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Air Quality Assessment

Coed Aben Road, Wrexham

Report Reference: CE-WH-1801-RP14-AQA-V1-FINAL

Report Date: 21 December 2023

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1 INTRODUCTION

1.1 BACKGROUND AND INSTRUCTION

1.1.1 Crestwood Environmental was commissioned by Novidon Limited (**the Application and Operator**) to undertake an Air Quality Assessment of potential atmospheric emissions from the Novidon starch manufacturing facility on land off Coed Aben Road, Wrexham.

1.1.2 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.

1.2 SITE LOCATION AND CONTEXT

1.2.1 The site is located off Coed Aben Road, Wrexham Industrial Estate, Wrexham, LL13 9UH, at approximate National Grid Reference (NGR): 337695, 349790. Reference should be made to Figure 1 for a map of the site and surrounding area.

1.2.2 The facility includes the following potential atmospheric emissions sources:

- Two gas boilers;
- One gas-fired heat exchanger;
- One dust extractor;
- One wet scrubber; and,
- One proposed gas-fired combined heat and power (CHP) unit.

1.2.3 Emissions from the above sources have the potential to cause impacts at sensitive locations. An Air Quality Assessment was therefore undertaken to define baseline conditions and quantify potential effects. The results are summarised in the following report.

2 LEGISLATION AND POLICY

2.1 LEGISLATION

2.1.1 The Air Quality Standards (Wales) Regulations (2010) and subsequent amendments include Air Quality Limit Values (AQLVs) for the following pollutants:

- Nitrogen dioxide (NO_2);
- 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).

2.1.2 The Air Quality Strategy (AQS) was produced 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[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.

2.1.3 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
C_6H_6	5	Annual mean
PM_{10}	40	Annual mean
	50	24-hour mean, not to be exceeded on more than 35 occasions per annum
SO_2	125	24-hour mean, not to be exceeded on more than 3 occasions per annum
	350	1-hour mean, not to be exceeded on more than 24 occasions per annum

[1] The AQS for England, Scotland, Wales and Northern Ireland, DEFRA, Scottish Executive, Welsh Assembly Government and DoE (Northern Ireland), 2007.

Pollutant	Air Quality Objective	
	Concentration (µg/m³)	**Averaging Period**
	266	15-minute mean, not to be exceeded on more than 35 occasions per annum
CO	10,000	8-hour running mean

2.1.4 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
1-hour mean	All locations where the annual mean and 24 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

2.2 LOCAL AIR QUALITY MANAGEMENT

2.2.1 Local Authorities 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 Local Authority is required to declare an Air Quality Management Area (AQMA). For each AQMA, the LA is required to produce an Air Quality Action Plan, the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

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

2.3 INDUSTRIAL POLLUTION CONTROL LEGISLATION

2.3.1 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).

2.4 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"*

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 (µg/m³)	**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

[3] UK Air Pollution Information System, www.apis.ac.uk.

within the assessment in Section 3.5.

3 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), Wrexham County Borough Council (WCBC) has undertaken Review and Assessment of air quality. 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 county.

3.3 AIR QUALITY MONITORING

3.3.1 Monitoring of pollutant concentrations is undertaken by WCBC throughout their area of jurisdiction. However, 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.

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 LAs in their Review and Assessment of air quality. The site is located in grid square NGR: 395500, 296500. Data for this location was downloaded from the DEFRA website[4] for the purpose of this assessment and is summarised in Table 4.

Table 4 Background Pollutant Concentrations

Pollutant	Predicted Background Concentration (µg/m³)
NO_2	10.02
C_6H_6	0.268
PM_{10}	12.54
SO_2	3.85
CO	254

3.4.2 It should be noted that the background NO_2 and PM_{10} concentrations were predicted for 2023, C_6H_6 for 2010 and SO_2 and CO for 2001. These are the most recent predictions available from DEFRA and are therefore considered to provide a reasonable representation of background concentrations in the vicinity of the site.

4 http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018.

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	Commercial - Village Bakery	337840.3	349905.7
R2	Commercial - Ardagh Group	337846.9	349742.6
R3	Residential - Coed Aben Road	337757.0	349585.9
R4	Commercial - Minuteman Press Printing	337683.9	349588.2
R5	Commercial - Alan Rhone Ltd	337628.8	349628.6
R6	Commercial - Zaviz International Ltd	337592.7	349669.5
R7	Commercial - Broadway Leisure Caravan Service Centre	337545.9	349724.9
R8	Residential - Erlas Lane	337297.6	349886.6
R9	Commercial - Village Bakery	337563.4	349828.0
R10	Commercial Unit	337639.2	349881.3

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. A study was therefore undertaken to identify the following sites of ecological or nature conservation importance:

- 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, Ancient Woodland (AW) and Local Nature Reserves within 2km of the facility.

3.5.5 The study was completed using the Multi-Agency Geographic Information for the

Countryside (MAGIC)[5] web-based interactive mapping service which draws together information on key environmental schemes and designations, as well as publicly available information. This indicated the following ecological designation within the relevant distances:

- 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.

3.5.6 For the purpose of the assessment, a discrete receptor was selected at the closest point of each designation to the facility to ensure the maximum potential impact was predicted. These are summarised in Table 6.

Table 6 Sensitive Ecological Receptor Locations

Receptor		NGR (m)	
		X	**Y**
E1	Unnamed AW	338670.9	348067.2
E2	Unnamed AW	338103.0	347814.0
E3	Unnamed AW	337527.9	349376.6
E4	Black Wood AW	336413.8	348570.0
E5	Rhododendron Spinney AW	336354.3	349900.0
E6	Unnamed AW	336969.4	349841.1
E7	Redwither Wood AW	337014.5	350683.2
E8	Clays Plantation AW	337166.9	350995.9
E9	Erlas Black Wood AW	337741.3	349945.9
E10	Vicarage Moss Ramsar	336149.3	353768.9
E11	River Dee and Bala Lake SAC	339782.0	355195.5
E12	River Dee and Bala Lake SAC	341047.8	353352.8
E13	River Dee and Bala Lake SAC	341999.6	351702.6
E14	River Dee and Bala Lake SAC	341603.0	348879.8
E15	River Dee and Bala Lake SAC	340064.1	346822.2

[5] https://magic.defra.gov.uk/MagicMap.aspx

E16	River Dee and Bala Lake SAC	338853.6	346570.9
E17	River Dee and Bala Lake SAC	337925.7	345121.5
E18	River Dee and Bala Lake SAC	336265.1	344275.0
E19	Johnstown Newt Sites SAC	331350.1	346914.9

3.5.7 Reference should be made to Figure 3 for a map of the ecological receptor locations.

3.5.8 Critical loads have been designated within the UK based on the sensitivity and relevant features of the receiving habitat. A review of the APIS[6] website was undertaken in order to identify the most suitable habitat description and associated critical load for the area of each designation considered within the assessment.

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

Table 7 Critical Loads for Nitrogen Deposition

Receptor	Site Interest Feature	Relevant Nitrogen Critical Load Class	Nitrogen Critical Load (kgN/ha/yr)	
			Low	High
E1	Broadleaved, Mixed and Yew Woodland	Broadleaved deciduous woodland	10	15
E2	Broadleaved, Mixed and Yew Woodland	Broadleaved deciduous woodland	10	15
E3	Broadleaved, Mixed and Yew Woodland	Broadleaved deciduous woodland	10	15
E4	Broadleaved, Mixed and Yew Woodland	Broadleaved deciduous woodland	10	15
E5	Broadleaved, Mixed and Yew Woodland	Broadleaved deciduous woodland	10	15
E6	Broadleaved, Mixed and Yew Woodland	Broadleaved deciduous woodland	10	15
E7	Broadleaved, Mixed and Yew Woodland	Broadleaved deciduous woodland	10	15
E8	Broadleaved, Mixed and Yew Woodland	Broadleaved deciduous woodland	10	15
E9	Broadleaved, Mixed and Yew Woodland	Broadleaved deciduous woodland	10	15
E10	Standing Water	Site specific advice should be sought	-	-
E11	Luronium natans	Permanent oligotrophic lakes, ponds and pools (including softwater lakes)	2	10
E12	Luronium natans	Permanent oligotrophic lakes, ponds and pools (including softwater lakes)	2	10
E13	Luronium natans	Permanent oligotrophic lakes, ponds and pools (including softwater lakes)	2	10

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

Receptor	Site Interest Feature	Relevant Nitrogen Critical Load Class	Nitrogen Critical Load (kgN/ha/yr)	
			Low	High
E14	Luronium natans	Permanent oligotrophic lakes, ponds and pools (including softwater lakes)	2	10
E15	Luronium natans	Permanent oligotrophic lakes, ponds and pools (including softwater lakes)	2	10
E16	Luronium natans	Permanent oligotrophic lakes, ponds and pools (including softwater lakes)	2	10
E17	Luronium natans	Permanent oligotrophic lakes, ponds and pools (including softwater lakes)	2	10
E18	Luronium natans	Permanent oligotrophic lakes, ponds and pools (including softwater lakes)	2	10
E19	Triturus cristatus	No comparable habitat with established critical load estimate available	-	-

3.5.10 The critical loads for acid deposition are presented in Table 8.

Table 8 Critical Loads for Acid Deposition

Designation	Interest Feature	Relevant Acidity Critical Load Class	Acid Critical Load (keq/ha/yr)		
			CLMinN	CLMaxS	CLMaxN
Unnamed AW	Broadleaved, Mixed and Yew Woodland	Broadleafed/Coniferous unmanaged woodland	0.357	1.400	1.757
Unnamed AW	Broadleaved, Mixed and Yew Woodland	Broadleafed/Coniferous unmanaged woodland	0.357	1.401	1.758
Unnamed AW	Broadleaved, Mixed and Yew Woodland	Broadleafed/Coniferous unmanaged woodland	0.357	1.400	1.757
Black Wood AW	Broadleaved, Mixed and Yew Woodland	Broadleafed/Coniferous unmanaged woodland	0.357	1.403	1.760
Rhododendron Spinney AW	Broadleaved, Mixed and Yew Woodland	Broadleafed/Coniferous unmanaged woodland	0.357	1.402	1.759
Unnamed AW	Broadleaved, Mixed and Yew Woodland	Broadleafed/Coniferous unmanaged woodland	0.357	1.382	1.739
Redwither Wood AW	Broadleaved, Mixed and Yew Woodland	Broadleafed/Coniferous unmanaged woodland	0.357	1.382	1.739
Clays Plantation AW	Broadleaved, Mixed and Yew	Broadleafed/Coniferous unmanaged woodland	0.357	1.400	1.757

Designation	Interest Feature	Relevant Acidity Critical Load Class	Acid Critical Load (keq/ha/yr)		
			CLMinN	CLMaxS	CLMaxN
	Woodland				
Erlas Black Wood AW	Broadleaved, Mixed and Yew Woodland	Broadleafed/Coniferous unmanaged woodland	0.357	1.400	1.757
Vicarage Moss Ramsar	Standing Water	Not Sensitive	-	-	-
River Dee and Bala Lake SAC	Old sessile oak woods with Ilex and Blechnum in the British Isles	Unmanaged Broadleafed/Coniferous Woodland	0.142	0.743	1.075
River Dee and Bala Lake SAC	Old sessile oak woods with Ilex and Blechnum in the British Isles	Unmanaged Broadleafed/Coniferous Woodland	0.142	0.743	1.075
River Dee and Bala Lake SAC	Old sessile oak woods with Ilex and Blechnum in the British Isles	Unmanaged Broadleafed/Coniferous Woodland	0.142	0.743	1.075
River Dee and Bala Lake SAC	Old sessile oak woods with Ilex and Blechnum in the British Isles	Unmanaged Broadleafed/Coniferous Woodland	0.142	0.743	1.075
River Dee and Bala Lake SAC	Old sessile oak woods with Ilex and Blechnum in the British Isles	Unmanaged Broadleafed/Coniferous Woodland	0.142	0.743	1.075
River Dee and Bala Lake SAC	Old sessile oak woods with Ilex and Blechnum in the British Isles	Unmanaged Broadleafed/Coniferous Woodland	0.142	0.743	1.075
River Dee and Bala Lake SAC	Old sessile oak woods with Ilex and Blechnum in the British Isles	Unmanaged Broadleafed/Coniferous Woodland	0.142	0.743	1.075
River Dee and Bala Lake SAC	Old sessile oak woods with Ilex and Blechnum in the British Isles	Unmanaged Broadleafed/Coniferous Woodland	0.142	0.743	1.075
Johnstown Newt Sites SAC	Triturus cristatus	Not Sensitive	-	-	-

3.5.11 Background annual mean NO_X concentrations and nitrogen and acid deposition rates were obtained from the APIS[7] website. These are summarised in Table 9.

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

Table 9 Baseline Pollution Levels at Ecological Receptors

Receptor		Annual Mean NO_x Conc. ($\mu g/m^3$)	Annual Mean SO_2 Conc. ($\mu g/m^3$)	Baseline Deposition Rate	
				Nitrogen (kgN/ha/yr)	Acid (keq/ha/yr)
E1	Unnamed AW	7.63	1.05	39.16	2.9
E2	Unnamed AW	6.8	0.91	38.76	2.87
E3	Unnamed AW	13.22	1.97	39.42	2.93
E4	Black Wood AW	9.33	1.12	38.32	2.84
E5	Rhododendron Spinney AW	8.36	1.23	38.59	2.87
E6	Unnamed AW	8.36	1.23	38.59	2.87
E7	Redwither Wood AW	14.7	1.78	39.78	2.96
E8	Clays Plantation AW	14.7	1.78	39.78	2.96
E9	Erlas Black Wood AW	13.22	1.97	39.42	2.93
E10	Vicarage Moss Ramsar	8.09	1.26	23.31	1.77
E11	River Dee and Bala Lake SAC	7.14	1.11	24.33	1.82
E12	River Dee and Bala Lake SAC	7.48	1.13	23.94	1.78
E13	River Dee and Bala Lake SAC	6.58	0.91	23.36	1.73
E14	River Dee and Bala Lake SAC	6.25	0.85	22.46	1.68
E15	River Dee and Bala Lake SAC	6.07	0.81	22	1.64
E16	River Dee and Bala Lake SAC	6.86	0.85	22.13	1.65
E17	River Dee and Bala Lake SAC	6.21	0.82	22.05	1.65
E18	River Dee and Bala Lake SAC	6.1	0.8	21.84	1.63
E19	Johnstown Newt Sites SAC	10.66	1.22	21.07	1.59

4 METHODOLOGY

4.1 INTRODUCTION

4.1.1 Emissions from the facility have the potential to cause air quality impacts 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 (v6.0.0.1), 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 scenarios considered in the modelling assessment for human receptors are summarised in Table 10.

Table 10 Human Receptor Assessment Scenarios

Parameter	Modelled As	
	Short Term	**Long Term**
NO_2	99.8th percentile (%ile) 1-hour mean	Annual mean
Total Volatile Organic Compounds (VOCs) (as C_6H_6)	100th %ile 24-hour mean	Annual mean
PM_{10}	90.4th %ile 1-hour mean	Annual mean
SO_2	99.9th %ile 15-minute mean	-
	99.7th %ile 1-hour mean	
	99.2nd %ile 24-hour 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.

4.3.3 The scenarios considered for ecological receptors in the modelling assessment are

summarised in Table 11.

Table 11 Ecological Receptor Assessment Scenarios

Parameter	Modelled As	
	Short Term	**Long Term**
NO_x	24-hour mean	Annual mean
SO_2		
Nitrogen deposition	-	Annual deposition
Acid deposition	-	Annual deposition

4.3.4 Predicted pollutant levels were summarised in the following formats:

- Process Contribution (PC) – Predicted pollutant level as a result of emissions from the facility only; and,
- Predicted Environmental Concentration (PEC) – Total predicted pollutant level as a result of emissions from the facility and existing baseline levels.

4.3.5 Predicted ground level pollutant concentrations and deposition rates were compared with the relevant AQOs, critical levels and critical loads. 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: 336945, 349041, to 338445, 350541. One cartesian grid with a resolution of 10m was used within the model to produce data suitable for contour plotting using the Surfer software package.

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 Information to describe the physical parameters of the emission sources was provided by the Applicant. These are summarised in Table 12.

Table 12 Physical Parameters of Release Points

Emission Point	NGR (m)		Stack Height (m)	Stack Diameter (m)	Exhaust Gas Temperature (°C)
	X	Y			
Yorkshireman boiler 1 & 2	337746.2	349801.2	13.5	0.70	215
Proposed Jenbacher CHP unit	337733.1	349795.7	15.0	0.25	90
Scrubber	337724.9	349815.2	5.0	0.10	24
Heat Exchanger	337667.6	349821.9	7.5	0.70	40

Emission Point	NGR (m)		Stack Height (m)	Stack Diameter (m)	Exhaust Gas Temperature (°C)
	X	Y			
Dust Extractor	337659.1	349824.2	7.5	0.25	38

4.5.2 Emission parameters for each source were derived from the Technical Data Sheets and stack emissions monitoring reports produced by Socotec. The relevant model inputs are summarised in Table 13.

Table 13 Emission Rates

Emission Source	Exhaust Gas Efflux Velocity (m/s)	NO_x Emission Rate (g/s)	SO_2 Emission Rate (g/s)	CO Emission Rate (g/s)	PM_{10} Emission Rate (g/s)	VOC Emission Rate (g/s)
Yorkshireman boiler 1 & 2	17.53	0.2558	0.0034	0.0132	0.004	0.0075
Proposed Jenbacher CHP unit	17.58	0.1623	-	-	-	-
Scrubber	0.10[(a)]	0.000006	0.000008	0.000011	0.000014	0.000003
Heat Exchanger	11.5	0.0015	0.0078	0.0017	0.0111	0.0161
Dust Extractor	10.9	0.0002	0.0019	0.0003	0.0005	0.0012

Note: (a) Efflux velocity set to 0.1m/s to reflect horizontal nature of release point.

4.5.3 Reference should be made to Figure 4 for a map of the emission source locations.

4.6 NO_X TO NO_2 CONVERSION

4.6.1 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.

4.6.2 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 Environment Agency guidance[8], which is endorsed by NRW.

4.7 BUILDING EFFECTS

4.7.1 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

[8] Environmental permitting: air dispersion modelling reports, EA, 2021.

than would arise in the absence of the buildings.

4.7.2 Analysis of the site layout indicated that a number of structures should be included within the model in order to take account of effects on pollutant dispersion. Input geometries are shown in Table 14.

Table 14 Building Geometries

Building	NGR (m)		Height (m)	Length (m)	Width (m)	Angle (°)
	X	Y				
Building – west wing	337663.3	349829.3	6.0	35.3	17.9	208.8
Building - central	337689.3	349780.7	7.5	94.1	74.6	208.6
Building – east wing	337746.8	349796.5	6.0	11.9	13.4	208.0

4.8 METEOROLOGICAL DATA

4.8.1 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.

4.8.2 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.

4.9 ROUGHNESS LENGTH

4.9.1 Roughness length (z_0) is a modelling parameter applied to allow consideration of surface height roughness elements. A z_0 of 0.5m was used to describe the modelling extents and meteorological site. This value is considered appropriate for the morphology of both areas and is suggested within ADMS-6 as being suitable for 'cities, woodlands'.

4.10 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 was used to describe the modelling extents and the meteorological site. This value is considered appropriate for the nature of both areas and is suggested within ADMS-6 as being suitable for 'mixed urban/industrial'.

4.11 TERRAIN DATA

4.11.1 Ordinance 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[9].

4.12 NITROGEN DEPOSITION

4.12.1 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'[10]. 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 15.

Table 15 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

4.12.2 The relevant deposition velocity for each ecological receptor was selected from Table 15 based on the vegetation type present within the designation.

4.13 ACID DEPOSITION

4.13.1 Predicted ground level pollutant 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 16.

Table 16 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
SO_2	0.012	0.024	9.84

4.13.2 The PC proportion of the EQS was calculated using the following formula obtained from the APIS website[11]:

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

[9] Note 105: Setting up Terrain Data for Input to CERC Models, CERC, 2016.
[10] Technical Guidance on Detailed Modelling approach for an Appropriate Assessment for Emissions to Air AQTAG 06, EA, 2014.
[11] https://www.apis.ac.uk/.

4.14 BACKGROUND CONCENTRATIONS

4.14.1 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.

4.14.2 WCBC do not undertake monitoring of NO_2, C_6H_6, PM_{10}, SO_2 or CO within the vicinity of the site. As such, background concentrations predicted by DEFRA, as shown in Table 4, were utilised to represent baseline levels throughout the assessment extents.

4.14.3 Baseline pollutant levels at the ecological receptors were obtained from APIS. These are shown in Table 9.

4.14.4 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'[12], 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.

4.15 ASSESSMENT CRITERIA

Human Receptors

4.15.1 EA guidance 'Air emissions risk assessment for your environmental permit'[13], which is currently endorsed by NRW, 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.

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

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

4.15.3 Should these criteria be exceeded then additional consideration to potential impacts should be provided.

Ecological Receptors

4.15.4 EA guidance 'Air emissions risk assessment for your environmental permit'[14], which is

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

currently endorsed by NRW, states that PCs at SACs 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;
- The long-term PC is less than 1% of the long-term environmental standard for protected conservation areas; or,
- The long-term PC is greater than 1% and the long-term PEC is less than 70% of the long-term environmental standard.

4.15.5 PCs at AWs can be screened as insignificant if they meet the following criteria:

- The short-term PC is less than 100% of the short-term environmental standard for protected conservation areas; and,
- The long-term PC is less than 100% of the long-term environmental standard for protected conservation areas.

4.15.6 Predicted PCs have been compared to the relevant EQSs and the criteria stated above. Where the impact is within these parameters, it can be concluded that impacts associated with an installation are acceptable. Should the criteria be exceeded then additional consideration to potential impacts should be provided.

4.16 MODELLING UNCERTAINTY

4.16.1 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 emissions estimates, operational procedures, land use characteristics and meteorology; and,
- Variability - randomness of measurements used.

4.16.2 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. The analysis was based on the worst-case year for each averaging period 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 derived from the plant specifications and stack emissions monitoring reports. As such, these are considered to be representative of normal operating conditions;
- Emission rates - Emission rates were derived from the plant specifications and stack emissions monitoring reports. As such, these are considered to be representative of normal operating conditions;
- Background concentrations - Background pollutant levels were obtained from the DEFRA and APIS websites. These are considered representative of baseline air quality conditions at sensitive locations within the vicinity of the site;
- 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.

4.16.3 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.

5 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 15 for graphical representations of PECs, inclusive of background levels, 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 averaging period. For example, the maximum annual mean NO_2 concentration was predicted using the 2018 meteorological data set. As such, the contours shown in Figure 6 were produced from the 2018 model outputs.

5.2 MAXIMUM OFF SITE POLLUTANT CONCENTRATIONS

5.2.1 Maximum predicted pollutant concentrations for any meteorological data set are summarised in Table 17.

Table 17 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	2.16	5.4	12.18	30.5
	99.8th %ile 1-hour	200	13.04	6.5	33.08	16.5
SO_2	99.2nd %ile 24-hour	125	1.70	1.4	9.40	7.5
	99.73rd %ile 1-hour	350	3.12	0.9	10.82	3.1
	99.9th %ile 15-minute	266	3.93	1.5	11.63	4.4
PM_{10}	Annual	40	0.75	1.9	13.29	33.2
	24-hour	50	2.18	4.4	27.26	54.5
CO	100th %ile 8-hour rolling	10000	4.08	0.04	512.08	5.1
C_6H_6	Annual	5	1.24	24.8	1.51	30.2
	24-hour	30	7.11	23.7	7.64	25.5

5.2.2 As shown in Table 17, maximum PECs were below the relevant EQSs at all locations.

5.2.3 It should be noted that the assessment assumed constant emissions without allowance for reduced work load or shut down. As such, actual impacts on annual mean concentrations are likely to be lower than those predicted.

5.3 HUMAN RECEPTORS

5.3.1 Predicted concentrations of each pollutant 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 at the sensitive human receptors, inclusive of background levels, are summarised in Table 18.

Table 18 Predicted Annual Mean NO_2 Concentrations

Receptor		Predicted Annual Mean NO_2 PEC (µg/m³)				
		2017	**2018**	**2019**	**2020**	**2021**
R1	Commercial - Village Bakery	10.82	10.66	10.67	10.77	10.52
R2	Commercial - Ardagh Group	11.07	10.79	10.92	10.80	10.92
R3	Residential - Coed Aben Road	10.22	10.25	10.24	10.25	10.28
R4	Commercial - Minuteman Press Printing	10.11	10.17	10.12	10.16	10.16
R5	Commercial - Alan Rhone Ltd	10.11	10.22	10.12	10.18	10.21
R6	Commercial - Zaviz International Ltd	10.13	10.24	10.13	10.20	10.25
R7	Commercial - Broadway Leisure Caravan Service Centre	10.11	10.20	10.11	10.18	10.18
R8	Residential - Erlas Lane	10.07	10.10	10.10	10.10	10.09
R9	Commercial - Village Bakery	10.17	10.28	10.25	10.27	10.25
R10	Commercial Unit	10.81	10.97	11.01	10.87	10.90

5.3.3 As indicated in Table 18, NO_2 PECs were below the annual mean EQS of 40µg/m³ at all human receptor locations for all meteorological data sets.

5.3.4 Reference should be made to Figure 6 for a graphical representation of predicted concentrations throughout the assessment extents.

5.3.5 Maximum predicted annual mean NO_2 concentrations at the human receptor locations are summarised in Table 19.

Table 19 Maximum Predicted Annual Mean NO_2 Concentrations

Receptor		Maximum Predicted Annual Mean NO_2 Concentration (µg/m²)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Commercial - Village Bakery	0.80	10.82	2.0	27.1
R2	Commercial - Ardagh Group	1.05	11.07	2.6	27.7
R3	Residential - Coed Aben Road	0.26	10.28	0.6	25.7
R4	Commercial - Minuteman Press Printing	0.15	10.17	0.4	25.4
R5	Commercial - Alan Rhone Ltd	0.20	10.22	0.5	25.5
R6	Commercial - Zaviz International Ltd	0.23	10.25	0.6	25.6
R7	Commercial - Broadway Leisure Caravan Service Centre	0.18	10.20	0.4	25.5
R8	Residential - Erlas Lane	0.08	10.10	0.2	25.2
R9	Commercial - Village Bakery	0.26	10.28	0.6	25.7
R10	Commercial Unit	0.99	11.01	2.5	27.5

5.3.6 As indicated in Table 19, PECs were below 70% of the EQS at all receptors. As such, impacts are not considered to be significant.

5.3.7 Predicted 99.8th %ile 1-hour mean NO_2 PECs at the sensitive human receptors, inclusive of background levels, are summarised in Table 20.

Table 20 Predicted 99.8th %ile 1-hour Mean NO_2 Concentrations

Receptor		Predicted 99.8th %ile 1-hour Mean NO_2 PEC (µg/m³)				
		2017	2018	2019	2020	2021
R1	Commercial - Village Bakery	24.37	24.35	24.31	24.33	24.33
R2	Commercial - Ardagh Group	24.90	24.87	24.89	24.90	24.90
R3	Residential - Coed Aben Road	23.01	23.09	23.14	23.13	23.11
R4	Commercial - Minuteman Press Printing	22.87	23.08	22.91	23.04	23.12
R5	Commercial - Alan Rhone Ltd	23.36	23.53	23.23	23.40	23.57

Receptor		Predicted 99.8th %ile 1-hour Mean NO_2 PEC (µg/m³)				
		2017	2018	2019	2020	2021
R6	Commercial - Zaviz International Ltd	23.53	23.67	23.51	23.59	23.77
R7	Commercial - Broadway Leisure Caravan Service Centre	23.11	23.19	23.18	23.28	23.41
R8	Residential - Erlas Lane	21.40	21.46	21.48	21.51	21.48
R9	Commercial - Village Bakery	23.87	24.09	24.04	24.10	24.03
R10	Commercial Unit	26.67	26.64	26.66	26.63	26.82

5.3.8 As indicated in Table 20, 99.8th %ile 1-hour mean NO_2 PECs were below the EQS of 200µg/m³ at all human receptor locations for all meteorological data sets.

5.3.9 Reference should be made to Figure 7 for a graphical representation of predicted concentrations throughout the assessment extents.

5.3.10 Maximum predicted 99.8th %ile 1-hour mean NO_2 concentrations at the human receptor locations are summarised in Table 21.

Table 21 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	Commercial - Village Bakery	4.33	24.37	2.2	2.4
R2	Commercial - Ardagh Group	4.86	24.90	2.4	2.7
R3	Residential - Coed Aben Road	3.10	23.14	1.5	1.7
R4	Commercial - Minuteman Press Printing	3.08	23.12	1.5	1.7
R5	Commercial - Alan Rhone Ltd	3.53	23.57	1.8	2.0
R6	Commercial - Zaviz International Ltd	3.73	23.77	1.9	2.1
R7	Commercial - Broadway Leisure Caravan Service Centre	3.37	23.41	1.7	1.9
R8	Residential - Erlas Lane	1.47	21.51	0.7	0.8
R9	Commercial - Village Bakery	4.06	24.10	2.0	2.3
R10	Commercial Unit	6.78	26.82	3.4	3.8

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

5.3.11 As indicated in Table 21, the PC proportion of EQS was below 10% at all receptors. As such, impacts are not considered to be significant.

Sulphur Dioxide

5.3.12 Predicted 99.2nd %ile 24-hour mean SO_2 PECs at the human receptor locations are summarised in Table 22.

Table 22 Predicted 99.2nd %ile 24-hour Mean SO_2 Concentrations

Receptor		Predicted 99.2nd %ile 24-hour Mean SO_2 PEC (µg/m^3)				
		2017	2018	2019	2020	2021
R1	Commercial - Village Bakery	7.86	7.87	7.87	7.88	7.86
R2	Commercial - Ardagh Group	7.91	7.93	7.89	7.91	7.93
R3	Residential - Coed Aben Road	7.81	7.83	7.84	7.81	7.83
R4	Commercial - Minuteman Press Printing	7.76	7.79	7.79	7.80	7.79
R5	Commercial - Alan Rhone Ltd	7.79	7.81	7.77	7.82	7.82
R6	Commercial - Zaviz International Ltd	7.84	7.86	7.79	7.83	7.89
R7	Commercial - Broadway Leisure Caravan Service Centre	7.88	7.93	7.86	7.88	7.98
R8	Residential - Erlas Lane	7.74	7.74	7.74	7.76	7.75
R9	Commercial - Village Bakery	7.94	7.97	7.97	8.02	8.03
R10	Commercial Unit	8.60	8.64	8.64	8.62	8.62

5.3.13 As indicated in Table 22, predicted 99.2nd %ile 24-hour mean SO_2 PECs were below the EQS of 125µg/m^3 at all human receptor locations. Reference should be made to Figure 7 for a graphical representation of predicted concentrations throughout the assessment extents.

5.3.14 Maximum predicted 99.2nd %ile 24-hour mean SO_2 concentrations at the receptor locations are summarised in Table 23.

Table 23 Maximum Predicted 99.2nd %ile 24-hour Mean SO_2 Concentrations

Receptor		Maximum Predicted 99.2nd %ile 24-hour Mean SO_2 Concentration (µg/m³)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[(a)]
		PC	PEC		
R1	Commercial - Village Bakery	0.18	7.88	0.14	0.15
R2	Commercial - Ardagh Group	0.23	7.93	0.18	0.20
R3	Residential - Coed Aben Road	0.14	7.84	0.12	0.12
R4	Commercial - Minuteman Press Printing	0.10	7.80	0.08	0.08
R5	Commercial - Alan Rhone Ltd	0.12	7.82	0.10	0.10
R6	Commercial - Zaviz International Ltd	0.19	7.89	0.15	0.16
R7	Commercial - Broadway Leisure Caravan Service Centre	0.28	7.98	0.22	0.24
R8	Residential - Erlas Lane	0.06	7.76	0.04	0.05
R9	Commercial - Village Bakery	0.33	8.03	0.26	0.28
R10	Commercial Unit	0.94	8.64	0.75	0.80

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

5.3.15 As indicated in Table 23, PCs were below 10% of the EQS at all receptors. As such, impacts are not considered to be significant.

5.3.16 Predicted 99.7th %ile 1-hour mean SO_2 PECs at the human receptor locations are summarised in Table 24.

Table 24 Predicted 99.7th %ile 1-hour Mean SO_2 Concentrations

Receptor		Predicted 99.7th %ile 1-hour Mean SO_2 PEC (µg/m³)				
		2017	2018	2019	2020	2021
R1	Commercial - Village Bakery	8.06	8.05	8.07	8.07	8.07
R2	Commercial - Ardagh Group	8.08	8.08	8.07	8.07	8.09
R3	Residential - Coed Aben Road	7.97	8.01	7.99	8.00	8.00
R4	Commercial - Minuteman Press Printing	7.97	7.96	7.97	7.98	7.97
R5	Commercial - Alan Rhone Ltd	7.97	8.01	8.00	8.02	8.02

Receptor		Predicted 99.7th %ile 1-hour Mean SO_2 PEC (µg/m³)				
		2017	2018	2019	2020	2021
R6	Commercial - Zaviz International Ltd	8.06	8.12	8.06	8.09	8.13
R7	Commercial - Broadway Leisure Caravan Service Centre	8.17	8.19	8.20	8.19	8.18
R8	Residential - Erlas Lane	7.84	7.86	7.86	7.86	7.86
R9	Commercial - Village Bakery	8.40	8.46	8.47	8.45	8.46
R10	Commercial Unit	9.10	9.10	9.11	9.10	9.11

5.3.17 As indicated in Table 24, predicted 99.7th %ile 1-hour mean SO_2 PECs were below the EQS of 350µg/m³ at all human receptor locations. Reference should be made to Figure 8 for a graphical representation of predicted concentrations throughout the assessment extents.

5.3.18 Maximum predicted 99.7th %ile 1-hour mean SO_2 concentrations at the human receptor locations are summarised in Table 25.

Table 25 Maximum Predicted 99.7th %ile 1-hour Mean SO_2 Concentrations

Receptor		Maximum Predicted 99.7th %ile 1-hour Mean SO_2 Concentration (µg/m³)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[(a)]
		PC	PEC		
R1	Commercial - Village Bakery	0.37	8.07	0.11	0.11
R2	Commercial - Ardagh Group	0.39	8.09	0.11	0.12
R3	Residential - Coed Aben Road	0.31	8.01	0.09	0.09
R4	Commercial - Minuteman Press Printing	0.28	7.98	0.08	0.08
R5	Commercial - Alan Rhone Ltd	0.32	8.02	0.09	0.09
R6	Commercial - Zaviz International Ltd	0.43	8.13	0.12	0.13
R7	Commercial - Broadway Leisure Caravan Service Centre	0.50	8.20	0.14	0.14
R8	Residential - Erlas Lane	0.16	7.86	0.05	0.05
R9	Commercial - Village Bakery	0.77	8.47	0.22	0.22
R10	Commercial Unit	1.41	9.11	0.40	0.41

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

5.3.19 As indicated in Table 25, PCs were below 10% of the EQS at all receptor locations. As such, predicted effects on 1-hour mean SO_2 concentrations are not considered to be significant, in accordance with the stated criteria.

5.3.20 Predicted 99.9th %ile 15-min mean SO_2 PECs at the sensitive human receptors are summarised in Table 26.

Table 26 Predicted 99.9th %ile 15-minute Mean SO_2 Concentrations

Receptor		Predicted 99.9th %ile 15-minute Mean SO_2 PEC (µg/m^3)				
		2017	2018	2019	2020	2021
R1	Commercial - Village Bakery	8.23	8.22	8.25	8.24	8.26
R2	Commercial - Ardagh Group	8.26	8.26	8.24	8.24	8.26
R3	Residential - Coed Aben Road	8.11	8.16	8.15	8.15	8.16
R4	Commercial - Minuteman Press Printing	8.15	8.18	8.11	8.14	8.12
R5	Commercial - Alan Rhone Ltd	8.17	8.19	8.15	8.22	8.21
R6	Commercial - Zaviz International Ltd	8.20	8.31	8.25	8.27	8.35
R7	Commercial - Broadway Leisure Caravan Service Centre	8.39	8.34	8.37	8.42	8.34
R8	Residential - Erlas Lane	7.89	7.96	7.96	7.90	7.95
R9	Commercial - Village Bakery	8.63	8.63	8.69	8.61	8.66
R10	Commercial Unit	9.30	9.32	9.32	9.31	9.35

5.3.21 As indicated in Table 26, predicted 99.9th %ile 15-min mean SO_2 PECs were below the EQS of 266µg/m^3 at all human receptor locations. Reference should be made to Figure 9 for a graphical representation of predicted concentrations throughout the assessment extents.

5.3.22 Maximum predicted 99.9th %ile 15-min mean SO_2 concentrations at the receptor locations are summarised in Table 27.

Table 27 Maximum Predicted 99.9th %ile 15-min Mean SO_2 Concentrations

Receptor		Maximum Predicted 99.9th %ile 15-minute Mean SO_2 Concentration (µg/m^3)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[(a)]
		PC	PEC		
R1	Commercial - Village Bakery	0.56	8.26	0.21	0.22

Receptor		Maximum Predicted 99.9th %ile 15-minute Mean SO_2 Concentration (µg/m³)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[a]
		PC	PEC		
R2	Commercial - Ardagh Group	0.56	8.26	0.21	0.22
R3	Residential - Coed Aben Road	0.46	8.16	0.17	0.18
R4	Commercial - Minuteman Press Printing	0.48	8.18	0.18	0.18
R5	Commercial - Alan Rhone Ltd	0.52	8.22	0.20	0.20
R6	Commercial - Zaviz International Ltd	0.65	8.35	0.24	0.25
R7	Commercial - Broadway Leisure Caravan Service Centre	0.72	8.42	0.27	0.28
R8	Residential - Erlas Lane	0.26	7.96	0.10	0.10
R9	Commercial - Village Bakery	0.99	8.69	0.37	0.38
R10	Commercial Unit	1.65	9.35	0.62	0.64

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

5.3.23 As indicated in Table 27, PCs were below 10% of the EQS at all receptor locations. As such, predicted effects on 15-min mean SO_2 concentrations are not considered to be significant, in accordance with the stated criteria.

Particulate Matter

5.3.24 Predicted annual mean PM_{10} PECs at the sensitive human receptors, inclusive of background levels, are summarised in Table 28.

Table 28 Predicted Annual Mean PM_{10} Concentrations

Receptor		Predicted Annual Mean PM_{10} PEC (µg/m³)				
		2017	2018	2019	2020	2021
R1	Commercial - Village Bakery	12.63	12.61	12.61	12.62	12.60
R2	Commercial - Ardagh Group	12.64	12.62	12.63	12.62	12.63
R3	Residential - Coed Aben Road	12.58	12.59	12.58	12.58	12.59
R4	Commercial - Minuteman Press Printing	12.56	12.56	12.56	12.56	12.57
R5	Commercial - Alan Rhone Ltd	12.55	12.56	12.55	12.56	12.56

Receptor		Predicted Annual Mean PM_{10} PEC (µg/m³)				
		2017	2018	2019	2020	2021
R6	Commercial - Zaviz International Ltd	12.55	12.57	12.56	12.57	12.57
R7	Commercial - Broadway Leisure Caravan Service Centre	12.56	12.58	12.56	12.57	12.58
R8	Residential - Erlas Lane	12.55	12.55	12.55	12.55	12.55
R9	Commercial - Village Bakery	12.57	12.60	12.59	12.60	12.59
R10	Commercial Unit	13.03	13.06	13.07	13.04	13.04

5.3.25 As indicated in Table 28, PM_{10} PECs were below the annual mean EQS of 40µg/m³ at all human receptor locations for all meteorological data sets.

5.3.26 Maximum predicted annual mean PM_{10} concentrations at the receptor locations are summarised in Table 29. Reference should be made to Figure 8 for a graphical representation of predicted concentrations throughout the assessment extents.

Table 29 Maximum Predicted Annual Mean PM_{10} Concentrations

Receptor		Maximum Predicted Annual Mean PM_{10} Concentration (µg/m²)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Commercial - Village Bakery	0.09	12.63	0.23	31.58
R2	Commercial - Ardagh Group	0.10	12.64	0.26	31.61
R3	Residential - Coed Aben Road	0.05	12.59	0.13	31.48
R4	Commercial - Minuteman Press Printing	0.03	12.57	0.06	31.41
R5	Commercial - Alan Rhone Ltd	0.02	12.56	0.06	31.41
R6	Commercial - Zaviz International Ltd	0.03	12.57	0.08	31.43
R7	Commercial - Broadway Leisure Caravan Service Centre	0.04	12.58	0.09	31.44
R8	Residential - Erlas Lane	0.01	12.55	0.02	31.37
R9	Commercial - Village Bakery	0.06	12.60	0.15	31.50
R10	Commercial Unit	0.53	13.07	1.33	32.68

5.3.27 As indicated in Table 29, PECs were below 70% of the EQS at all receptors. As such, impacts are not considered to be significant.

5.3.28 Predicted 90.4th %ile 24-hour mean PM_{10} PECs, inclusive of background levels, are summarised in Table 30.

Table 30 Predicted 90.4th %ile 24-hour Mean PM_{10} Concentrations

Receptor		Predicted 90.4th %ile 24-hour Mean PM_{10} PEC (µg/m^3)				
		2017	2018	2019	2020	2021
R1	Commercial - Village Bakery	25.34	25.31	25.31	25.36	25.27
R2	Commercial - Ardagh Group	25.38	25.30	25.35	25.31	25.34
R3	Residential - Coed Aben Road	25.22	25.23	25.23	25.22	25.24
R4	Commercial - Minuteman Press Printing	25.15	25.16	25.15	25.15	25.16
R5	Commercial - Alan Rhone Ltd	25.13	25.16	25.13	25.15	25.15
R6	Commercial - Zaviz International Ltd	25.12	25.21	25.13	25.18	25.16
R7	Commercial - Broadway Leisure Caravan Service Centre	25.11	25.21	25.14	25.18	25.17
R8	Residential - Erlas Lane	25.10	25.12	25.11	25.11	25.11
R9	Commercial - Village Bakery	25.17	25.26	25.25	25.29	25.27
R10	Commercial Unit	26.53	26.54	26.51	26.48	26.45

5.3.29 As indicated in Table 30, 24-hour mean PM_{10} PECs were below the EQS of 50µg/m^3 at all human receptor locations for all meteorological data sets.

5.3.30 Maximum predicted 90.4th %ile 24-hour mean PM_{10} concentrations at the receptor locations are summarised in Table 31. Reference should be made to Figure 9 for a graphical representation of predicted concentrations throughout the assessment extents.

Table 31 Maximum Predicted 90.4th %ile 24-hour Mean PM_{10} Concentrations

Receptor		Maximum Predicted 90.4th %ile 24-hour Mean PM_{10} Concentration (µg/m^3)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[(a)]
		PC	PEC		
R1	Commercial - Village Bakery	0.28	25.36	0.56	1.12
R2	Commercial - Ardagh Group	0.30	25.38	0.60	1.19
R3	Residential - Coed Aben Road	0.16	25.24	0.32	0.65

Receptor		Maximum Predicted 90.4th %ile 24-hour Mean PM_{10} Concentration (µg/m³)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[a]
		PC	PEC		
R4	Commercial - Minuteman Press Printing	0.08	25.16	0.17	0.34
R5	Commercial - Alan Rhone Ltd	0.08	25.16	0.17	0.33
R6	Commercial - Zaviz International Ltd	0.13	25.21	0.26	0.52
R7	Commercial - Broadway Leisure Caravan Service Centre	0.13	25.21	0.26	0.52
R8	Residential - Erlas Lane	0.04	25.12	0.08	0.15
R9	Commercial - Village Bakery	0.28	25.36	0.56	1.12
R10	Commercial Unit	0.30	25.38	0.60	1.19

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

5.3.31 As indicated in Table 31, PCs were below 10% of the EQS at all human receptor locations. As such, predicted effects on 24-hour mean PM_{10} concentrations are not considered to be significant.

Carbon Monoxide

5.3.32 Predicted 100th %ile 8-hour rolling mean CO PECs at the human receptor locations are summarised in Table 32.

Table 32 Predicted 100th %ile 8-hour Rolling Mean CO Concentrations

Receptor		Predicted 100th %ile 8-hour Rolling Mean CO PEC (µg/m³)				
		2017	2018	2019	2020	2021
R1	Commercial - Village Bakery	508.65	508.64	508.63	508.64	508.63
R2	Commercial - Ardagh Group	508.82	508.81	508.85	508.80	508.83
R3	Residential - Coed Aben Road	508.46	508.47	508.49	508.45	508.49
R4	Commercial - Minuteman Press Printing	508.47	508.47	508.45	508.46	508.45
R5	Commercial - Alan Rhone Ltd	508.48	508.54	508.44	508.51	508.56
R6	Commercial - Zaviz International Ltd	508.60	508.66	508.63	508.59	508.69
R7	Commercial - Broadway Leisure Caravan Service Centre	508.73	508.78	508.80	508.68	508.76

Receptor		Predicted 100th %ile 8-hour Rolling Mean CO PEC (µg/m³)				
		2017	2018	2019	2020	2021
R8	Residential - Erlas Lane	508.25	508.26	508.30	508.25	508.27
R9	Commercial - Village Bakery	509.25	509.19	509.43	509.25	509.24
R10	Commercial Unit	509.94	509.93	510.00	509.93	510.02

5.3.33 As indicated in Table 32, predicted CO concentrations were below the 8-hour rolling mean EQS of 10,000µg/m³ at all human receptor locations. Reference should be made to Figure 10 for a graphical representation of predicted concentrations throughout the assessment extents.

5.3.34 Maximum predicted 100th %ile 8-hour rolling mean CO concentrations at the human receptor locations are summarised in Table 33.

Table 33 Maximum Predicted 100th %ile 8-hour Rolling Mean CO Concentrations

Receptor		Maximum Predicted 100th %ile 8-hour Rolling Mean CO Concentration (µg/m³)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)(a)
		PC	PEC		
R1	Commercial - Village Bakery	0.65	508.65	0.01	0.01
R2	Commercial - Ardagh Group	0.85	508.85	0.01	0.01
R3	Residential - Coed Aben Road	0.49	508.49	0.00	0.01
R4	Commercial - Minuteman Press Printing	0.47	508.47	0.00	0.00
R5	Commercial - Alan Rhone Ltd	0.56	508.56	0.01	0.01
R6	Commercial - Zaviz International Ltd	0.69	508.69	0.01	0.01
R7	Commercial - Broadway Leisure Caravan Service Centre	0.80	508.80	0.01	0.01
R8	Residential - Erlas Lane	0.30	508.30	0.00	0.00
R9	Commercial - Village Bakery	1.43	509.43	0.01	0.02
R10	Commercial Unit	2.02	510.02	0.02	0.02

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

5.3.35 As indicated in Table 33, PCs were below 10% of the AQO at all receptor locations. As such, predicted effects on 100th %ile 8-hour rolling mean CO concentrations are not considered to be significant, in accordance with the stated criteria.

Volatile Organic Compounds

5.3.36 Predicted annual mean VOC (as C_6H_6) PECs at the human receptors, inclusive of background levels, are summarised in Table 34.

Table 34 Predicted Annual Mean VOC (as C_6H_6) Concentrations

Receptor		Predicted Annual Mean VOC (as C_6H_6) PEC (µg/m³)				
		2017	2018	2019	2020	2021
R1	Commercial - Village Bakery	0.43	0.39	0.39	0.41	0.37
R2	Commercial - Ardagh Group	0.44	0.40	0.42	0.40	0.42
R3	Residential - Coed Aben Road	0.33	0.34	0.34	0.34	0.36
R4	Commercial - Minuteman Press Printing	0.30	0.31	0.30	0.31	0.31
R5	Commercial - Alan Rhone Ltd	0.29	0.31	0.29	0.30	0.30
R6	Commercial - Zaviz International Ltd	0.29	0.32	0.29	0.31	0.32
R7	Commercial - Broadway Leisure Caravan Service Centre	0.30	0.33	0.30	0.32	0.33
R8	Residential - Erlas Lane	0.28	0.28	0.28	0.28	0.28
R9	Commercial - Village Bakery	0.32	0.37	0.36	0.36	0.36
R10	Commercial Unit	1.08	1.14	1.16	1.10	1.11

5.3.37 As indicated in Table 34, predicted VOC (as C_6H_6) PECs were below the annual mean EQS of 5µg/m³ at all human receptor locations for all meteorological data sets.

5.3.38 Maximum predicted annual mean VOC (as C_6H_6) concentrations at the receptor locations are summarised in Table 35. Reference should be made to Figure 10 for a graphical representation of predicted concentrations throughout the assessment extents.

Table 35 Maximum Predicted Annual Mean VOC (as C_6H_6) Concentrations

Receptor		Predicted Annual Mean VOC (as C_6H_6) Concentration (µg/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R1	Commercial - Village Bakery	0.16	0.43	3.15	8.51
R2	Commercial - Ardagh Group	0.18	0.44	3.52	8.88

Receptor		Predicted Annual Mean VOC (as C_6H_6) Concentration (µg/m³)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
R3	Residential - Coed Aben Road	0.09	0.36	1.74	7.10
R4	Commercial - Minuteman Press Printing	0.04	0.31	0.84	6.20
R5	Commercial - Alan Rhone Ltd	0.04	0.31	0.75	6.11
R6	Commercial - Zaviz International Ltd	0.05	0.32	1.03	6.39
R7	Commercial - Broadway Leisure Caravan Service Centre	0.06	0.33	1.21	6.57
R8	Residential - Erlas Lane	0.02	0.28	0.33	5.69
R9	Commercial - Village Bakery	0.10	0.37	1.99	7.35
R10	Commercial Unit	0.89	1.16	17.88	23.24

5.3.39 As indicated in Table 35, PECs were below 70% of the EQS at all receptors. As such, impacts are not considered to be significant.

5.3.40 Predicted 100th %ile 24-mean VOC (as C_6H_6) PECs, inclusive of background levels, are summarised in Table 36.

Table 36 Predicted 100th %ile 24-hour Mean VOC (as C_6H_6) Concentrations

Receptor		Predicted 100th %ile 24-hour Mean VOC (as C_6H_6) PEC (µg/m³)				
		2017	2018	2019	2020	2021
R1	Commercial - Village Bakery	1.33	1.30	1.30	1.31	1.23
R2	Commercial - Ardagh Group	1.49	1.50	1.54	1.40	1.52
R3	Residential - Coed Aben Road	1.00	1.08	1.22	1.02	1.27
R4	Commercial - Minuteman Press Printing	1.07	1.03	1.06	0.99	0.94
R5	Commercial - Alan Rhone Ltd	0.99	1.01	1.01	1.08	1.14
R6	Commercial - Zaviz International Ltd	1.12	1.23	1.02	1.15	1.57
R7	Commercial - Broadway Leisure Caravan Service Centre	1.61	1.59	1.27	1.40	1.77
R8	Residential - Erlas Lane	0.75	0.83	0.74	0.82	0.78

Receptor		Predicted 100th %ile 24-hour Mean VOC (as C_6H_6) PEC (µg/m³)				
		2017	2018	2019	2020	2021
R9	Commercial - Village Bakery	1.78	2.52	1.57	2.18	2.09
R10	Commercial Unit	4.17	3.94	4.35	4.17	4.28

5.3.41 As indicated in Table 36, 100th %ile 24-hour mean VOC (as C_6H_6) PECs were below the EQS of 30µg/m³ at all human receptor locations for all meteorological data sets.

5.3.42 Maximum predicted 100th %ile 1-hour mean VOC concentrations at the human receptor locations are summarised in Table 37. Reference should be made to Figure 11 for a graphical representation of predicted concentrations throughout the assessment extents.

Table 37 Maximum Predicted 100th %ile 24-hour Mean VOC (as (C_6H_6) Concentrations

Receptor		Maximum Predicted 100th %ile 24-hour Mean VOC (as C_6H_6) Concentration (µg/m³)		PC Proportion of EQS (%)	PC Proportion of EQS Headroom (%)[(a)]
		PC	PEC		
R1	Commercial - Village Bakery	0.80	1.33	2.7	2.7
R2	Commercial - Ardagh Group	1.00	1.54	3.3	3.4
R3	Residential - Coed Aben Road	0.73	1.27	2.4	2.5
R4	Commercial - Minuteman Press Printing	0.54	1.07	1.8	1.8
R5	Commercial - Alan Rhone Ltd	0.60	1.14	2.0	2.1
R6	Commercial - Zaviz International Ltd	1.03	1.57	3.4	3.5
R7	Commercial - Broadway Leisure Caravan Service Centre	1.23	1.77	4.1	4.2
R8	Residential - Erlas Lane	0.30	0.83	1.0	1.0
R9	Commercial - Village Bakery	1.98	2.52	6.6	6.7
R10	Commercial Unit	3.81	4.35	12.7	12.9

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

5.3.43 As indicated in Table 37, PCs were below 20% of the EQS headroom at all human receptor locations. As such, predicted effects on 24-hour mean VOC concentrations are not considered to be significant.

5.4 ECOLOGICAL RECEPTORS

5.4.1 Predicted concentrations and deposition rates of each pollutant at the 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 ecological receptor locations, inclusive of background levels, are summarised in Table 38.

Table 38 Predicted Annual Mean NO_x Concentrations

Receptor		Predicted Annual Mean NO_x PEC (µg/m³)				
		2017	**2018**	**2019**	**2020**	**2021**
E1	Unnamed AW	7.67	7.68	7.68	7.68	7.68
E2	Unnamed AW	6.82	6.82	6.82	6.82	6.82
E3	Unnamed AW	13.26	13.31	13.27	13.30	13.30
E4	Black Wood AW	9.34	9.35	9.34	9.34	9.35
E5	Rhododendron Spinney AW	8.37	8.38	8.38	8.38	8.38
E6	Unnamed AW	8.38	8.40	8.40	8.40	8.40
E7	Redwither Wood AW	14.83	14.84	14.85	14.82	14.84
E8	Clays Plantation AW	14.85	14.86	14.87	14.85	14.87
E9	Erlas Black Wood AW	14.44	14.50	14.51	14.49	14.41
E10	Vicarage Moss Ramsar	8.12	8.12	8.12	8.12	8.12
E11	River Dee and Bala Lake SAC	7.15	7.15	7.15	7.15	7.15
E12	River Dee and Bala Lake SAC	7.49	7.49	7.49	7.49	7.49
E13	River Dee and Bala Lake SAC	6.59	6.59	6.59	6.59	6.59
E14	River Dee and Bala Lake SAC	6.27	6.26	6.27	6.27	6.26
E15	River Dee and Bala Lake SAC	6.09	6.10	6.09	6.09	6.10
E16	River Dee and Bala Lake SAC	6.87	6.88	6.87	6.87	6.88
E17	River Dee and Bala Lake SAC	6.21	6.21	6.21	6.21	6.21
E18	River Dee and Bala Lake SAC	6.10	6.10	6.10	6.10	6.10
E19	Johnstown Newt Sites SAC	10.66	10.66	10.66	10.66	10.66

5.4.3 As indicated in Table 38, annual mean NO_X PECs were below the EQS of 30µg/m³ at all ecological receptors for all meteorological data sets.

5.4.4 Maximum predicted annual mean NO_x concentrations at the ecological receptor locations are summarised in Table 39.

Table 39 Maximum Predicted Annual Mean NO_X Concentrations

Receptor		Maximum Predicted Annual Mean NO_X Concentration ($\mu g/m^2$)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E1	Unnamed AW	0.05	7.68	0.18	25.62
E2	Unnamed AW	0.02	6.82	0.06	22.73
E3	Unnamed AW	0.09	13.31	0.29	44.36
E4	Black Wood AW	0.02	9.35	0.06	31.16
E5	Rhododendron Spinney AW	0.02	8.38	0.06	27.93
E6	Unnamed AW	0.04	8.40	0.15	28.01
E7	Redwither Wood AW	0.15	14.85	0.48	49.48
E8	Clays Plantation AW	0.17	14.87	0.56	49.56
E9	Erlas Black Wood AW	1.29	14.51	4.31	48.38
E10	Vicarage Moss Ramsar	0.03	8.12	0.11	27.08
E11	River Dee and Bala Lake SAC	0.01	7.15	0.03	23.83
E12	River Dee and Bala Lake SAC	0.01	7.49	0.04	24.97
E13	River Dee and Bala Lake SAC	0.01	6.59	0.05	21.98
E14	River Dee and Bala Lake SAC	0.02	6.27	0.06	20.89
E15	River Dee and Bala Lake SAC	0.03	6.10	0.09	20.33
E16	River Dee and Bala Lake SAC	0.02	6.88	0.05	22.92
E17	River Dee and Bala Lake SAC	0.00	6.21	0.02	20.72
E18	River Dee and Bala Lake SAC	0.00	6.10	0.01	20.34
E19	Johnstown Newt Sites SAC	0.00	10.66	0.00	35.54

5.4.5 As shown in Table 39, PCs were below 1% of the EQS at the Ramsar and SACs. Additionally, PCs were below 100% of the EQS at all AWs. As such, predicted impacts 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 ecological receptor locations, inclusive of background levels, are summarised in Table 40.

Table 40 Predicted 24-hour Mean NO_X Concentrations

Receptor		Predicted 24-hour Mean NO_X PEC ($\mu g/m^3$)				
		2017	2018	2019	2020	2021
E1	Unnamed AW	15.62	15.68	15.68	15.66	15.63
E2	Unnamed AW	13.78	13.85	13.82	13.81	13.86
E3	Unnamed AW	27.66	27.63	27.30	27.71	28.19
E4	Black Wood AW	19.03	18.99	18.87	18.88	19.01
E5	Rhododendron Spinney AW	16.94	17.13	16.93	17.03	17.06

Receptor		Predicted 24-hour Mean NO_X PEC (µg/m³)				
		2017	2018	2019	2020	2021
E6	Unnamed AW	17.29	17.76	17.23	17.50	17.51
E7	Redwither Wood AW	30.10	30.22	30.22	30.08	30.24
E8	Clays Plantation AW	30.17	30.25	30.23	30.16	30.29
E9	Erlas Black Wood AW	34.61	33.32	33.05	33.97	34.60
E10	Vicarage Moss Ramsar	16.33	16.35	16.36	16.34	16.33
E11	River Dee and Bala Lake SAC	14.35	14.37	14.38	14.34	14.37
E12	River Dee and Bala Lake SAC	15.05	15.05	15.04	15.05	15.06
E13	River Dee and Bala Lake SAC	13.26	13.29	13.26	13.32	13.26
E14	River Dee and Bala Lake SAC	12.66	12.64	12.60	12.62	12.60
E15	River Dee and Bala Lake SAC	12.31	12.39	12.37	12.34	12.37
E16	River Dee and Bala Lake SAC	13.82	13.89	13.86	13.84	13.90
E17	River Dee and Bala Lake SAC	12.46	12.49	12.47	12.49	12.48
E18	River Dee and Bala Lake SAC	12.26	12.25	12.24	12.24	12.24
E19	Johnstown Newt Sites SAC	21.35	21.34	21.35	21.35	21.35

5.4.7 As indicated in Table 40, predicted 24-hour mean NO_X PECs were below the EQS of 75µg/m³ at all ecological receptor locations for all meteorological data sets.

5.4.8 Maximum predicted 24-hour mean NO_X concentrations at the ecological receptor locations are summarised in Table 41.

Table 41 Maximum Predicted 24-hour Mean NO_X Concentrations

Receptor		Maximum Predicted 24-hour Mean NO_X Concentration (µg/m²)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E1	Unnamed AW	0.42	15.68	0.57	20.91
E2	Unnamed AW	0.26	13.86	0.34	18.47
E3	Unnamed AW	1.75	28.19	2.34	37.59
E4	Black Wood AW	0.37	19.03	0.49	25.37
E5	Rhododendron Spinney AW	0.41	17.13	0.55	22.84
E6	Unnamed AW	1.04	17.76	1.39	23.69
E7	Redwither Wood AW	0.84	30.24	1.13	40.33
E8	Clays Plantation AW	0.89	30.29	1.19	40.39
E9	Erlas Black Wood AW	8.17	34.61	10.89	46.15
E10	Vicarage Moss Ramsar	0.18	16.36	0.24	21.81
E11	River Dee and Bala Lake SAC	0.10	14.38	0.13	19.17
E12	River Dee and Bala Lake SAC	0.10	15.06	0.13	20.08
E13	River Dee and Bala Lake SAC	0.16	13.32	0.21	17.76

Receptor		Maximum Predicted 24-hour Mean NO_x Concentration (µg/m²)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E14	River Dee and Bala Lake SAC	0.16	12.66	0.21	16.88
E15	River Dee and Bala Lake SAC	0.25	12.39	0.34	16.53
E16	River Dee and Bala Lake SAC	0.18	13.90	0.24	18.53
E17	River Dee and Bala Lake SAC	0.07	12.49	0.09	16.65
E18	River Dee and Bala Lake SAC	0.06	12.26	0.09	16.35
E19	Johnstown Newt Sites SAC	0.03	21.35	0.04	28.47

5.4.9 As shown in Table 41, PCs were below 10% of the EQS at the Ramsar and SACs. Additionally, PCs were below 100% of the EQS at all AWs. As such, predicted impacts on 24-hour mean NO_x concentrations are not considered to be significant, in accordance with the stated criteria.

Sulphur Dioxide

5.4.10 Predicted annual mean SO_2 PECs at the ecological receptor locations are summarised in Table 42.

Table 42 Predicted Annual Mean SO_2 Concentrations

Receptor		Predicted Annual Mean SO_2 PEC (µg/m³)				
		2017	2018	2019	2020	2021
E1	Unnamed AW	1.09	1.08	1.08	1.09	1.08
E2	Unnamed AW	0.96	0.95	0.95	0.95	0.95
E3	Unnamed AW	1.98	1.98	1.98	1.98	1.98
E4	Black Wood AW	1.13	1.13	1.13	1.13	1.13
E5	Rhododendron Spinney AW	1.24	1.24	1.24	1.24	1.24
E6	Unnamed AW	1.24	1.25	1.24	1.24	1.25
E7	Redwither Wood AW	1.80	1.81	1.81	1.81	1.81
E8	Clays Plantation AW	2.03	2.05	2.07	2.04	2.05
E9	Erlas Black Wood AW	1.97	1.97	1.97	1.97	1.97
E10	Vicarage Moss Ramsar	1.26	1.26	1.26	1.26	1.26
E11	River Dee and Bala Lake SAC	1.11	1.11	1.11	1.11	1.11
E12	River Dee and Bala Lake SAC	1.13	1.13	1.13	1.13	1.13
E13	River Dee and Bala Lake SAC	0.91	0.91	0.91	0.91	0.91
E14	River Dee and Bala Lake SAC	0.85	0.85	0.85	0.85	0.85
E15	River Dee and Bala Lake SAC	0.81	0.81	0.81	0.81	0.81
E16	River Dee and Bala Lake SAC	0.85	0.85	0.85	0.85	0.85
E17	River Dee and Bala Lake SAC	0.87	0.87	0.87	0.87	0.86
E18	River Dee and Bala Lake SAC	0.80	0.80	0.80	0.80	0.80

Receptor		Predicted Annual Mean SO_2 PEC (µg/m³)				
		2017	2018	2019	2020	2021
E19	Johnstown Newt Sites SAC	1.22	1.22	1.22	1.22	1.22

5.4.11 As indicated in Table 42, predicted annual mean SO_2 concentrations were below the annual mean EQS of 10µg/m³ at all ecological receptor locations.

5.4.12 Maximum predicted annual mean SO_2 concentrations at the ecological receptor locations are summarised in Table 43.

Table 43 Maximum Predicted Annual Mean SO_2 Concentrations

Receptor		Maximum Predicted Annual Mean SO_2 Concentration (µg/m²)		Proportion of EQS (%)	
		PC	PEC	PC	PEC
E1	Unnamed AW	0.04	1.09	0.41	10.91
E2	Unnamed AW	0.05	0.96	0.48	9.58
E3	Unnamed AW	0.01	1.98	0.11	19.81
E4	Black Wood AW	0.01	1.13	0.10	11.30
E5	Rhododendron Spinney AW	0.01	1.24	0.14	12.44
E6	Unnamed AW	0.02	1.25	0.16	12.46
E7	Redwither Wood AW	0.00	1.78	0.04	17.84
E8	Clays Plantation AW	0.29	2.07	2.87	20.67
E9	Erlas Black Wood AW	0.00	1.97	0.01	19.71
E10	Vicarage Moss Ramsar	0.00	1.26	0.01	12.61
E11	River Dee and Bala Lake SAC	0.00	1.11	0.03	11.13
E12	River Dee and Bala Lake SAC	0.00	1.13	0.00	11.30
E13	River Dee and Bala Lake SAC	0.00	0.91	0.00	9.10
E14	River Dee and Bala Lake SAC	0.00	0.85	0.01	8.51
E15	River Dee and Bala Lake SAC	0.00	0.81	0.04	8.14
E16	River Dee and Bala Lake SAC	0.00	0.85	0.05	8.55
E17	River Dee and Bala Lake SAC	0.05	0.87	0.49	8.69
E18	River Dee and Bala Lake SAC	0.00	0.80	0.01	8.01
E19	Johnstown Newt Sites SAC	0.00	1.22	0.00	12.20

5.4.13 As indicated in Table 43, PCs were below 1% of the EQS at the Ramsar and SAC. Additionally, PCs were below 100% of the EQS at all AWs. As such, predicted effects on annual mean SO_2 concentrations are not considered to be significant, in accordance with the stated criteria.

Nitrogen Deposition

5.4.14 Predicted annual nitrogen PC deposition rates at the ecological receptor locations are summarised in Table 44.

Table 44 Predicted Annual PC Nitrogen Deposition Rates

Receptor		Predicted Annual PC Nitrogen Deposition Rate (kgN/ha/yr)				
		2017	2018	2019	2020	2021
E1	Unnamed AW	0.0074	0.0102	0.0094	0.0091	0.0110
E2	Unnamed AW	0.0032	0.0039	0.0034	0.0036	0.0039
E3	Unnamed AW	0.0087	0.0177	0.0095	0.0152	0.0171
E4	Black Wood AW	0.0020	0.0033	0.0020	0.0027	0.0035
E5	Rhododendron Spinney AW	0.0021	0.0037	0.0032	0.0033	0.0031
E6	Unnamed AW	0.0047	0.0088	0.0073	0.0080	0.0074
E7	Redwither Wood AW	0.0269	0.0284	0.0293	0.0247	0.0287
E8	Clays Plantation AW	0.0307	0.0319	0.0339	0.0300	0.0335
E9	Erlas Black Wood AW	0.2460	0.2575	0.2606	0.2560	0.2394
E10	Vicarage Moss Ramsar	0.0028	0.0031	0.0034	0.0028	0.0033
E11	River Dee and Bala Lake SAC	0.0009	0.0010	0.0009	0.0009	0.0009
E12	River Dee and Bala Lake SAC	0.0011	0.0011	0.0012	0.0011	0.0011
E13	River Dee and Bala Lake SAC	0.0014	0.0011	0.0012	0.0014	0.0013
E14	River Dee and Bala Lake SAC	0.0018	0.0013	0.0016	0.0016	0.0015
E15	River Dee and Bala Lake SAC	0.0021	0.0025	0.0023	0.0025	0.0028
E16	River Dee and Bala Lake SAC	0.0011	0.0016	0.0015	0.0014	0.0017
E17	River Dee and Bala Lake SAC	0.0004	0.0004	0.0004	0.0005	0.0004
E18	River Dee and Bala Lake SAC	0.0002	0.0002	0.0002	0.0003	0.0003
E19	Johnstown Newt Sites SAC	0.0001	0.0001	0.0001	0.0001	0.0001

5.4.15 Maximum predicted annual nitrogen PC deposition rates at the ecological receptor locations are summarised in Table 45.

Table 45 Maximum Predicted Annual Nitrogen Deposition Rates

Receptor		Maximum Predicted Annual Nitrogen Deposition Rate (kgN/ha/yr)		Proportion of Low EQS (%)	
		PC	PEC	PC	PEC
E1	Unnamed AW	0.01	39.17	0.11	391.71
E2	Unnamed AW	0.00	38.76	0.04	387.64
E3	Unnamed AW	0.02	39.44	0.18	394.38
E4	Black Wood AW	0.00	38.32	0.03	383.23
E5	Rhododendron Spinney AW	0.00	38.59	0.04	385.94
E6	Unnamed AW	0.01	38.60	0.09	385.99
E7	Redwither Wood AW	0.03	39.81	0.29	398.09
E8	Clays Plantation AW	0.03	39.81	0.34	398.14
E9	Erlas Black Wood AW	0.26	39.68	2.61	396.81

Receptor		Maximum Predicted Annual Nitrogen Deposition Rate (kgN/ha/yr)		Proportion of Low EQS (%)	
		PC	PEC	PC	PEC
E10	Vicarage Moss Ramsar	0.00	23.31	-	-
E11	River Dee and Bala Lake SAC	0.00	24.33	0.05	1216.55
E12	River Dee and Bala Lake SAC	0.00	23.94	0.06	1197.06
E13	River Dee and Bala Lake SAC	0.00	23.36	0.07	1168.07
E14	River Dee and Bala Lake SAC	0.00	22.46	0.09	1123.09
E15	River Dee and Bala Lake SAC	0.00	22.00	0.14	1100.14
E16	River Dee and Bala Lake SAC	0.00	22.13	0.08	1106.58
E17	River Dee and Bala Lake SAC	0.00	22.05	0.02	1102.52
E18	River Dee and Bala Lake SAC	0.00	21.84	0.01	1092.01
E19	Johnstown Newt Sites SAC	0.00	21.07	-	-

5.4.16 As shown in Table 45, PCs were below 1% of the EQS at the Ramsar and SAC. Additionally, PCs were below 100% of the EQS at all AWs. As such, predicted effects on nitrogen deposition are not considered to be significant, in accordance with the stated criteria.

Acid Deposition

5.4.17 Predicted annual acid PC deposition rates at the ecological receptor locations are summarised in Table 46.

Table 46 Predicted Annual PC Acid Deposition Rates

Receptor		Predicted Annual PC Acid Deposition Rate (keq/ha/yr)				
		2017	2018	2019	2020	2021
E1	Unnamed AW	0.00053	0.00073	0.00067	0.00065	0.00079
E2	Unnamed AW	0.00023	0.00027	0.00025	0.00025	0.00028
E3	Unnamed AW	0.00062	0.00126	0.00068	0.00109	0.00122
E4	Black Wood AW	0.00015	0.00024	0.00015	0.00019	0.00025
E5	Rhododendron Spinney AW	0.00015	0.00026	0.00023	0.00023	0.00022
E6	Unnamed AW	0.00034	0.00063	0.00052	0.00057	0.00052
E7	Redwither Wood AW	0.00192	0.00203	0.00209	0.00176	0.00205
E8	Clays Plantation AW	0.00219	0.00228	0.00242	0.00214	0.00239
E9	Erlas Black Wood AW	0.01755	0.01836	0.01859	0.01826	0.01708
E10	Vicarage Moss Ramsar	0.00020	0.00022	0.00024	0.00020	0.00024
E11	River Dee and Bala Lake SAC	0.00006	0.00007	0.00007	0.00006	0.00007
E12	River Dee and Bala Lake SAC	0.00008	0.00008	0.00008	0.00008	0.00008
E13	River Dee and Bala Lake SAC	0.00010	0.00008	0.00009	0.00010	0.00009
E14	River Dee and Bala Lake SAC	0.00013	0.00009	0.00011	0.00011	0.00011

Receptor		Predicted Annual PC Acid Deposition Rate (keq/ha/yr)				
		2017	2018	2019	2020	2021
E15	River Dee and Bala Lake SAC	0.00015	0.00018	0.00017	0.00018	0.00020
E16	River Dee and Bala Lake SAC	0.00008	0.00011	0.00010	0.00010	0.00012
E17	River Dee and Bala Lake SAC	0.00003	0.00003	0.00003	0.00003	0.00003
E18	River Dee and Bala Lake SAC	0.00001	0.00002	0.00001	0.00002	0.00002
E19	Johnstown Newt Sites SAC	0.00001	0.00001	0.00001	0.00001	0.00001

5.4.18 Maximum predicted annual acid deposition rates at the ecological receptor locations are summarised in Table 47.

Table 47 Maximum Predicted Annual Acid Deposition Rates

Receptor		Maximum Predicted Annual Acid PC Deposition Rate (keq/ha/yr)		PC Proportion of EQS (%)
		Nitrogen	Sulphur	
E1	Unnamed AW	0.00079	0.00958	0.59
E2	Unnamed AW	0.00028	0.01136	0.66
E3	Unnamed AW	0.00126	0.00267	0.22
E4	Black Wood AW	0.00025	0.00242	0.15
E5	Rhododendron Spinney AW	0.00026	0.00329	0.20
E6	Unnamed AW	0.00063	0.00388	0.26
E7	Redwither Wood AW	0.00209	0.00096	0.49
E8	Clays Plantation AW	0.00242	0.06772	3.99
E9	Erlas Black Wood AW	0.01859	0.00033	1.08
E10	Vicarage Moss Ramsar	0.00024	0.00006	-
E11	River Dee and Bala Lake SAC	0.00007	0.00031	0.03
E12	River Dee and Bala Lake SAC	0.00008	0.00005	0.01
E13	River Dee and Bala Lake SAC	0.00010	0.00006	0.01
E14	River Dee and Bala Lake SAC	0.00013	0.00015	0.03
E15	River Dee and Bala Lake SAC	0.00020	0.00050	0.06
E16	River Dee and Bala Lake SAC	0.00012	0.00055	0.06
E17	River Dee and Bala Lake SAC	0.00003	0.00583	0.55
E18	River Dee and Bala Lake SAC	0.00002	0.00009	0.01
E19	Johnstown Newt Sites SAC	0.00001	0.00003	-

5.4.19 As shown in Table 45, PCs were below 1% of the EQS at the Ramsar and SAC. Additionally, PCs were below 100% of the EQS at all AWs. As such, predicted effects on acid deposition are not considered to be significant, in accordance with the stated criteria.

6 CONCLUSION

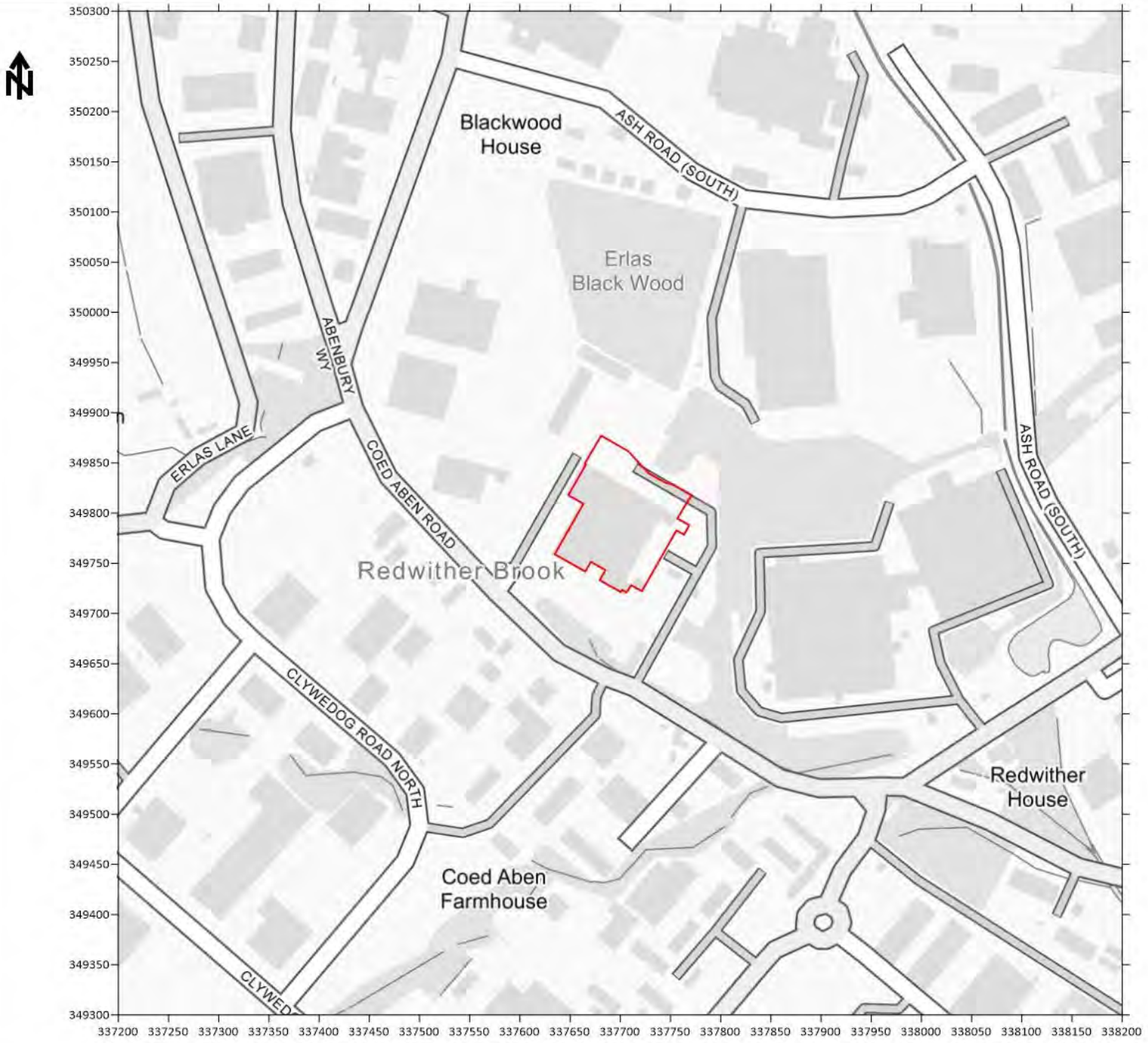
6.1.1 Crestwood Environmental was commissioned by Novidon Limited (**the Application and Operator**) to undertake an Air Quality Assessment of potential atmospheric emissions from the Novidon starch manufacturing facility on land off Coed Aben Road, Wrexham.

6.1.2 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.

6.1.3 Dispersion modelling was undertaken 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 EQSs and significance criteria.

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

6.1.5 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.



Legend

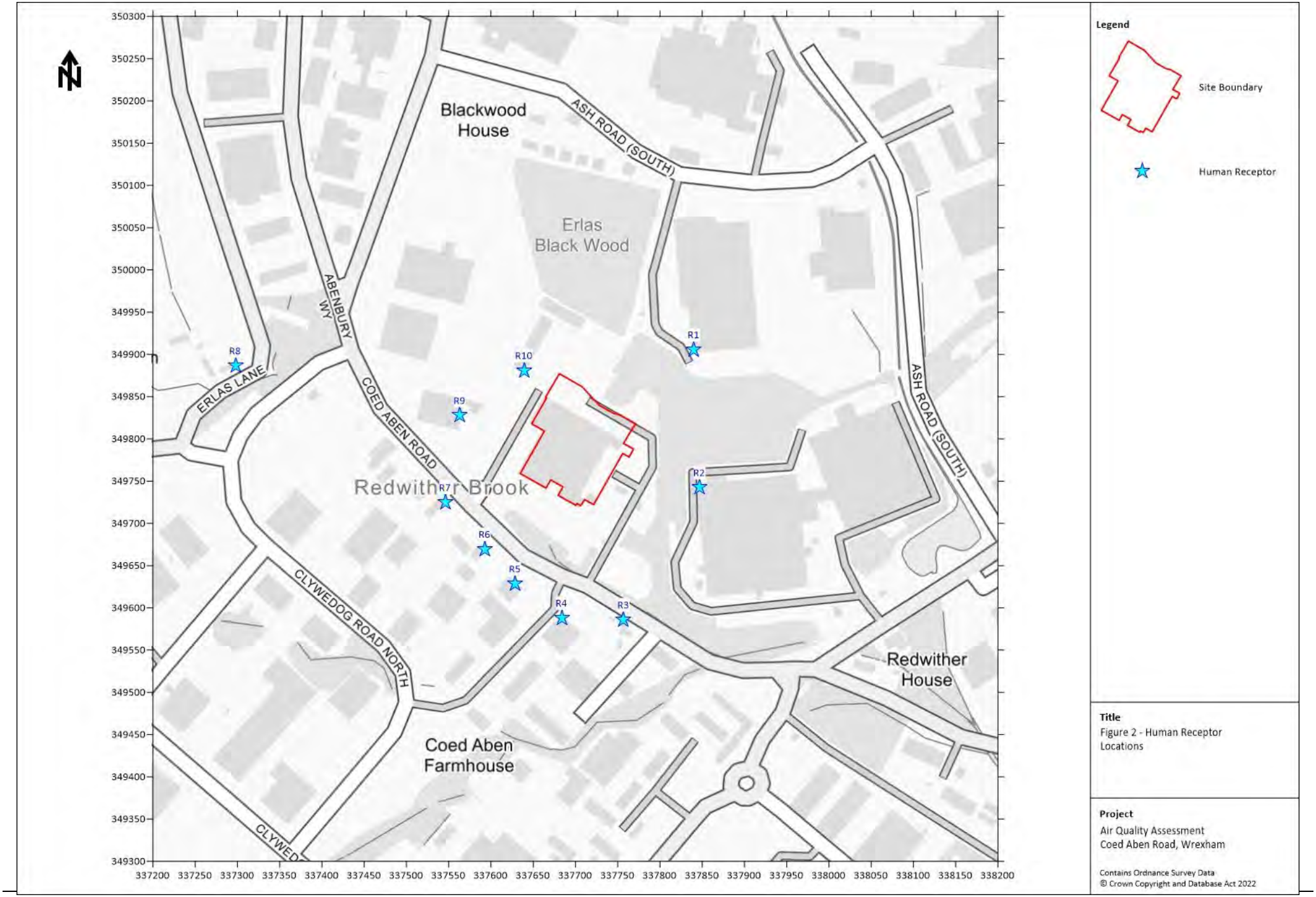
Site Boundary

Title

Figure 1 - Site Location

Project

Air Quality Assessment
Coed Aben Road, Wrexham


Blackwood House
ASH ROAD (SOUTH)
Erlas Black Wood
ABENBURY WY
ERLAS LANE
COED ABEN ROAD
Redwither Brook
CLYWEDOG ROAD NORTH
Coed Aben Farmhouse
Redwither House
R1
R2
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R4
R5
R6
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R8
R9
R10
Legend
Site Boundary
Human Receptor
Title
Figure 2 - Human Receptor Locations
Project
Air Quality Assessment
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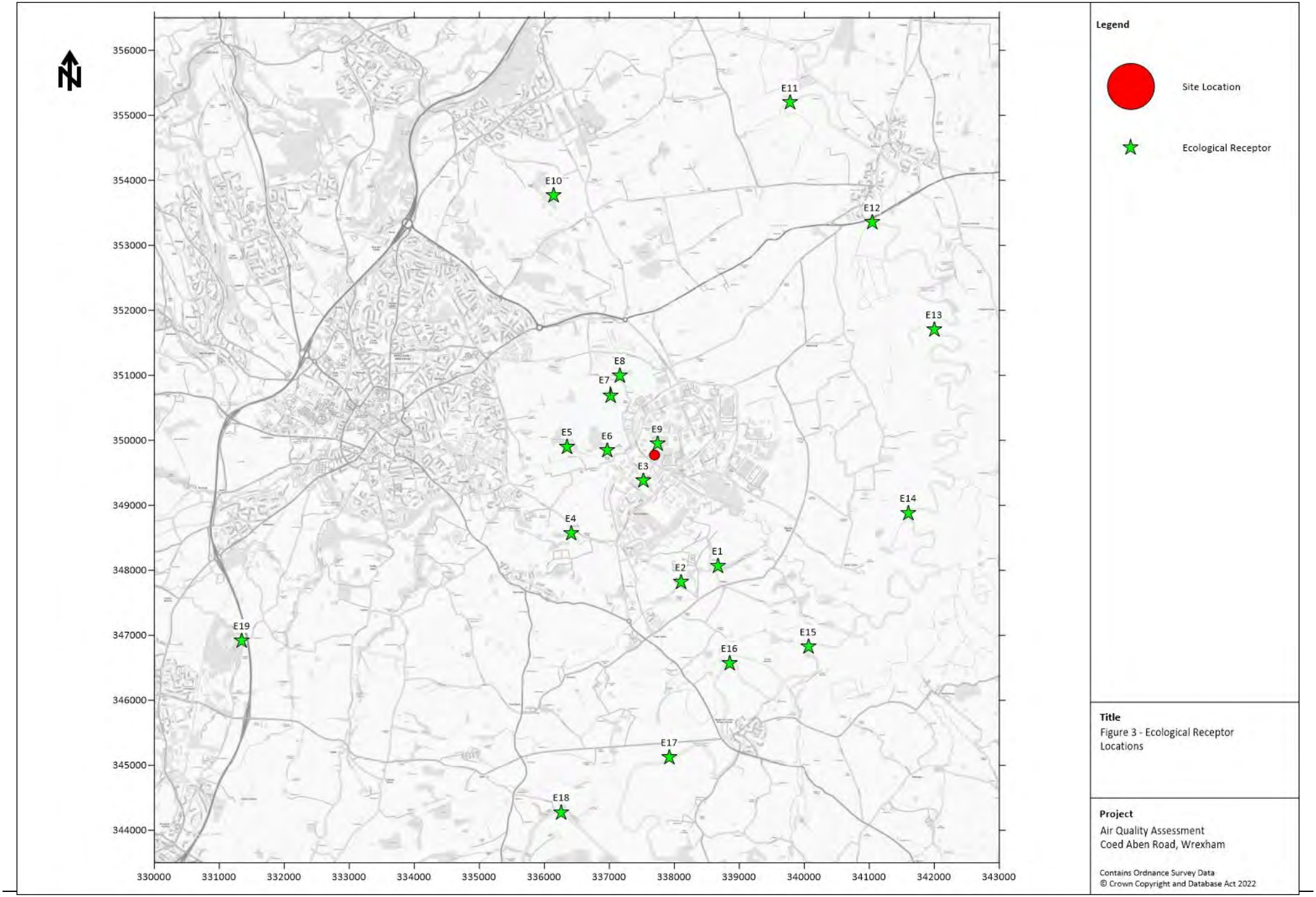
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E19
Legend
Site Location
Ecological Receptor
Title
Figure 3 - Ecological Receptor Locations
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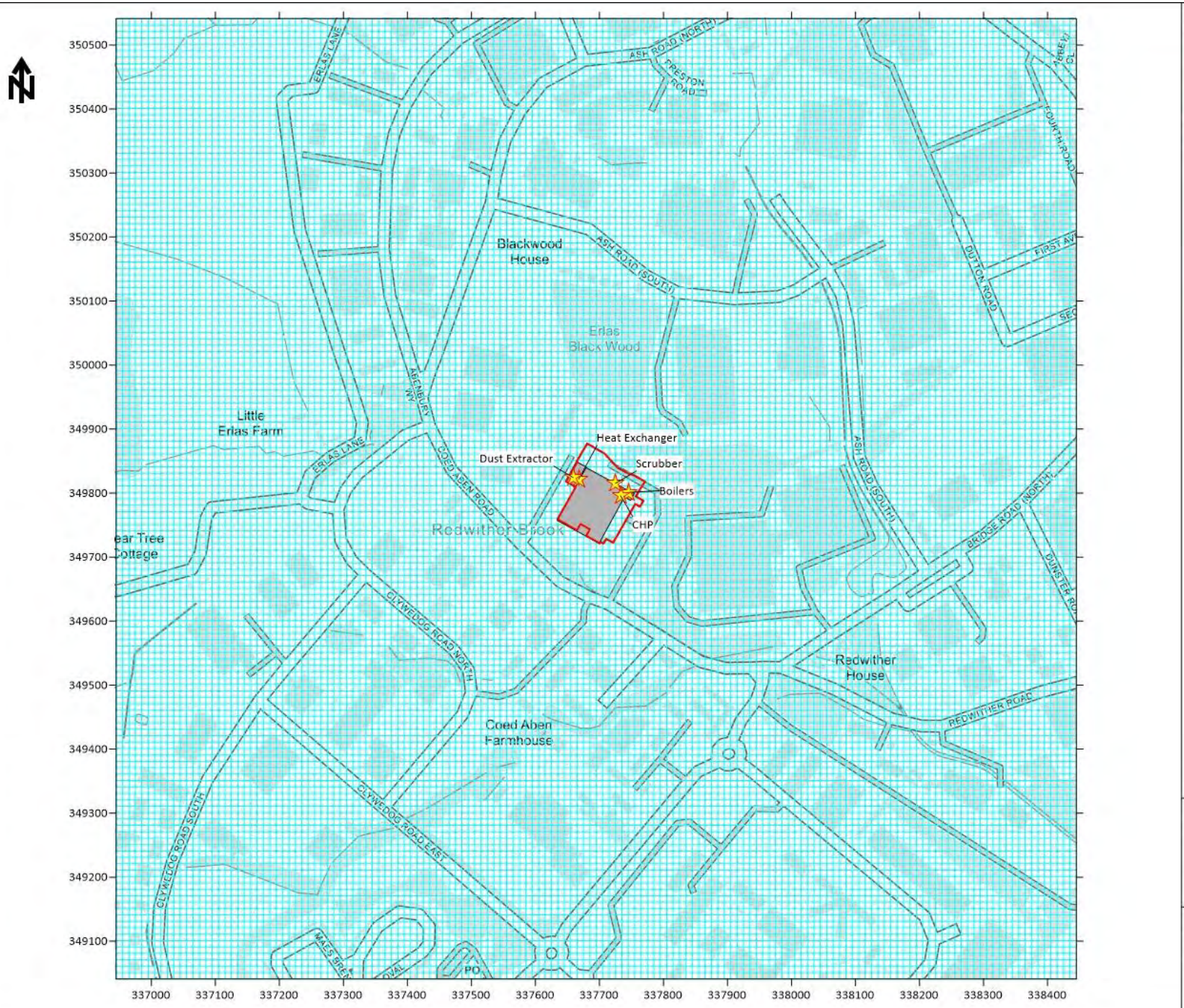

Title
Figure 4 - ADMS-6 Inputs

Project
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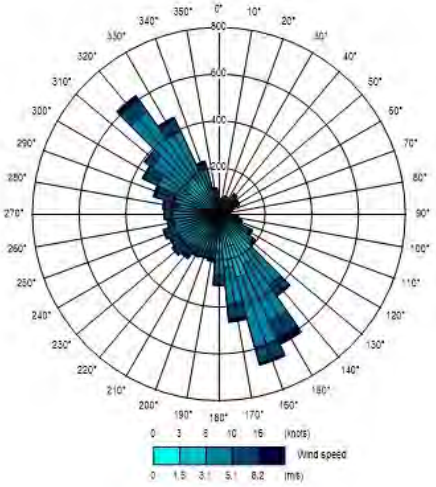
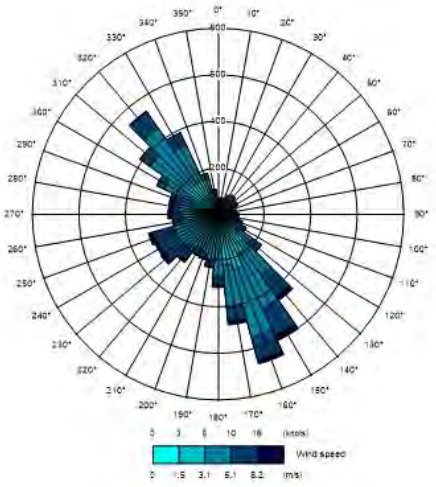
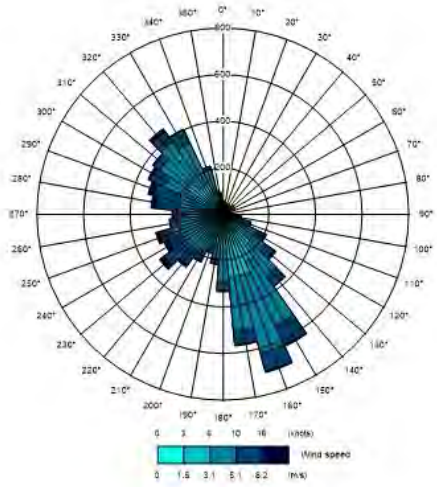
Coed Aben Road, Wrexham



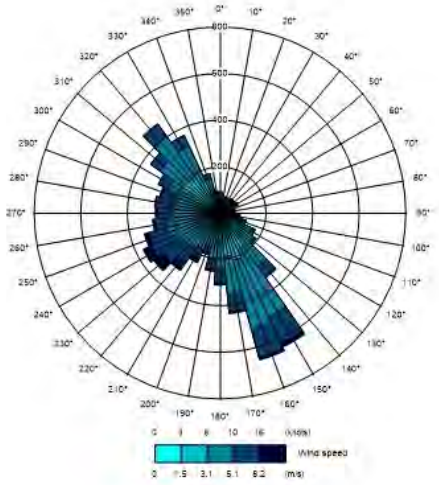
2017 Meteorological Data



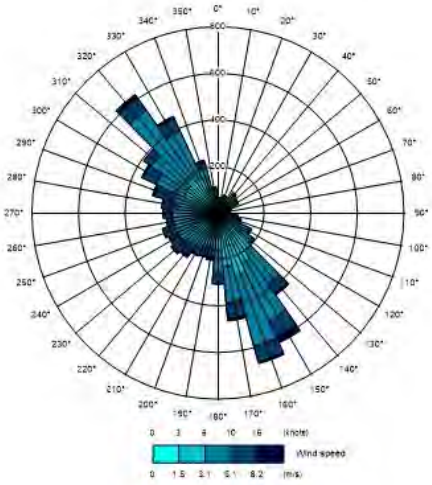
2018 Meteorological Data



2019 Meteorological Data



2020 Meteorological Data



2021 Meteorological Data

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Title
Figure 5 - Wind Roses of 2017 to 2021 Hawarden Meteorological Station Data

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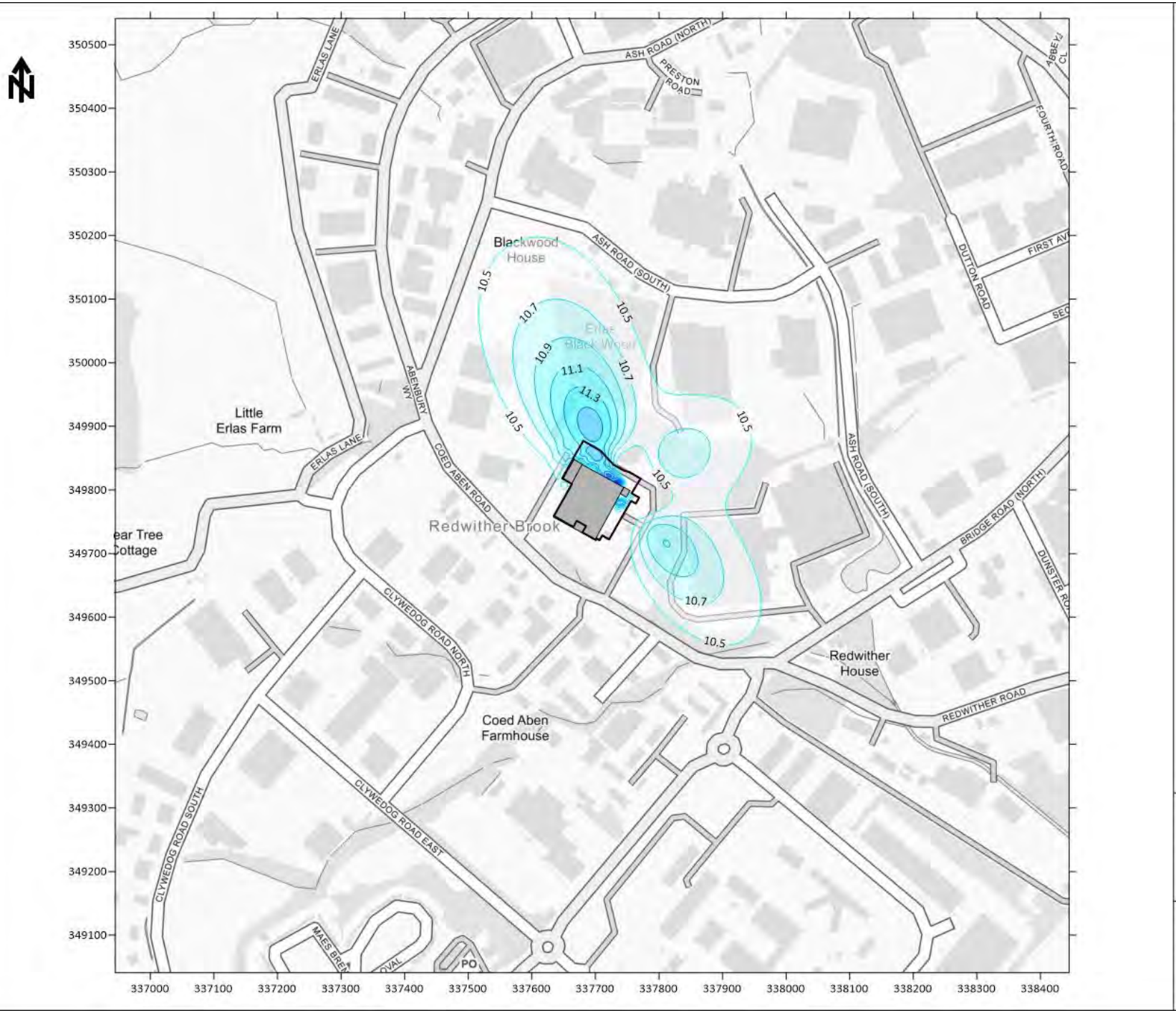
Coed Aben Road, Wrexham



Title
Figure 6 - Predicted Annual Mean NO_2 Concentrations (µg/m³)
2018 Meteorological Data

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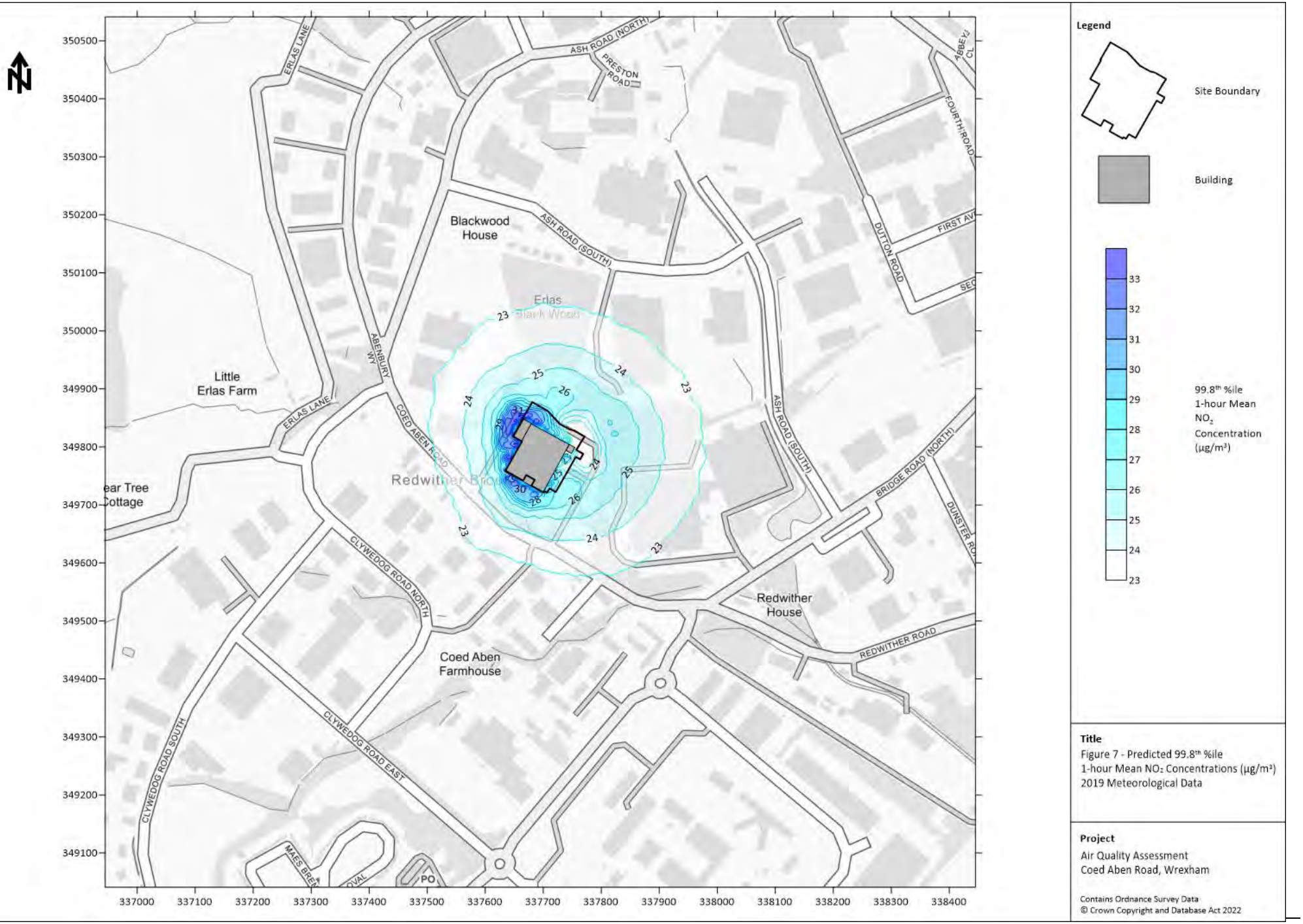
Air Quality Assessment
Coed Aben Road, Wrexham


Legend
Site Boundary
Building
99.8th %ile 1-hour Mean NO2 Concentration (µg/m³)
33
32
31
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Title
Figure 7 - Predicted 99.8th %ile 1-hour Mean NO2 Concentrations (µg/m³) 2019 Meteorological Data
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Air Quality Assessment
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Blackwood House
Little Erlas Farm
Redwither House
Coed Aben Farmhouse
ASH ROAD (NORTH)
ASH ROAD (SOUTH)
PRESTON ROAD
ERLAS LANE
ABENBURY WY
COED ABEN ROAD
CLYWEDOG ROAD NORTH
CLYWEDOG ROAD SOUTH
CLYWEDOG ROAD EAST
REDWITHER ROAD
BRIDGE ROAD (NORTH)
DUTTON ROAD
FOURTH ROAD
FIRST AV
DUNSTER RO
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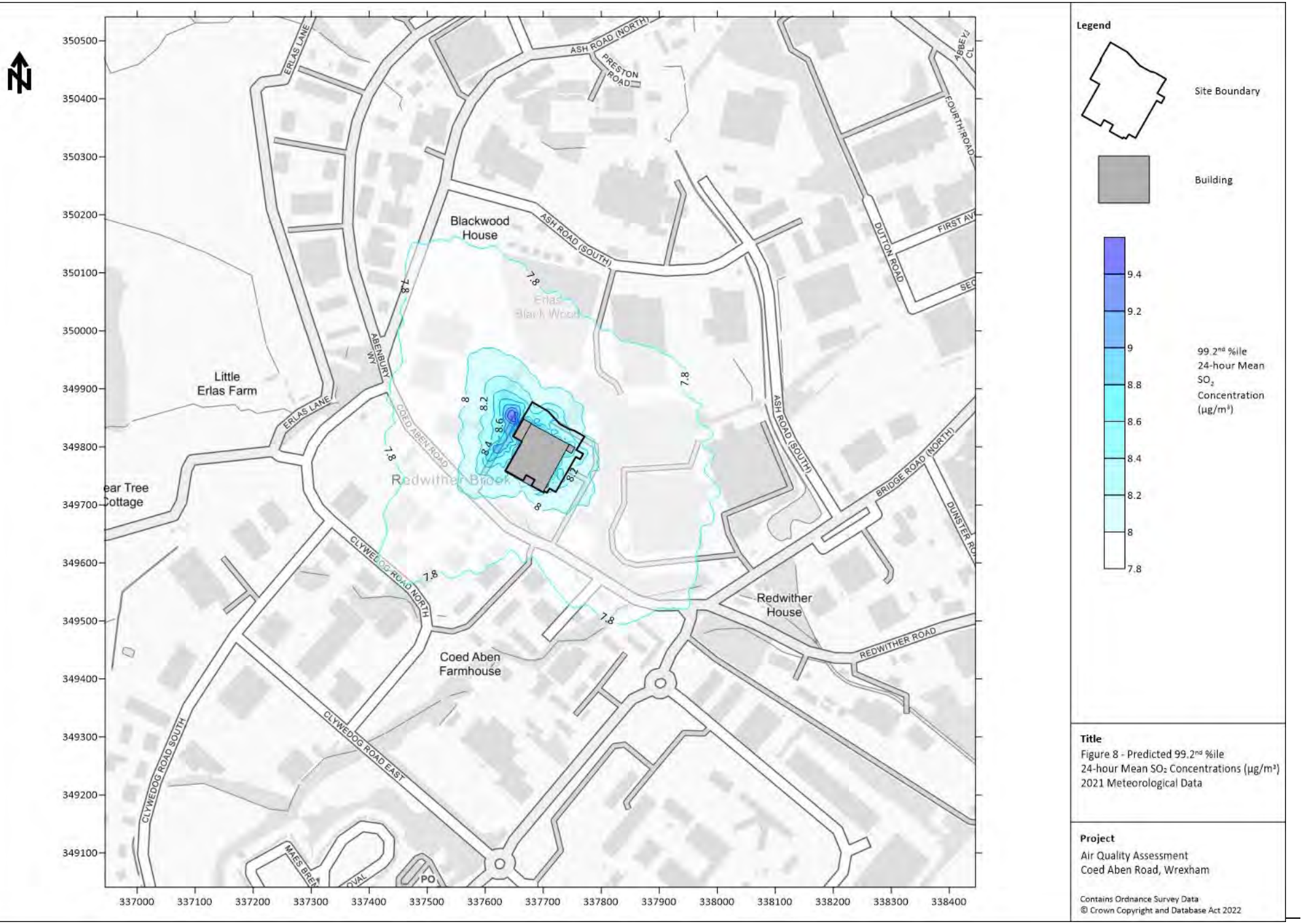
Legend
Site Boundary
Building
99.2nd %ile 24-hour Mean SO2 Concentration (µg/m³)
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9.2
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8.8
8.6
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8.2
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7.8
Title
Figure 8 - Predicted 99.2nd %ile 24-hour Mean SO2 Concentrations (µg/m³) 2021 Meteorological Data
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Blackwood House
Little Erlas Farm
Redwither House
Coed Aben Farmhouse
Redwither Brook
ASH ROAD (NORTH)
ASH ROAD (SOUTH)
ERLAS LANE
PRESTON ROAD
FOURTH ROAD
DUTTON ROAD
FIRST AV
ABENBURY WY
COED ABEN ROAD
BRIDGE ROAD (NORTH)
CLYWEDOG ROAD NORTH
CLYWEDOG ROAD SOUTH
CLYWEDOG ROAD EAST
REDWITHER ROAD
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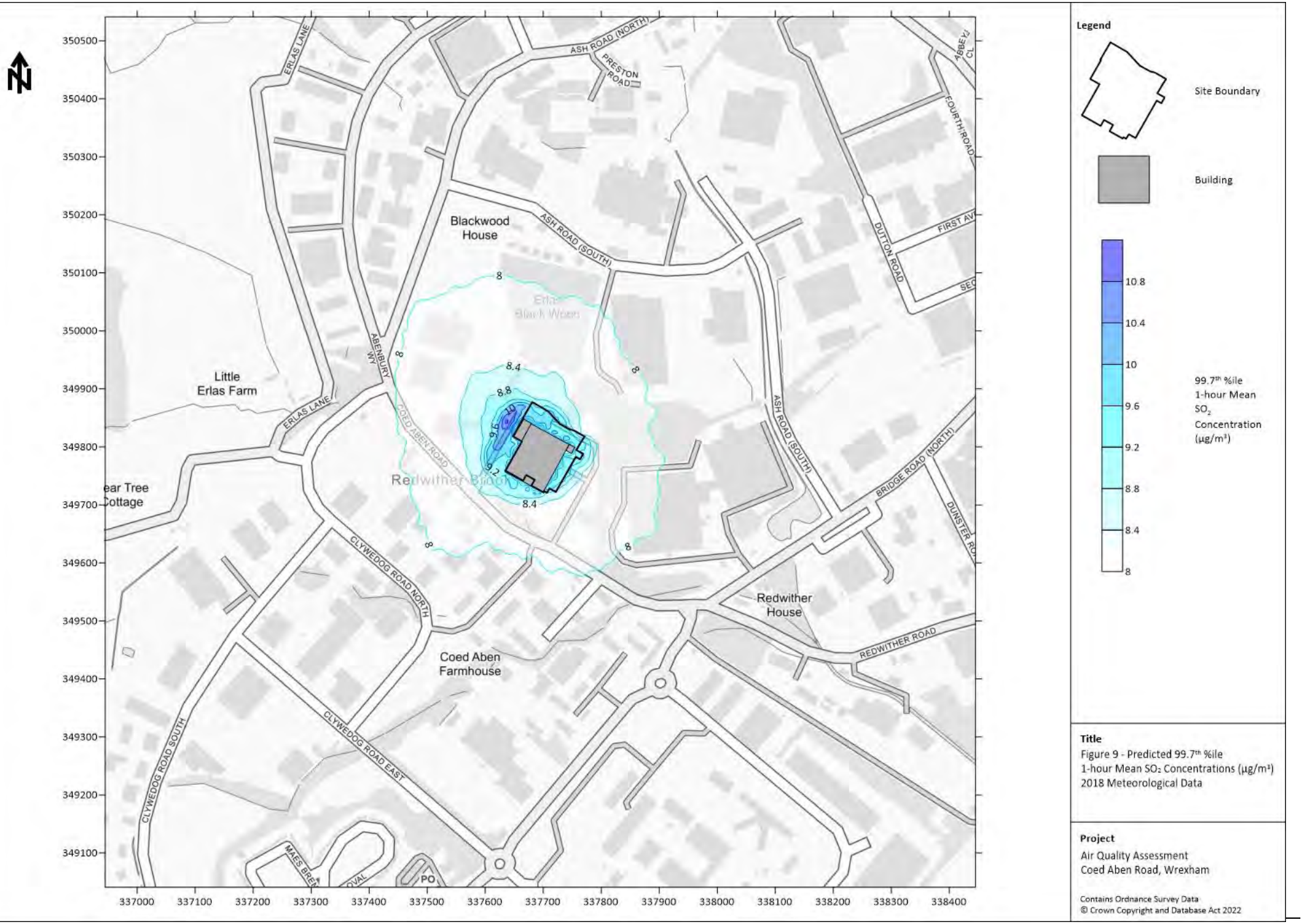

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Figure 9 - Predicted 99.7th %ile 1-hour Mean SO_2 Concentrations (µg/m³) 2018 Meteorological Data

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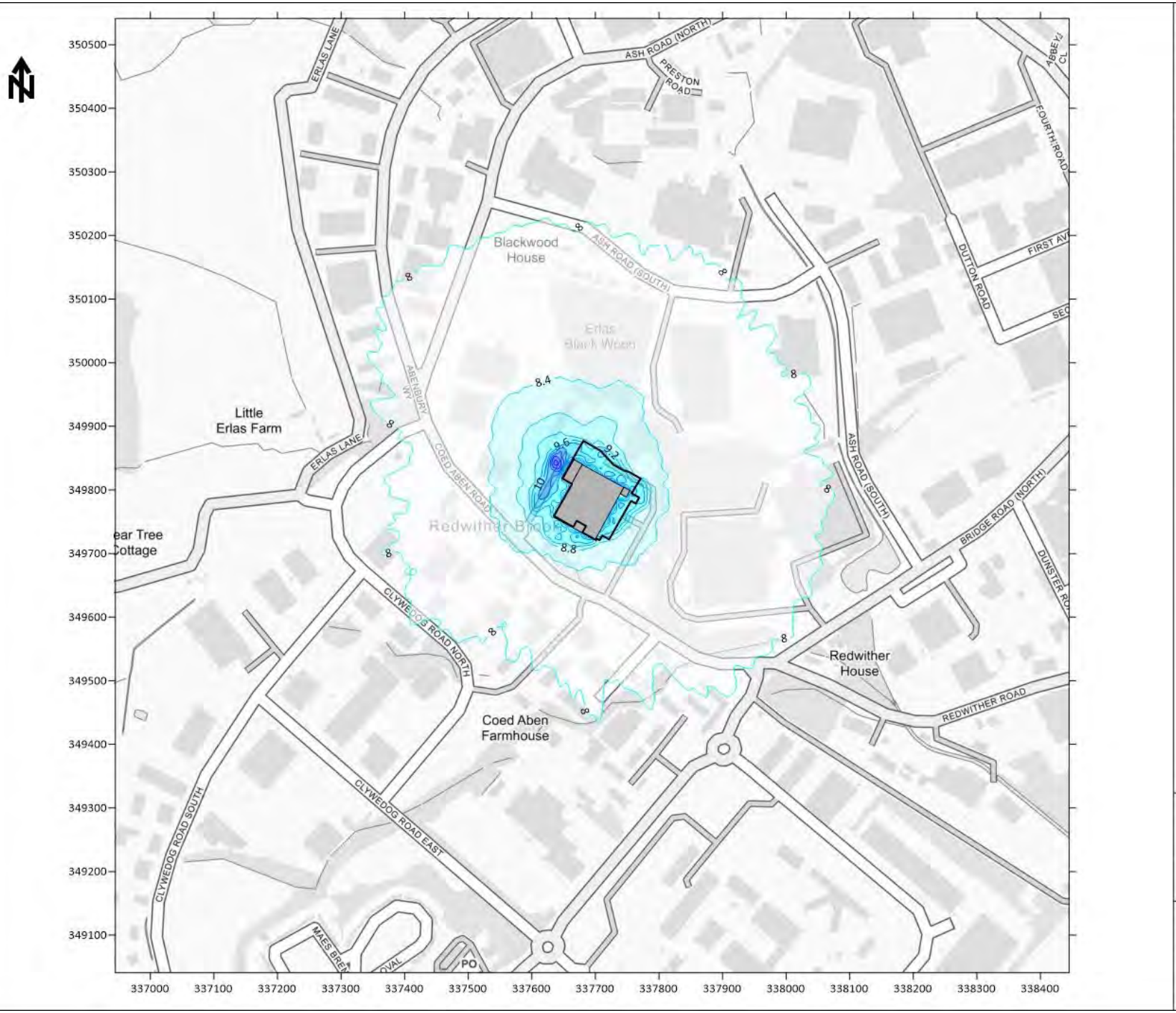
Air Quality Assessment
Coed Aben Road, Wrexham


Legend
Site Boundary
Building
99.9th %ile 15-minute Mean SO2 Concentration (µg/m³)
11.6
11.2
10.8
10.4
10
9.6
9.2
8.8
8.4
8
Title
Figure 10 - Predicted 99.9th %ile 15-minute Mean SO2 Concentrations (µg/m³) 2017 Meteorological Data
Project
Air Quality Assessment
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ASH ROAD (NORTH)
ASH ROAD (SOUTH)
PRESTON ROAD
ERLAS LANE
ABENBURY WY
COED ABEN ROAD
FOURTH ROAD
DUTTON ROAD
FIRST AV
BRIDGE ROAD (NORTH)
DUNSTER RO
REDWITHER ROAD
CLYWEDOG ROAD NORTH
CLYWEDOG ROAD SOUTH
CLYWEDOG ROAD EAST
MAES BRE
OVAL
PO
Blackwood House
Erlas Black Wood
Little Erlas Farm
Redwither Bridge
Redwither House
Coed Aben Farmhouse
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349900
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338000
338100
338200
338300
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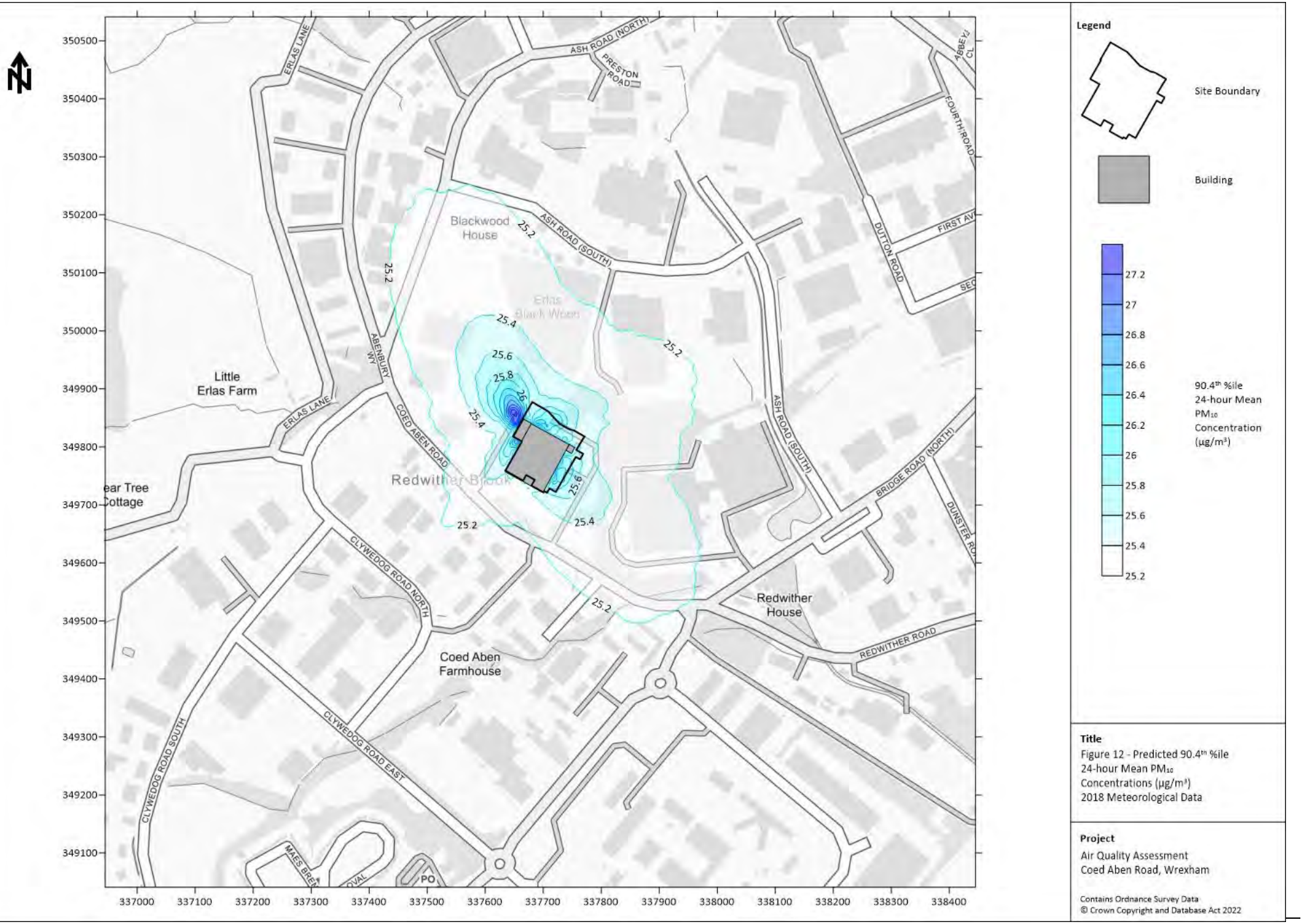
Title
Figure 11 - Predicted Annual Mean PM_{10} Concentrations (µg/m³)
2019 Meteorological Data

Project
Air Quality Assessment
Coed Aben Road, Wrexham


Legend
Site Boundary
Building
27.2
27
26.8
26.6
26.4
26.2
26
25.8
25.6
25.4
25.2
90.4th %ile 24-hour Mean PM10 Concentration (µg/m³)
Title
Figure 12 - Predicted 90.4th %ile 24-hour Mean PM10 Concentrations (µg/m³) 2018 Meteorological Data
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Contains Ordnance Survey Data
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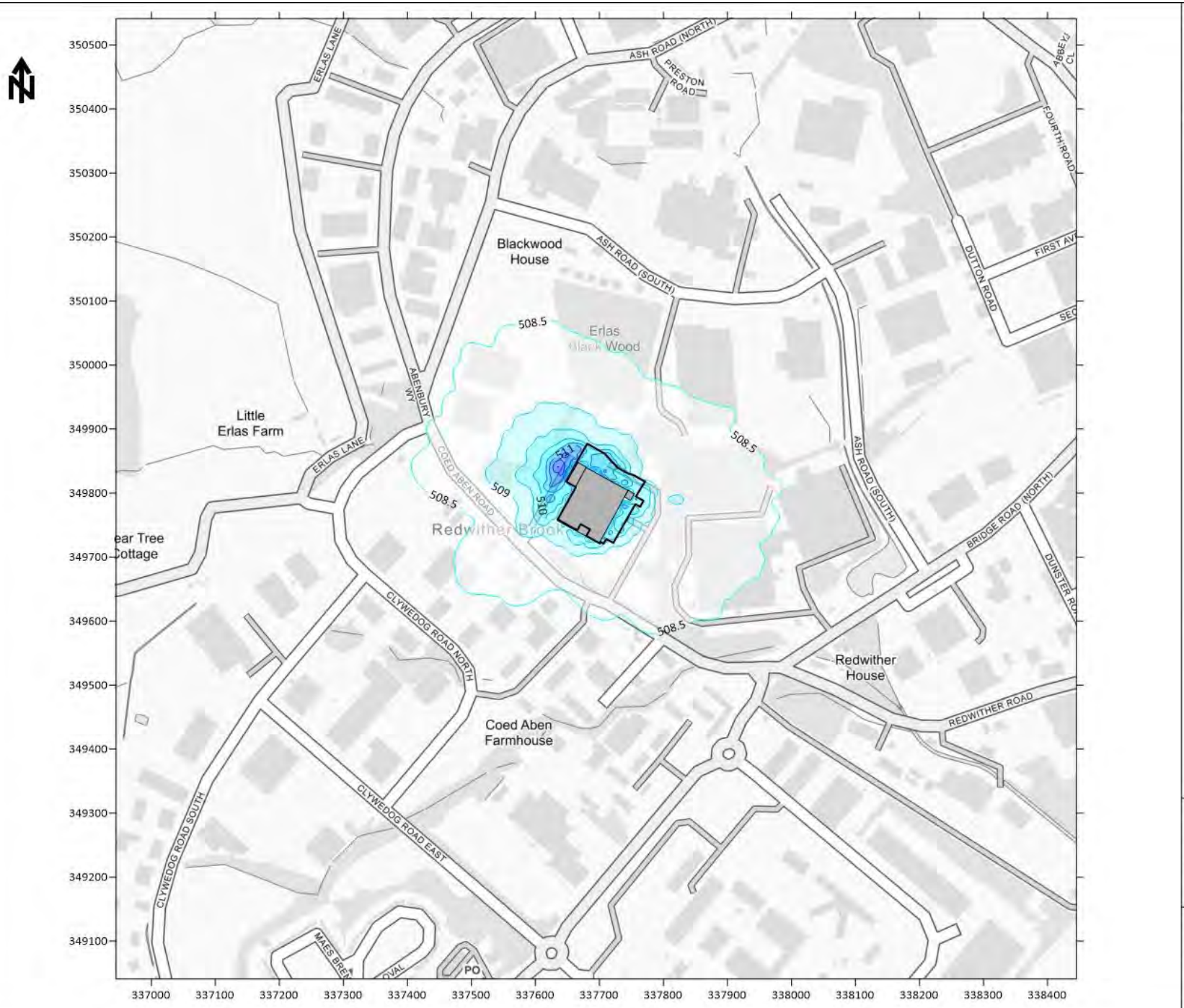
Blackwood House
Little Erlas Farm
Redwither House
Coed Aben Farmhouse
ASH ROAD (NORTH)
ASH ROAD (SOUTH)
PRESTON ROAD
ERLAS LANE
ABENBURY WY
COED ABEN ROAD
CLYWEDOG ROAD NORTH
CLYWEDOG ROAD SOUTH
CLYWEDOG ROAD EAST
REDWITHER ROAD
BRIDGE ROAD (NORTH)
DUTTON ROAD
FOURTH ROAD
FIRST AV
DUNSTER RO
MAES BRE
OVAL
PO
350500
350400
350300
350200
350100
350000
349900
349800
349700
349600
349500
349400
349300
349200
349100
337000
337100
337200
337300
337400
337500
337600
337700
337800
337900
338000
338100
338200
338300
338400



Title
Figure 13 - Predicted 100th %ile 8-hour Rolling Mean CO Concentration (µg/m³) 2019 Meteorological Data

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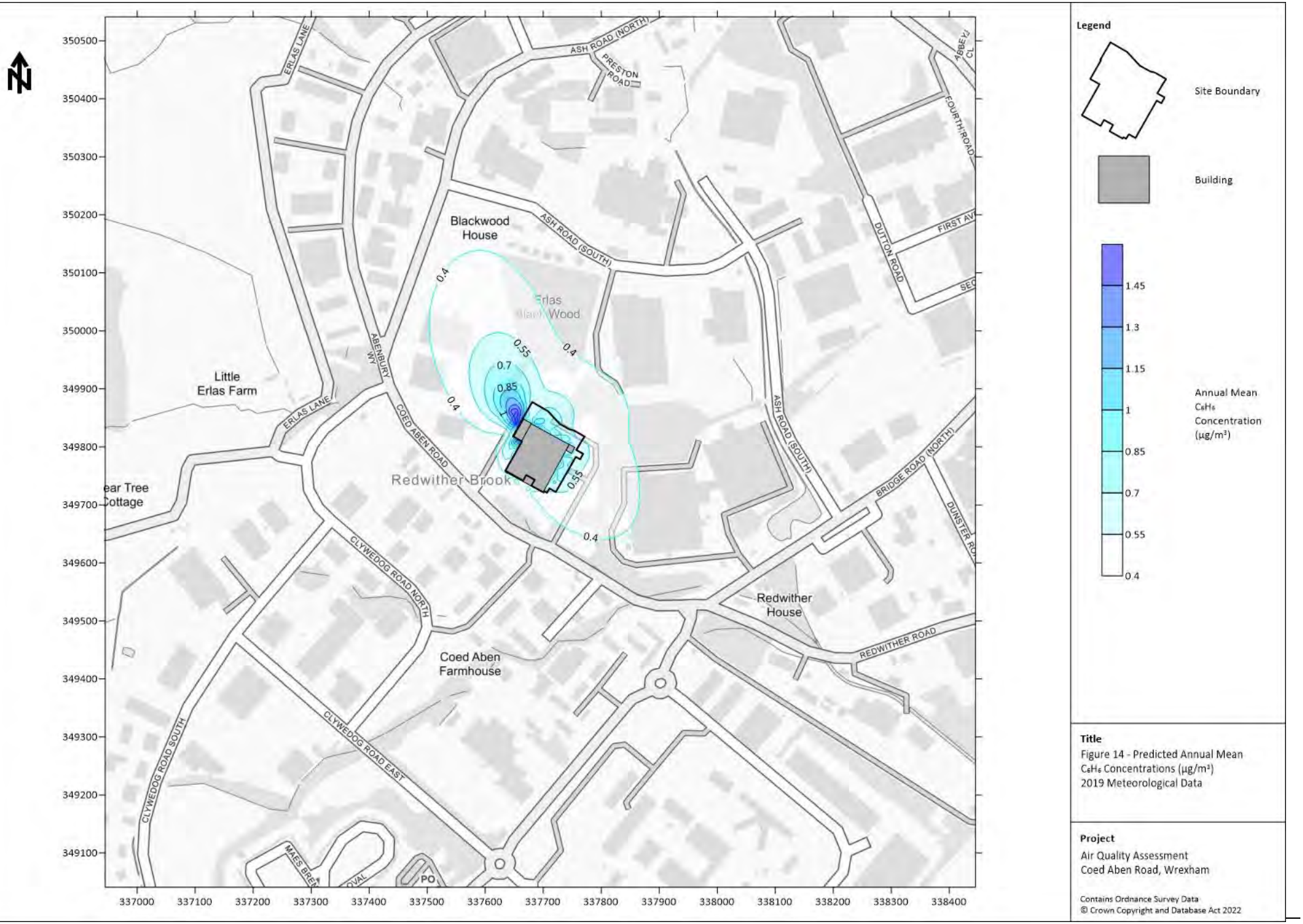
Legend
Site Boundary
Building
1.45
1.3
1.15
1
0.85
0.7
0.55
0.4
Annual Mean C6H6 Concentration (µg/m³)
Blackwood House
Little Erlas Farm
Redwither Brook
Coed Aben Farmhouse
Redwither House
ASH ROAD (NORTH)
ASH ROAD (SOUTH)
ERLAS LANE
ABENBURY WY
COED ABEN ROAD
CLYWEDOG ROAD NORTH
CLYWEDOG ROAD SOUTH
CLYWEDOG ROAD EAST
BRIDGE ROAD (NORTH)
REDWITHER ROAD
DUTTON ROAD
FOURTH ROAD
PRESTON ROAD
350500
350400
350300
350200
350100
350000
349900
349800
349700
349600
349500
349400
349300
349200
349100
337000
337100
337200
337300
337400
337500
337600
337700
337800
337900
338000
338100
338200
338300
338400
Title
Figure 14 - Predicted Annual Mean C6H6 Concentrations (µg/m³) 2019 Meteorological Data
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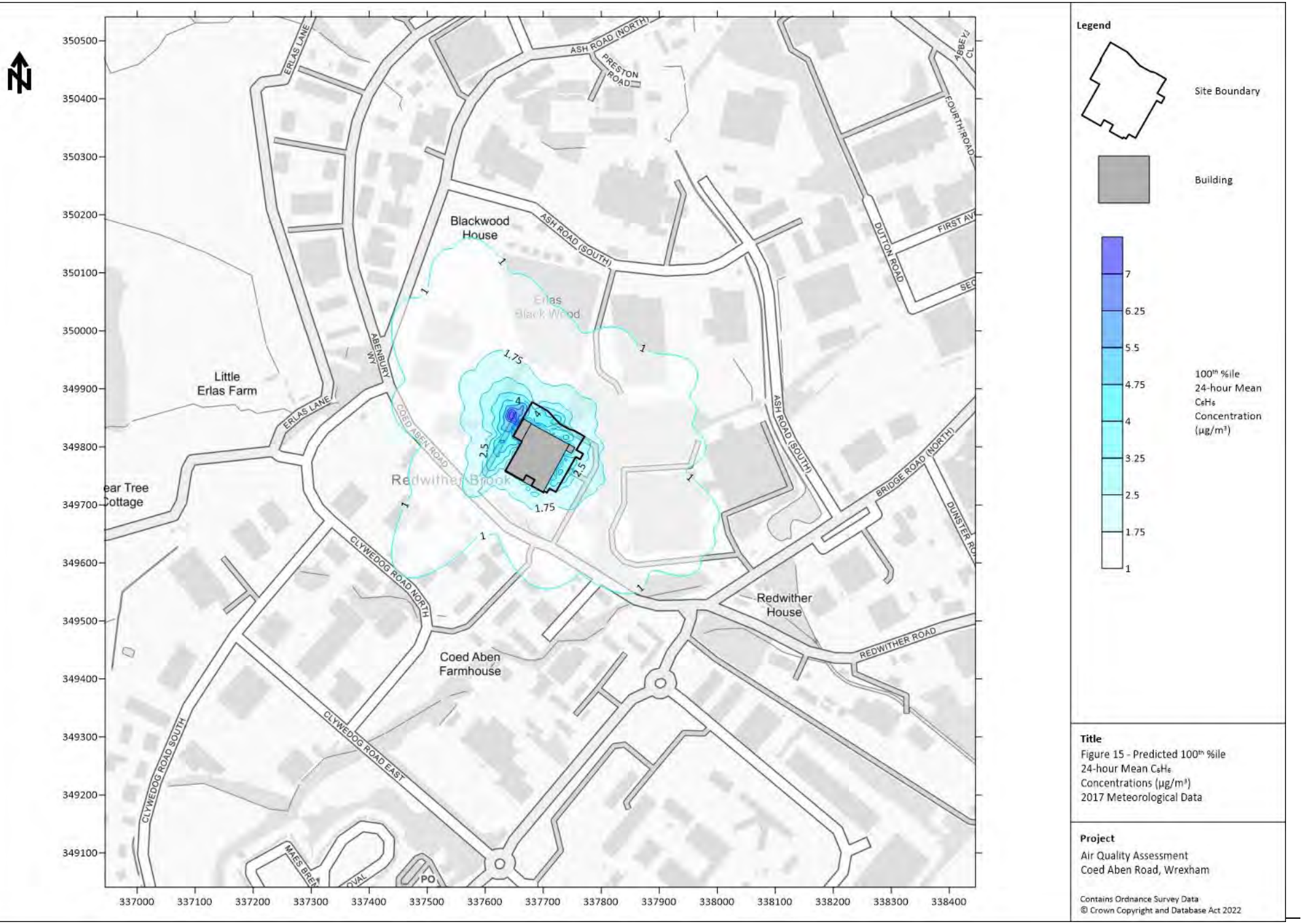

Title
Figure 15 - Predicted 100th %ile 24-hour Mean C_6H_6 Concentrations (µg/m³) 2017 Meteorological Data

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