

Project

Wrenbury Way, Cefn-Mawr
Odour Consultancy Services

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Experts in air quality
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Contents

1	Introduction	3
2	Odour in Legislation, Policy and Guidance	4
3	Assessment Approach	7
4	Odour Impact Assessment	14
5	Mitigation.....	20
6	Summary.....	21
7	References.....	22
8	Appendices	23
A1	Professional Experience.....	24
A2	Wind Roses.....	25
A3	Model Inputs – Odour Emission Rates	28
A4	Odour Contours.....	29
A5	Sniff Test Data	33

1 Introduction

- 1.1 This report describes the assessment of odour effects associated with Cefn Mawr Sewage Treatment Works (STW) on a proposed residential development located immediately northeast of the works at Wrenbury Way in Cefn Mawr, Wrexham. The assessment has been carried out by Air Quality Consultants Ltd (AQC) on behalf of SRL Technical Services Ltd and is provided to support discharge of planning condition 27, which states:

“No part of the development shall commence until an Odour Impact Assessment Report which has regard to the Institute of Air Quality Managements “guidance on the assessment of odour for planning” has been submitted to and approved in writing by the Local Planning Authority. The development shall be carried out in accordance with the recommendations contained with the approved report.”

- 1.2 It should be noted that the development site has previously been approved, and partially built, for residential development. In addition, no odour assessment was requested by Wrexham County Borough Council or any statutory consultee (including Welsh Water) to support either this or the previous application, suggesting that the potential for adverse odour effects at the site was deemed not a significant risk to future amenity. Whilst it is not known whether any changes to the STW have taken place since the original application was approved, review of aerial imagery of the works suggests no significant changes to the treatment process have taken place.
- 1.3 The professional experience of the consultants who have prepared the assessment is summarised in Appendix A1.
- 1.4 The assessment identifies the potential odour effects associated with the STW using complaints analysis, odour dispersion modelling and field odour surveys (sniff testing).

2 Odour in Legislation, Policy and Guidance

National Legislation

Environmental Protection Act

- 2.1 There are currently no statutory standards in the UK covering the release and subsequent impacts of odours. This is due to complexities involved with measuring and assessing odours against compliance criteria, and the inherently subjective nature of odours.
- 2.2 It is recognised that odours have the potential to pose a nuisance for residents living near to an offensive source of odour. Determination of whether or not an odour constitutes a statutory nuisance in these cases is usually the responsibility of the local planning authority or the Environment Agency. The Environmental Protection Act 1990 (1990) outlines that a local authority can require measures to be taken where any:

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

“fumes or gases are emitted from premises so as to be prejudicial to health or cause a nuisance..”

- 2.3 Odour can also be controlled under the Statutory Nuisance provisions of Part III of the Environmental Protection Act.

Planning Policy

- 2.4 Land-use planning policy in Wales is established within the policy document Planning Policy Wales (PPW) (Welsh Government, 2021), which provides the strategic policy framework for the effective preparation of local planning authority development plans. With regard to pollution and health effects, it states:

“Planning authorities have a role to play in the prevention of physical and mental illnesses caused, or exacerbated, by pollution, disconnection of people from social activities (which contributes to loneliness) as well as the promotion of travel patterns which facilitate active lifestyles. The planning system must consider the impacts of new development on existing communities and maximise health protection and well-being and safeguard amenity. This will include considering the provision of, and access to, community and health assets, such as community halls, libraries, doctor’s surgeries and hospitals. Health impacts should be minimised in all instances, and particularly where new development could have an adverse impact on health, amenity and well-being. In such circumstances, where health or amenity impacts cannot be overcome satisfactorily, development should be refused”.

“Planning authorities should develop and maintain places that support healthy, active lifestyles across all age and socio-economic groups, recognising that investment in walking and cycling

infrastructure can be an effective preventative measure which reduces financial pressures on public services in the longer term. The way a development is laid out and arranged can influence people's behaviours and decisions and can provide effective mitigation against air and noise pollution. Effective planning can provide calming, tranquil surroundings as well as stimulating and sensory environments, both of these make an important contribution to successful places"

"Green infrastructure can be an effective means of enhancing health and well-being, through linking dwellings, workplaces and community facilities and providing high quality, accessible green spaces. In all development and in public spaces especially, there should be sensitive management of light, and exposure to airborne pollution should be kept as low as reasonably practicable. The compatibility of land uses will be a key factor in addressing air quality and creating appropriate soundscapes which are conducive to, and reflective of, particular social and cultural activities and experiences, particularly in busy central areas of towns and cities. Equally, the provision of quiet, tranquil areas which provide peaceful sanctuaries in otherwise noisy environments can help to reduce general levels of pollution and promote both mental and physical well-being".

- 2.5 PPW places a general presumption in favour of sustainable development, stressing the importance of local development plans, and states that the planning system should perform an environmental role to minimise pollution. Local development plans should enable consideration of the effects that the proposed development may have on air quality, as well as the effect that air quality may have on the proposed development. To prevent unacceptable risks from air pollution, planning decisions should ensure that new development is appropriate for its location.
- 2.6 PPW also places considerable emphasis on the Well-being of Future Generations Act (Welsh Government, 2015) with the intention to improve the social, economic, environmental and cultural well-being of Wales, and outlines how this can be achieved through the concept of 'Placemaking'.
- 2.7 PPW is supported by a series of Technical Advice Notes (TANs) and National Assembly for Wales Circulars. Local planning authorities have to take PPW, TANs and Circulars into account when preparing Development Plans.
- 2.8 With respect to planning policy guidance, TAN 18 on transport (Welsh Government, 2015) makes reference to local air quality and the need for Air Quality Action Plans to be prepared for any Air Quality Management Areas declared.
- 2.9 The need for compliance with any statutory air quality limit values and objectives is stressed, and the presence of AQMAs must be accounted for in terms of the cumulative impacts on air quality from individual sites in local areas. New developments in AQMAs should be consistent with local air quality action plans.

Odour Guidance

Natural Resources Wales Guidance

- 2.10 The Environment Agency has produced a horizontal guidance note (H4) (which has been adopted by Natural Resources Wales) on odour assessment and management (Environment Agency, 2011), which is designed for operators of regulated processes (i.e., those which classify as Part A(1) processes under the Pollution Prevention and Control (PPC) regime). The H4 guidance document is primarily aimed at methods to control and manage the release of odours, but also contains a series of recommended assessment methods which can be used to assess potential odour impacts.

Institute of Air Quality Management Guidance

- 2.11 The latest UK guidance on odour was published by the Institute of Air Quality Management (IAQM) in 2018 (IAQM, 2018). The IAQM guidance sets out assessment methods which may be utilised in the assessment of odours for planning applications. It is the only UK odour guidance document which contains a method for estimating the significance of potential odour impacts.
- 2.12 The IAQM guidance endorses the use of multiple assessment tools for odours, stating that, “*best practice is to use a multi-tool approach where practicable*”. This is in order to improve the robustness of the assessment conclusions. Some of the methods outlined in the IAQM guidance have been adopted in this odour assessment.

3 Assessment Approach

- 3.1 Odour impact assessment is a challenging and subjective science. There are a number of odour assessment methods and tools that have been developed which are widely used in the UK, including desk-based methods, such as complaints analysis and qualitative risk assessment, through to field odour testing (sniff testing) and dispersion modelling. Each has its advantages and disadvantages and not all assessment methods are appropriate in every case; for example, where a potentially odorous process is proposed rather than existing, then assessment methods such as sniff testing and odour sampling are less relevant than predictive methods such as odour risk assessment. The scale and location of odorous processes is also important in selecting appropriate assessment methodologies, with more simple methodologies often sufficient for small or remotely located processes.
- 3.2 The approach to assessing the odour effects from the STW has been to use odour dispersion modelling using the ADMS-5 dispersion model as well as semi-quantitative on-site field odour assessments (sniff testing) and a review of the odour complaints record.

Odour Sniff Testing

Sniff Test Methodology

- 3.3 This assessment uses the approach set out in the IAQM Guidance on the Assessment of Odours for Planning (IAQM, 2018), as set out below.
- 3.4 The observers undertaking the sniff-tests have had their olfactory acuity checked prior to carrying out the observations to demonstrate that their sense of smell is within the 'normal' range (i.e. is neither over- nor under-sensitive to odours). On the evening before, and on the day of the observations, the observers consumed no strong food or drinks. No strongly scented toiletries were worn. These protocols are recommended in a number of odour guidance documents, including those published by the IAQM (IAQM, 2018) and Environment Agency (Environment Agency, 2011).
- 3.5 The sniff tests conducted followed the procedure described in the IAQM guidance on assessment of odours for planning (IAQM, 2018). The tests aimed to identify key characteristics of all odours detected, in particular their 'FIDOR' factors (as described in IAQM and EA guidance), which were appraised and recorded using the guidance outlined in Table 1.

Table 1: Description of the FIDOR factors

Factor	Description
Frequency	The frequency with which odours are detected.
Intensity ^a	The degree to which an odour is detectable on a 0-6 scale where: 0 = No odour 1 = Very faint odour (there is probably some doubt as to whether the odour is actually present) 2 = Faint odour (the odour is present but cannot be described using precise words or terms) 3 = Distinct odour (the odour character is barely/just recognisable) 4 = Strong odour (the odour character is easily recognisable) 5 = Very strong odour (the odour is offensive; exposure to this level would be considered undesirable) 6 = Extremely strong odour (the odour is offensive; an instinctive reaction would be to mitigate against further exposure)
Duration	The duration of exposure to detectable odours.
Offensiveness	The level of pleasantness or unpleasantness of odours, in relation to its Hedonic Tone. Hedonic Tone is scored on a scale of +4 to -4 where: +4 = Pleasant odours; 0 = Neutral odours; and -4 = Foul odours.
Receptor sensitivity	The sensitivity of the location where odours are detected, and/or the proximity of odour releases to an odour-sensitive location.

^a Intensity scale has been taken from the IAQM guidance (IAQM, 2018), and is based upon the VDI 3940 scale. Odours of intensity of 4 or greater are considered to have significant potential for annoyance. Odours of intensity of 2 or less are so faint that the character of the odour cannot be described and annoyance is unlikely.

- 3.6 Two site visits were carried out to undertake the sniff testing, with two full surveys undertaken during each visit. During each site visit, the sniff test surveys started at the most distant location downwind of the odour source and were then carried out along a transect running across the site towards the odour source. At each location, the odour detected during each of 30 observations was recorded. Based on 5-10 seconds between each observation, each test lasted for a total of approximately three to five minutes. The intensity was noted using the criteria set out in Table 1, and, where relevant, a description of the odour was recorded.

Assessment of Odour Impacts

- 3.7 The IAQM guidance on the assessment of odours for planning (IAQM, 2018) includes an approach to determine the impacts of odours based on the results of sniff testing. This involves a two-stage process; the first stage is to identify the odour exposure at a sniff test location and the second stage is to combine the odour exposure with the sensitivity of the location to determine an odour impact for each location.
- 3.8 The matrix shown in Table 2 is transposed from the IAQM guidance and shows how the odour exposure at each sniff-test location is estimated. The matrix requires two parameters to be

calculated; first the average odour intensity during the sniff test (I_{mean}), which is the average odour intensity from the 30 observations made during each test; and the second is the percentage odour time ($t_{\geq 4}$), which is the percentage of time during each sniff test when an odour intensity of 4 or higher was recorded by the observer.

Table 2: Matrix to Assess Odour Exposure at each Sniff-Test Location

Average Intensity (I_{mean})	Percentage odour time ($t_{\geq 4}$) during the test				
	$\leq 10\%$	11-20%	21-30%	31-40%	$\geq 41\%$
6	Large	Very Large	Very Large	Very Large	Very Large
5	Medium	Large	Large	Very Large	Very Large
4	Small	Medium	Medium	Large	Large
3	Small	Medium	Medium	Medium	Medium
2	Small	Small	Medium	Medium	Medium
1	Small	Small	Small	N/A	N/A

Notes: I_{mean} should be rounded to the nearest whole number.

The following overriding considerations affect the scoring of the odour annoyance impact: if $I_{\text{mean}} = 0$, or if $I_{\text{mean}} = 1$, and $t_{\geq 4} = 0\%$, then the odour effect can for practical purposes be considered negligible.

- 3.9 This process identifies the odour exposure during each test. To extrapolate this to estimate the total odour exposure at a given location, the results of multiple sniff tests can be combined, applying professional judgement, and taking account of factors such as the frequency of wind conditions and the variability of the odour source being assessed.
- 3.10 Once the overall odour exposure at a given location has been estimated, the odour impact can be determined using the matrix presented in Table 3 which is also transposed from the IAQM guidance. The matrix combines the overall odour exposure with the sensitivity of the location to determine the odour impact. The IAQM guidance provides a description and examples of low, medium and high sensitivity receptors. The receptor sensitivity principally relates to the perceived level of amenity that would be expected by users of a particular land use, where land uses such as industry and farms are considered to be of low sensitivity, commercial premises and recreation facilities are considered to be of medium sensitivity, and residential properties, schools and hospitals are considered to be of high sensitivity to odours.

Table 3: Matrix to Assess Odour Impact at each Sniff-Test Location

Overall Odour Exposure ^a	Receptor Sensitivity		
	Low	Medium	High
Very Large	Substantial Adverse	Substantial Adverse	Substantial Adverse
Large	Moderate Adverse	Moderate Adverse	Substantial Adverse
Medium	Slight Adverse	Slight Adverse	Moderate Adverse
Small	Negligible	Negligible	Slight Adverse

^a Determined using the matrix in Table 2.

A further application of professional judgement then needs to be applied to conclude the significance of the odour effect on the development as a whole, taking into account the possibly different magnitudes of effects that occur at different receptors.

- 3.11 The matrix in Table 3 can be used to identify the potential odour impacts at an individual location, but the guidance advises that the overall significance of odour effects on a development is determined using professional judgement, taking account of the significance of impacts at all locations. The professional experience of the consultants who completed this assessment are summarised in A1.

Odour Dispersion Modelling

Model Inputs

- 3.12 Odour dispersion modelling for the STW has been carried out using the ADMS-5 dispersion model. The locations of the modelled odour sources are shown in Figure 1. A summary of the model input parameters, including the corresponding source names in relation to the source numbers shown in the figure, is provided in Appendix A3.
- 3.13 Information on the STW process, and the identification of sources to be included in the model, has been determined through satellite imagery and observations made from the development site. Where information was unknown, realistic worst-case assumptions have been made. The odour emission rates for the identified sources have been estimated using library odour emissions data obtained from the UK Water Industry Research Ltd Technical Reference Document (UKWIR, 2001) and using elements of professional judgement. The professional experience of the odour practitioners who carried out this assessment is set out in Appendix A1.

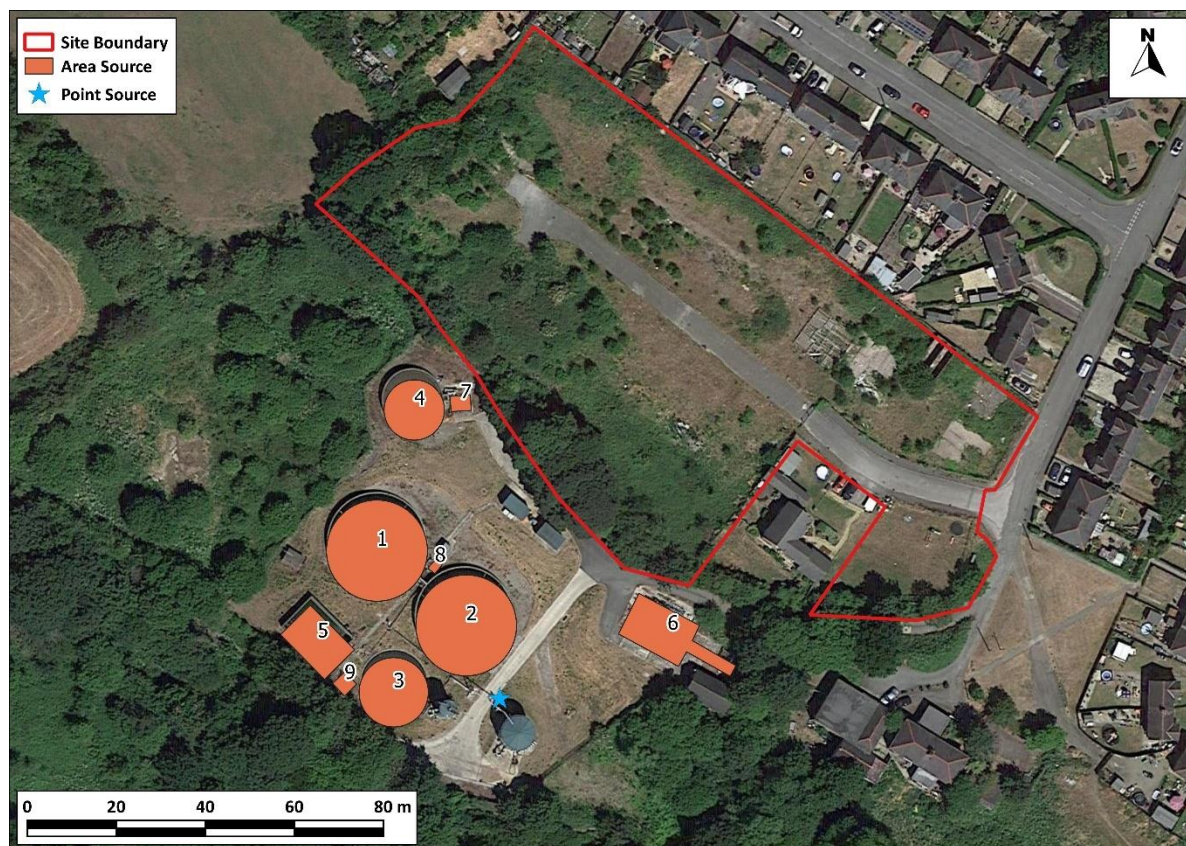


Figure 1: Modelled Odour Sources

Imagery ©2021 Google.

Meteorological Data

- 3.14 The model has been run using five-years of hourly sequential meteorological data (2015-2019) from Shawbury. Wind roses for the meteorological data used in the modelling are displayed in Appendix A2.
- 3.15 For the dispersion site, a variable surface roughness file was used. The meteorological input parameters for the modelling are set out in Table 4.

Table 4: Meteorological Data Model Input Parameters

Site	Surface Roughness	MO Length	Priestley-Taylor Parameter
Shawbury	0.1	1	1
Dispersion Site	Variable SR file used	10	1

Treatment of Buildings

- 3.16 The model has not been run to include buildings. Building downwash is only applicable to point source emissions; the tanker discharge point (modelled as a point source; see Appendix A3) is low

level and very close to the ground, and thus dispersion will not be significantly affected by nearby buildings or tanks at the STW.

Sensitive Locations

- 3.17 Concentrations have been predicted across nested Cartesian grids. These grid points have a spacing of 5 m x 5 m within 200 m of the STW, 25 m x 25 m within 400 m, 50 m x 50 m within 1,000 m, 250 m x 250 m within 2,000 m and 500 m x 500 m within 5,000 m of the STW. The receptor grid has been modelled at a height of 1.5 m above ground level, the approximate average height of the human nose.

Terrain

- 3.18 Local terrain has been included within the model based on OS Terrain 50 data.

Model Outputs

- 3.19 The model has been run to predict 98th percentile of 1-hour odour concentrations across the grid of receptors. The predicted 98th percentiles of 1-hour odour concentrations are compared to the suggested benchmarks outlined in the Environment Agency's H4 guidance document (Environment Agency, 2011).
- 3.20 The IAQM guidance states that *"odours from sewage treatment works plant operating normally, i.e. non-septic conditions, would not be expected to be at the 'most offensive' end of the spectrum...and can be considered on par with 'moderately offensive' odours such as intensive livestock rearing"*. Therefore, the odours from the STW have been assumed to be *"moderately offensive"* when assessing the significance of the impacts.
- 3.21 The IAQM guidance provides descriptors for odour effects for *"moderately offensive"* odours for high sensitivity land use (i.e., residential). These have been set out in Table 5 below and have been used to determine the overall significance of the odour effects at the proposed development.

Table 5: Odour Effect Descriptors for Impacts Predicted by Modelling – “Moderately Offensive” Odours at High Sensitivity Receptors

Odour Exposure Level (ouE/m ³)	Odour Effect
≥10	Substantial
5<10	Moderate
3<5	Moderate
1.5<3	Slight
0.5<1.5	Negligible
<0.5	Negligible

4 Odour Impact Assessment

Odour Complaints

- 4.1 Paul Campini, Enforcement Officer at Wrexham County Borough Council, has confirmed that, as of 6th May 2021, no complaints have been received relating to odours from Cefn Mawr STW. It is noted that no complaints have been registered from the residential property located approximately 17 m downwind of the inlet works (likely to be the most odorous stage of the treatment process).

Odour Dispersion Modelling

Model Results

- 4.2 The ADMS-5 model has been run to predict 98th percentile 1-hour odour concentrations across a grid of receptor points to produce ground-level odour contour plots.
- 4.3 In order to demonstrate the predicted spatial dispersion of odours from the STW, a contour plot of odour concentrations from the worst-case model scenario (using 2019 meteorological data) is shown in Figure 2. This shows that the 98th percentile of 1-hour odour concentrations above the 10 OU_E/m³ criterion extends across 92% of the development site, covering approximately 9,370 m². This area is representative of land on which highly sensitive receptors would be subject to *substantial adverse* impacts due to odours (see Table 5) and thus would not be suitable for residential development. The 98th percentile of 1-hour odour concentrations above the 5 OU_E/m³ criterion covers the remaining area of the development site; this area is again representative of land on which highly sensitive receptors would be subject to *moderate adverse* impacts from the STW and thus would not be suitable for residential development.

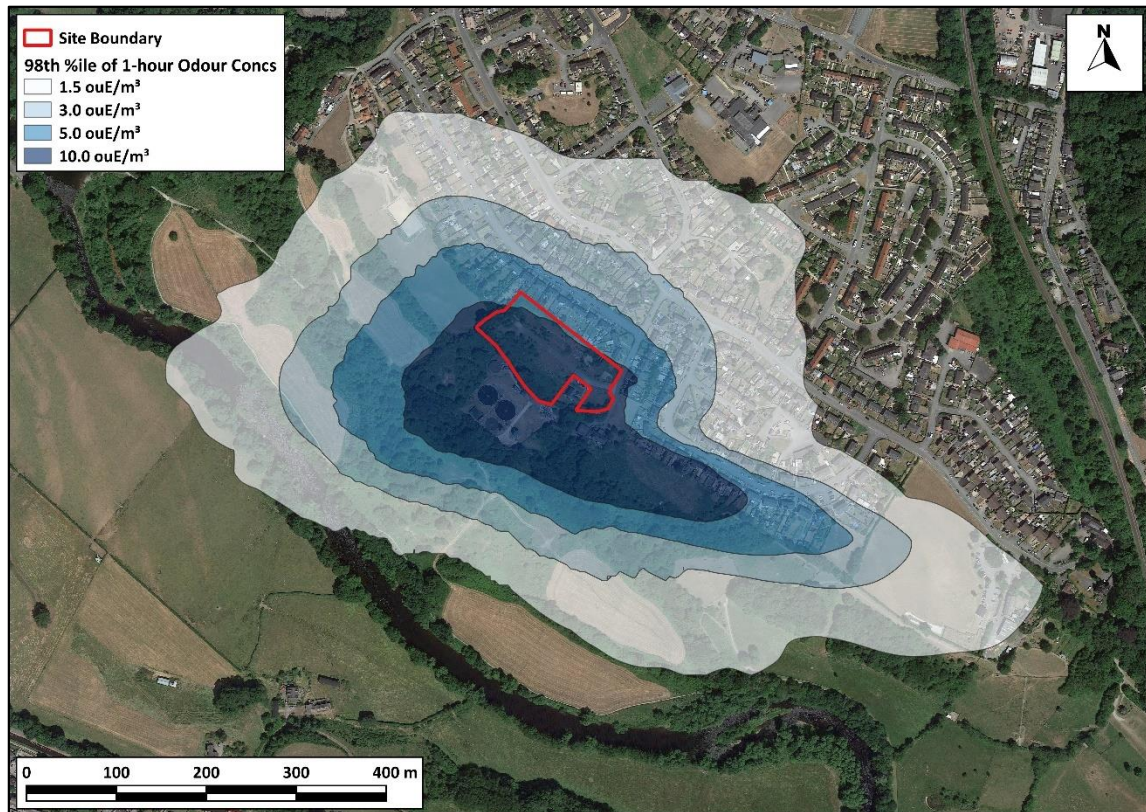


Figure 2: Contour Plot of 98th Percentile of 1-hour Odour Concentrations

Imagery ©2021 Google.

Potential Odour Effects

- 4.4 The dispersion modelling has identified any breaches of the 10 OU_E/m³ and 5 OU_E/m³ criteria across the entire development site, resulting in *moderate adverse to substantial adverse* impacts. The IAQM guidance (IAQM, 2018) states that where “*the overall effect is greater than “slight adverse”, the effect is likely to be considered significant*”. As such, based solely on the results of the modelling study, the odour effects from the STW are judged to be significant and thus present constraints to residential development across the entire site.

Sniff Testing

- 4.5 Sniff tests were undertaken across the development site on two separate days. On each visit, two full surveys of the site were carried out with most locations replicated across the two tests. The locations of the sniff test surveys for each day are shown in Figure 3 and Figure 4. The worst-case odour effect from either of the two tests undertaken on that day has been presented for each location.



Figure 3: Sniff Test Locations and Worst-Case Effect - 9th June 2021

Imagery ©2021 Google.



Figure 4: Sniff Test Locations and Worst-Case Effect - 10th June 2021

Imagery ©2021 Google.

Sniff Test Results – 9th June 2021

- 4.6 The sniff tests were undertaken in warm weather (~22°C) and light south-south-westerly winds; these conditions are considered to be worst-case in terms of both the odour generation at the STW and the potential for odour impacts across the proposed development site.
- 4.7 Odours identified by the assessor as being related to the STW were detected at 14 of the 15 locations during the first test, and at 10 of the 12 locations during the second test. The assessor noted that, at most locations, the odours were typical of a “filter bed” (responsible for tertiary stages of treatment at the STW) and were “mildly offensive”. At location 6 during the first test, odours were noted as being identifiably more offensive than at other locations.
- 4.8 Based upon the observations made across the development site over two full tests, and using the IAQM impact matrices set out in Table 2 and Table 3, the impacts range from *negligible* at five locations, *slight adverse* at four locations, *moderate adverse* at eight locations and *substantial adverse* at a single location.

Sniff Test Results – 10th June 2021

- 4.9 As per the initial tests, the sniff tests were undertaken in warm weather (~22°C) and light south-south-westerly winds; these conditions are considered to be worst-case in terms of both the odour generation at the STW and the potential for odour impacts across the proposed development site.
- 4.10 Odours identified by the assessor as being related to the STW were detected at every location during the first test, and at 14 of the 16 locations during the second test. Odours were described by the assessor as being “*sewage related*” and “*unpleasant*” at most locations, with maximum odour intensities of 4. At the location at the south of the site adjacent to the existing house (location 3), however, the odours were described as being “*acrid*”, “*vile*”, “*extremely unpleasant*” and “*sulphur*” with maximum intensities of 6 in the first test and 5 in the second. This location was very close to, and downwind of, the sewage inlet works; this stage of treatment handles raw sewage and thus generates odours high in intensity and offensiveness.
- 4.11 Based upon the observations made across the development site over two full tests, and using the IAQM impact matrices set out in Table 2 and Table 3, the impacts range from *negligible* at one location, *slight adverse* at 13 locations, and *moderate adverse* at two locations.

Summary

- 4.12 The results of the sniff test demonstrate that a large proportion of the proposed development site could experience *moderate adverse* odour impacts, with one *substantial adverse* impact at the western-most area of the site. As set out in Paragraph 4.4, the effect is significant if impacts are greater than *slight adverse*; therefore, based upon the worst-case results of the sniff tests, odour effects from the STW are judged to be significant and thus present constraints to residential development across the entire site.

Overall Significance of Odour Effects

- 4.13 The findings of the odour modelling suggest that the entire development site could be subject to *moderate adverse* to *substantial adverse* odour effects. However, the modelling also demonstrates that a number of existing residential properties currently experience *moderate adverse* to *substantial adverse* effects, and an absence of any odour-related complaints from existing residents thus suggests that the model is over-predicting (as complaints would be expected in areas of significant adverse effects). The results of the sniff testing further demonstrate that the model is over-predicting; a *substantial adverse* impact is only predicted at one test location. Nevertheless, the results of the sniff tests do predict *moderate adverse* impacts across a large portion of the development site extending to the northern-most boundary of the site.
- 4.14 The IAQM guidance (IAQM, 2018) states that where “*the overall effect is greater than “slight adverse”, the effect is likely to be considered significant*”. As such, overall the risk of significant

adverse odour effects from the STW on future residents of the proposed development cannot be ruled out.

- 4.15 The overall judgement is made in accordance with IAQM guidance (IAQM, 2018), which states that the assessment of the significance of odour effects should be based on the drawing together of findings from multiple odour assessment tools, applying an appropriate amount of weight to each tool according to how well-suited it is to the study scenario in question. In the case of the STW, the use of sniff testing is common, well documented and is generally considered to be robust, and therefore the findings of the sniff tests have been attributed more weight than the findings of the dispersion modelling which is inherently high in uncertainty and has adopted a very conservative approach in the absence of site-specific emissions data.
- 4.16 It should be noted, however, that the potential for adverse odour effects was not raised by Welsh Water or the Council for a previous planning application at the development site, which was subsequently approved without the requirement for an odour assessment. Furthermore, the requirement for an odour assessment for this latest application was only raised as a planning condition following approval of the development. In light of this, and considering that the proposed properties do not encroach on the STW closer than an existing property from which there have been no complaints, it is possible that the sniff tests were undertaken during particularly worst-case conditions which do not represent typical odour conditions at the site.

5 Mitigation

- 5.1 Should the development proceed, and odour complaints occur amongst the new residents, it may be necessary to apply mitigation to reduce the risk of further annoyance. Odours are difficult to mitigate at a receptor; they are much more effectively controlled at the source, and thus odour mitigation measures at the works may be required in the event of persistent odour annoyance.

6 Summary

- 6.1 The potential for odour effects resulting from the operation of Cefn Mawr STW on a proposed residential development located immediately northeast of the works has been assessed, using odour dispersion modelling, sniff testing and complaints analysis.
- 6.2 The odour dispersion modelling, which has adopted a highly conservative approach, has identified the potential for *moderate adverse* to *substantial adverse* effects across the entire development site. However, the absence of any complaints from local residents suggests that the model is over-predicting. The results of four sniff test surveys undertaken across two days also suggest that the model is overly-conservative; however, odour effects across the development site are still judged to be *moderate adverse* at a significant number of test locations extending across the length of the development site.
- 6.3 Based upon the findings of this odour assessment, which uses elements of professional judgement (see Appendix A1 for the professional experience of the practitioners who completed this assessment), it is judged that, overall, the STW will lead to significant odour effects at future residential properties. This overall judgement of 'significant' suggests that there will be a loss of amenity for local residents and that justifiable odour complaints, particularly during the summer months, are likely. However, the proposed development does not introduce any residential properties closer than an existing property (which is located 17 m downwind of the STW inlet works), and the absence of any complaints made to the Council therefore suggest that existing odours at the development site are not present at intensities and durations to result in annoyance. It is thus possible that the sniff tests may have been undertaken during particularly worst-case odour events at the STW which do not represent 'typical' operational conditions.

7 References

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8 Appendices

A1	Professional Experience.....	24
A2	Wind Roses.....	25
A3	Model Inputs – Odour Emission Rates	28
A4	Odour Contours.....	29
A5	Sniff Test Data	33

A1 Professional Experience

Penny Wilson, BSc (Hons) CSci MEnvSc MIAQM

Ms Wilson is an Associate Director with AQC, with more than 20 years' relevant experience in the field of air quality. She has been responsible for numerous assessments for a range of infrastructure developments including power stations, road schemes, ports, airports and residential/commercial developments. The assessments have covered operational and construction impacts, including odours. She also provides services to local authorities in support of their LAQM duties, including the preparation of Review and Assessment and Action Plan reports, as well as audits of Air Quality Assessments submitted with planning applications. She has provided expert evidence to a number of Public Inquiries, and is a Member of the Institute of Air Quality Management and a Chartered Scientist.

Paul Outen, BSc (Hons) MEnvSc MIAQM

Mr Outen is a Principal Consultant with AQC, with over eleven years' experience in the assessment of air quality and odours. He undertakes air quality and odour assessments for AQC, covering residential and commercial developments, industrial installations, road schemes, energy centres and mineral and waste facilities. These involve qualitative assessments, and quantitative modelling assessments using the ADMS dispersion models, for both planning and permitting purposes. He has also presented evidence at public hearings. Mr Outen has a particular interest in odour assessment, and has extensive experience in the assessment of odours across a wide range of industries throughout the UK, Europe and Asia. He also has experience in pollutant monitoring techniques. He regularly undertakes site audits for various installations to advise on pollution control and mitigation strategies. He is a Member of both the Institution of Environmental Sciences and Institute of Air Quality Management.

A2 Wind Roses

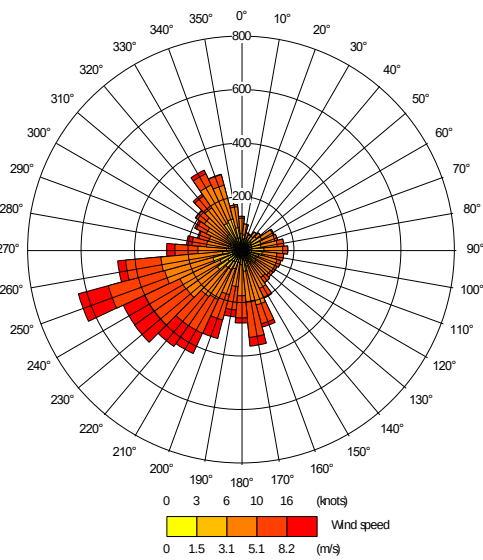


Figure A2.1: Wind Rose from Shawbury Meteorological Station for 2015

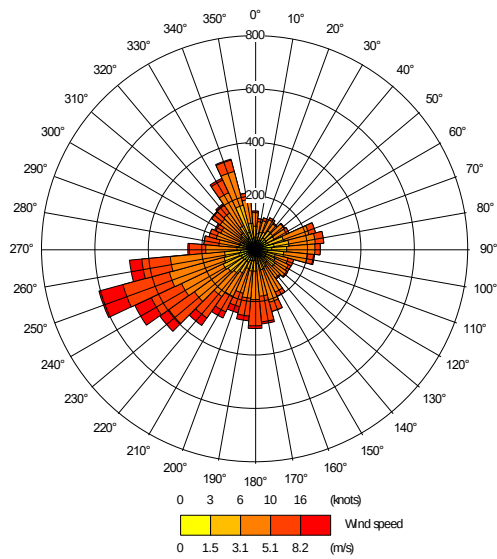


Figure A2.2: Wind Rose from Shawbury Meteorological Station for 2016

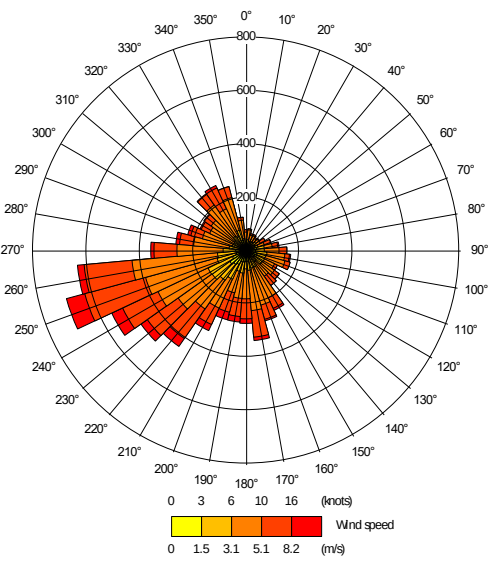


Figure A2.3: Wind Rose from Shawbury Meteorological Station for 2017

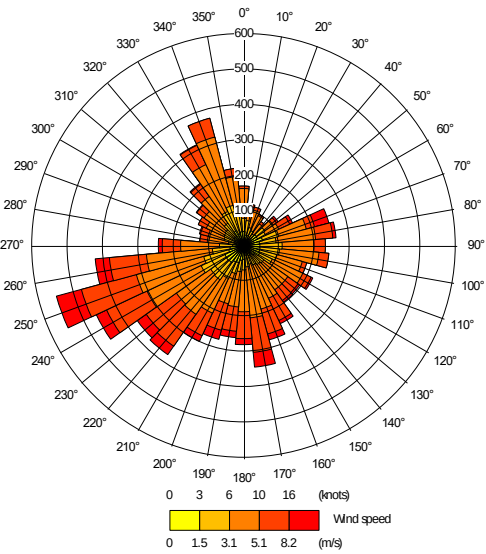


Figure A2.4: Wind Rose from Shawbury Meteorological Station for 2018

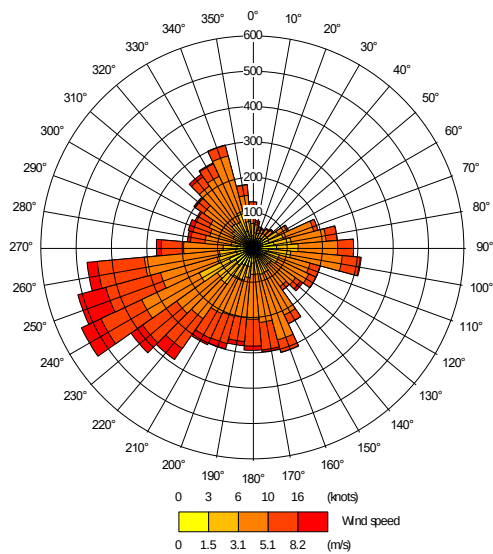


Figure A2.5: Wind Rose from Shawbury Meteorological Station for 2019

A3 Model Inputs – Odour Emission Rates

Table A3.1: Modelled Emission Rates ^a

Source ID	Odour Source	Modelled Parameters			
		Surface Area (m ²)	Height (m)	Odour Emission Rate (OUE/m ² /s)	Time Weighted Total Source Emission (OUE/s)
1	Filter Bed 1	405	0.5	1.2	486
2	Filter Bed 2	405	0.5	1.2	486
3	Final Settlement / Humus Tank	190	0.5	1.2	228
4	PST	144	0.5	7.5	1,080
5	Storm Tank ^b	134	0.5	2.5	335
6	Inlet Works	190	0.5	50	9,500
7	PST Desludge Well ^c	16	0.5	140	2,240
8	Filter Bed Dist Chamber	5	0.5	250	1,250
9	Final Tank Desludge Well ^c	15	0.5	140	2,100
10	Displaced Tanker Air ^d	N/A	0.5	2,500 (OUE/s)	14.9
Total					17,720 ^e

^a All emission rates have been obtained from UKWIR (UKWIR, 2001).

^b The storm tank has been modelled assuming it always contain odorous sewage as a worst-case assumption.

^c The desludge wells have been modelled assuming they always contain odorous sewage as a worst-case assumption.

^d The STW is believed to include sludge export facilities, however it is unknown as to the frequency of export activities. As a realistic assumption, based upon information on sludge export volumes obtained from Welsh Water¹, it has been assumed that sludge is exported from the STW once per week, with each tanker removing 18 m³ of sludge over a period of one hour.

^e A total, time-weighted site emission of 17,720 OUE/s is higher than would be expected from a STW of this size (Cefn Mawr STW serves a population equivalent of 7,029²) and thus the modelling is considered conservative.

¹ <https://corporate.dwrcymru.com/-/media/Project/Files/Page-Documents/Corporate/Library/Bioresrouces-Trading/Dwr-Cymru-Bioresources-Market-Information-2016-2017.ashx>

² <https://uwatd.eu/United-Kingdom/agglomeration/ukwawaagg000121/2016>

A4 Odour Contours

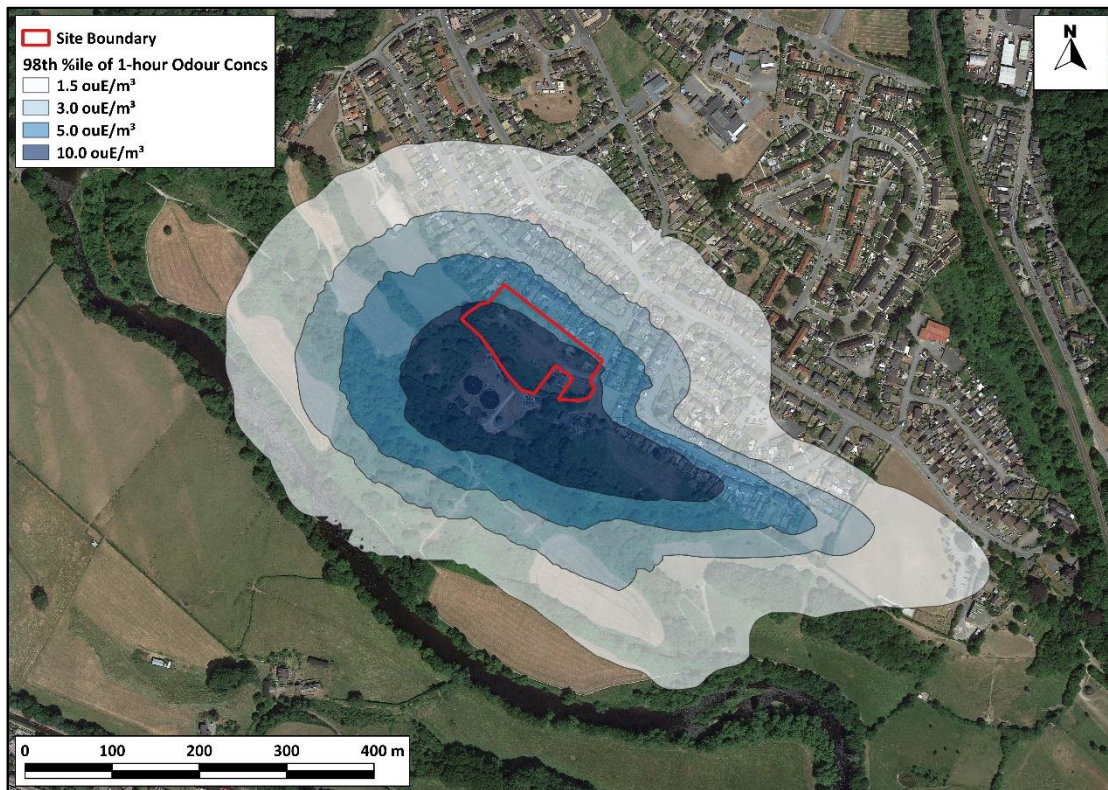


Figure A4.1: Contour plot of 98th percentile of hourly mean odour concentrations, using 2015 meteorological data

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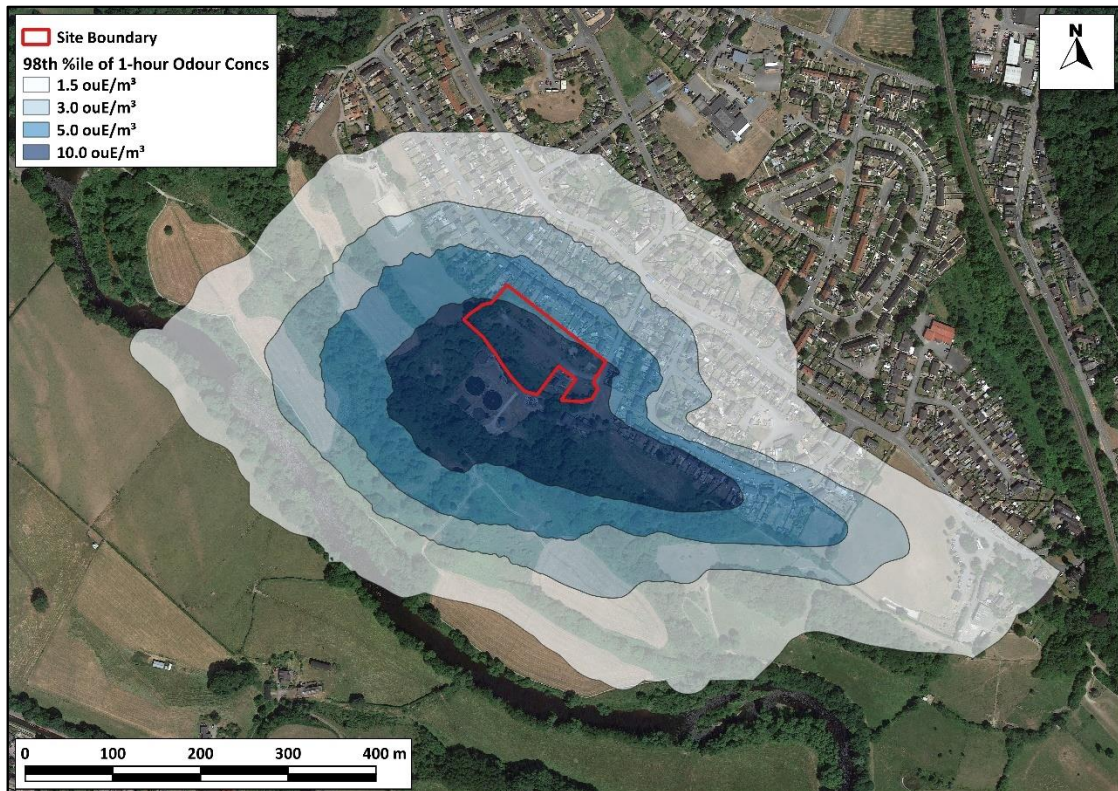


Figure A4.2: Contour plot of 98th percentile of hourly mean odour concentrations, using 2016 meteorological data

Imagery ©2021 Google.

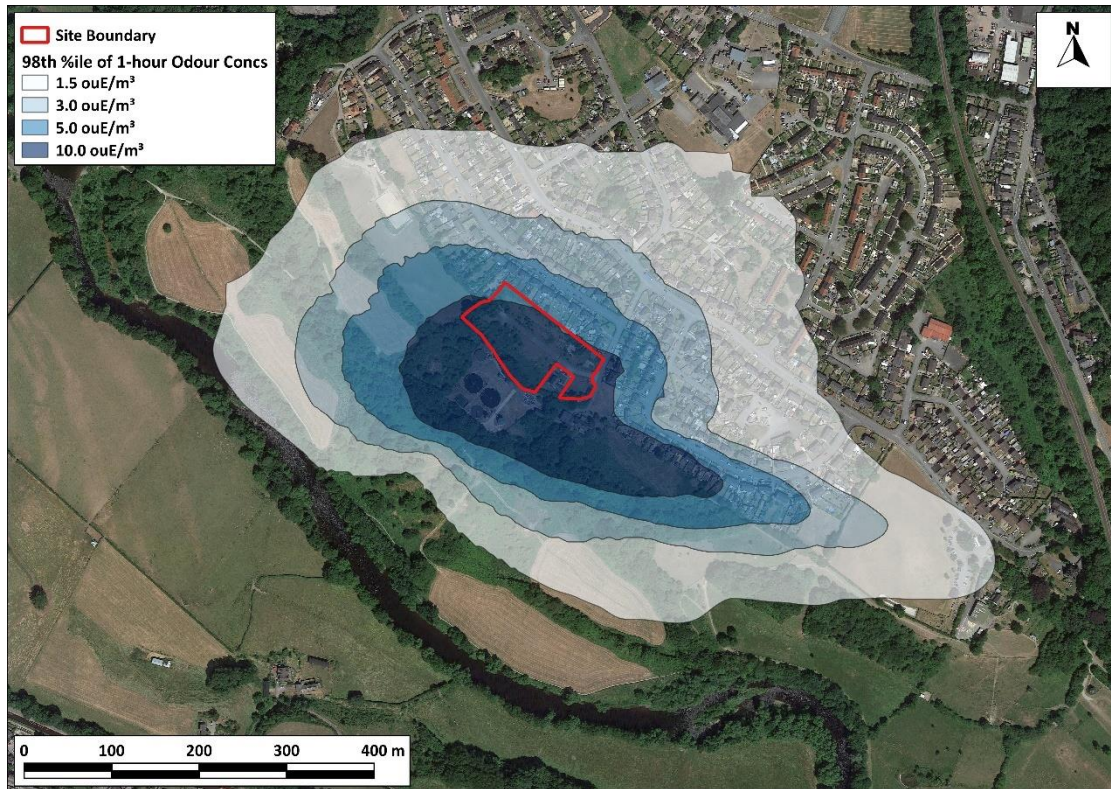


Figure A4.3: Contour plot of 98th percentile of hourly mean odour concentrations, using 2017 meteorological data

Imagery ©2021 Google.

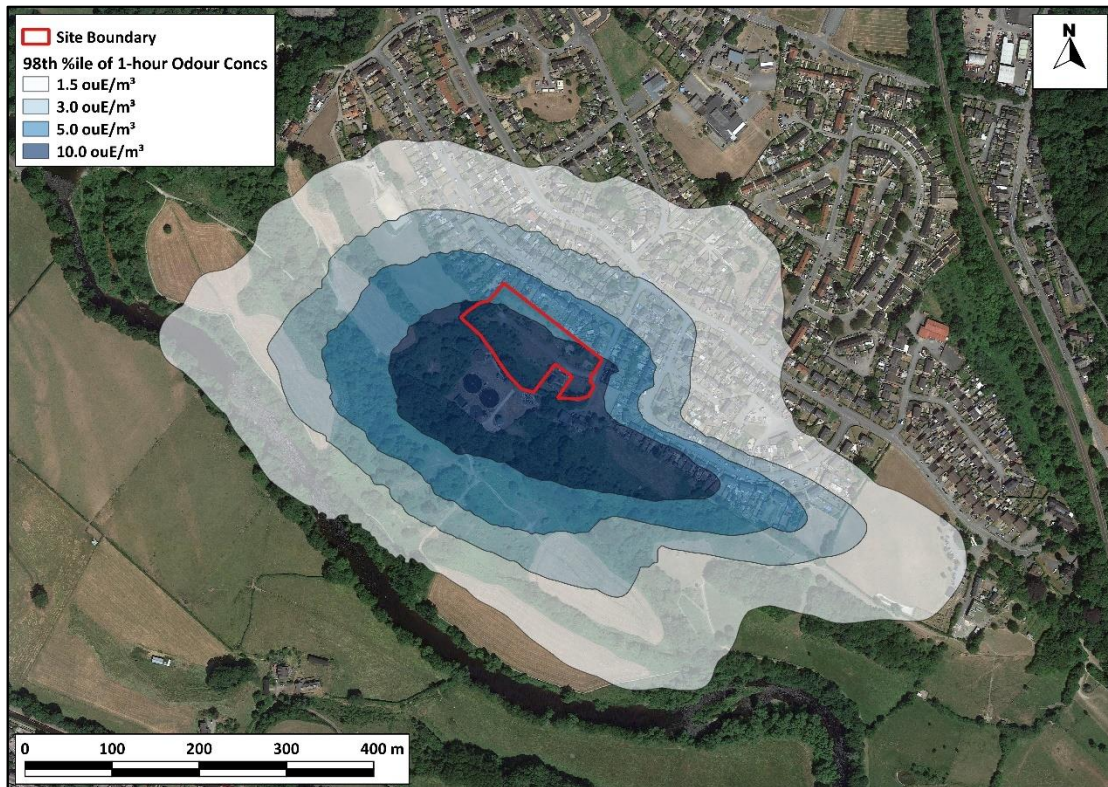


Figure A4.4: Contour plot of 98th percentile of hourly mean odour concentrations, using 2018 meteorological data

Imagery ©2021 Google.

A5 Sniff Test Data

Date		09/06/2021																							
Wind Speed (mph)		10			2			3			4			10			10			10			still		
Wind Direction		SSW			SSW			SSW			SSW			SSW			SSW			SSW			SSW		
Start Time		12:08			12:13			12:25			12:33			12:43			12:48			12:52			12:57		
Sniff Location		1			2			3			4			5			6			7			8		
Sensitivity		high			high			high			high			high			high			high			high		
Results		Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted
Odour Intensity	1	2	Yes	2	3	Yes	3	3	Yes	3	4	Yes	4	0	Yes	0	2	Yes	2	3	Yes	3	2	Yes	2
	2	3	Yes	3	4	Yes	4	2	Yes	2	3	Yes	3	2	Yes	2	2	Yes	2	2	Yes	2	3	Yes	3
	3	3	Yes	3	2	Yes	2	4	Yes	4	4	Yes	4	0	Yes	0	2	Yes	2	3	Yes	3	3	Yes	3
	4	2	Yes	2	4	Yes	4	3	Yes	3	3	Yes	3	0	Yes	0	2	Yes	2	4	Yes	4	2	Yes	2
	5	2	Yes	2	3	Yes	3	4	Yes	4	3	Yes	3	0	Yes	0	2	Yes	2	2	Yes	2	3	Yes	3
	6	2	Yes	2	3	Yes	3	3	Yes	3	3	Yes	3	0	Yes	0	4	Yes	4	3	Yes	3	3	Yes	3
	7	3	Yes	3	4	Yes	4	2	Yes	2	2	Yes	2	0	Yes	0	4	Yes	4	3	Yes	3	2	Yes	2
	8	2	Yes	2	3	Yes	3	3	Yes	3	3	Yes	3	0	Yes	0	3	Yes	3	3	Yes	3	3	Yes	3
	9	3	Yes	3	2	Yes	2	4	Yes	4	3	Yes	3	0	Yes	0	3	Yes	3	2	Yes	2	2	Yes	2
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	13	3	Yes	3	4	Yes	4	0	Yes	0	2	Yes	2	0	Yes	0	2	Yes	2	4	Yes	4	2	Yes	2
	14	3	Yes	3	4	Yes	4	0	Yes	0	2	Yes	2	0	Yes	0	2	Yes	2	4	Yes	4	2	Yes	2
	15	2	Yes	2	3	Yes	3	0	Yes	0	4	Yes	4	0	Yes	0	3	Yes	3	4	Yes	4	2	Yes	2
	16	2	Yes	2	3	Yes	3	0	Yes	0	3	Yes	3	0	Yes	0	3	Yes	3	4	Yes	4	2	Yes	2
	17	2	Yes	2	4	Yes	4	0	Yes	0	3	Yes	3	0	Yes	0	2	Yes	2	3	Yes	3	2	Yes	2
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	20	2	Yes	2	3	Yes	3	3	Yes	3	3	Yes	3	0	Yes	0	2	Yes	2	3	Yes	3	3	Yes	3
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	27	2	Yes	2	3	Yes	3	3	Yes	3	3	Yes	3	0	Yes	0	3	Yes	3	3	Yes	3	3	Yes	3
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	29	2	Yes	2	3	Yes	3	3	Yes	3	2	Yes	2	0	Yes	0	3	Yes	3	3	Yes	3	3	Yes	3
	30	2	Yes	2	3	Yes	3	2	Yes	2	2	Yes	2	0	Yes	0	4	Yes	4	3	Yes	3	3	Yes	3
Odour Descriptor		faint sewage odours			detectable sewage odour, inoffensive			detectable to faint, possible slaughterhouse odours at 3 to 5?			odour detectable, mildly offensive			very faint detectable			sewage detectable, offensive at times			easily recognisable filter bed			faint filter bed, river silt odours		
End Time		12:11			12:16			12:28			12:36			12:46			12:51			12:55			13:00		
Mean Odour Intensity		2			3			2			3			0			3			3			2		
% Odour Time (T≥4)		0			23			10			17			0			13			33			0		
Odour Exposure		Small			Medium			Small			Medium			Negligible			Medium			Medium			Small		
Odour Impact		Negligible			Moderate Adverse			Slight Adverse			Moderate Adverse			Negligible			Moderate Adverse			Moderate Adverse			Negligible		

Date			09/06/2021																							
Wind Speed (mph)			10			10			11			10			10			10			10					
Wind Direction			ssw			ssw			ssw			ssw			ssw			ssw			ssw					
Start Time			13:05			13:09			13:15			13:22			13:25			13:33			13:38					
Sniff Location			9			10			11			12			13			14			15					
Sensitivity			high			high			high			high			high			high			high					
Results			Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted
Odour Intensity	1	0	Yes	0	2	Yes	2	3	Yes	3	2	Yes	2	3	Yes	3	2	Yes	2	4	Yes	4		Yes	0	
	2	0	Yes	0	3	Yes	3	3	Yes	3	2	Yes	2	4	Yes	4	2	Yes	2	3	Yes	3		Yes	0	
	3	0	Yes	0	2	Yes	2	2	Yes	2	2	Yes	2	3	Yes	3	2	Yes	2	3	Yes	3		Yes	0	
	4	0	Yes	0	3	Yes	3	2	Yes	2	2	Yes	2	2	Yes	2	2	Yes	2	4	Yes	4		Yes	0	
	5	0	Yes	0	2	Yes	2	2	Yes	2	2	Yes	2	3	Yes	3	2	Yes	2	4	Yes	4		Yes	0	
	6	0	Yes	0	3	Yes	3	4	Yes	4	2	Yes	2	3	Yes	3	2	Yes	2	4	Yes	4		Yes	0	
	7	3	Yes	3	3	Yes	3	3	Yes	3	2	Yes	2	2	Yes	2	2	Yes	2	3	Yes	3		Yes	0	
	8	0	Yes	0	3	Yes	3	3	Yes	3	3	Yes	3	2	Yes	2	2	Yes	2	3	Yes	3		Yes	0	
	9	0	Yes	0	3	Yes	3	3	Yes	3	3	Yes	3	2	Yes	2	2	Yes	2	4	Yes	4		Yes	0	
	10	0	Yes	0	3	Yes	3	2	Yes	2	2	Yes	2	2	Yes	2	2	Yes	2	4	Yes	4		Yes	0	
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	25	0	Yes	0	4	Yes	4	3	Yes	3	2	Yes	2	3	Yes	3	1	Yes	1	4	Yes	4		Yes	0	
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	27	0	Yes	0	3	Yes	3	2	Yes	2	2	Yes	2	3	Yes	3	1	Yes	1	4	Yes	4		Yes	0	
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	30	4	Yes	4	3	Yes	3	3	Yes	3	2	Yes	2	3	Yes	3	4	Yes	4	3	Yes	3		Yes	0	
Odour Descriptor			barely detectable until end, sewage odours, offensive			filter bed, inoffensive			filter bed, mildly offensive			nothing, mitigated by plants			filterbed, mildly offensive			filter bed, mildly offensive			filter bed, mildly offensive					
End Time			13:08			13:12			13:18			13:25			13:28			13:36			13:41					
Mean Odour Intensity			1			3			3			2			3			2			4			0		
% Odour Time (T≥4)			7			23			23			0			23			7			57			0		
Odour Exposure			Small			Medium			Medium			Small			Medium			Small			Large			Negligible		
Odour Impact			Slight Adverse			Moderate Adverse			Moderate Adverse			Negligible			Moderate Adverse			Slight Adverse			Substantial Adverse			Negligible		

Date		09/06/2021																							
Wind Speed (mph)		10			10			10			10			10			10			10			10		
Wind Direction		ssw			ssw			ssw			ssw			ssw			ssw			ssw			ssw		
Start Time		13:51			13:55			13:57			14:02			14:07			14:12			14:17			14:22		
Sniff Location		1			2.5			4			5			6.5			8			9			10.5		
Sensitivity		high			high			high			high			high			high			high			high		
Results		Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted
Odour Intensity	1	0	Yes	0	0	No	0	3	Yes	3	0	Yes	0	0	Yes	0	3	Yes	3	3	Yes	3	2	Yes	2
	2	0	Yes	0	0	No	0	4	Yes	4	0	Yes	0	0	Yes	0	2	Yes	2	3	Yes	3	2	Yes	2
	3	0	Yes	0	2	No	N/A	4	Yes	4	0	Yes	0	0	Yes	0	2	Yes	2	3	Yes	3	4	Yes	4
	4	0	Yes	0	2	No	N/A	4	Yes	4	0	Yes	0	0	Yes	0	2	Yes	2	3	Yes	3	3	Yes	3
	5	0	Yes	0	2	No	N/A	4	Yes	4	0	Yes	0	0	Yes	0	3	Yes	3	2	Yes	2	3	Yes	3
	6	0	Yes	0	2	No	N/A	4	Yes	4	2	Yes	2	3	Yes	3	2	Yes	2	2	Yes	2	3	Yes	3
	7	0	Yes	0	2	No	N/A	3	Yes	3	2	Yes	2	3	Yes	3	2	Yes	2	2	Yes	2	3	Yes	3
	8	3	Yes	3	2	No	N/A	3	Yes	3	0	Yes	0	2	Yes	2	2	Yes	2	2	Yes	2	3	Yes	3
	9	3	Yes	3	2	No	N/A	3	Yes	3	0	Yes	0	3	Yes	3	2	Yes	2	2	Yes	2	3	Yes	3
	10	0	Yes	0	2	No	N/A	4	Yes	4	0	Yes	0	3	Yes	3	2	Yes	2	0	Yes	0	3	Yes	3
	11	0	Yes	0	2	No	N/A	4	Yes	4	3	Yes	3	4	Yes	4	2	Yes	2	0	Yes	0	2	Yes	2
	12	0	Yes	0	3	No	N/A	3	Yes	3	3	Yes	3	4	Yes	4	2	Yes	2	0	Yes	0	2	Yes	2
	13	0	Yes	0	3	No	N/A	3	Yes	3	2	Yes	2	3	Yes	3	4	Yes	4	0	Yes	0	4	Yes	4
	14	0	Yes	0	2	No	N/A	3	Yes	3	2	Yes	2	3	Yes	3	3	Yes	3	3	Yes	3	3	Yes	3
	15	0	Yes	0	2	No	N/A	2	Yes	2	2	Yes	2	3	Yes	3	2	Yes	2	3	Yes	3	3	Yes	3
	16	0	Yes	0	2	No	N/A	2	Yes	2	2	Yes	2	3	Yes	3	2	Yes	2	3	Yes	3	3	Yes	3
	17	0	Yes	0	2	No	N/A	2	Yes	2	2	Yes	2	2	Yes	2	3	Yes	3	3	Yes	3	3	Yes	3
	18	3	Yes	3	2	No	N/A	2	Yes	2	2	Yes	2	3	Yes	3	2	Yes	2	3	Yes	3	3	Yes	3
	19	3	Yes	3	2	No	N/A	2	Yes	2	2	Yes	2	3	Yes	3	3	Yes	3	4	Yes	4	3	Yes	3
	20	0	Yes	0	2	No	N/A	2	Yes	2	2	Yes	2	2	Yes	2	4	Yes	4	3	Yes	3	3	Yes	3
	21	0	Yes	0	2	No	N/A	2	Yes	2	2	Yes	2	2	Yes	2	3	Yes	3	3	Yes	3	3	Yes	3
	22	0	Yes	0	2	No	N/A	2	Yes	2	3	Yes	3	2	Yes	2	4	Yes	4	4	Yes	4	3	Yes	3
	23	0	Yes	0	2	No	N/A	2	Yes	2	2	Yes	2	2	Yes	2	3	Yes	3	3	Yes	3	0	Yes	0
	24	0	Yes	0	2	No	N/A	4	Yes	4	2	Yes	2	2	Yes	2	4	Yes	4	3	Yes	3	0	Yes	0
	25	0	Yes	0	2	No	N/A	4	Yes	4	0	Yes	0	2	Yes	2	4	Yes	4	3	Yes	3	3	Yes	3
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	29	0	Yes	0	3	No	N/A	4	Yes	4	3	Yes	3	2	Yes	2	3	Yes	3	3	Yes	3	3	Yes	3
	30	3	Yes	3	3	No	N/A	4	Yes	4	3	Yes	3	2	Yes	2	2	Yes	2	3	Yes	3	3	Yes	3
Odour Descriptor		faint to detectable sewage			bin smell in adjacent residential property			offensive sewage odours			detectable odours, mildly offensive			faint filter bed, inoffensive			filter bed, clearly detectable, mildly offensive			filter bed detectable, mildly offensive			varying offensiveness		
End Time		13:53			13:57			13:59			14:04			14:09			14:14			14:19			14:24		
Mean Odour Intensity		1			0			3			2			2			3			3			3		
% Odour Time (T≥4)		7			0			47			3			7			17			10			13		
Odour Exposure		Small			Negligible			Medium			Small			Small			Medium			Small			Medium		
Odour Impact		Slight Adverse			Negligible			Moderate Adverse			Slight Adverse			Slight Adverse			Moderate Adverse			Slight Adverse			Moderate Adverse		

Date		09/06/2021																							
Wind Speed (mph)		10				10				10				10											
Wind Direction		ssw				ssw				ssw				ssw											
Start Time		14:27				14:30				14:34				14:38											
Sniff Location		12				13				14				15											
Sensitivity		High				high				high				high											
Results		Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted
Odour Intensity	1	3	Yes	3	0	Yes	0	0	Yes	0	4	Yes	4		Yes	0		Yes	0		Yes	0		Yes	0
	2	3	Yes	3	4	Yes	4	0	Yes	0	3	Yes	3		Yes	0		Yes	0		Yes	0		Yes	0
	3	3	Yes	3	4	Yes	4	0	Yes	0	4	Yes	4		Yes	0		Yes	0		Yes	0		Yes	0
	4	2	Yes	2	4	Yes	4	0	Yes	0	4	Yes	4		Yes	0		Yes	0		Yes	0		Yes	0
	5	2	Yes	2	0	Yes	0	0	Yes	0	3	Yes	3		Yes	0		Yes	0		Yes	0		Yes	0
	6	2	Yes	2	3	Yes	3	0	Yes	0	3	Yes	3		Yes	0		Yes	0		Yes	0		Yes	0
	7	2	Yes	2	3	Yes	3	0	Yes	0	4	Yes	4		Yes	0		Yes	0		Yes	0		Yes	0
	8	2	Yes	2	3	Yes	3	0	Yes	0	3	Yes	3		Yes	0		Yes	0		Yes	0		Yes	0
	9	2	Yes	2	3	Yes	3	0	Yes	0	3	Yes	3		Yes	0		Yes	0		Yes	0		Yes	0
	10	2	Yes	2	0	Yes	0	0	Yes	0	3	Yes	3		Yes	0		Yes	0		Yes	0		Yes	0
	11	2	Yes	2	0	Yes	0	0	Yes	0	3	Yes	3		Yes	0		Yes	0		Yes	0		Yes	0
	12	3	Yes	3	3	Yes	3	0	Yes	0	3	Yes	3		Yes	0		Yes	0		Yes	0		Yes	0
	13	3	Yes	3	3	Yes	3	0	Yes	0	3	Yes	3		Yes	0		Yes	0		Yes	0		Yes	0
	14	3	Yes	3	0	Yes	0	0	Yes	0	2	Yes	2		Yes	0		Yes	0		Yes	0		Yes	0
	15	2	Yes	2	0	Yes	0	0	Yes	0	2	Yes	2		Yes	0		Yes	0		Yes	0		Yes	0
	16	2	Yes	2	0	Yes	0	0	Yes	0	2	Yes	2		Yes	0		Yes	0		Yes	0		Yes	0
	17	2	Yes	2	0	Yes	0	0	Yes	0	2	Yes	2		Yes	0		Yes	0		Yes	0		Yes	0
	18	2	Yes	2	0	Yes	0	0	Yes	0	2	Yes	2		Yes	0		Yes	0		Yes	0		Yes	0
	19	2	Yes	2	0	Yes	0	0	Yes	0	2	Yes	2		Yes	0		Yes	0		Yes	0		Yes	0
	20	2	Yes	2	0	Yes	0	0	Yes	0	2	Yes	2		Yes	0		Yes	0		Yes	0		Yes	0
	21	2	Yes	2	0	Yes	0	0	Yes	0	3	Yes	3		Yes	0		Yes	0		Yes	0		Yes	0
	22	0	Yes	0	0	Yes	0	0	Yes	0	2	Yes	2		Yes	0		Yes	0		Yes	0		Yes	0
	23	2	Yes	2	0	Yes	0	0	Yes	0	2	Yes	2		Yes	0		Yes	0		Yes	0		Yes	0
	24	2	Yes	2	0	Yes	0	0	Yes	0	2	Yes	2		Yes	0		Yes	0		Yes	0		Yes	0
	25	3	Yes	3	0	Yes	0	0	Yes	0	2	Yes	2		Yes	0		Yes	0		Yes	0		Yes	0
	26	3	Yes	3	0	Yes	0	0	Yes	0	2	Yes	2		Yes	0		Yes	0		Yes	0		Yes	0
	27	3	Yes	3	0	Yes	0	0	Yes	0	2	Yes	2		Yes	0		Yes	0		Yes	0		Yes	0
	28	2	Yes	2	0	Yes	0	0	Yes	0	2	Yes	2		Yes	0		Yes	0		Yes	0		Yes	0
	29	3	Yes	3	0	Yes	0	0	Yes	0	2	Yes	2		Yes	0		Yes	0		Yes	0		Yes	0
	30	3	Yes	3	0	Yes	0	0	Yes	0	2	Yes	2		Yes	0		Yes	0		Yes	0		Yes	0
Odour Descriptor		almost nothing, v faint sewage				sewage, filter bed, mildly offensive				wind direction changed, nothing				mildly offensive odours, filterbeds?											
End Time		14:29				14:32				14:36				14:40											
Mean Odour Intensity		2				1				0				3				0				0			
% Odour Time (T≥4)		0				10				0				13				0				0			
Odour Exposure		Small				Small				Negligible				Medium				Negligible				Negligible			
Odour Impact		Negligible				Slight Adverse				Negligible				Moderate Adverse				Negligible				Negligible			

Date		10/06/2021																							
Wind Speed		0.6			1.2			0			0.4			1.6			2			1.9			1.2		
Wind Direction		SSW			SSW			SSW			SSW			SSW			SSW			SSW			SSW		
Start Time		11:15			11:18			11:22			11:28			11:34			11:37			11:42			11:46		
Sniff Location		1			2			3			4			5			6			7			8		
Sensitivity		High			High			High			High			High			High			High			High		
Results		Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted
Odour Intensity	1	0	Yes	0	4	Yes	4	4	Yes	4	3	Yes	3	4	Yes	4	0	Yes	0	3	Yes	3	0	Yes	0
	2	0	Yes	0	0	Yes	0	4	Yes	4	4	Yes	4	4	Yes	4	4	Yes	4	0	Yes	0	0	Yes	0
	3	0	Yes	0	0	Yes	0	3	Yes	3	3	Yes	3	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	4	0	Yes	0	4	Yes	4	3	Yes	3	3	Yes	3	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0
	5	0	Yes	0	3	Yes	3	4	Yes	4	0	Yes	0	4	Yes	4	4	Yes	4	0	Yes	0	0	Yes	0
	6	3	Yes	3	3	Yes	3	6	Yes	6	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0
	7	3	Yes	3	3	Yes	3	6	Yes	6	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0
	8	0	Yes	0	0	Yes	0	5	Yes	5	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0
	9	0	Yes	0	0	Yes	0	6	Yes	6	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	10	0	Yes	0	0	Yes	0	6	Yes	6	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	11	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	3	Yes	3
	12	0	Yes	0	4	Yes	4	0	Yes	0	3	Yes	3	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0
	13	0	Yes	0	0	Yes	0	6	Yes	6	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	14	0	Yes	0	0	Yes	0	4	Yes	4	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	15	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	16	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0
	17	0	Yes	0	0	Yes	0	3	Yes	3	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	18	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	19	0	Yes	0	0	Yes	0	6	Yes	6	0	Yes	0	3	Yes	3	4	Yes	4	0	Yes	0	0	Yes	0
	20	0	Yes	0	0	Yes	0	6	Yes	6	0	Yes	0	3	Yes	3	0	Yes	0	0	Yes	0	0	Yes	0
	21	0	Yes	0	0	Yes	0	6	Yes	6	0	Yes	0	2	Yes	2	0	Yes	0	0	Yes	0	0	Yes	0
	22	0	Yes	0	0	Yes	0	6	Yes	6	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	23	0	Yes	0	0	Yes	0	6	Yes	6	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	24	0	Yes	0	0	Yes	0	6	Yes	6	0	Yes	0	0	Yes	0	5	Yes	5	0	Yes	0	2	Yes	2
	25	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	26	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4
	27	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	3	Yes	3
	28	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	29	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	4	Yes	4	0	Yes	0
	30	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	3	Yes	3	2	Yes	2
Odour Descriptor		STW related odours			STW related odours			Acrid, vile, extremely unpleasant, sulphur-like			STW related odours			STW related odours			STW related odours			STW related odours			STW related odours		
End Time		11:18			11:22			11:28			11:34			11:37			11:42			11:46			11:50		
Mean Odour Intensity		0			1			3			1			1			1			1			0		
% Odour Time (T≥4)		3			13			60			7			17			23			13			3		
Odour Exposure		Negligible			Small			Medium			Small			Small			Small			Small			Negligible		
Odour Impact		Negligible			Slight Adverse			Moderate Adverse			Slight Adverse			Slight Adverse			Slight Adverse			Slight Adverse			Negligible		

Date		10*6/21																							
Wind Speed		1.1			1.2			2.6			1			0			0.4			1.3			1		
Wind Direction		SSW			SSW			SSW			SSW			SSW			SSW			SSW			SSW		
Start Time		11:50			11:55			12:00			12:04			12:08			12:11			12:16			12:20		
Sniff Location		9			10			11			12			13			14			15			16		
Sensitivity		High			High			High			High			High			High			High			High		
Results		Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted
Odour Intensity	1	4	Yes	4	0	Yes	0	3	Yes	3	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0
	2	0	Yes	0	0	Yes	0	3	Yes	3	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0
	3	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	3	Yes	3
	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0
	5	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0
	6	3	Yes	3	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	3	Yes	3	0	Yes	0	0	Yes	0
	7	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	3	Yes	3	0	Yes	0	0	Yes	0
	8	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	3	Yes	3
	9	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0
	10	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	3	Yes	3	0	Yes	0	0	Yes	0	0	Yes	0
	11	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	12	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0
	13	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	14	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	15	3	Yes	3	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	16	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	17	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4
	18	5	Yes	5	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4
	19	5	Yes	5	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	20	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	21	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	22	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	23	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	3	Yes	3	0	Yes	0
	24	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	3	Yes	3	0	Yes	0
	25	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	26	4	Yes	4	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	27	4	Yes	4	0	Yes	0	0	Yes	0	3	Yes	3	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	28	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	3	Yes	3
	29	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	3	Yes	3
	30	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	3	Yes	3
Odour Descriptor		STW related odours			STW related odours			STW related odours			STW related odours			STW related odours			STW related odours			STW related odours			STW related odours		
End Time		11:55			12:00			12:04			12:08			12:11			12:16			12:20			12:23		
Mean Odour Intensity		2			1			0			0			1			0			0			1		
% Odour Time (T _{z4})		40			17			3			7			23			3			0			7		
Odour Exposure		Medium			Small			Negligible			Negligible			Small			Negligible			Negligible			Negligible		
Odour Impact		Moderate Adverse			Slight Adverse			Negligible			Negligible			Slight Adverse			Negligible			Negligible			Slight Adverse		

Date		10/06/2021																							
Wind Speed		0.5			0			0			0.7			2			0.3			0.3			1.7		
Wind Direction		SSW			SSW			SSW			SSW			SSW			SSW			SSW			SSW		
Start Time		12:30			12:33			12:37			12:40			12:44			12:48			12:51			12:54		
Sniff Location		1			2			3			4			5			6			7			8		
Sensitivity		High			High			High			High			High			High			High			High		
Results		Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted
Odour Intensity	1	3	Yes	3	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0
	2	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	5	Yes	5	0	Yes	0
	3	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0
	4	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0
	5	3	Yes	3	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0
	6	3	Yes	3	0	Yes	0	5	Yes	5	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0
	7	0	Yes	0	0	Yes	0	5	Yes	5	0	Yes	0	3	Yes	3	0	Yes	0	4	Yes	4	0	Yes	0
	8	0	Yes	0	0	Yes	0	5	Yes	5	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0
	9	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	4	Yes	4
	10	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	11	4	Yes	4	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0
	12	3	Yes	3	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	4	Yes	4
	13	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	4	Yes	4	4	Yes	4	0	Yes	0	0	Yes	0
	14	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0
	15	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	4	Yes	4	4	Yes	4	0	Yes	0
	16	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	3	Yes	3	4	Yes	4	0	Yes	0
	17	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0
	18	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	19	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0
	20	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0
	21	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0
	22	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	23	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	24	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	2	Yes	2	0	Yes	0	0	Yes	0
	25	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	26	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	27	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	28	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	29	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	2	Yes	2	2	Yes	2	0	Yes	0
	30	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	2	Yes	2	0	Yes	0	4	Yes	4
Odour Descriptor		STW related odours			NA			Vile, acrid, very unpleasant, sulphur-like			NA			STW related odours			STW related odours			STW related odours			STW related odours		
End Time		12:33			12:37			12:40			12:44			12:48			12:51			12:54			12:57		
Mean Odour Intensity		1			0			3			0			1			1			1			0		
% Odour Time (T≥4)		3			0			70			0			13			27			30			10		
Odour Exposure		Small			Negligible			Medium			Negligible			Small			Small			Small			Negligible		
Odour Impact		Slight Adverse			Negligible			Moderate Adverse			Negligible			Slight Adverse			Slight Adverse			Slight Adverse			Negligible		

Date		10/06/2021																							
Wind Speed		1.6			1.2			1.2			0.7			0.7			1.2			0.7			1		
Wind Direction		SSW			SSW			SSW			SSW			SSW			SSW			SSW			SSW		
Start Time		12:57			13:00			13:03			13:07			13:11			13:14			13:17			13:21		
Sniff Location		9			10			11			12			13			14			15			16		
Sensitivity		High			High			High			High			High			High			High			High		
Results		Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted	Score	Related to Source?	Adjusted
Odour Intensity	1	0	Yes	0	4	Yes	4	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	2	0	Yes	0	4	Yes	4	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	3	0	Yes	0	4	Yes	4	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	4	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	5	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	3	Yes	3	0	Yes	0	0	Yes	0
	6	3	Yes	3	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	3	Yes	3	0	Yes	0	0	Yes	0
	7	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	8	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0
	9	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0
	10	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	11	0	Yes	0	0	Yes	0	0	Yes	0	2	Yes	2	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	12	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	13	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	14	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	15	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	3	Yes	3	0	Yes	0	0	Yes	0	0	Yes	0
	16	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	3	Yes	3	0	Yes	0	0	Yes	0	0	Yes	0
	17	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0
	18	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	3	Yes	3	0	Yes	0	0	Yes	0
	19	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0
	20	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	3	Yes	3	0	Yes	0
	21	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	3	Yes	3	0	Yes	0
	22	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0
	23	0	Yes	0	4	Yes	4	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	24	0	Yes	0	5	Yes	5	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	25	0	Yes	0	4	Yes	4	3	Yes	3	4	Yes	4	0	Yes	0	0	Yes	0	4	Yes	4	4	Yes	4
	26	0	Yes	0	0	Yes	0	0	Yes	0	4	Yes	4	4	Yes	4	0	Yes	0	4	Yes	4	4	Yes	4
	27	0	Yes	0	0	Yes	0	3	Yes	3	3	Yes	3	0	Yes	0	0	Yes	0	3	Yes	3	0	Yes	0
	28	0	Yes	0	0	Yes	0	3	Yes	3	3	Yes	3	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0
	29	0	Yes	0	0	Yes	0	3	Yes	3	0	Yes	0	0	Yes	0	3	Yes	3	3	Yes	3	3	Yes	3
	30	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	0	Yes	0	2	Yes	2	3	Yes	3
Odour Descriptor		STW related odours			STW related odours			STW related odours			STW related odours			STW related odours			STW related odours			STW related odours			STW related odours		
End Time		13:00			13:03			13:07			13:11			13:14			13:17			13:21			13:25		
Mean Odour Intensity		0			1			1			1			1			1			1			0		
% Odour Time (T24)		3			30			10			10			13			10			7			7		
Odour Exposure		Negligible			Small			Small			Small			Small			Small			Small			Negligible		
Odour Impact		Negligible			Slight Adverse			Slight Adverse			Slight Adverse			Slight Adverse			Slight Adverse			Slight Adverse			Negligible		

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