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ODOUR ASSESSMENT

PROPOSED RESIDENTIAL DEVELOPMENT
RIVERSIDE, DRIFFIELD

Client: Eko Custom Homes

REPORT REF: P5682-R1-V3

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ODOUR ASSESSMENT

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APPENDICES

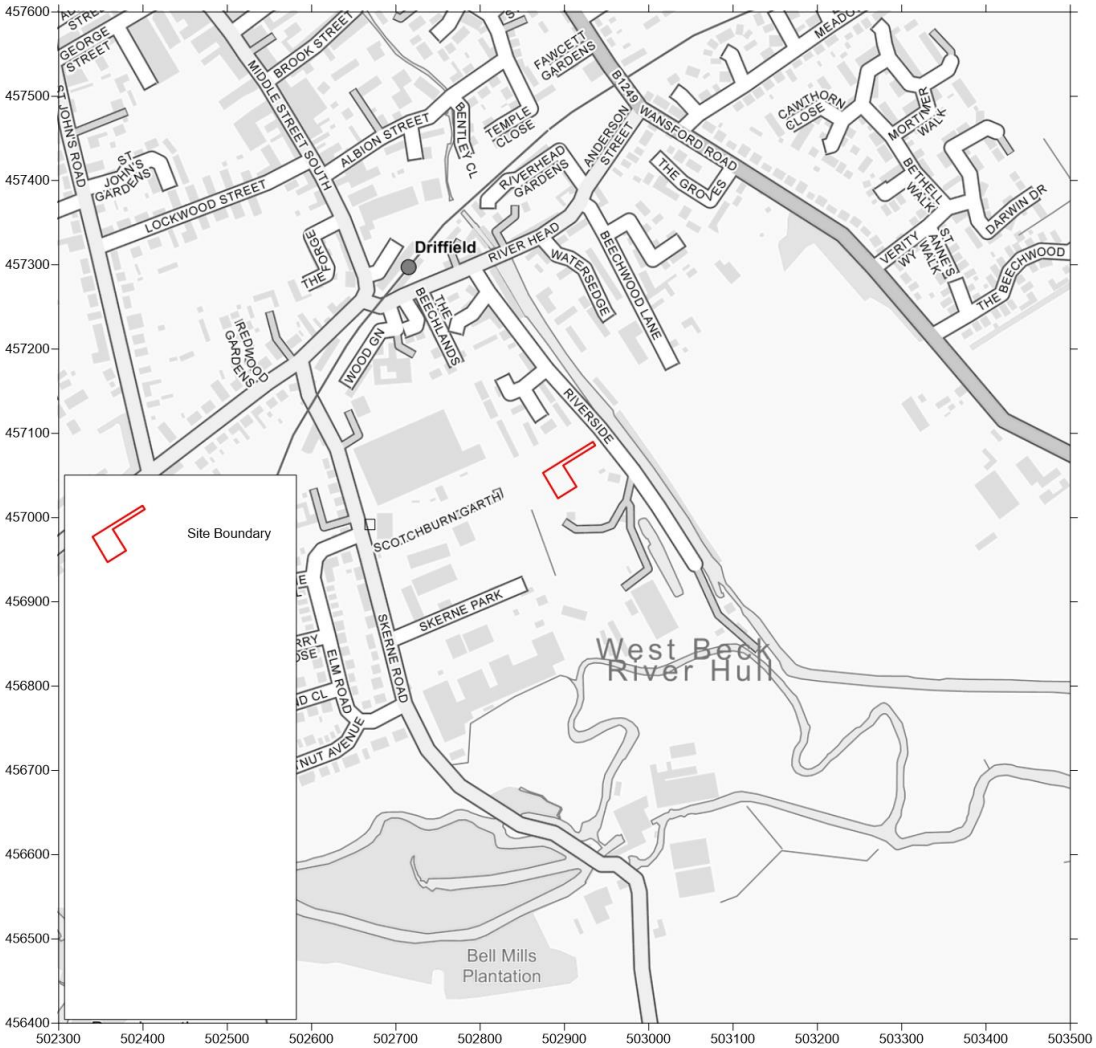
1 INTRODUCTION

1.1.1 By instruction dated 17th August 2022, NoiseAir Limited was commissioned to undertake an Odour Assessment in support of a planning application for a proposed residential development on land off Riverside Close, Driffield.

1.1.2 The site is located in the vicinity of a Wastewater Treatment Works (WwTWs) which is operated by Yorkshire Water (YW). Odour emissions from the facility have the potential to cause loss of amenity for future residents of the development. An Odour Assessment was therefore undertaken in order to evaluate baseline conditions and consider the suitability of the site for the proposed end use.

1.2 Site Location and Context

1.2.1 The proposed development is located on land off Riverside Close, Driffield, at approximate National Grid Reference (NGR): 502900, 457040. **Figure 1** details the locations of the site.



1.2.2 The proposals comprise the construction of two residential dwellings alongside associated parking and landscaping.

1.2.3 The proposed development is located in the vicinity of a WwTWs operated by YW. There is potential for odours from the WwTWs to cause loss of amenity for future residents of the scheme. As such, an Odour Assessment has been undertaken to evaluate baseline conditions and consider the suitability of the site for the proposed end use. The findings are detailed in the following report.

2 ODOUR BACKGROUND

2.1 Odour Definition

2.1.1 The Institute of Air Quality Management (IAQM) guidance[1] defines odour as:

"[…] the human olfactory response (perception followed by psychological appraisal) to one, or more often a complex mixture of, chemical species in the air."

2.1.2 The stated definition is considered to be relevant in the context of this assessment.

2.2 Odour Impacts

2.2.1 The magnitude of odour impact depends on a number of factors and the potential for complaints varies due to the subjective nature of odour perception. The **FIDOL** acronym (also stated as **FIDOR** in Environment Agency (EA) guidance[2]) is described by the IAQM[3] as follows:

- **F**requency - How often an individual is exposed to odour;
- **I**ntensity - The individual's perception of the strength of the odour;
- **D**uration - The overall duration that individuals are exposed to an odour over time;
- **O**dour unpleasantness - Odour unpleasantness describes the character of an odour as it relates to the 'hedonic tone' (which may be pleasant, neutral or unpleasant) at a given odour concentration/ intensity. This can be measured in the laboratory as the hedonic tone, and when measured by the standard method and expressed on a standard nine-point scale it is termed the hedonic score; and,
- **L**ocation - The type of land use and nature of human activities in the vicinity of an odour source. Tolerance and expectation of the receptor. The 'Location' factor can be considered to encompass the receptor characteristics, receptor sensitivity, and socio-economic factors.

2.2.2 It is important to note that even infrequent emissions may cause loss of amenity if odours are perceived to be particularly intense or offensive.

2.2.3 The **FIDOL** factors can be further considered to provide the following issues in regard to the potential for an odour emission to cause a nuisance:

- The rate of emission of the compound(s);
- The duration and frequency of emissions;

1 Guidance on the Assessment of Odour for Planning v1.1, IAQM, 2018.
2 H4: Odour Management, EA, 2011.
3 Guidance on the Assessment of Odour for Planning v1.1, IAQM, 2018.

- The time of the day that this emission occurs;
- The prevailing meteorology;
- The sensitivity of receptors to the emission i.e. whether the odorous compound is more likely to cause nuisance, such as the sick or elderly, who may be more sensitive;
- The odour detection capacity of individuals to the various compound(s); and,
- The individual perception of the odour (i.e. whether the odour is regarded as unpleasant). This is greatly subjective and may vary significantly from individual to individual. For example, some individuals may consider some odours as pleasant, such as petrol, paint and creosote.

2.3 Odour Legislative Control

2.3.1 The main requirement with respect to odour control from premises not authorised under the Environmental Permitting (England and Wales) Regulations (2016) and subsequent amendments, such as WwTWs, 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."

2.3.2 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 Local Authority 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 operations are being controlled according to best practicable means (BPM). The term BPM is defined as:

- "Practicable" means reasonably practicable having regard among other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications;
- The "means" to be employed include the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design, construction and maintenance of buildings and structures;
- The test is to apply only so far as compatible with any duty imposed by law; and,
- The test is to apply only so far as compatible with safety and safe working conditions, and with the exigencies of any emergency or unforeseeable circumstances.

2.3.3 It should be noted that where an operator can demonstrate that BPM is being applied, or where an agreed degree of abatement deemed to be BPM is added, this will not necessarily result in the total elimination of odours.

2.4 Odour Benchmark Levels

2.4.1 There is no statutory limit in the UK for ambient odour concentrations, whether set for individual chemical species or for mixtures. However, a number of indicative criteria have been utilised for the assessment of potential impacts. These are discussed in the following Sections.

Environment Agency Criteria

2.4.2 The EA has issued guidance on odour[4] which contains indicative benchmark levels for use in the assessment of potential impacts from facilities regulated under the Environmental Permitting (England and Wales) Regulations (2016) and subsequent amendments.

2.4.3 Benchmark levels are stated as the 98th percentile (%ile) of hourly mean concentrations in European odour units (ou_E) over a year for odours of different offensiveness. In practice this is the 175th highest hourly average recorded in the year. This parameter reflects the previously described FIDOL factors, where an odour is likely to be noted on several occasions above a particular threshold concentration before an annoyance occurs. EA odour benchmark levels are summarised in **Table 1**.

Table 1: Odour Benchmark Levels

Relative Offensiveness of Odour	Benchmark Level as 98th %ile of 1-hour Means (ou_E/m^3)
Most offensive processes: Processes involving decaying animal or fish Processes involving septic effluent or sludge Biological landfill odours	1.5
Moderately offensive odours: Intensive livestock rearing Fat frying (food processing) Sugar beet processing Well aerated green waste composting	3.0
Less offensive odours: Brewery Confectionery Coffee roasting Bakery	6.0

[4] H4: Odour Management, Environment Agency, 2011.

Wastewater Industry Research

2.4.4 In addition to the levels shown in **Table 1**, the wastewater industry has published an in-depth study through the United Kingdom Waste Industry Research (UKWIR) into the correlation between modelled odour impacts and human response (dose-effect). This was based on a review of the relationship between reported odour complaints and modelled odour impacts at nine WwTWs in the UK with ongoing odour complaints. The findings of this research (and subsequent UKWIR research) indicated the following:

- At modelled exposures of below $5ou_E/m^3$ as 98th %ile of 1-hour means, complaints are relatively rare, at only 3% of the total registered;
- At modelled exposures between $5ou_E/m^3$ and $10ou_E/m^3$ as a 98th %ile of 1-hour means, a significant proportion of total registered complaints occur, 38% of the total; and,
- The majority of complaints occur in areas of modelled exposure greater than $10ou_E/m^3$ as a 98th %ile of 1-hour means, 59% of the total.

Chartered Institute of Water and Environmental Management

2.4.5 The Chartered Institute of Water and Environmental Management (CIWEM) has released a Position Statement on the Control of Odour which provides guidance on likely responses to odour concentrations. These are summarised in **Table 2**.

Table 2: CIWEM Odour Guidance

Odour Concentration as 98th %ile of 1-hour Means (ou_E/m^3)	Response
Less than 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
5-10	Complaints may occur and depending on the sensitivity of the locality and nature of the odour this level may constitute a nuisance
Greater than 10	Complaints are highly likely and odour exposure at these levels represents an actionable nuisance

Planning Case Law

2.4.6 A $5ou_E/m^3$ impact criterion has been accepted as being appropriate for avoidance of significant risk of annoyance and a low risk of nuisance in a number of planning applications involving WwTWs (e.g. Newbiggin, JS Bloor Ltd, Leighton Linslade, etc).

Department for Environment, Food and Rural Affairs

2.4.7 In order to provide some context to the odour benchmark values, the Department for Environment, Food and Rural Affairs (DEFRA) have provided the following descriptors[5]:

- $1ou_E/m^3$ is the point of detection;
- $5ou_E/m^3$ is a faint odour; and,
- $10ou_E/m^3$ is a distinct odour.

2.4.8 An odour a strength of $1ou_E/m^3$ is in reality so weak that it would not normally be detected outside the controlled environment of an odour laboratory by the majority of people (that is individuals with odour sensitivity in the "normal" range - approximately 96% of the population[6]). It is important to note that these values are based on laboratory measurements and in the general environment other factors affect our sense of odour perception. These include:

- The population is continuously exposed to a wide range of background odours at a range of different concentrations, and usually people are unaware of there being any background odours at all due to normal habituation. Individuals can also develop a tolerance to background and other specific odours. In an odour laboratory the determination of detection threshold is undertaken by comparison with non-odorous air, and in carefully controlled, odour-free, conditions. Normal background odours such as those from traffic, vegetation, grass mowing etc, can provide background odour concentrations from 5 to $60ou_E/m^3$ or more[7];
- The recognition threshold may be about $3ou_E/m^3$ [8], although it might be less for offensive substances or higher if the receptor is less familiar with the odour or distracted by other stimuli; and,
- An odour which fluctuates rapidly in concentration is often more noticeable than a steady odour at a low concentration.

2.5 National Planning Policy

2.5.1 The revised National Planning Policy Framework[9] (NPPF) was published in July 2021 and sets out the Government's planning policies for England and how these are expected to be applied.

5 Odour Guidance for Local Authorities, DEFRA, 2010.
6 Odour Guidance for Local Authorities, DEFRA, 2010.
7 Odour Guidance for Local Authorities, DEFRA, 2010.
8 Odour Guidance for Local Authorities, DEFRA, 2010.
9 NPPF, Ministry of Housing, Communities and Local Government, 2021.

2.5.2 The purpose of the planning system is to contribute to the achievement of sustainable development. In order to ensure this, the NPPF recognises three overarching objectives, including the following of relevance to odour:

"c) An environmental objective - to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy."

2.5.3 Chapter 12 of the NPPF details objectives in relation to achieving well-designed place. It states that:

"Planning policies and decisions should ensure that developments:

[…]

f) create places that are safe, inclusive and accessible and which promote health and well-being, with a high standard of amenity for existing and future users; and where crime and disorder, and the fear of crime, do not undermine the quality of life and community cohesions and resilience."

2.5.4 The implications of the NPPF have been considered throughout this assessment.

2.6 Local Planning Policy

2.6.1 The East Riding of Yorkshire Council (ERYC) Local Plan comprises a suite of planning documents that together provide the long term development plan for ERYC. The Strategy Document[10], adopted on 6th April 2016, sets the overall strategic direction for the Local Plan, providing policies to guide decisions on planning applications.

2.6.2 Review of the Strategy Document indicated the following policy of relevance to this assessment:

"Policy ENV6: Managing environmental hazards

A. Environmental hazards, such as flood risk, coastal change, groundwater pollution and other forms of pollution, will be managed to ensure that development does not result in unacceptable consequences to its users, the wider community, and the environment

[…]."

[10] East Riding Local Plan 2012-2029, Strategy Document, ERoYC, 2016.

2.6.3 The implications of the stated policy were considered as necessary throughout the assessment

2.7 Institute of Air Quality Management Guidance

2.7.1 The IAQM published the 'Guidance on the Assessment of Odour for Planning'[11] document on 20th May 2014. This was updated in 2018[12] and specifically deals with assessing odour impacts for planning purposes, namely potential effects on amenity. The assessment methodology outlined in the guidance has been utilised throughout this report where relevant.

[11] Guidance on the Assessment of Odour for Planning, IAQM, 2014.
[12] Guidance on the Assessment of Odour for Planning v1.1, IAQM, 2018

3 METHODOLOGY

3.1 Introduction

3.1.1 The WwTWs may result in odour emissions during normal operation. These were assessed using dispersion modelling in accordance with the following stages:

- Identification of odour sources and emission parameters;
- Identification of odour emission rates;
- Dispersion modelling of odour emissions; and,
- Comparison of modelling results with relevant criteria.

3.1.2 The following Sections outline the methodology and inputs used for the assessment.

3.2 Dispersion Modelling

3.2.1 Dispersion modelling was undertaken using ADMS-5.2 (v5.2.4.0), which is developed by Cambridge Environmental Research Consultants (CERC) Ltd. ADMS-5 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.

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

3.2.3 The model requires input data that details the following parameters:

- Assessment area;
- Process conditions;
- Pollutant emission rates;
- Terrain information;
- Building dimensions;
- Meteorological data;
- Roughness length (z_0); and,
- Monin-Obukhov length.

3.2.4 These are detailed in the following Sections.

3.3 Odour Sources

3.3.1 Potential odour sources associated with operation of the WwTWs were identified based on aerial photography and information obtained from the ERYC planning portal. It should be noted that YW have submitted a planning application (reference: 22/02291/CM) which is pending determination for the installation of additional sludge thickening plant at the facility. The proposed units have been included within the dispersion model in order to provide a robust assessment of conditions at the site should this application be granted. The identified odour sources are summarised in **Table 3**.

Table 3: Odour Sources

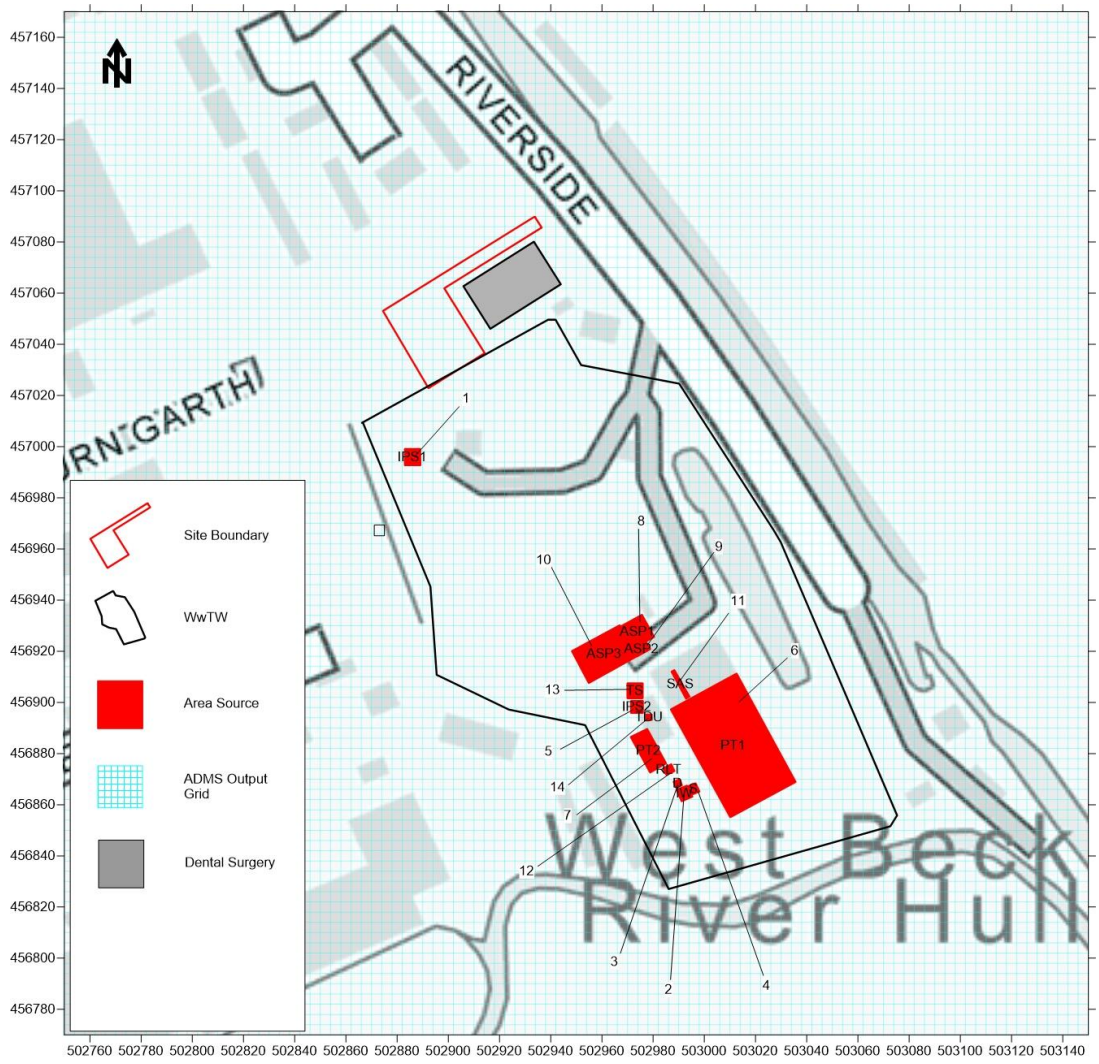
Source	Source Description	Description	Total Exposed Area (m^2)
1	Inlet Pumping Station	1 circular tank	38.5
2	Inlet Works	Inlet chambers and channels	15.8
3	Detritors/Channels	Distribution channels	6.2
4	Grit Skip	2 rectangular skips	12.3
5	Inlet Pumping Station	1 circular tank	20.5
6	Primary Tank	3 large rectangular tanks	1,392.0
7	Primary Tank	1 small rectangular tank	108.5
8	Anoxic Selector	Rectangular tank	104.0
9	Anoxic Selector	Rectangular tank	19.6
10	Diffused Aeration	Large rectangular tanks	304.3
11	Surplus Activated Sludge	Rectangular tank	16.5
12	Returned Liquor Tank	1 circular tank	10.0
13	Thickened Sludge	1 circular tank	33.2
14	Thickening/Dewatering Unit	1 circular tank	4.3

3.3.2 A summary of the model inputs used to represent the sources shown in **Table 3** is provided in **Table 4**. It should be noted that the inputs are the same as those utilised as part of a previous Odour Assessment[13] completed by NoiseAir Limited in support of two residential developments adjacent to the proposals which have been granted planning permission (22/00756/PLF and 22/01035/PLF).

[13] Odour Assessment - Riverside, Driffield, NoiseAir Limited, 2022.

Table 4: Source Input Data			
Source	**Source Description**	**Source Type**	**Modelled Area (m^2)**
1	Inlet Pumping Station	Area	38.0
2	Inlet Works	Area	21.7
3	Detritors/Channels	Area	6.1
4	Grit Skip	Area	11.7
5	Inlet Pumping Station	Area	21.4
6	Primary Tank	Area	1,400.9
7	Primary Tank	Area	111.0
8	Anoxic Selector	Area	92.9
9	Anoxic Selector	Area	18.7
10	Diffused Aeration	Area	296.2
11	Surplus Activated Sludge	Area	16.6
12	Returned Liquor Tank	Area	10.2
13	Thickened Sludge	Area	34.3
14	Thickening/Dewatering Unit	Area	4.2

3.3.3 Reference should be made to **Figure 2** for a map of the source locations.



3.4 Odour Emission Rates

3.4.1 Emission rates for the sources were obtained from the UKWIR technical reference document 'Odour Control in Wastewater Treatment'[14], which have been derived based on the results of monitoring undertaken at similar facilities. The document was therefore considered a suitable source of data for use in the assessment.

3.4.2 A summary of the data is provided in **Table 5**.

14 Odour Control in Wastewater - A Technical Reference Document, UKWIR, 2001.

Table 5: Odour Emission Rates		
Source	**Source Description**	**Typical Emission Rate ($ou_E/m^2/s$)**
1	Inlet Pumping Station	6.2
2	Inlet Works	6.2
3	Detritors/Channels	6.2
4	Grit Skip	50.0
5	Inlet Pumping Station	6.2
6	Primary Tank	1.9
7	Primary Tank	1.9
8	Anoxic Selector	4.0
9	Anoxic Selector	4.0
10	Diffused Aeration	4.0
11	Surplus Activated Sludge	0.3
12	Returned Liquor Tank	40.0
13	Thickened Sludge	40.0
14	Thickening/Dewatering Unit	710.0

3.4.3 The emission rates shown in **Table 5** were multiplied by the areas shown in **Table 4** to determine the total release per source. These were then applied to the sources within ADMS-5, allowing for any differences between modelled and actual areas.

3.4.4 In order to provide a robust assessment of potential impacts a number of worst-case assumptions regarding odour emissions were adopted. These include the following:

- It was assumed that both grit skips are full at all times. This is considered to represent a worst-case assumption as there will be periods when the skips do not operate at full capacity and therefore the exposed surface of potentially odourous material will be lower; and,
- Based on information submitted in support of planning application 22/02291/CM, it is understood that air will be extracted from the proposed thickening/dewatering unit and transferred to an abatement system for treatment prior to discharge to atmosphere. The emission rate shown in **Table 5** was factored by 50% to reflect containment of emissions from the proposed thickening/dewatering unit. However, no further reduction was applied to represent treatment of emissions. This is considered to represent a worst-case assessment approach, as well designed and managed abatement systems have the capacity to achieve considerably higher reduction efficiencies than 50%.

3.5 Modelling Scenarios

3.5.1 The scenarios considered in the modelling assessment are summarised in **Table 6**.

Table 6: Assessment Scenarios		
Parameter	**Modelled As**	
Odour	98th %ile 1-hour mean	-

3.6 Assessment Area

3.6.1 The assessment area was defined based on the development locations and anticipated pollutant dispersion patterns. Ambient concentrations were predicted over NGR: 502750, 456770 to 503150, 457170. 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.

3.6.2 Reference should be made to **Figure 2** for a graphical representation of the assessment grid extents.

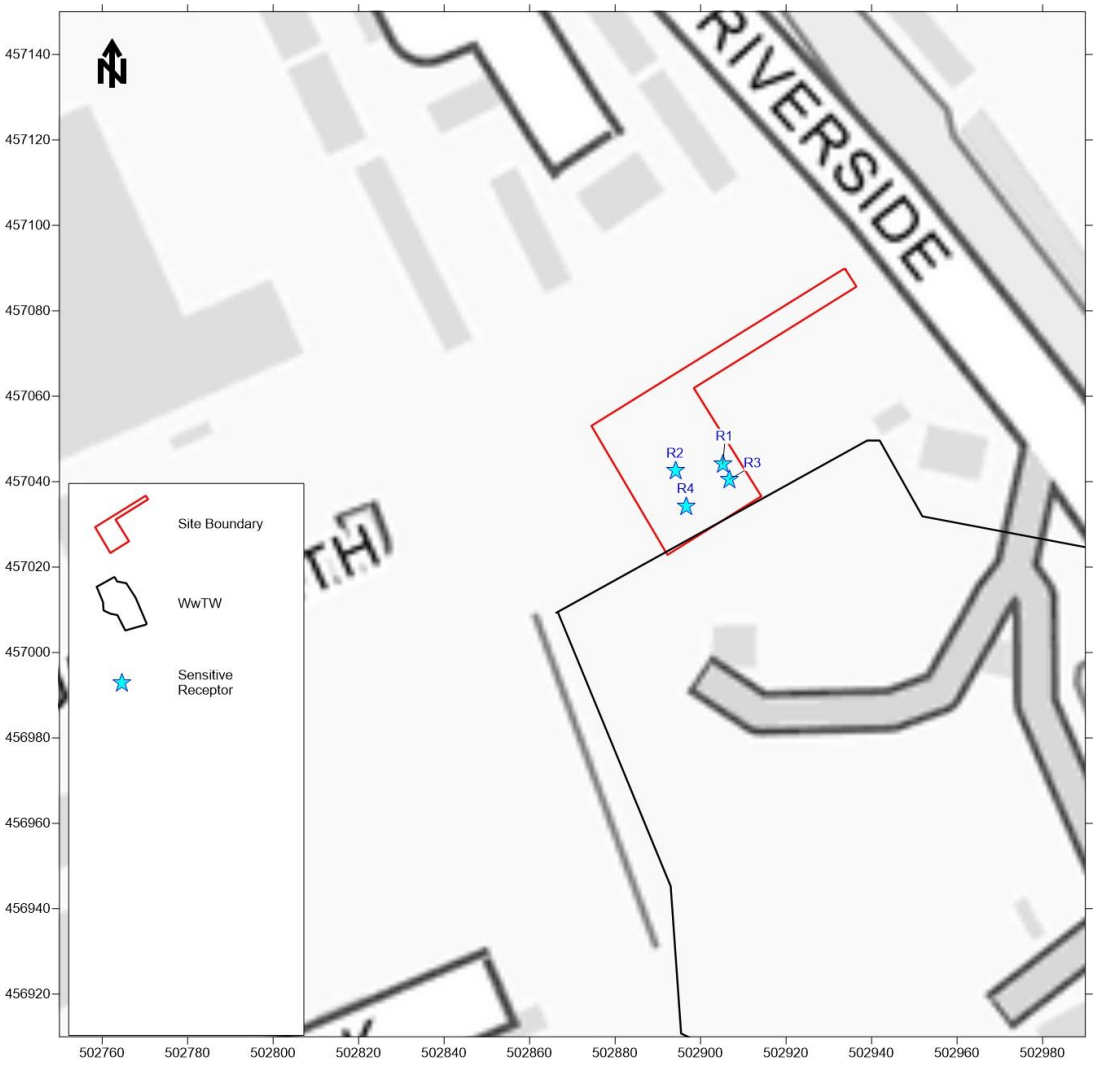
3.6.3 Discrete receptor points were selected to represent proposed residential properties at the development. These are classified as **high** sensitivity according to the IAQM criteria which is provided in **Table 7**.

Table 7: Odour Receptor Sensitivity	
Sensitivity	**Description**
High	Surrounding land where: Users can reasonably expect enjoyment of a high level of amenity; and, People would reasonable be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land Examples may include residential dwellings, hospitals, schools/education and tourist/cultural
Medium	Surrounding land where: Users would expect to enjoy a reasonable level of amenity, but would mot reasonably expect to enjoy the same level of amenity as in their home; or, People would not reasonably be expected to be present here continuously or regularly for extended periods as part of the normal patterns of use of the land Examples may include places of work, commercial/retail premises and playing/recreation fields
Low	Surrounding land where: The enjoyment of amenity would not reasonably be expected: or, There is transient exposure, where the people would regularly be expected to be present only for limited periods of time as part of the normal pattern of use of the land Examples may include industrial use, farms, footpaths and roads

3.6.4 The receptor locations are summarised in **Table 8**.

Table 8: Sensitive Receptor Locations	
Position	**Receptor Description**
1	Eastern property - Rear façade
2	Western property - Rear façade
3	Eastern property - Rear garden
4	Western property - Rear garden

3.6.5 Reference should be made to **Figure 3** for a map of the receptor locations.



3.7 Terrain Data

3.7.1 Ordnance Survey OS Terrain 50 data was included in the model for the site and surrounding area in order to take account of the specific flow field produced by variations in ground

height throughout the assessment extents. This was pre-processed using the method suggested by CERC.

3.8 Meteorological Data

3.8.1 Meteorological data used in the assessment was taken from Leconfield meteorological station over the period 1st January 2017 to 31st December 2021 (inclusive). This observation station is located at NGR: 503329, 442674, which is approximately 13.9km south 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.

3.8.2 All meteorological files used in the assessment were provided by Atmospheric Dispersion Modelling Ltd, which is an established distributor of data within the UK.

3.9 Roughness Length

3.9.1 A z_0 of 0.5m was used within the model to describe the modelling extents. This is considered appropriate for the morphology of the area and is suggested within ADMS-5 as being suitable for "parkland, open suburbia".

3.9.2 A z_0 of 0.3m was used within the model to describe the meteorological site. This value is considered appropriate for the morphology of the area and is suggested within ADMS-5 as being suitable for "agricultural areas (max)".

3.10 Monin-Obukhov Length

3.10.1 The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 30m was used to describe the modelling extents. This value is considered appropriate for the nature of the area and is suggested within ADMS-5 as being suitable for "mixed urban/industrial".

3.10.2 A minimum Monin-Obukhov length of 10m was used to describe the meteorological site. This value is considered appropriate for the nature of the area and is suggested within ADMS-5 as being suitable for "small towns < 50,000".

3.11 Assessment Criteria

3.11.1 Predicted ground level odour concentrations were compared with the odour benchmark level of $3.0ou_E/m^3$ as a 98th %ile of 1-hour means, based on previous planning case law, research undertaken by UKWIR and the position statement produced by CIWEM.

3.12 Significance of Odour Impacts

3.12.1 The significance of impacts was assessed through the interaction of the predicted 98th %ile of 1-hour mean odour concentrations and receptor sensitivity, as outlined in the IAQM guidance[15]. The relevant assessment matrix is summarised in **Table 9**.

Table 9: Odour Impact

Odour Exposure Level as 98th %ile of 1-hour Means (ou_E/m^3)	Receptor Sensitivity		
	Low	Medium	High
Greater than 10	Moderate	Substantial	Substantial
5 - 10	Slight	Moderate	Moderate
3 - 5	Negligible	Slight	Moderate
1.5 - 3	Negligible	Negligible	Slight
0.5 - 1.5	Negligible	Negligible	Negligible
Less than 0.5	Negligible	Negligible	Negligible

3.12.2 The IAQM guidance[16] states that an assessment must reach a conclusion on the likely significance of the predicted impact. Where the overall effect is **moderate** or **substantial**, the effect is likely to be considered **significant**, whilst if the effect is **slight** or **negligible**, the impact is likely to be considered **not significant**. It should be noted that this is a binary judgement of either it is **significant** or it is **not significant**. This has been considered to determine the overall significance of potential odour effects associated with the WwTWs.

3.13 Modelling Uncertainty

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

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

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

15 Guidance on the Assessment of Odour for Planning v1.1, IAQM, 2018.
16 Guidance on the Assessment of Odour for Planning v1.1, IAQM, 2018.

- Choice of model - ADMS-5 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 a local observation station 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;
- Emission rates - Emission rates were derived from UKWIR technical guidance for odour emissions monitored at similar facilities. As such, they are considered to be representative of potential releases during normal operation;
- 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 are as accurate as possible and worst-case conditions were considered as necessary in order to ensure a robust assessment of potential pollutant concentrations.

3.13.3 Results were considered in the context of the IAQM criteria. 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 ASSESSMENT

4.1 Predicted Odour Concentrations

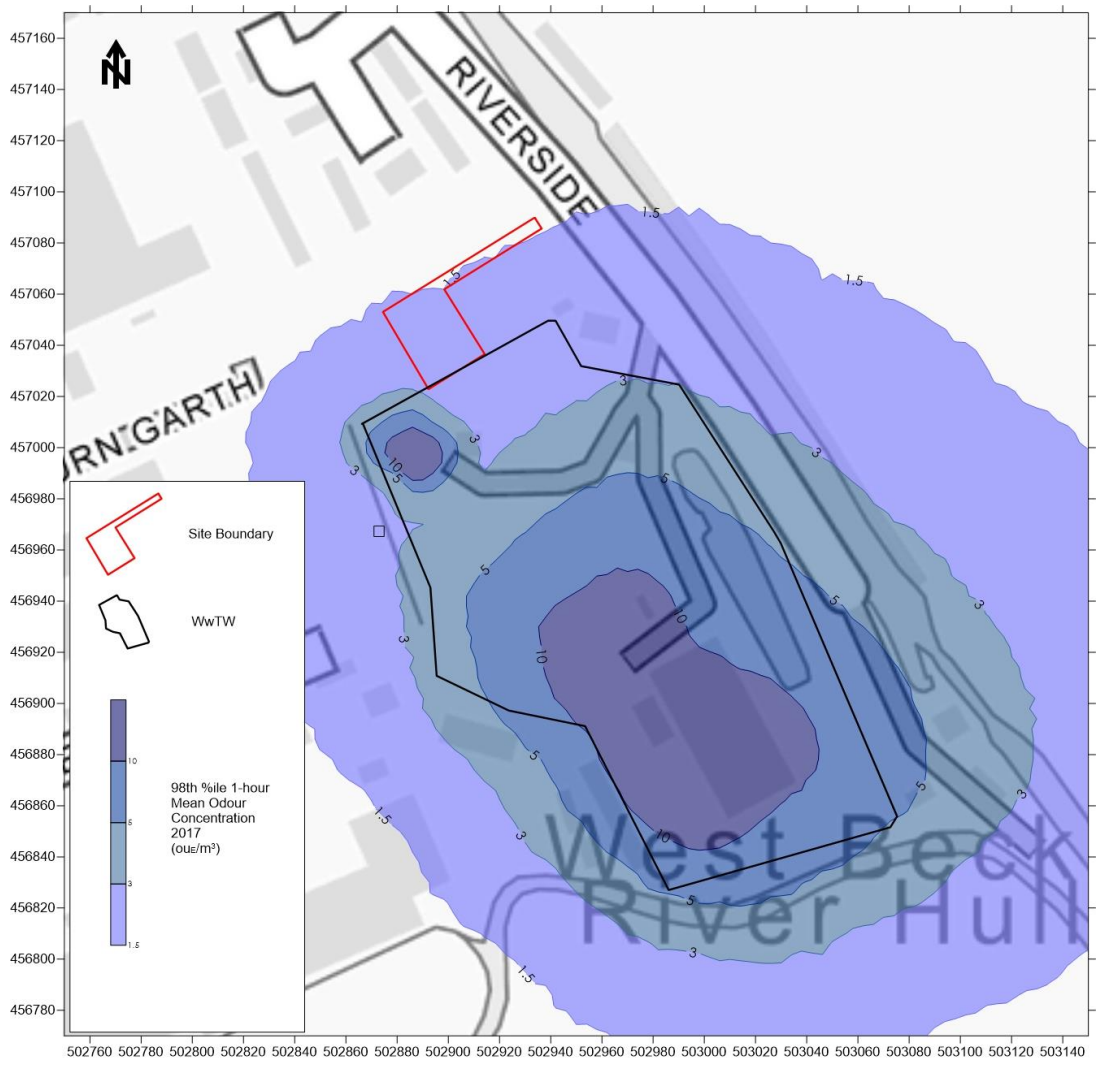
4.1.1 Dispersion modelling was modelling of potential odour emissions was undertaken using the input data specified previously. Predicted odour concentrations at the discrete receptor locations are summarised in **Table 10**. It should be noted that the odour concentrations are presented as 98th %ile of 1-hour mean values over the relevant assessment year. The maximum concentration across the five years of results is highlighted in **bold**.

Table 10: Predicted Odour Concentrations

Receptor	Predicted 98th %ile 1-hour Mean Odour Concentration (ou_E/m^3)				
	2017	2018	2019	2020	2021
1	1.77	1.75	**1.78**	1.43	1.71
2	1.84	1.84	**1.87**	1.43	1.73
3	1.81	1.80	**1.81**	1.47	1.75
4	2.00	1.99	**2.03**	1.57	1.86

4.1.2 As shown in **Table 10**, predicted odour concentrations were below the relevant criteria of $3ou_E/m^3$ at all receptor locations for all meteorological data sets.

4.1.3 Reference should be made to Figure 4 to Figure 8 for graphical representations of predicted odour concentrations throughout the assessment extents. As shown in the Figures, predicted odour concentrations were below the $3ou_E/m^3$ benchmark at all locations across the development for all meteorological years.


RIVERSIDE
Site Boundary
WwTW
98th %ile 1-hour Mean Odour Concentration 2017 (ouE/m³)
West Beck
River Hull
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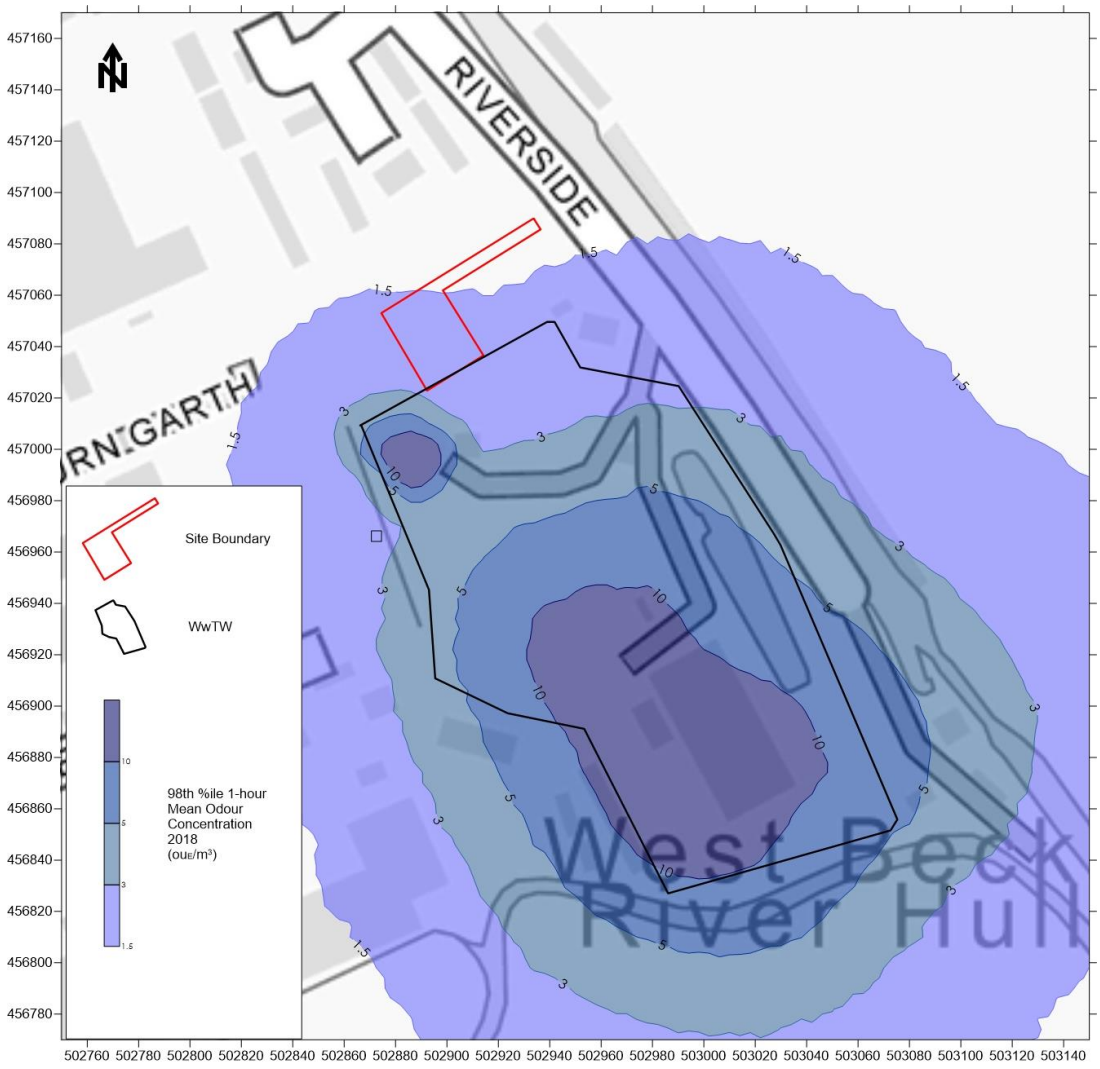
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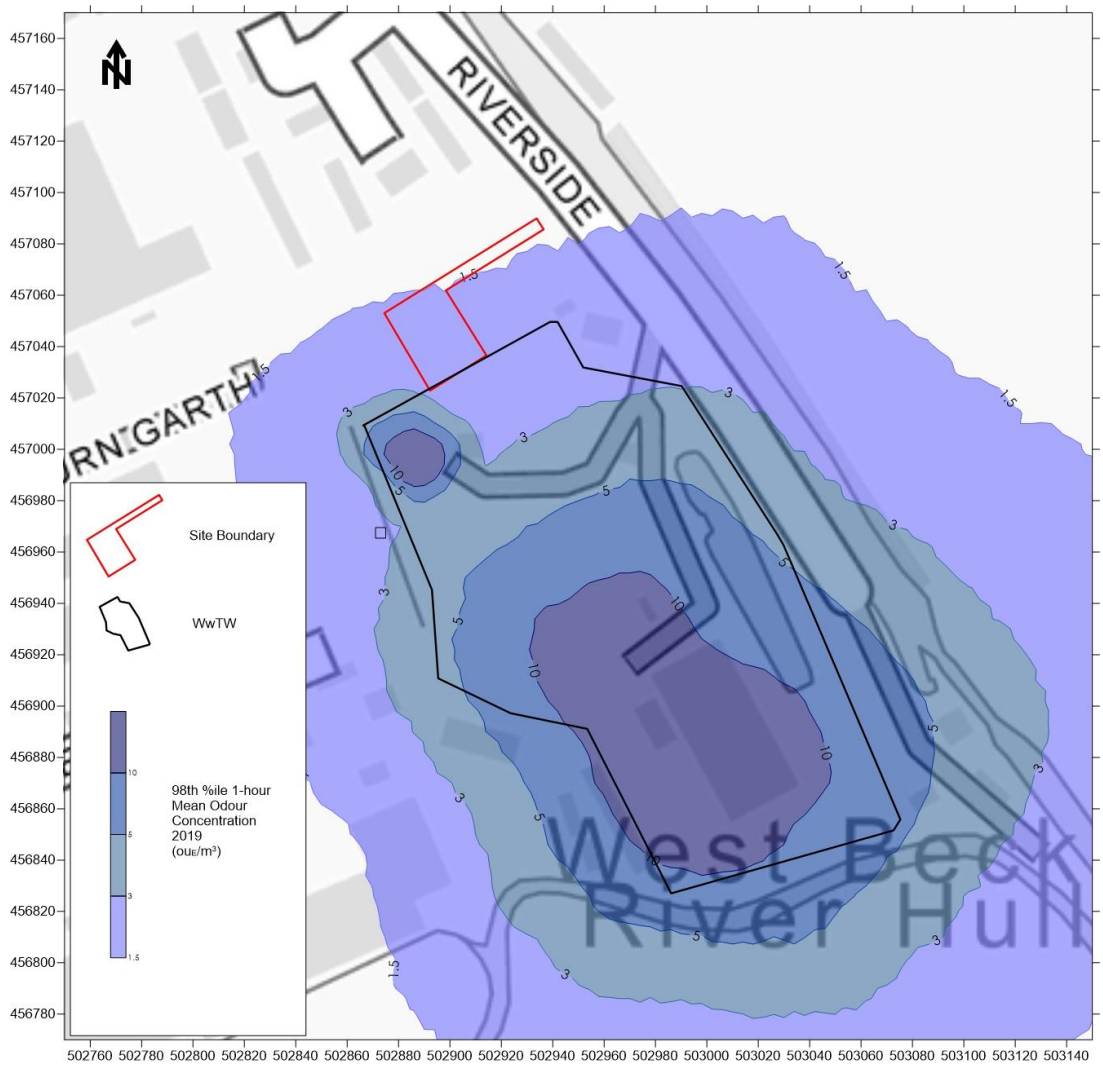
RIVERSIDE
Site Boundary
WwTW
98th %ile 1-hour Mean Odour Concentration 2019 (ouE/m³)
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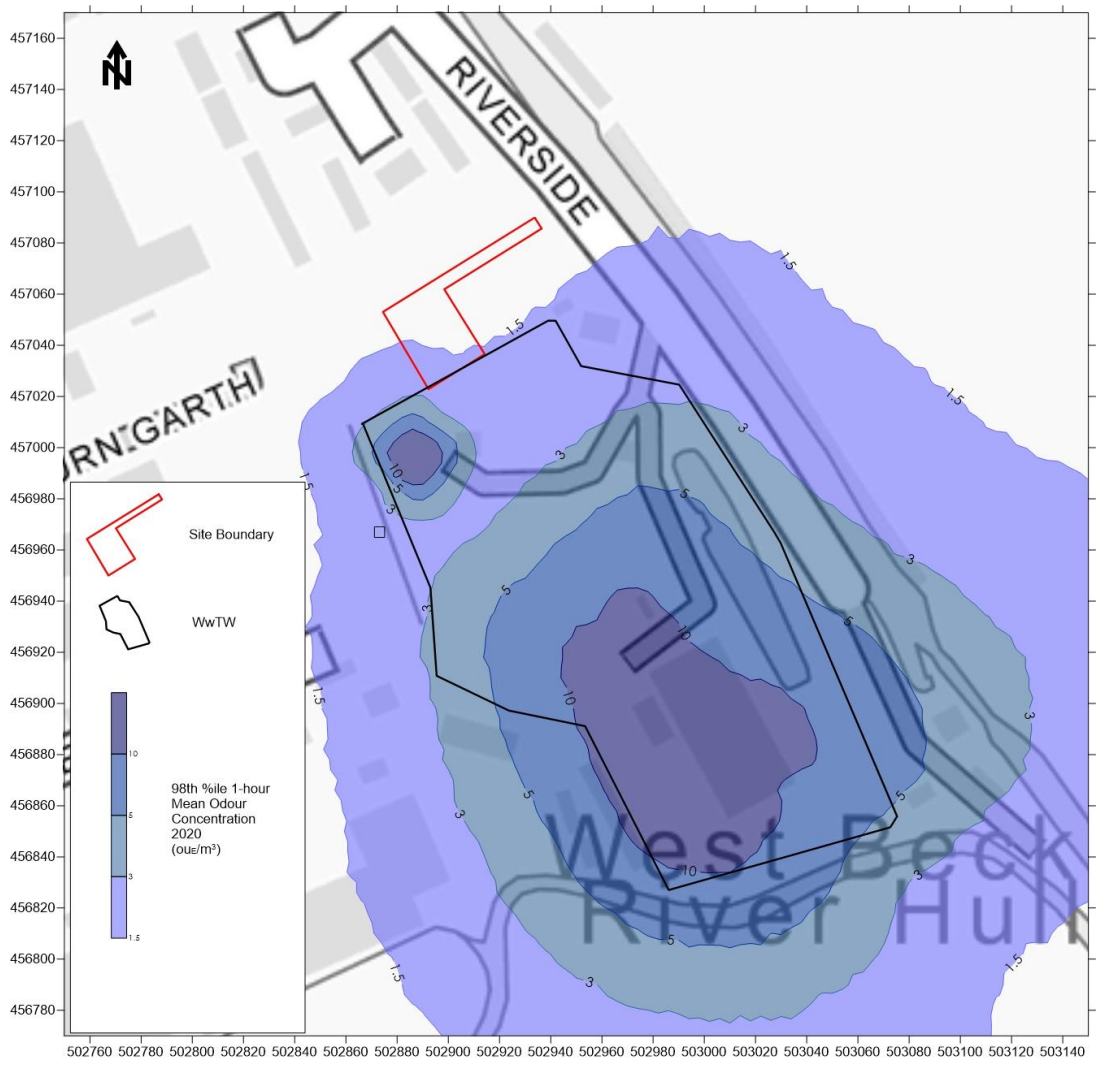
RIVERSIDE
Site Boundary
WwTW
98th %ile 1-hour Mean Odour Concentration 2020 (ouE/m³)
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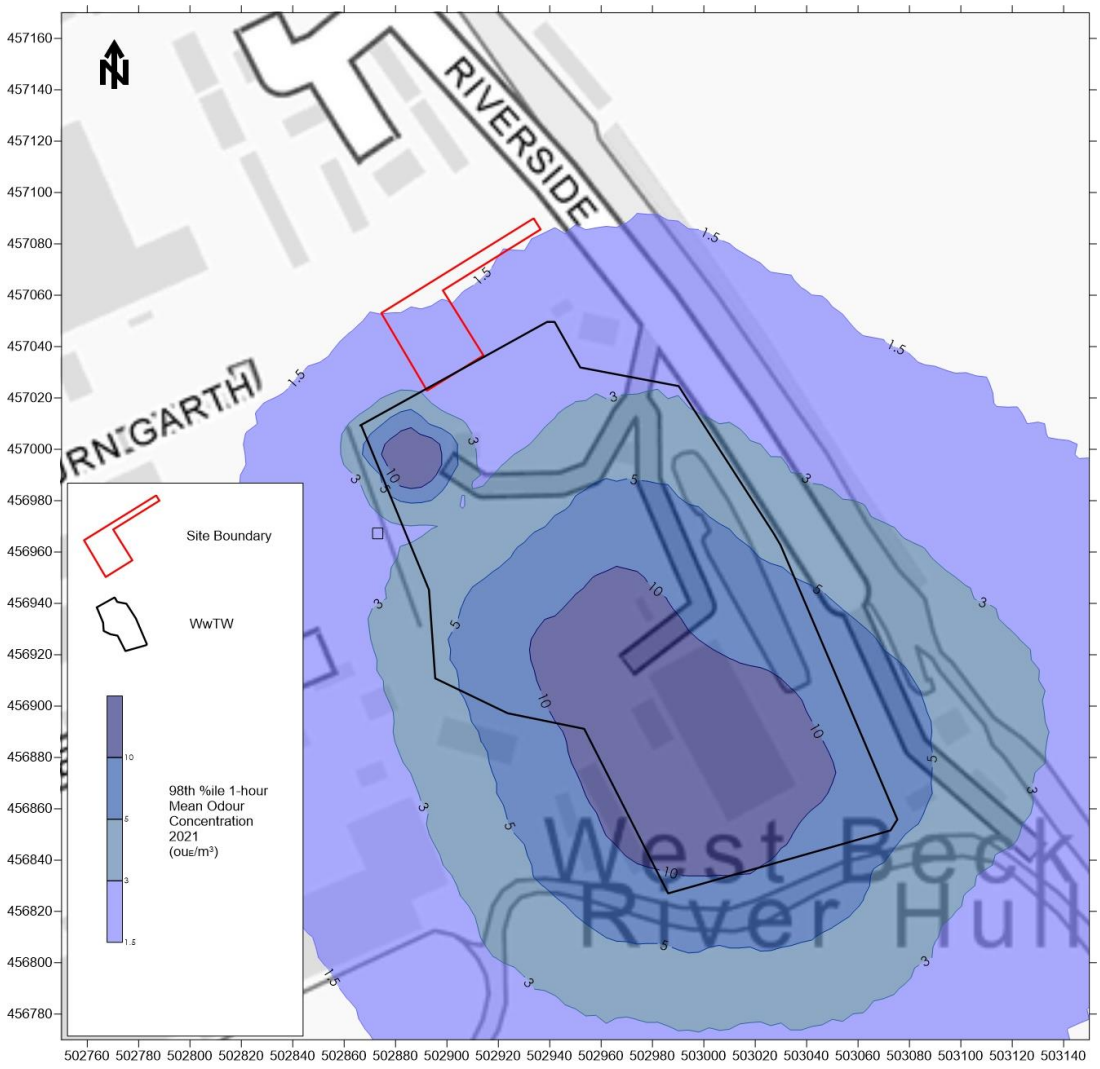

4.2 Impact Significance

4.2.1 The significance of predicted odour impacts at the sensitive receptors is summarised in **Table 11**.

Table 11: Predicted Odour Impacts

Receptor	Odour Exposure Level as 98th %ile of 1-hour Means (ou_E/m^3)	Receptor Sensitivity	Significance of Impact
R1	1.5 - 3	High	Slight
R2	1.5 - 3	High	Slight
R3	1.5 - 3	High	Slight
R4	1.5 - 3	High	Slight

4.2.2 As shown in **Table 11**, the significance of odour impacts as a result of emissions from the WwTWs was predicted to be **slight** at all locations.

4.2.3 The IAQM guidance[17] states that only if the impact is **moderate** or **substantial**, the effect is considered **significant**. As such, impacts are considered **not significant**, in accordance with the stated methodology.

4.2.4 This conclusion is supported by the findings of the Field Odour Surveys completed by NoiseAir Limited in support of planning applications 22/00756/PLF and 22/01035/PLF, which included observations at the boundary of the proposed development and in the immediate vicinity of the site. The results indicated that predicted impacts were **not significant** at all survey locations.

4.2.5 Based on the dispersion modelling results and the findings of the previous Field Odour Surveys, it is not anticipated that significant odour impacts will occur at the proposed development as a result of emissions from the WwTWs.

[17] Guidance on the Assessment of Odour for Planning v1.1, IAQM, 2018.

5 CONCLUSIONS

5.1.1 NoiseAir Limited was commissioned to undertake an Odour Assessment in support of a planning application for a proposed residential development on land off Riverside Close, Driffield.

5.1.2 The site is located in the vicinity of a WwTWs which is operated by YW. Odour emissions from the facility have the potential to cause loss of amenity for future residents of the development. An Odour Assessment was therefore undertaken in order to evaluate baseline conditions at the sites and consider their suitability for the proposed end use.

5.1.3 The risk of potential odour effects at the development sites was also assessed using dispersion modelling. The results of the assessment indicated the odour effect significance was **slight** as a result of emissions from identified sources at the WwTWs.

5.1.4 The findings of Field Odour Surveys completed in support of planning applications 22/00756/PLF and 22/01035/PLF were also considered as part of the assessment, which indicated that predicted impacts were **not significant** at all survey locations. Based on the results of the dispersion modelling and Field Odour Surveys, the overall odour effects on the development are considered to be **not significant**. As such, odour is not considered a constraint to planning consent for the scheme.

APPENDIX A - REPORT LIMITATIONS

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APPENDIX B - GLOSSARY

Maximum Odour Intensity (I_{max})	The maximum odour intensity recorded during a Survey
Average Odour Intensity (Imean)	The average odour intensity recorded during a Survey
Percentage Odour Time (tI>4)	The number of times where an odour is recognisable during a Survey, divided by the total number of samples

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