



Redrow Homes

LAND SOUTH OF RUTHIN ROAD

Odour Impact Assessment





Redrow Homes

LAND SOUTH OF RUTHIN ROAD

Odour Impact Assessment

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. UK-70098269

OUR REF. NO. AQ1

DATE: OCTOBER 2025

WSP

Matrix House

Basing View

Basingstoke, Hampshire

RG21 4FF

Phone: +44 1256 318 800

[WSP.com](https://www.wsp.com)

QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Draft for comment	Update of model		
Date	September 2025	October 2025		
Prepared by	Meg Smith	Meg Smith		
Signature				
Checked by	Andy Talbot	Alex Jones		
Signature				
Authorised by	Alex Jones	Alex Jones		
Signature				
Project number	UK-70098269			
Report number	AQ1			
File reference	\\uk.wspgroup.com\central data\Projects\70098xxx\70098269 - Ruthin Road Nutrient Neutrality Assessment\03 WIP\AQ\Report\2025			

CONTENTS

1	INTRODUCTION	1
1.2	SITE DESCRIPTION	1
1.3	BACKGROUND	1
1.4	REPORT STRUCTURE	1
1.5	ABBREVIATIONS AND GLOSSARY	2
2	LEGISLATIVE CONTEXT	4
2.1	RELEVANT LEGISLATION	4
2.2	RELEVANT POLICY	5
2.3	RELEVANT GUIDANCE	5
3	ODOUR ASSESSMENT CRITERIA	8
3.1	BACKGROUND	8
3.2	CIWEM POLICY POSITION STATEMENT	8
3.3	SITE SPECIFIC ODOUR CRITERIA USE IN THIS ASSESSMENT	9
4	ODOUR ASSESSMENT METHODOLOGY	10
4.1	ESTIMATE OF PROCESS EMISSIONS	10
4.2	THE DISPERSION MODEL	12
4.3	MODEL SET-UP	12
4.4	METEOROLOGY	12
4.5	TERRAIN	13
4.6	BUILDING DOWNWASH	13
4.7	RECEPTORS	13
4.8	DISPERSION MODEL UNCERTAINTY	14

4.9	SIGNIFICANCE OF RESULTS	15
5	ODOUR MODELLING RESULTS	16
6	CONCLUSION	18

TABLES

Table 1-1 – Report structure	1
Table 1-2 - Abbreviations	2
Table 1-3 – Glossary of Terms	2
Table 2-1 – Legislation relevant to the assessment of odour	4
Table 2-2 – Policy relevant to the assessment of odour	5
Table 2-3 – Guidance relevant to the assessment of odour	6
Table 4-1 – Odour emission rates for the modelled sources	11
Table 4-2 - Identified discrete sensitive receptor locations	13
Table 4-3 – Nested grid parameters	14
Table 4-4 – Proposed odour effect descriptors for impacts predicted by modelling – ‘Moderately Offensive’ odours	15
Table 5-1 - Maximum odour concentrations for discrete receptors	16
Table 5-2 – Highest concentrations at discrete receptors in any year	16

APPENDICES

APPENDIX A

FIGURES

1 INTRODUCTION

- 1.1.1. WSP UK Ltd (hereinafter referred to as 'WSP') has been commissioned by Redrow Homes to carry out an assessment of the potential impacts on amenity arising from the proposed Wastewater Treatment Works (WwTW) for the wider Proposed Development on land immediately south of Ruthin Road, Wrexham (hereinafter referred to as the 'Application Site' or 'Site').

1.2 SITE DESCRIPTION

- 1.2.1. The Application Site lies within the administrative boundary of Wrexham County Borough Council (WCBC) and is located immediately south of Ruthin Road, adjacent to the east of the A483, to the west of Wrexham and north of Rhostyllen and the River Clywedog. Locally, the Application Site is bordered to the east by residential properties along Homestead Lane and The Homestead and Ysgol Clywedog Secondary School, in addition to residential properties to the north of Ruthin Road, and Bryn Tyrion Hall School adjacent to the southwest Application Site boundary.
- 1.2.2. The Proposed Development comprises up to 1,350 dwellings, plus associated roads, open space, community facilities, a site for a primary school and a WwTW. The proposed Masterplan is illustrated in **Figure A-1** in **Appendix A** which shows the location of the WwTW in relation to the wider Proposed Development and surrounding area.

1.3 BACKGROUND

- 1.3.1. Redrow Homes is investigating the potential impact of odour from the proposed Ruthin Road WwTW. It has been recommended by the potential WwTW suppliers engaged that a buffer zone of 40 – 50 m around the sources is adequate. There are existing sensitive residential receptors adjacent to the east of the Application Site boundary (Homestead Lane and The Homestead), as well as sensitive receptors that would be introduced as part of the Proposed Development. Therefore, an odour impact assessment is required to assess the potential odour impacts, and to confirm the suitability of the proposed WwTW placement.

1.4 REPORT STRUCTURE

- 1.4.1. The remainder of this report is set out in **Table 1-1**.

Table 1-1 – Report structure

Item	Source
Section 2	Details the legislation, guidance and policy
Section 3	Details the assessment criteria
Section 4	Describes the dispersion model, assessment methodology, model inputs and assumptions used in the assessment
Section 5	Presents an assessment of the potential odour impacts from the WwTW
Section 6	Contains a summary and conclusion of the assessment

1.5 ABBREVIATIONS AND GLOSSARY

1.5.1. **Table 1-2** below details the abbreviations that are used within this assessment.

Table 1-2 - Abbreviations

Abbreviation	Description
BAT	Best available techniques
BPM	Best Practicable Means
C98,1hr	98th percentile of 1-hour mean concentration
CIWEM	Chartered Institute of Water Environmental Management
EA	Environment Agency
EPA	US Environmental Protection Agency
EPR	Environmental Permitting Regulations
IAQM	The Institute of Air Quality Management
NGR	National Grid Reference
NWP	Numerical Weather Predictions
ouE/m ³	European odour units
UKWIR	UK Water Industry Research
WCBC	Wrexham County Borough Council
WwTW	Wastewater Treatment Works

1.5.2. In dealing with the assessment and control of odour, there are a number of technical terms that are used by professionals in the field which may not be immediately transparent to the lay person. Included below in **Table 1-3** is a selection of the common terms and concepts of common usage, together with explanations of their meanings.

Table 1-3 – Glossary of Terms

Term	Meaning
Odour	The property of a substance, in this case ambient air that gives it a particular scent or smell. Odours can be characterised as pleasant, neutral or unpleasant.
Odour Units	The way in which odour is quantified. In simple terms, 1 odour unit is taken to be the limit of detection for an odour by a person with a normal sense of smell. This is determined by a panel of people with “calibrated” noses and is enumerated when half of the panel members cannot tell the difference between clean air and a sample of diluted odorous air. 5 odour units is judged to be a faint odour and 10 odour units is a distinct odour.

Term	Meaning
Odour assessment	The process by which the environmental impact of odours is evaluated, typically involving measurement of the emission strength and modelling to determine the extent and magnitude of the impact.
Odour nuisance	A legal term, whereby odour is deemed to be present at such a level and frequently enough to give rise to a nuisance under the provisions of the Environmental Protection Act, 1990.
Odour annoyance	A technical term, indicating the point at which a person finds an odour annoying, as distinct from a nuisance.
Odour abatement	Any method by which odour emissions to the atmosphere may be reduced; typical technologies include adsorption onto activated carbon, bio-filtration or liquid adsorption.
Odour concentration	The amount of odour presents in cubic metre of sample gas at standard conditions. The odour concentration is measured in European odour units (ouE/m ³). The odour concentration at the detection threshold is defined to be 1 ouE/m ³ . If an odour sample has been diluted in an olfactometer by a factor of 10,000 to reach the 50% detection threshold, then the concentration of the original sample is 10,000 odour units.
Odour sensitive receptor	The closest building or installation where odour annoyance may occur, such as residential homes, school, hospital, overnight facility for holidays, etc.
Odour unit	The amount of odorant(s) that, when evaporated into 1 cubic metre of neutral gas at standard conditions, elicits a physiological response from a panel (detection threshold) equivalent to that elicited by one European Reference Odour Mass (EROM), evaporated in one cubic metre of neutral gas at standard conditions.
Olfactometer	Apparatus in which a sample of odorous gas is diluted with neutral gas in a defined way and presented to an odour panel under reproducible conditions.
Odour Modelling	Use of a mathematical dispersion model software code, in combination with meteorological data, odour emission rates and locational information, to simulate the way in which odour emitted into air disperses and dilutes in the atmosphere.

2 LEGISLATIVE CONTEXT

2.1 RELEVANT LEGISLATION

2.1.1. Details of the relevant legislation that has been referred to within this odour impact assessment are provided in **Table 2-1**.

Table 2-1 – Legislation relevant to the assessment of odour

Legislation	Context
Environmental Protection Act 1990	Section 79, 80 and 82 of the Environmental Protection Act 1990¹ deal with the matter of Statutory Nuisance. This empowers local authorities to conduct surveys of their administrative areas and, if an authority considers that an odour nuisance has occurred and/ or is likely to re-occur, then it has a duty to declare this and issue an Abatement Notice, requiring the owner/ operator of the trade premises causing the odour to abate it within a certain time scale. Section 79 of the Act defines the type of nuisance that can arise and the most applicable categories to odour are: ■ Fumes or gases emitted from premises so as to be prejudicial to health or a nuisance; and ■ Any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance. The operator of the premises can appeal against the Abatement Notice, using a defence that Best Practicable Means (BPM) are being applied.
Environmental permitting (England and Wales) Regulations	The 2010/75 EU Directive² was transposed into Environmental Permitting Regulations (EPR) for England and Wales in 2013³. EPR's were put in place to administer the permitting of installations that were likely to have the potential to generate significant impacts upon the environment. In some cases, this can include effluent treatment plants where significant quantities (greater than 50 tonnes/day) on non-hazardous wastes are biologically or physico-chemically treated for disposal. Environmental Permits commonly contain Conditions that require installation operators to meet certain limits for discharge of emissions to atmosphere, including H₂S concentrations from both point sources and fugitive releases. The 2019 regulations update the 2013 regulations and ensures the regulations remain fully operable post Brexit. There are no changes to the permit requirements for facilities treating greater than 50 tonnes per day of non-hazardous wastes for disposal.
Planning Act 2008	The Planning Act 2008⁴ stipulates that developers are expected to demonstrate that odour risks have been identified, assessed and appropriately managed to ensure that strategic developments meet environmental standards and maintain public confidence.

¹ UK Parliament (2022). *Environmental Protection Act 1990* [online]. Available at: <https://www.legislation.gov.uk/ukpga/1990/43/section/79> [Accessed August 2025].

² UK Parliament (2010). *Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)* [online]. Available at: <https://www.legislation.gov.uk/eudr/2010/75/contents> [Accessed September 2025].

³ UK Parliament (2013). *The Environmental Permitting (England and Wales) (Amendments) Regulations 2013* [online]. Available at: <https://www.legislation.gov.uk/uksi/2013/390/contents/made> [Accessed August 2025].

⁴ UK Parliament (2008). *Planning Act 2008* [online]. Available at: <https://www.legislation.gov.uk/ukpga/2008/29> [Accessed August 2025].

Legislation	Context
Town and Country Planning Act 1990	Odour is considered a material planning consideration under the Town and Country Planning Act 1990 ⁵ , particularly where it may affect residential amenity or sensitive receptors. Planning authorities can require odour impact assessments for developments that may impose conditions to mitigate odour emissions. This ensures that new developments do not cause unacceptable nuisance or conflict with existing land uses.

2.2 RELEVANT POLICY

- 2.2.1. Details of the relevant policy that has been referred to within this odour impact assessment are provided in **Table 2-2**.

Table 2-2 – Policy relevant to the assessment of odour

Policy	Context
Planning Policy Wales	The Planning Policy Wales ⁶ sets out the land use planning policies of the Welsh Government. The document states that the health imperative of good air quality contributes to the overall character and quality of places and the health and well-being of people should be fully recognised.
Future Wales – The National Plan 2040	Future Wales – the National Plan 2040 ⁷ is the national development framework, setting the direction for development in Wales to 2040. It is a development plan with a strategy for addressing key national priorities through the planning system.
Wrexham Unitary Development Plan	The Wrexham Unitary Development Plan ⁸ Policy GDP1 indicates that: “All new development should... f) ensure the safety and amenity of the public and safeguard the environment from the adverse effects of pollution of water, land or air, hazards from industry and quarrying, and associated noise, odour or vibration arising from development.”

2.3 RELEVANT GUIDANCE

- 2.3.1. Details of the relevant guidance that has been referred to within this odour impact assessment are provided in **Table 2-3**.

⁵ UK Parliament (1990). *Town and Country Planning Act 1990* [online]. Available at: <https://www.legislation.gov.uk/ukpga/1990/8/contents> [Accessed August 2025].

⁶ Welsh Government (2024). *Planning Policy Wales* [online]. Available at: <https://www.gov.wales/sites/default/files/publications/2024-07/planning-policy-wales-edition-12.pdf> [Accessed August 2025].

⁷ Welsh Government (2021). *Future Wales – The National Plan 2040* [online]. Available at: <https://www.gov.wales/sites/default/files/publications/2021-02/future-wales-the-national-plan-2040.pdf> [Accessed September 2025].

⁸ Wrexham County Borough Council (2005). *Wrexham Unitary Development Plan (1996-2011), adopted February 2005* [online]. Available at: <https://www.wrexham.gov.uk/service/development-plans-and-other-planning-policy/unitary-development-plan-1996-2011> [Accessed August 2025].

Table 2-3 – Guidance relevant to the assessment of odour

Guidance	Context
H4 Odour Management	In 2011, the Environment Agency (EA) published its H4 horizontal guidance on odour ⁹ which is to be applied to installations permitted under the EPR. This provides guidance to installation operators on how to comply with the Conditions in their Environmental Permits. The guidance also sets out the requirements for the production of an Odour Management Plan for those activities where odour emission is expected to occur. Control measures to reduce the emission of odorous compounds are suggested, along with dispute resolution procedures when a complaint occurs resulting from odorous emissions.
Guidance on the assessment of odour for planning	The Institute of Air Quality Management (IAQM) issued updated guidance on the assessment of odour for planning¹⁰ in 2018. The guidance presents useful tools for assessing odour, odour assessment criteria and how to draw conclusions from assessment results. The guidance states that <i>'IAQM is of the opinion that the practitioner should observe, from the various scientific studies, case law and practical examples of the investigation of odour annoyance cases, that in any specific case, an appropriate criterion could like somewhere in the range of 1 to 10 ouE/m³ as the 98th percentile of hourly mean odour concentrations'</i>. The guidance also provides suggested significance criteria considering the odour exposure level, sensitivity of the receiving receptor and the offensiveness of the odour (i.e. whether it is 'moderately offensive' or 'most offensive'.)
Best Available Techniques (BAT) Reference Document for Waste Treatment	In 2018, a revision of the best available techniques (BAT) conclusions ¹¹ was published by the Industrial Emissions Directive (2010/75/EU) Integrated Pollution Prevention and Control (IPCC) to provide an update of best available techniques for treating waste and BAT associated emission levels (BAT-AELs), including a BAT-AELs for odour concentrations to be applied for channelled emissions.
Odour Control in Wastewater Treatment	UK Water Industry Research (UKWIR) provides comprehensive guidance ¹² on odour control from WwTWs. The guidance also includes typical odour emission rates for different WwTW processes which can be used to inform an odour assessment.

⁹ Environment Agency (2011). *H4 Odour Management – How to comply with your environmental permit* [online]. Available at: <https://www.gov.uk/government/publications/environmental-permitting-h4-odour-management> [Accessed August 2025].

¹⁰ Institute of Air Quality Management (2018). *Guidance on the assessment of odour for planning v1.1* [online]. Available at: <https://iaqm.co.uk/text/guidance/odour-guidance-2014.pdf> [Accessed August 2025].

¹¹ European Commission (2010). *Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control) Best Available Techniques (BAT) Reference Document for Waste Treatment* [online]. Available at: https://bureau-industrial-transformation.jrc.ec.europa.eu/sites/default/files/2019-11/JRC113018_WT_Bref.pdf [Accessed August 2025].

¹² United Kingdom Water Industry Research (2001). *Odour Control in Wastewater Treatment – Technical Reference Document* [online]. Available at: <https://ukwir.org/eng/reports/01-WW-13-3/115332/Odour-Control-in-Wastewater-Treatment--A-Technical-Reference-Documnt> [Accessed August 2025].

Guidance	Context
Code of Practice on Odour Nuisance from Sewage Treatment Works	This guidance ¹³ was produced in 2006 and has now been withdrawn but still contains useful information for odour assessments. It was aimed at environmental health practitioners, the public and sewage treatment works operators. The overall objective of the guidance is to achieve a balance between reasonable and best practice management of the treatment processes by the operator, understanding on the part of the public and effective regulation by local authorities.
Odour Guidance for Local Authorities	The Odour Guidance for Local Authorities ¹⁴ was published in 2010 by Defra and is aimed at providing local authorities with an over-arching guide as to how odour issues should be investigated.

¹³ Department for Environment, Food and Rural Affairs (2011). *Code of Practice on Odour Nuisance from Sewage Treatment Works* [online]. Available at: <https://www.gov.uk/government/publications/code-of-practice-on-odour-nuisance-from-sewage-treatment-works> [Accessed August 2025].

¹⁴ Department for Environment, Food and Rural Affairs (2010). *Odour Guidance for Local Authorities* [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/645286/pb13554-local-auth-guidance-100326.pdf [Accessed August 2025].

3 ODOUR ASSESSMENT CRITERIA

3.1 BACKGROUND

- 3.1.1. In 1993 a public inquiry into Newbiggin-by-the-Sea WwTW established an ambient odour annoyance standard on 5 European odour units per cubic metre (ouE/m^3) based on the 98th percentile of 1-hour mean concentration ($C_{98,1\text{hr}}$)¹⁵ at a particular location over a calendar year. This annoyance standard has been used as an assessment criterion both by the UK water industry and odour assessment practitioners in the UK. The protocol used for the determination of odour at the time of the 1993 public inquiry was a Dutch standard that used a particular concentration of an odorous chemical in air to screen panellists for sensitivity. Since the advent of the European standard on olfactometry, the sensitivity of the test has changed, with the original Dutch standard of $5\text{ouE}/\text{m}^3$ being equivalent to the European standard of $2.5\text{ouE}/\text{m}^3$.
- 3.1.2. In 2022, the EA published a draft copy of its Horizontal Guidance Document H4 and, in 2011, a final version. The document includes a graduated scale of '*indicative odour thresholds*', depending upon the perceived offensiveness of the odour, as follows:
- $1.5\text{ouE}/\text{m}^3$ ($C_{98,1\text{hr}}$) for the most offensive odours;
 - $3.0\text{ouE}/\text{m}^3$ ($C_{98,1\text{hr}}$) for the moderately offensive odours; and
 - $6.0\text{ouE}/\text{m}^3$ ($C_{98,1\text{hr}}$) for the least offensive odours.
- 3.1.3. The thresholds were derived from studies in Holland on the offensiveness of odours from intensive pig farming in rural areas. It is generally considered that sewage treatment works odours fall into the 'moderately offensive odours' category ($3.0\text{ouE}/\text{m}^3$), unless there is septic wastewater or sludge on the Site, in which case the most stringent criterion of $1.5\text{ouE}/\text{m}^3$ may apply.

3.2 CIWEM POLICY POSITION STATEMENT

- 3.2.1. The Chartered Institute of Water Environmental Management (CIWEM) has issued a Policy Position Statement¹⁶ outlining its position regarding the control of odour and the likely level of impact as indicated by modelling studies. This statement is frequently used by the water industry as the basis of assigning acceptable criteria for odour impact assessments.
- 3.2.2. Within the statement, CIWEM indicates that odour impact criteria should be regarded as indicative guidelines and should not be applied as statutory numerical standards. Based on research undertaken in the UK at the time the statement was issued, the body considered that the following framework of $C_{98,1\text{hr}}$ criteria were the most reliable indicators of the likelihood of complaints associated with wastewater treatment facilities.:
- $C_{98,1\text{hr}}$ $10\text{ouE}/\text{m}^3$ – complaints are highly likely and odour exposure at these levels represents an actionable nuisance;

¹⁵ In this case the 98th percentile equates to the top 175 1-hour mean concentrations in a year (i.e. 2% of 8,760 hours). For the remainder of the time, the odour experienced would be less than faint. This reflects the fact that it is not possible to guarantee that sewage treatment will never produce any odours, but it is intended to restrict the number of times that odours could be noticed to a not unreasonable frequency.

¹⁶ Chartered Institute of Water Environmental Management (2012). *Policy Position Statement* [online]. Available at: <https://www.ciwem.org/policy-reports/policy-position-statements> [Accessed August 2025].

- $C_{98,1hr} 50\text{uE/m}^3$ – complaints may occur and depending on the sensitivity of the locality and nature of the odour this level may constitute a nuisance; and
- $C_{98,1hr}$ less than 30uE/m^3 – complaints are unlikely to occur and exposure below this level are unlikely to constitute significant pollution or significant detriment to amenity unless the locality is highly sensitive or the odour highly unpleasant in nature.

3.3 SITE SPECIFIC ODOUR CRITERIA USE IN THIS ASSESSMENT

- 3.3.1. Although the proposed WwTW comprises sludge treatment, the sludge thickening plant and sludge storage is fully enclosed. Therefore, it is considered odours from WwTW is best described as 'moderately offensive odour' and 30uE/m^3 is considered a suitable threshold for residential receptors.

4 ODOUR ASSESSMENT METHODOLOGY

4.1 ESTIMATE OF PROCESS EMISSIONS

- 4.1.1. The parameters included for the modelled sources are included in **Table 4-1**. The assessment has been based on 'typical' odour emission rates from the UKWIR technical guidance document. The location of the sources was estimated based on a Site plan showing a similar design as to what is currently proposed to be implemented at the Ruthin Road development and shown in **Figure A-3** in **Appendix A**. The sludge holding tanks, sludge thickening building and the inlet will be fully enclosed. Therefore, using assumptions based on similar projects that utilise similar plant that WSP has worked on, an 80% reduction in the associated emission rate has been applied for these sources.

Table 4-1 – Odour emission rates for the modelled sources

Source ID	Name	Type	Effluent type	Number of sources	Height (m)	Surface area (m ²)	Volume (m ³)	Odour emission rate (ouE/m ² /s)	Odour emission rate (ouE/m ³ /s)
I_1	Inlet	Area	Untreated sewage	1	1.5	9.8	n/a	10.0 ^(a)	n/a
IBT_1	Influent balance tank	Area	Untreated sewage	1	5.6	20.1	n/a	6.2	n/a
R_1/ R_2/ R_3/ R_4	Reactor	Area	Activated sludge	4	6.3	113.1	n/a	4.0	n/a
SHT_1	Sludge holding tank	Area	Raw sewage sludge	1	6.3	46.6	n/a	8.0 ^(a)	n/a
TST_1	Thickened sludge tank	Area	Raw sewage sludge	1	5.6	31.9	n/a	8.0 ^(a)	n/a
STB_1	Sludge thickening building	Volume	Raw sewage sludge	1	4.8/	n/a	96.8	n/a	2.0 ^(a)
TFP_1	Kiosk housing the tertiary filter plant	Volume	Treated sewage	1	3.0	n/a	54.6	n/a	0.2 ^(a)
TFP_2	Tertiary filter plant	Area	Treated sewage	1	3.0	55.1	n/a	1.1 ^(a)	n/a

Table notes:

(a) 80% reduction from the 'library' emission rate as the source is fully enclosed

4.2 THE DISPERSION MODEL

- 4.2.1. This study uses the AERMOD View 11.2.1, developed by Lakes Environmental Software and incorporates AERMOD, a steady-state Gaussian dispersion model developed by US Environmental Protection Agency (EPA). AERMOD provides modellers with the tools and functionality required to perform air quality analysis that help to address permitting, regulatory and nuisance issues.
- 4.2.2. AERMOD takes into account the obstruction of wind flow from structures, such as buildings through the use of the BPIP PRIME module. AERMOD also provides the ability to create discrete, gridded and polygon receptor arrays, as well as generating variable density and 3D gridded networks.
- 4.2.3. AERMOD has been used extensively to predict odour impacts from WwTWs and is therefore considered appropriate for the odour assessment of the Ruthin Road WwTW.

4.3 MODEL SET-UP

- 4.3.1. The locations and dimensions of the on-site processes, to which the above odour emission rates were assigned, were entered into the AERMOD dispersion model, having been scaled from drawings from similar facilities and Google Earth imagery. The following additional model settings and input data were incorporated:
 - Hourly sequential meteorological data obtained from Numerical Weather Predictions (NWP) for years 2020-2024;
 - Surface roughness value (a measure of the smoothness of the surrounding land surface which influences atmospheric turbulence) of 0.3m, equivalent to the typical value for maximum agricultural areas;
 - Although the gradients within this area are generally low, terrain information was included within the model to allow for slope effects. The presence of elevated terrain can significantly affect ground level concentrations of pollutants emitted from elevated sources; and
 - A regular receptor grid of points across an area around the WwTW with a 20m spacing, measuring in total 1km by 1km.

4.4 METEOROLOGY

- 4.4.1. For meteorological data to be suitable for dispersion modelling purposed, a number of meteorological parameters need to be measured on an hourly basis. These parameters include; wind speed, wind direction, cloud cover, temperature and humidity. There are only a limited number of sites in Wales where the required meteorological measurements are recorded. The year of meteorological data that is used for a modelling assessment can also have a significant effect on odour dispersion, therefore several years of meteorological data are used for the odour assessment.
- 4.4.2. The nearest observed meteorological station is Hawarden Airport, located approximately 15.6km north, with a difference in elevation of approximately -80m. However, there are a number of variables that may make Hawarden Airport unsuitable for use at this Site. This includes the difference in elevation and topographical influences local to both the Site (such as the Clwydian Range & Dee Valley National Landscape) and Hawarden Airport (River Dee and associated estuary). As such, this assessment has used meteorological data obtained through NWP. In some instances, NWP data is considered more representative of local conditions because when obtained, the Site's exact National Grid Reference (NGR) location is used. This allows the influence of other parameters (such as terrain and surface roughness) to be accounted for, reducing the need of

professional judgement when inputting the parameters for both the meteorological site and the modelled Site.

- 4.4.3. **Figure A-4** in **Appendix A** shows the wind roses from NWP NGR: 332003, 349684 for each year modelled (2020 to 2024), which illustrates the frequency and distribution of wind directions and wind speeds.

4.5 TERRAIN

- 4.5.1. The presence of elevated terrain can significantly affect ground level concentrations of pollutants emitted from elevated sources. AERMOD models terrain by calculating a weighted sum of two idealised solutions: plume impaction, which is appropriate for very stable meteorological conditions, e.g. extreme winter conditions, and a terrain-following solution where the plume centreline retains its height above the terrain, which is appropriate for neutral meteorological conditions, e.g. windy, overcast conditions.
- 4.5.2. Elevations at the proposed location for the WwTW at Ruthin Road is approximately 94m. Terrain elevation in a 1km radius from the proposed WwTW location does not change by the commonly applied 1 in 10 criterion (100m). However, for completeness, terrain data have been included in the dispersion modelling assessment.

4.6 BUILDING DOWNWASH

- 4.6.1. AERMOD takes into account the effects of building downwash. Downwash is the enhanced turbulent mixing of pollutants in the lee of buildings which can result in high pollutant concentrations in the wake of the building. However, AERMOD only accounts for the effect of buildings from point sources and not area or volume sources. Therefore, no buildings have been included in the model.

4.7 RECEPTORS

- 4.7.1. Discrete sensitive receptors were chosen based on the nearest existing and proposed residential locations, and other sensitive areas such as school and places where people relax, such as recreational areas, whilst also considering the prevailing wind conditions. They were judged in terms of their exposure to pollutants and proximity to the proposed WwTW location. Locations of the sensitive human receptors are detailed in **Table 4-2** and **Figure A-5** in **Appendix A**.

Table 4-2 - Identified discrete sensitive receptor locations

Receptor		X (m)	Y (m)	Receptor Use	Sensitivity
R1	Pentre Bach	331786	350108	Residential	High
R2	Ysgol Clywedog Secondary School	332231	349865	School	High
R3	Proposed residential locations	331872	349637	Residential (proposed)	High
R4	Proposed school	331902	349743	School (proposed)	High
R5	High Ridge Drive	332134	349608	Residential	High
R6	The Homestead	332106	349687	Residential	High

Receptor		X (m)	Y (m)	Receptor Use	Sensitivity
R7	Local community centre	331270	350165	Recreational	Medium

- 4.7.2. Having taken into account receptors which are in close proximity to the proposed WwTW, it is also important to consider the tolerance of these receptors to the impact of odorous emissions. This is described as receptor sensitivity and can be generalised into three main categories:
- High sensitivity receptor – including residential properties and schools;
 - Medium sensitivity receptor – including commercial/ retail premises; and
 - Low sensitivity receptor – including industrial areas and farms.
- 4.7.3. Most of the receptors considered in this assessment are classed as high sensitivity receptors, including residential receptors. As such, the impact of the predicted odour concentrations at these locations will be judged on their sensitivity accordingly.
- 4.7.4. It should be noted that the discrete receptor locations included in **Table 4-2** are only snapshot locations and does not always cover the whole receptor. Therefore, in addition to modelling discrete receptor locations, a nested grid centred on the WwTW has been modelled with a minimum grid resolution of 10m, to assess the impact of atmospheric odour dispersion from the Site on surrounding areas. The nested grid boundary box has a size of 50m x 50m with a receptor spacing of 10m. Further nested grid parameters are shown in **Table 4-3**.

Table 4-3 – Nested grid parameters

Distance from bounding box (m)	Receptor spacing
200	10
500	25
1000	50

4.8 DISPERSION MODEL UNCERTAINTY

- 4.8.1. Dispersion modelling is not a precise or exact science, because it uses simplified mathematical expressions to stimulate very complex physical environmental processes in the atmosphere. There is, therefore, a degree of uncertainty in the results that we obtain from modelling exercises. Modelling has been used for the assessment of odour emissions for more than 30 years in the UK and, in general, properly applied, the results do more or less accord with reality.
- 4.8.2. However, in order to try to counter this inherent uncertainty, a number of steps are routinely taken to consider a 'worst-case' position input conditions, such that the model outputs should be at or close to the upper bound of the likely results. These include:
- Assuming in the model that the processes will be emitting odour at the maximum measured rates continuously throughout the year; and
 - Repeating the modelling with five years of hourly sequential meteorological data and reporting the year which yields the highest results.
- 4.8.3. The odour modelling presented in this report is based on preliminary design details from similar facilities and set in a conservative location on the proposed WwTW parcel in the masterplan. As

such, the data for the modelled odour sources is not definitive and should be considered as indicative only.

4.9 SIGNIFICANCE OF RESULTS

- 4.9.1. The odour concentrations at each receptor have been assessed using the proposed odour effect descriptors for predicted impacts set out in the IAQM guidance.
- 4.9.2. As stated in **Section 3.3**, this assessment assesses against the $C_{98,1hr}$ 3ouE/m³ ('Moderately Offensive' odours). Therefore, the table from the IAQM guidance have been reproduced below for 'Moderately Offensive' odours.

Table 4-4 – Proposed odour effect descriptors for impacts predicted by modelling – 'Moderately Offensive' odours

Odour exposure level ($C_{98,1hr}$ ouE/m ³)	Receptor sensitivity		
	Low	Medium	High
≥ 10	Moderate	Substantial	Substantial
5 -< 10	Moderate	Moderate	Substantial
3 -< 5	Negligible	Slight	Moderate
1.5 -< 3	Negligible	Negligible	Slight
0.5 -< 1.5	Negligible	Negligible	Negligible
< 0.5	Negligible	Negligible	Negligible

5 ODOUR MODELLING RESULTS

- 5.1.1. **Table 5-1** shows the maximum $C_{98,1hr}$ odour concentration for discrete receptors in each assessment year for the proposed WwTW at Ruthin Road. Maximum concentrations for each year are below the $C_{98,1hr}$ 3.0 ouE/m³ annoyance threshold at all receptors. The odour concentration modelled over the five-year period ranged between 0.80 ouE/m³ (2022) and 0.94 ouE/m³ (2020), both modelled at Receptor R6.

Table 5-1 - Maximum odour concentrations for discrete receptors

Year	Maximum odour concentration, $C_{98,1hr}$ (ouE/m ³)	Receptor	% of criterion $C_{98,1hr}$ 3.0 ouE/m ³
2020	0.94	R6	31.4
2021	0.85	R6	28.4
2022	0.80	R6	26.8
2023	0.82	R6	27.2
2024	0.81	R6	26.9

- 5.1.2. **Table 5-2** presents the highest concentrations for each discrete receptor, with the predicted concentrations as a percentage of the relevant assessment criterion ($C_{98,1hr}$ 3.0 ouE/m³). The table shows that there are no predicted exceedances of this threshold at any of the discrete receptor locations.
- 5.1.3. Following the proposed odour effect descriptors set by the IAQM for 'Moderately Offensive' odours (included in **Table 4-4**), effects at all the modelled sensitive human receptors are 'negligible'.

Table 5-2 – Highest concentrations at discrete receptors in any year

Receptor	Description of receptor	Maximum odour concentration, $C_{98,1hr}$ (ouE/m ³)	Year maximum odour concentration was modelled	% of criterion $C_{98,1hr}$ 3.0 ouE/m ³	Impact ('Moderately Offensive')
R1	Residential	0.05	2021	1.6%	Negligible
R2	School	0.12	2022	4.2%	Negligible
R3	Residential (proposed)	0.37	2023	12.2%	Negligible
R4	School (proposed)	0.50	2023	16.7%	Negligible
R5	Residential	0.51	2021	17.0%	Negligible
R6	Residential	0.94	2020	31.4%	Negligible

Receptor	Description of receptor	Maximum odour concentration, $C_{98,1hr}$ (ouE/m ³)	Year maximum odour concentration was modelled	% of criterion $C_{98,1hr}$ 3.0 ouE/m ³	Impact ('Moderately Offensive')
R7	Recreational	0.01	2023	0.3%	Negligible

- 5.1.4. **Figure A-6 in Appendix A** shows the odour concentration contour plot generated from the odour emission data in **Table 5-2**. Maximum $C_{98,1hr}$ odour concentrations in the 2020-2024 period are presented. $C_{98,1hr}$ odour contours of 1.5, 3.0 and 5.0 ouE/m³ are shown on the plot. The isopleths for each individual year modelled are shown in **Figure A-7 to Figure A-11 in Appendix A**.
- 5.1.5. With reference to the maximum odour concentrations illustrated in **Figure A-6 in Appendix A**, the $C_{98,1hr}$ 3.0 ouE/m³ odour contour does not extend beyond the masterplan red line boundary. The $C_{98,1hr}$ 1.5 ouE/m³ odour contour line extends beyond the red line boundary south of the proposed WwTW, although does not reach any sensitive receptors
- 5.1.6. As the masterplan currently stands, it is concluded that that odours from the proposed WwTW will not adversely affect the amenity of both existing and proposed receptors. However, it should be noted that owing to the assumptions made in this assessment, it is recommended that additional modelling is completed following consultation with the relevant design team regarding the confirmed plant on-site and finalisation of the WwTW site plan.

6 CONCLUSION

- 6.1.1. The assessment adopts the IAQM benchmark for “moderately offensive” odours, namely a 98th percentile one-hour mean concentration ($C_{98,1hr}$) of 3.0 ouE/m³ for high-sensitivity receptors such as residential properties and schools. This benchmark is widely recognised in UK planning practice for wastewater odour assessments.
- 6.1.2. Dispersion modelling was undertaken using the AERMOD model, incorporating terrain effects and receptor nesting, and applying five consecutive years of site-specific meteorological data (2020–2024) derived from NWP. The modelling approach reflects conservative assumptions, including continuous maximum emissions and full enclosure of key odour sources, consistent with sector guidance and best practice. The assessment is precautionary in nature, incorporating conservative assumptions and worst-case meteorological conditions; actual operational impacts would be expected to be at or below those predicted.
- 6.1.3. The highest predicted odour concentration at any modelled existing or proposed receptor is 0.94 ouE/m³ (at R6 in 2020) which represents 31.4% of the applicable IAQM criterion. Under IAQM effect descriptors, this level of exposure is classified as negligible for all discrete receptors assessed. Additionally, odour contour plots confirm that the 3.0 ouE/m³ isopleth remains entirely within the masterplan boundary, and the 1.5 ouE/m³ isopleth does not intersect any existing or proposed sensitive receptors. This includes the proposed residential parcels and primary school parcel within the masterplan. As such, the level of exposure is classified as negligible for all sensitive receptors. Accordingly, the proposed development is not expected to result in significant adverse effects on amenity.
- 6.1.4. These conclusions accord with Planning Policy Wales and Wrexham UDP Policy GDP1(f) in safeguarding amenity from odour, with controls secured by condition.
- 6.1.5. Odour does not present a material constraint to the grant of planning permission and is not anticipated to give rise to statutory nuisance under the Environmental Protection Act 1990.
- 6.1.6. Following detailed design, the applicant shall submit a Design Compliance Note confirming that the final WwTW layout and odour-relevant assets are materially consistent with the assessed scenario; where changes are material, an updated odour screening shall be provided to confirm continued compliance with 3.0 ouE/m³ ($C_{98,1hr}$) at sensitive receptors.

Appendix A

FIGURES

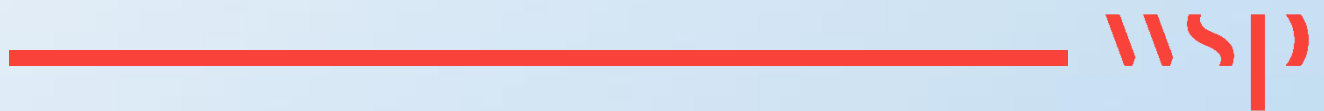




Figure A-1 - Proposed masterplan

Figure A-2 - Location of WwTW

Figure A-3 - Modelled sources

Figure A-4 - NWP meteorological wind rose 2020 - 2024

Figure A-5 - Location of identified sensitive receptors

Figure A-6 - 98th percentile odour contours (ouE/m³) – maximum over the 2020 to 2024 period

Figure A-7 - 98th percentile odour contours (ouE/m³) – 2020

Figure A-8 - 98th percentile odour contours (ouE/m³) – 2021

Figure A-9 - 98th percentile odour contours (ouE/m³) – 2022

Figure A-10 - 98th percentile odour contours (ouE/m³) – 2023

Figure A-11 - 98th percentile odour contours (ouE/m³) – 2024



KEY	
Red line boundary	
Client:	Redrow Homes
Project:	Land south of Ruthin Road
Title:	Figure A-1: Proposed masterplan
Figure: 5-1	Drawn: MS
Date: 24/09/25	Checked: AT
Scale: 1:1	Approved: AT



KEY

Red line boundary

Proposed WwTWs

00.0550.11 km

Client:

Redrow Homes

Project:

Land south of Ruthin Road

Title:

Figure A-2: Location of WwTW

Figure: A-2

Date: 24/09/25

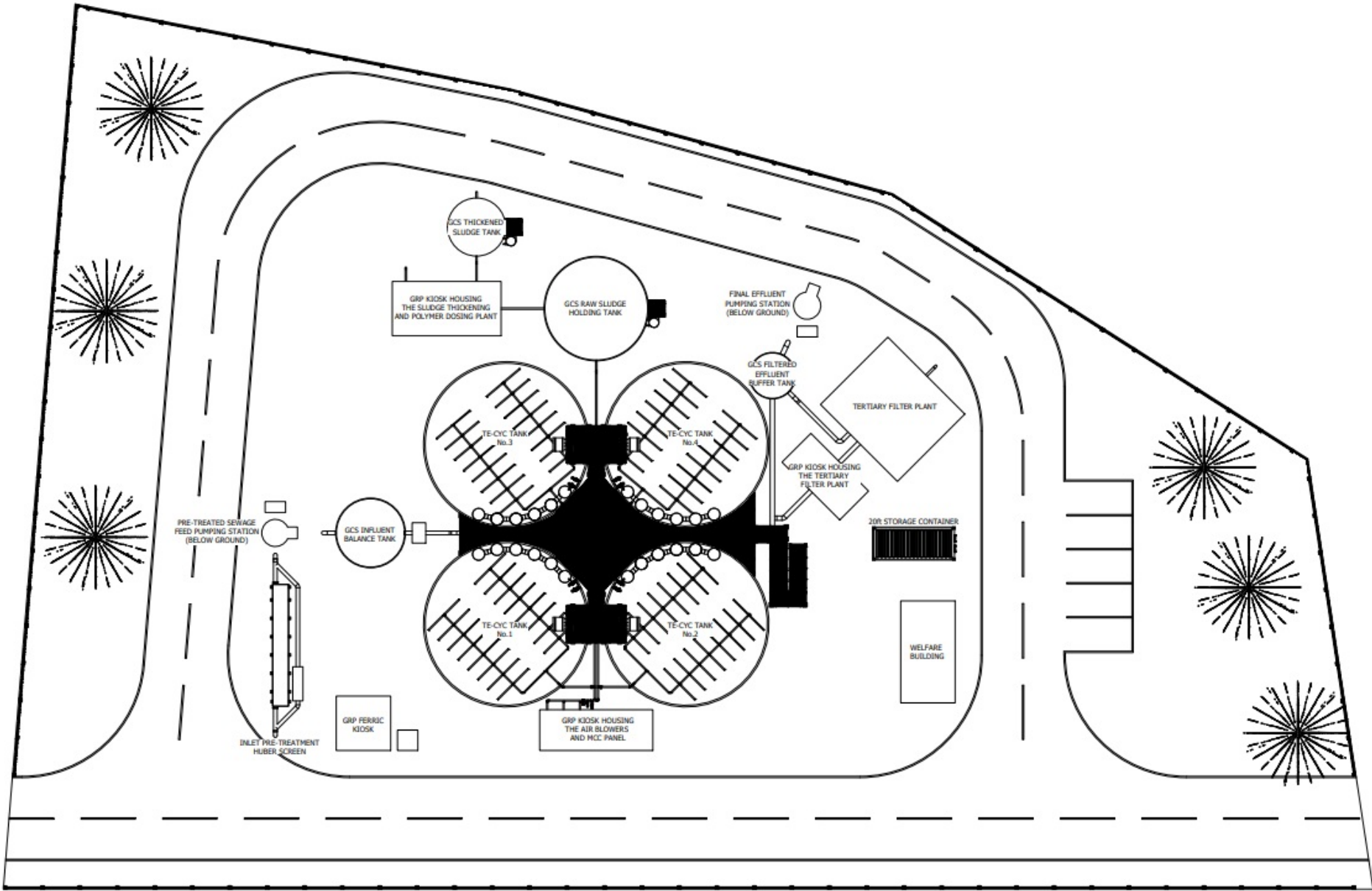
Scale: 1:1

Drawn: MS

Checked: AT

Approved: AT

Created by: UKMLS775 File Location: /70098269 - Ruthin Road Nutrient Neutrality Assessment/03 WIP/AQ/2025 update



Client:
Redrow Homes

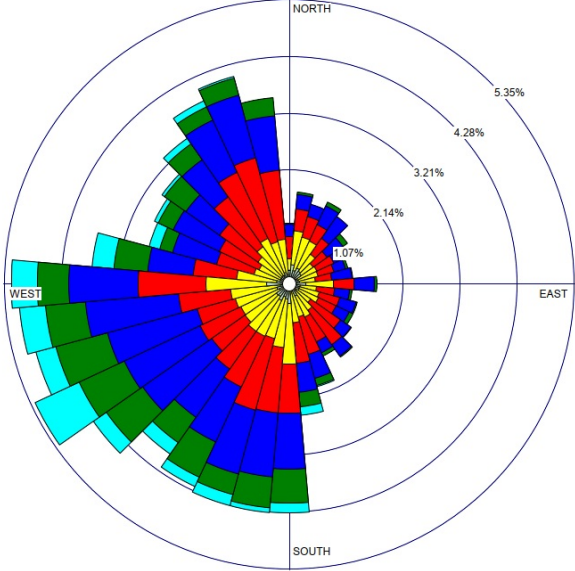
Project:
Land south of Ruthin Road

Title:
Figure A-3: Modelled sources

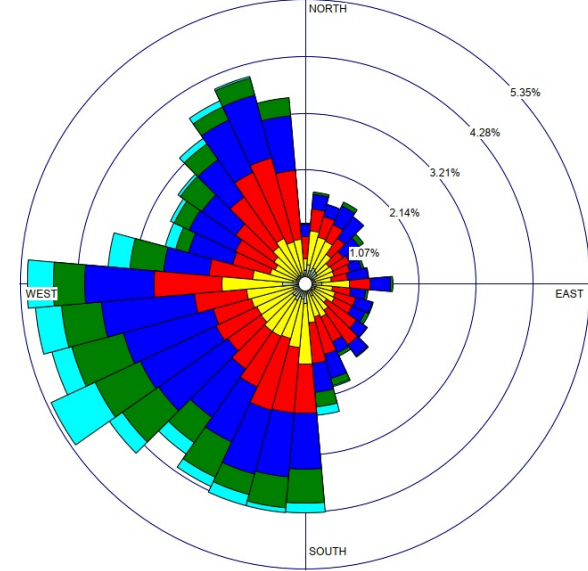
Figure: A-3
Date: 24/09/25
Scale: 1:1

Drawn: MS
Checked: AT
Approved: AT

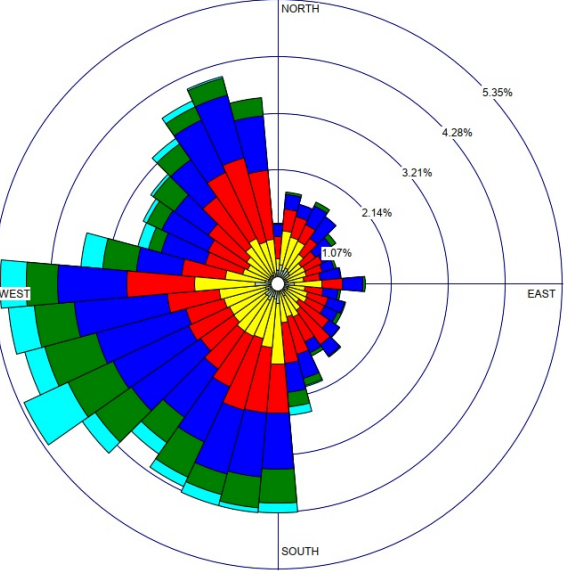
2020



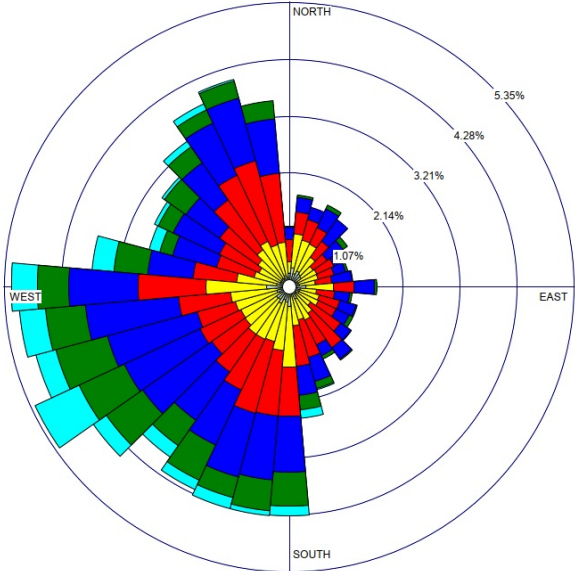
2021



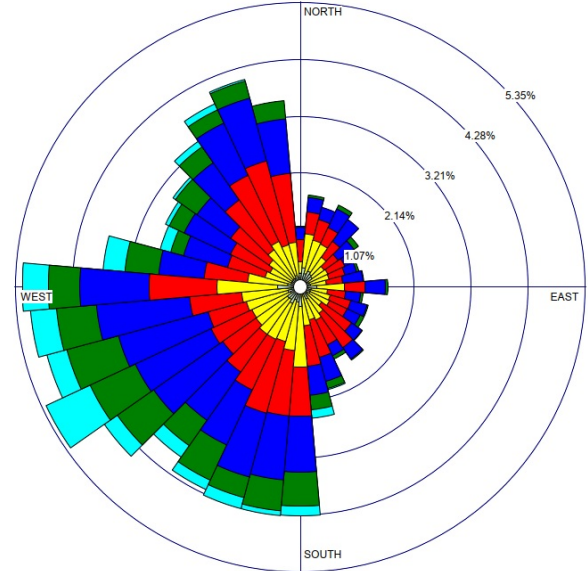
2022



2023



2024



KEY

WIND SPEED
(Knots)

- >= 21.58
- 17.11 - 21.58
- 11.08 - 17.11
- 7.00 - 11.08
- 4.08 - 7.00
- 0.97 - 4.08

Calms: 0.19%



Client:
Redrow Homes

Project:
Land south of Ruthin Road

Title:
Figure A-4: NWP meteorological wind rose 2020 - 2024

Figure: A-4
Date: 03/10/25
Scale: 1:1
Drawn: MS
Checked: AT
Approved: AT



KEY

-  Red line boundary
-  Proposed WwTWs
-  Human receptor



0 50 100 m



Client:

Redrow Homes

Project:

Land south of Ruthin Road

Title:

Figure A-5: Location of identified sensitive receptors

Figure: A-5	Drawn: MS
Date: 24/09/25	Checked: AT
Scale: 1:1	Approved: AT



KEY

Red line boundary

Proposed WwTWs

Human receptor

Odour concentration
(C98,1hr ouE/3)

1.5

3.0

5.0

0

25

50 m

Client:

Redrow Homes

Project:

Land south of Ruthin Road

Title:

Figure A-6: 98th percentile odour contours (ouE/m3) – maximum over 2020 -2024

Figure: A-6

Date: 02/10/25

Scale: 1:1

Drawn: MS

Checked: AT

Approved: AT



KEY

- Red line boundary
- Proposed WwTWs
- Human receptor

Odour concentration
(C98,1hr ouE/3)

- 1.5
- 3.0
- 5.0



0 25 50 m



Client:

Redrow Homes

Project:

Land south of Ruthin Road

Title:

Figure A-7: 98th percentile odour contours (ouE/m³) – 2020

Figure: A-7	Drawn: MS
Date: 02/10/25	Checked: AT
Scale: 1:1	Approved: AT



KEY

Red line boundary

Proposed WwTWs

Human receptor

Odour concentration
(C98,1hr ouE/3)

1.5

3.0

5.0

02550 m

Client:

Redrow Homes

Project:

Land south of Ruthin Road

Title:

Figure A-8: 98th percentile odour contours (ouE/m3) – 2021

Figure: A-8

Drawn: MS

Date: 02/10/25

Checked: AT

Scale: 1:1

Approved: AT



KEY	
	Red line boundary
	Proposed WwTWs
	Human receptor
Odour concentration (C98,1hr ouE/3)	
	1.5
	3.0
	5.0
Client:	Redrow Homes
Project:	Land south of Ruthin Road
Title: Figure A-9: 98th percentile odour contours (ouE/m3) – 2022	
Figure: A-9 Date: 02/10/25 Scale: 1:1	Drawn: MS Checked: AT Approved: AT



KEY	
	Red line boundary
	Proposed WwTWs
	Human receptor
Odour concentration (C98,1hr ouE/3)	
	1.5
	3.0
	5.0
Client:	Redrow Homes
Project:	Land south of Ruthin Road
Title:	Figure A-10: 98th percentile odour contours (ouE/m3) – 2023
Figure: A-10	Drawn: MS
Date: 02/10/25	Checked: AT
Scale: 1:1	Approved: AT



KEY

- Red line boundary
- Proposed WwTWs
- Human receptor

Odour concentration
(C98,1hr ouE/3)

- 1.5
- 3.0
- 5.0

Client:

Redrow Homes

Project:

Land south of Ruthin Road

Title:

Figure A-11: 98th percentile odour contours (ouE/m3) – 2024

Figure: A-11
Date: 02/10/25
Scale: 1:1

Drawn: MS
Checked: AT
Approved: AT



Matrix House
Basing View
Basingstoke, Hampshire
RG21 4FF

wsp.com

WSP UK Limited makes no warranties or guarantees, actual or implied, in relation to this report, or the ultimate commercial, technical, economic, or financial effect on the project to which it relates, and bears no responsibility or liability related to its use other than as set out in the contract under which it was supplied.