Air Quality Assessment: Coed Aben Road, Wrexham

For: Duynie Ingredients Ltd

Site: Coed Aben Road, Wrexham, LL13 9UH

Date: 14/11/2025

Document Ref: 318659

Issue 01

Quality Assurance

Issue Record

Revision	Description	Date	Author	Reviewer	Approver
1.0	First Issue	14 November 2025	SC	JJ	JJ

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1. Introduction

1.1 Background

Duynie Ingredients Ltd (the Client) operates a modified starch manufacturing facility (hereafter referred to as 'the facility') at its premises on Coed Aben Road, Wrexham.

Natural Resources Wales (NRW) considers that this activity should be regulated as a chemicals manufacturing process under the Environmental Permitting Regulations (EPR) and so the Client has submitted an application for an Environmental Permit for the facility.

An Air Quality Assessment[1] for the facility was prepared in February 2025 which undertook dispersion modelling of emissions from the following plant:

- Two gas boilers;
- CHP unit;
- Scrubber;
- Heat exchanger; and
- Dust extractor.

A subsequent site visit to the facility was undertaken by Arthian Ltd (Arthian). This was to assist with a response to a previous Request for Information (Schedule 5 Notice) issued by NRW relating to the permit application. During the site visit, it was identified that not all of the emissions points at the facility had been included in the previous Air Quality Assessment[1].

As such, an updated Air Quality Assessment is required which includes detailed dispersion modelling of emissions from all relevant identified emission points at the facility. Arthian has been commissioned to undertake the updated Air Quality Assessment.

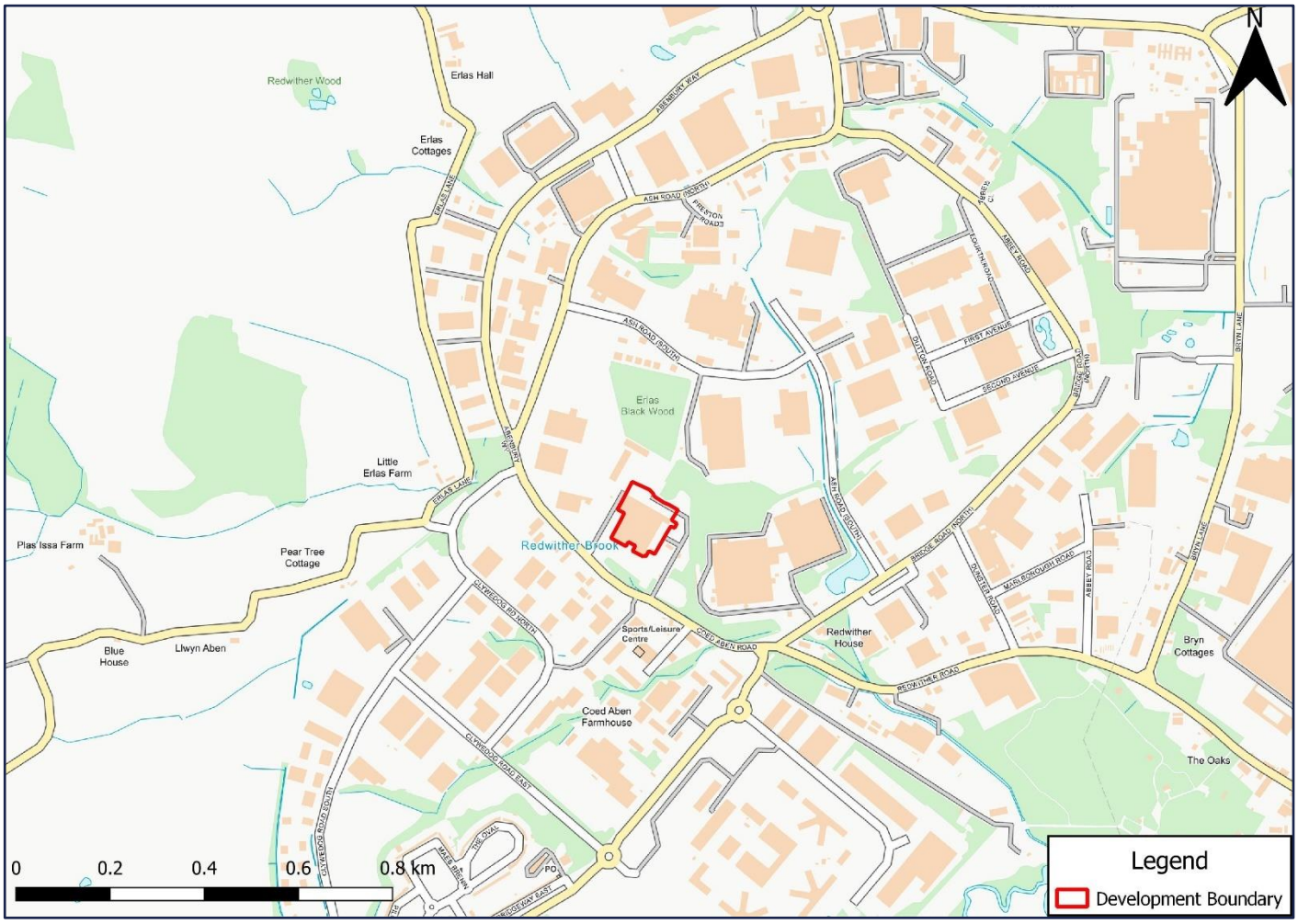
1.2 Site Description

The site is located off Coed Aben Road, Wrexham Industrial Estate, Wrexham, LL13 9UH.

Located within an industrial estate, the facility is bounded by existing commercial and industrial sites on all sides. A location plan of the site and the surrounding area is shown below in Figure 1.1.

[1] Crestwood Environmental Ltd. Coed Aben Road, Wrexham. Air Quality Assessment. Report Reference: CE-WH-1801-RP14-AQA-V2-FINAL

Figure 1.1: Site Location



2. Legislation, Environmental Standards & Guidance

2.1 Industrial Pollution Control Legislation

Atmospheric emissions from industry are controlled in Wales through the Environmental Permitting (England and Wales) Regulations (2016) and subsequent amendments. Activities at the site are included within the Regulations. As such, the facility is required to operate in accordance with an Environmental Permit issued by the Natural Resource Wales (NRW).

2.2 Environmental Standards

2.2.1 Air Quality Limit Values and Objectives

The Air Quality Standards (Wales) Regulations (2010) and subsequent amendments include air quality limit values for the following pollutants:

- Nitrogen dioxide (NO_2);
- Oxides of nitrogen (NO_x)
- Sulphur dioxide (SO_2);
- Lead;
- Particulate matter with an aerodynamic diameter of less than 2.5µm (PM_{10});
- Particulate matter with an aerodynamic diameter of less than 2.5µm ($PM_{2.5}$);
- Benzene (C_6H_6); and,
- Carbon monoxide (CO).

The Air Quality Strategy (AQS) was published by the Department for Environment, Food and Rural Affairs (Defra) in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment (Northern Ireland) and published in July 2007. 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 exceedances over a specified timescale. These are generally in line with the air quality limit values, although the requirements for the determination of compliance vary.

Table 2.1 summarises the relevant air quality objectives[2] which have been considered in this assessment.

The facility emissions may contain a variety of volatile organic compounds (VOCs), the exact blend of which is unknown. There is no specific standard for assessment of VOCs, and so the VOCs will be assumed to consist entirely of C_6H_6 and assessed against the C_6H_6 standard. This is considered a highly conservative approach.

[2] https://uk-air.defra.gov.uk/assets/documents/Air_Quality_Objectives_Update.pdf

Table 2.1: Air Quality Objectives

Pollutant	Objective	Reference	Additional Information
Human Health			
NO_2	40 µg/m^3	Annual Mean	-
	200 µg/m^3	1-Hour Mean	Not to be exceeded more than 18 times a year (99.79th percentile)
C_6H_6	5 µg/m^3	Annual Mean	-
PM_{10}	40 µg/m^3	Annual Mean	-
	50 µg/m^3	24-Hour Mean	Not to be exceeded more than 35 times a year (90.41st percentile)
$PM_{2.5}$	20 µg/m^3	Annual Mean	-
SO_2	125 µg/m^3	24-Hour Mean	Not to be exceeded more than 3 times a year (99.18th percentile)
	350 µg/m^3	1-Hour Mean	Not to be exceeded more than 24 times a year (99.73rd percentile)
	266 µg/m^3	15-Minute Mean	Not to be exceeded more than 35 times a year (99.90th percentile)
CO	10,000 µg/m^3	8-Hour Running Mean	-
Vegetation & Ecosystems			
NO_x	30 µg/m^3	Annual Mean	Objective for the protection of vegetation and ecosystems, referred to as critical level
SO_2	20 µg/m^3	Annual Mean	Objective for the protection of vegetation and ecosystems, referred to as critical level

2.2.2 Environmental Assessment Levels

Environmental Assessment Levels (EALs) are used to help regulators assess the acceptability of an operator's emissions to air and their relative contribution to the environment. They represent a pollutant concentration in ambient air at which no significant risks to public health are expected. Relevant EALs[3] are summarised below.

Table 2.2: EALs

Pollutant	Objective	Reference	Additional Information
NO_x	75 µg/m^3	24-Hour Mean	Objective for the protection of vegetation and ecosystems
C_6H_6	30 µg/m^3	24 Hour Mean	-

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

Pollutant	Objective	Reference	Additional Information
SO_2	10 µg/m^3	Annual Mean	Objective for the protection of vegetation and ecosystems where lichens or bryophytes are present. This is more stringent than the limit value outlined in Section 2.1. As the ecosystems relevant to this assessment include estuaries and lochs, which could host such organisms, this more stringent EAL will be used in preference to the limit value.
CO	30,000 µg/m^3	1-Hour Mean	-
Hydrogen Chloride (HCl)	750 µg/m^3	1-Hour Mean	-

2.3 Guidance

A summary of the publications referred to in the undertaking of this assessment is provided below.

2.3.1 Local Air Quality Management Review and Assessment Technical Guidance

Defra has published Local Air Quality Management (LAQM) technical guidance for use by local authorities in their review and assessment work. This guidance, referred to in this document as LAQM.TG22, has been used where appropriate in the assessment presented herein.

LAQM.TG22 summarises locations at which the air quality objectives should apply for human health exposure, based on associated averaging periods. This has been reproduced in Appendix A. It is also noted that the objectives do not apply in workplace locations, to internal air or where people are unlikely to be regularly exposed (e.g. centre of roadways).

2.3.2 Environment Agency Guidance Air Emissions Risk Assessment for you Environmental Permit

Environment Agency guidance ‘Air emissions risk assessment for your environmental permit’ is currently endorsed by NRW. This provides guidance on determining the impacts of emissions to air and the standards that are required to be met.

3. Baseline Air Quality

3.1 Introduction

The existing air quality in the vicinity of the site was reviewed in order to provide a baseline for the air quality assessment. The findings are summarised below.

3.2 Local Air Quality Management

Where a local authority identifies an area of non-compliance with the limit values set out in Table 2.1, and there is relevant public exposure, there remains a statutory need for the authority to declare the geographic extent of non-compliance as an Air Quality Management Area (AQMA) and to draw up an air quality action plan (AQAP) detailing remedial measures to address the issue.

Wrexham County Borough Council (WCBC) have not declared any AQMAs within its jurisdiction. As such, potential impacts of the facility on AQMAs are considered negligible and have not been considered further in this assessment.

3.3 Sensitive Human Health Receptors

A sensitive receptor is defined as any location which may be affected by changes in air quality. A review of the surrounding area was undertaken to identify potentially sensitive receptors in regard to potential human health impacts. This focused on identifying the high sensitivity receptors nearest to the site in all directions. All of the averaging periods set out in LAQM.TG22 apply at high sensitivity receptors (reproduced in Appendix A).

Discrete receptors were identified to represent the nearest existing sensitive receptors (e.g. commercial land use and residential dwellings) to the site in all cardinal directions. Figure 3.1 and Table 3.1 summarise the discrete sensitive receptors which were modelled. All modelled receptors were modelled at a breathable height of 1.5m (ground floor).

Table 3.1: Modelled Human Health Sensitive Receptors

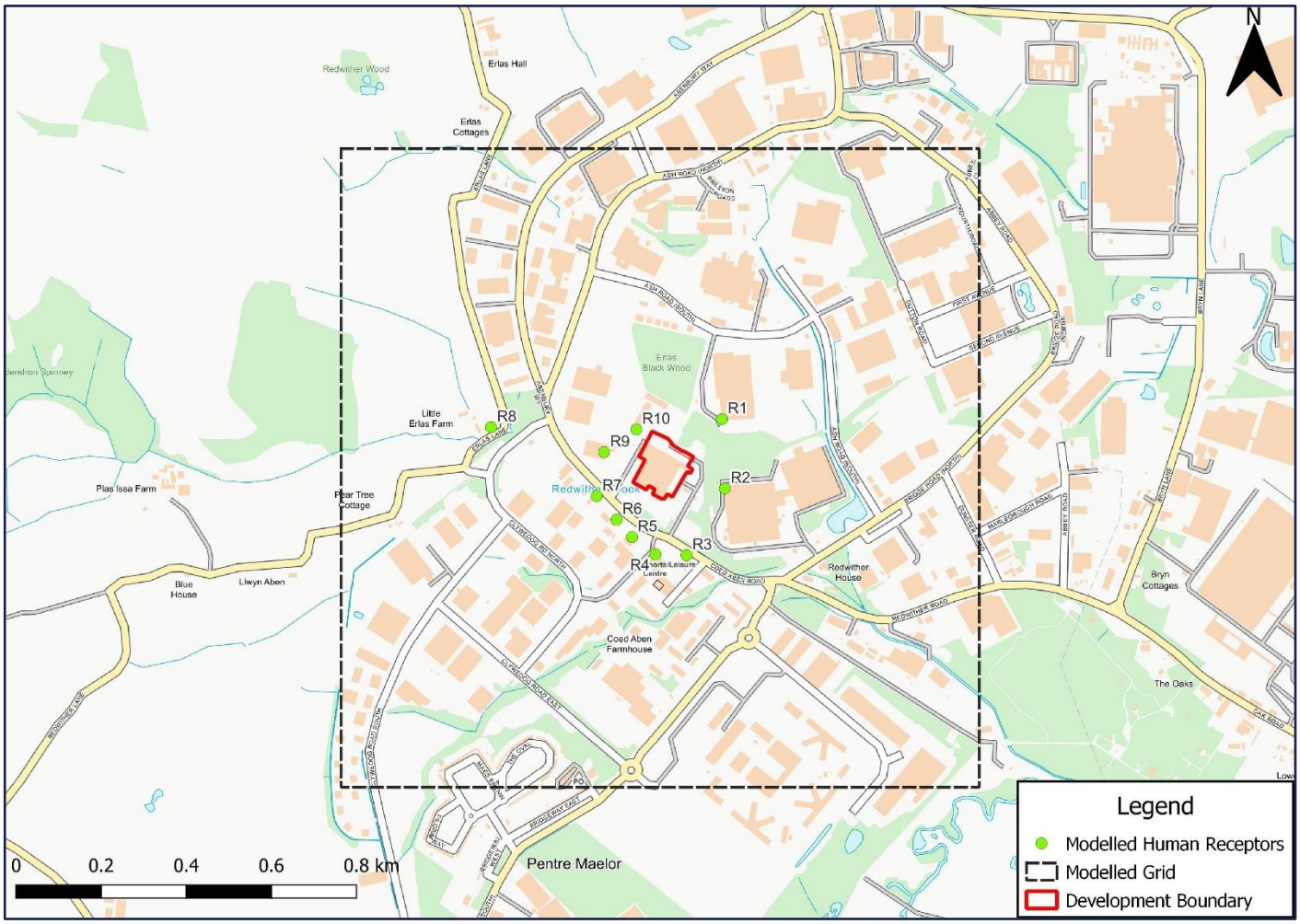
Receptor ID	Location	X Coordinate (m)	Y Coordinate (m)	Z Coordinate (m)
R1	Commercial - Village Bakery	337840	349906	1.5
R2	Commercial - Ardagh Group	337847	349743	1.5
R3	Residential - Coed Aben Road	337757	349586	1.5
R4	Commercial - Minuteman Press Printing	337684	349588	1.5
R5	Commercial - Alan Rhone Ltd	337629	349629	1.5
R6	Commercial - Zaviz International Ltd	337593	349670	1.5
R7	Commercial - Broadway Leisure Caravan Service Centre	337546	349725	1.5

Receptor ID	Location	X Coordinate (m)	Y Coordinate (m)	Z Coordinate (m)
R8	Residential - Erlas Lane	337298	349887	1.5
R9	Commercial - Village Bakery	337563	349828	1.5
R10	Commercial Unit	337639	349881	1.5

There are other sensitive receptors in the vicinity of the site where the annual average environmental standards do not apply. These include the gardens and garages of residential properties as well as the site itself where workers could be exposed to unacceptable air quality conditions. In order to assess these receptors, a grid was included in the dispersion modelling assessment.

The modelled grid domain was from easting 370939 – 307546 and northing 372939 – 309546 with a grid spacing of 10 m. The grid covers an area an area of 2.25 km^2 and was modelled at a breathable height of 1.5m. The extent of the grid is shown in Figure 3.1.

Figure 3.1: Modelled Sensitive Human Receptors



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3.4 Background Air Quality (Human Health Receptors)

Review of WCBC monitoring data indicated that the closest survey position to the site is approximately 3km south-west of the boundary, adjacent to an A-road. Due to the distance between the two locations and difference in surrounding land use, it is not considered likely that recorded concentrations would be representative of those in the vicinity of the site. As such, this source of data has not been considered further in the context of the assessment.

For this assessment, the background air quality has been characterised by drawing on information from the following public sources:

- Defra maps which show estimated background pollutant concentrations across the UK K in 1 km grid squares;
- HCl – monitored result for the nearest monitoring station on the UKEAP Acid Gases & Aerosol Network.

3.4.1 NO_2, PM_{10} and $PM_{2.5}$

Defra background concentration data was obtained for the human health sensitive receptors as identified in Table 3.1. The highest background concentration from these receptors was selected for use within the modelled grid as a conservative approach. The short-term background concentrations are taken as twice the annual mean concentrations as per modelling good practice.

Table 3.2: Annual Mean NO_2, PM_{10} and $PM_{2.5}$ Background Concentration

Year	Annual Mean NO_2 (µg/m^3)	Annual Mean PM_{10} (µg/m^3)	Annual Mean $PM_{2.5}$ (µg/m^3)
2021	9.5	11.7	6.4

The year-on-year data provided by the background maps is based on a modelling assessment with 2021 as the reference year, and this predicted a decreasing trend in concentration. However, this decrease is not always apparent in reality. Therefore, 2021 data have been used within this assessment as a conservative assumption.

3.4.2 C_6H_6, CO and SO_2

For C_6H_6, CO and SO_2, Defra 2001 data were used, as this was the last year such emissions were mapped. The highest background concentration from all receptors was selected for use within the modelled grid as a conservative approach. The annual mean data is provided (and presented below) in Table 3.3. The short-term background concentrations are taken as twice the annual mean concentrations as per modelling good practice.

Table 3.3: Annual Mean C_6H_6, CO and SO_2 Background Concentration

Year	Annual Mean C_6H_6 (µg/m^3)	Annual Mean CO (µg/m^3)	Annual Mean SO_2 (µg/m^3)
2021	0.4	254	3.9

3.4.3 HCl

The UKEAP Acid Gases & Aerosol Network was used to derive appropriate background concentrations of HCl. The closest monitoring location in this network, which monitors HCl, is Plas Y Brenin which is a rural background site located approximately 65km west of the facility. The most recent full year in which HCl was monitored at this location is 2015. Average HCl backgrounds from this location are detailed in Table 3.4 below.

Table 3.4: Plas Y Brenin HCl Background Concentration

Year	Annual Mean HCl (µg/m^3)
2015	0.19

3.5 Sensitive Ecological Receptors

Ecological site receptors within the distance thresholds outlined below were also considered:

- Special Areas of Conservation (SAC), Special Protection Areas or Ramsar sites within 10km of the facility; and,
- Sites of Special Scientific Interest, National Nature Reserves, Local Wildlife Sites (LWS) and Ancient Woodland (AW) within 2km of the facility.

The following sensitive ecological site receptors have been identified based on the above criteria:

- Peter's Dingle LWS;
- Wrexham Industrial Estate LWS;
- Cefn Park LWS;
- Black Wood AW;
- Rhododendron Spinney AW;
- Redwither Wood AW;
- Clays Plantation AW;
- Erlas Black Wood AW;
- Vicarage Moss Ramsar;
- River Dee and Bala Lake SAC;
- Johnstown Newt Sites SAC; and,
- Four unnamed AWs.

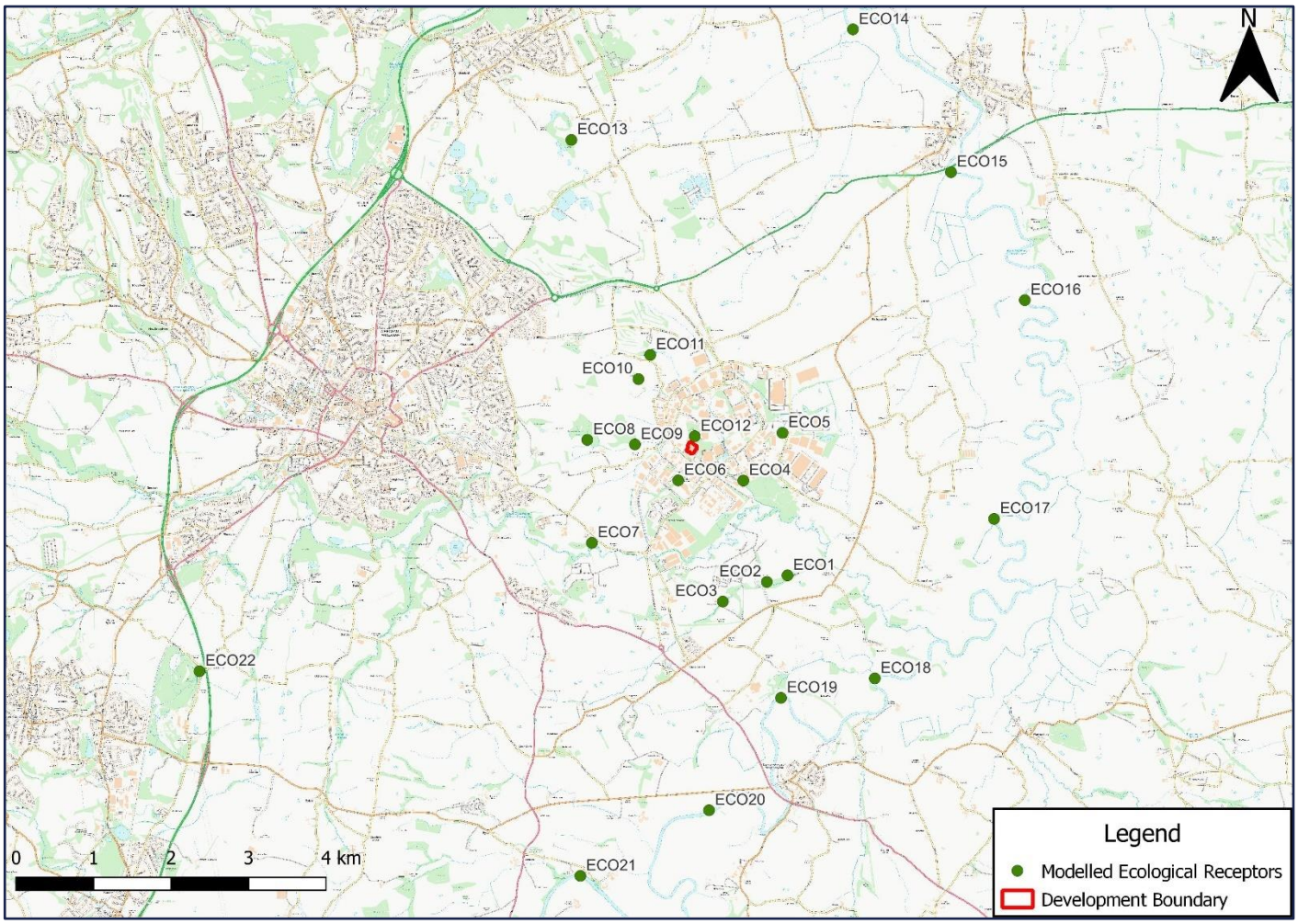
To facilitate the dispersion modelling assessment, discrete receptors were placed at the closest points of each designation to allow initial assessment of potential impact in terms of NO_x, SO_2, nitrogen deposition (eutrophication) and acidification. The modelled receptors are shown in Table 3.5 and Figure 3.2. All ecological receptors were modelled at a height of 0m.

Table 3.5: Modelled Ecological Sensitive Receptors

Receptor ID	Location	X Coordinate (m)	Y Coordinate (m)	Z Coordinate (m)
ECO1	Peter's Dingle LWS	338937	348152	0
ECO2	Unnamed AW	338671	348067	0
ECO3	Unnamed AW	338103	347814	0
ECO4	Wrexham Industrial Estate LWS	338368	349375	0
ECO5	Wrexham Industrial Estate LWS	338873	349989	0
ECO6	Unnamed AW	337528	349377	0
ECO7	Black Wood AW	336414	348570	0
ECO8	Rhododendron Spinney AW and Cefn Park LWS	336354	349900	0
ECO9	Unnamed AW and Cefn Park LWS	336969	349841	0
ECO10	Redwither Wood AW	337015	350683	0

Receptor ID	Location	X Coordinate (m)	Y Coordinate (m)	Z Coordinate (m)
ECO11	Clays Plantation AW	337167	350996	0
ECO12	Erlas Black Wood AW	337741	349946	0
ECO13	Vicarage Moss Ramsar/SSSI	336149	353769	0
ECO14	River Dee and Bala Lake SAC	339782	355196	0
ECO15	River Dee and Bala Lake SAC	341048	353353	0
ECO16	River Dee and Bala Lake SAC	342000	351703	0
ECO17	River Dee and Bala Lake SAC	341603	348880	0
ECO18	River Dee and Bala Lake SAC	340064	346822	0
ECO19	River Dee and Bala Lake SAC	338854	346571	0
ECO20	River Dee and Bala Lake SAC	337926	345122	0
ECO21	River Dee and Bala Lake SAC	336265	344275	0
ECO22	Johnstown Newt Sites SAC	331350	346915	0

Figure 3.2: Modelled Sensitive Ecological Receptors



3.6 Background Air Quality (Ecological)

APIS[4] is a support tool for assessment of potential effects of air pollutants on habitats and species developed in partnership by the UK conservation agencies and regulatory agencies and the Centre for Ecology and Hydrology. Relevant background annual mean NO_x and SO_2 concentrations and nitrogen and acid deposition rates have been sourced from APIS. In addition, habitat specific critical loads have been collated for nitrogen and acid deposition.

3.6.1 NO_x and SO_2

The 3-year average (2020 – 2022) baseline concentrations of annual mean NO_x and SO_2 are presented in Table 3.6.

Table 3.6: Background Annual Mean NO_x and SO_2

Receptor ID	Location	Annual Mean NO_x (µg/m^3)	Annual Mean SO_2 (µg/m^3)
ECO1	Peter's Dingle LWS	7.4	1.3
ECO2	Unnamed AW	7.4	1.3
ECO3	Unnamed AW	6.7	1.1
ECO4	Wrexham Industrial Estate LWS	12.2	3.4
ECO5	Wrexham Industrial Estate LWS	12.2	3.4
ECO6	Unnamed AW	12.6	3
ECO7	Black Wood AW	9.5	1.5
ECO8	Rhododendron Spinney AW and Cefn Park LWS	8.2	1.5
ECO9	Unnamed AW and Cefn Park LWS	8.2	1.5
ECO10	Redwither Wood AW	13.5	2.9
ECO11	Clays Plantation AW	13.5	2.9
ECO12	Erlas Black Wood AW	12.6	3
ECO13	Vicarage Moss Ramsar/SSSI	7.8	1.4
ECO14	River Dee and Bala Lake SAC	7	1.3
ECO15	River Dee and Bala Lake SAC	7.2	1.3
ECO16	River Dee and Bala Lake SAC	6.8	1.2
ECO17	River Dee and Bala Lake SAC	6.1	0.9
ECO18	River Dee and Bala Lake SAC	6	0.9

[4] https://www.apis.ac.uk/

Receptor ID	Location	Annual Mean NO_x (µg/m^3)	Annual Mean SO_2 (µg/m^3)
ECO19	River Dee and Bala Lake SAC	6.7	1
ECO20	River Dee and Bala Lake SAC	6.2	0.9
ECO21	River Dee and Bala Lake SAC	6.1	0.9
ECO22	Johnstown Newt Sites SAC	10.9	1.5

3.6.2 Nitrogen Deposition

The 3-year average (2020 – 2022) nitrogen deposition current loads and habitat specific critical loads are presented in Table 3.7.

Table 3.7: Nitrogen Deposition Rates and Habitat Specific Critical Loads

Receptor ID	APIS Critical Load Class	Nitrogen Deposition (kg N/ha/yr)	
		Critical Load	Current Load
ECO1	Broadleaved deciduous woodland	10-15	37.1
ECO2			37.1
ECO3			36.8
ECO4			37.5
ECO5	Lowland to montane, dry to mesic grassland usually dominated by Nardus stricta	6-10	20.4
ECO6	Broadleaved deciduous woodland	10-15	37.1
ECO7			36.1
ECO8			36.2
ECO9			36.2
ECO10			37.3
ECO11			37.3
ECO12			37.1
ECO13	Valley mires, poor fens and transition mires	5-15	20.6
ECO14	Permanent oligotrophic lakes, ponds and pools (including softwater lakes)	2-10	22.3
ECO15			22.3
ECO16			21.6
ECO17			20.5
ECO18			20
ECO19			20
ECO20			20

Receptor ID	APIS Critical Load Class	Nitrogen Deposition (kg N/ha/yr)	
		Critical Load	Current Load
ECO21			19.8
ECO22	No comparable habitat with established critical load estimate available.		

3.6.3 Acid Deposition

The 3-year average (2020 – 2022) acid deposition current loads and habitat specific critical loads are presented in Table 3.8.

Table 3.8: Acid Deposition Rates and Habitat Specific Critical Loads

Receptor ID	APIS Critical Load Class	Acid Deposition (kg_{eq}/ha/yr)			
		Critical Load			Current Load
		MinCLminN	MinCLmaxN	MinCLmaxS	
ECO13	Bogs	0.321	0.519	0.198	1.6
ECO14	Unmanaged Broadleafed/Coniferous Woodland	0.142	1.075	0.743	1.7
ECO15					1.7
ECO16					1.6
ECO17					1.6
ECO18					1.5
ECO19					1.5
ECO20					1.5
ECO21					1.5
ECO22	No comparable habitat with established critical load estimate available.				

It is noted that the previous Air Quality Assessment[1] included critical levels for AWs and LWS. However, since this assessment was completed APIS have updated their website and relevant acid critical level estimates for these habitats are no longer available. As such, it is not possible to assess acid deposition impacts at these receptors (ECO1-ECO12).

4. Point Source Emissions Methodology

Where possible, this updated assessment has followed the same methodology as the previous assessment[1].

4.1 Model Choice

ADMS 6.0, the model used to undertake this exercise, is a new generation Gaussian plume air dispersion model, which means that the atmospheric boundary layer properties are characterised by two parameters (the boundary layer depth and the Monin-Obukhov length) rather than in terms of the single parameter Pasquill-Gifford class. Dispersion under convective meteorological conditions uses a skewed Gaussian concentration distribution (shown by validation studies to be a better representation than a symmetrical Gaussian expression).

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.

4.2 Modelling Scenarios

Table 4.1 summaries the scenarios considered in the air quality assessment of human and ecological receptors.

For short-term concentrations, the objectives are expressed in terms of the number of periods in a calendar year for which the short-term concentration should not be exceeded. For the purposes of assessing these short-term objectives, there are respective percentiles as shown in Table 4.1.

Table 4.1: Assessment of Human Receptors

Air Quality Standard	Short-Term	Long-Term
Human Receptors		
NO_2	99.79th percentile 1-hour mean	Annual mean
C_6H_6	100th percentile 24-hour mean	Annual mean
PM_{10}	90.41st percentile 24-hour mean	Annual mean
$PM_{2.5}$	-	Annual mean
SO_2	99.90th percentile 15-minute mean	-
	99.73rd percentile 1-hour mean	
	99.18th percentile 24-hour mean	
CO	100th percentile 1-hour mean	-
	100th percentile 8-hour running mean	
HCl	100th percentile 1-hour mean	-
Ecological Receptors		
NO_x	100th percentile 24-hour mean	Annual mean

Air Quality Standard	Short-Term	Long-Term
SO_2	-	Annual mean
Nitrogen Deposition	-	Annual mean
Acid Deposition	-	Annual mean

4.3 Emission Parameters

The modelled emissions parameters for all identified plant are summarised in Table 4.2 and Table 4.3 below. These parameters are based on site specific monitoring undertaken by Element (between the 25th and 26th of September 2025) and from the parameters used in the previous assessment[1]. As a worst-case approach, the model has assumed that all plant will be running on a 100% utilisation basis.

There are no defined air quality standards for Total Particulate Matter (TPM). As such, this has been assessed against the limit values for PM_{10} and $PM_{2.5}$. This approach assumed that all TMP is PM_{10} and that all TMP is $PM_{2.5}$. This is a conservative assumption.

Preliminary model runs were carried out to confirm the highest risk pollutants. This confirmed that NO_x, SO_2, PM_{10}, $PM_{2.5}$ and C_6H_6 were of higher risk than CO and HCl, which were screened out for human health impacts. As such, CO and HCl emissions are not considered further in this assessment.

Table 4.2: Modelled Emission Parameters 1

Parameter	Boiler 1	Boiler 2	CHP	Heat Exchanger	Dust Extractor 1	Dust Extractor 2	Scrubber
Stack Location X(m), Y(m)	337746, 349801	337746, 349801	337733, 349796	337668, 349822	337729, 337717	337717, 349772	337725, 349815
Modelled Stack Height (m)	13.5	13.5	15	7.5	7.5	9.9	5
Stack Internal Diameter (m)	0.7	0.7	0.25	0.7	0.74	0.3	0.15
Exit Temperature (°C)	123	123	90	40	33.3	33	10.6
Efflux Velocity – actual (m/s)	3.8	3.8	17.58	11.5	11.4	23.6	0.47
NO_x Emissions Rate (g/s)	0.0683	0.0683	0.1623	0.0015	17,601	6,004	-
CO Emission Rate (g/s)	0.0017	0.0017	-	0.0017	-	-	-
TPM Emission Rate (g/s)	-	-	-	0.0111	-	-	-
HCl Emission Rate (g/s)	-	-	-	-	0.0639	0.0023	0.000001
VOC (as C_6H_6) Emission Rate (g/s)	-	-	-	0.0161	0.0002	-	0.000017
SO_2 Emission Rate (g/s)	-	-	-	0.0078	-	-	-

Table 4.3: Modelled Emission Parameters 2

Parameter	Starch Dryer 1	Starch Dryer 2	Starch Dryer 3	Starch Dryer 4	Starch Dryer 5	Horizontal Reactor 1	Horizontal Reactor 2	Horizontal Reactor 3
Stack Location X(m), Y(m)	337738, 349802	337734, 349795	337730, 349787	337725, 349778	337725, 349803	337716, 349789	337718, 349792	337721, 349797
Modelled Stack Height (m)	9.3	9.3	9.3	9.3	9.3	9.0	9.0	9.0
Stack Internal Diameter (m)	0.74	0.74	0.74	0.74	0.74	0.2	0.2	0.2
Exit Temperature (°C)	33.3	33.3	33.3	33.3	33.3	42.8	42.8	42.8
Efflux Velocity – actual (m/s)	11.4	11.4	11.4	11.4	11.4	2.3	2.3	2.3
NO_x Emissions Rate (g/s)	-	-	-	-	-	-	-	-
CO Emission Rate (g/s)	-	-	-	-	-	-	-	-
TPM Emission Rate (g/s)	0.0639	0.0639	0.0639	0.0639	0.0639	0.000042	0.000042	0.000042
HCl Emission Rate (g/s)	0.0002	0.0002	0.0002	0.0002	0.0002	0.000001	0.000001	0.000001
VOC (as C_6H_6) Emission Rate (g/s)	-	-	-	-	-	0.0003	0.0003	0.0003
SO_2 Emission Rate (g/s)	-	-	-	-	-	-	-	-

4.4 Modelled Domain

The modelled domain originated at easting 370939 and northing 372939 and extended 1.5 km in each ordinal direction with a grid spacing of 10 m. This was to create an adequately large domain to encompass a variety of different land uses/receptors around the site whilst maintaining sufficiently short grid spacing to maximise model accuracy.

4.5 Modelled Buildings

Turbulence can be induced by nearby buildings and structures, causing pollutants emitted from an elevated source to be displaced and dispersed rapidly towards the ground, resulting in elevated ground level concentrations. The buildings that were deemed to have the biggest potential to impact on emissions were included in the dispersion model.

The parameters for the selected modelling buildings are detailed in Table 4.4 below. To ensure consistency, the same building parameters have been used from the previous assessment[1].

For the purpose of the dispersion modelling assessment, the buildings have been simplified. This results in a set-up as shown in Figure 4.1 and Figure 4.2.

Table 4.4: Modelled Buildings

Building ID	Building Centre		Modelled Height (m)	Length (m)	Width (m)
	X Coordinate (m)	Y Coordinate (m)			
1	337663	349829	6.0	35.3	17.9
2[1]	337689	349781	7.5	94.1	74.6
3	337747	349797	6.0	11.9	13.4

Note: [1] Considered most likely to impact the dispersion of the pollutants based on its proximity to the stacks. Thus, it was entered into the model as the 'main' building.

Figure 4.1: Modelled Buildings

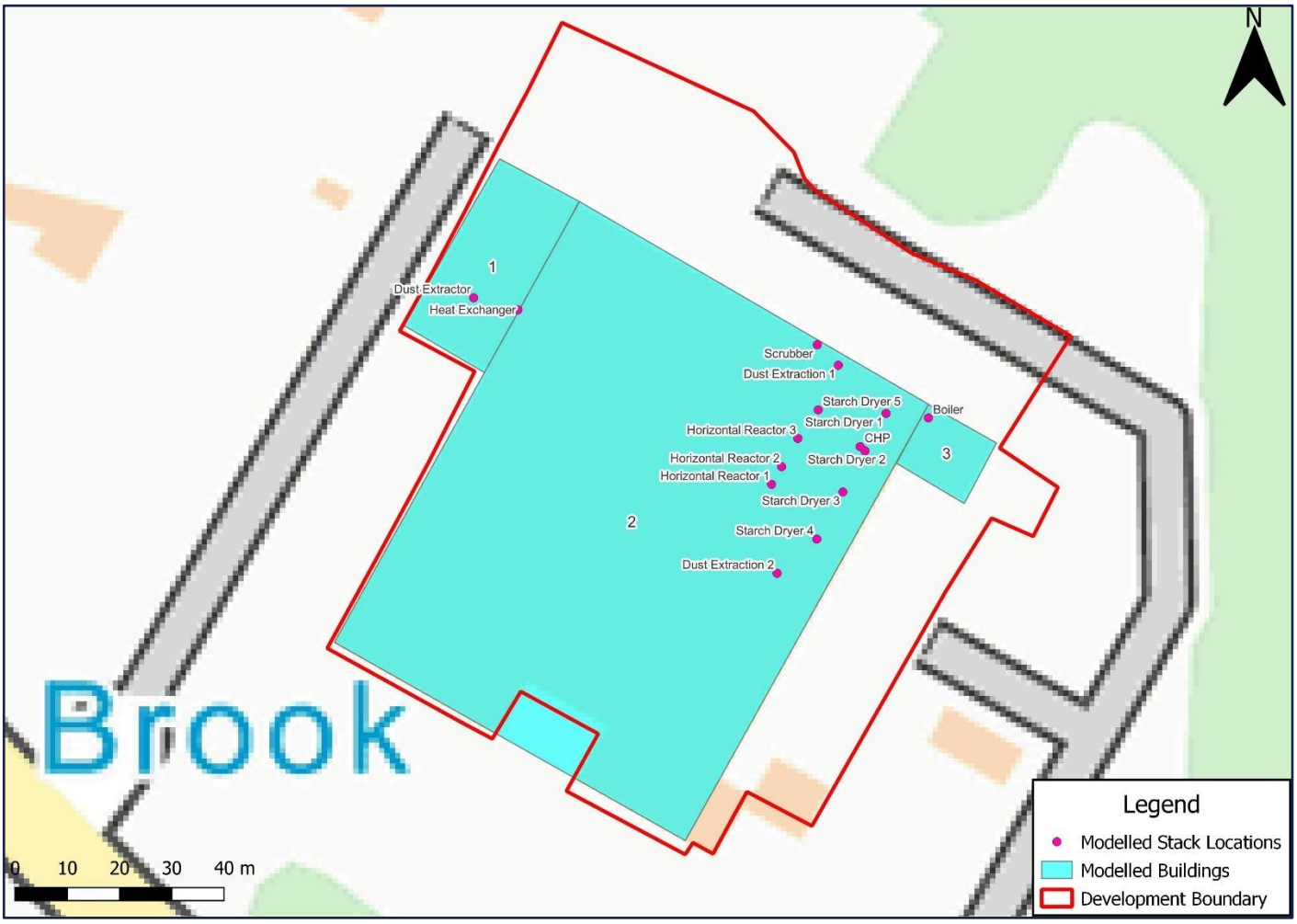
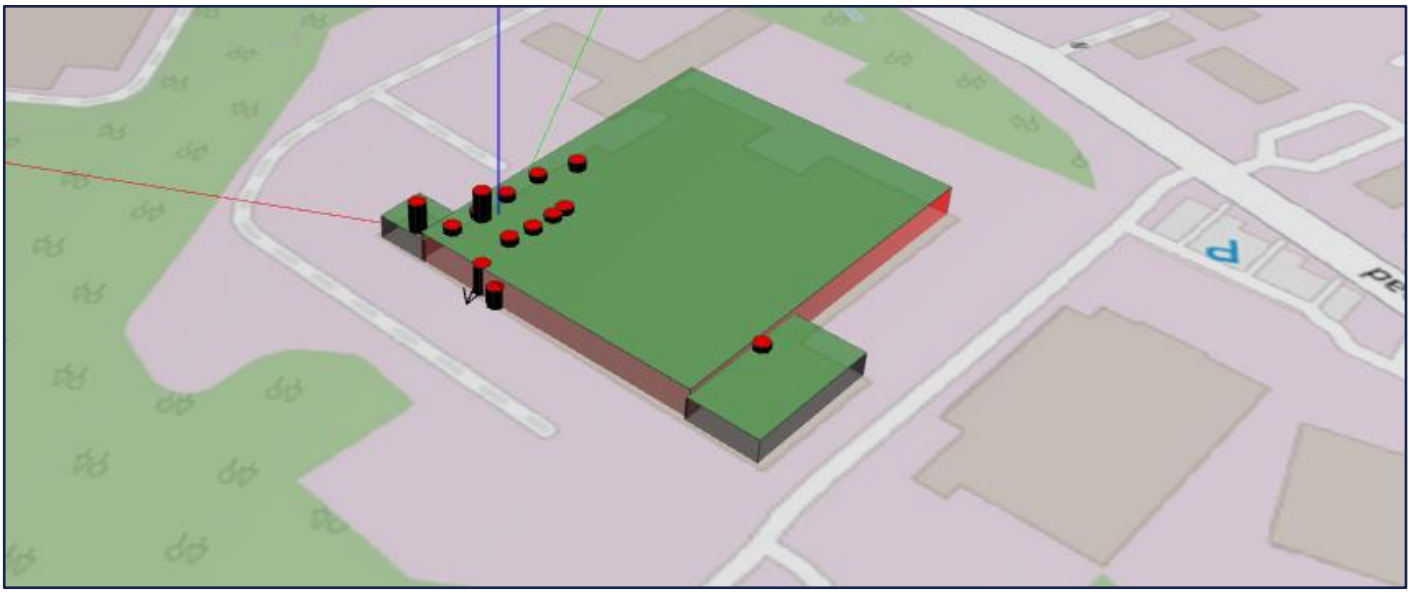


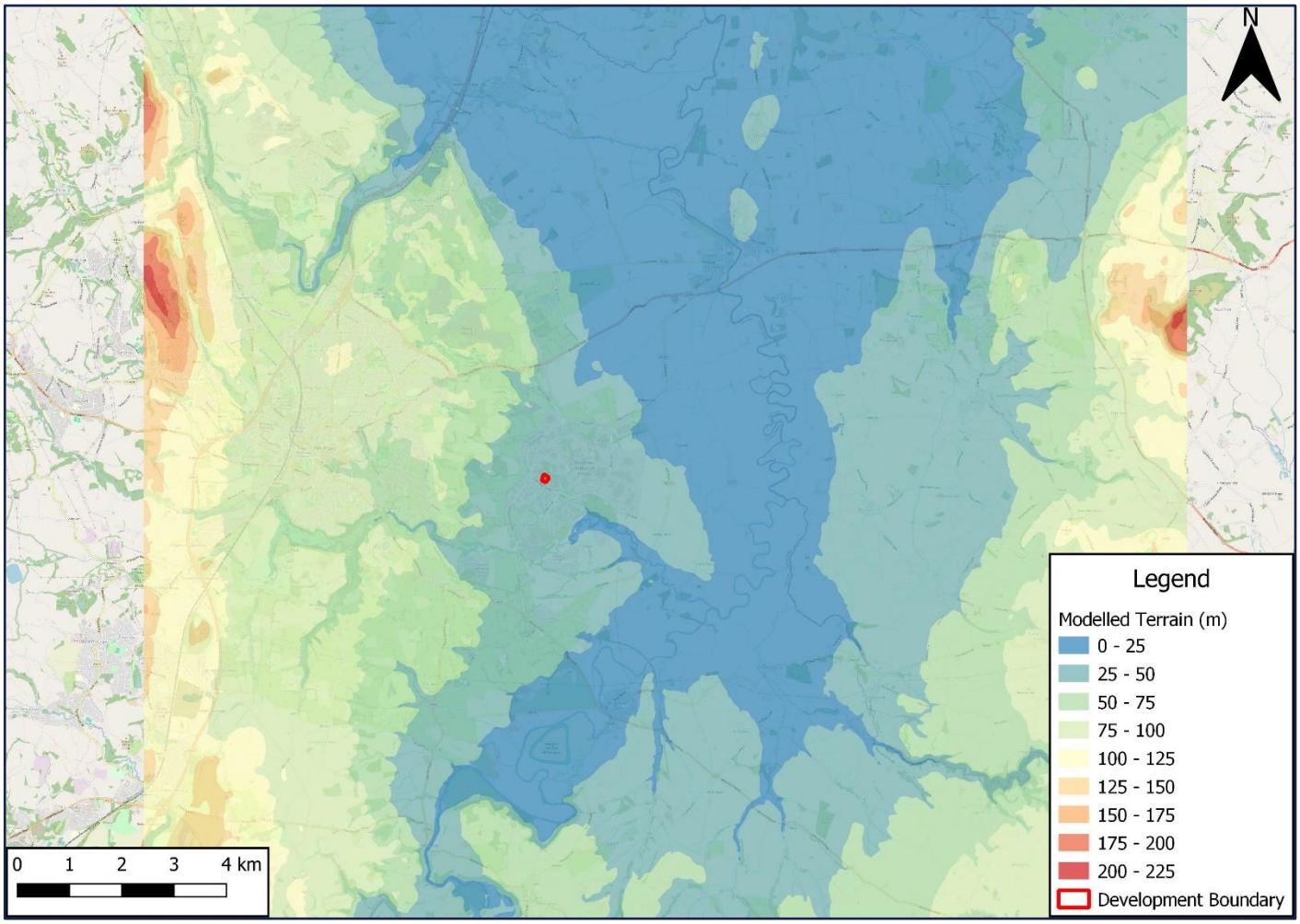
Figure 4.2: 3D Model Layout



4.6 Modelled Terrain

The terrain around the site is variable in all directions and has the potential to impact dispersion and requires inclusion in the model as it may impact dispersion of pollutants. Terrain data was obtained from Ordnance Survey in 'OS Terrain 50, ASCII Grid and GML' format. The terrain grid is necessarily larger than the modelled domain. The terrain grid was modelled at a resolution of 50m. The terrain data is visualised in Figure 4.3.

Figure 4.3: Modelled Terrain



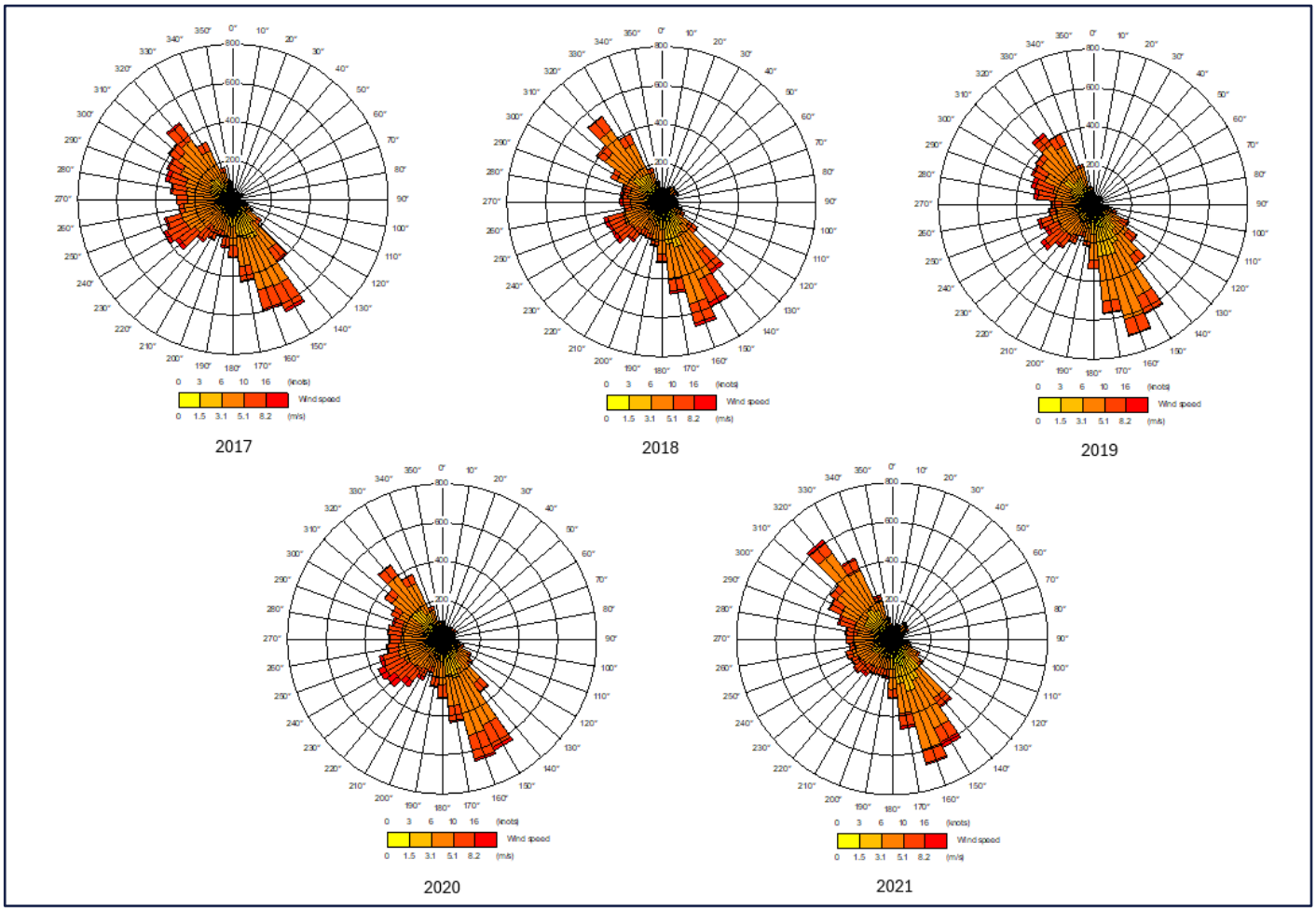
Contains © Open Street Map 2025

4.7 Meteorology

Meteorological data used in the assessment was taken from Hawarden meteorological station over the period 1st January 2017 to 31st December 2021 (inclusive). Hawarden meteorological station is located at NGR: 334586, 364102, which is approximately 15.3km north of the facility. It is anticipated that conditions would be similar over a distance of this magnitude. The data was therefore considered suitable for an assessment of this nature.

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 4.4 for wind roses of the utilised meteorological records.

Figure 4.4: Hawarden Meteorological Station 2017-2021 Wind Rose Data



4.8 Surface Characteristics

A surface roughness length is used to characterise the texture of land as this can impact dispersion of pollutants. A length of 0.5 m (e.g. open suburbia) has been used for the site and meteorological site.

4.9 Minimum Monin-Obukhov Length

4.10.1 The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 30m (mixed urban/industrial) has been used for the site and meteorological site to account for the effects of buoyancy on turbulent flows.

4.10 Special Treatments

No special treatment (such as: dry or wet deposition; short-term releases; coastal modules; fluctuations; or chemistry) were deemed appropriate or used within the dispersion model.

4.11 Modelling Uncertainty

There are a variety of factors which can lead to potential uncertainty in dispersion modelling predictions. Arthian aimed to control these uncertainties by following relevant modelling good practice, and where unknowns exist to use suitably conservative assumptions/estimates. It is noted:

- The atmospheric dispersion model ADMS-6 has been verified by CERC through a number of studies to ensure predictions are suitably robust;
- Emission rates and operational plant parameters were based on site specific stack monitoring undertaken by Element and those used in the previous assessment[1];
- Background pollutant concentrations and loads were obtained from Defra and APIS to provide an estimate of baseline conditions at human health and ecological receptors;
- To help account for inter-year variability in meteorological conditions, five years of meteorological data was used in the assessment, with the maximum (worst case year) concentration at each receptor considered/reported; and,
- Surface roughness and the Monin-Obukhov length for the dispersion site and meteorological site were defined based on the land use guidance provided by CERC.

4.12 Model Output

Predicted pollutant concentrations were summarised in the following formats:

- Process contribution (PC) - Predicted pollutant level due to emissions from the facility only; and,
- Predicted environmental concentration (PEC) - Total predicted pollutant level due to emissions from the facility and existing baseline conditions.

4.13 NO_x to NO_2 Conversion

Combustion emissions of NO_x are mainly in the form of nitric oxide (NO). NO_2 forms where the NO is oxidised due to excess oxygen in the combustion gases or other atmospheric reactions. In accordance with EA guidance, which is endorsed by NRW, the NO_x to NO_2 conversions (at the point of impact) were assumed to be 70% for long-term average concentrations and 35% for short-term average concentrations.

4.14 Calculation of Contribution to Critical Loads

Deposition rates were calculated using empirical methods recommended by the EA technical guidance AQTAG06. Dry deposition flux was calculated using the following equation:

Dry deposition flux (µg/m2/s) = ground level concentration (µg/m3) x deposition velocity (m/s)

Wet deposition occurs via the incorporation of the pollutant into water droplets which are then removed in rain or snow and is not considered significant over short distances (AQTAG06) compared with dry deposition and therefore for the purposes of this assessment, wet deposition has not been considered consistent with AQTAG06. The applied deposition velocities are as shown in Table 4.5.

Table 4.5: Deposition Velocities

Pollutant	Deposition Velocity (m/s)	
NO_2	Grassland	0.0015
	Woodland	0.003
SO_2	Grassland	0.012
	Woodland	0.024

The predicted deposition rates were converted from µg/m^2/s to units of nitrogen deposition and acid equivalent deposition as detailed in Table 4.6.

Table 4.6: Applied Deposition Conversion Factors

Pollutant	Conversion	Factor
NO_2 to Nitrogen Deposition	N kg/ha/year	95.9
	k_{eq}/ha/yr	6.84
SO_2	k_{eq}/ha/yr	9.84

4.14.1 Calculation of PC as a percentage of Acid CLo Function

The calculation of the process contribution of N to the acid CLo function has been carried out according to the guidance on APIS, which is as follows:

"The potential impacts of additional sulphur and/or nitrogen deposition from a source are partly determined by PEC, because only if PEC of nitrogen deposition is greater than CLminN will the additional nitrogen deposition from the source contribute to acidity. Consequently, if PEC is less that CLminN only the acidifying affects of sulphur from the process need to be considered:

Where PEC N Deposition < CLminN

*PC as % CL function = (PC S deposition/CLmaxS)*100*

Where PEC is greater than CLminN (the majority of cases), the combined inputs of sulphur and nitrogen need to be considered. In such cases, the total acidity input should be calculated as a proportion of the CLmaxN.

Where PEC N Deposition > CLminN

*PC as %CL function = ((PC of S+N deposition)/CLmaxN)*100"*

4.15 Background Concentrations

A review of existing data in the vicinity of the site was undertaken in Section 3.0 in order to identify suitable background values for use in the assessment.

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 'Air emissions risk assessment for your environmental permit' , 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 Significance

4.16.1 Human Receptors

In accordance with the EA's AERA guidance, which is currently endorsed by NRW, a PC for any substance can be considered 'insignificant' if the PC meets the following criteria:

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

Initially, the maximum predicted PC across the modelled grid has been assessed against these criteria. If the above criteria are achieved at the point of maximum impact, then it can be concluded that impacts are 'insignificant' at all locations and that no further assessment is required.

If these criteria are exceeded, the predicted environmental concentration (PEC - defined as the PC plus the background concentration) is then calculated and consideration given to predicted impacts at discrete receptor locations.

Further action is not required, and impacts are considered to be acceptable and not to constitute 'significant pollution' if both of the following criteria are met:

- The proposed emissions comply with Best Available Techniques Associated Emission Levels (BAT AEL) or equivalent where there is no BAT AEL; and
- The resulting PECs are predicted to not exceed environmental standards.

4.16.2 Ecological Receptors

In addition to the AERA guidance, the EA's Operational Instruction 66_12 details how the air quality impacts on ecological sites can be assessed. This guidance provides risk-based screening criteria to determine whether impacts will have 'no likely significant effects (alone and in-combination)' for European sites, 'no likely damage' for SSSIs, as follows:

- PC <1% long-term critical level and/or critical load for European sites and SSSIs; and
- PC <10% short-term critical level for NOx and hydrogen fluoride (if applicable) for European sites and SSSIs.

In addition to the above, the EA uses less stringent criteria to assess impacts on Local Wildlife Sites (LWS) and AW as detailed below:

- PC <100% long-term critical level and/or critical load.
- PC <100% short-term critical level and/or critical load.

However, it is normal practice to assess impacts on LWS and AW in the same manner as SSSI and European sites, although, the determination of significance may be different. As a worst-case approach, the stricter criteria for SSSI and European sites has been utilised in this assessment.

Where impacts cannot be classified as resulting in 'no likely significant effect', more detailed assessment may be required depending on the sensitivity of the feature in accordance with EAs Operational Instruction 67_12. This can require the consideration of the potential for in-combination effects, the actual distribution of sensitive features within the site, and local factors (such as the water table).

The guidance provides the following further criteria:

- If the PEC<100% of the appropriate critical level and/or critical load it can be assumed there will be no adverse effect.
- If the background is below the critical level and/or critical load, but a small PC leads to an exceedance – decision based on local considerations.
- If the background is currently above the critical level and/or critical load and the additional PC will cause a small increase – decision based on local considerations.
- If the background is below the critical level and/or critical load, but a significant PC leads to an exceedance – cannot conclude no adverse effect.
- If the background is currently above the critical level and/or critical load and the additional PC is large - cannot conclude no adverse effect.

5. Point Source Emissions Assessment

5.1 Introduction

Table 5.1 summarises the various impact assessments which were undertaken.

Table 5.1: Impact Assessment Summary

Assessment Type	Section	Relevant Table	Comment
Prediction of maximum concentrations (µg/m^3) across the modelled grid	5.2	Table 5.2 to 5.11	Assessment of pollutant impact relative to the environmental standards outlined in Section 2.0.
Prediction of maximum concentrations (µg/m^3) at sensitive human health receptors	5.3	Table 5.12 to 5.21	
Prediction of maximum concentrations (µg/m^3) at sensitive ecological receptors	5.4	Table 5.22 to 5.24	
Prediction of maximum depositions at sensitive ecological receptors		Table 5.25 to 5.26	Assessment of pollutant impact in terms of the habitat specific critical loads outlined in Section 3.6.

In each instance a screening exercise using only the PC value relative to the applicable environmental standard was undertaken i.e. not considering background concentrations. Where screening occurs, the associated impact is considered negligible. The screening criteria are as follows:

- For long term (i.e. annual mean) assessment, screening occurred where the PC value was <1% of the relevant environmental standard, and
- For short term (i.e. 1-hour mean) assessment, screening occurred where the PC value was <10% of the relevant environmental standard.

5.2 Gridded Receptors

As summarised in Section 4.7, five years of weather data have been run to help account for the variation in weather conditions which will be experienced at the facility. The results presented below represent the maximum predicted concentrations from these five modelled years.

5.2.1 Annual Mean NO_2

As shown in Table 5.2, the annual mean NO_2 PCs are above 1% of the limit value at worst case locations across the modelled grid. This is highlighted in Figure B.1 which shows that exceedances of the 1% limit value are predicted across an area predominately to the north and east of the site boundary. Concentrations are predicted to drop below 1% of the limit value approximately 625 m from the site boundary.

The corresponding NO_2 PECs are below the 40 µg/m^3 limit value across the modelled grid, as shown in Figure B.2. A maximum PEC of 15.8 µg/m^3 is predicted across the grid which is 61% below the limit value. As such, the

predicted effects of annual mean NO_2 concentrations across the modelled grid are considered to be insignificant.

5.2.2 1-Hour Mean NO_2

As shown in Table 5.3, the 1-hour mean NO_2 PCs are above 10% of the limit value at worst case locations across the modelled grid. This is highlighted in Figure B.3 which shows that exceedances of the 10% limit value are predicted across a small area within and just outside the facility boundary. Concentrations are predicted to drop below 10% of the limit value approximately 30 m from the site boundary.

The corresponding NO_2 PECs are below the 200 µg/m^3 limit value across the modelled grid, as shown in Figure B.4. A maximum PEC of 46.7 µg/m^3 is predicted across the grid which is 77% below the limit value. As such, the predicted effects of 1-hour mean NO_2 concentrations across the modelled grid are considered to be insignificant.

5.2.3 Annual Mean PM_{10}

As shown in Table 5.4, the annual mean PM_{10} PCs are above 1% of the limit value at worst case locations across the modelled grid. This is highlighted in Figure B.5 which shows that exceedances of the 1% limit value are predicted across an area predominately to the north and east of the site boundary. Concentrations are predicted to drop below 1% of the limit value approximately 950 m from the site boundary.

The corresponding PM_{10} PECs are below the 40 µg/m^3 limit value across the modelled grid, as shown in Figure B.6. A maximum PEC of 39.8 µg/m^3 is predicted across the grid which is just below the limit value. However, this is located within the site boundary where the annual mean objective doesn't apply. Concentrations beyond the site boundary are largely below 20 µg/m^3 which is 50% below the limit value. As such, the predicted effects of annual mean PM_{10} concentrations across the modelled grid are considered to be insignificant.

5.2.4 24-Hour Mean PM_{10}

As shown in Table 5.5, the 24-hour mean PM_{10} PCs are above 10% of the limit value at worst case locations across the modelled grid. This is highlighted in Figure B.7 which shows that exceedances of the 10% limit value are predicted across an area largely to the north and east of the site boundary. Concentrations are predicted to drop below 10% of the limit value approximately 235 m from the site boundary.

The corresponding PM_{10} PECs are above the 50 µg/m^3 limit value across the modelled grid. However, as shown in Figure B.8 these exceedances are largely contained to the site boundary. There is a small area of exceedance just beyond the site boundary, however, this land is controlled by the site operator. Concentrations beyond the site boundary, at the closest neighbouring receptors, are all below 50 µg/m^3. As such, the predicted effects of 24-hour mean PM_{10} concentrations across the modelled grid are considered to be insignificant.

5.2.5 Annual Mean $PM_{2.5}$

As shown in Table 5.6, the annual mean $PM_{2.5}$ PCs are above 1% of the limit value at worst case locations across the modelled grid. This is highlighted in Figure B.9 which shows that exceedances of the 1% limit value are predicted across a large area to the north, east and south-east of the site boundary. Concentrations are predicted to drop below 1% of the limit value more than 1km from the site boundary.

The corresponding $PM_{2.5}$ PECs exceed the 20 µg/m^3 limit value at the worst-case grid locations, as shown in Figure B.6. A maximum PEC of 34.5 µg/m^3 is predicted across the grid which is 72% above the limit value. However, this is located within the site boundary where the annual mean objective doesn't apply. Concentrations beyond the site boundary are largely below 15 µg/m^3 which is 25% below the limit value of the limit value. As such, the predicted effects of annual mean $PM_{2.5}$ concentrations across the modelled grid are considered to be insignificant.

5.2.6 24-Hour Mean SO_2

As shown in

Table 5.7, the 24-hour mean SO_2 PCs are below 10% of the limit value at worst case locations across the modelled grid. Furthermore, the corresponding SO_2 PECs are below the 125 µg/m^3 limit value across the modelled grid. As such, the predicted effects of 24-hour mean SO_2 concentrations across the modelled grid are considered to be insignificant.

5.2.7 1-Hour Mean SO_2

As shown in Table 5.8, the 1-hour mean SO_2 PCs are below 10% of the limit value at worst case locations across the modelled grid. Furthermore, the corresponding SO_2 PECs are below the 350 µg/m^3 limit value across the modelled grid. As such, the predicted effects of 1-hour mean SO_2 concentrations across the modelled grid are considered to be insignificant.

5.2.8 15-Minute Mean SO_2

As shown in Table 5.9, the 15-minute mean SO_2 PCs are below 10% of the limit value at worst case locations across the modelled grid. Furthermore, the corresponding SO_2 PECs are below the 266 µg/m^3 limit value across the modelled grid. As such, the predicted effects of 15-minute mean SO_2 concentrations across the modelled grid are considered to be insignificant.

5.2.9 Annual Mean VOC as C_6H_6

As shown in Table 5.10, the annual mean VOC PCs are above 1% of the limit value at worst case locations across the modelled grid. However, the corresponding VOC PECs are below the 5 µg/m^3 limit value across the modelled grid. A maximum PEC of 1.8 µg/m^3 is predicted across the grid which is 64% below the limit value.

Furthermore (as stated in Section 2.1), there is no specific standard for assessment of VOCs, and so the VOCs has been assumed to consist entirely of C_6H_6 and assessed against the C_6H_6 standard. This is understood to represent a highly conservative approach. A 2002 academic study on the speciation of UK emissions of non-methane volatile organic compounds[5] indicated that the proportion of C_6H_6 emission from the combustion of natural gas in an internal combustion engine is 0.5% of the total non-methanogenic VOC (NMVOC) fraction

[5] Passant, N.R. (2002) Speciation of UK emissions of non-methane volatile organic compounds. AEA Technology. AEAT/ENV/R/0545 Issue 1

within the group. If the 0.5% factor is applied to the maximum gridded results, it reduces the maximum gridded annual mean PC to 0.01 µg/m^3 which is 0.2% of the environmental standard. Considering the above, the predicted effects of annual mean VOC concentrations across the modelled grid are considered to be insignificant.

5.2.10 24-Hour Mean VOC as C_6H_6

As shown in Table 5.11, the 24-hour mean VOC PCs are above 10% of the limit value at worst case locations across the modelled grid. However, the corresponding VOC PECs are below the 30 µg/m^3 limit value across the modelled grid. A maximum PEC of 8.6 µg/m^3 is predicted across the grid which is 71% below the limit value.

Furthermore, if the 0.5% factor is applied to the maximum gridded results, it reduces the maximum gridded 24-hour mean PC to 0.04 µg/m^3 which is 0.1% of the environmental standard. Considering the above, the predicted effects of 24-hour mean VOC concentrations across the modelled grid are considered to be insignificant.

Table 5.2: Maximum Predicted Concentration of Annual Mean NO_2 Across Modelled Grid (Long Term)

Year	Reference Period	Limit Value (µg/m³)	PC (µg/m³)	PC: % of Limit	BC (µg/m³)	PEC (µg/m³)	PEC: % of Limit	Location (x, y, z)		
2017	Annual Mean	40	**5.7**	**14%**	9.5	15.2	38%	337735	349811	1.5
2018			**6.2**	**15%**		15.7	39%	337735	349811	1.5
2019			**6.1**	**15%**		15.6	39%	337735	349811	1.5
2020			**5.9**	**15%**		15.4	38%	337735	349811	1.5
2021			**6.3**	**16%**		15.8	39%	337735	349811	1.5

Table 5.3: Maximum Predicted Concentration of 1-Hour Mean NO_2 (99.79th percentile) Across Modelled Grid (Short Term)

Year	Reference Period	Limit Value (µg/m³)	PC (µg/m³)	PC: % of Limit	BC (µg/m³)	PEC (µg/m³)	PEC: % of Limit	Location (x, y, z)		
2017	1-Hour Mean	200	**26.0**	**13%**	19.0	45.0	23%	337695	349851	1.5
2018			**27.7**	**14%**		46.7	23%	337695	349851	1.5
2019			**25.6**	**13%**		44.6	22%	337695	349851	1.5
2020			**26.7**	**13%**		45.7	23%	337695	349851	1.5
2021			**27.7**	**14%**		46.7	23%	337695	349851	1.5

Table 5.4: Maximum Predicted Concentration of Annual Mean PM_{10} Across Modelled Grid (Long Term)

Year	Reference Period	Limit Value (µg/m³)	PC (µg/m³)	PC: % of Limit	BC (µg/m³)	PEC (µg/m³)	PEC: % of Limit	Location (x, y, z)		
2017	Annual Mean	40	**27.5**	**69%**	11.7	39.2	98%	337735	349781	1.5
2018			**28.1**	**70%**		39.8	99%	337735	349781	1.5
2019			**27.4**	**68%**		39.1	98%	337735	349781	1.5
2020			**27.1**	**68%**		38.8	97%	337735	349781	1.5
2021			**27.7**	**69%**		39.4	98%	337735	349781	1.5

Table 5.5: Maximum Predicted Concentration of 24-Hour Mean PM_{10} (90.41st percentile) Across Modelled Grid (Short Term)

Year	Reference Period	Limit Value (µg/m³)	PC (µg/m³)	PC: % of Limit	BC (µg/m³)	PEC (µg/m³)	PEC: % of Limit	Location (x, y, z)		
2017	24-Hour Mean	50	**41.2**	**82%**	23.4	**64.6**	**129%**	337735	349781	1.5
2018			**41.7**	**83%**		**65.1**	**130%**	337705	349851	1.5
2019			**40.6**	**81%**		**64.0**	**128%**	337735	349781	1.5
2020			**42.0**	**84%**		**65.4**	**131%**	337735	349781	1.5
2021			**42.4**	**85%**		**65.8**	**132%**	337735	349781	1.5

Table 5.6: Maximum Predicted Concentration of Annual Mean $PM_{2.5}$ Across Modelled Grid (Long Term)

Year	Reference Period	Limit Value (µg/m³)	PC (µg/m³)	PC: % of Limit	BC (µg/m³)	PEC (µg/m³)	PEC: % of Limit	Location (x, y, z)		
2017	Annual Mean	20	**27.5**	**137%**	6.4	**33.9**	**169%**	337735	349781	1.5
2018			**28.1**	**140%**		**34.5**	**172%**	337735	349781	1.5
2019			**27.4**	**137%**		**33.8**	**169%**	337735	349781	1.5
2020			**27.1**	**136%**		**33.5**	**168%**	337735	349781	1.5
2021			**27.7**	**138%**		**34.1**	**170%**	337735	349781	1.5

Table 5.7: Maximum Predicted Concentration of 24-Hour Mean SO_2 (99.18th percentile) Across Modelled Grid (Short Term)

Year	Reference Period	Limit Value (µg/m³)	PC (µg/m³)	PC: % of Limit	BC (µg/m³)	PEC (µg/m³)	PEC: % of Limit	Location (x, y, z)		
2017	24-Hour Mean	125	2.9	2%	7.8	SCREENED		337645	349861	1.5
2018			3.1	3%		SCREENED		337645	349861	1.5
2019			3.1	2%		SCREENED		337645	349861	1.5
2020			3.1	2%		SCREENED		337645	349861	1.5
2021			3.3	3%		SCREENED		337645	349861	1.5

Table 5.8: Maximum Predicted Concentration of 1-Hour Mean SO_2 (99.73rd percentile) Across Modelled Grid (Short Term)

Year	Reference Period	Limit Value (µg/m³)	PC (µg/m³)	PC: % of Limit	BC (µg/m³)	PEC (µg/m³)	PEC: % of Limit	Location (x, y, z)		
2017	1-Hour Mean	350	4.3	1%	7.8	SCREENED		337655	349871	1.5
2018			4.4	1%		SCREENED		337655	349871	1.5
2019			4.4	1%		SCREENED		337655	349871	1.5
2020			4.4	1%		SCREENED		337655	349871	1.5
2021			4.4	1%		SCREENED		337655	349871	1.5

Table 5.9: Maximum Predicted Concentration of 15-Minute Mean SO_2 (99.90th percentile) Across Modelled Grid (Short Term)

Year	Reference Period	Limit Value (µg/m³)	PC (µg/m³)	PC: % of Limit	BC (µg/m³)	PEC (µg/m³)	PEC: % of Limit	Location (x, y, z)		
2017	15-Minute Mean	266	4.5	2%	7.8	SCREENED		337655	349871	1.5
2018			4.5	2%		SCREENED		337655	349871	1.5
2019			4.5	2%		SCREENED		337655	349871	1.5
2020			4.6	2%		SCREENED		337625	349811	1.5
2021			4.5	2%		SCREENED		337625	349831	1.5

Table 5.10: Maximum Predicted Concentration of Annual Mean VOC (as C_6H_6) Across Modelled Grid (Long Term)

Year	Reference Period	Limit Value (µg/m³)	PC (µg/m³)	PC: % of Limit	BC (µg/m³)	PEC (µg/m³)	PEC: % of Limit	Location (x, y, z)		
2017	Annual Mean	5	**1.3**	**26%**	0.4	1.7	34%	337655	349851	1.5
2018			**1.4**	**29%**		1.8	37%	337655	349851	1.5
2019			**1.4**	**29%**		1.8	37%	337655	349841	1.5
2020			**1.4**	**27%**		1.8	35%	337655	349851	1.5
2021			**1.4**	**27%**		1.8	35%	337655	349851	1.5

Table 5.11: Maximum Predicted Concentration of 100th Percentile 24-Hour Mean VOC (as C_6H_6) Across Modelled Grid (Short Term)

Year	Reference Period	Limit Value (µg/m³)	PC (µg/m³)	PC: % of Limit	BC (µg/m³)	PEC (µg/m³)	PEC: % of Limit	Location (x, y, z)		
2017	24-Hour Mean	30	**7.8**	**26%**	0.4	8.6	29%	337645	349861	1.5
2018			**7.8**	**26%**		8.6	29%	337645	349861	1.5
2019			**7.1**	**24%**		7.9	26%	337635	349841	1.5
2020			**7.5**	**25%**		8.3	28%	337645	349861	1.5
2021			**7.5**	**25%**		8.3	28%	337645	349861	1.5

5.3 Discrete Human Receptors

5.3.1 Annual Mean NO_2

The maximum predicted annual mean NO_2 concentrations at the human receptor locations are summarised in Table 5.12.

Table 5.12: Maximum Predicted Concentrations of Annual Mean NO_2 at Receptors (Long Term)

Receptor ID	Annual Mean			
	PC (µg/m³)	PC: % of Limit	PEC (µg/m³)	PEC: % of Limit
R1	**1.4**	**4%**	10.9	27%
R2	**2.0**	**5%**	11.5	29%
R3	**0.5**	**1%**	10.0	25%
R4	0.3	<1%	SCREENED	
R5	0.4	<1%	SCREENED	
R6	**0.4**	**1%**	9.9	25%
R7	0.3	<1%	SCREENED	
R8	0.1	<1%	SCREENED	
R9	**0.4**	**1%**	9.9	25%
R10	**1.9**	**5%**	11.4	29%

The annual mean PCs are above 1% of the limit value at six of the ten modelled receptors. A maximum PC of 2.0 µg/m³ is predicted at receptor R2 which is commercial use approximately 90m east of the site boundary. This corresponds to 5% of the limit value.

The corresponding NO_2 PECs are well below the 40 µg/m³ limit value at all modelled receptors. A maximum PEC of 11.5 µg/m³ is predicted at receptor R2 which is below the limit value by 71%.

As such, predicted effects of annual mean NO_2 concentrations on discrete sensitive human receptors are considered to be not significant.

5.3.2 1-Hour Mean NO_2

The maximum predicted 99.79th percentile 1-hour mean NO_2 concentrations at the human receptor locations are summarised in Table 5.13.

Table 5.13: Maximum Predicted Concentrations of 1-Hour Mean NO_2 at Receptors (Short Term)

Receptor ID	99.79th Percentile 1-Hour Mean			
	PC (µg/m³)	PC: % of Limit	PEC (µg/m³)	PEC: % of Limit
R1	8.4	4%	SCREENED	
R2	9.2	5%	SCREENED	
R3	5.4	3%	SCREENED	
R4	5.3	3%	SCREENED	
R5	6.2	3%	SCREENED	
R6	6.6	3%	SCREENED	
R7	5.8	3%	SCREENED	
R8	3.0	1%	SCREENED	
R9	7.6	4%	SCREENED	
R10	13.5	7%	SCREENED	

The 99.79th percentile 1-hour mean PCs are below 10% of the limit value at all modelled receptors. A maximum PC of 13.5 µg/m³ is predicted at receptor R10 which is commercial use approximately 35m west of the site boundary. This corresponds to 7% of the limit value.

Furthermore, corresponding NO_2 PECs are well below the 200 µg/m³ limit value at all modelled receptors. A maximum PEC of 32.5 µg/m³ is predicted at receptor R10 which is below the limit value by 84%.

As such, predicted effects of 1-hour mean NO_2 concentrations on discrete sensitive human receptors are considered to be not significant.

5.3.3 Annual Mean PM_{10}

The maximum predicted annual mean PM_{10} concentrations at the human receptor locations are summarised in Table 5.14.

Table 5.14: Maximum Predicted Concentrations of Annual Mean PM_{10} at Receptors (Long Term)

Receptor ID	Annual Mean			
	PC (µg/m³)	PC: % of Limit	PEC (µg/m³)	PEC: % of Limit
R1	**2.5**	**6%**	14.2	36%
R2	**3.8**	**9%**	15.5	39%
R3	**1.1**	**3%**	12.8	32%
R4	**0.6**	**1%**	12.3	31%
R5	**0.7**	**2%**	12.4	31%
R6	**0.8**	**2%**	12.5	31%
R7	**0.6**	**1%**	12.3	31%
R8	0.2	<1%	SCREENED	
R9	**0.9**	**2%**	12.6	32%
R10	**5.0**	**13%**	16.7	42%

The annual mean PM_{10} PCs are above 1% of the limit value at nine of the ten modelled receptors. A maximum PC of 5.0 µg/m³ is predicted at receptor R10 which corresponds to 13% of the limit value.

The corresponding PM_{10} PECs are well below the 40 µg/m³ limit value at all modelled receptors. A maximum PEC of 16.7 µg/m³ is predicted at receptor R10, which is below the limit value by 58%. As such, predicted effects of annual mean PM_{10} concentrations on discrete sensitive human receptors are considered insignificant.

5.3.4 24-Hour Mean PM_{10}

The maximum predicted 90.41st percentile 24-hour mean PM_{10} concentrations at the human receptor locations are summarised in Table 5.15.

Table 5.15: Maximum Predicted Concentrations of 90.41st Percentile 24-Hour Mean PM_{10} at Receptors (Short Term)

Receptor ID	90.41st Percentile 24-Hour Mean			
	PC (µg/m³)	PC: % of Limit	PEC (µg/m³)	PEC: % of Limit
R1	**7.3**	**15%**	30.7	61%
R2	**11.1**	**22%**	34.5	69%
R3	3.4	7%	SCREENED	
R4	2.1	4%	SCREENED	
R5	2.8	6%	SCREENED	
R6	3.1	6%	SCREENED	
R7	1.9	4%	SCREENED	
R8	0.7	1%	SCREENED	
R9	3.3	7%	SCREENED	
R10	**13.8**	**28%**	37.2	74%

The 90.41st percentile 24-hour mean PM_{10} PCs are below 10% of the limit value at seven of the ten modelled receptors. A maximum PC of 13.8 µg/m³ is predicted at receptor R10 which corresponds to 28% of the limit value.

The corresponding PM_{10} PECs are below the 50 µg/m³ limit value at all modelled receptors. A maximum PEC of 37.2 µg/m³ is predicted at receptor R10, which is below the limit value by 26%. As such, predicted effects of 24-hour mean PM_{10} concentrations on discrete sensitive human receptors is considered insignificant.

5.3.5 Annual Mean $PM_{2.5}$

The maximum predicted annual mean $PM_{2.5}$ concentrations at the human receptor locations are summarised in Table 5.16.

Table 5.16: Maximum Predicted Concentrations of Annual Mean $PM_{2.5}$ at Receptors (Long Term)

Receptor ID	Annual Mean			
	PC (µg/m³)	PC: % of Limit	PEC (µg/m³)	PEC: % of Limit
R1	**2.5**	**13%**	8.9	45%
R2	**3.8**	**19%**	10.2	51%
R3	**1.1**	**6%**	7.5	38%
R4	**0.6**	**3%**	7.0	35%
R5	**0.7**	**3%**	7.1	35%
R6	**0.8**	**4%**	7.2	36%
R7	**0.6**	**3%**	7.0	35%
R8	**0.2**	**1%**	6.6	33%
R9	**0.9**	**5%**	7.3	37%
R10	**5.0**	**25%**	11.4	57%

The annual mean $PM_{2.5}$ PCs are above 1% of the limit value at all modelled receptors. A maximum PC of 5.0 µg/m³ is predicted at receptor R10 which corresponds to 25% of the limit value.

The corresponding PM_{10} PECs are well below the 20 µg/m³ limit value at all modelled receptors. A maximum PEC of 11.4 µg/m³ is predicted at receptor R10, which is below the limit value by 43%. As such, predicted effects of annual mean $PM_{2.5}$ concentrations on discrete sensitive human receptors are considered insignificant.

5.3.6 24-Hour Mean SO_2

The maximum predicted 99.18th percentile 24-hour mean SO_2 concentrations at the human receptor locations are summarised in Table 5.17.

Table 5.17: Maximum Predicted Concentrations of 99.18th Percentile 24-Hour Mean SO_2 at Receptors (Short Term)

Receptor ID	99.18th Percentile 24-Hour Mean			
	PC (µg/m^3)	PC: % of Limit	PEC (µg/m^3)	PEC: % of Limit
R1	0.3	<1%	SCREENED	
R2	0.3	<1%	SCREENED	
R3	0.2	<1%	SCREENED	
R4	0.2	<1%	SCREENED	
R5	0.2	<1%	SCREENED	
R6	0.3	<1%	SCREENED	
R7	0.4	<1%	SCREENED	
R8	0.1	<1%	SCREENED	
R9	0.5	<1%	SCREENED	
R10	1.8	1%	SCREENED	

The 99.18th percentile 24-hour mean SO_2 PCs are below 10% of the limit value at all modelled receptors. A maximum PC of 1.8 µg/m^3 is predicted at receptor R10 which corresponds to 1% of the limit value.

Furthermore, the corresponding SO_2 PECs are well below the 125 µg/m^3 limit value at all modelled receptors. A maximum PEC of 9.5 µg/m^3 is predicted at receptor R10, which is below the limit value by 92%. As such, predicted effects of 24-hour mean SO_2 concentrations on discrete sensitive human receptors is considered insignificant.

5.3.7 1-Hour Mean SO_2

The maximum predicted 99.73rd percentile 1-hour mean SO_2 concentrations at the human receptor locations are summarised in Table 5.18.

Table 5.18: Maximum Predicted Concentrations of 99.73rd Percentile 1-Hour Mean SO_2 at Receptors (Short Term)

Receptor ID	99.73rd Percentile 1-Hour Mean			
	PC (µg/m³)	PC: % of Limit	PEC (µg/m³)	PEC: % of Limit
R1	0.6	<1%	SCREENED	
R2	0.6	<1%	SCREENED	
R3	0.5	<1%	SCREENED	
R4	0.4	<1%	SCREENED	
R5	0.5	<1%	SCREENED	
R6	0.7	<1%	SCREENED	
R7	0.7	<1%	SCREENED	
R8	0.3	<1%	SCREENED	
R9	1.2	<1%	SCREENED	
R10	2.5	1%	SCREENED	

The 99.73rd percentile 1-hour mean SO_2 PCs are below 10% of the limit value at all modelled receptors. A maximum PC of 2.5 µg/m³ is predicted at receptor R10 which corresponds to 1% of the limit value.

Furthermore, the corresponding SO_2 PECs are well below the 350 µg/m³ limit value at all modelled receptors. A maximum PEC of 10.3 µg/m³ is predicted at receptor R10, which is below the limit value by 97%. As such, predicted effects of 1-hour mean SO_2 concentrations on discrete sensitive human receptors is considered insignificant.

5.3.8 15-Minute Mean SO_2

The maximum predicted 99.90th percentile 15-minute mean SO_2 concentrations at the human receptor locations are summarised in Table 5.19.

Table 5.19: Maximum Predicted Concentrations of 99.90th Percentile 15-Minute Mean SO_2 at Receptors (Short Term)

Receptor ID	99.90th Percentile 15-Minute Mean			
	PC (µg/m³)	PC: % of Limit	PEC (µg/m³)	PEC: % of Limit
R1	0.8	<1%	SCREENED	
R2	0.7	<1%	SCREENED	
R3	0.7	<1%	SCREENED	
R4	0.6	<1%	SCREENED	
R5	0.7	<1%	SCREENED	
R6	0.9	<1%	SCREENED	
R7	0.9	<1%	SCREENED	
R8	0.4	<1%	SCREENED	
R9	1.5	1%	SCREENED	
R10	2.7	1%	SCREENED	

The 99.90th percentile 15-minute mean SO_2 PCs are below 10% of the limit value at all modelled receptors. A maximum PC of 2.7 µg/m³ is predicted at receptor R10 which corresponds to 1% of the limit value.

Furthermore, the corresponding SO_2 PECs are well below the 266 µg/m³ limit value at all modelled receptors. A maximum PEC of 10.4 µg/m³ is predicted at receptor R10, which is below the limit value by 96%. As such, predicted effects of 15-minute mean SO_2 concentrations on discrete sensitive human receptors is considered insignificant.

5.3.9 Annual Mean VOC as C_6H_6

The maximum predicted annual mean VOC concentrations at the human receptor locations are summarised in Table 5.20.

Table 5.20: Maximum Predicted Concentrations of Annual Mean VOC at Receptors (Long Term)

Receptor ID	Annual Mean			
	PC (µg/m³)	PC: % of Limit	PEC (µg/m³)	PEC: % of Limit
R1	**0.1**	**2%**	0.5	10%
R2	**0.1**	**3%**	0.5	11%
R3	**0.1**	**2%**	0.5	10%
R4	<0.1	<1%	SCREENED	
R5	<0.1	<1%	SCREENED	
R6	<0.1	<1%	SCREENED	
R7	0.1	1%	0.5	9%
R8	<0.1	<1%	SCREENED	
R9	**0.1**	**2%**	0.5	10%
R10	**0.9**	**17%**	1.3	25%

The annual mean VOC PCs are above 1% of the limit value at six of the ten modelled receptors. A maximum PC of 0.9 µg/m³ is predicted at receptor R10 which corresponds to 17% of the limit value.

The corresponding VOC PECs are well below the 5 µg/m³ limit value at all modelled receptors. A maximum PEC of 1.3 µg/m³ is predicted at receptor R10, which is below the limit value by 75%. As such, predicted effects of annual mean VOC concentrations on discrete sensitive human receptors are considered insignificant.

Furthermore, if the 0.5% factor is applied to the maximum gridded results, it reduces the maximum annual mean PC to 0.001 µg/m³ which is less than 0.1% of the environmental standard.

5.3.10 24-Hour Mean VOC as C_6H_6

The maximum predicted 100th percentile 24-hour mean VOC concentrations at the human receptor locations are summarised in Table 5.21.

Table 5.21: Maximum Predicted Concentrations of 100th Percentile 24-Hour Mean VOC at Receptors (Short Term)

Receptor ID	100th Percentile 24-Hour Mean			
	PC (µg/m³)	PC: % of Limit	PEC (µg/m³)	PEC: % of Limit
R1	0.7	2%	SCREENED	
R2	0.8	3%	SCREENED	
R3	0.6	2%	SCREENED	
R4	0.5	2%	SCREENED	
R5	0.5	2%	SCREENED	
R6	1.1	4%	SCREENED	
R7	1.0	3%	SCREENED	
R8	0.2	1%	SCREENED	
R9	1.6	5%	SCREENED	
R10	**4.0**	**13%**	4.8	16%

The 100th percentile 24-hour mean VOC PCs are below 10% of the limit value at nine of the ten modelled receptors. A maximum PC of 4.0 µg/m³ is predicted at receptor R10 which corresponds to 3% of the limit value.

The corresponding VOC PECs are well below the 30 µg/m³ limit value at all modelled receptors. A maximum PEC of 4.8 µg/m³ is predicted at receptor R10, which is below the limit value by 84%. As such, predicted effects of 24-hour mean VOC concentrations on discrete sensitive human receptors is considered insignificant.

Furthermore, if the 0.5% factor is applied to the maximum gridded results, it reduces the maximum 24-hour mean PC to 0.02 µg/m³ which is less than 0.1% of the environmental standard.

5.4 Assessment at Sensitive Ecological Receptors

5.4.1 Annual Mean NO_x

The maximum predicted annual mean NO_x concentrations at the ecological receptor locations are summarised in Table 5.22.

Table 5.22: Maximum Predicted Concentrations of Annual Mean NO_x at Ecological Receptors

Receptor ID	Annual Mean			
	PC (µg/m³)	PC: % of Limit	PEC (µg/m³)	PEC: % of Limit
ECO1	0.1	<1%	SCREENED	
ECO2	0.1	<1%	SCREENED	
ECO3	<0.1	<1%	SCREENED	
ECO4	0.3	1%	SCREENED	
ECO5	0.1	<1%	SCREENED	
ECO6	0.2	1%	SCREENED	
ECO7	<0.1	<1%	SCREENED	
ECO8	<0.1	<1%	SCREENED	
ECO9	0.1	<1%	SCREENED	
ECO10	0.2	<1%	SCREENED	
ECO11	0.2	<1%	SCREENED	
ECO12	**2.8**	**9%**	15.4	51%
ECO13	<0.1	<1%	SCREENED	
ECO14	<0.1	<1%	SCREENED	
ECO15	<0.1	<1%	SCREENED	
ECO16	<0.1	<1%	SCREENED	
ECO17	<0.1	<1%	SCREENED	
ECO18	<0.1	<1%	SCREENED	
ECO19	<0.1	<1%	SCREENED	
ECO20	<0.1	<1%	SCREENED	
ECO21	<0.1	<1%	SCREENED	
ECO22	<0.1	<1%	SCREENED	

The annual mean NO_x PCs are below 1% of the limit value at twenty-one of the twenty-two modelled receptors. A maximum PC of 2.8 µg/m^3 is predicted at receptor ECO12, which is an Ancient Woodland approximately 90m north of the facility. This corresponds to 9% of the limit value.

The corresponding NO_x PECs are well below the 30 µg/m^3 limit value at all modelled receptors. A maximum PEC of 15.4 µg/m^3 is predicted at receptor ECO12, which is below the limit value by 49%. As such, predicted effects of annual mean NO_x concentrations on discrete sensitive ecological receptors is considered insignificant.

5.4.2 24-Hour Mean NO_x

The maximum predicted 100th percentile 24-hour mean NO_x concentrations at the ecological receptor locations are summarised in Table 5.23.

Table 5.23: Maximum Predicted Concentrations of 100th Percentile 24-Hour Mean NO_x at Ecological Receptors

Receptor ID	100th Percentile 24-Hour Mean			
	PC (µg/m^3)	PC: % of Limit	PEC (µg/m^3)	PEC: % of Limit
ECO1	0.7	1%	SCREENED	
ECO2	0.5	1%	SCREENED	
ECO3	0.4	<1%	SCREENED	
ECO4	1.8	2%	SCREENED	
ECO5	1.1	1%	SCREENED	
ECO6	3.3	4%	SCREENED	
ECO7	0.4	1%	SCREENED	
ECO8	0.4	1%	SCREENED	
ECO9	1.3	2%	SCREENED	
ECO10	1.0	1%	SCREENED	
ECO11	1.1	2%	SCREENED	
ECO12	**13.0**	**17%**	38.2	51%
ECO13	0.2	<1%	SCREENED	
ECO14	0.1	<1%	SCREENED	
ECO15	0.1	<1%	SCREENED	
ECO16	0.1	<1%	SCREENED	
ECO17	0.2	<1%	SCREENED	
ECO18	0.3	<1%	SCREENED	

Receptor ID	100th Percentile 24-Hour Mean			
	PC (µg/m³)	PC: % of Limit	PEC (µg/m³)	PEC: % of Limit
ECO19	0.2	<1%	SCREENED	
ECO20	0.1	<1%	SCREENED	
ECO21	0.1	<1%	SCREENED	
ECO22	<0.1	<1%	SCREENED	

The 24-hour mean NO_x PCs are below 10% of the limit value at twenty-one of the twenty-two modelled receptors. A maximum PC of 13.0 µg/m³ is predicted at receptor ECO12 corresponds to 17% of the limit value.

The corresponding NO_x PECs are well below the 75 µg/m³ limit value at all modelled receptors. A maximum PEC of 38.2 µg/m³ is predicted at receptor ECO12, which is below the limit value by 49%. As such, predicted effects of 24-hour mean NO_x concentrations on discrete sensitive ecological receptors is considered insignificant.

5.4.3 Annual Mean SO_2

The maximum predicted annual mean SO_2 concentrations at the ecological receptor locations are summarised in Table 5.24.

Table 5.24: Maximum Predicted Concentrations of Annual Mean SO_2 at Ecological Receptors

Receptor ID	Annual Mean			
	PC (µg/m³)	PC: % of Limit	PEC (µg/m³)	PEC: % of Limit
ECO1	<0.1	<1%	SCREENED	
ECO2	<0.1	<1%	SCREENED	
ECO3	<0.1	<1%	SCREENED	
ECO4	<0.1	<1%	SCREENED	
ECO5	<0.1	<1%	SCREENED	
ECO6	<0.1	<1%	SCREENED	
ECO7	<0.1	<1%	SCREENED	
ECO8	<0.1	<1%	SCREENED	
ECO9	<0.1	<1%	SCREENED	
ECO10	<0.1	<1%	SCREENED	
ECO11	<0.1	<1%	SCREENED	
ECO12	0.1	<1%	SCREENED	

Receptor ID	Annual Mean			
	PC (µg/m³)	PC: % of Limit	PEC (µg/m³)	PEC: % of Limit
ECO13	<0.1	<1%	SCREENED	
ECO14	<0.1	<1%	SCREENED	
ECO15	<0.1	<1%	SCREENED	
ECO16	<0.1	<1%	SCREENED	
ECO17	<0.1	<1%	SCREENED	
ECO18	<0.1	<1%	SCREENED	
ECO19	<0.1	<1%	SCREENED	
ECO20	<0.1	<1%	SCREENED	
ECO21	<0.1	<1%	SCREENED	
ECO22	<0.1	<1%	SCREENED	

The annual mean SO_2 PCs are below 1% of the limit value at all modelled receptors. A maximum PC of 0.1 µg/m³ is predicted at receptor ECO12, which corresponds to less than 1% of the limit value.

Furthermore, the corresponding SO_2 PECs are well below the 10 µg/m³ limit value at all modelled receptors. A maximum PEC of 3.4 µg/m³ is predicted at receptor ECO12, which is below the limit value by 66%. As such, predicted effects of annual mean SO_2 concentrations on discrete sensitive ecological receptors is considered insignificant.

5.4.4 Annual Nitrogen Deposition

The maximum predicted annual nitrogen deposition at the ecological receptor locations are summarised in Table 5.25.

Table 5.25: Maximum Predicted Nitrogen Deposition at Ecological Receptors

Receptor ID	Annual Deposition					
	PC (kgN/ha/yr)	PC: % of Lower Critical Load	PC: % of Upper Critical Load	PEC (kgN/ha/yr)	PEC: % of Lower Critical Load	PEC: % of Upper Critical Load
ECO1	0.021	0.2%	0.1%	SCREENED		
ECO2	0.018	0.2%	0.1%	SCREENED		
ECO3	0.008	<0.1%	<0.1%	SCREENED		
ECO4	0.082	0.8%	0.5%	SCREENED		

Receptor ID	Annual Deposition					
	PC (kgN/ha/yr)	PC: % of Lower Critical Load	PC: % of Upper Critical Load	PEC (kgN/ha/yr)	PEC: % of Lower Critical Load	PEC: % of Upper Critical Load
ECO5	0.018	0.3%	0.2%	SCREENED		
ECO6	0.045	0.4%	0.3%	SCREENED		
ECO7	0.006	<0.1%	<0.1%	SCREENED		
ECO8	0.006	<0.1%	<0.1%	SCREENED		
ECO9	0.016	0.2%	0.1%	SCREENED		
ECO10	0.048	0.5%	0.3%	SCREENED		
ECO11	0.058	0.6%	0.4%	SCREENED		
ECO12	**0.794**	**7.9%**	**5.3%**	**37.9**	**379%**	**253%**
ECO13	0.004	<0.1%	<0.1%	SCREENED		
ECO14	0.002	<0.1%	<0.1%	SCREENED		
ECO15	0.002	<0.1%	<0.1%	SCREENED		
ECO16	0.002	<0.1%	<0.1%	SCREENED		
ECO17	0.003	0.1%	<0.1%	SCREENED		
ECO18	0.004	0.2%	<0.1%	SCREENED		
ECO19	0.003	0.1%	<0.1%	SCREENED		
ECO20	<0.001	<0.1%	<0.1%	SCREENED		
ECO21	<0.001	<0.1%	<0.1%	SCREENED		

The annual nitrogen deposition PCs are below 1% of the lower and upper critical loads at twenty of the twenty-one modelled receptors. A maximum concentration of 0.8 kgN/ha/yr is recorded at receptor ECO12 which corresponds to 8% of the lower critical load. As highlighted in Table 3.7, existing nitrogen deposition at receptor ECO12 far exceeds the lower and upper critical loads.

As stated in the EA's Operational Instruction 67_12, where the background is currently above the limit and the additional PC will cause a small increase, decisions on significance can based on local considerations. Considering that existing deposition rates at receptor ECO12 exceed the lower and upper critical loads and given the nitrogen deposition PC is relatively small (max of 0.8 N/ha/yr at ECO12), the effects of nitrogen deposition on sensitive ecological receptors is predicted to be insignificant.

Furthermore, as stated in Section 4.15, the significance criteria for all ecological receptors have been assessed against the stricter criteria for European site. Receptor ECO12 is an Ancient Woodland and therefore should be assessed against the less stringent criteria as detailed below:

- PC <100% long-term critical level and/or critical load.

The PC at receptor ECO12 is well below 100% of the lower and upper critical load.

5.4.5 Annual Acid Deposition

The maximum predicted annual acid deposition at the ecological receptor locations are summarised in Table 5.26.

Table 5.26: Maximum Predicted Acid Deposition at Ecological Receptors

Receptor ID	Annual Deposition				
	PC ($_{keq}$/ha/yr)	CLmaxN ($_{keq}$/ha/yr)	PC: % of Critical Load	PEC ($_{keq}$/ha/yr)	PEC: % of Critical Load
ECO13	0.0004	0.5190	<0.1%	SCREENED	
ECO14	0.0003	1.0750	<0.1%	SCREENED	
ECO15	0.0003	1.0750	<0.1%	SCREENED	
ECO16	0.0004	1.0750	<0.1%	SCREENED	
ECO17	0.0005	1.0750	<0.1%	SCREENED	
ECO18	0.0008	1.0750	<0.1%	SCREENED	
ECO19	0.0005	1.0750	<0.1%	SCREENED	
ECO20	0.0001	1.0750	<0.1%	SCREENED	
ECO21	<0.0001	1.0750	<0.1%	SCREENED	

The annual mean acid deposition PCs are below 1% of the ClmaxN at all modelled receptors. The actual contribution of the facility (PC) to acid deposition is imperceptible with a maximum predicted concentration of <0.001 $_{keq}$/ha/year.

Considering the above, and with reference to the EA's Operational Instruction 67_12, the effects of acid deposition on sensitive ecological receptors are considered insignificant.

6. Conclusions

Arthian was commissioned by Duynie Ingredients Ltd to undertake an Air Quality Assessment of potential atmospheric emissions from the starch manufacturing facility on land off Coed Aben Road, Wrexham.

Combustion emissions from the site have the potential to cause air quality impacts during operation. An Air Quality Assessment was therefore undertaken to define baseline conditions and quantify potential effects.

Dispersion modelling was undertaken in order to predict pollutant concentrations at sensitive locations as a result of emissions from the site. Impacts at sensitive receptors were quantified and the results compared with the relevant assessment levels and significance criteria.

The results of the assessment indicated that the operation of the plant is not predicted to result in exceedances of the relevant assessment levels at any sensitive human receptor within the vicinity of the installation. Impacts were not predicted to be significant in accordance with the relevant methodology.

Impacts were also predicted at relevant ecological sites. The results indicated that emissions from the facility would not significantly affect existing conditions at any designation.

Appendices

Appendix A: Examples of Where Air Quality Objectives Should Apply

Averaging Period	Objectives should apply at:	Objectives should not generally apply at:
Annual Mean	• All locations where members of the public might be regularly exposed. • Building facades of residential properties, schools, hospitals, care homes, etc.	• Building facades 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.
24 Hour Mean and 8 Hour Mean	• All locations where the annual mean objectives 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 24 and 8 hour mean objectives would apply. • Kerbside sites (e.g. pavements of busy shopping streets). • Those parts of car parks, bus stations and railway stations, etc. which are not fully enclosed, where the public might reasonably be expected to spend one hour or more. • Any outdoor locations at which the public may be expected to spend one hour or longer.	• Kerbside sites where the public would not be expected to have regular access.
15 Minute Mean	• All locations where members of the public might reasonably be expected to spend a period of 15 minutes or longer.	

Appendix B: Contour Plots

Figure B.1: Annual Mean NO_2 PC as a Percentage of the Limit Value (Limit: 40 µg/m^3)

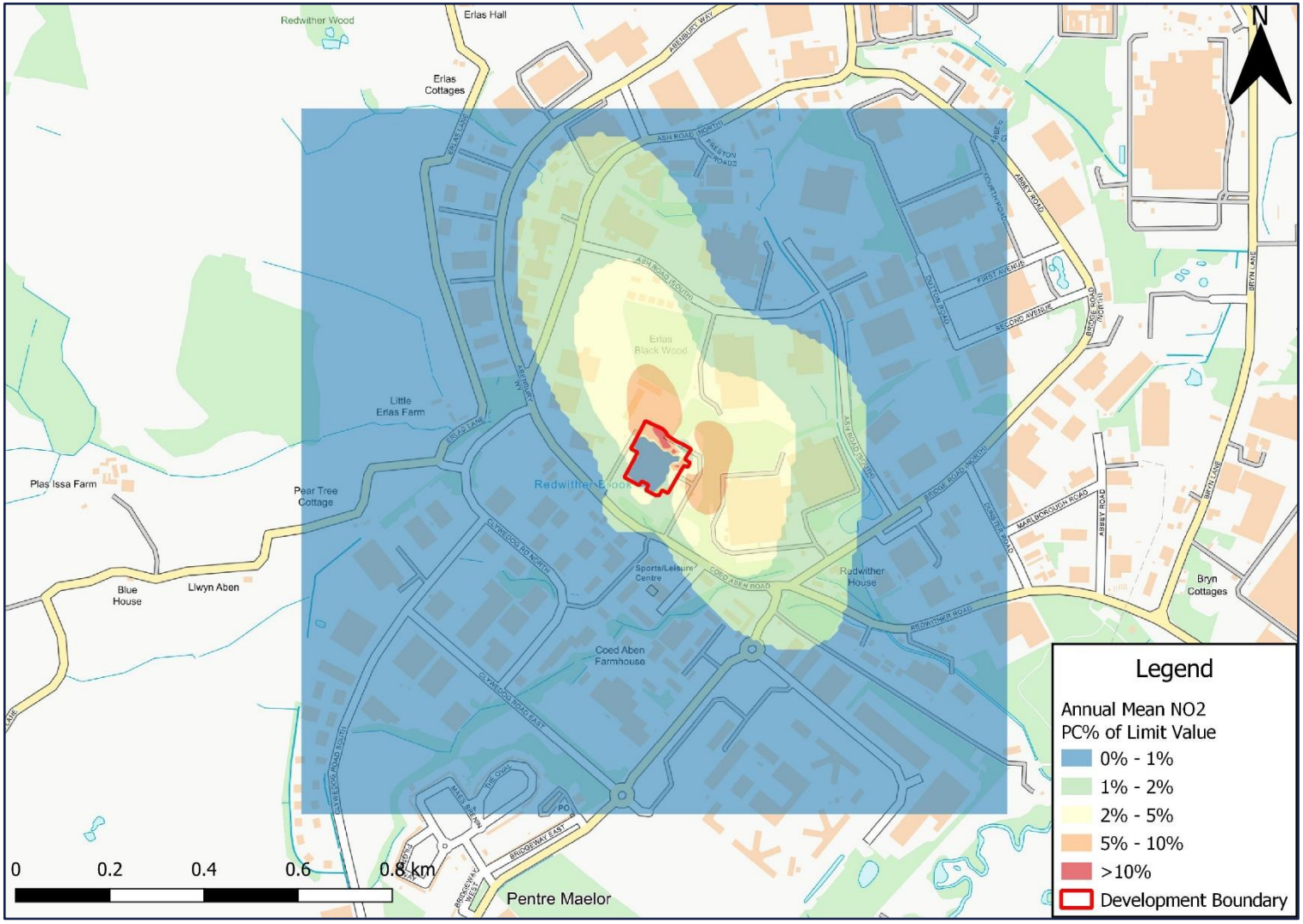


Figure B.2: Annual Mean NO_2 PEC (µg/m^3) (Limit: 40 µg/m^3)

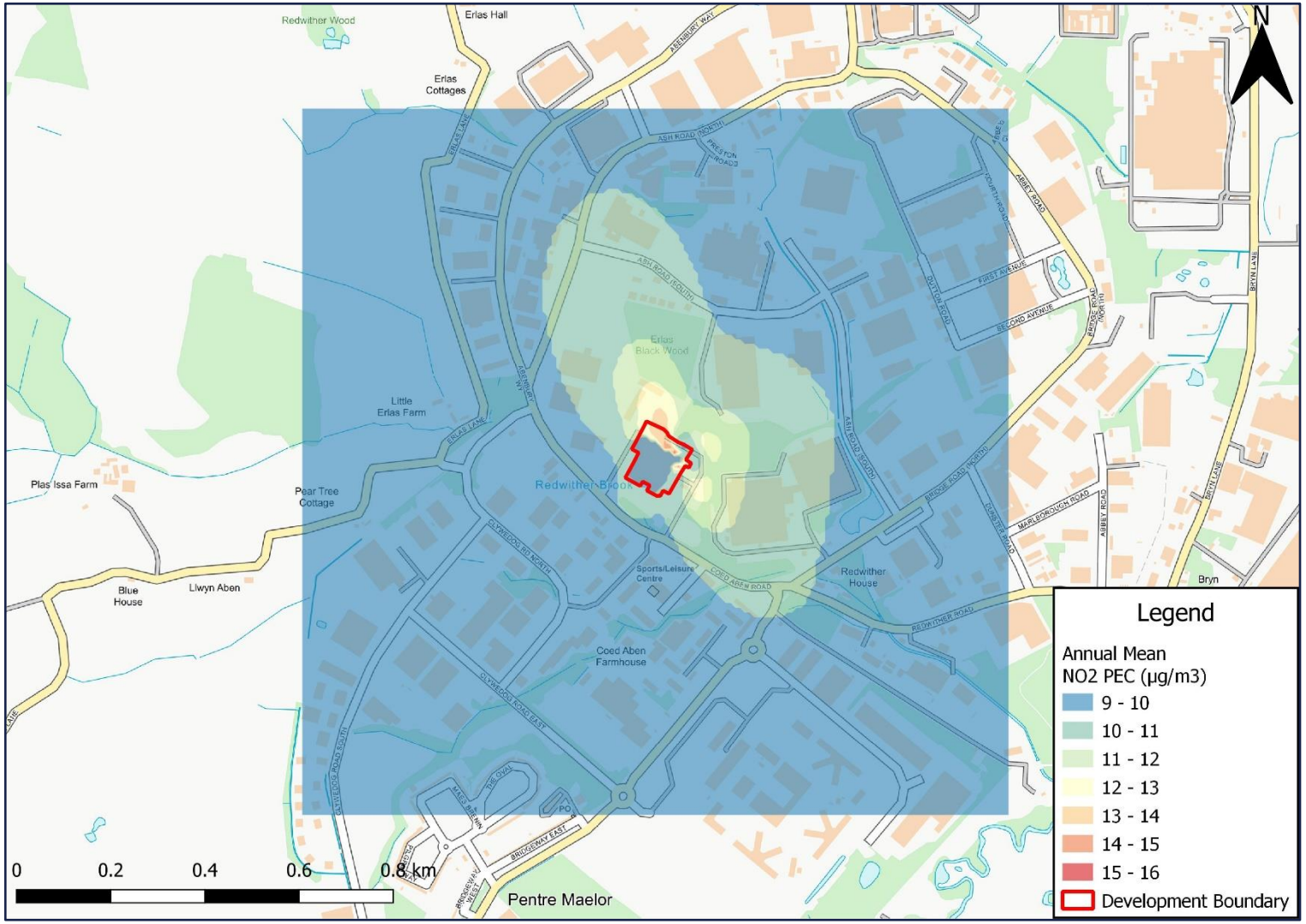


Figure B.3: 99.79th Percentile 1-Hour Mean NO_2 PC as a Percentage of the Limit Value (Limit: 200 µg/m³)

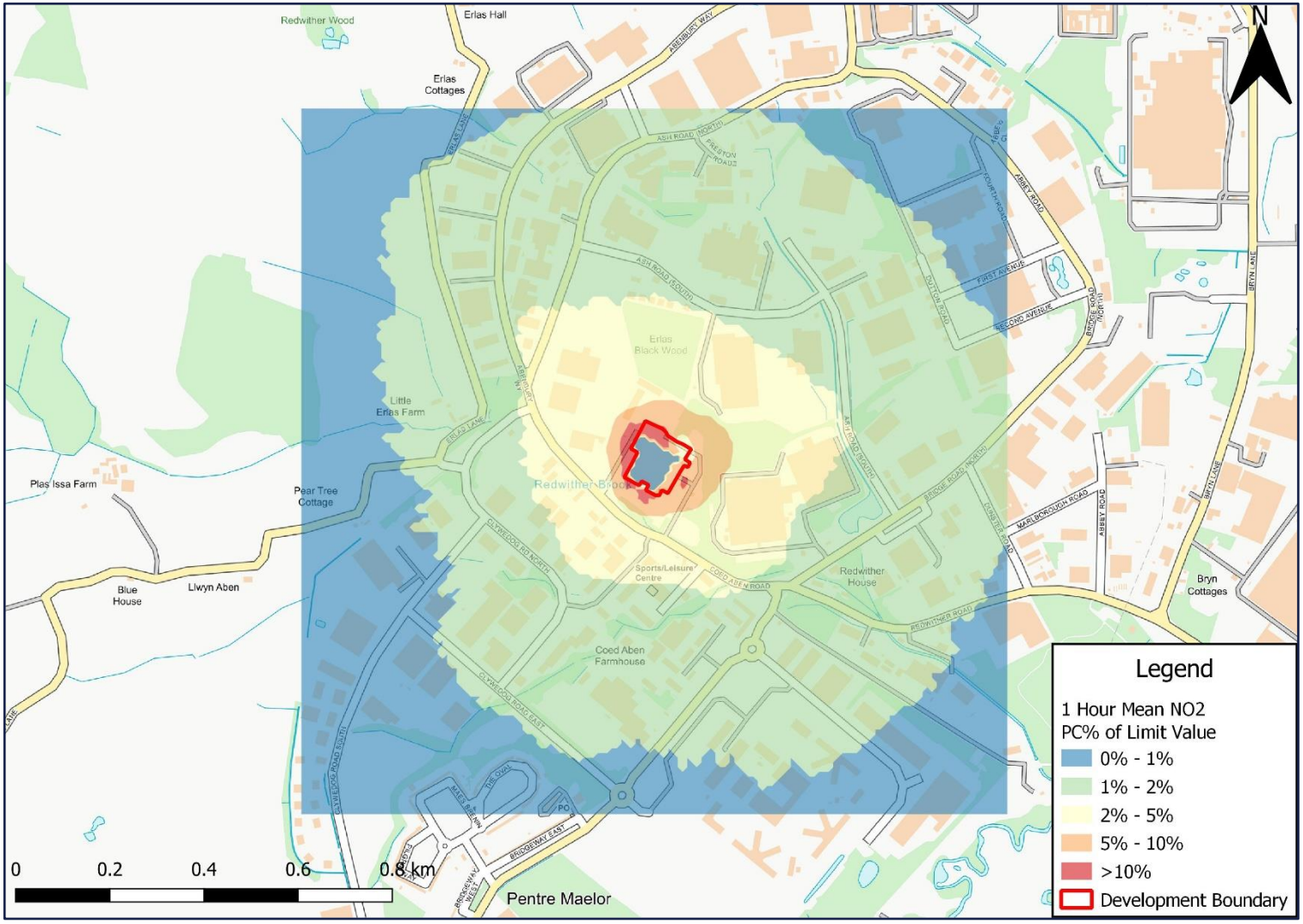


Figure B.4: 99.79th Percentile 1-Hour Mean NO_2 PEC (µg/m³) (Limit: 200 µg/m³)

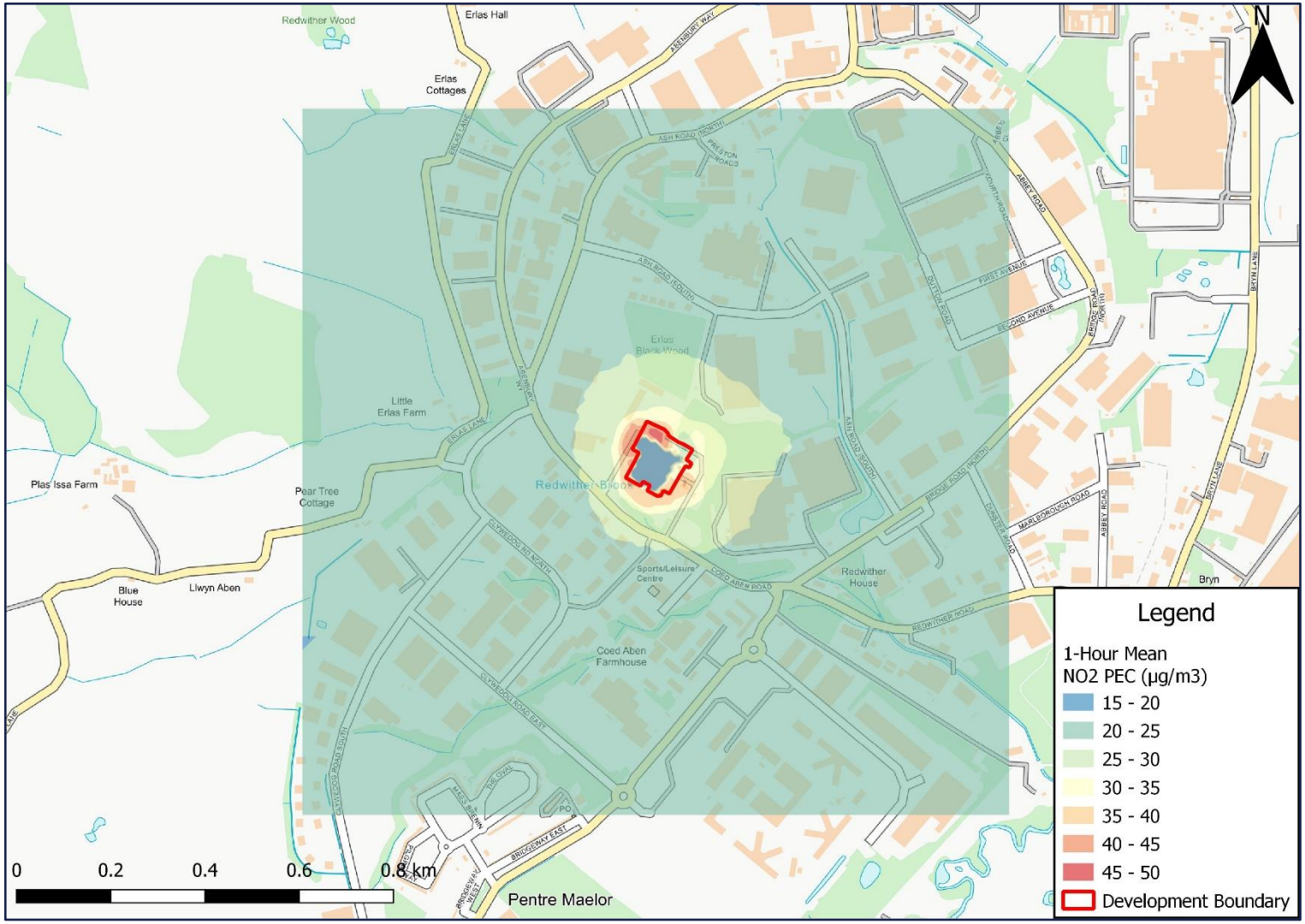


Figure B.5: Annual Mean PM_{10} PC as a Percentage of the Limit Value (Limit: 40 µg/m^3)

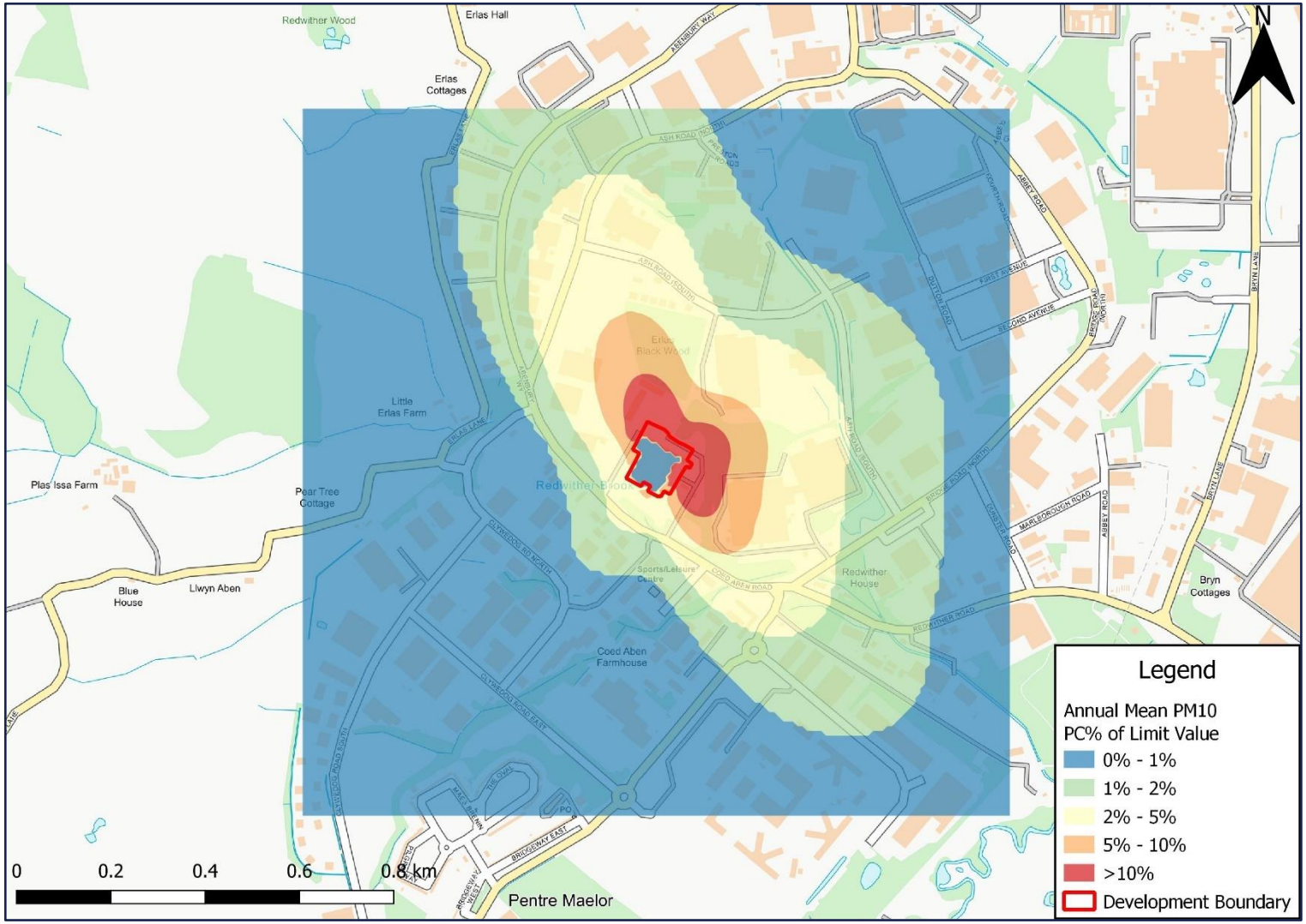


Figure B.6: Annual Mean PM_{10} PEC (µg/m³) (Limit: 40 µg/m³)

Figure B.7: 90.41st Percentile 24-Hour Mean PM_{10} PC as a Percentage of the Limit Value (Limit: 50 µg/m³)

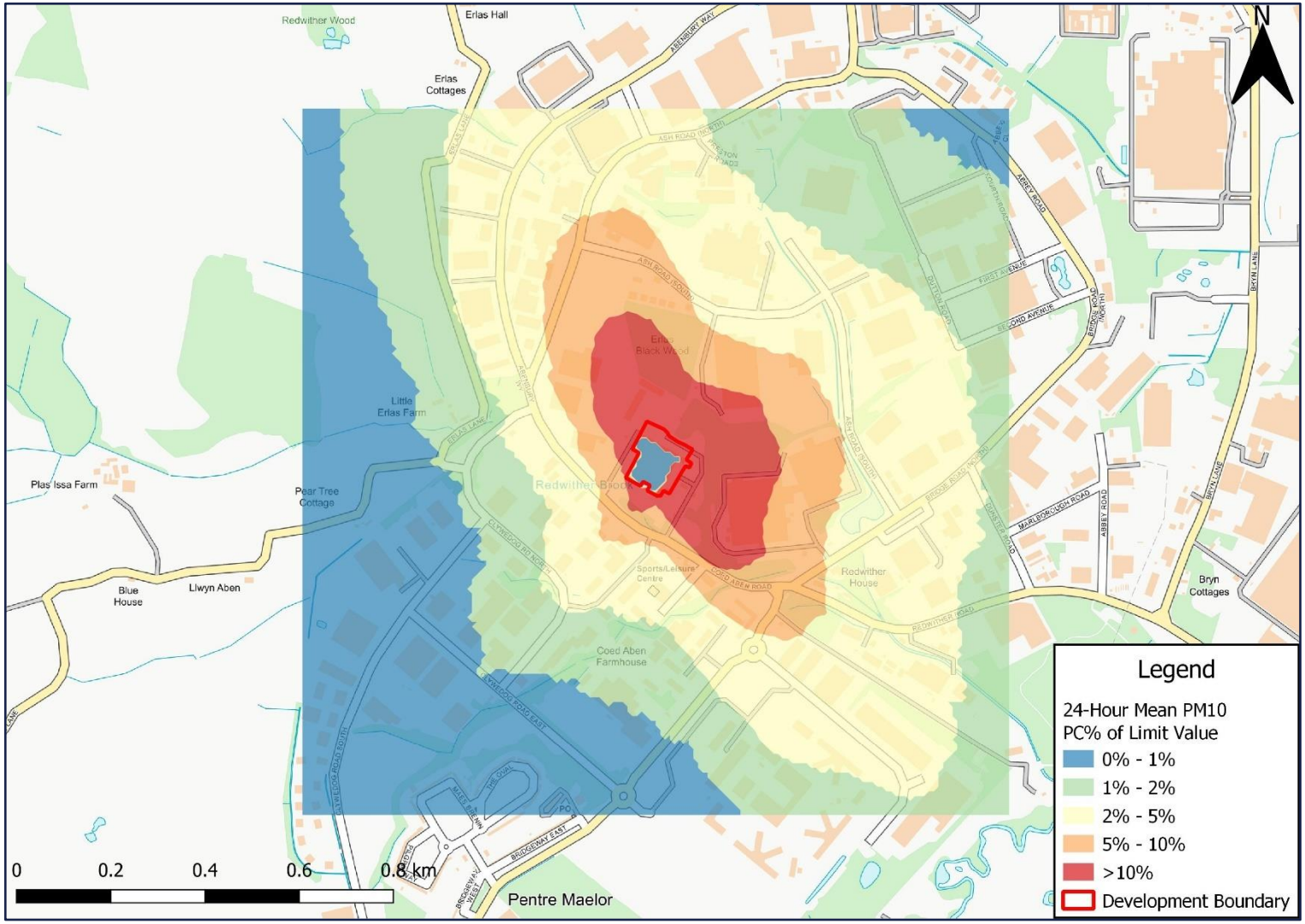


Figure B.8: 90.41st Percentile 24-Hour Mean PM_{10} PEC (µg/m³) (Limit: 50 µg/m³)

Figure B.9: Annual Mean $PM_{2.5}$ PC as a Percentage of the Limit Value (Limit: 20 µg/m³)

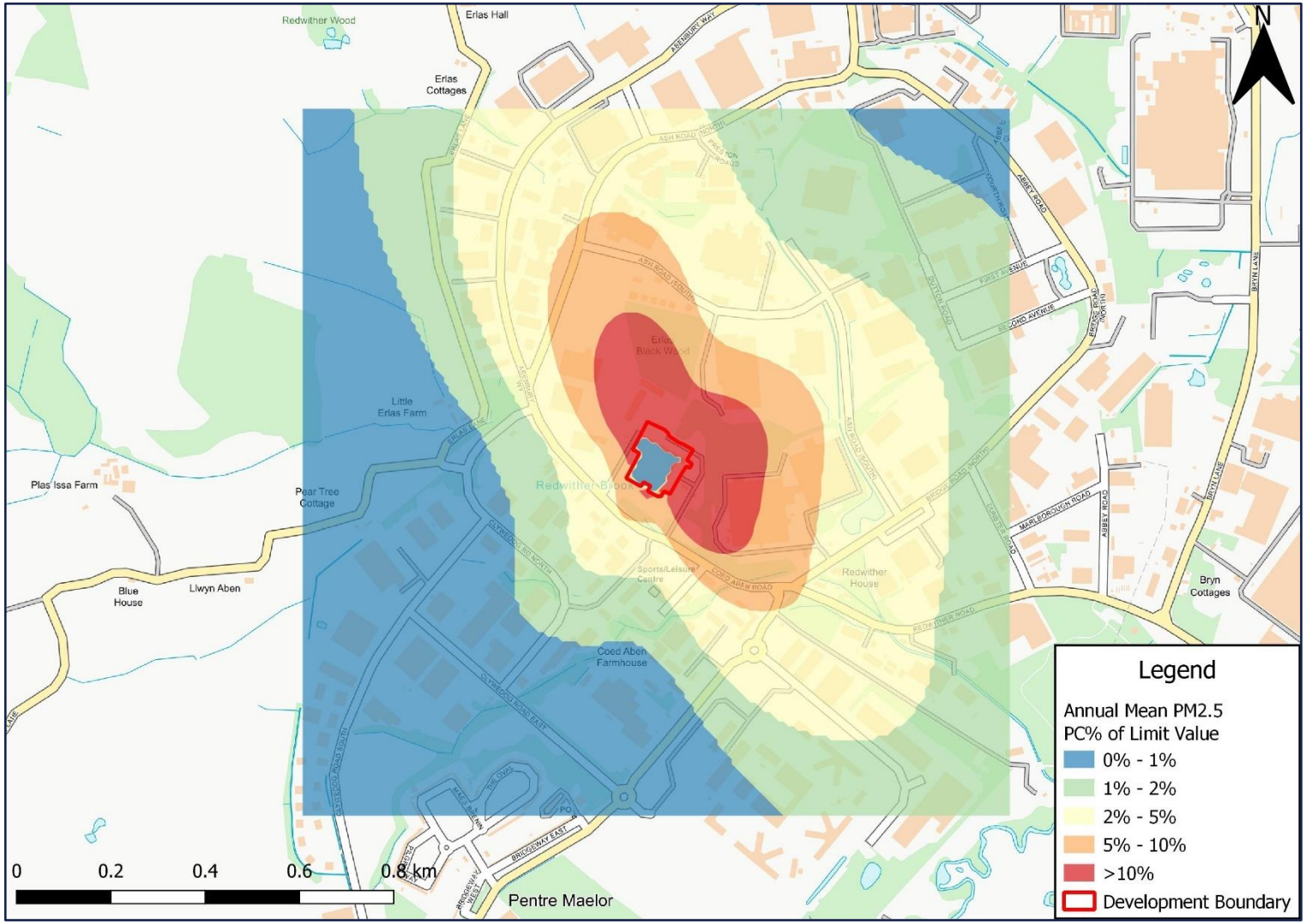


Figure B.10: Annual Mean $PM_{2.5}$ PEC (µg/m³) (Limit: 20 µg/m³)