

Air Quality Assessment
Ffordd Llandygai, Bangor

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Executive Summary

Redmore Environmental Ltd was commissioned by Williams Homes (Bala) Ltd to undertake an Air Quality Assessment in support of a planning application for a residential development on land off Ffordd Llandygai, Bangor.

The proposals have the potential to cause air quality impacts as a result of dust emissions during the construction phase. Additionally, the site is located in close proximity to Bangor Crematorium. Emissions from cremators installed at the site have the potential to cause air quality impacts at the proposed development. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and evaluate potential effects.

Potential construction phase air quality impacts from fugitive dust emissions were assessed as a result of earthworks, construction and trackout activities. It is considered that the use of good practice control measures would provide suitable mitigation for a development of this size and nature and reduce potential impacts to an acceptable level.

Dispersion modelling was undertaken in order to predict pollutant concentrations at the proposed development as a result of emissions from Bangor Crematorium. The results indicated that predicted concentrations of all pollutants were below the relevant Environment Quality Standards at the site. As such, impacts on the development were classified as **not significant** in accordance with the relevant guidance.

Based on the assessment results, air quality issues are not considered a constraint to planning consent for the development.

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1.0 INTRODUCTION

1.1 Background

- 1.1.1 Redmore Environmental Ltd was commissioned by Williams Homes (Bala) Ltd to undertake an Air Quality Assessment in support of a planning application for a residential development on land off Ffordd Llandygai, Bangor.
- 1.1.2 The proposals have the potential to cause impacts at sensitive locations as a result of dust emissions during the construction phase. Additionally, the site is located in proximity to Bangor Crematorium. Emissions from the cremators installed at the site have the potential to cause air quality impacts at the proposed development. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and evaluate potential effects.

1.2 Site Location and Context

- 1.2.1 The proposed development is located on land off Ffordd Llandygai, at National Grid Reference (NGR): 259270, 371835. Reference should be made to Figure 1 for a map of the site and surrounding area.
- 1.2.2 The proposals comprise the construction of 51 residential units with associated landscaping and access route.
- 1.2.3 The proposals have the potential to cause impacts at sensitive locations as a result of dust emissions during the construction phase. Additionally, the site is located in proximity to Bangor Crematorium. Emissions from the cremators installed at the site have the potential to cause air quality impacts at the proposed development. As such, an Air Quality Assessment has been undertaken in order to determine baseline conditions and evaluate potential effects. The findings are detailed in the following report.

2.0 LEGISLATION AND POLICY

2.1 Legislation

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

- Nitrogen dioxide;
- Sulphur dioxide;
- Lead;
- Particulate matter with an aerodynamic diameter of less than 10µm (PM₁₀);
- Particulate matter with an aerodynamic diameter of less than 2.5µm;
- Benzene (C₆H₆); 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 2007¹. 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/m ³)	Averaging Period
PM ₁₀	40	Annual mean

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 ($\mu\text{g}/\text{m}^3$)	Averaging Period
	50	24-hour mean, not to be exceeded on more than 35 occasions per annum
C ₆ H ₆	5	Annual mean
CO	10,000	8-hour running mean

2.1.4 Table 2 summarises the advice provided in DEFRA guidance² 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
24-hour mean and 8-hour mean	All locations where the annual mean objective would apply, together with hotels Gardens of residential properties	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.

2.2 Dust Legislation

2.2.1 The main requirements with respect to dust control from construction sites is that provided in Section 79 of Part III of the Environmental Protection Act (1990). The Act defines nuisance as:

"any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance."

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

2.2.2 Enforcement of the Act, in regard to nuisance, is currently under the jurisdiction of the local Environmental Health Department, whose officers are deemed to provide an independent evaluation of nuisance. If the LA is satisfied that a statutory nuisance exists, or is likely to occur or happen again, it must serve an Abatement Notice under Part III of the Environmental Protection Act (1990). The only defence is to show that the process to which the nuisance has been attributed and its operation are being controlled according to best practicable means.

2.3 Environmental Assessment Levels

2.3.1 An Environmental Assessment Level (EAL) is the concentration of a substance, which, in a particular environmental medium, the regulators regard as an appropriate comparator value. This enables comparison between the environmental effects of different substances in that medium and between environmental effects in different media, enabling the summation of those effects.

2.3.2 Ideally EALs to fulfil this objective would be defined for each pollutant:

- Based on the sensitivity of particular habitats or receptors (in particular three main types of receptor should be considered, protection of human health, protection of natural ecosystems and protection of specific sensitive receptors, e.g. materials, commercial activities requiring a particular environmental quality);
- Be produced according to a standardised protocol to ensure that they are consistent, reproducible and readily understood;
- Provide similar measure of protection for different receptors both within and between media; and,
- Take account of habitat specific environmental factors such as pH, nutrient status, bioaccumulation, transfer and transformation processes where necessary.

- 2.3.3 In accordance with Natural Resources Wales (NRW) guidance³, EALs for use in the assessment were obtained from Environment Agency (EA) guidance 'Air emissions risk assessment for your environment permit'⁴. These are summarised in Table 3.

Table 3 Environmental Assessment Levels

Pollutant	Environmental Assessment Level (µg/m ³)	
	Long Term (Annual)	Short Term
C ₆ H ₆	-	30 ^(a)
Hydrogen chloride (HCl)	-	750 ^(b)

Note: (a) 24-hour mean

(b) 1-hour mean

2.4 Local Air Quality Management

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

2.5 Industrial Pollution Control Legislation

- 2.5.1 Atmospheric emissions from industry are controlled in Wales through the Environmental Permitting (England and Wales) Regulations (2016) and subsequent amendments. The operation of a crematorium is included within the Regulations. As such, the facility is required to operate in accordance with an Environmental Permit. Amongst conditions of operation are stated Emission Limit Values (ELVs) for various pollutants produced by the processes. Compliance with these conditions must be demonstrated through periodic

³ <https://naturalresources.wales/permits-and-permissions/installations/guidance-on-complying-with-an-environmental-permit-for-an-installation/?lang=en>

⁴ <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>.

monitoring requirements, which have been set in order to limit potential impacts in the surrounding area.

2.6 National Planning Policy

2.6.1 Planning Policy Wales⁵ was published in February 2021 and sets out the land use planning policies of the Welsh Government, including air quality. Chapter 6, Section 6.7 - Air Quality and Soundscape, provides a framework for addressing air quality and states that:

"The planning system should maximise its contribution to achieving the well-being goals, and in particular a healthier Wales, by aiming to reduce average population exposure to air and noise pollution alongside action to tackle high pollution hotspots. In doing so, it should consider the long-term effects of current and predicted levels of air and noise pollution on individuals, society and the environment and identify and pursue any opportunities to reduce, or at least, minimise population exposure to air and noise pollution, and improve soundscapes, where it is practical and feasible to do so.

[...]

In proposing new development, planning authorities and developers must, therefore:

- address any implication arising as a result of its association with, or location within, air quality management areas, noise action planning priority areas or areas where there are sensitive receptors;
- not create areas of poor air quality or inappropriate soundscape; and,
- seek to incorporate measures which reduce overall exposure to air and noise pollution and create appropriate soundscapes."

[...]"

2.6.2 This has been considered throughout this assessment.

⁵ Planning Policy Wales Edition 11, Welsh Assembly Government, 2021.

2.7 Local Planning Policy

- 2.7.1 The Anglesey and Gwynedd Joint Local Development Plan 2011 - 2026⁶ was adopted by the Isle of Anglesey County Council (IoACC) and Gwynedd Council (GC) in July 2017. Review of the document indicated the following policy of relevance to this report:

"Policy PCYFF 2: Development Criteria

[...]

Additionally, planning permission will be refused where the proposed development would have an unacceptable adverse impact on:

7. The health, safety or amenity of occupiers of local residences, other land and property uses or characteristics of the locality due to increased activity, disturbance, vibration, noise, dust, fumes, litter, drainage, light pollution, or other forms of pollution or nuisance;

[...]"

- 2.7.2 The above policy was taken into consideration throughout the undertaking of the assessment.

⁶ Anglesey and Gwynedd Joint Local Development Plan 2011 - 2026, IoACC and GC, 2017.

3.0 METHODOLOGY

3.1 Introduction

3.1.1 The proposed development has the potential to cause impacts at sensitive locations as a result of dust emissions during the construction phase. Additionally, the site is located in proximity to Bangor Crematorium. Emissions from the cremators installed at the site have the potential to cause air quality impacts at the development. These have been assessed in accordance with the following methodology, which was agreed with Ffion Muscroft, Environmental Health Officer at GC, on 27th June 2023.

3.2 Construction Phase Assessment

3.2.1 There is the potential for fugitive dust emissions to occur as a result of construction phase activities. These have been assessed in accordance with the methodology outlined within the Institute of Air Quality Management (IAQM) document 'Guidance on the Assessment of Dust from Demolition and Construction V1.1'⁷.

3.2.2 Activities on the proposed construction site have been divided into three types to reflect their different potential impacts. These are:

- Earthworks;
- Construction; and,
- Trackout.

3.2.3 The potential for dust emissions was assessed for each activity that is likely to take place and considered three separate dust effects:

- Annoyance due to dust soiling;
- Harm to ecological receptors; and,
- The risk of health effects due to a significant increase in exposure to PM10.

3.2.4 The assessment steps are detailed below.

⁷ Guidance on the Assessment of Dust from Demolition and Construction V1.1, IAQM, 2016.

Step 1

- 3.2.5 Step 1 screens the requirement for a more detailed assessment. Should human receptors be identified within 350m from the boundary or 50m from the construction vehicle route up to 500m from the site entrance, then the assessment proceeds to Step 2. Additionally, should ecological receptors be identified within 50m of the site or the construction vehicle route up to 500m from the site entrance, then the assessment also proceeds to Step 2.
- 3.2.6 Should sensitive receptors not be present within the relevant distances then **negligible** impacts would be expected and further assessment is not necessary.

Step 2

- 3.2.7 Step 2 assesses the risk of potential dust impacts. A site is allocated a risk category based on two factors:
- The scale and nature of the works, which determines the magnitude of dust arising as: small, medium or large (Step 2A); and,
 - The sensitivity of the area to dust impacts, which can be defined as low, medium or high sensitivity (Step 2B).
- 3.2.8 The two factors are combined in Step 2C to determine the risk of dust impacts without mitigation applied.
- 3.2.9 Step 2A defines the potential magnitude of dust emission through the construction phase. The relevant criteria are summarised in Table 4.

Table 4 Construction Dust - Magnitude of Emission

Magnitude	Activity	Criteria
Large	Earthworks	<ul style="list-style-type: none">• Total site area greater than 10,000m²• Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size)• More than 10 heavy earth moving vehicles active at any one time• Formation of bunds greater than 8m in height• More than 100,000 tonnes of material moved

Magnitude	Activity	Criteria
	Construction	<ul style="list-style-type: none"> Total building volume greater than 100,000m³ On site concrete batching Sandblasting
	Trackout	<ul style="list-style-type: none"> More than 50 Heavy Duty Vehicle (HDV) trips per day Potentially dusty surface material (e.g. high clay content) Unpaved road length greater than 100m
Medium	Earthworks	<ul style="list-style-type: none"> Total site area 2,500m² to 10,000m² Moderately dusty soil type (e.g. silt) 5 to 10 heavy earth moving vehicles active at any one time Formation of bunds 4m to 8m in height Total material moved 20,000 tonnes to 100,000 tonnes
	Construction	<ul style="list-style-type: none"> Total building volume 25,000m³ to 100,000m³ Potentially dusty construction material (e.g. concrete) On site concrete batching
	Trackout	<ul style="list-style-type: none"> 10 to 50 HDV trips per day Moderately dusty surface material (e.g. high clay content) Unpaved road length 50m to 100m
Small	Earthworks	<ul style="list-style-type: none"> Total site area less than 2,500m² Soil type with large grain size (e.g. sand) Less than 5 heavy earth moving vehicles active at any one time Formation of bunds less than 4m in height Total material moved less than 20,000 tonnes Earthworks during wetter months
	Construction	<ul style="list-style-type: none"> Total building volume less than 25,000m³ Construction material with low potential for dust release (e.g. metal cladding or timber)
	Trackout	<ul style="list-style-type: none"> Less than 10 HDV trips per day Surface material with low potential for dust release Unpaved road length less than 50m

3.2.10 Step 2B defines the sensitivity of the area around the development to potential dust impacts. The influencing factors are shown in Table 5.

Table 5 Construction Dust - Examples of Factors Defining Sensitivity of an Area

Receptor Sensitivity	Examples	
	Human Receptors	Ecological Receptors
High	<ul style="list-style-type: none"> • Users expect high levels of amenity • High aesthetic or value property • People expected to be present continuously for extended periods of time • Locations where members of the public are exposed over a time period relevant to the AQO for PM₁₀. e.g. residential properties, hospitals, schools and residential care homes 	<ul style="list-style-type: none"> • Internationally or nationally designated site e.g. Special Area of Conservation
Medium	<ul style="list-style-type: none"> • Users would expect to enjoy a reasonable level of amenity • Aesthetics or value of their property could be diminished by soiling • People or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land e.g. parks and places of work 	<ul style="list-style-type: none"> • Nationally designated site e.g. Sites of Special Scientific Interest
Low	<ul style="list-style-type: none"> • Enjoyment of amenity would not reasonably be expected • Property would not be expected to be diminished in appearance • Transient exposure, where people would only be expected to be present for limited periods. e.g. public footpaths, playing fields, shopping streets, farmland, short term car parks and roads 	<ul style="list-style-type: none"> • Locally designated site e.g. Local Nature Reserve

3.2.11 The guidance also provides the following factors to consider when determining the sensitivity of an area to potential dust impacts:

- Any history of dust generating activities in the area;
- The likelihood of concurrent dust generating activity on nearby sites;
- Any pre-existing screening between the source and receptors;
- Any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which works will take place;
- Any conclusions drawn from local topography;
- Duration of the potential impact, as a receptor may become more sensitive over time; and,

- Any known specific receptor sensitivities which go beyond the classifications given in the document.

3.2.12 These factors were considered in the undertaking of this assessment.

3.2.13 The criteria for determining the sensitivity of the area to dust soiling effects on people and property is summarised in Table 6.

Table 6 Construction Dust - Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		Less than 20	Less than 50	Less than 100	Less than 350
High	More than 100	High	High	Medium	Low
	10 - 100	High	Medium	Low	Low
	1 - 10	Medium	Low	Low	Low
Medium	More than 1	Medium	Low	Low	Low
Low	More than 1	Low	Low	Low	Low

3.2.14 Table 7 outlines the criteria for determining the sensitivity of the area to human health impacts.

Table 7 Construction Dust - Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Background Annual Mean PM ₁₀ Concentration	Number of Receptors	Distance from the Source (m)				
			Less than 20	Less than 50	Less than 100	Less than 200	Less than 350
High	Greater than 32µg/m ³	More than 100	High	High	High	Medium	Low
		10 - 100	High	High	Medium	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	28 - 32µg/m ³	More than 100	High	High	Medium	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	High	Medium	Low	Low	Low

Receptor Sensitivity	Background Annual Mean PM ₁₀ Concentration	Number of Receptors	Distance from the Source (m)				
			Less than 20	Less than 50	Less than 100	Less than 200	Less than 350
	24 - 28µg/m ³	More than 100	High	Medium	Low	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	Less than 24µg/m ³	More than 100	Medium	Low	Low	Low	Low
		10 - 100	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	Medium	Greater than 32µg/m ³	More than 10	High	Medium	Low	Low
			1 - 10	Medium	Low	Low	Low
	28 - 32µg/m ³	More than 10	Medium	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	24 - 28µg/m ³	More than 10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	Less than 24µg/m ³	More than 10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	Low	-	1 or more	Low	Low	Low	Low

3.2.15 Table 8 outlines the criteria for determining the sensitivity of the area to ecological impacts.

Table 8 Construction Dust - Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m)	
	Less than 20	Less than 50
High	High	Medium
Medium	Medium	Low

Receptor Sensitivity	Distance from the Source (m)	
	Less than 20	Less than 50
Low	Low	Low

3.2.16 Step 2C combines the dust emission magnitude with the sensitivity of the area to determine the risk of unmitigated impacts.

3.2.17 Table 9 outlines the risk category from earthworks and construction activities.

Table 9 Construction Dust - Dust Risk Category from Earthworks and Construction Activities

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

3.2.18 Table 10 outlines the risk category from trackout activities.

Table 10 Construction Dust - Dust Risk Category from Trackout Activities

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Low	Negligible
Low	Low	Low	Negligible

Step 3

3.2.19 Step 3 requires the identification of site specific mitigation measures within the IAQM guidance⁸ to reduce potential dust impacts based upon the relevant risk categories

⁸ Guidance on the Assessment of Dust from Demolition and Construction V1.1, IAQM, 2016.

identified in Step 2. For sites with **negligible** risk, mitigation measures beyond those required by legislation are not required. However, additional controls may be applied as part of good practice.

Step 4

3.2.20 Once the risk of dust impacts has been determined and the appropriate mitigation measures identified, the final step is to determine the significance of any residual impacts. For almost all construction activity, the aim should be to control effects through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be **not significant**.

3.2.21 The determination of significance relies on professional judgement and reasoning should be provided as far as practicable. The IAQM guidance suggests the provision of details of the assessor's qualifications and experience. These are provided in Appendix 1.

3.3 Crematorium Emissions Assessment

3.3.1 Emissions from the cremators installed at Bangor Crematorium have the potential to cause air quality impacts at the proposed development. Potential effects have therefore been defined by predicting pollutant concentrations at the scheme using dispersion modelling.

Dispersion Modelling

3.3.2 Dispersion modelling was undertaken using ADMS-6.0 (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.

3.3.3 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.

Modelling Scenarios

The scenarios considered in the modelling assessment for receptors are summarised in Table 11.

Table 11 Assessment Scenarios

Parameter	Modelled As	
	Short Term	Long Term
PM ₁₀	90.4 th percentile (%ile) 24-hour mean	Annual mean
Total Volatile Organic Compounds (VOCs) as C ₆ H ₆	100 th %ile 24-hour mean	Annual mean
CO	100 th %ile 8-hour rolling mean	-
HCl	100 th %ile 1-hour mean	-

3.3.4 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 11 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.

3.3.5 Predicted pollutant concentrations were summarised in the following formats:

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

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

Assessment Area

- 3.3.7 The assessment area was defined based on the facility location, anticipated pollutant dispersion patterns and the positioning of sensitive receptors at the development. Ambient concentrations were predicted over NGR: 258765, 371225 to 259625, 372085. 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.
- 3.3.8 Reference should be made to Figure 3 for a graphical representation of the assessment grid extents.

Process Conditions and Emissions

- 3.3.9 The crematorium includes three separate cremators. However, emissions from all three units are collected and discharged to atmosphere via a single common flue. As such, emissions from the facility were represented by one point source within the model. The relevant inputs are summarised in Table 12. These were derived from the Emissions Monitoring results for the crematorium undertaken Element⁹ and air dispersion modelling prepared by NIFES Consulting Group¹⁰. This information was provided by GC.

Table 12 Process Conditions

Parameter	Unit	Value
Stack position	NGR	259206, 371637
Stack height	m	15.6
Stack diameter	m	0.37
Crematorium exhaust gas temperature	°C	110.0 ^(a)
Reference oxygen content	%	11.0
Exhaust gas oxygen content	%	12
Combined exhaust gas flow rate	Nm ³ /s	1.10 ^(b)

⁹ Emissions Monitoring, Element, 2023.

¹⁰ Air Dispersion Modelling, NIFES Consulting Group, 2010.

Parameter	Unit	Value
Combined exhaust gas efflux velocity	m/s	15.54

Note: (a) Lowest temperature measured for all cremators as part of Emissions Monitoring undertaken by Element¹¹ in order to ensure a worst-case assessment of thermal buoyancy and its effect on initial dispersion and dilution of emissions.

(b) Volumetric flow rate calculated based on individual values for each cremator provided in the Emissions Monitoring reports prepared by Element¹² and using precautionary assumptions on flow characteristics where applicable.

3.3.10 Emissions were assumed to be constant with the crematorium in operation 24-hours per day, 365-days per year. This is considered to be a worst-case assessment scenario as cremation work load is not reflected in the modelled emissions.

3.3.11 Reference should be made to Figure 3 for a map of the emission source location.

3.3.12 The relevant ELVs for exhaust gas pollutant concentrations for the crematorium are shown in Table 13. These are the maximum permitted levels and therefore provide a worst case representation of potential emissions.

Table 13 Emission Concentrations

Pollutant	Pollutant Emission Concentration (mg/Nm ³)
PM ₁₀	160
Total Volatile Organic Compounds (VOCs) as C ₆ H ₆	20
CO	200
HCl	200

3.3.13 The ELV for organic carbon is stated as total VOC. However, for the purposes of dispersion modelling it was considered that the entire VOC emission consisted of only C₆H₆. This allowed the maximum ground level impacts to be assessed with respect to the EQSs. Actual plant emissions of VOC are unlikely to only consist of one species, resulting in a worst-case assessment. It should be noted that emissions were modelled as VOC and results factored to C₆H₆ using the relative atomic mass to carbon ratio.

¹¹ Emissions Monitoring, Element, 2023.

¹² Emissions Monitoring, Element, 2023.

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

Table 14 Pollutant Mass Emission Rates

Pollutant	Pollutant Mass Emission Rate (g/s)
PM ₁₀	0.1755
Total VOCs (TVOCs) as C ₆ H ₆	0.0219
CO	0.2194
HCl	0.2194

Building Effects

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

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

Table 15 Building Geometries

Building	NGR (m)		Height (m)	Length / Diameter (m)	Width (m)	Angle (°)
	X	Y				
Bangor Crematorium	259215.9	371635.6	12.6	35.2	43.6	240.1

3.3.17 Reference should be made to Figure 3 for a map of the building location.

Meteorological Data

3.3.18 Meteorological data used in the assessment was taken from Rhyl meteorological station over the period 1st January 2016 to 31st December 2020 (inclusive). This station is located

at NGR: 299442, 374621, which is approximately 40km east of the facility. It is anticipated that conditions would be reasonably similar over a distance of this magnitude. The data was therefore considered suitable for an assessment of this nature.

- 3.3.19 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 for wind roses of the utilised meteorological records.

Roughness Length

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

Monin-Obukhov Length

- 3.3.21 The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 10m was used to describe the modelling extents and meteorological site. This value is considered appropriate for the nature of both areas and is suggested within ADMS-6 as being suitable for 'small towns <50,000'.

Terrain Data

- 3.3.22 Ordnance Survey OS Terrain 50 data was included in the model for the site and surrounding area in order to take account of the specific flow field produced by variations in ground height throughout the assessment extents. This was pre-processed using the method suggested by CERC¹³.

Background Concentrations

- 3.3.23 Review of existing data in the vicinity of the site was undertaken in Section 4.0 in order to identify suitable background values for use in the assessment. These were subsequently utilised to represent existing concentrations at sensitive human receptors in the vicinity of the site. A summary of the relevant values is provided in Table 16.

¹³ Note 105: Setting up Terrain Data for Input to CERC Models, CERC, 2016.

Table 16 Background Pollutant Concentrations

Pollutant	Background Pollutant Concentration Used in Model ($\mu\text{g}/\text{m}^3$)	Source
PM ₁₀	9.10	DEFRA mapping
C ₆ H ₆	0.134	DEFRA mapping
CO	179	DEFRA mapping
HCl	0.44	UKEAP Network (Plas Y Brenin)

3.3.24 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 NRW guidance, 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.

Assessment Criteria

3.3.25 The IAQM guidance 'Land-Use Planning & Development Control: Planning for Air Quality'¹⁴ indicates that air quality impacts arising from surrounding sources on new occupants of a development are best described in relation to whether an EQS will or will not be met, or is at risk of not being met. Furthermore, the guidance indicates that any exceedance of an objective value is likely to be considered as being **significant**. Conversely, concentrations below the EQS would be classified as **not significant**. These factors have been considered as appropriate as part of analysis and interpretation of the modelling results.

Modelling Uncertainty

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

¹⁴ Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2017.

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

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

- Choice of model - ADMS-6 is a commonly used atmospheric dispersion model and results have been verified through a number of studies to ensure predictions are as accurate as possible;
- Meteorological data - Modelling was undertaken using five annual meteorological data sets from an observation station local to the site to account for inter-year variability. The assessment was based on the worst-case year to ensure maximum concentrations were considered;
- Surface characteristics - The z_0 and Monin-Obukhov length were determined for both the dispersion and meteorological sites based on the surrounding land uses and guidance provided by CERC. Terrain data was included and processed using the method outlined by CERC;
- Crematorium operating conditions - Operational parameters were derived from relevant emissions monitoring results and information provided by GC. As such, these are considered to be representative of likely operating conditions;
- Emission rates - Emission rates were derived from the relevant ELVs for the crematorium. As such, these are considered to be representative of maximum releases;
- Background concentrations - Background pollutant levels were obtained from the DEFRA website. 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.

3.3.28 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.

4.0 **BASELINE**

4.1 **Introduction**

- 4.1.1 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.

4.2 **Local Air Quality Management**

- 4.2.1 As required by the Environment Act (1995), GC has undertaken Review and Assessment of air quality within their area of jurisdiction. This process has indicated that concentrations of all pollutants considered within the AQS are below the AQOs within the district. As such, no AQMAs have been designated.

4.3 **Air Quality Monitoring**

Local Authority Monitoring

- 4.3.1 Monitoring of pollutant concentrations is undertaken by GC throughout their area of jurisdiction. The closest survey site to the proposed facility is approximately 1.7km west of the boundary. Due to the distance between the two locations, it is not considered likely that similar pollution levels would occur at these positions. As such, this source of data has not been considered further in the context of the assessment.

Acid Gas Monitoring

- 4.3.2 Concentrations of HCl are monitored in the UK through the UK Eutrophying and Acidifying Pollutants (UKEAP) network. The closest site to the facility is Plas Y Brenin at NGR: 271690, 357786, approximately 18.78km south-west of the site. The most recent data available for HCl is summarised in Table 17.

Table 17 Acid Gas Monitoring Results

Species	2015 Annual Mean Concentration ($\mu\text{g}/\text{m}^3$)
HCl	0.22

4.4 **Background Pollutant Concentrations**

- 4.4.1 Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by DEFRA for the entire of the UK to assist Local Authorities in their Review and Assessment of air quality. The site is located in grid square NGR: 259500, 371500. Data for this location was downloaded from the DEFRA website¹⁵ for the purpose of the assessment and is summarised in Table 18.

Table 18 Background Pollutant Concentration Predictions

Pollutant	Predicted Background Pollutant Concentration ($\mu\text{g}/\text{m}^3$)
PM ₁₀	9.10
C ₆ H ₆	0.13
CO	179.00

- 4.4.2 It should be noted that background PM₁₀ is predicted for 2023, CO for 2001 and C₆H₆ for 2010. 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.

4.5 **Sensitive Receptors**

- 4.5.1 A sensitive receptor is defined as any location which may be affected by changes in air quality. These have been defined in the following Sections.

Construction Phase Sensitive Receptors

- 4.5.2 Receptors sensitive to potential dust impacts during earthworks and construction were identified from a desk-top study of the area up to 350m from the development boundary. These are summarised in Table 19.

¹⁵ <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>.

Table 19 Earthworks and Construction Dust Sensitive Receptors

Distance from Site Boundary (m)	Approximate Number of Human Receptors	Approximate Number of Ecological Receptors
Up to 20	1 - 10	0
Up to 50	1 - 10	0
Up to 100	10 - 100	-
Up to 350	More than 100	-

- 4.5.3 Receptors sensitive to potential dust impacts from trackout were identified from a desk-top study of the area up to 50m from the road network within 500m of the site access. These are summarised in Table 20.

Table 20 Trackout Dust Sensitive Receptors

Distance from Site Access Route (m)	Approximate Number of Human Receptors	Approximate Number of Ecological Receptors
Up to 20	10 - 100	0
Up to 50	10 - 100	0

- 4.5.4 There are no ecological receptors within 50m of the development boundary or the access route within 500m of the site entrance. As such, ecological impacts as a result of dust emissions during the construction phase have not been assessed further within this report.
- 4.5.5 Based on the criteria shown in Table 5, the sensitivity of the receiving environment to potential dust impacts was determined as **high**. This was because the identified receptors included residential properties.
- 4.5.6 The sensitivity of the receiving environment to specific potential dust impacts, based on the criteria detailed in Section 3.2, is shown in Table 21.

Table 21 Sensitivity of the Surrounding Area to Potential Dust Impacts

Potential Impact	Sensitivity of the Surrounding Area		
	Earthworks	Construction	Trackout
Dust Soiling	Medium	Medium	Medium
Human Health	Low	Low	Low

Crematorium Emissions Assessment Sensitive Receptors

4.5.7 Three discrete receptor locations were selected in order to represent the façades of the closest residential properties associated with the proposed development to Bangor Crematorium. These are summarised in Table 22.

Table 22 Crematorium Emissions Assessment Receptor Locations

Receptor		NGR (m)	
		X	Y
R1	Proposed Residential Unit Façade	259263.4	371773.5
R2	Proposed Residential Unit Façade	259253.1	371812.6
R3	Proposed Residential Unit Façade	259243.5	371931.5

4.5.8 Reference should be made to Figure 2 for a map of the receptor locations.

5.0 **ASSESSMENT**

5.1 **Introduction**

- 5.1.1 There is the potential for air quality impacts as a result of dust emissions during the construction of the proposed development. Additionally, emissions from the crematorium have the potential to cause air quality impacts at the scheme. These are assessed in the following Sections.

5.2 **Construction Phase Assessment**

Step 1

- 5.2.1 The undertaking of activities such as excavation, ground works, cutting, construction, concrete batching and storage of materials has the potential to result in fugitive dust emissions throughout the construction phase. Vehicle movements both on-site and on the local road network also have the potential to result in the re-suspension of dust from haul roads and highway surfaces.
- 5.2.2 The potential for impacts at sensitive locations depends significantly on local meteorology during the undertaking of dust generating activities, with the most significant effects likely to occur during dry and windy conditions.
- 5.2.3 The desk-study undertaken to inform the baseline identified a number of sensitive receptors within 350m of the site boundary. As such, a detailed assessment of potential dust impacts was required.

Step 2

Earthworks

- 5.2.4 Earthworks will primarily involve excavating material, haulage, tipping and stockpiling, as well as site levelling and landscaping. The proposed development site covers an area above 10,000m². In accordance with the criteria outlined in Table 4, the magnitude of potential dust emissions from earthworks is therefore **large**.

5.2.5 Table 21 indicates the sensitivity of the area to dust soiling effects on people and property is **medium**. In accordance with the criteria outlined in Table 9, the development is considered to be a **medium** risk site for dust soiling as a result of earthworks.

5.2.6 Table 21 indicates the sensitivity of the area to human health impacts is **low**. In accordance with the criteria outlined in Table 9, the development is considered to be a **low** risk site for human health impacts as a result of earthworks.

Construction

5.2.7 The total proposed building volume is less than 25,000m³. In accordance with the criteria outlined in Table 4, the magnitude of potential dust emissions from construction is therefore **small**.

5.2.8 Table 21 indicates the sensitivity of the area to dust soiling effects on people and property is **medium**. In accordance with the criteria outlined in Table 9, the development is considered to be a **low** risk site for dust soiling as a result of construction activities.

5.2.9 Table 21 indicates the sensitivity of the area to human health impacts is **low**. In accordance with the criteria outlined in Table 9, the development is considered to be a **negligible** risk site for human health impacts as a result of construction activities.

Trackout

5.2.10 Based on the site area and existing hardstanding provision, it is anticipated that the unpaved road length is likely to be above 100m. In accordance with the criteria outlined in Table 4, the magnitude of potential dust emissions from trackout is therefore **high**.

5.2.11 Table 21 indicates the sensitivity of the area to dust soiling effects to people and property is **medium**. In accordance with the criteria outlined in Table 10, the development is considered to be a **medium** risk site for dust soiling as a result of trackout activities.

5.2.12 Table 21 indicates the sensitivity of the area to human health impacts is **low**. In accordance with the criteria outlined in Table 10, the development is considered to be a **low** risk site for human health impacts as a result of trackout activities.

Summary of the Risk of Dust Effects

5.2.13 A summary of the risk from each dust generating activity is provided in Table 23.

Table 23 Summary of Potential Unmitigated Dust Risks

Potential Impact	Risk		
	Earthworks	Construction	Trackout
Dust Soiling	Medium	Low	Medium
Human Health	Low	Negligible	Low

5.2.14 As indicated in Table 23, the potential risk of dust soiling is **medium** from earthworks and trackout and **low** from construction. The potential risk of human health impacts is **low** from earthworks and trackout and **negligible** from construction.

5.2.15 It should be noted that the potential for impacts depends significantly on the distance between the dust generating activity and receptor location. Risk was predicted based on a worst-case scenario of works being undertaken at the site boundary closest to each sensitive area. Therefore, actual risk is likely to be lower than that predicted during the majority of the construction phase.

Step 3

5.2.16 The IAQM guidance¹⁶ provides potential mitigation measures to reduce impacts as a result of fugitive dust emissions during the construction phase. These have been adapted for the development site as summarised in Table 24. This can be incorporated into the Construction Environmental Management Statement submitted as part of the application.

¹⁶ Guidance on the Assessment of Dust from Demolition and Construction V1.1, IAQM, 2016.

Table 24 Fugitive Dust Emission Mitigation Measures

Issue	Control Measure
Communications	<ul style="list-style-type: none"> • Develop and implement a stakeholder communications plan that includes community engagement before work commences on site • Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager • Display the head or regional office contact information • Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the LA
Site management	<ul style="list-style-type: none"> • Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken • Make the complaints log available to the LA upon request • Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book
Monitoring	<ul style="list-style-type: none"> • Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the LA when asked • Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the LA upon request • Increase the frequency of site inspections when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions
Site preparation	<ul style="list-style-type: none"> • Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible • Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site • Fully enclose site or specific operations where there is a high potential for dust production and they are active for an extensive period • Avoid site runoff of water or mud • Keep site fencing and scaffolding clean using wet methods • Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used • Cover, seed or fence stockpiles to prevent wind whipping
Operating vehicle/machinery and sustainable travel	<ul style="list-style-type: none"> • Ensure all vehicles switch off engines when stationary - no idling vehicles • Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable • Produce a Construction Logistics Plan to manage the sustainable delivery of goods

Issue	Control Measure
Operations	<ul style="list-style-type: none"> • Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques • Ensure an adequate water supply on the site for effective dust suppression, using non-potable water where possible and appropriate • Use enclosed chutes and conveyors and covered skips • Minimise drop heights and use fine water sprays wherever appropriate • Ensure equipment is available to clean any dry spillages, and clean up spillages as soon as reasonably practicable using wet cleaning methods
Waste management	<ul style="list-style-type: none"> • Avoid bonfires or burning of waste materials
Earthworks	<ul style="list-style-type: none"> • Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable • Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable • Only remove the cover in small areas during work and not all at once
Construction	<ul style="list-style-type: none"> • Avoid scabbling (roughening of concrete surfaces) if possible • Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out • Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery
Trackout	<ul style="list-style-type: none"> • Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site • Avoid dry sweeping of large areas • Ensure vehicles entering and leaving the site are covered to prevent escape of materials during transport • Implement a wheel washing system, if required • Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits

Step 4

5.2.17 Assuming the relevant mitigation measures outlined in Table 24 are implemented, the residual impacts from all dust generating activities is predicted to be **not significant**, in accordance with the IAQM guidance¹⁷.

¹⁷ Guidance on the Assessment of Dust from Demolition and Construction V1.1, IAQM, 2016.

5.3 Crematorium Emissions Assessment

5.3.1 Dispersion modelling was undertaken with the inputs described in Section 3.3. The results are outlined in the following Sections.

Maximum Pollutant Concentrations

5.3.2 Maximum predicted pollutant concentrations throughout the assessment extents for any meteorological data set are summarised in Table 25.

Table 25 Maximum Predicted Pollutant Concentrations

Pollutant	Averaging Period	EQS ($\mu\text{g}/\text{m}^3$)	PC ($\mu\text{g}/\text{m}^3$)	PC Proportion of EQS (%)	PEC ($\mu\text{g}/\text{m}^3$)	PEC Proportion of EQS (%)
PM ₁₀	Annual mean	40	4.90	12.3	14.00	35.0
	90.4 th %ile 24-hour mean	50	12.89	25.8	31.09	62.2
C ₆ H ₆	Annual mean	5	0.61	12.2	0.75	14.9
	100 th %ile 24-hour mean	30	2.76	9.2	3.03	10.1
CO	100 th %ile 8-hour rolling mean	10,000	38.41	0.4	396.41	4.0
HCl	100 th %ile 1-hour mean	750	77.13	10.3	77.57	10.3

5.3.3 As shown in Table 25, there were no predicted exceedences of the relevant EQSs for all respective averaging periods of all pollutants.

5.3.4 Reference should be made to Figures 5 to 10 for graphical representations of predicted pollutant concentrations, inclusive of background pollutant 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 species. For example, the maximum annual mean PM₁₀ concentration was

predicted using the 2017 meteorological data set. As such, the contours shown in Figure 5 were produced from these outputs.

Receptor Locations

5.3.5 Predicted concentrations of each pollutant at the receptor locations identified in Table 22 which were selected to represent the façades of residential properties associated with the development are summarised in the following sections.

Particulate Matter

5.3.6 Predicted annual mean PM₁₀ PECs at the receptor locations, inclusive of background levels, are summarised in Table 26.

Table 26 Predicted Annual Mean PM₁₀ Concentrations

Receptor		Predicted Annual Mean PM ₁₀ PEC (µg/m ³)				
		2016	2017	2018	2019	2020
R1	Proposed Residential Unit Façade	11.03	11.43	11.48	11.28	11.32
R2	Proposed Residential Unit Façade	10.21	10.41	10.56	10.44	10.41
R3	Proposed Residential Unit Façade	9.59	9.58	9.70	9.66	9.64

5.3.7 As indicated in Table 26, predicted PM₁₀ concentrations were below the annual mean EQS of 40µg/m³ at all receptor locations selected to represent the development for all meteorological data sets. As such, impacts as a result of annual mean PM₁₀ concentrations are considered to be **not significant**, in accordance with the IAQM guidance.

5.3.8 Reference should be made to Figure 5 for a graphical representation of predicted concentrations throughout the assessment extents.

5.3.9 Predicted 90.4th %ile 24-hour mean PM₁₀ PECs at the receptors, inclusive of background levels, are summarised in Table 27.

Table 27 Predicted 90.4th %ile 24-hour Mean PM₁₀ Concentrations

Receptor		Predicted 90.4 th %ile 24-hour Mean PM ₁₀ PEC (µg/m ³)				
		2016	2017	2018	2019	2020
R1	Proposed Residential Unit Façade	23.47	24.08	24.15	24.07	23.76
R2	Proposed Residential Unit Façade	21.18	21.70	21.94	21.78	21.68
R3	Proposed Residential Unit Façade	19.59	19.59	19.74	19.75	19.68

5.3.10 As indicated in Table 27, predicted 90.4th %ile 24-hour mean PM₁₀ concentrations were below the EQS of 50µg/m³ at all receptor locations selected to represent the development. As such, impacts as a result of 24-hour mean PM₁₀ concentrations are considered to be **not significant**, in accordance with the IAQM guidance.

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

Volatile Organic Compounds

5.3.12 Predicted annual mean VOC (as C₆H₆) PECs at the receptors, inclusive of background levels, are summarised in Table 28.

Table 28 Predicted Annual Mean VOC (as C₆H₆) Concentrations

Receptor		Predicted Annual Mean VOC (as C ₆ H ₆) PEC (µg/m ³)				
		2016	2017	2018	2019	2020
R1	Proposed Residential Unit Façade	0.38	0.42	0.43	0.41	0.41
R2	Proposed Residential Unit Façade	0.27	0.30	0.32	0.30	0.30
R3	Proposed Residential Unit Façade	0.20	0.19	0.21	0.20	0.20

5.3.13 As indicated in Table 28, predicted annual mean VOC (as C₆H₆) concentrations were below the EQS of 5µg/m³ at all receptor location selected to represent the development. As such, impacts as a result of annual mean VOC (as C₆H₆) concentrations are considered to be **not significant**, in accordance with the IAQM guidance.

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

5.3.15 Predicted 100th %ile 24-hour mean C₆H₆ PECs at the receptor locations, inclusive of background levels, are summarised in Table 29.

Table 29 Predicted 100th %ile 24-hour Mean VOC (as C₆H₆) Concentrations

Receptor		Predicted 100 th %ile 24-hour Mean VOC (as C ₆ H ₆) PEC (µg/m ³)				
		2016	2017	2018	2019	2020
R1	Proposed Residential Unit Façade	1.73	1.59	1.62	1.62	1.47
R2	Proposed Residential Unit Façade	1.42	1.11	1.13	1.09	1.02
R3	Proposed Residential Unit Façade	0.75	0.76	0.69	0.71	0.76

5.3.16 As indicated in Table 29, predicted 100th %ile 24-hour mean VOC (as C₆H₆) concentrations were below the EQS of 30µg/m³ at all receptor location selected to represent the development. As such, impacts as a result of 24-hour mean VOC (as C₆H₆) concentrations are considered to be **not significant**, in accordance with the IAQM guidance.

5.3.17 Reference should be made to Figure 8 for a graphical representation of predicted concentrations throughout the assessment extents.

Carbon Monoxide

5.3.18 Predicted 8-hour rolling mean CO PECs at the receptors, inclusive of background levels, are summarised in Table 30.

Table 30 Predicted 100th %ile 8-hour Rolling Mean CO Concentrations

Receptor		Predicted 100 th %ile 8-hour Rolling Mean CO PEC (µg/m ³)				
		2016	2017	2018	2019	2020
R1	Proposed Residential Unit Façade	381.59	379.54	383.75	381.17	381.97
R2	Proposed Residential Unit Façade	376.24	372.48	377.07	376.59	375.05

Receptor		Predicted 100 th %ile 8-hour Rolling Mean CO PEC (µg/m ³)				
		2016	2017	2018	2019	2020
R3	Proposed Residential Unit Façade	369.42	368.74	367.41	367.34	372.28

5.3.19 As indicated in Table 30, predicted 100th %ile 8-hour rolling mean CO concentrations were below the EQS of 10,000µg/m³ at all receptor locations selected to represent the development. As such, impacts as a result of 8-hour rolling mean CO concentrations are considered to be **not significant**, in accordance with the IAQM guidance.

5.3.20 Reference should be made to Figure 9 for a graphical representation of predicted concentrations throughout the assessment extents.

Hydrogen Chloride

5.3.21 Predicted 100th %ile 1-hour mean HCl PECs at the receptors, inclusive of background levels, are summarised in Table 31.

Table 31 Predicted 100th %ile 1-hour Mean HCl Concentrations

Receptor		Predicted 100 th %ile 1-hour Mean HCl PEC (µg/m ³)				
		2016	2017	2018	2019	2020
R1	Proposed Residential Unit Façade	29.48	29.38	29.52	29.59	29.88
R2	Proposed Residential Unit Façade	26.77	26.29	26.92	26.39	27.01
R3	Proposed Residential Unit Façade	17.09	16.70	18.83	16.91	19.28

5.3.22 As indicated in Table 31, predicted 100th %ile 1-hour mean HCl PECs were below the EQS of 750µg/m³ at all receptor location selected to represent the development for all meteorological data sets. As such, impacts as a result of 1-hour mean HCl concentrations are considered to be **not significant**, in accordance with the IAQM guidance.

5.3.23 Reference should be made to Figure 10 for a graphical representation of predicted concentrations throughout the assessment extents.

6.0 CONCLUSION

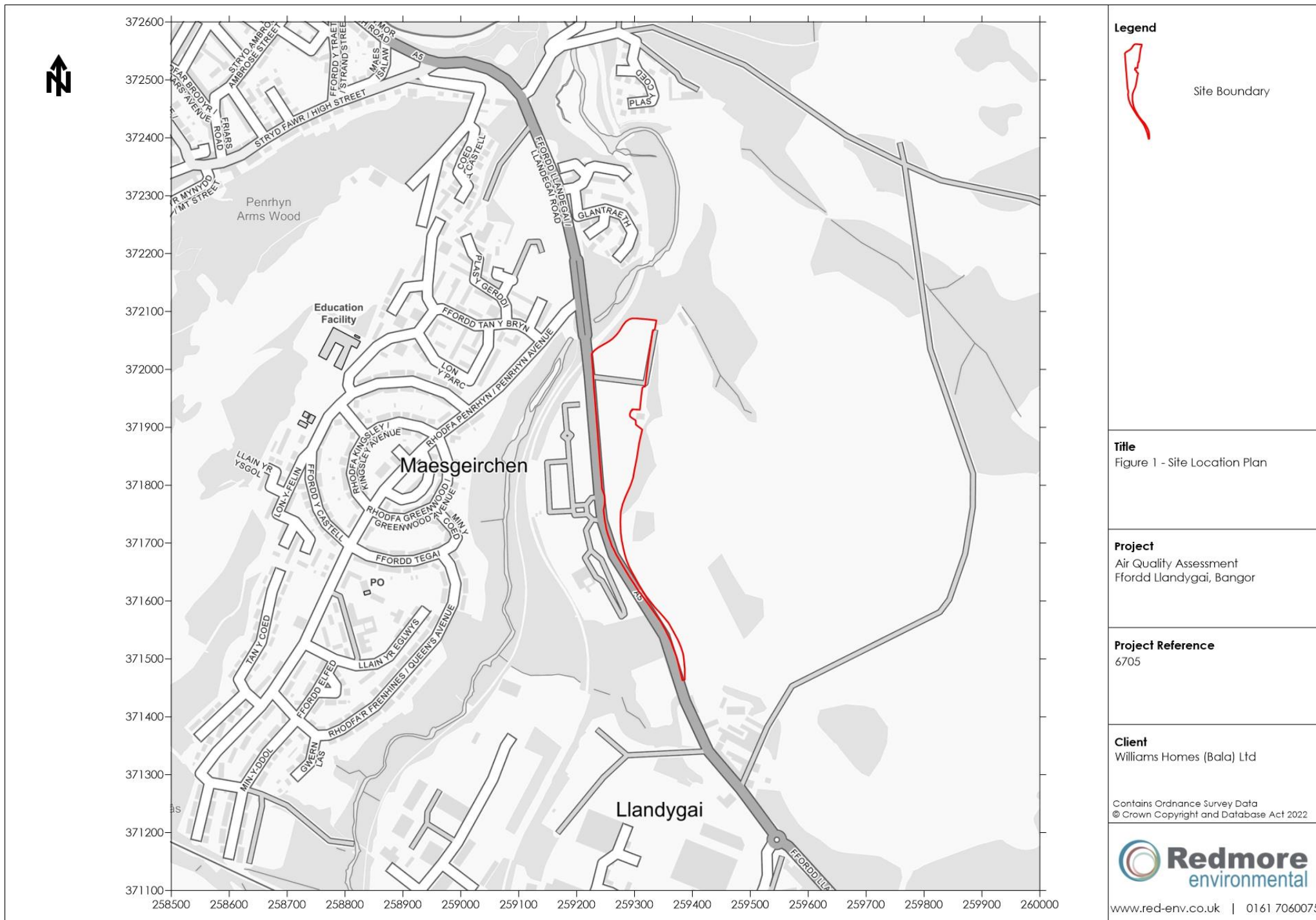
- 6.1.1 Redmore Environmental Ltd was commissioned by Williams Homes (Bala) Ltd to undertake an Air Quality Assessment in support of a planning application for a residential development on land off Ffordd Llandygai, Bangor.
- 6.1.2 The proposals have the potential to cause impacts at sensitive locations as a result of dust emissions during the construction phase. Additionally, the site is located in proximity to Bangor Crematorium. Emissions from the cremators installed at the site have the potential to cause air quality impacts at the proposed development. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and evaluate potential effects.
- 6.1.3 Potential construction phase dust impacts were assessed in accordance with the IAQM methodology. Assuming good practice dust control measures are implemented, the residual significance of potential air quality impacts from dust generated by earthworks, construction and trackout activities was predicted to be **not significant**.
- 6.1.4 Dispersion modelling was undertaken in order to predict pollutant concentrations at proposed development as a result of emissions from Bangor Crematorium. The results indicated that predicted concentrations of all pollutants were below the relevant EQSs at all modelled locations for all meteorological data sets. As such, impacts on the development were classified as **not significant** in accordance with the relevant IAQM guidance¹⁸.
- 6.1.5 Based on the assessment results, air quality issues are not considered a constraint to planning consent for the proposed development.

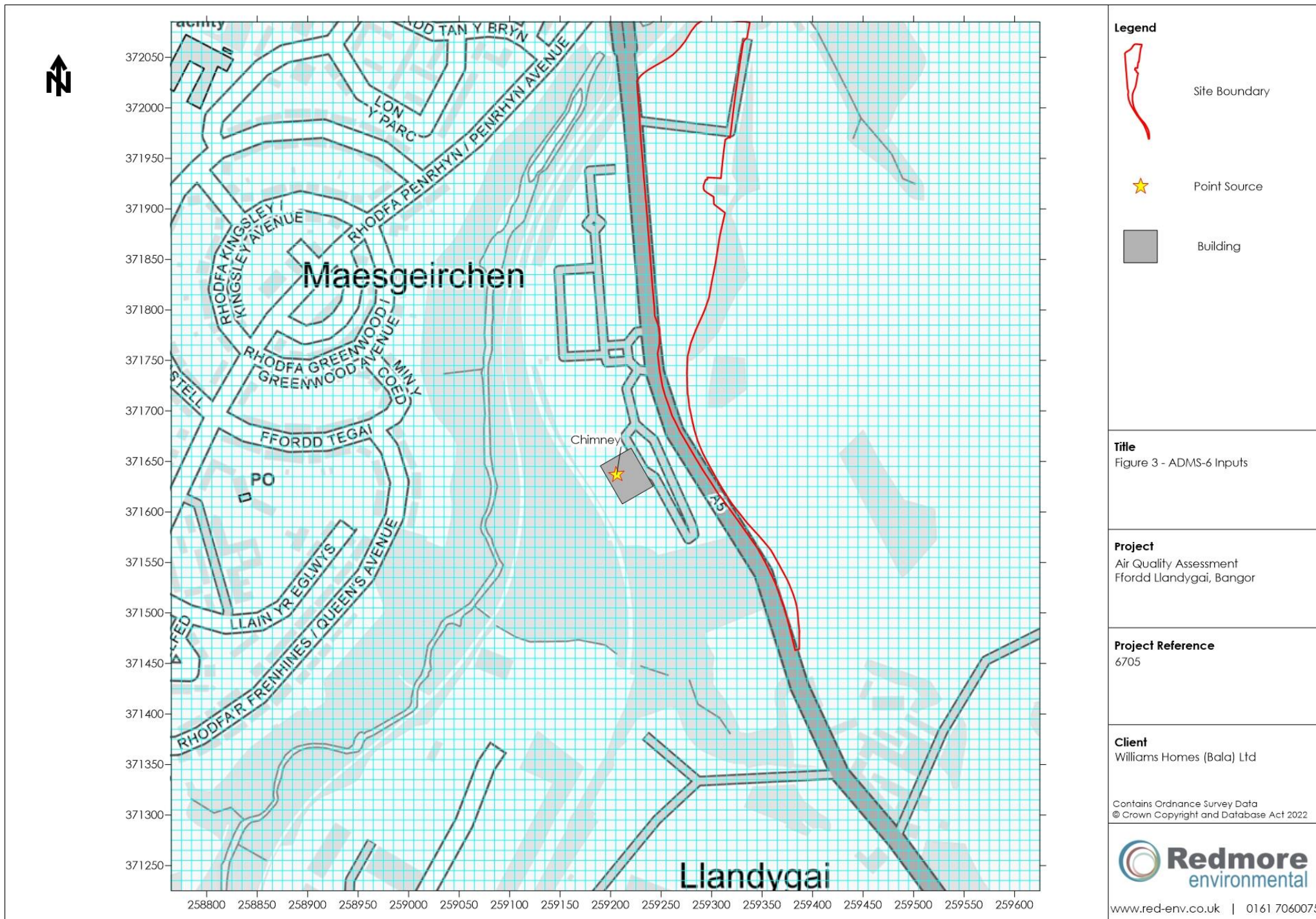
¹⁸ Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2017.

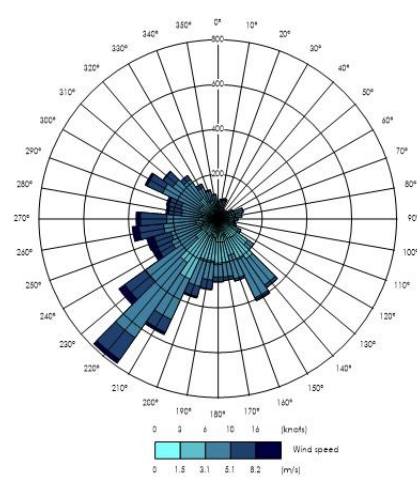
7.0 **ABBREVIATIONS**

AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Strategy
C ₆ H ₆	Benzene
CERC	Cambridge Environmental Research Consultants
CO	Carbon Monoxide
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EAL	Environmental Assessment Levels
ELV	Emission Limit Value
EQS	Environmental Quality Standard
GC	Gwynedd Council
HCl	Hydrogen Chloride
HDV	Heavy Duty Vehicles
IoACC	Isle of Anglesey County Council
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
MAGIC	Multi-Agency Geographic Information for the Countryside
NGR	National Grid Reference
NRW	Natural Resources Wales
PC	Process Contribution
PEC	Predicted Environmental Concentration
PM ₁₀	Particulate matter with an aerodynamic diameter of less than 10µm
VOC	Volatile Organic Compounds
Z ₀	Roughness length
%ile	Percentile

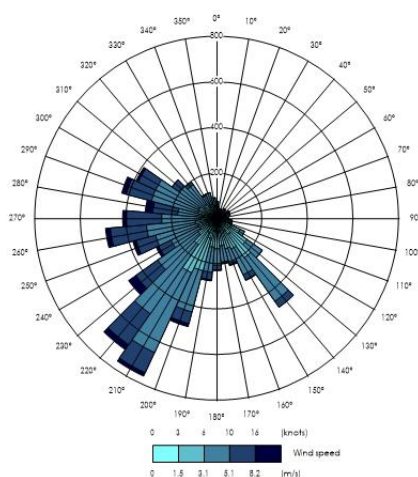
Figures



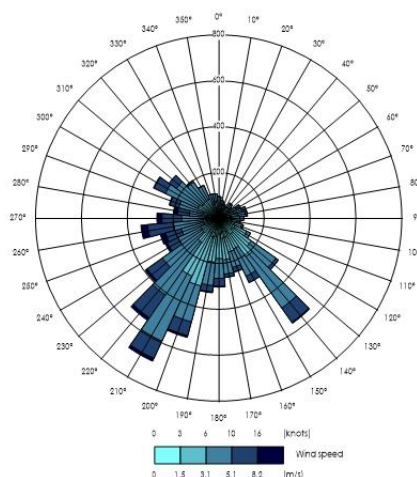




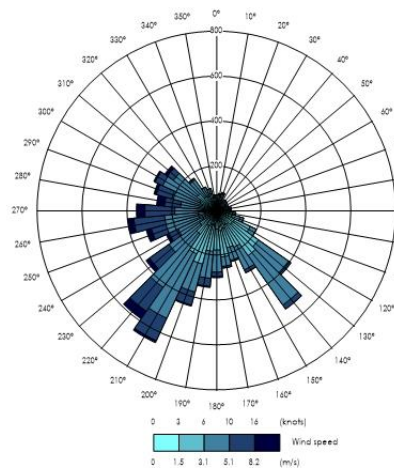
2016 Meteorological Data



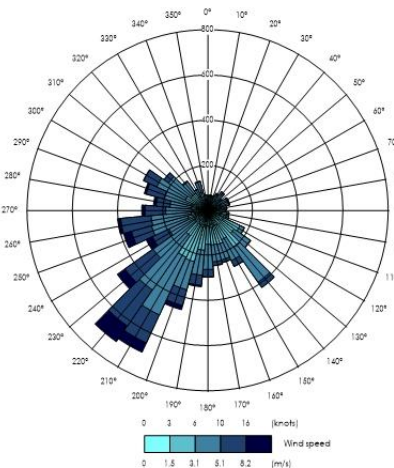
2017 Meteorological Data



2018 Meteorological Data



2019 Meteorological Data



2020 Meteorological Data

Legend

Title

Figure 4 - Wind Roses of 2016 to 2020 Rhyl Meteorological Station Data

Project

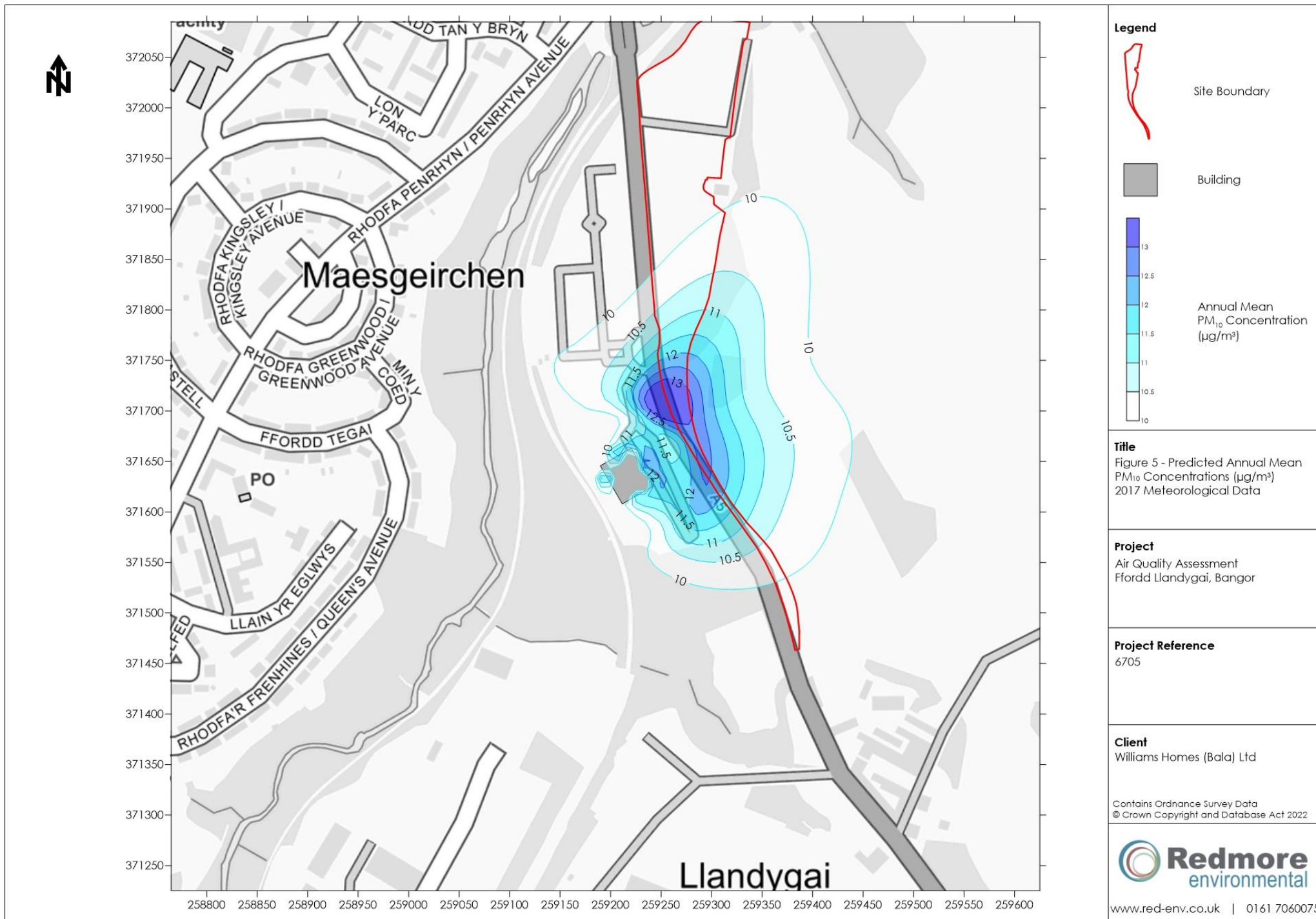
Air Quality Assessment
Ffordd Llandygai, Bangor

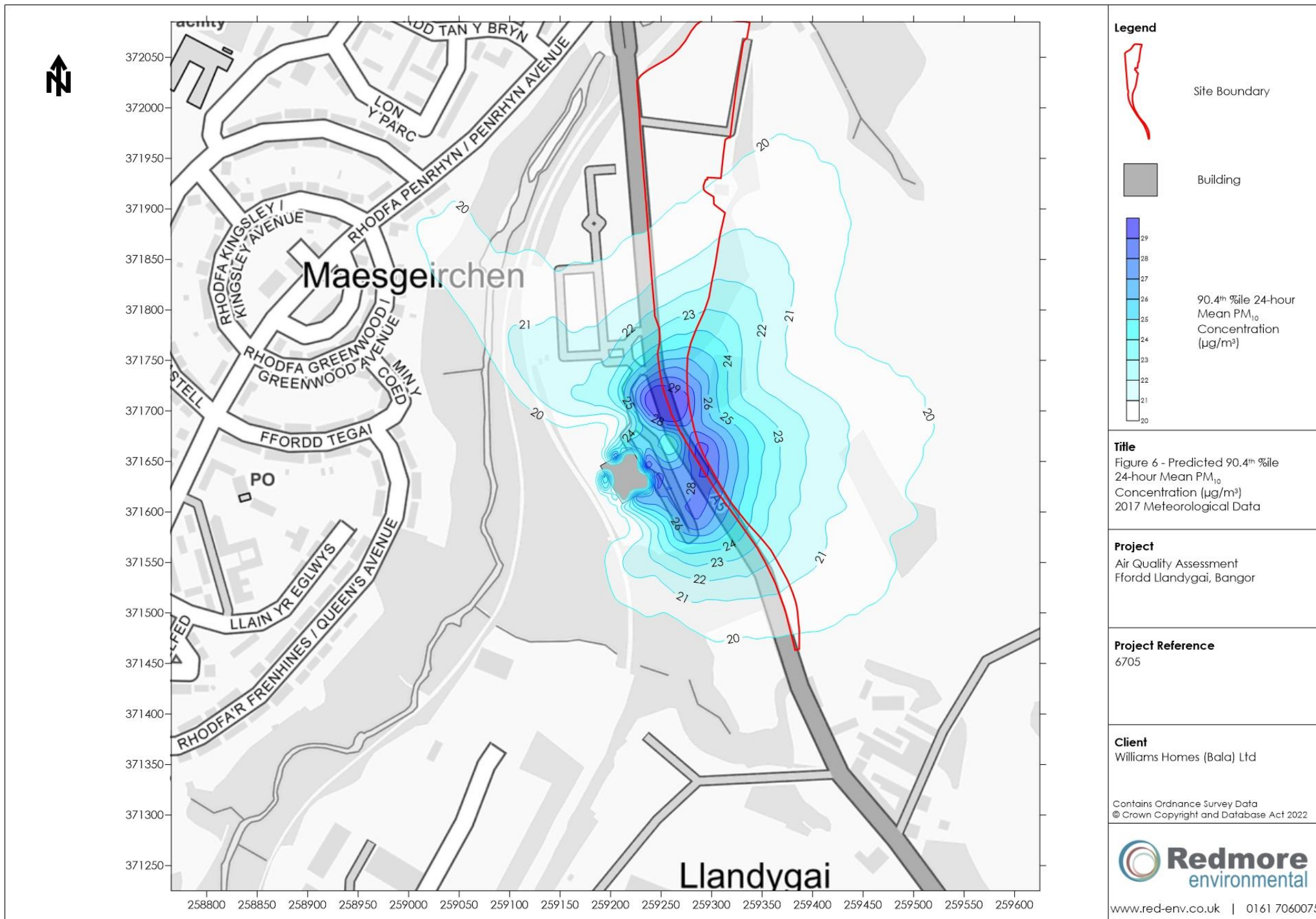
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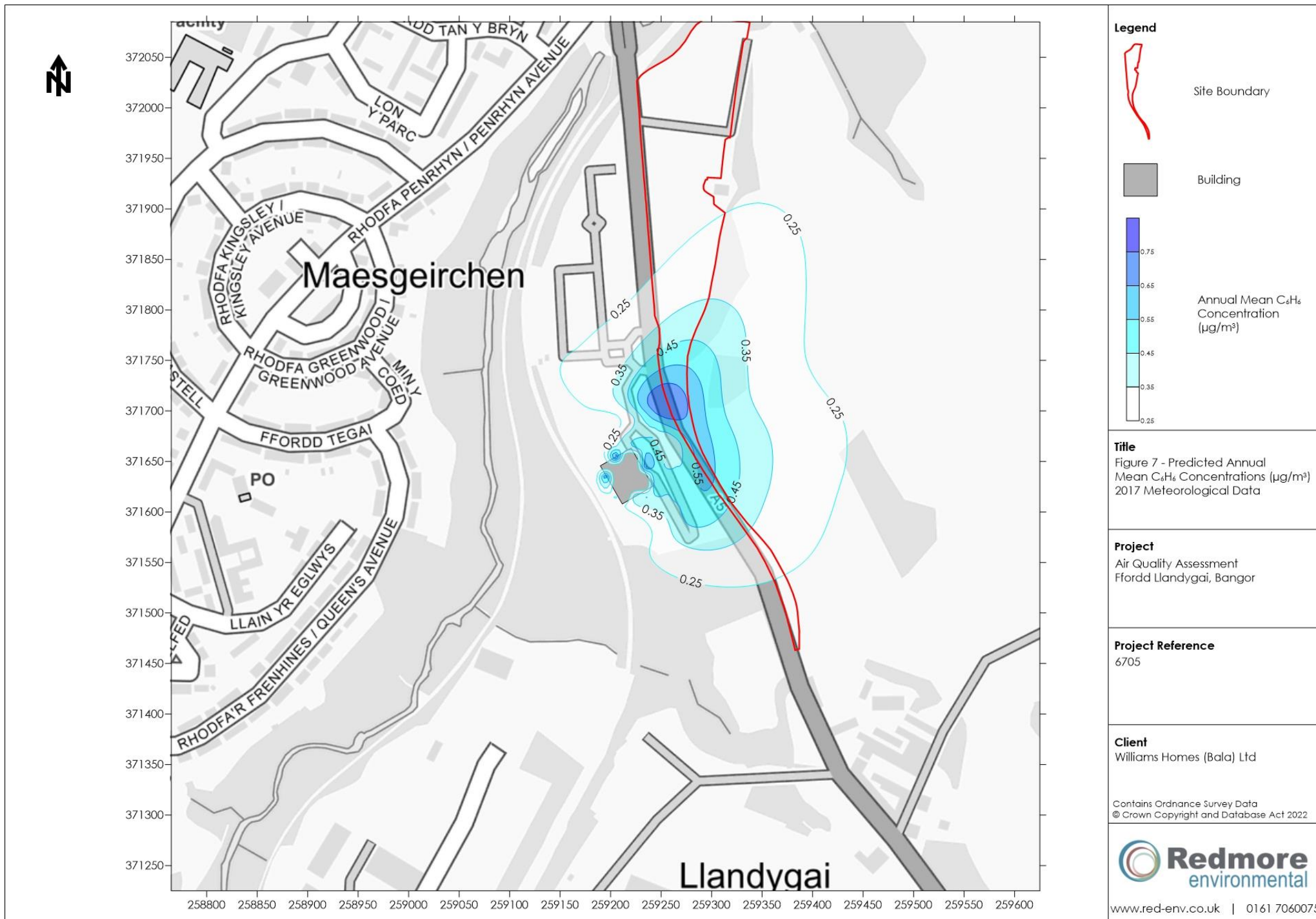
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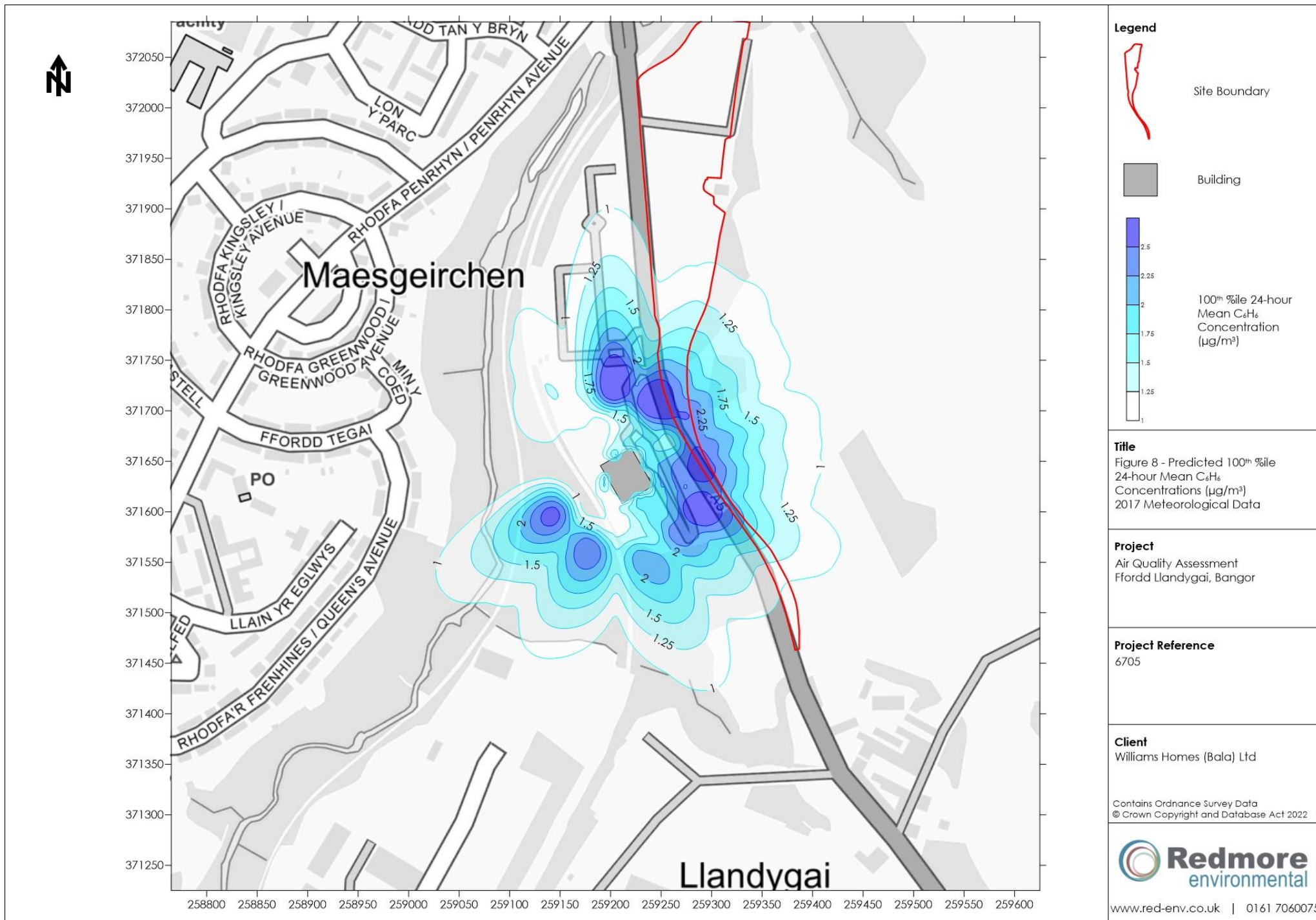
Client

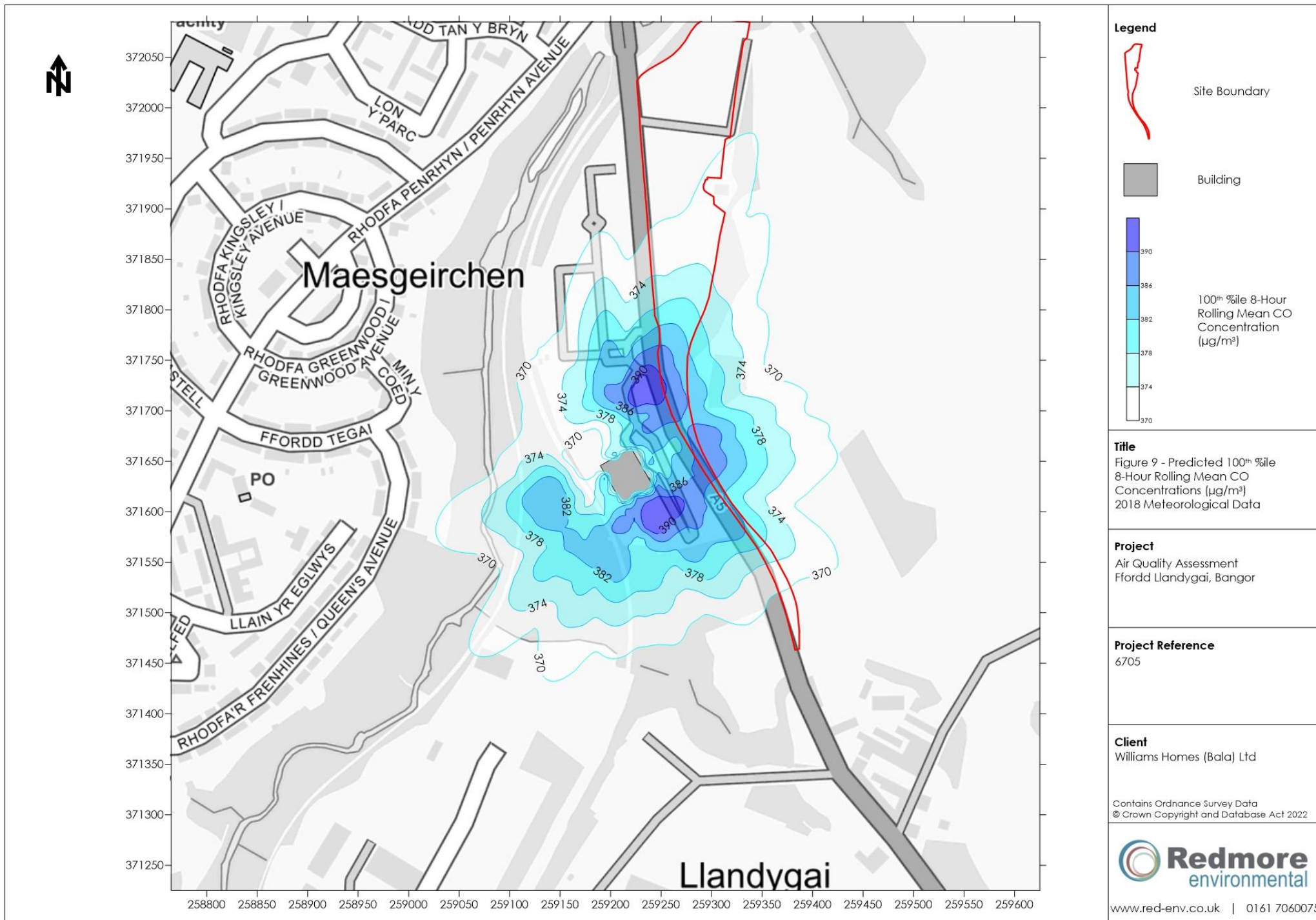
Williams Homes (Bala) Ltd

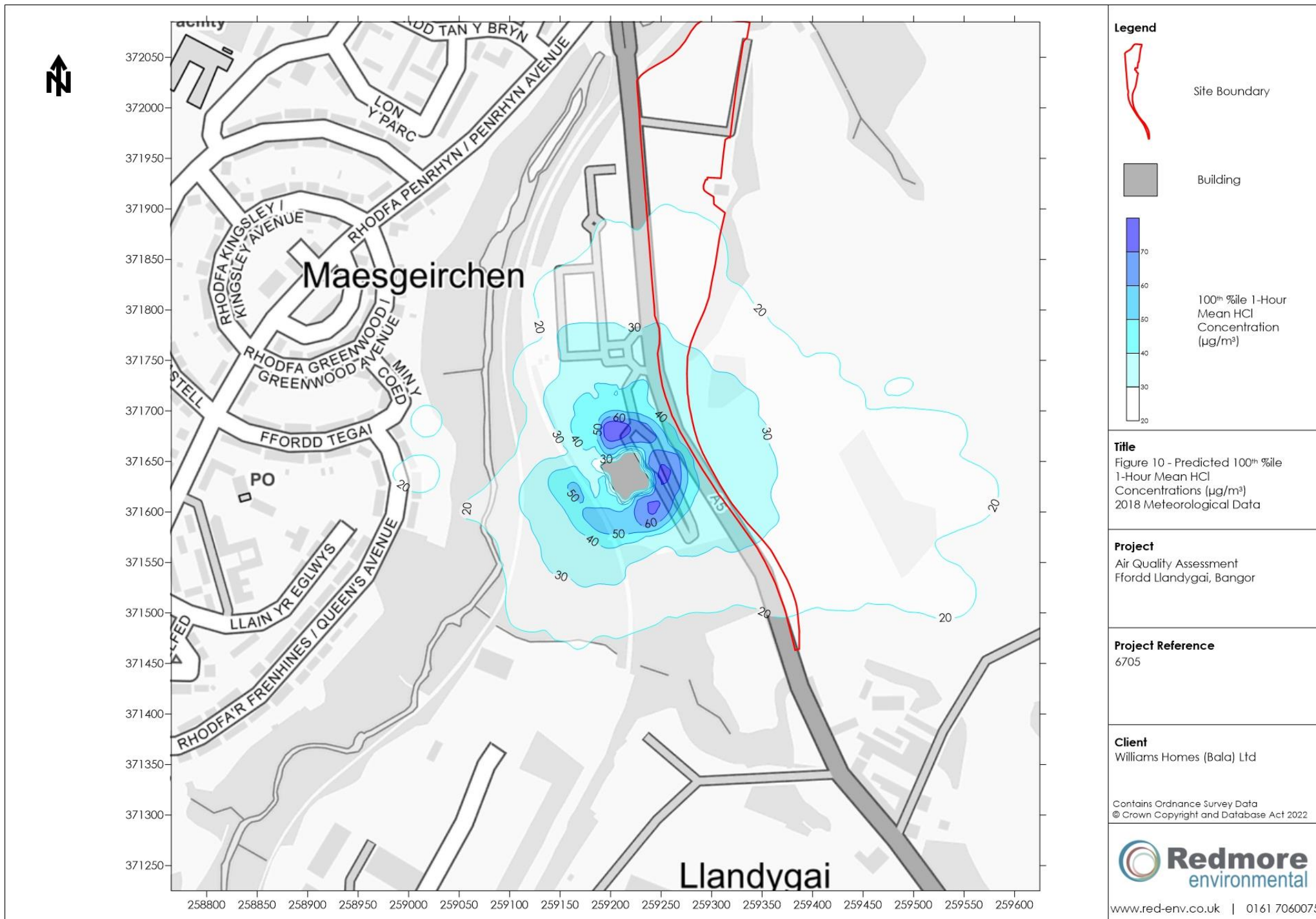












Appendix 1 - Curricula Vitae

KEY EXPERIENCE:

Ger is a Director with specialist experience in the odour and air quality sectors. His key capabilities include:

- Production of Air Quality, Dust and Odour Assessments in accordance with Department for Environment, Food and Rural Affairs (DEFRA) and Institute of Air Quality Management (IAQM) methodologies for a range of residential, commercial and industrial sectors.
- Detailed dispersion modelling of industrial sources using ADMS-5 to determine impacts of emissions on local air quality and amenity as a consequence of odour.
- Odour sampling and analysis as part of performance testing for odour abatement plant and mitigation appraisal.
- Odour and dust surveys to assess amenity and suitability of sites for residential development.
- Odour and dust risk assessments to determine odour effect significance in accordance with IAQM Guidance.
- Modelling of road vehicle exhaust emissions using ADMS-Roads. Studies have included assessment of road traffic exhaust emissions on sensitive receptors and exposure of new residents to poor air quality.
- Design and project management of pollutant monitoring campaigns.
- Co-ordination and management of large-scale multi-disciplinary projects and submissions.

SELECT PROJECTS SUMMARY:**Industrial**

GP Plantscape, Blantyre - Odour Assessment in relation to existing operations at the In-Vessel Composting (IVC) facility operated by the company.

Moir Seafoods, Morpeth - Odour Management Plan prepared to control impacts associated with emissions from the facility operated by the company.

Bioganix, Bonby - Odour and Air Quality Assessments in support of an Environmental Permit Variation for the food waste processing facility operated by the company.

Alne Material Recycling, York - Odour Emissions Monitoring and Odour Assessment undertaken in support of compliance with the Environmental Permit for the facility.

Dryholme Anaerobic Digestion (AD) Plant - Odour and Air Quality Assessments in support of an Environmental Permit Variation for the facility.

Pets Choice, Blackburn - Odour and Air Quality Assessments in support of an Environmental Permit Application for the manufacturing facility operated by the company.

Crofthead Biogas AD Plant - Odour and Air Quality Assessments in support of an Environmental Permit Application for the facility.

Cofresh Snack Foods - Odour Assessment to investigate potential impacts associated with emissions from the manufacturing facility operated by the company.

Tulip Fresh Meats, Ashton-Under-Lyne - Odour consultancy services in support of an Environmental Permit Variation Application for the facility.

Residential

Broadnook Garden Suburb, Birstall - Odour Assessment in support of a residential development which involved completion of Field Odour Surveys and a Risk Assessment in accordance with IAQM guidance.

Hungerford House Farm, Madeley - Odour Assessment in support of the conversion of an existing agricultural building to a residential dwelling.

Hales Pasture Farm, Allstock - Odour consultancy services in support of a nuisance claim by the owner of the property.

North Leigh Park, Wigan - Odour Assessment in support of a planning application for residential development.

New Road, Tintwistle - Odour Assessment to evaluate potential impacts at a proposed residential development as a result of emissions from an existing Wastewater Treatment Works (WwTWs).

Land at Mobberley - Odour Assessment to evaluate potential impacts at a proposed residential development as a result of emissions from an existing WwTWs.

Island Carr Road, Brigg - Odour Assessment to evaluate potential impacts at a proposed residential development as a result of emissions from an existing WwTWs.

Moorland Grange Farm, Bingley - Odour Assessment in support of the conversion of an existing agricultural building to a residential dwelling.

Irwell Vale Mill, Ramsbottom - Odour Assessment to evaluate potential impacts at a proposed residential development as a result of emissions from an existing WwTWs.

KEY EXPERIENCE:

Liam is a Senior Environmental Consultant with specialist experience in the air quality sector. His key capabilities include:

- Production of Air Quality Assessments in accordance with Department for Environment, Food and Rural Affairs (DEFRA) methodologies for a range of residential, commercial and industrial sectors.
- Detailed dispersion modelling of road vehicle exhaust emissions using ADMS-Roads. Studies have included assessment of road traffic exhaust emissions on sensitive receptors and exposure of new residents to poor air quality.
- Advanced Canyon Modelling to evaluate the impact of altered urban topography on air quality in built up areas.
- Assessment of construction dust impacts from a range of development sizes.
- Definition of baseline air quality and identification of sensitive areas across the UK.
- Assessment of industrial emissions using ADMS-5 software to determine impacts on sensitive human and ecological receptors in accordance with IAQM and Environment Agency (EA) guidance.

SELECT PROJECTS SUMMARY:

Heathrow Marriott Hotel, London

Air Quality Assessment for an extension of the existing Heathrow Marriott Hotel, London, to provide an additional 260 bedrooms. The development had the potential to cause impacts at sensitive locations. These may include fugitive dust emissions during construction and road traffic exhaust emissions from vehicles travelling to and from the site during operation. An assessment was therefore undertaken in order to determine baseline conditions and consider potential effects as a result of the proposals. Review of the results indicated an acceptable level of emissions from the scheme

Duchesse Belle Public House, Battersea

Production of an Air Quality Assessment in support of a mixed use development located within an Air Quality Management Area (AQMA). Dispersion modelling was undertaken in order to quantify pollutant concentrations at several heights of the proposed building. Predicted NO₂ and PM₁₀ concentrations were found to be below relevant air quality criteria at all sensitive locations included within the development

Home Farm Logs, Southwell

Air Quality Assessment in support of planning application for two biomass boilers at Home Farm Log, Southwell. A desktop study indicated sensitive ecological designations and human receptors in the vicinity of the site. Detailed dispersion modelling was therefore undertaken in order to quantify changes in pollution levels as result of atmospheric emissions from the plant at the identified locations. The results indicated impacts to be not significant in accordance with EA guidance

Monier Road, London

Production of an Air Quality Assessment in support of the installation of two gas boilers and a Combined Heat and Power unit within a residential block. Dispersion modelling of combustion emissions using ADMS-5 was undertaken in order to predict impacts at sensitive receptors. The results indicated pollutant levels as a result of the operation of the plant to be below the relevant AQOs at all locations within the vicinity of the installation. Mitigation was therefore not required

Liverpool Road, Eccles

Air Quality Assessment in support of 16 residential units and associated infrastructure. The site was situated in close proximity to the M60 motorway. As such, the proposals had the potential to introduce future occupants into an area of poor air quality. Dispersion modelling was therefore undertaken and outputs verified against local monitoring locations. This showed future occupants would not be exposed to exceedences of the relevant AQOs. Suitable mitigation to control potential impacts associated with fugitive dust releases during construction were also identified

Newton Road, Hereford

Air Quality Assessment in support of a residential development situated in an AQMA. The scheme was situated in close proximity to a junction and associated road traffic emissions. Concerns were therefore raised regarding the exposure of future occupants to poor air quality. Detailed dispersion modelling was subsequently undertaken using ADMS-Roads to assess PM₁₀ and NO₂ concentrations across the site. Results indicated that pollution levels were below the air quality standards across the site