and $PM_{2.5}$ concentrations at discrete receptors that would occur from the road traffic associated with the construction of the Proposed Development, at the selected sensitive receptors, is presented in Table

7A. 31 and Table 7A. 32. Any errors in the addition of PC to the baseline concentrations are due to rounding only.

6.2.2 The maximum predicted change in annual mean PM_{10} and $PM_{2.5}$ concentrations at the selected sensitive receptors is +0.1 µg/m^3. This change in annual mean PM_{10} and $PM_{2.5}$ concentrations would not be a perceptible at air quality sensitive receptors, nor would it result in any additional days on which the PM_{10} 24-hour objective is exceeded.

6.2.3 The predicted annual mean concentrations are well below the respective Environmental Standards for PM_{10} and $PM_{2.5}$.

Table 7A. 31: Predicted change in annual mean PM_{10} concentrations at discrete receptors (µg/m^3) due to construction road traffic emissions, with comparison against Environmental Standard criteria

RECEPTOR	2024 BASELINE	CHANGE DUE TO ROAD	PC % ENV STD	PEC	PEC % ENV STD
R1	12.4	<0.1	0.1	12.5	31.2
R2	12.3	<0.1	<0.1	12.3	30.8
R3	12.5	0.1	0.2	12.6	31.4
R8	12.3	<0.1	<0.1	12.3	30.8
R12	13.3	0.1	0.3	13.4	33.5
R13	12.8	<0.1	0.1	12.8	32.1
R14	13.0	0.1	0.2	13.1	32.7
R15	13.6	0.1	0.4	13.7	34.3
R16	12.4	<0.1	0.1	12.4	31.1
S1	13.4	0.1	0.3	13.5	33.8

Table 7A. 32: Predicted change in annual mean $PM_{2.5}$ concentrations at discrete receptors (µg/m^3) due to construction road traffic emissions with comparison against Environmental Standard criteria

RECEPTOR	2024BASELINE	CHANGE DUE TO ROAD	PC % ENV STD	PEC	PEC % ENV STD
R1	9.4	<0.1	0.1	9.4	37.6
R2	9.3	<0.1	<0.1	9.3	37.3
R3	9.4	0.1	0.2	9.5	37.9
R8	9.3	<0.1	<0.1	9.3	37.3
R12	9.9	0.1	0.3	10.0	39.9
R13	9.6	<0.1	0.1	9.6	38.5
R14	9.7	<0.1	0.2	9.8	39.2
R15	10.1	0.1	0.3	10.2	40.7
R16	9.4	<0.1	0.1	9.4	37.5
S1	10.0	0.1	0.3	10.1	40.2

7.0 OPERATION DISPERSION MODELLING RESULTS

7.1 Evaluation of Emissions Stack Height

7.1.1 This section reports the results of an evaluation of the release height for the emissions stack ('the stack') serving the combustion process, using the ADMS 5 dispersion model. The selection of an appropriate stack release height requires a number of factors to be taken into account, the most important of which is the need to balance a release height sufficient to achieve adequate dispersion of pollutants against other constraints such as visual impact.

7.1.2 Emissions from the stack have been modelled at heights between 34m and 70m, at 5m increments except for between 34m and 50m where a 2m increment was used. A graph, showing the PC to annual mean and maximum 1-hour pollutant concentrations for a modelled unit emission rate is presented in Graph 7A. 2. The purpose of the graph is to evaluate the optimum release height in terms of the dispersion of pollutants which would occur, against the visual constraints of further increases in release height. The comparison is based on emissions from the Augmented Power scenario.

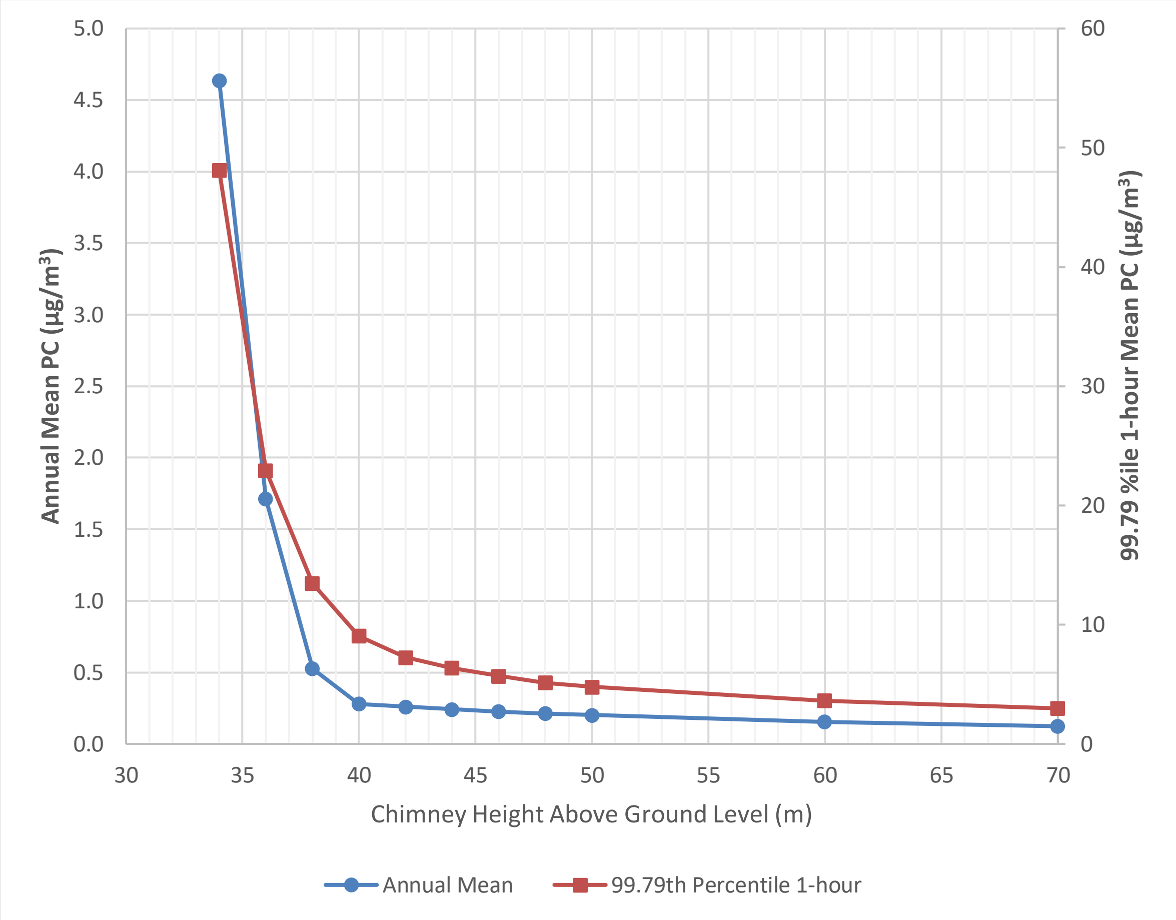
7.1.3 Analysis of the annual mean curve shows that the benefit of incremental increases in release height up to 38m is relatively pronounced. At heights above 40m, the air quality benefit of increasing release height further is reduced.

7.1.4 The relative benefit of increasing the release height on maximum 1-hour concentrations follows a similar pattern to the annual mean curve. A flattening of the curve is seen at heights of greater than 40m, above which a reduced improvement in ground level concentrations is predicted with increasing release height.

7.1.5 The design release height of the stack is 40m above ground level. The graph illustrates that the use of a stack releasing emissions at 40m above ground level or greater would be capable of mitigating both the short-term and long-term impacts of the modelled emissions of all pollutants, such that no significant adverse effects would occur at any receptor. The incremental benefit of further increases in the release height become less effective in reducing the PC to annual mean ground-level concentrations.

7.1.6 It is therefore considered that 40m represents a height at which the visual impacts of further increases in stack release heights outweigh the benefits to air quality, in terms of human health.

Graph 7A. 2: Predicted Process Contribution to annual mean NO_2 ground level pollutant concentrations at stack release heights between 34 m and 70 m



7.2 Sensitivity of Results to Meteorological Data

7.2.1 The dispersion modelling assessment has been undertaken using meteorological data from Gurteen, for the years 2016 to 2020. Table 7A.33, below, presents the maximum predicted ground-level impact, for a number of the averaging periods evaluated throughout the assessment, for each year of meteorological data within the dataset. The comparison is based on emissions from the Full Load stack at a release height of 40m, and the figure highlighted in bold is the highest value obtained from the five years of meteorological data modelled.

Table 7A.33: Maximum Modelled Impact on Ground Level Concentrations (µg/m³), Raw Model Output

MET YEAR	AVERAGING PERIOD AND STATISTIC		
	ANNUAL AVERAGE	1 HR 99.79TH %ILE	MAX 8 HR RUNNING MEAN
2016	0.17	7.36	22.48
2017	0.15	5.01	16.77
2018	0.15	7.70	13.83
2019	0.16	5.39	11.53
2020	**0.21**	**11.16**	**23.87**

7.2.2 The results presented in Table 7A.33 demonstrate that there is a variation in the meteorological dataset for which the maximum modelled impact is reported for each averaging period. For this reason, the values reported in the table are the maximum value obtained from modelling each of the five years meteorological data within the assessment. The reported values can therefore be considered to represent a worst-case assessment of impacts that would be experienced during typical meteorological conditions.

7.3 Modelling Results for NO_2

Stack Emissions

7.3.1 Oxides of nitrogen are emitted from the stack. In view of existing baseline pollutant concentrations and the proximity of major traffic routes near to the Site (the main source of NO_2 in most urban and rural areas), emissions of this pollutant would also potentially have the greatest impact on local air quality. This section focuses on the change in local annual mean NO_X and NO_2 concentrations that would occur as a result of the operation of the main stack.

7.3.2 A contour plot, showing the modelled PC to annual mean NO_2 concentrations due to emissions from the main stack, is presented in Figure 7A-4 of Annex A to this report for the 2020 meteorological year (maximum modelled concentrations). An isopleth plot of the PC (sometimes referred to as a 'contour' plot) showing the PC to 99.79th percentile of 1-hr NO_2 concentrations is presented in Figure 7A-5 of Annex A to this report for the 2020 meteorological year (maximum modelled concentrations).

7.3.3 The annual mean contour plot indicates that, with a release height of 40 m above ground level, the maximum PC to ground level NO_2 concentrations would occur approximately 800 m to the north-east of the location of the stack, with the closest sensitive receptor being R5 . At this location, the predicted annual mean NO_2 PC is 0.2 µg/m^3, which is 0.5% of the Environmental Standard. The PEC is 4.1 µg/m^3 which is 10.3% of the Environmental Standard.

7.3.4 The largest predicted increase in 99.79th percentile of hourly means NO_2 concentrations, during full load continuous operation, occur closer to the main stack. The maximum predicted PC to short term NO_2 concentrations is 11.2 µg/m^3. Such an impact is 5.6 of the 99.79th percentile 1-hour Environmental Standard for NO_2 of 200 µg/m^3. The PEC in the area around the location of maximum impact is 19.0 µg/m^3, which is 9.5% of the Environmental Standard.

Change in NO_2 Concentrations at Discrete Receptors during Operational Phase

7.3.5 The predicted change in annual mean NO_2 concentrations, that would occur during the operation of the Proposed Development, at the selected sensitive receptors, is presented in Table 7A. 34. Any errors/ discrepancy in the addition of PC to the baseline concentrations are due to rounding only.

7.3.6 The maximum predicted change in annual mean NO_2 concentrations from the full load scenario (continuous operation) at selected receptors is 0.2 µg/m^3, and this would occur at R5, the residential property near the equestrian centre, north east of the Proposed Development. The annual mean NO_2 PC at all receptors would remain below the annual mean NO_2 Environmental Standard, therefore the change is not predicted to lead to a risk of the annual mean air quality standard being exceeded.

7.3.7 The receptor with the highest PEC is also receptorR5. At this location annual mean NO_2 concentrations are predicted to be 4.1 µg/m^3. Therefore, with the Proposed Development in operation, annual mean concentrations would remain below the annual mean Environmental Standard for NO_2, and any measured exceedance at this location would not be directly caused by the operation of the Proposed Development.

7.3.8 The predicted change in short-term NO_2 concentrations (99.79th percentile of hourly means), that would occur during the operation of the Proposed Development, at the selected sensitive receptors, is presented in Table 7A. 35.

7.3.9 The maximum predicted change in short-term NO_2 concentrations from the full load scenario (continuous operation) at selected receptors is 9.9 µg/m^3, and this would occur at R4, the Equestrian Centre north-east of the Proposed Development. The short-term NO_2 PC at all receptors would remain below the short-term NO_2 Environmental Standard, therefore the change is not predicted to lead to a risk of the annual mean air quality standard being exceeded.

7.3.10 The receptor with the highest PEC is also receptor R4. At this location annual mean NO_2 concentrations are predicted to be 17.7 µg/m^3. Therefore, with the Proposed Development in operation, short-term concentrations would remain below the Environmental Standard for NO_2, and any measured exceedance at this location would not be directly caused by the operation of the Proposed Development.

7.3.11 Results for other scenarios are reported in Table 7A. 36 to Table 7A. 38. For the Backup, Augmented Power and Low Load scenarios, only short-term emissions were modelled as they will only be occurring for short period of time.

Table 7A. 34: Predicted Change in Annual Mean NO_2 Concentrations at Discrete Receptors (µg/m^3) Due to Emissions from the Proposed Development for the Full Load Scenario, with Comparison Against Environmental Standard Criteria

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R1	3.9	<0.1	0.1	3.9	9.8
R2	3.9	<0.1	0.1	3.9	9.8
R3	3.9	<0.1	<0.1	3.9	9.8
R4	3.9	0.2	0.5	4.1	10.3
R5	3.9	0.2	0.5	4.1	10.3
R6	3.9	<0.1	<0.1	3.9	9.8
R7	3.9	<0.1	0.1	3.9	9.8
R8	3.9	<0.1	<0.1	3.9	9.8
R9	3.9	0.1	0.1	4.0	9.9
R10	3.9	0.1	0.2	4.0	10.0
R11	3.9	<0.1	<0.1	3.9	9.8
R12	3.9	<0.1	0.1	3.9	9.8
R13	3.9	0.1	0.2	4.0	9.9
R14	3.9	0.1	0.2	4.0	10.0

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R15	3.9	0.1	0.1	4.0	9.9
R16	3.9	<0.1	<0.1	3.9	9.8
S1	3.9	<0.1	0.1	3.9	9.8
S2	3.9	<0.1	0.1	3.9	9.8

Table 7A. 35: Predicted Change in 99.79th Percentile of Hourly Mean NO_2 Concentrations at Discrete receptors (µg/m^3) Due to Emissions from the Proposed Development for the Full Load Scenario, with Comparison Against Environmental Standard Criteria

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R1	7.8	2.7	1.4	10.5	5.3
R2	7.8	2.8	1.4	10.6	5.3
R3	7.8	1.5	0.8	9.3	4.7
R4	7.8	9.9	4.9	17.7	8.8
R5	7.8	9.2	4.6	17.0	9
R6	7.8	1.5	0.7	9.3	4.6
R7	7.8	2.3	1.1	10.1	5.0
R8	7.8	1.4	0.7	9.2	4.6
R9	7.8	2.6	1.3	10.4	5.2
R10	7.8	3.1	1.5	10.9	5.4
R11	7.8	1.3	0.6	9.1	4.5
R12	7.8	0.9	0.5	8.7	4.4
R13	7.8	2.0	1.0	9.8	4.9
R14	7.8	3.1	1.5	10.9	5.4
R15	7.8	1.9	1.0	9.7	4.9
R16	7.8	1.5	0.8	9.3	4.7
S1	7.8	0.9	0.4	8.7	4.3
S2	7.8	1.4	0.7	9.2	4.6

Table 7A. 36: Predicted Change in 99.79th Percentile of Hourly Mean NO_2 Concentrations at Discrete receptors (µg/m^3) Due to Emissions from the Proposed Development for the Backup scenario, with Comparison Against Environmental Standard Criteria

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R1	7.8	7.2	3.6	15.0	7.5
R2	7.8	7.3	3.7	15.1	7.6
R3	7.8	4.1	2.0	11.9	5.9
R4	7.8	26.3	13.2	34.1	17.1
R5	7.8	23.9	11.9	31.7	15.8
R6	7.8	3.9	2.0	11.7	5.9
R7	7.8	6.2	3.1	14.0	7.0
R8	7.8	3.4	1.7	11.2	5.6
R9	7.8	6.9	3.5	14.7	7.4
R10	7.8	8.0	4.0	15.8	7.9
R11	7.8	3.5	1.8	11.3	5.7

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R12	7.8	2.3	1.2	10.1	5.1
R13	7.8	5.1	2.5	12.9	6.4
R14	7.8	8.0	4.0	15.8	7.9
R15	7.8	4.9	2.4	12.7	6.3
S1	7.8	2.3	1.1	10.1	5.0
S2	7.8	3.6	1.8	11.4	5.7

Table 7A. 37: Predicted Change in 99.79th Percentile of Hourly Mean NO_2 Concentrations at Discrete receptors ($\mu g/m^3$) Due to Emissions from the Proposed Development for the Augmented Power scenario, with Comparison Against Environmental Standard Criteria

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R1	7.8	2.5	1.3	10.3	5.2
R2	7.8	2.6	1.3	10.4	5.2
R3	7.8	1.5	0.7	9.3	4.6
R4	7.8	8.2	4.1	16.0	8.0
R5	7.8	8.2	4.1	16.0	8.0
R6	7.8	1.3	0.7	9.1	4.6
R7	7.8	2.2	1.1	10.0	5.0
R8	7.8	1.3	0.6	9.1	4.5
R9	7.8	2.6	1.3	10.4	5.2
R10	7.8	3.1	1.5	10.9	5.4
R11	7.8	1.3	0.6	9.1	4.5
R12	7.8	0.9	0.5	8.7	4.4
R13	7.8	2.0	1.0	9.8	4.9
R14	7.8	3.0	1.5	10.8	5.4
R15	7.8	1.9	1.0	9.7	4.9
R16	7.8	0.9	0.4	8.7	4.3
S1	7.8	1.4	0.7	9.2	4.6
S2	7.8	0.8	0.4	8.6	4.3

Table 7A. 38: Predicted Change in 99.79th Percentile of Hourly Mean NO_2 Concentrations at Discrete receptors ($\mu g/m^3$) Due to Emissions from the Proposed Development for the Low Load scenario, with Comparison Against Environmental Standard Criteria

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R1	7.8	2.6	1.3	10.4	5.2
R2	7.8	2.6	1.3	10.4	5.2
R3	7.8	1.5	0.8	9.3	4.7
R4	7.8	9.6	4.8	17.4	8.7
R5	7.8	8.2	4.1	16.0	8
R6	7.8	1.4	0.7	9.2	4.6
R7	7.8	2.2	1.1	10.0	5.0
R8	7.8	1.2	0.6	9.0	4.5
R9	7.8	1.9	0.9	9.7	4.8

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R10	7.8	2.0	1.0	9.8	4.9
R11	7.8	1.1	0.6	8.9	4.5
R12	7.8	0.6	0.3	8.4	4.2
R13	7.8	1.2	0.6	9.0	4.5
R14	7.8	1.9	0.9	9.7	4.8
R15	7.8	1.1	0.6	8.9	4.5
R16	7.8	1.3	0.7	9.1	4.6
S1	7.8	0.6	0.3	8.4	4.2
S2	7.8	0.9	0.5	8.7	4.4

7.3.12 Based on the results of the modelling, it is predicted that the operation of the Proposed Development would not directly increase the risk of an exceedance of the annual mean Environmental Standard for NO_2 for any scenario.

7.3.13 The significance of the predicted change in annual mean NO_2, CO, PM_{10} and $PM_{2.5}$ concentrations during operation is discussed in EIAR Chapter 7: Air Quality and Climate in EIAR Volume I.

7.4 Modelling Results for CO

7.4.1 The predicted change in 8-hour rolling CO concentrations, that would occur during the operation of the Proposed Development, at the selected sensitive receptors, is presented in Table 7A. 39. Any errors/ discrepancy in the addition of PC to the baseline concentrations are due to rounding only.

7.4.2 The maximum predicted change in 8-hour rolling CO concentrations from the full load scenario (continuous operation) at selected receptors is 18.4 µg/m^3, and this would occur at R4, the Equestrian Centre north-east of the Proposed Development. The 8-hour rolling CO PC at all receptors would remain below the 8-hour rolling CO Environmental Standard, therefore the change is not predicted to lead to a risk of the annual mean air quality standard being exceeded.

7.4.3 The receptor with the highest PEC is also Receptor R4. At this location 8-hour rolling CO concentrations are predicted to be 118. µg/m^3. Therefore, with the Proposed Development in operation, annual mean concentrations would remain below the 8-hour rolling Environmental Standard for CO, and any measured exceedance at this location would not be directly caused by the operation of the Proposed Development.

7.4.4 Results for other scenarios are reported in Table 7A. 40 to Table 7A. 42.

Table 7A. 39: Predicted Change in 8-hour Rolling CO Concentrations at Discrete Receptors (µg/m^3) Due to Emissions from the Proposed Development for the Full Load Scenario, with Comparison Against Environmental Standard Criteria

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R1	100	5.6	0.1	105.6	1.1
R2	100	4.2	<0.1	104.2	1.0
R3	100	3.4	<0.1	103.4	1.0

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R4	100	18.4	0.2	118.4	1.2
R5	100	17.1	0.2	117.1	1.2
R6	100	4.3	<0.1	104.3	1.0
R7	100	5.7	0.1	105.7	1.1
R8	100	3.5	<0.1	103.5	1.0
R9	100	4.1	<0.1	104.1	1.0
R10	100	3.6	<0.1	103.6	1.0
R11	100	4.0	<0.1	104.0	1.0
R12	100	1.3	<0.1	101.3	1.0
R13	100	2.6	<0.1	102.6	1.0
R14	100	4.1	<0.1	104.1	1.0
R15	100	2.6	<0.1	102.6	1.0
R16	100	4.7	<0.1	104.7	1.0
S1	100	1.6	<0.1	101.6	1.0
S2	100	2.8	<0.1	102.8	1.0

Table 7A. 40: Predicted Change in 8-hour Rolling CO Concentrations at Discrete Receptors (μg/m^3) Due to Emissions from the Proposed Development for the Backup Scenario, with Comparison Against Environmental Standard Criteria

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R1	100	5.2	0.1	105.2	1.1
R2	100	3.9	<0.1	103.9	1.0
R3	100	3.2	<0.1	103.2	1.0
R4	100	16.4	0.2	116.4	1.2
R5	100	15.3	0.2	115.3	1.2
R6	100	2.9	<0.1	102.9	1.0
R7	100	5.2	0.1	105.2	1.1
R8	100	3.3	<0.1	103.3	1.0
R9	100	3.6	<0.1	103.6	1.0
R10	100	3.2	<0.1	103.2	1.0
R11	100	3.7	<0.1	103.7	1.0
R12	100	1.2	<0.1	101.2	1.0
R13	100	2.3	<0.1	102.3	1.0
R14	100	3.6	<0.1	103.6	1.0
R15	100	2.3	<0.1	102.3	1.0
R16	100	1.4	<0.1	101.4	1.0
S1	100	2.5	<0.1	102.5	1.0
S2	100	1.5	<0.1	101.5	1.0

Table 7A. 41: Predicted Change in 8-hour Rolling CO Concentrations at Discrete Receptors (µg/m^3) Due to Emissions from the Proposed Development for the Augmented Power Scenario, with Comparison Against Environmental Standard Criteria

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R1	100	5.2	0.1	105.2	1.1
R2	100	3.8	<0.1	103.8	1.0
R3	100	3.1	<0.1	103.1	1.0
R4	100	16.7	0.2	116.7	1.2
R5	100	15.8	0.2	115.8	1.2
R6	100	3.8	<0.1	103.8	1.0
R7	100	5.4	0.1	105.4	1.1
R8	100	3.1	<0.1	103.1	1.0
R9	100	4.0	<0.1	104.0	1.0
R10	100	3.5	<0.1	103.5	1.0
R11	100	3.7	<0.1	103.7	1.0
R12	100	1.3	<0.1	101.3	1.0
R13	100	2.6	<0.1	102.6	1.0
R14	100	4.0	<0.1	104.0	1.0
R15	100	2.6	<0.1	102.6	1.0
S1	100	1.6	<0.1	101.6	1.0
S2	100	2.7	<0.1	102.7	1.0

Table 7A. 42: Predicted Change in 8-hour Rolling CO Concentrations at Discrete Receptors (µg/m^3) Due to Emissions from the Proposed Development for the Low Load Scenario, with Comparison Against Environmental Standard Criteria

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R1	100	5.5	0.1	105.5	1.1
R2	100	4.2	<0.1	104.2	1.0
R3	100	3.1	<0.1	103.1	1.0
R4	100	14.5	0.1	114.5	1.1
R5	100	12.6	0.1	112.6	1.1
R6	100	3.2	<0.1	103.2	1.0
R7	100	4.2	<0.1	104.2	1.0
R8	100	2.5	<0.1	102.5	1.0
R9	100	2.5	<0.1	102.5	1.0
R10	100	2.3	<0.1	102.3	1.0
R11	100	3.1	<0.1	103.1	1.0
R12	100	0.8	<0.1	100.8	1.0
R13	100	1.6	<0.1	101.6	1.0
R14	100	2.5	<0.1	102.5	1.0
R15	100	1.7	<0.1	101.7	1.0
R16	100	4.3	<0.1	104.3	1.0
S1	100	0.8	<0.1	100.8	1.0
S2	100	1.7	<0.1	101.7	1.0

7.5 Modelling Results: Impact on Designated Nature Sites

7.5.1 The results of the dispersion modelling of predicted impacts on sensitive ecological receptors are presented in Table 7A.43 to Table 7A.45. The tables set out the predicted PC to atmospheric concentrations of NO_X, acid deposition and nutrient nitrogen deposition.

7.5.2 The EPA AG4 guidance document on dispersion modelling (EPA, 2020) and the EPA guidance document on Environmental Impact Assessment (EPA, 2017) do not mention significance as such, therefore, for the purposes of this assessment, impacts on nature conservation receptors have been considered to be insignificant ('not significant') and therefore screened out from the need for further assessment where the annual mean PC is less than 1% of the relevant environmental standard. This approach is comparable with an approach set out within the UK Environment Agency guidance for assessing emissions to air from combustion processes.

7.5.3 The assessment results show that the predicted impacts are within the above criteria for insignificance at all of the selected receptors; no PCs of more than 1% of the long-term Critical Loads have been predicted to occur at designated site for any of the scenarios.

7.5.4 The effect of atmospheric pollutant concentrations, nitrogen deposition rates and acid deposition rates on local Ramsar, SPA, SAC, NHAs and locally designated sites can therefore be screened out for further assessment.

Table 7A.43: Dispersion Modelling Results for Ecological Receptors Due to Emissions from the Proposed Development for the Full Load Scenario - NO_X Annual Mean

REC ID	SITE NAME	ANNUAL MEAN (µg/m³)					
		BKG µg/m³	CLE	PC	PC/ CL	PEC	PEC/ CL
E5	Capira/Derrew Bog NHA	5.6	30	<0.1	0.1	5.6	18.7
E6	Lough Derg SAC and SPA	5.6	30	<0.1	<0.1	5.6	18.7
E7	Lough Derg SAC	5.6	30	<0.1	<0.1	5.6	18.7
E8	Barroughter Bog SAC	5.6	30	<0.1	<0.1	5.6	18.7
E9	Slieve Aughty Mountains SPA	5.6	30	<0.1	<0.1	5.6	18.7
E10	Slieve Aughty Mountains SPA	5.6	30	<0.1	<0.1	5.6	18.7
E11	Lough Rea SPA	5.6	30	<0.1	<0.1	5.6	18.7
E1	Eskerboy Bog NHA	5.6	30	<0.1	0.1	5.6	18.8
E2	Cloonoolish Bog NHA	5.6	30	<0.1	0.1	5.6	18.8
E3	Moorfield Bog NHA	5.6	30	<0.1	0.1	5.6	18.8
E4	Ardgraigue Bog SAC	5.6	30	<0.1	0.1	5.6	18.8
E12	Middle Shannon Callows SPA/SAC	5.6	30	<0.1	<0.1	5.6	18.7
E13	Middle Shannon Callows SPA/SAC	5.6	30	<0.1	0.1	5.6	18.7
E14	Meeneen Bog NHA	5.6	30	<0.1	0.1	5.6	18.7
E15	Cloonmoylan Bog SAC	5.6	30	<0.1	<0.1	5.6	18.7
E16	Rosturra Wood SAC	5.6	30	<0.1	<0.1	5.6	18.7
E17	Pollnaknockaun Wood Nature Reserve SAC	5.6	30	<0.1	<0.1	5.6	18.7
E18	Derrycrag Wood Nature Reserve SAC	5.6	30	<0.1	<0.1	5.6	18.7
E19	Slieve Aughty Bog NHA	5.6	30	<0.1	<0.1	5.6	18.7

REC ID	SITE NAME	ANNUAL MEAN (µg/m³)					
		BKG µg/m³	CLE	PC	PC/ CL	PEC	PEC/ CL
E20	Slieve Aughty Bog NHA	5.6	30	<0.1	<0.1	5.6	18.7
E21	Slieve Aughty Bog NHA	5.6	30	<0.1	<0.1	5.6	18.7
E22	Ancient Woodland: Bog Wood	5.6	30	<0.1	<0.1	5.6	18.7
E23	Ancient Woodland: Rinmaher Wood	5.6	30	<0.1	<0.1	5.6	18.7
E24	Ancient Woodland: Derryvunlam	5.6	30	<0.1	<0.1	5.6	18.7

Table 7A.44: Dispersion Modelling Results for Ecological Receptors due to Emissions from the Proposed Development for the Full Load Scenario – Nutrient Nitrogen Deposition (kg/ha/yr)

REC ID	SITE NAME	NUTRIENT NITROGEN DEPOSITION (KG/HA/YR)					
		BACKGROUND NITROGEN DEPOSITION (Kg N/ha/yr)	CLE	PC	PC/ CL (%)	PEC	PEC/ CL (%)
E5	Capira/Derrew Bog NHA	12	10.0	<0.1	<0.1	12.0	120.0
E6	Lough Derg SAC and SPA	12	5.0	<0.1	<0.1	12.0	240.0
E7	Lough Derg SAC	12	5.0	<0.1	<0.1	12.0	240.0
E8	Barroughter Bog SAC	12	5.0	<0.1	<0.1	12.0	240.0
E9	Slieve Aughty Mountains SPA	12	20.0	<0.1	<0.1	12.0	60.0
E10	Slieve Aughty Mountains SPA	12	20.0	<0.1	<0.1	12.0	60.0
E11	Lough Rea SPA	12	20.0	<0.1	<0.1	12.0	60.0
E1	Eskerboy Bog NHA	12	10.0	<0.1	0.1	12.0	120.1
E2	Cloonoolish Bog NHA	12	10.0	<0.1	0.1	12.0	120.1

REC ID	SITE NAME	NUTRIENT NITROGEN DEPOSITION (KG/HA/YR)					
		BACKGROUND NITROGEN DEPOSITION (Kg N/ha/yr)	CLE	PC	PC/ CL (%)	PEC	PEC/ CL (%)
E3	Moorfield Bog NHA	12	10.0	<0.1	0.1	12.0	120.1
E4	Ardgraigue Bog SAC	12	5.0	<0.1	0.1	12.0	240.1
E12	Middle Shannon Callows SPA/SAC	12	5.0	<0.1	0.1	12.0	240.1
E13	Middle Shannon Callows SPA/SAC	12	5.0	<0.1	0.1	12.0	240.1
E14	Meeneen Bog NHA	12	10.0	<0.1	<0.1	12.0	120.0
E15	Cloonmoylan Bog SAC	12	5.0	<0.1	<0.1	12.0	240.0
E16	Rosturra Wood SAC	12	10.0	<0.1	<0.1	12.0	120.0
E17	Pollnaknockaun Wood Nature Reserve SAC	12	10.0	<0.1	<0.1	12.0	120.0
E18	Derrycrag Wood Nature Reserve SAC	12	10.0	<0.1	<0.1	12.0	120.0
E19	Slieve Aughty Bog NHA	12	10.0	<0.1	<0.1	12.0	120.0
E20	Slieve Aughty Bog NHA	12	10.0	<0.1	<0.1	12.0	120.0
E21	Slieve Aughty Bog NHA	12	10.0	<0.1	<0.1	12.0	120.0
E22	Ancient Woodland: Bog Wood	12	10.0	<0.1	<0.1	12.0	120.0
E23	Ancient Woodland: Rinmaher Wood	12	10.0	<0.1	<0.1	12.0	120.0
E24	Ancient Woodland: Derryvunlam	12	10.0	<0.1	<0.1	12.0	120.0

Table 7A.45: Dispersion Modelling Results for Ecological Receptors Due to Emissions from the Proposed Development for the Full Load Scenario – Total Acid Deposition N + S (keq/ha/yr)

REC ID	SITE NAME	NUTRIENT NITROGEN DEPOSITION (KG/HA/YR)					
		BACKGROUND ACIDIC DEPOSITION (Kg N/ha/yr)	CL_E	PC	PC/ CL (%)	PEC	PEC/ CL (%)
E5	Capira/Derrew Bog NHA	12.5	0.142	<0.1	0.2	0.5	352.3
E6	Lough Derg SAC and SPA	12.5	0.142	<0.1	0.1	0.5	352.2
E7	Lough Derg SAC	12.5	0.142	<0.1	0.1	0.5	352.2
E8	Barroughter Bog SAC	12.5	0.321	<0.1	<0.1	12.5	3894.1
E9	Slieve Aughty Mountains SPA	Not Sensitive					
E10	Slieve Aughty Mountains SPA						
E11	Lough Rea SPA						
E1	Eskerboy Bog NHA	12.5	0.142	<0.1	0.3	0.5	352.5
E2	Cloonoolish Bog NHA	12.5	0.142	<0.1	0.3	0.5	352.4
E3	Moorfield Bog NHA	12.5	0.142	<0.1	0.3	0.5	352.4
E4	Ardgraigue Bog SAC	12.5	0.321	<0.1	0.1	0.5	155.9
E12	Middle Shannon Callows SPA/SAC	12.5	0.223	<0.1	0.1	0.5	224.3
E13	Middle Shannon Callows SPA/SAC	12.5	0.223	<0.1	0.1	0.5	224.3
E14	Meeneen Bog NHA	12.5	0.142	<0.1	0.2	0.5	352.3
E15	Cloonmoylan Bog SAC	12.5	0.321	<0.1	<0.1	0.5	155.8
E16	Rosturra Wood SAC	12.5	0.142	<0.1	0.2	0.5	352.3
E17	Pollnaknockaun Wood Nature Reserve SAC	12.5	0.142	<0.1	0.2	0.5	352.3
E18	Derrycrag Wood Nature Reserve SAC	12.5	0.142	<0.1	0.1	0.5	352.3

REC ID	SITE NAME	NUTRIENT NITROGEN DEPOSITION (KG/HA/YR)					
		BACKGROUND ACIDIC DEPOSITION (Kg N/ha/yr)	CL_E	PC	PC/ CL (%)	PEC	PEC/ CL (%)
E19	Slieve Aughty Bog NHA	12.5	0.142	<0.1	0.1	0.5	352.2
E20	Slieve Aughty Bog NHA	12.5	0.142	<0.1	0.1	0.5	352.2
E21	Slieve Aughty Bog NHA	12.5	0.142	<0.1	0.1	0.5	352.2
E22	Ancient Woodland: Bog Wood	12.5	0.142	<0.1	<0.1	0.5	352.2
E23	Ancient Woodland: Rinmaher Wood	12.5	0.142	<0.1	0.2	0.5	352.3
E24	Ancient Woodland: Derryvunlam	12.5	0.142	<0.1	0.2	0.5	352.3

8.0 CUMULATIVE IMPACTS

8.1.1 The emissions to air from other committed developments and cumulative emission sources in the area around the site have been assessed in this section as separate groups within the dispersion model, one representing sources running on natural gas and the other sources running on backup fuel as an emergency case. The source groups are described below:

- The Proposed Development; and
- The existing Tynagh CCGT Power Station; and
- Tynagh 1 OCGT Approved Development Ref 21/2192.

8.1 Dispersion Modelling Results – Human Health

8.1.1 Annex D includes the cumulative modelled results for annual mean NO_2, 99.79th Percentile NO_2, 8-hour rolling CO, daily NO_x, nutrient nitrogen and acid deposition. Discussion of the modelled results is within the following sections.

Annual Mean NO_2

8.1.2 The maximum Process Contribution (PC) was 1.1 µg/m^3 at R4, the equestrian centre north of the Proposed Development. This represents 2.7% of the Environmental, and the PEC off 5.2 µg/m^3 represents 12.9% of the Standard.

99.79th Percentile NO_2

8.1.3 With the sources running on natural gas, the highest PC was located at R4, the equestrian centre north of the Proposed Development. The PC was 16.4 µg/m^3 which is 9.7% of the Environmental Standard. With the sources running on backup fuel, the highest PC was located at R5, the residential property near the equestrian centre north of the Proposed Development. The PC was 37.0 µg/m^3 which is 18.5% of the Environmental Standard.

8-hour Rolling CO

8.1.4 For 8-hour rolling CO with the sources running on natural gas, the highest PC was 27.8 µg/m^3 at R4, the equestrian centre north of the Proposed Development. This represents 0.3% of the Environmental Standard of 10,000µg/m^3. With the sources running on backup fuel, the highest PC was 68.9 µg/m^3 at R3, located on LP4310 Gortymadden to Tynagh Road. This represents 0.7% of the Environmental Standard of 10,000µg/m^3.

8.1.5 The significance of the predicted change in NO_2 and CO concentrations from other committed developments and cumulative emission sources is discussed in EIAR Chapter 7: Air Quality and Climate (refer to EIAR Volume I).

8.2 Dispersion Modelling Results – Ecological Receptors

8.2.1 The predicted process contributions for each of the modelled scenarios, due to the operation of the Proposed Development, at the selected sensitive ecological receptors:

- Do not exceed the first stage screening threshold of 1% of the environmental standard for annual mean NOx concentrations;
- Do not exceed the screening threshold of 1% of the environmental standard for annual mean nutrient nitrogen deposition; and
- Do not exceed the screening threshold of 1% of the environmental standard for annual mean acid deposition, expect at E1 (Eskerboy Bog NHA), E2 (Cloonoolish Bog NHA) and E3 (Moorfield Bog NHA) where the PC is predicted to reach 2.0%, 1.7% and 1.3% of the critical load (CL). The predicted total deposition rates are, respectively, 354.1%, 353.8% and 353.4% of the CL, which means that the background depositions alone are already well above the CL, and the Proposed Development would not create any new exceedance.

8.2.2 As the screening thresholds were not exceeded except at E1, E2 and E3, where no new exceedances were created,, there would not be the need to proceed to a more detailed assessment of the effect of emissions from Proposed Development.

9.0 ASSESSMENT OF LIMITATIONS AND ASSUMPTIONS

9.1.1 This section outlines the potential limitations associated with the dispersion modelling assessment. Where assumptions have been made, these are also detailed here.

9.1.2 The greatest uncertainty associated with any dispersion modelling assessment arises through the inherent uncertainty of the dispersion modelling process itself. Despite this, the use of dispersion modelling is a widely applied and accepted approach for the prediction of impacts from a development such as this.

9.1.3 In order to minimise the likelihood of under-estimating the PC to ground level concentrations from the emissions stack, the following assumptions have been made within the assessment:

- The Proposed Development has been assumed to operate on a continuous basis i.e. for 8,760 hour per year, although in practice the plant will require routine maintenance periods;
- The modelling predictions are based on the use of five full years of meteorological data from Gurteen, for the years 2016 to 2020 inclusive;
- The use of five years data can be considered to represent the majority of meteorological conditions that would be experienced during the future operation of the Proposed Development; and
- Emission concentrations for the process are calculated based on the use of IED limits, BAT-AEL concentrations, manufacturer data or maximum measured emission rates at comparable facilities.

9.1.4 The following assumptions have been made in the preparation of the assessment:

- A 100% NO_x to NO_2 conversion rate has been assumed in predicting the long-term PC, and 50% for the short-term PC;
- Local background data in Ireland is relatively difficult to obtain therefore, aside from NO_2, national values were used; and
- There are no EFT and tools available specifically for the Republic of Ireland, therefore UK values had to be used as the most representative source of information.

9.1.5 In particular, the use of IED or BAT-AEL emission limits for most of the pollutants in the study is likely to result in an over-prediction of impacts from the Proposed Development. Emissions tests on other facilities of comparable design within the UK have shown that actual emissions associated with this type of facility actually represent only a fraction of their respective ELVs for most pollutants.

10.0 CONCLUSIONS

10.1.1 This report has assessed the impact on local air quality of the operation of the Proposed Development. The assessment has used the dispersion models ADMS and ADMS Roads.

10.1.2 The assessment of emissions from the Proposed Development emissions stack (‘the stack’) has focused on the impact on ground-level concentrations of the pollutants specified in the IED. Particular attention has been given to the impact on concentrations of NO_2 and CO in the vicinity of residential properties in close proximity to the Proposed Development and near to major traffic routes.

10.1.3 An evaluation of release height for the Proposed Development stack has shown that a release height of 40m above ground level is capable of mitigating the short-term and long-term impacts of emissions to a level which is not significant, with regard to existing air quality and ambient air quality standards. The design of the Proposed Development includes a stack with a release height of 40m above ground level.

10.1.4 Emissions from the Proposed Development stack and construction road traffic would result in small increases in ground-level concentrations of the modelled pollutants. Taking into account available information on background concentrations within the modelled domain, predicted operational concentrations of the modelled pollutants would be within current Environmental Standards for the protection of human health.

10.1.5 The results from modelling of emissions from the Proposed Development stack predicted an impact on annual mean NO_2 concentrations of less than 0.4 $\mu g/m^3$ throughout the modelled domain.

10.1.6 The modelling of impacts at designated ecological sites has predicted that Proposed Development stack emissions would give rise to no significant effects with regard to increases in atmospheric concentrations of NO_X or through deposition of nutrient nitrogen and acid.

10.1.7 Modelling of the cumulative impact of emissions from the Proposed Development, Tynagh 1 Approved Development and the existing CCGT Power Station unit has shown that the combined impact on local pollutant concentrations would result in no significant effects.

10.1.8 The use of emission concentrations at the BAT-AEL emission limit values is likely to have resulted in an over-prediction of impacts from the Proposed Development. Therefore, the reported impacts are considered to represent a realistic worst case and a robust assessment of likely significance effects at all sensitive receptor locations has been carried out.

11.0 REFERENCES

AEAT (2008), Analysis of the relationship between annual mean nitrogen dioxide concentrations and exceedances of the 1-hour mean AQS Objective, accessed on 14th December 2022http://laqm.defra.gov.uk/documents/NO2relationship_report.pdf

CERC (2018), ADMS Roads and ADMS 5 Validation Papers, Cambridge Environmental Research Consultants, from: http://www.cerc.co.uk/environmental-software/model-validation.html accessed on 14th December 2022

Centre for Ecology and Hydrology and APIS (2020) Air Pollution Information Service, url: http://www.apis.ac.uk accessed on 14th December 2022

Council of European Communities (1999), First Daughter Directive on limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air, 1999/30/EC

Council of European Communities (2000), Second Daughter Directive on limit values for benzene and carbon monoxide in ambient air, 2000/69/EC

Council of European Communities (2002), Third Daughter Directive on ozone in ambient air, 2002/3/EC.

Council of the European Union (1996) Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management

Council of the European Union (1997) Directive 97/101/EC: Council Decision of 27 January 1997 establishing a reciprocal exchange of information and data from networks and individual stations measuring ambient air pollution within the Member States

Council of the European Union (2008) Council Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe

Council of the European Union (2015) Council Directive (EU) 2015/2193 of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants

Environmental Protection Agency (2020a). Air Dispersion Modelling from Industrial Installations Guidance Note (AG4). https://www.epa.ie/publications/compliance--enforcement/air/air-guidance-notes/epa-air-dispersion-modelling-guidance-note-ag4-2020.php accessed on 14th December 2022

Environmental Protection Agency (2020b). Air Quality in Ireland 2019. https://www.epa.ie/publications/monitoring--assessment/air/air-quality-in-ireland-2019.php accessed on 14th December 2022

Environmental Protection Agency (2022). Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. https://www.epa.ie/publications/monitoring--assessment/assessment/guidelines-on-the-information-to-be-contained-in-environmental-impact-assessment.php accessed on 6th December 2022

European Commission (2017). Best Available Techniques (BAT) Reference Document for Large Combustion Plants, Publications Office of the European Union, 2017

Government of Ireland – Department of Housing, Local Government and Heritage (2020). Project Ireland 2040 – National Planning Framework. https://assets.gov.ie/100716/f6daba1e-cb06-4eeb-94a7-98fea655517e.pdf accessed on 14th December 2022

Government of Ireland – Department of Housing, Local Government and Heritage (2018). Project Ireland 2040 – National Development Plan 2018 - 2027, Updated 26 November 2020. https://www.gov.ie/pdf/?file=https://assets.gov.ie/37937/12baa8fe0dcb43a78122fb316dc51277.pdf#page=null accessed on 14th December 2022

Government of Ireland (2011). National Air Quality Standards Regulations - S.I. No. 180 of 2011. https://assets.gov.ie/46933/e3e8439ee9ef4bd7bb8443e57ede2944.pdf accessed on 14th December 2022

Transport Infrastructure Ireland (formerly National Roads Authority) (2011). Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes. https://www.tii.ie/technical-services/environment/planning/Guidelines-for-the-Treatment-of-Air-Quality-during-the-Planning-and-Construction-of-National-Road-Schemes.pdf accessed on 14th December 2022

Institute of Air Quality Management (2016) Guidance on the assessment of dust from demolition and construction Version 1.1 dated 01/06/16.

Institute of Air Quality Management (2017) Land-Use Planning & Development Control: Planning for Air Quality v1.2.

Institute of Air Quality Management (2020) A guide to the assessment of air quality impacts on designated nature conservation sites, v1.1 May 2020

Defra (2021), Emission Factor Toolkit version 11.0, accessed via URL https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html accessed on 14th December 2022

Defra (2020), Defra NO_x to NO_2 Calculator (v8.1, august 2020), accessed via URL https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc accessed on 14th December 2022

EA (2018), Air emissions risk assessment for your environmental permit, https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit. Accessed 14th December 2022

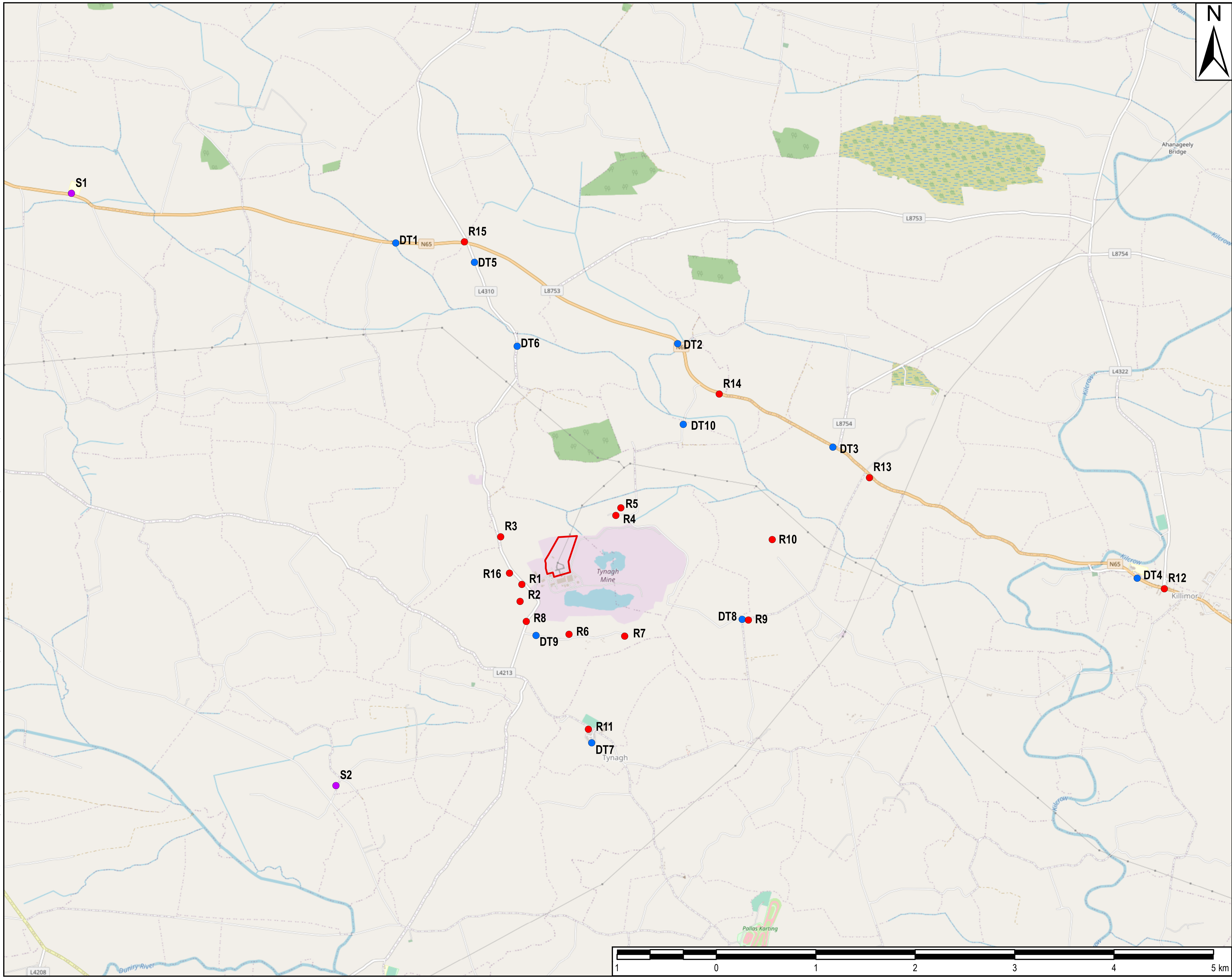
European Commission (2010), Industrial Emissions Directive

Official Journal of the European Union (2017), Commission Implementing Decision (EU) 2017/1442of 31st July 2017, establishing best available techniques

(BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants

Laxen and Marner (2003), Analysis of the Relationship between 1-hour and annual mean nitrogen dioxide at UK Roadside and Kerbside Monitoring Sites

ANNEX A: FIGURES



LEGEND

- Proposed Development Site
- AECOM NO Diffusion Tube Monitoring

Receptors

Human Health Receptors

- Receptor
- School

Notes:

Purpose of Issue:
ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR)

Client:

Project Title:
TYNAGH NORTH OCGT

Drawing Title:
AIR QUALITY STUDY AREA AND HUMAN RECEPTORS AND BASELINE MONITORING LOCATIONS

Drawn:	Chk'd:	App'd:	Issue:
TS	JB	POC	August 2023

AECOM Internal Project No:	Scale at A3:
60661667	1:35,000

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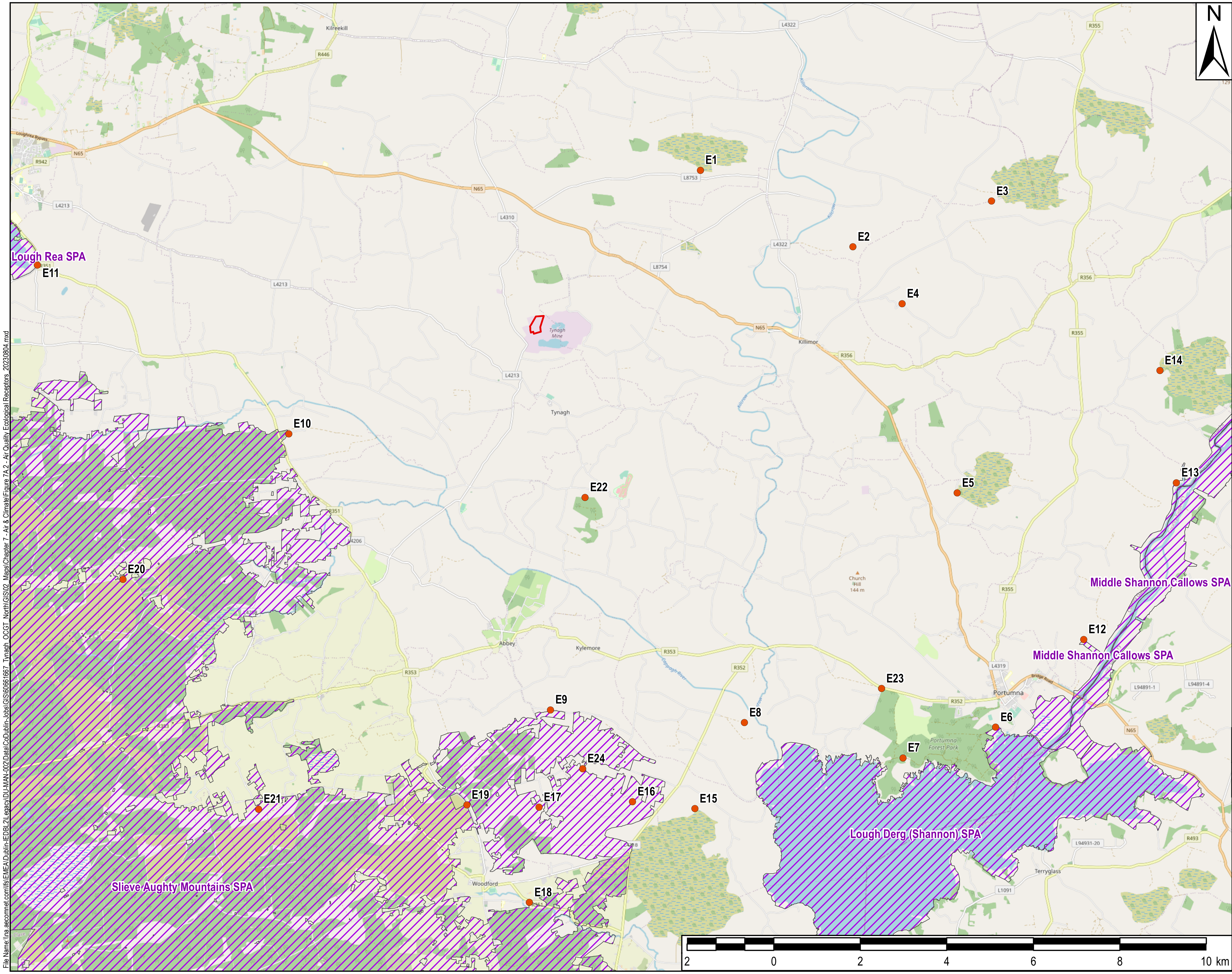
Drawing No:	Rev:
FIGURE 7A.1	**0**



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Purpose of Issue:
ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR)

Client:
EP Energy Developments

Project Title:
TYNAGH NORTH OCGT

Drawing Title:
AIR QUALITY ECOLOGICAL RECEPTORS

Drawn:	Chk'd:	App'd:	Issue:
TS	JB	POC	August 2023

AECOM Internal Project No:	Scale at A3:
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Drawing No: **FIGURE 7A.2**
Rev: **0**

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LEGEND

Proposed Development Site

Emission Source

Notes:
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Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Purpose of Issue:
ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR)

Client:
EP Energy Developments

Project Title:
TYNAGH NORTH OCGT

Drawing Title:
AIR QUALITY STUDY AREA MODELLED EMISSION SOURCES

Drawn:	Chk'd:	App'd:	Issue:
TS	JB	POC	Jan 2023

AECOM Internal Project No:	Scale at A3:
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FIGURE 7A.3	0

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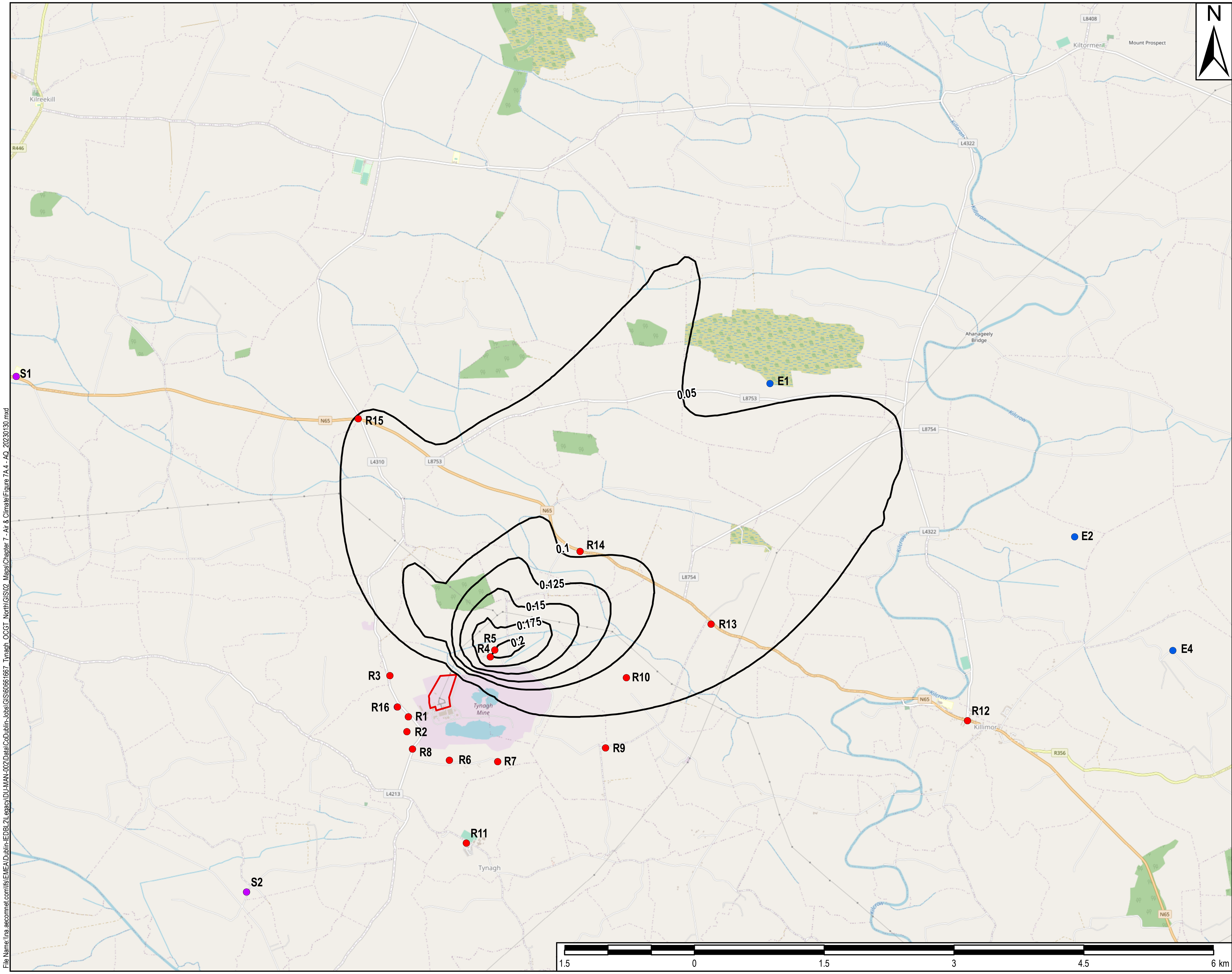

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LEGEND

- Proposed Development Site
- OCGT Annual Mean NO_2 Process Contribution (µg/m³)
- Ecological Receptor

Receptors

Human Health Receptors

- Receptor
- School

Notes:
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Purpose of Issue:
ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR)

Client:
EP Energy Developments

Project Title:
TYNAGH NORTH OCGT

Drawing Title:
ANNUAL MEAN NO_2 PROCESS CONTRIBUTION FOR FULL LOAD CONTINUOUS OPERATIONS FOR WORST AFFECTED METEOROLOGICAL YEAR OF 2020

Drawn:	Chk'd:	App'd:	Issue:
TS	JB	POC	August 2023

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FIGURE 7A.4	0

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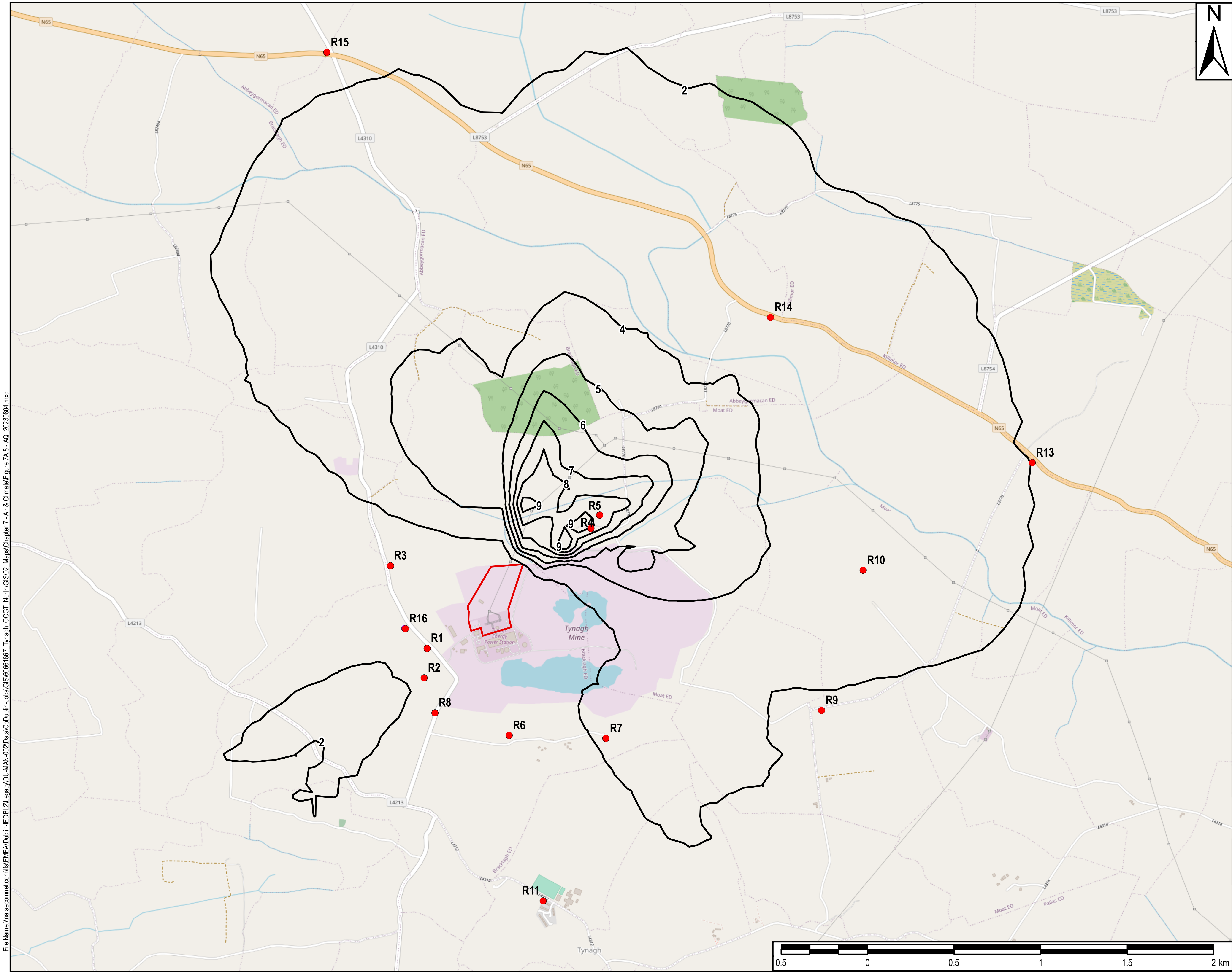

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LEGEND

Proposed Development Site

99.79th Percentile NO_2 Process Contribution (µg/m³)

Receptors

Human Health Receptors

Receptor

Notes:

Purpose of Issue:

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR)

Client:

EP Energy Developments

Project Title:

TYNAGH NORTH OCGT

Drawing Title:

99.79TH PERCENTILE NO2 PROCESS CONTRIBUTION FOR FULL LOAD CONTINUOUS OPERATIONS FOR WORST AFFECTED METEOROLOGICAL YEAR OF 2020

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TS	JB	POC	August 2023

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FIGURE 7A.5	0

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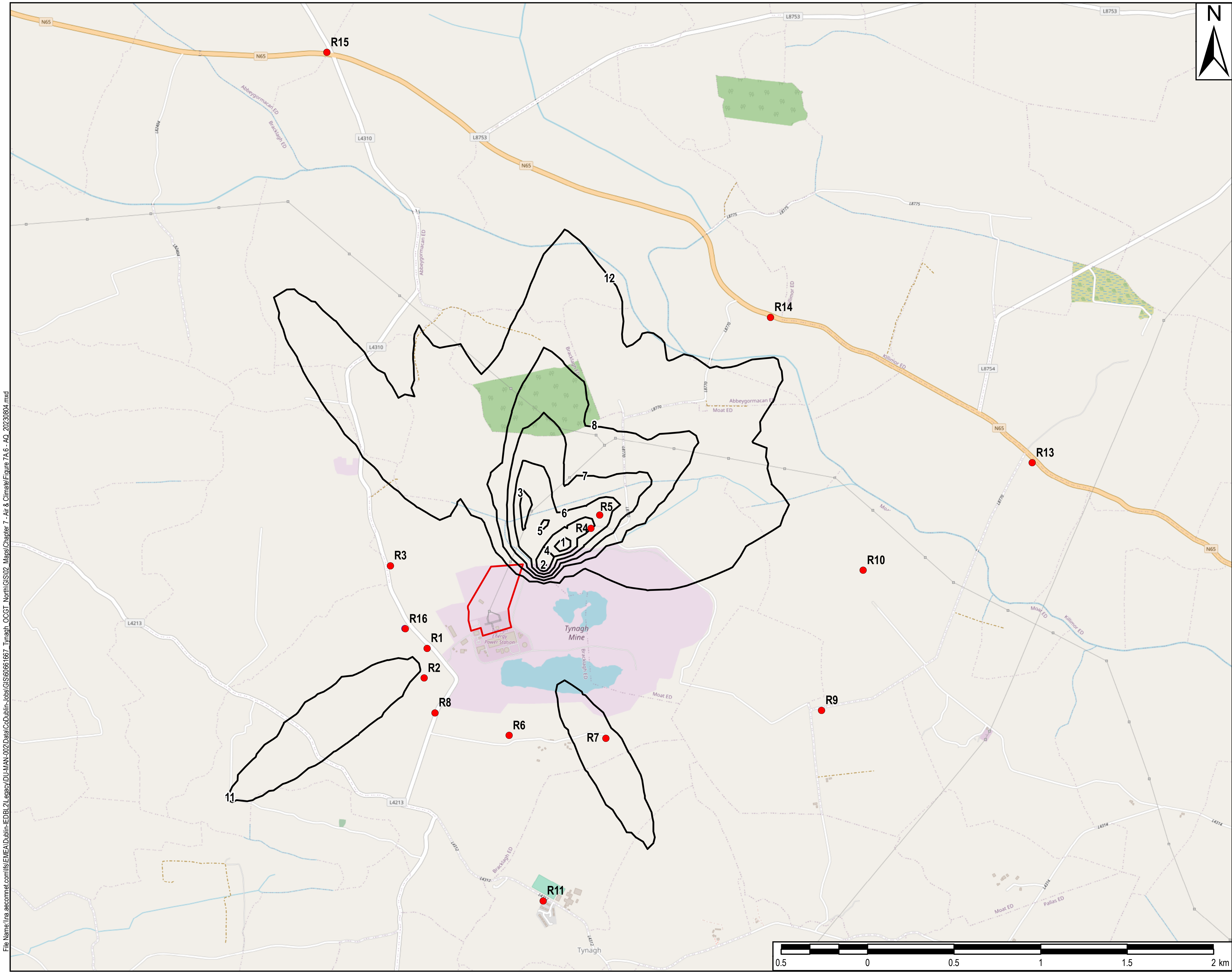

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LEGEND

- Proposed Development Site
- Maximum 8-hour Running Mean CO Process Contribution

Receptors

Human Health Receptors

- Receptor

Notes:
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Purpose of Issue:
ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR)

Client:
EP Energy Developments

Project Title:
TYNAGH NORTH OCGT

Drawing Title:
MAXIMUM 8-HOUR RUNNING MEAN CO PROCESS CONTRIBUTION FOR FULL LOAD CONTINUOUS OPERATIONS FOR WORST AFFECTED METEOROLOGICAL YEAR OF 2020

Drawn:	Chk'd:	App'd:	Issue:
TS	JB	POC	August 2023

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FIGURE 7A.6	0

ANNEX B: ROAD TRAFFIC FLOW DATA

Traffic Data used in Modelling of Road Emissions

Table B.1: 2021 baseline traffic data

LINK	AADT (VEH/DAY)	%HDV	SPEED (KPH)
Tynagh_Road(LP4310)_1	753	13.0	65.3
Tynagh_Road(LP4310)_2	753	13.0	65.3
N65_West	3742	10.2	75.8
N65_East_1	3576	10.2	75.8
N65_East_2	3576	10.2	75.8
N65_East_50kph	3576	10.2	50
Tynagh_Road(LP4310)_60kph	753	13.0	60
N65_East_60kph_1	3576	10.2	60
N65 West_60kph	3742	10.2	60
N65 East_3	3576	10.2	75.8
N65_East_60kph_2	3576	10.2	60
N65 East_60kph_3	3576	10.2	60

Table B.2: 2024 baseline traffic + committed development traffic data

LINK	AADT (VEH/DAY)	%HDV	SPEED (KPH)
Tynagh_Road(LP4310)_1	911	13.7	65.3
Tynagh_Road(LP4310)_2	911	13.7	65.3
N65_West	4529	10.7	75.8
N65_East_1	4329	10.7	75.8
N65_East_2	4329	10.7	75.8
N65_East_50kph	4329	10.7	50
Tynagh_Road(LP4310)_60kph	911	13.7	60
N65_East_60kph_1	4329	10.7	60
N65 West_60kph	4529	10.7	60
N65 East_3	4329	10.7	75.8
N65_East_60kph_2	4329	10.7	60
N65 East_60kph_3	4329	10.7	60

Table B.3: 2024 baseline traffic + committed development traffic + Proposed Developments peak overlap construction traffic data

LINK	AADT (VEH/DAY)	%HDV	SPEED (KPH)
Tynagh_Road(LP4310)_1	1119	22.6	65.3
Tynagh_Road(LP4310)_2	1119	22.6	65.3
N65_West	4737	13.0	75.8
N65_East_1	4537	13.0	75.8
N65_East_2	4537	13.0	75.8
N65_East_50kph	4537	13.0	50
Tynagh_Road(LP4310)_60kph	1119	22.6	60
N65_East_60kph_1	4537	13.0	60
N65 West_60kph	4737	13.0	60
N65 East_3	4537	13.0	75.8
N65_East_60kph_2	4537	13.0	60
N65 East_60kph_3	4537	13.0	60

ANNEX C: RAW DIFFUSION TUBE RESULTS FROM STAFFORDSHIRE LABORATORY

Staffordshire County Council

the knot unites

0719

To:

AECOM Infrastructure &
Environment UK Ltd
Scott House
Alencon Link
BASINGSTOKE
Hampshire
RG21 7PP

REPORT

For the attention of: Elisa Uginet

Date : 3 August 2021

Site : Project Tynagh

NO_2 - Batch 1

Method : E/5049

Issue No. : 1

Lab Ref	Sample Details	Exposure Time Hours	*Nitrogen Dioxide (20°C) µg/m^3	Comments
10528920	DT1	650	7.8	-
10528921	DT2	649	7.7	-
10528922	DT3	650	8.9	-
10528923	DT4	650	5.7	-
10528924	DT5	649	5.0	-
10528925	DT6	649	3.7	-
10528926	DT7	649	2.2	-
10528927	DT8	649	2.0	-
10528928	DT9	I/S	I/S	Tube missing
10528929	DT10	648	2.5	-
10528930	Control	649	1.2	-

Comments

The limit of detection for the laboratory method E/5049 is 0.049µg NO_2. This equates to 1.0µg/m^3 based on an exposure of 720 hours.

Emma Loach
Lab Manager

I/S - Insufficient sample - unable to complete analysis for the reason given in the sample comments. Tests marked * are included in the UKAS accreditation schedule for this laboratory. Further information on accredited tests can be obtained on request. Opinions and Interpretations expressed herein are outside the scope of UKAS accreditation. The laboratory does not accept any liability for data supplied by the client in the form of air volumes and exposure dates.

Emma Loach
Laboratory Manager

Staffordshire Highways Laboratory
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Tel: 01785 277360
E-mail: emma.loach@staffordshire.gov.uk
www.staffordshire.gov.uk

To:

AECOM Infrastructure &
Environment UK Ltd
Scott House
Alencon Link
BASINGSTOKE
Hampshire
RG21 7PP

0719

REPORT

For the attention of: Elisa Uginet

Date : 16 September 2021

Site : Project Tynagh

NO2 - Batch 2

Method : E/5049

Issue No. : 1

Lab Ref	Sample Details	Exposure Time Hours	*Nitrogen Dioxide (20℃) µg/m^3	Comments
10532022	DT1	816	2.3	-
10532023	DT2	816	6.4	-
10532024	DT3	816	8.0	-
10532025	DT4	816	5.3	-
10532026	DT5	816	4.9	-
10532027	DT6	816	4.1	-
10532028	DT7	816	2.6	-
10532029	DT8	816	2.5	-
10532030	DT9	816	2.8	-
10532031	DT10	816	3.1	-
10532032	Control	816	< 1.0	-

Comments

The limit of detection for the laboratory method E/5049 is 0.049µg NO2. This equates to 1.0µg/m^3 based on an exposure of 720 hours.

Emma Loach
Lab Manager

I/S - Insufficient sample - unable to complete analysis for the reason given in the sample comments. Tests marked * are included in the UKAS accreditation schedule for this laboratory. Further information on accredited tests can be obtained on request. Opinions and Interpretations expressed herein are outside the scope of UKAS accreditation. The laboratory does not accept any liability for data supplied by the client in the form of air volumes and exposure dates.

Emma Loach
Laboratory Manager

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E-mail: emma.loach@staffordshire.gov.uk
www.staffordshire.gov.uk

To:

AECOM Infrastructure &
Environment UK Ltd
Scott House
Alencon Link
BASINGSTOKE
Hampshire
RG21 7PP

0719

REPORT

For the attention of: Elisa Uginet

Date : 5 October 2021
Site : Project Tynagh
NO2 - Batch 3
Method : E/5049
Issue No. : 1

Lab Ref	Sample Details	Exposure Time Hours	*Nitrogen Dioxide (20℃) µg/m^3	Comments
10534162	DT1	792	9.0	-
10534163	DT2	792	7.7	-
10534164	DT3	792	11.5	-
10534165	DT4	793	7.2	-
10534166	DT5	792	6.8	-
10534167	DT6	792	4.5	-
10534168	DT7	792	2.9	-
10534169	DT8	792	2.5	-
10534170	DT9	792	3.1	-
10534171	DT10	792	3.0	-
10534172	Control	792	< 1.0	-

Comments

The limit of detection for the laboratory method E/5049 is 0.049µg NO2. This equates to 1.0µg/m^3 based on an exposure of 720 hours.

Mark Chapman
Testing Manager

Emma Loach
Laboratory Manager

Staffordshire Highways Laboratory
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ANNEX D: ASSESSMENT OF CUMULATIVE IMPACTS

Table 7A. 46: Predicted change in annual mean NO_2 concentrations at discrete receptors (µg/m^3) due to emissions from the Proposed Development for the Cumulative scenario on natural gas, with comparison against Environmental Standard Criteria

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R1	3.9	0.1	0.2	4.0	9.9
R2	3.9	0.1	0.3	4.0	10.0
R3	3.9	0.6	1.6	4.5	11.3
R4	3.9	1.1	2.7	5.0	12.5
R5	3.9	1.1	2.7	5.0	12.4
R6	3.9	0.1	0.3	4.0	10.0
R7	3.9	0.3	0.8	4.2	10.6
R8	3.9	0.2	0.5	4.1	10.3
R9	3.9	0.5	1.2	4.4	10.9
R10	3.9	0.6	1.4	4.5	11.1
R11	3.9	0.1	0.4	4.0	10.1
R12	3.9	0.2	0.5	4.1	10.2
R13	3.9	0.4	1.1	4.3	10.8
R14	3.9	0.5	1.3	4.4	11.1
R15	3.9	0.3	0.7	4.2	10.5
S1	3.9	0.2	0.4	4.1	10.1
S2	3.9	0.2	0.4	4.1	10.1

Table 7A. 47: Predicted change in 99.79th percentile of hourly means NO_2 concentrations at discrete receptors (µg/m^3) due to emissions from the Proposed Development for the Cumulative scenario on natural gas, with comparison against Environmental Standard Criteria

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R1	7.8	3.4	1.7	11.2	5.6
R2	7.8	4.5	2.2	12.3	6.1
R3	7.8	17.8	8.9	25.6	12.8
R4	7.8	19.4	9.7	27.2	13.6
R5	7.8	18.5	9.3	26.3	13.2
R6	7.8	6.1	3.0	13.9	6.9
R7	7.8	12.5	6.2	20.3	10.1
R8	7.8	7.3	3.7	15.1	7.6
R9	7.8	9.1	4.5	16.9	8.4
R10	7.8	8.2	4.1	16.0	8.0
R11	7.8	8.3	4.2	16.1	8.1
R12	7.8	2.9	1.4	10.7	5.3
R13	7.8	5.4	2.7	13.2	6.6
R14	7.8	7.9	4.0	15.7	7.9
R15	7.8	5.1	2.5	12.9	6.4
S1	7.8	6.7	3.4	14.5	7.3
S2	7.8	2.7	1.4	10.5	5.3

Table 7A. 48: Predicted change in 99.79th percentile of hourly means NO_2 concentrations at discrete receptors (µg/m^3) due to emissions from the Proposed Development for the

Cumulative scenario on backup fuel, with comparison against Environmental Standard Criteria

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R1	7.8	7.2	3.6	15.0	7.5
R2	7.8	8.1	4.1	15.9	8.0
R3	7.8	26.6	13.3	34.4	17.2
R4	7.8	35.1	17.5	42.9	21.4
R5	7.8	37.0	18.5	44.8	22.4
R6	7.8	8.5	4.2	16.3	8.1
R7	7.8	17.6	8.8	25.4	12.7
R8	7.8	9.3	4.7	17.1	8.6
R9	7.8	16.7	8.4	24.5	12.3
R10	7.8	15.5	7.7	23.3	11.6
R11	7.8	14.5	7.3	22.3	11.2
R12	7.8	5.8	2.9	13.6	6.8
R13	7.8	10.6	5.3	18.4	9.2
R14	7.8	15.7	7.8	23.5	11.7
R15	7.8	10.1	5.1	17.9	9.0
S1	7.8	8.9	4.4	16.7	8.3
S2	7.8	5.4	2.7	13.2	6.6

Table 7A. 49: Predicted change in 8-hour rolling CO concentrations at discrete receptors (μg/m^3) due to emissions from the Proposed Development for the Cumulative scenario on natural gas, with comparison against Environmental Standard Criteria

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R1	100	6.6	0.1	106.6	1.1
R2	100	7.3	0.1	107.3	1.1
R3	100	22.2	0.2	122.2	1.2
R4	100	27.8	0.3	127.8	1.3
R5	100	25.5	0.3	125.5	1.3
R6	100	10.2	0.1	110.2	1.1
R7	100	13.2	0.1	113.2	1.1
R8	100	10.8	0.1	110.8	1.1
R9	100	11.0	0.1	111.0	1.1
R10	100	10.4	0.1	110.4	1.1
R11	100	14.4	0.1	114.4	1.1
R12	100	3.5	<0.1	103.5	1.0
R13	100	6.3	0.1	106.3	1.1
R14	100	8.8	0.1	108.8	1.1
R15	100	6.5	0.1	106.5	1.1
S1	100	9.5	0.1	109.5	1.1
S2	100	3.5	<0.1	103.5	1.0

Table 7A. 50: Predicted change in 8-hour rolling CO concentrations at discrete receptors (μg/m^3) due to emissions from the Proposed Development for the Cumulative scenario on backup fuel, with comparison against Environmental Standard Criteria

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R1	100	14.7	0.1	114.7	1.1
R2	100	14.5	0.1	114.5	1.1

RECEPTOR	BACKGROUND	PC PROPOSED DEVELOPMENT STACK	PC % AQS	PEC	PEC % AQS
R3	100	68.9	0.7	168.9	1.7
R4	100	46.9	0.5	146.9	1.5
R5	100	44.8	0.4	144.8	1.4
R6	100	17.0	0.2	117.0	1.2
R7	100	36.3	0.4	136.3	1.4
R8	100	21.2	0.2	121.2	1.2
R9	100	27.8	0.3	127.8	1.3
R10	100	23.3	0.2	123.3	1.2
R11	100	36.1	0.4	136.1	1.4
R12	100	9.2	0.1	109.2	1.1
R13	100	13.9	0.1	113.9	1.1
R14	100	16.6	0.2	116.6	1.2
R15	100	15.0	0.1	115.0	1.1
S1	100	21.3	0.2	121.3	1.2
S2	100	10.7	0.1	110.7	1.1

Table 7A.51: Dispersion Modelling Results for Ecological Receptors for the Cumulative Scenario- NO_X Annual Mean

REC ID	SITE NAME	ANNUAL MEAN (µg/m³)					
		BKG µg/m³	CLE	PC	PC/ CL	PEC	PEC/ CL
E5	Capira/Derrew Bog NHA	5.6	30	0.1	0.4	5.7	19.1
E6	Lough Derg SAC and SPA	5.6	30	0.1	0.2	5.7	18.9
E7	Lough Derg SAC	5.6	30	0.1	0.2	5.7	18.8
E8	Barroughter Bog SAC	5.6	30	0.1	0.2	5.7	18.8
E9	Slieve Aughty Mountains SPA	5.6	30	0.1	0.2	5.7	18.9
E10	Slieve Aughty Mountains SPA	5.6	30	0.1	0.2	5.7	18.8
E11	Lough Rea SPA	5.6	30	<0.1	0.1	5.6	18.8
E1	Eskerboy Bog NHA	5.6	30	0.3	0.9	5.9	19.6
E2	Cloonoolish Bog NHA	5.6	30	0.2	0.8	5.8	19.4
E3	Moorfield Bog NHA	5.6	30	0.2	0.6	5.8	19.3
E4	Ardgraigue Bog SAC	5.6	30	0.2	0.6	5.8	19.2
E12	Middle Shannon Callows SPA/SAC	5.6	30	0.1	0.3	5.7	18.9
E13	Middle Shannon Callows SPA/SAC	5.6	30	0.1	0.3	5.7	19.0
E14	Meeneen Bog NHA	5.6	30	0.1	0.3	5.7	19.0
E15	Cloonmoylan Bog SAC	5.6	30	0.1	0.2	5.7	18.8
E16	Rosturra Wood SAC	5.6	30	0.1	0.2	5.7	18.8
E17	Pollnaknockaun Wood Nature Reserve SAC	5.6	30	0.1	0.2	5.7	18.8
E18	Derrycrag Wood Nature Reserve SAC	5.6	30	<0.1	0.2	5.6	18.8
E19	Slieve Aughty Bog NHA	5.6	30	<0.1	0.2	5.6	18.8
E20	Slieve Aughty Bog NHA	5.6	30	0.1	0.2	5.7	18.9

REC ID	SITE NAME	ANNUAL MEAN (µg/m³)					
		BKG µg/m³	CLE	PC	PC/ CL	PEC	PEC/ CL
E21	Slieve Aughty Bog NHA	5.6	30	<0.1	0.2	5.6	18.8
E22	Ancient Woodland: Bog Wood	5.6	30	<0.1	<0.1	5.6	18.7
E23	Ancient Woodland: Rinmaher Wood	5.6	30	0.1	0.2	5.7	18.9
E24	Ancient Woodland: Derryvunlam	5.6	30	0.1	0.2	5.7	18.8

Table 7A.52: Dispersion Modelling Results for Ecological Receptors for the Cumulative Scenario – Nutrient Nitrogen Deposition (kg/ha/yr)

REC ID	SITE NAME	NUTRIENT NITROGEN DEPOSITION (KG/HA/YR)					
		BACKGROUND NITROGEN DEPOSITION (Kg N/ha/yr)	CLE	PC	PC/ CL	PEC	PEC/ CL
E5	Capira/Derrew Bog NHA	12	10.0	<0.1	0.2	12.0	120.2
E6	Lough Derg SAC and SPA	12	5.0	<0.1	0.2	12.0	240.2
E7	Lough Derg SAC	12	5.0	<0.1	0.2	12.0	240.2
E8	Barroughter Bog SAC	12	5.0	<0.1	0.2	12.0	240.2
E9	Slieve Aughty Mountains SPA	12	20.0	<0.1	<0.1	12.0	60.0
E10	Slieve Aughty Mountains SPA	12	20.0	<0.1	<0.1	12.0	60.0
E11	Lough Rea SPA	12	20.0	<0.1	<0.1	12.0	60.0
E1	Eskerboy Bog NHA	12	10.0	<0.1	0.4	12.0	120.4
E2	Cloonoolish Bog NHA	12	10.0	<0.1	0.3	12.0	120.3
E3	Moorfield Bog NHA	12	10.0	<0.1	0.3	12.0	120.3
E4	Ardgraigue Bog SAC	12	5.0	<0.1	0.5	12.0	240.5

REC ID	SITE NAME	NUTRIENT NITROGEN DEPOSITION (KG/HA/YR)					
		BACKGROUND NITROGEN DEPOSITION (Kg N/ha/yr)	CLE	PC	PC/ CL	PEC	PEC/ CL
E12	Middle Shannon Callows SPA/SAC	12	5.0	<0.1	0.2	12.0	240.2
E13	Middle Shannon Callows SPA/SAC	12	5.0	<0.1	0.3	12.0	240.3
E14	Meeneen Bog NHA	12	10.0	<0.1	0.1	12.0	120.1
E15	Cloonmoylan Bog SAC	12	5.0	<0.1	0.1	12.0	240.1
E16	Rosturra Wood SAC	12	10.0	<0.1	0.1	12.0	120.1
E17	Pollnaknockaun Wood Nature Reserve SAC	12	10.0	<0.1	0.1	12.0	120.1
E18	Derrycrag Wood Nature Reserve SAC	12	10.0	<0.1	0.1	12.0	120.1
E19	Slieve Aughty Bog NHA	12	10.0	<0.1	0.1	12.0	120.1
E20	Slieve Aughty Bog NHA	12	10.0	<0.1	0.1	12.0	120.1
E21	Slieve Aughty Bog NHA	12	10.0	<0.1	0.1	12.0	120.1
E22	Ancient Woodland: Bog Wood	12	10.0	<0.1	<0.1	12.0	120.0
E23	Ancient Woodland: Rinmaher Wood	12	10.0	<0.1	0.2	12.0	120.2
E24	Ancient Woodland: Derryvunlam	12	10.0	<0.1	0.2	12.0	120.2

Table 7A.53: Dispersion Modelling Results for Ecological Receptors for the Cumulative Scenario – Total Acid Deposition N + S (keq/ha/yr)

REC ID	SITE NAME	NUTRIENT NITROGEN DEPOSITION (KG/HA/YR)					
		BACKGROUND ACIDIC DEPOSITION (Kg N/ha/yr)	CLE	PC	PC/ CL	PEC	PEC/ CL
E5	Capira/Derrew Bog NHA	0.5	0.142	<0.01	0.9	0.5	353.0
E6	Lough Derg SAC and SPA	0.5	0.142	<0.01	0.4	0.5	352.5
E7	Lough Derg SAC	0.5	0.142	<0.01	0.4	0.5	352.5
E8	Barroughter Bog SAC	0.5	0.321	<0.01	0.2	0.5	155.9
E9	Slieve Aughty Mountains SPA	Not Sensitive					
E10	Slieve Aughty Mountains SPA						
E11	Lough Rea SPA						
E1	Eskerboy Bog NHA	0.5	0.142	<0.01	2.0	0.5	354.1
E2	Cloonoolish Bog NHA	0.5	0.142	<0.01	1.7	0.5	353.8
E3	Moorfield Bog NHA	0.5	0.142	<0.01	1.3	0.5	353.4
E4	Ardgraigue Bog SAC	0.5	0.321	<0.01	0.5	0.5	156.3
E12	Middle Shannon Callows SPA/SAC	0.5	0.223	<0.01	0.4	0.5	224.6
E13	Middle Shannon Callows SPA/SAC	0.5	0.223	<0.01	0.4	0.5	224.7
E14	Meeneen Bog NHA	0.5	0.142	<0.01	0.7	0.5	352.8
E15	Cloonmoylan Bog SAC	0.5	0.321	<0.01	0.2	0.5	155.9
E16	Rosturra Wood SAC	0.5	0.142	<0.01	0.7	0.5	352.8
E17	Pollnaknockaun Wood Nature Reserve SAC	0.5	0.142	<0.01	0.8	0.5	352.9
E18	Derrycrag Wood Nature Reserve SAC	0.5	0.142	<0.01	0.7	0.5	352.8
E19	Slieve Aughty Bog NHA	0.5	0.142	<0.01	0.3	0.5	352.5

REC ID	SITE NAME	NUTRIENT NITROGEN DEPOSITION (KG/HA/YR)					
		BACKGROUND ACIDIC DEPOSITION (Kg N/ha/yr)	CLE	PC	PC/ CL	PEC	PEC/ CL
E20	Slieve Aughty Bog NHA	0.5	0.142	<0.01	0.5	0.5	352.6
E21	Slieve Aughty Bog NHA	0.5	0.142	<0.01	0.4	0.5	352.5
E22	Ancient Woodland: Bog Wood	0.5	0.142	<0.01	0.2	0.5	352.3
E23	Ancient Woodland: Rinmaher Wood	0.5	0.142	<0.01	0.9	0.5	353.0
E24	Ancient Woodland: Derryvunlam	0.5	0.142	<0.01	0.8	0.5	352.9

ANNEX E: TERRAIN DOWNWASH SENSITIVITY TEST

Note:

As discussed in 4.5.17, the differences in terrain height around the Proposed Development have the potential to affect the dispersion of emissions from the stacks. As a sensitivity study, a terrain file of about 8km by 8km centred on the Proposed Development has been added to the model. Outputs and a comparison to the main model are displayed below.

The dispersion modelling assessment has been undertaken using meteorological data from Gurteen, for the years 2016 to 2020.

Table E.1, below, presents the predicted impacts, for long and short-term NO_2, at all discrete receptors in the area impacted by the terrain file. The comparison is based on a unit emission rate from the main plant stack at a release height of 40m.

Table E.1: Modelled Concentrations at Sensitive Receptors (μg/m³)

Receptor Name	Annual Mean NO_2			99th Percentile of the hourly mean NO_2			8-hour rolling CO		
	With Terrain file	Flat Terrain	Difference (%)	With Terrain file	Flat Terrain	Difference (%)	With Terrain file	Flat Terrain	Difference (%)
R1	0.04	0.04	<0.1	2.60	2.74	5.1	5.30	5.64	6.0
R2	0.04	0.04	<0.1	2.74	2.77	1.1	4.11	4.21	2.4
R3	0.02	0.02	<0.1	1.52	1.54	1.3	3.40	3.43	0.9
R4	0.20	0.20	<0.1	9.10	9.89	8.0	17.76	18.35	3.2
R5	0.20	0.20	<0.1	8.80	9.22	4.6	16.63	17.08	2.6
R6	0.01	0.01	<0.1	1.57	1.45	-8.3	4.63	4.26	-8.7
R7	0.03	0.03	<0.1	2.32	2.29	-1.3	5.75	5.74	-0.2
R8	0.02	0.02	<0.1	1.38	1.36	-1.5	3.79	3.50	-8.3
R9	0.05	0.05	<0.1	2.62	2.63	0.4	4.03	4.05	0.5
R10	0.08	0.08	<0.1	3.11	3.09	-0.6	3.54	3.58	1.1
R11	0.01	0.01	<0.1	1.33	1.29	-3.1	4.11	3.98	-3.3
R13	0.07	0.07	<0.1	1.98	1.97	-0.5	2.60	2.60	<0.1
R14	0.09	0.10	10.0	3.07	3.09	0.6	4.03	4.08	1.2

R15	0.05	0.05	<0.1	1.92	1.91	-0.5	2.58	2.59	0.4
R16	0.02	0.02	<0.1	1.43	1.53	6.5	5.10	4.70	-8.5
S2	0.02	0.02	<0.1	1.40	1.39	-0.7	2.79	2.77	-0.7

Summary:

The results presented in Table E.1 demonstrate that there is a small variation in the model outputs with and without the terrain file. The change, as a percentage of the flat terrain output, is always below <0.1% except for receptor R14 for the annual mean NO_2 where the flat terrain output is higher by 0.01 µg/m^3. It can also be seen that the predicted concentrations at certain receptors are higher with terrain (negative change) but others are lower, with flat terrain being the highest estimate a bit more than half the time.

Overall, no option seems to be a worst-case more than the other, and considering that the uncertainty of the model is higher with more complex data, the reported values (flat terrain) can therefore be considered to better represent the impacts that would be experienced with the Proposed Development.

ANNEX F: CONSTRUCTION DUST MITIGATION MEASURES

Table F.1: Embedded Construction Phase Mitigation Measures

PHASE	MITIGATION MEASURE
Communications	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
	Display the head or regional office contact information.
	Develop and implement a Dust Management Plan (DMP), which may form part of a CEMP, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site.
Site Management	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
	Make the complaints log available to the local authority when asked.
	Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.
Monitoring	Undertake daily on-site and off-site visual inspections, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.
	Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.
	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
	Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.
Preparing and maintaining the site	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
	Erect solid screens or barriers if required around dusty activities or the site boundary that are at least as high as any stockpiles on site.
	Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period.
	Avoid site runoff of water or mud.
	Keep site fencing, barriers and scaffolding clean using wet methods.
	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
	Cover, seed or fence any stockpiles to prevent wind whipping.

Operating vehicle / machinery and sustainable travel	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
	Ensure all vehicles switch off engines when stationary - no idling vehicles
	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
	Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
Operations	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
	Use enclosed chutes and conveyors and covered skips.
	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
	Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
Measures specific to earthwork	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
	Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.
	Only remove the cover in small areas during work and not all at once.
Measures specific to construction	Avoid scabbling (roughening of concrete surfaces) if possible.
	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
	For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.
Waste Management	Avoid bonfires and burning of waste materials.
Measures specific to trackout	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site.
	Avoid dry sweeping of large areas.
	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
	Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.

	Record all inspections of haul routes and any subsequent action in a site log book
	Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
	Implement a wheel washing system.
	Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
	Access gates to be located at least 10 m from receptors where possible.