Redmore environmental

Air Quality Assessment

Melton Road, Melton Mowbray

Client: Foyle Food Group Ltd

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Redmore environmental

Executive Summary

Redmore Environmental Ltd was commissioned by Foyle Food Group Ltd to undertake an Air Quality Assessment in support of an Environmental Permit Application for a gas fired boiler installed at Foyle Food Group Ltd, Melton Road, Melton Mowbray.

Atmospheric emissions from the plant have the potential to cause air quality impacts during normal operation. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and consider potential effects.

Dispersion modelling was undertaken in order to predict pollutant concentrations at sensitive locations as a result of emissions from the facility. The results indicated that impacts on pollutant concentrations were not predicted to be significant at any human or ecological receptor location in the vicinity of the site.

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1.0 INTRODUCTION

1.1 Background

1.1.1 Redmore Environmental Ltd was commissioned by Foyle Food Group Ltd to undertake an Air Quality Assessment in support of an Environmental Permit Application for a gas fired boiler installed at Foyle Food Group Ltd, Melton Road, Melton Mowbray.

1.1.2 Atmospheric emissions from the plant have the potential to cause air quality impacts during normal operation. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and consider potential effects.

1.2 Site Location and Context

1.2.1 The site is located at Foyle Food Group Ltd, Melton Road, Melton Mowbray, at approximate National Grid Reference (NGR): 464640, 320980. Reference should be made to Figure 1 for a map of the site and surrounding area.

1.2.2 The Environmental Permit covers one hot water 1.26MW_{th} boiler. Combustion emissions are released at a height of 8m via a dedicated flue.

1.2.3 The operation of the boiler results in atmospheric emissions from the combustion of natural gas. An initial Screening Assessment was therefore undertaken to consider associated air quality impacts using the Environment Agency (EA) H1 Assessment Tool. The results indicated that impacts could not be screened as insignificant. As such, detailed dispersion modelling has been undertaken in order to provide further consideration of potential air quality impacts as a result of emissions from the boiler. The methodology and findings are detailed in the following report.

2.0 LEGISLATION AND POLICY

2.1 Legislation

2.1.1 The Air Quality Standards Regulations (2010) came into force on 11th June 2010 and include Air Quality Limit Values (AQLVs) for the following pollutants:

- Nitrogen dioxide (NO_2);
- Sulphur dioxide;
- Lead;
- Particulate matter with an aerodynamic diameter of less than 10µm;
- Particulate matter with an aerodynamic diameter of less than 2.5µm;
- Benzene; and,
- Carbon monoxide (CO).

2.1.2 Air Quality Target Values (AQTV) were also provided for several additional pollutants.

2.1.3 The Air Quality Strategy (AQS) was produced by the Department for Environment, Food and Rural Affairs (DEFRA) and published on 28th April 2023[1]. The document contains standards, objectives and measures for improving ambient air quality, including a number of Air Quality Objectives (AQOs). These are maximum ambient pollutant concentrations that are not to be exceeded either without exception or with a permitted number of exceedences over a specified timescale. These are generally in line with the AQLVs, although the requirements for the determination of compliance vary.

2.1.4 Table 1 presents the AQOs for pollutants considered within this assessment.

Table 1 Air Quality Objectives

Pollutant	Air Quality Objective	
	Concentration (µg/m³)	Averaging Period
NO_2	40	Annual mean
	200	1-hour mean, not to be exceeded on more than 18 occasions per annum

1 The AQS: Framework for Local Authority Delivery, DEFRA, 2023.

Pollutant	Air Quality Objective	
	Concentration (μg/m³)	Averaging Period
CO	10,000	8-hour rolling mean

2.1.5 Table 2 summarises the advice provided in DEFRA guidance[2] on where the AQOs for pollutants considered within this report apply.

Table 2 Examples of Where the Air Quality Objectives Apply

Averaging Period	Objective Should Apply At	Objective Should Not Apply At
Annual mean	All locations where members of the public might be regularly exposed Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access Hotels, unless people live there as their permanent residence Gardens of residential properties Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
8-hour mean	All locations where the annual mean objective would apply, together with hotels Gardens of residential properties	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1-hour mean	All locations where the annual mean and 8-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets) Those parts of car parks, bus stations and railway stations etc which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer	Kerbside sites where the public would not be expected to have regular access

2 Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

2.2 Local Air Quality Management

2.2.1 Local Authorities (LAs) are required to periodically review and assess air quality within their area of jurisdiction under the system of Local Air Quality Management (LAQM). This review and assessment of air quality involves comparing present and likely future pollutant concentrations against the AQOs. If it is predicted that levels at locations of relevant exposure, as summarised in Table 2, are likely to be exceeded, the LA is required to declare an Air Quality Management Area (AQMA). For each AQMA the LA is required to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

2.3 Industrial Pollution Control Legislation

2.3.1 Atmospheric emissions from industry are controlled in England through the Environmental Permitting (England and Wales) Regulations (2016) and subsequent amendments. The operation of a medium combustion plant (MCP) is included within the Regulations. As such the facility is required to operate in accordance with an Environmental Permit issued by the EA. This includes a number of conditions and monitoring requirements in order restrict environmental impacts as result of atmospheric emissions associated with the authorised activities.

2.4 Critical Loads and Levels

2.4.1 A critical load is defined by the UK Air Pollution Information System (APIS)[3] as:

> "A quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge."

2.4.2 A critical level is defined as:

> "Concentrations of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur according to present knowledge."

3 UK APIS, www.apis.ac.uk.

2.4.3 A critical load refers to deposition of a pollutant, while a critical level refers to pollutant concentrations in the atmosphere (which usually have direct effects on vegetation or human health).

2.4.4 When pollutant loads (or concentrations) exceed the critical load or level it is considered that there is a risk of harmful effects. The excess over the critical load or level is termed the exceedence. A larger exceedence is often considered to represent a greater risk of damage.

2.4.5 Maps of critical loads and levels and their exceedences have been used to show the potential extent of pollution damage and aid in developing strategies for reducing pollution. Decreasing deposition below the critical load is seen as means for preventing the risk of damage. However, even a decrease in the exceedence may infer that less damage will occur.

2.4.6 Table 3 presents the critical levels for the protection of vegetation for pollutants considered within this assessment.

Table 3 Critical Levels for the Protection of Vegetation

Pollutant	Critical Level	
	Concentration ($\mu g/m^3$)	Averaging Period
Oxides of nitrogen (NO_x)	30	Annual mean
	75	24-hour mean

2.4.7 Critical loads have been designated within the UK based on the sensitivity of the receiving habitat and have been identified for the relevant designations considered within the assessment in Section 3.5.

3.0 BASELINE

3.1 Introduction

3.1.1 Existing air quality conditions in the vicinity of the site were identified in order to provide a baseline for assessment. These are detailed in the following Sections.

3.2 Local Air Quality Management

3.2.1 As required by the Environment Act (1995), Melton Borough Council (MBC) has undertaken Review and Assessment of air quality within their area of jurisdiction. This process has indicated that concentrations of all pollutants considered within the AQS are currently below the relevant AQOs. As such, no AQMAs have been designated within the borough.

3.3 Air Quality Monitoring

3.3.1 Monitoring of pollutant concentrations is undertaken by MBC throughout their area of jurisdiction. However, the closest survey position is approximately 10km from the site. It is considered unlikely that similar concentrations would occur over a distance of this magnitude. As such, this source of data was not considered further in the context of the assessment.

3.4 Background Pollutant Concentrations

3.4.1 Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by DEFRA for the entire of the UK to assist Local Authorities in their Review and Assessment of air quality. The site is located in grid square NGR: 464500, 321500. Data for this location was downloaded from the DEFRA website[4] for the purpose of the assessment and is summarised in Table 4.

[4] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html.

Table 4 Background Pollutant Concentration Predictions

Pollutant	Predicted Background Pollutant Concentration (µg/m^3)
NO_2	8.36
CO	299

3.4.2 It should be noted that concentrations of NO_2 are predicted for 2024 and CO for 2001. These were the most recent predictions available from DEFRA at the time of assessment and are therefore considered to provide a reasonable representation of background concentrations in the vicinity of the site.

3.5 Sensitive Receptors

3.5.1 A sensitive receptor is defined as any location which may be affected by changes in air quality. These have been defined for human and ecological receptors in the following Sections.

Human Receptors

3.5.2 A desk-top study was undertaken in order to identify any sensitive human receptor locations in the vicinity of the site that required specific consideration during the assessment. These are summarised in Table 5.

Table 5 Sensitive Human Receptor Locations

Receptor		NGR (m)	
		X	Y
R1	Residential - A46	464431.0	320870.0
R2	Residential - A46	464397.5	320749.1
R3	Residential - Oaks Farm Close	464190.4	320595.1
R4	Residential - Egmont Farm	464004.0	321748.0
R5	Residential - Willoughby Lodge	464434.7	321731.6
R6	Residential - Six Hills Road	465245.8	321439.3
R7	Residential - Six Hills Lane	465528.3	321300.2

Receptor		NGR (m)	
		X	Y
R8	Residential - Six Hills Road	465553.0	320433.8
R9	Residential - Wolds Farm	464394.2	320079.4

3.5.3 Reference should be made to Figure 2 for a map of the sensitive human receptor locations.

Ecological Receptors

3.5.4 Atmospheric emissions from the facility have the potential to impact on receptors of ecological sensitivity within the vicinity of the site. The Conservation of Habitats and Species Regulations (2010) and subsequent amendments require competent authorities to review applications and consents that have the potential to impact on ecological designations. The MCP screening tool[5] was therefore utilised in order to identify any sites of ecological or nature conservation importance that required consideration within the assessment. These are summarised in Table 6. It should be noted that for the purpose of the modelling assessment, discrete receptors were placed at the closest points of the designation to the facility to ensure the maximum potential impact was predicted.

Table 6 Ecological Receptor Locations

Receptor		NGR (m)	
		X	Y
E1	Twenty Acre Piece Site of Special Scientific Interest (SSSI)	464376.4	321042.1

3.5.5 Reference should be made to Figure 3 for a map of the ecological receptor location.

3.5.6 Critical loads have been designated within the UK based on the sensitivity and relevant features of the receiving habitat. A review of information provided by the APIS[6] website and MAGIC web-based interactive mapping service[7] was undertaken in order to identify

5 https://www.apis.ac.uk/MCP-screening-tool.

6 http://www.apis.ac.uk/.

7 Multi-Agency Geographic Information for the Countryside, www.magic.gov.uk.

the most sensitive habitat and associated critical load for each designation considered within the assessment.

3.5.7 The relevant critical loads for nitrogen deposition are presented in Table 7.

Table 7 Critical Loads for Nitrogen Deposition

Receptor		Feature	Nitrogen Critical Load Class	Nitrogen Critical Load (kgN/ha/yr)	
				Low	High
E1	Twenty Acre Piece SSSI	Molinia caerulea - cirsium dissectum fen meadow	Rich fens	15	25

3.5.8 The relevant acid deposition critical loads are presented in Table 8.

Table 8 Critical Loads for Acid Deposition

Receptor		Feature	Acidity Critical Load Class	Acid Critical Load (keq/ha/yr)		
				CLMinN	CLMaxS	CLMaxN
E1	Twenty Acre Piece SSSI	-[(a)]	-	-	-	-

Note: (a) Critical load not assigned for feature on APIS.

Baseline pollutant concentrations and deposition rates at each ecological receptor were obtained from the APIS website[8] and are summarised in Table 9.

Table 9 Baseline Pollution Levels at Ecological Receptors

Receptor		Annual Mean NO_x Concentration ($\mu g/m^3$)	Baseline Deposition Rate	
			Nitrogen (kgN/ha/yr)	Acid (keq/ha/yr)
E1	Twenty Acre Piece SSSI	10.27	17.96	1.27

8 UK APIS, www.apis.ac.uk.

4.0 METHODOLOGY

4.1 Introduction

4.1.1 Combustion emissions from the plant have the potential to contribute to elevated pollutant concentrations in the vicinity of the site. These have been quantified through dispersion modelling in accordance with the methodology outlined in the following Sections.

4.2 Dispersion Model

4.2.1 Dispersion modelling was undertaken using ADMS-6 (v6.0.2.0), which is developed by Cambridge Environmental Research Consultants (CERC) Ltd. ADMS-6 is a short-range dispersion modelling software package that simulates a wide range of buoyant and passive releases to atmosphere. It is a new generation model utilising boundary layer height and Monin-Obukhov length to describe the atmospheric boundary layer and a skewed Gaussian concentration distribution to calculate dispersion under convective conditions.

4.2.2 The model utilises hourly meteorological data to define conditions for plume rise, transport and diffusion. It estimates the concentration for each source and receptor combination for each hour of input meteorology and calculates user-selected long-term and short-term averages.

4.3 Modelling Scenarios

4.3.1 The parameters considered in the modelling assessment for human receptors are summarised in Table 10.

Table 10 Human Receptor Assessment Parameters

Parameter	Modelled As	
	Short Term	Long Term
NO_2	99.8th percentile (%ile) 1-hour mean	Annual mean
CO	100th %ile 8-hour rolling mean	-

4.3.2 Some short-term air quality criteria are framed in terms of the number of occasions in a calendar year on which the concentration should not be exceeded. As such, the %iles shown in Table 10 were selected to represent the relationship between the permitted number of exceedences of short-period concentrations and the number of periods within a calendar year.

4.3.1 The parameters considered in the modelling assessment for ecological receptors are summarised in Table 11.

Table 11 Ecological Receptor Assessment Parameters

Parameter	Modelled As	
	Short Term	Long Term
NO_x	24-hour mean	Annual mean
Nitrogen deposition	-	Annual deposition
Acid deposition	-	Annual deposition

4.3.2 Predicted pollutant levels were summarised in the following formats:

- Process contribution (PC) - Predicted pollutant level as a result of emissions from the boiler; and,
- Predicted environmental concentration (PEC) - Total predicted pollutant level as a result of emissions from the boiler and existing background conditions.

4.3.3 Predicted ground level pollutant concentrations and deposition rates were compared with the relevant AQOs, critical loads and critical levels. These criteria are collectively referred to as Environmental Quality Standards (EQSs).

4.4 Assessment Area

4.4.1 The assessment area was defined based on the facility location, anticipated pollutant dispersion patterns and the positioning of sensitive receptors. Ambient concentrations were predicted over NGR: 463900, 320230 to 465400, 321730. One Cartesian grid with a resolution of 10m was used within the model.

4.4.2 Reference should be made to Figure 4 for a graphical representation of the assessment grid extents.

4.5 Process Conditions

4.5.1 The release parameters were obtained from the Operator and a Stack Emissions Monitoring Report[9] prepared by Atesta for monitoring undertaken at the facility in June 2024. These are shown in Table 12.

Table 12 Source Parameters

Parameter	Unit	Value
Stack position	NGR	464661.4, 320975.6
Stack height	m	8.0
Stack diameter(a)	m	0.4
Exhaust gas temperature	°C	116.4
Stack oxygen (O_2) content	%	3.9
Exhaust gas flow rate	m^3/s	0.307
Exhaust gas flow rate(b)	Nm^3/s	0.183
Exhaust gas efflux velocity	m/s	3.2

Note: (a) Diameter at the release point.
(b) 273K, dry, 3% O_2.

4.5.2 Reference should be made to Figure 4 for a map of the emission source location.

4.6 Emissions

4.6.1 Pollutant emission concentrations for CO were obtained from the Stack Emissions Monitoring Report provided by Atesta. The MCP directive ELV was utilised for NO_x. These are shown in Table 13.

[9] Foyle Food Group Ltd, Melton Mowbray - JOB-1155, Atesta, 2024.

Table 13 Pollutant Emission Concentrations

Pollutant	Pollutant Emission Concentration (mg/Nm^3)
NO_x	100
CO	4.6

4.6.2 The pollutant mass emission rates for use in the assessment were derived from the concentrations shown in Table 13 and the flow rate shown in Table 12. These are summarised in Table 14.

Table 14 Pollutant Mass Emission Rates - Per Boiler

Pollutant	Pollutant Mass Emission Rate (g/s)
NO_x	0.0183
CO	0.0004

4.6.3 Emissions were assumed to be constant, with the boiler in operation 24-hours per day, 365-days per year. This is considered to be a worst-case assessment scenario as plant shutdown or periods of reduced work load are not reflected in the modelled emissions.

4.7 NO_x to NO_2 Conversion

4.7.1 Emissions of total NO_x from combustion processes are predominantly in the form of nitric oxide (NO). Excess oxygen in the combustion gases and further atmospheric reactions cause the oxidation of NO to NO_2. Comparisons of ambient NO and NO_2 concentrations in the vicinity of point sources in recent years has indicated that it is unlikely that more than 30% of the NO_x is present at ground level as NO_2.

4.7.2 Ambient NO_x concentrations were predicted through dispersion modelling. Concentrations of NO_2 shown in the results section assume 70% conversion from NO_x to NO_2 for annual means and 35% conversion for 1-hour concentrations, based upon EA guidance[10].

10 https://www.gov.uk/guidance/environmental-permitting-air-dispersion-modelling-reports.

4.8 Building Effects

4.8.1 The dispersion of substances released from elevated sources can be influenced by the presence of buildings close to the emission point. Structures can interrupt the wind flows and cause significantly higher ground-level concentrations close to the source than would arise in the absence of the buildings.

4.8.2 Analysis of the site layout indicated that a single structure should be included within the model in order to take account of effects on pollutant dispersion. Building input geometries are shown in Table 15.

Table 15 Building Geometries

Building	NGR (m)		Height (m)	Length (m)	Width (m)	Angle (°)
	X	Y				
Building 1	464639.7	320980.6	7.5	33.3	73.4	151.8

4.9 Meteorological Data

4.9.1 Meteorological data used in the assessment was taken from East Midlands Airport meteorological station over the period 1st January 2018 to 31st December 2022 (inclusive). This observation station is located at NGR: 445745, 326055, which is approximately 19.0km north-west of the facility. It is anticipated that conditions would be reasonably similar over a distance of this magnitude. The data was therefore considered suitable for an assessment of this nature.

4.9.2 All meteorological files used in the assessment were provided by Atmospheric Dispersion Modelling Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 5 for wind roses of the utilised meteorological records.

4.10 Roughness Length

4.10.1 A roughness length (z_0) of 0.3m was used to describe the modelling extents. This value is considered appropriate for the morphology of the area and is suggested within ADMS-6 as being suitable for 'agricultural areas (max)'.

4.10.2 A z_0 of 0.2m was used to describe the meteorological site. This value is considered appropriate for the morphology of the area The value is suggested within ADMS-6 as being suitable for 'agricultural areas (min)'.

4.11 Monin-Obukhov Length

4.11.1 The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 1m was used to describe the modelling extents. This value is considered appropriate for the nature of the area and is suggested within ADMS-6 as being suitable for 'rural areas'.

4.11.2 A minimum Monin-Obukhov length of 10m was used to describe the meteorological site. This value is considered appropriate for the nature of the area and is suggested within ADMS-6 as being suitable for 'small towns <50,000'.

4.12 Terrain Data

4.12.1 Ordnance Survey OS Terrain 50 data was included in the model for the site and surrounding area in order to take account of the specific flow field produced by variations in ground height throughout the assessment extents. This was pre-processed using the method suggested by CERC[11].

4.13 Nitrogen Deposition

4.13.1 Nitrogen deposition rates were calculated using the conversion factors provided within EA document 'Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06'[12]. Predicted pollutant concentrations were multiplied by the relevant deposition velocity and conversion factor to calculate the speciated dry deposition flux. The conversion factors used for the determination of nitrogen deposition are presented within Table 16.

11 Note 105: Setting up Terrain Data for Input to CERC Models, CERC, 2016.

12 Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06, EA, 2014.

Table 16 Conversion Factors to Determine Dry Deposition Flux for Nitrogen Deposition

Pollutant	Deposition Velocity (m/s)		Conversion Factor (µg/m²/s to kg/ha/yr of pollutant species)
	Grassland	Forest	
NO_2	0.0015	0.003	95.9

4.13.2 The relevant deposition velocity for each ecological receptor was selected from Table 16 based on the vegetation type present within the designation.

4.14 Acid Deposition

4.14.1 Predicted ground level NO_2 concentrations were converted to kilo-equivalent ion depositions (keq/ha/yr) for comparison with the critical load for acid deposition at each of the identified ecological receptors. The conversion to units of equivalents, a measure of the potential acidifying effect of a species, was undertaken using the standard conversion factors shown in Table 17.

Table 17 Conversion Factors to Determine Dry Deposition Flux for Acid Deposition

Pollutant	Deposition Velocity (m/s)		Conversion Factor (µg/m²/s to keq/ha/yr of pollutant species)
	Grassland	Forest	
NO_2	0.0015	0.003	6.84

4.14.2 The following formula was used to calculate predicted PCs as a proportion of the critical load function where PECs were identified to be greater than the CLminN value:

PC as %CL function = ((PC of N deposition)/CLmaxN) x 100

4.14.3 The above formula was obtained from the APIS website[13].

4.15 Background Concentrations

4.15.1 Review of existing data in Section 3.0 was undertaken in order to identify suitable baseline values for use in the assessment. This indicated the closest monitors are positioned a

13 http://www.apis.ac.uk/.

significant distance from the facility and results are unlikely to be representative of the site location. As such, the background concentrations predicted by DEFRA were utilised to represent existing concentrations in the vicinity of the site, as summarised in Table 4.

4.15.2 Background levels at the ecological receptor were obtained from the APIS website, as summarised in Table 9.

4.15.3 It is not possible to add short-term peak baseline and process concentrations. This is because the conditions which give rise to peak ground-level concentrations of substances emitted from an elevated source at a particular location and time are likely to be different to the conditions which give rise to peak concentrations due to emissions from other sources. This point is addressed in in EA guidance 'Air emissions risk assessment for your environmental permit'[14], which advises that an estimate of the maximum combined pollutant concentration can be obtained by adding the maximum predicted short-term concentration due to emissions from the source to twice the annual mean baseline concentration. This approach was adopted throughout the assessment.

4.16 Assessment Criteria

Human Receptors

4.16.1 EA guidance 'Air emissions risk assessment for your environmental permit'[15] states that PCs can be screened as insignificant if they meet the following criteria:

- The short-term PC is less than 10% of the short-term environmental standard; and,
- The long-term PC is less than 1% of the long-term environmental standard.

4.16.2 If these criteria are exceeded the following guidance is provided on when whether PECs can be screened as insignificant:

- The short-term PC is less than 20% of the short-term environmental standard minus twice the long-term background concentration; and,
- The long-term PEC is less than 70% of the long-term environmental standard.

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[14] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit.

[15] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit.

Ecological Receptors

4.16.3 EA guidance 'Air emissions risk assessment for your environmental permit'[16] states that PCs at SSSIs can be screened as insignificant if they meet the following criteria:

- The short-term PC is less than 10% of the short-term environmental standard for protected conservation areas; and,
- The long-term PC is less than 1% of the long-term environmental standard for protected conservation areas.

4.16.4 Predicted PCs have been compared to the relevant EQSs and the criteria stated above. Where the impact is within these parameters, the EA concludes that impacts associated with an installation are acceptable.

4.17 Modelling Uncertainty

4.17.1 Uncertainty in dispersion modelling predictions can be associated with a variety of factors, including:

- Model uncertainty - due to model limitations;
- Data uncertainty - due to errors in input data, including emission estimates, operational procedures, land use characteristics and meteorology; and,
- Variability - randomness of measurements used.

4.17.2 Potential uncertainties in the model results were minimised as far as practicable and worst-case inputs used in order to provide a robust assessment. This included the following:

- Choice of model - ADMS-6 is a commonly used atmospheric dispersion model and results have been verified through a number of studies to ensure predictions are as accurate as possible;
- Meteorological data - Modelling was undertaken using five annual meteorological data sets from an observation station local to the site to account for inter-year

[16] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit.

variability. The assessment was based on the worst-case year to ensure maximum concentrations were considered;

- Surface characteristics - The z_0 and Monin-Obukhov length were determined for both the dispersion and meteorological sites based on the surrounding land uses and guidance provided by CERC. Terrain data was included and processed using the method outlined by CERC;
- Plant operating conditions - Operational parameters were obtained from Foyle Food Group Limited and the Stack Emissions Monitoring Report[17] prepared by Atesta. As such, input parameters are considered to be representative of normal operating conditions;
- Emission rates - Emission rates were obtained from the Stack Emissions Monitoring Report completed by Atesta[18]. Emissions were assumed to be constant throughout the modelling period, which does not allow for plant shutdown or periods of reduced workload. These assumptions are likely to overestimate actual emissions and therefore result in a worst-case assessment;
- Background concentrations - Background pollutant levels were obtained from the DEFRA and APIS websites. As such, they are considered suitable for an assessment of this nature;
- Receptor locations - A Cartesian Grid was included in the model in order to provide suitable data for contour plotting. Receptor points were also included at sensitive locations to provide additional consideration of these areas; and,
- Variability - All model inputs were as accurate as possible and worst-case conditions were considered as necessary in order to ensure a robust assessment of potential pollutant concentrations.

4.17.3 Results were considered in the context of the relevant EQSs. It is considered that the use of the stated measures to reduce uncertainty and the use of worst-case assumptions when necessary has resulted in model accuracy of an acceptable level.

17 Foyle Food Group Ltd, Melton Mowbray - JOB-1155, Atesta, 2024.

18 Foyle Food Group Ltd, Melton Mowbray - JOB-1155, Atesta, 2024.

5.0 RESULTS

5.1 Introduction

5.1.1 Dispersion modelling was undertaken with the inputs described in Section 4.0. The results are outlined in the following Sections.

5.1.2 Reference should be made to Figure 6 to Figure 8 for graphical representations of predicted pollutant concentrations, inclusive of background, throughout the assessment extents. It should be noted that the values shown in the Figures are predictions from the meteorological data set which resulted in the maximum pollutant concentration for that species. For example, the maximum annual mean NO_2 concentration was predicted using the 2021 meteorological data set. As such, the contours shown in Figure 6 were produced from the 2021 model outputs.

5.2 Maximum Pollutant Concentrations

5.2.1 The maximum predicted pollutant concentrations at any point within the modelling extents for any meteorological data set are summarised in Table 18.

Table 18 Maximum Predicted Pollutant Concentrations

Pollutant	Averaging Period	EQS (μg/m³)	PC (μg/m³)	PC Proportion of EQS (%)	PEC (μg/m³)	PEC Proportion of EQS (%)
NO_2	Annual	40	5.94	14.9	14.30	35.7
	99.8th %ile 1-hour	200	11.26	5.6	27.98	14.0
CO	8-hour rolling	10,000	0.64	0.0	598.64	6.0

5.2.2 As shown in Table 18, there were no predicted exceedences of any EQS at any location for any pollutant or averaging period of interest.

5.3 Sensitive Human Receptors

5.3.1 Predicted pollutant concentrations at the sensitive human receptor locations identified in Table 5 are summarised in the following Sections.

Nitrogen Dioxide

5.3.2 Predicted annual mean NO_2 PECs, inclusive of background levels, are summarised in Table 19.

Table 19 Predicted Annual Mean NO_2 Concentrations

Receptor		Predicted Annual Mean NO_2 PEC (µg/m^3)				
		2018	2019	2020	2021	2022
R1	Residential - A46	8.42	8.40	8.40	8.41	8.40
R2	Residential - A46	8.39	8.39	8.39	8.40	8.39
R3	Residential - Oaks Farm Close	8.37	8.37	8.37	8.38	8.37
R4	Residential - Egmont Farm	8.36	8.36	8.36	8.36	8.36
R5	Residential - Willoughby Lodge	8.36	8.37	8.37	8.36	8.37
R6	Residential - Six Hills Road	8.37	8.37	8.37	8.37	8.38
R7	Residential - Six Hills Lane	8.37	8.37	8.37	8.37	8.37
R8	Residential - Six Hills Road	8.37	8.37	8.36	8.36	8.37
R9	Residential - Wolds Farm	8.36	8.36	8.37	8.37	8.36

5.3.3 As indicated in Table 19, predicted NO_2 concentrations were below the annual mean EQS of 40µg/m^3 at all sensitive receptor locations for all meteorological data sets.

5.3.4 Maximum predicted annual mean NO_2 concentrations at the receptor locations are summarised in Table 20. Reference should be made to Figure 6 for a graphical representation of predicted concentrations throughout the assessment extents.

Table 20 Maximum Predicted Annual Mean NO_2 Concentrations

Receptor		Maximum Predicted Annual Mean NO_2 Concentration (µg/m^3)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Residential - A46	0.06	8.42	0.1	21.0
R2	Residential - A46	0.04	8.40	0.1	21.0

Receptor		Maximum Predicted Annual Mean NO_2 Concentration (μg/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R3	Residential - Oaks Farm Close	0.02	8.38	0.0	20.9
R4	Residential - Egmont Farm	0.01	8.36	0.0	20.9
R5	Residential - Willoughby Lodge	0.01	8.37	0.0	20.9
R6	Residential - Six Hills Road	0.02	8.38	0.0	20.9
R7	Residential - Six Hills Lane	0.01	8.37	0.0	20.9
R8	Residential - Six Hills Road	0.01	8.37	0.0	20.9
R9	Residential - Wolds Farm	0.01	8.37	0.0	20.9

5.3.5 As indicated in Table 20, PCs were below 1% of the EQS at all receptor locations. As such, predicted effects on annual mean NO_2 concentrations are not considered to be significant, in accordance with the stated criteria.

5.3.6 Predicted 99.8th %ile 1-hour mean NO_2 PECs, inclusive of background levels, are summarised in Table 21.

Table 21 Predicted 99.8th %ile 1-hour Mean NO_2 Concentrations

Receptor		Predicted 99.8th %ile 1-hour Mean NO_2 PEC (μg/m³)				
		2018	2019	2020	2021	2022
R1	Residential - A46	17.49	17.42	17.45	17.46	17.51
R2	Residential - A46	17.28	17.25	17.19	17.28	17.23
R3	Residential - Oaks Farm Close	17.09	17.07	17.03	17.12	17.07
R4	Residential - Egmont Farm	16.89	17.01	16.96	16.96	16.95
R5	Residential - Willoughby Lodge	16.86	17.04	17.13	16.90	17.09
R6	Residential - Six Hills Road	16.92	17.09	17.02	17.02	17.09
R7	Residential - Six Hills Lane	16.96	17.02	16.99	17.01	16.95
R8	Residential - Six Hills Road	17.10	16.97	17.02	17.01	17.03
R9	Residential - Wolds Farm	16.95	17.02	17.03	16.91	17.06

5.3.7 As indicated in Table 21, predicted 99.8th %ile 1-hour mean NO_2 concentrations were below the EQS of 200µg/m³ at all sensitive receptor locations for all meteorological data sets.

5.3.8 Maximum predicted 99.8th %ile 1-hour mean NO_2 concentrations at the receptor locations are summarised in Table 22. Reference should be made to Figure 7 for a graphical representation of predicted concentrations throughout the assessment extents.

Table 22 Maximum Predicted 99.8th %ile 1-hour Mean NO_2 Concentrations

Receptor		Maximum Predicted 99.8th %ile 1-hour Mean NO_2 Concentration (µg/m³)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[a]
		PC	PEC		
R1	Residential - A46	0.79	17.51	0.4	0.4
R2	Residential - A46	0.57	17.28	0.3	0.3
R3	Residential - Oaks Farm Close	0.41	17.12	0.2	0.2
R4	Residential - Egmont Farm	0.29	17.01	0.1	0.2
R5	Residential - Willoughby Lodge	0.41	17.13	0.2	0.2
R6	Residential - Six Hills Road	0.37	17.09	0.2	0.2
R7	Residential - Six Hills Lane	0.30	17.02	0.1	0.2
R8	Residential - Six Hills Road	0.39	17.10	0.2	0.2
R9	Residential - Wolds Farm	0.35	17.06	0.2	0.2

Note: (a) PC proportion of EQS minus twice the long-term background concentration.

5.3.9 As indicated in Table 22, the PC proportion of the EQS was below 10% at all receptor locations. As such, predicted effects on 1-hour mean NO_2 concentrations are not considered to be significant in accordance with the stated criteria.

Carbon Monoxide

5.3.10 Predicted 8-hour rolling mean CO PECs, inclusive of background levels, are summarised in Table 23.

Table 23 Predicted 8-hour Rolling Mean CO Concentrations

Receptor		Predicted 8-hour Rolling Mean CO PEC (µg/m³)				
		2018	2019	2020	2021	2022
R1	Residential - A46	598.03	598.03	598.04	598.03	598.03
R2	Residential - A46	598.02	598.02	598.03	598.02	598.02
R3	Residential - Oaks Farm Close	598.02	598.01	598.01	598.01	598.01
R4	Residential - Egmont Farm	598.01	598.01	598.01	598.01	598.01
R5	Residential - Willoughby Lodge	598.01	598.01	598.01	598.01	598.02
R6	Residential - Six Hills Road	598.01	598.01	598.01	598.01	598.02
R7	Residential - Six Hills Lane	598.01	598.01	598.01	598.01	598.01
R8	Residential - Six Hills Road	598.01	598.01	598.02	598.01	598.01
R9	Residential - Wolds Farm	598.01	598.01	598.01	598.01	598.01

5.3.11 As indicated in Table 23, predicted CO concentrations were below the 8-hour rolling mean EQS of 10,000µg/m³ at all sensitive receptor locations for all meteorological data sets.

5.3.12 Maximum predicted 8-hour rolling mean CO concentrations at the receptor locations are summarised in Table 24. Reference should be made to Figure 8 for a graphical representation of predicted concentrations throughout the assessment extents.

Table 24 Maximum Predicted 8-hour Rolling Mean CO Concentrations

Receptor		Maximum Predicted 8-hour Rolling Mean CO Concentration (µg/m³)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)(a)
		PC	PEC		
R1	Residential - A46	0.04	598.04	0.0	6.0
R2	Residential - A46	0.03	598.03	0.0	6.0
R3	Residential - Oaks Farm Close	0.02	598.02	0.0	6.0
R4	Residential - Egmont Farm	0.01	598.01	0.0	6.0
R5	Residential - Willoughby Lodge	0.02	598.02	0.0	6.0

Receptor		Maximum Predicted 8-hour Rolling Mean CO Concentration (μg/m³)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[a]
		PC	PEC		
R6	Residential - Six Hills Road	0.02	598.02	0.0	6.0
R7	Residential - Six Hills Lane	0.01	598.01	0.0	6.0
R8	Residential - Six Hills Road	0.02	598.02	0.0	6.0
R9	Residential - Wolds Farm	0.01	598.01	0.0	6.0

Note: (a) PC proportion of EQS minus twice the long-term background concentration.

5.3.13 As indicated in Table 24 the PC proportion of the EQS was below 10% at all receptor locations. As such, predicted effects on 8-hour rolling mean CO concentrations are not considered to be significant in accordance with the stated criteria.

5.4 Ecological Receptors

5.4.1 Predicted concentrations and deposition rates at the sensitive ecological receptor locations identified in Table 6 are summarised in the following Sections.

Nitrogen Oxides

5.4.2 Predicted annual mean NO_x PECs at the receptor, inclusive of background levels, are summarised in Table 25.

Table 25 Predicted Annual Mean NO_x Concentrations

Receptor		Predicted Annual Mean NO_x PEC (μg/m³)				
		2018	2019	2020	2021	2022
E1	Twenty Acre Piece SSSI	10.32	10.32	10.31	10.32	10.33

5.4.3 As indicated in Table 25, predicted annual mean NO_x concentrations were below the EQS of 30μg/m³ at the ecological receptor for all meteorological data sets.

5.4.4 Maximum predicted annual mean NO_x concentrations at the receptor are summarised in Table 26.

Table 26 Maximum Predicted Annual Mean NO_x Concentrations

Receptor		Maximum Predicted Annual Mean NO_x Concentration (µg/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E1	Twenty Acre Piece SSSI	0.06	10.33	0.2	34.4

5.4.5 As shown in Table 26, PCs were below 1% of the EQS at the SSSI. As such, predicted effects on annual mean NO_x concentrations are not considered to be significant, in accordance with the stated criteria.

5.4.6 Predicted 24-hour mean NO_x PECs at the receptor, inclusive of background levels, are summarised in Table 27.

Table 27 Predicted 24-hour Mean NO_x Concentrations

Receptor		Predicted 24-hour Mean NO_x PEC (µg/m³)				
		2018	2019	2020	2021	2022
E1	Twenty Acre Piece SSSI	21.35	21.34	21.20	21.28	21.22

5.4.7 As indicated in Table 27, predicted 24-hour mean NO_x concentrations were below the EQS of 75µg/m³ at the ecological receptor for all meteorological data sets.

5.4.8 Maximum predicted 24-hour mean NO_x concentrations at the receptor are summarised in Table 28.

Table 28 Maximum Predicted 24-hour Mean NO_x Concentrations

Receptor		Maximum Predicted 24-hour Mean NO_x Concentration (µg/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E1	Twenty Acre Piece SSSI	0.81	21.35	1.1	28.5

5.4.9 As shown in Table 28, PCs were below 10% of the EQS at the SSSI. As such, predicted effects on 24-hour mean NO_x concentrations are not considered to be significant, in accordance with the stated criteria.

Nitrogen Deposition

5.4.10 Predicted annual nitrogen PC deposition rates at the receptor are summarised in Table 29.

Table 29 Predicted Annual Nitrogen Deposition Rates

Receptor		Predicted Annual PC Nitrogen Deposition Rate (kgN/ha/yr)				
		2018	2019	2020	2021	2022
E1	Twenty Acre Piece SSSI	0.0050	0.0053	0.0039	0.0051	0.0058

5.4.11 Maximum predicted annual nitrogen deposition rates at the receptor are summarised in Table 30.

Table 30 Maximum Predicted Annual Nitrogen Deposition Rates

Receptor		Maximum Predicted Annual PC Nitrogen Deposition Rate (kgN/ha/yr)	PC Proportion of EQS (%)	
			Low EQS	High EQS
E1	Twenty Acre Piece SSSI	0.0058	0.04	0.02

5.4.12 As shown in Table 30, PCs were below 1% of the EQS at the SSSI. As such, predicted effects on nitrogen deposition are not considered to be significant, in accordance with the stated criteria.

Acid Deposition

5.4.13 Predicted annual acid PC deposition rates at the receptor are summarised in Table 31.

Table 31 Predicted Annual PC Acid Deposition Rates

Receptor		Predicted Annual PC Acid Deposition Rate (keq/ha/yr)				
		2018	2019	2020	2021	2022
E1	Twenty Acre Piece SSSI	0.0004	0.0004	0.0003	0.0004	0.0004

5.4.14 Maximum predicted annual acid deposition rates at the receptor are summarised in Table 32.

Table 32 Predicted Annual Acid Deposition Rates

Receptor		Maximum Predicted Annual Acid PC Deposition Rate (keq/ha/yr)	PC Proportion of EQS (%)
E1	Twenty Acre Piece SSSI	0.0004	-

6.0 CONCLUSION

6.1.1 Redmore Environmental Ltd was commissioned by Foyle Food Group Ltd to undertake an Air Quality Assessment in support of an Environmental Permit Application for a gas fired boiler at Foyle Food Group Ltd, Melton Road, Melton Mowbray.

6.1.2 Atmospheric emissions from the plant have the potential to cause air quality impacts during normal operation. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and consider potential effects.

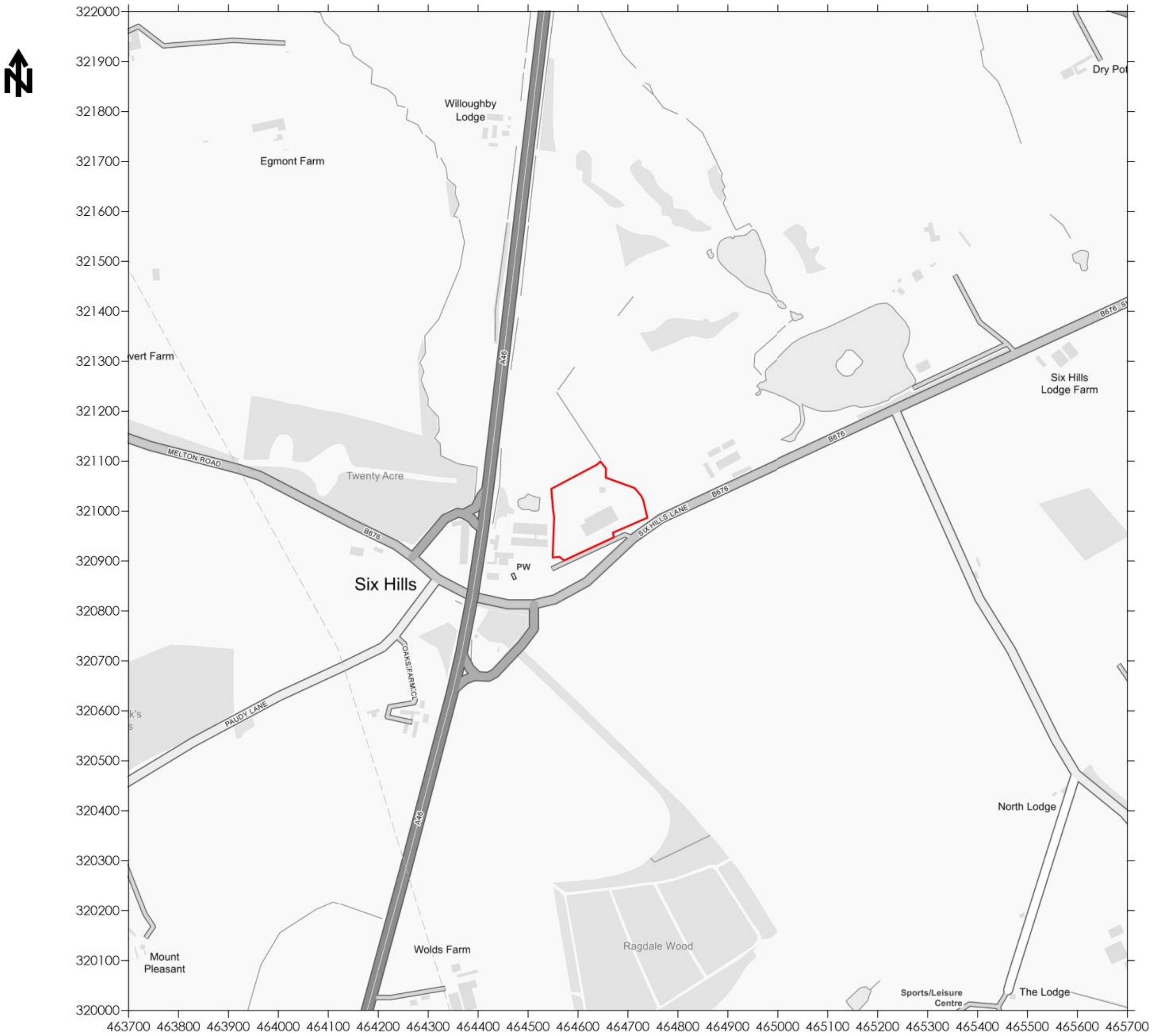
6.1.3 Dispersion modelling was undertaken using ADMS-6 in order to predict NO_2 and NO_x concentrations, as well as nitrogen deposition, at sensitive locations as a result of emissions from the boiler.

6.1.4 The results indicated that impacts on pollutant concentrations were not predicted to be significant at any human or ecological receptor location in the vicinity of the site.

7.0 ABBREVIATIONS

APIS	Air Pollution Information System
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Strategy
CERC	Cambridge Environmental Research Consultants
CO	Carbon monoxide
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EQS	Environmental Quality Standard
LAQM	Local Air Quality Management
MAGIC	Multi-Agency Geographic Information for the Countryside
MBC	Melton Borough Council
MCP	Medium Combustion Plant
NGR	National Grid Reference
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
PC	Process Contribution
PEC	Predicted Environmental Concentration
SSSI	Site of Special Scientific Interest
z_0	Roughness length
%ile	Percentile

Figures



Legend

Site Boundary

Title

Figure 1 - Site Location Plan

Project

Air Quality Assessment
Melton Road, Melton Mowbray

Project Reference

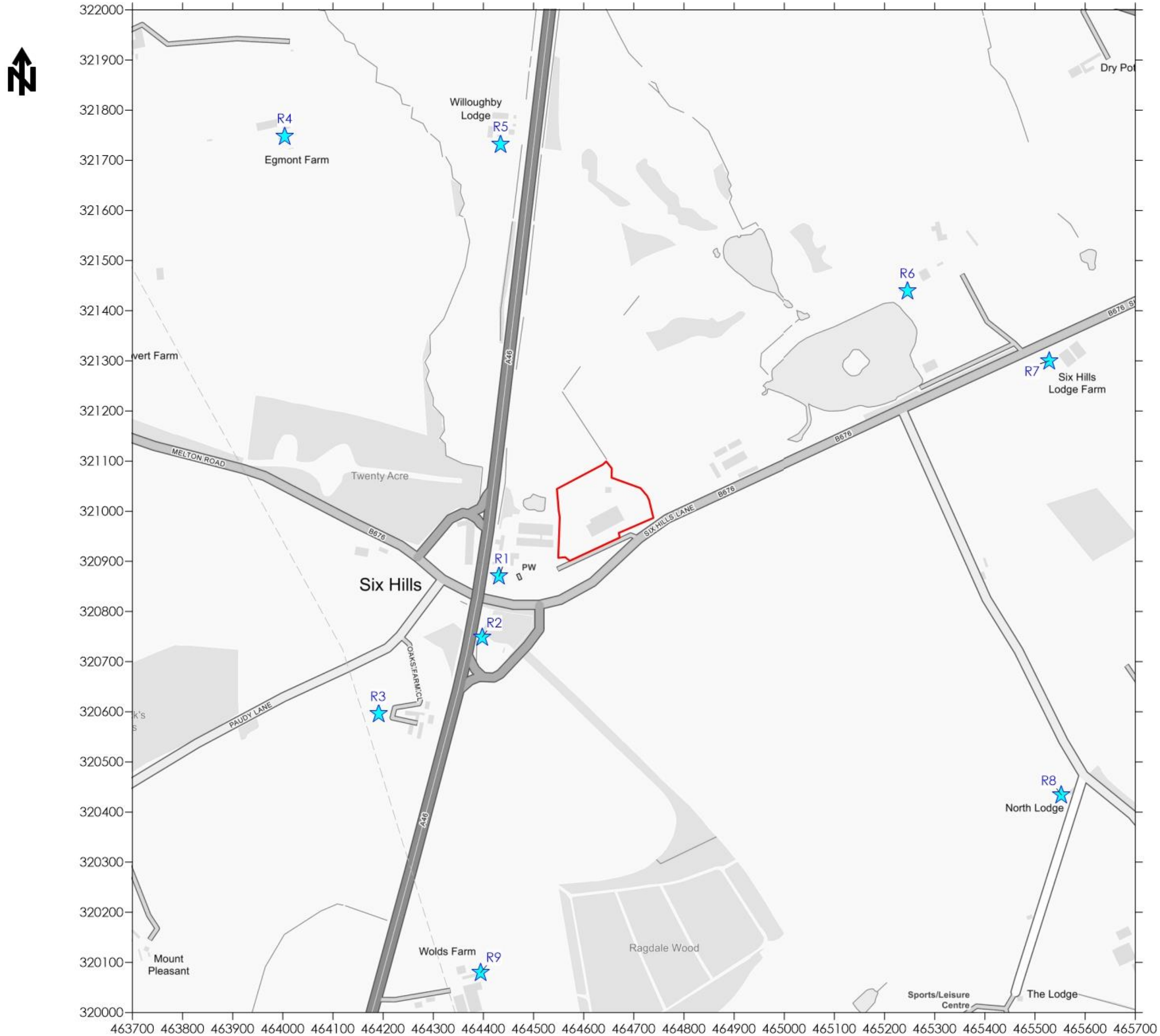
8160-1

Client

Foyle Food Group Ltd

Redmore environmental

www.red-env.co.uk | 0161 7060075



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Site Boundary

Human Receptor

Title

Figure 2 - Human Receptor Locations

Project

Air Quality Assessment
Melton Road, Melton Mowbray

Project Reference

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Site Boundary

Ecological Receptor

Title

Figure 3 - Ecological Receptor Locations

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Site Boundary

Stack

Building

Output Grid

Title
Figure 4 - ADMS-6 Inputs

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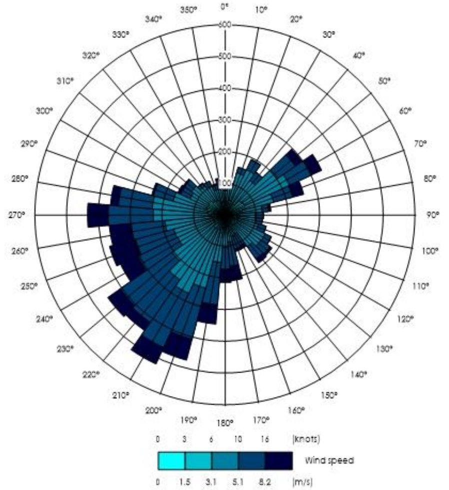
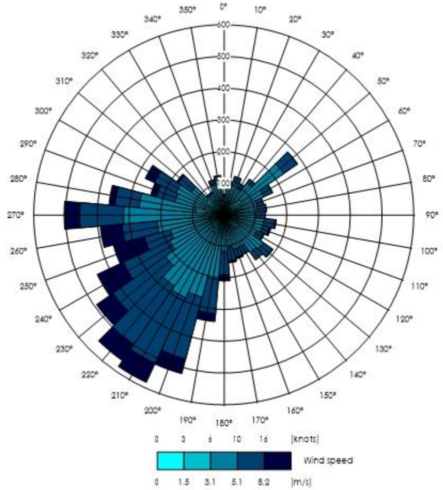
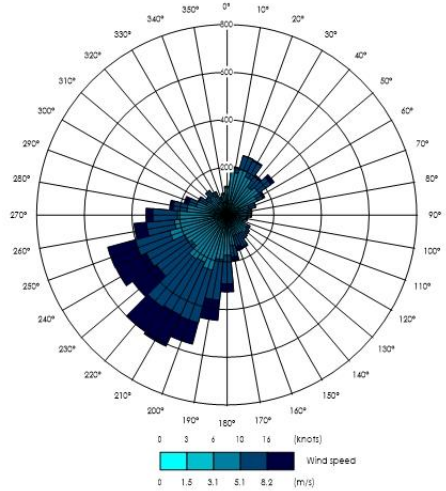


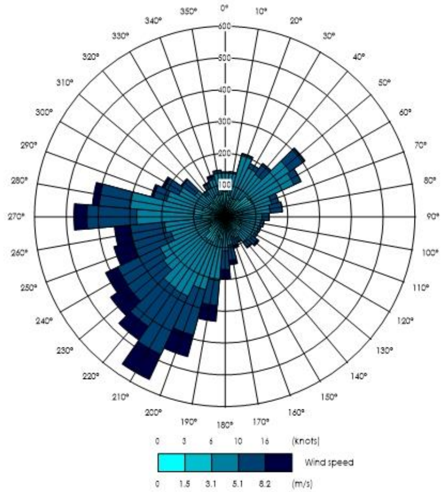
2018 Meteorological Data



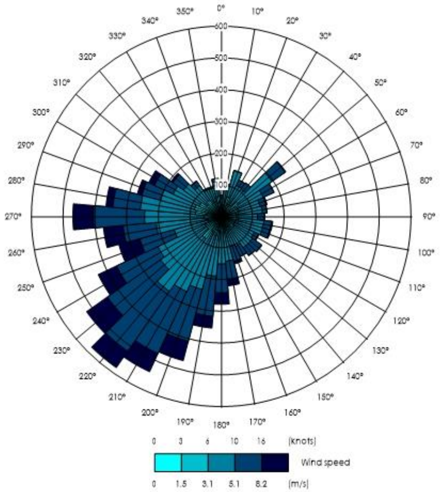
2019 Meteorological Data



2020 Meteorological Data



2021 Meteorological Data



2022 Meteorological Data

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Title

Figure 5 - Wind Roses of 2018 to 2022 East Midlands Airport Meteorological Station Data

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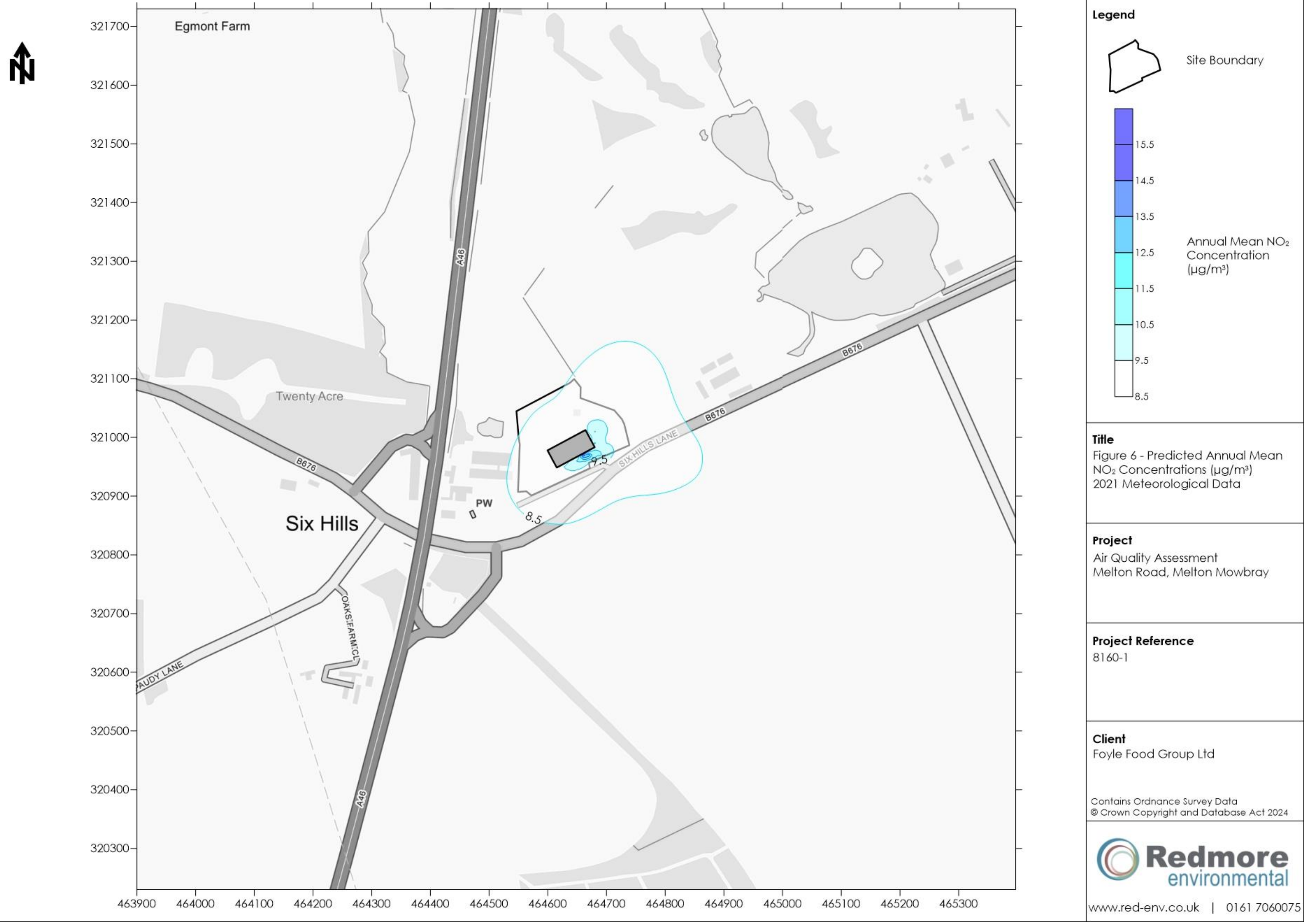

Title

Figure 6 - Predicted Annual Mean NO_2 Concentrations ($\mu g/m^3$)
2021 Meteorological Data

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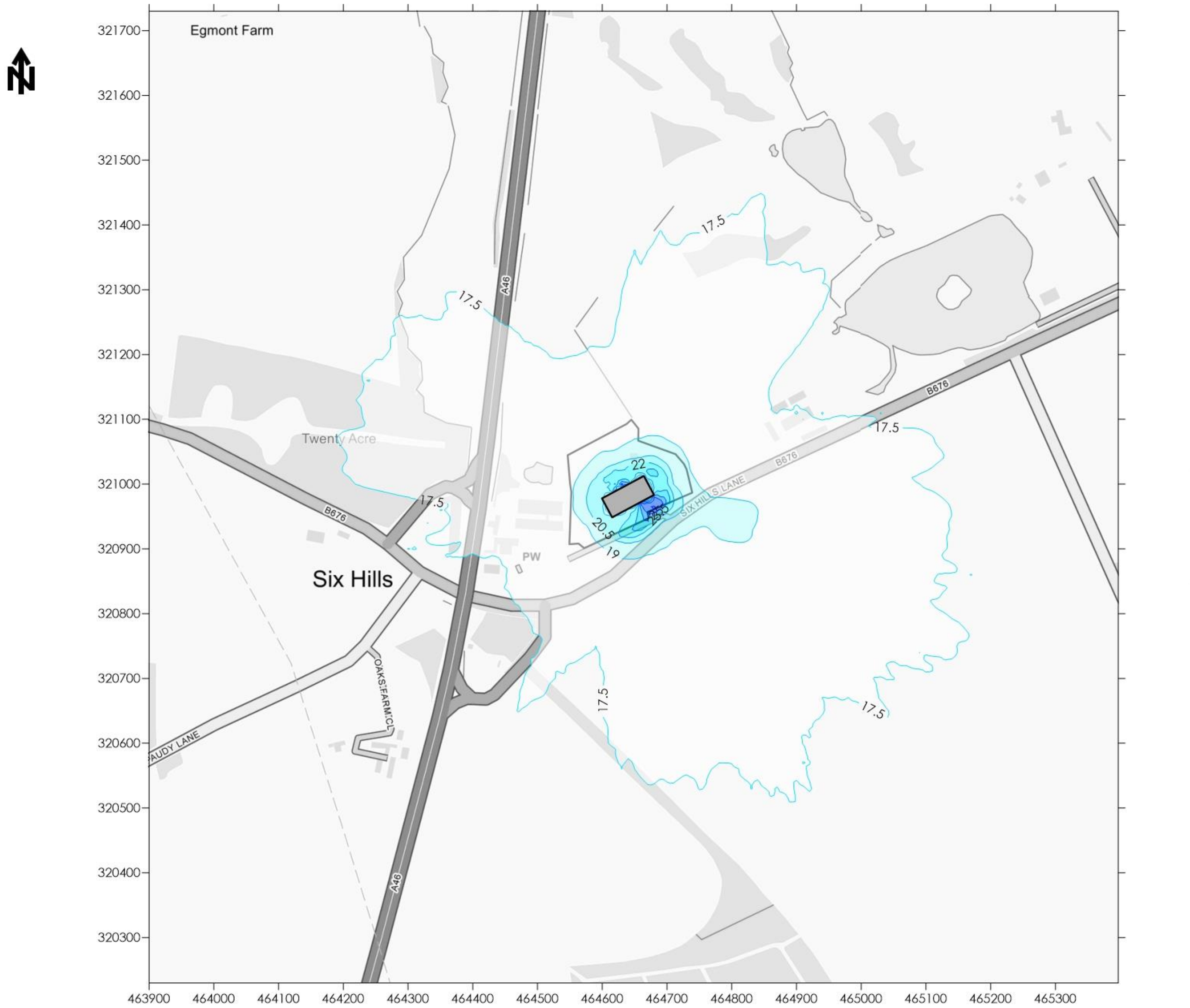

Title

Figure 7 - Predicted 99.8th %ile 1-hour Mean NO_2 Concentrations (µg/m³) 2021 Meteorological Data

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Site Boundary

598.65
598.55
598.45
598.35
598.25
598.15
598.05

100th %ile 8-hour Rolling Mean CO Concentration (µg/m³)

Title

Figure 8 - Predicted 100th %ile 8-hour Rolling Mean CO Concentrations (µg/m³) 2021 Meteorological Data

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