# Proposed Residential Development

# Darwen Hollins Paper Mill

## Odour Assessment

## Gleeson Developments

SLR Ref: 410.03044.00059
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# 1.0 INTRODUCTION

SLR Consulting Limited (SLR) has been commissioned by Gleeson Developments to undertake an Odour Assessment to support the planning application for the proposed residential development on land at Darwen Hollins Paper Mill.

The development comprises 151 residential dwellings and associated infrastructure.

The proposed development site is located in close proximity to the Darwen wastewater treatment works (WwTW), operated by United Utilities.

## 1.1 Background

The proposed development site is located approximately 80m south of the Darwen WwTW at its closest point. United Utilities have submitted an Environmental Impact Assessment (EIA) request for Screening Opinion to Blackburn with Darwen Council (BwDC) to rationalise the WwTW site (BwDC planning application reference: 10/15/0101). The rationalisation of the Darwen WwTW will involve decommissioning most of the existing treatment infrastructure, and construction of a new pumping station to transfer flows for treatment into the wider Blackburn sewage network for treatment at the Blackburn WwTw, located approximately 100m to the north-west of the proposed development site. However, whilst a number of treatment stages will be decommissioned a number of sources present at the WwTW will remain which have the potential to generate odour, including primary settlement treatment tanks and storm tanks, which will be in close proximity to the proposed development site. Furthermore, timescales for the rationalisation and decommissioning of the Darwen WwTW are currently unknown.

This Odour Assessment has therefore been undertaken in order to ensure that potential odours from Darwen WwTW do not represent a development constraint. The decommissioning of the WwTW has yet to commence and, therefore, this assessment determines potential odour generated by all treatment sources currently present at the Darwen WwTw.

## 1.2 Assessment Scope

Pre-application discussion was undertaken with the Environmental Health team of BwDC in order to agree upon the extent and methodology of the Odour Assessment. The scope of works was agreed by the BwDC Environmental Health on 22nd November 2016[1].

Three odour monitoring surveys were undertaken at the location of the proposed development site, in order to assess potential odour from Darwen WwTW.

The odour monitoring survey is undertaken in accordance with the Institute of Air Quality Management (IAQM) *Guidance on the assessment of odour for planning* (2014)[2], with further reference to the Department for the Environment, Food and Rural Affairs (DEFRA) Odour Guidance for Local Authorities[3].

[1] E-mail communication between Simon Kirkby, Senior Environmental Health Officer within Blackburn with Darwen Council, and SLR Consulting, dated 22nd November 2016.

[2] Guidance on the assessment of odour for planning. Institute of Air Quality Management, London. www.iaqm.co.uk/text/guidance/odour-guidance-2014.

[3] DEFRA (2010) Odour Guidance for Local Authorities.

### 1.3 Project Structure

The remainder of this report is structured as follows:

- Section 2 presents an overview of the relevant legislation and guidance;
- Section 3 details the assessment methodology;
- Section 4 presents the results of the odour assessment periods;
- Section 5 characterises the future baseline environment in the vicinity of the site from an odour perspective; and
- Section 6 concludes the study.

## 2.0 RELEVANT LEGISLATION AND GUIDANCE

This section details the assessment criteria and background information used in this odour assessment.

### 2.1 Odour

The following section provides background information that was used as a basis for this assessment.

#### 2.1.1 Definition

Odour may be defined as *'a characteristic property of any compound that makes it perceptible to the sense of smell, whether pleasant or unpleasant, fragrance or stench*[4].

An alternative definition of an odour is an '*organoleptic attribute perceptible by the olfactory organ on sniffing certain volatile substances*[5].

#### 2.1.2 Effect of Environmental Odours

The IAQM Guidance on the assessment of odour for planning document[6] defines the possible effects of environmental odours as:

> *'Most odours are mixtures of many chemicals that interact to produce what we detect as a smell. A distinction should be made between: odour-free air, containing no odourous chemicals; and fresh air, usually perceived as being air that contains no chemicals or contaminants that are unpleasant (i.e. air that smells ;clean'). Fresh air may contain odours chemicals, but these odours will usually be pleasant in character, such as freshly mown grass or sea spray. Perceptions of odour – whether it is found to be acceptable, objectionable or offensive – are partly innate and hard-wired, and partly determined through life expectancies and hence can be subject to the individual.'*

Typical odour effects reported by people include the following: nausea; headaches; retching; difficulty breathing; frustration; annoyance; depression, stress; tearfulness; reduced appetite; sleep deprivation; and embarrassment in front of visitors. Odour effects, such as those described above, contribute to a reduced quality of life for the individuals who are exposed to the odour.

### 2.2 Planning Policy

#### 2.2.1 National Policy

The National Planning Policy Framework (NPPF) was formally adopted on 27th March 2012 and describes the policy context in relation to pollutants, including atmospheric pollution:

> *Para 109 The planning system should contribute to and enhance the natural and local environment by*

[4] Horizontal Guidance H4: Odour Management – How to comply with your Environmental Permit, Environment Agency, 2011.
[5] Odour Measurement and Control, AEA, 1990.
[6] Guidance on the assessment of odour for planning. Institute of Air Quality Management, London. www.iaqm.co.uk/text/guidance/odour-guidance-2014.

*[...] preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of land, air, water or noise pollution or land instability."*

*"Para 120 To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner."*

*"Para 122: In doing so, local planning authorities should focus on whether the development itself is an acceptable use of the land, and the impact of the use, rather than the control of processes or emissions themselves where these are subject to approval under pollution control regimes. Local planning authorities should assume that these regimes will operate effectively."*

Where pollution is defined as:

*"Annex 2: Glossary Anything that affects the quality of land, air, water or soils, which might lead to an adverse impact on human health, the natural environment or general amenity. Pollution can arise from a range of emissions, including smoke, fumes, gases, dust, steam, odour, noise and light."*

The policies within the NPPF in relation to air pollution are considered within this Odour Assessment.

The accompanying National Planning Practice Guidance (NPPG), provides guiding principles on how planning can take account of the impact of new development on air quality, and includes the following in regard to odour:

"*Odour and dust can also be a planning concern, for example, because of the effect on local amenity.*"

*"When deciding whether air quality is relevant to a planning application, considerations could include whether the development would:*

- *Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality."*

*"Assessments should be proportionate to the nature and scale of development proposed and the level of concern about air quality, and because of this are likely to be locationally specific. The scope and content of supporting information is therefore best discussed and agreed between the local planning authority and applicant before it is commissioned."*

The guidance within the NPPG specifically relating to odour has been considered as part of this Odour Assessment.

### 2.2.2 Local Policy

BwDC Local Development Framework (LDF) is used to guide planning within the Borough. The main document within the LDF is the Core Strategy[7] which was adopted in January 2011. The Core Strategy sets out priorities for the future planning and development of the Borough for the next 15 years.

Review of the Core Strategy highlighted no policies relating to odour.

## 2.3 Odour Nuisance Regulation

The main requirements with respect to odour control from industrial or trade premises that are not permitted under the Environmental Permitting (England and Wales) Regulations (2007), and subsequent amendments, 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.'*

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 (LA) is satisfied that a statutory nuisance exists, or is likely to occur or happen again, it must serve an abatement notice under Part III of the Environmental Protection Act (1990). Enforcement can insist that there be no malodour beyond the boundary of the works. A defence is to show that the process to which the nuisance has been attributed and its operation, are being controlled according to Best Practicable Means (BPM).

## 2.4 Odour Impact Context

The DEFRA guidance document[8] states that, in the case of nuisance resulting from odour:

> *'The emission would also have to interfere, in a material or substantial way, with the victim's use of his property.*
>
> *The interference must have some quality which makes it unreasonable for the victim. Under the nuisance limb, interference in a person's 'personal comfort' is required. The standard is an objective one. So, where a particularly sensitive victim experiences as significant an interference in his personal comfort which an average would not, there can be no statutory nuisance. [...] Odour statutory nuisances are often geographically widespread, having the potential to affect a large number of people.'*

## 2.5 Assessment of Predicted Odour Impact

There is neither European nor United Kingdom (UK) specific regulatory standards for the assessment of the impact of odours (i.e. numerical standards in relation to exposure). However, it may be reasonably argued that complaints are likely to occur when odours become detectable and recognisable on a frequent basis. The longer the odour detection

[7] Core Strategy, Part of the Blackburn with Darwen Local Development Framework, Darwen with Blackburn Council, January 2011.

[8] DEFRA, Odour Guidance for Local Authorities, 2010, page 13.

persists for an individual, the greater the level of complaints may be expected, particularly if the odours are unpleasant.

The potential for odorous compounds to cause nuisance is dependent upon a wide range of factors, including:

- the rate of emission of the compound(s);
- the duration and frequency of exposure;
- the time of the day that this emission occurs;
- the prevailing meteorology;
- the sensitivity of the '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.

These factors are considered within the IAQM *Guidance on the assessment of odour for planning*[2] which was released in May 2014. An individual's response to and perception of odour can be judged in terms of the FIDOL factors, defined as Frequency, Intensity, Duration, Offensiveness and Location.

1. the *frequency* is a measure of how often to which an individual is exposed to a specific odour. Individuals are more likely to tolerate a more pleasant / inoffensive should they only occur infrequently. Odours are more likely to be considered a nuisance if the exposure increases in frequency.
2. the *intensity*, or perceived strength, of an odour is directly linked to the likelihood of complaint, with a distinct odour at a higher intensity more likely to give rise to specific complaints.
3. the *duration* of exposure to an odour – complaints are more likely to occur if an individual is subject to a specific odour over a longer period of time.
4. the *offensiveness* of an odour, also termed 'hedonic tone', is a subjective measure of how pleasant or unpleasant on odour is deemed to be. Odours resulting from sewage treatment processes, specifically those processes which process septic effluent or sludge are more likely to be considered offensive and give rise to complaints.
5. the *location* of an odour is a consideration of both the land-use surrounding an odorous source, and the sensitivity of surrounding receptors. For example, in a rural context those odours associated with agriculture / farming would be considered more acceptable at sensitive residential locations due to the accepted and typical nature of the odour. The converse would be expected in an urban locale.

The FIDOL approach can be followed in order to determine whether an odour can be perceived as a nuisance. However, the approach recognises that multiple FIDOL factors need to be considered before an odour can be considered to be a statutory nuisance – the longer the odour detection persists for an individual, the greater the level of complaints may be expected, particularly if the odours are unpleasant.

## 3.0 ASSESSMENT METHODOLOGY

The IAQM '*Guidance on the assessment of odour for planning*' is specifically designed for assessing odour impacts for planning purposes rather than for environmental protection Regulatory purposes (e.g. Environmental Permitting, statutory nuisance investigations, etc.).

The scope of the IAQM guidance specifically addresses:

> '*planning application[s] […] when a sensitive use is being proposed near to an existing odorous process (known as 'encroachment')*'. The guidance states '*best practice is to use a multi-tool approach, where practicable.'*

The IAQM guidance presents a step-by-step approach to determine the most appropriate assessment method to assess potential odour impacts from existing odorous activities based upon the potential for the proposed development to experience adverse odour effects. If there is a low likelihood (risk) of adverse odour effects, the IAQM guidance considers that '*a single assessment tool may suffice and/or may be more qualitative that quantitative*'. This assessment approach meets the requirements in the air quality section of the National Planning Practice Guidance (NPPG) for assessments to be '*proportionate to the nature of scale of development proposed and the level of concern*'.

### 3.1 Existing Complaints – Established Baseline

Freedom of Information (FoI) requests were made to BwDC[9], to determine the location of any existing complaints regarding odour attributed to the Darwen WwTW.

The following response was received from BwDC:

> *'Thank you for your request for information regarding odour complaints (reference number 01337). Blackburn with Darwen Borough Council can confirm a nil response.'*

On the basis that no complaints have been received from existing receptors, it is considered that a programme of 'sniff-test' odour surveys is an appropriate assessment method to determine potential WwTW related odour at the location of the proposed development site.

### 3.2 Development Site Location

The proposed development is located to the north of Darwen town centre at the former Darwen Hollins Paper Mill. Access to the site was via Hollins Road or Hollins Grove Street.

The Darwen WwTW, the potential source of odour, is located between the development site and the M65. The northern boundary of the proposed development is located approximately 85m to the south at its closest point.

There are a number of additional industrial uses in the development locale, however, none of these are considered to be potential odour sources. It is noted that during pre-application discussions with the Environmental Health Team at BwDC, no additional sources of potential odour were requested to be considered as part of the assessment.

### 3.3 Sniff-tests

The sniff test comprises of two steps:

[9] Freedom of Information request, reference: 01337, Blackburn with Darwen Council, dated 9th November 2016.

1. conduct the sniff testing; and
2. estimate the odour exposure at the test locations.

The procedure for 'sniff testing' is detailed within Box 4 - Appendix 2 of the IAQM guidance. The procedure involved the tester making observations on frequency, intensity, duration and offensiveness at a series of locations within the area of interest selected on the basis of wind direction.

The sniff test has been used to gather information on the odour intensity, character, unpleasantness, frequency and duration at the test locations. The test locations were identified during an initial walkover of the site, taking into account the area of interest (i.e. the development area), the orientation in relation to the prevailing wind direction and the distance from source the sample area needed to cover. These test locations are shown in Drawing AQ1.

At each sample location, the tester makes notes typically every 10 seconds to give 30 samples over a 5 minute observation period on the odour intensity using the VDI scale (see Table 3-1).

**Table 3-1**
**VDI Scale 3940[10] Odour Intensity Scale**

| Odour Strength | Intensity Level | Comments |
|---|---|---|
| No odour / not perceptible | 0 | No odour when compared to a clean site |
| Slight / very weak | 1 | There is probably some doubt as to whether the odour is actually present |
| Slight / weak | 2 | The odour is present but cannot be describes using precise words / terms |
| Distinct | 3 | The odour character is barely recognisable |
| Strong | 4 | The odour character is easily recognisable |
| Very Strong | 5 | The odour is offensive. Exposure to this level would be considered undesirable |
| Extremely Strong | 6 | The odour is offensive. An instinctive reaction would be to mitigate against further exposure |

Note:
The IAQM guidance notes:
- The Odour Detection Threshold (ODT) of 1 $ou_E/m^3$ is somewhere between 0 and 1.
- VDI 3940 says that the recognition threshold intensity is generally 3-10 times higher than the ODT (i.e. 3-10 $ou_E/m^3$).

The pervasiveness / extent of the odour at the test location is assessed by calculating the 'percentage odour time [$t_{I\geq}4$]', which is the number of samples where odours are recognisable, divided by the total number of samples (i.e. 30). A 'recognisable odour' is where the odour strength exceeds the recognition threshold and is definitely recognisable by the assessor, i.e. the assessor is capable of definitely identifying its quality/character, which corresponds to VDI intensity of 4 or more. The average odour intensity [$I_{mean}$], over the test period is calculated and the maximum intensity observed is noted.

The intensity, frequency and duration are then considered together to assess exposure using the matrix presented in Table 3-2.

[10] VDI 3940: 1993, Determination of Odorants in Ambient Air by Field Inspection, Pub. Verein Deutscher Ingenieure, Dusseldorf. Available from Beuth Verlag GmbH, Berlin.

**Table 3-2**
**Matrix to assess the odour exposure (neutral and unpleasant odours) at time and place of sampling**

| | | Percentage Odour time during the test | | | | |
|---|---|---|---|---|---|---|
| | | 10% | 11-20% | 21-30% | 31-40% | >41% |
| **Average Intensity** | 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:
- Average Intensity is rounded to the nearest whole number:
- If the mean is 0 then the odour effect can for practical purposes be considered negligible; and
- If the mean is 1 but the percentage odour time is 0, then the odour effect can for practical purposes be considered negligible.

The limitations to the observational tools include the following:

- the nature of an odour experience is subjective and perceived over very short time periods (as short as a few seconds), making most conventional sampling periods inappropriate; and
- the difficulty of measuring odour at ambient levels; no analytical techniques can currently match the sensitivity and speed of response and breadth of application of the human nose.

A full description of the methodology undertaken at each sample point and how the results are interpreted in accordance with the IAQM guidance is presented in Appendix AQ1.

## 4.0 ASSESSMENT RESULTS

Sniff testing was undertaken on the 23rd November 2016 and 1st December 2016 by personnel from the SLR Air Quality team. The survey locations used in each assessment are illustrated on Drawing AQ1. The times of each assessment are shown were follows:

Assessments were undertaken over the following periods:

- Assessment No. 1: 23rd November 2016 09:50 – 11:52; and
- Assessment No. 2: 1st December 2016 10:35 – 12:15 and 12:17 – 13:56.

### 4.1 Meteorological Conditions

A summary of the meteorological conditions[11] on the day of each survey are presented in Figure 4-1 and Figure 4-2.

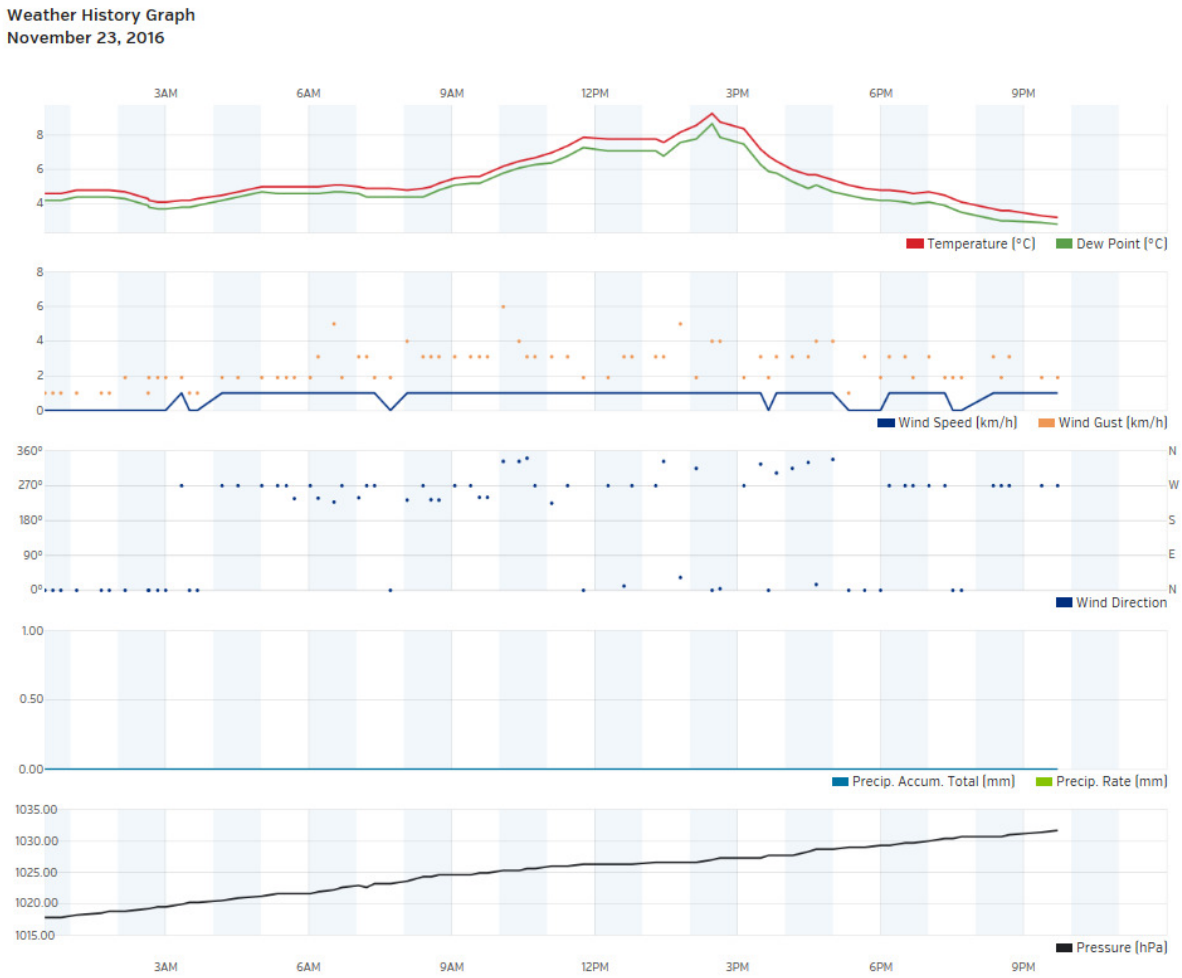



**Figure 4-1**
**Assessment Number 1 – Summary of Meteorological Conditions, 23rd November 2016**

[11] Meteorological data taken from the observation station at Oarwen, Gillbrand Street, located approximately 400m south of the Site. Sourced from: www.wunderground.com/, accessed December 2016.

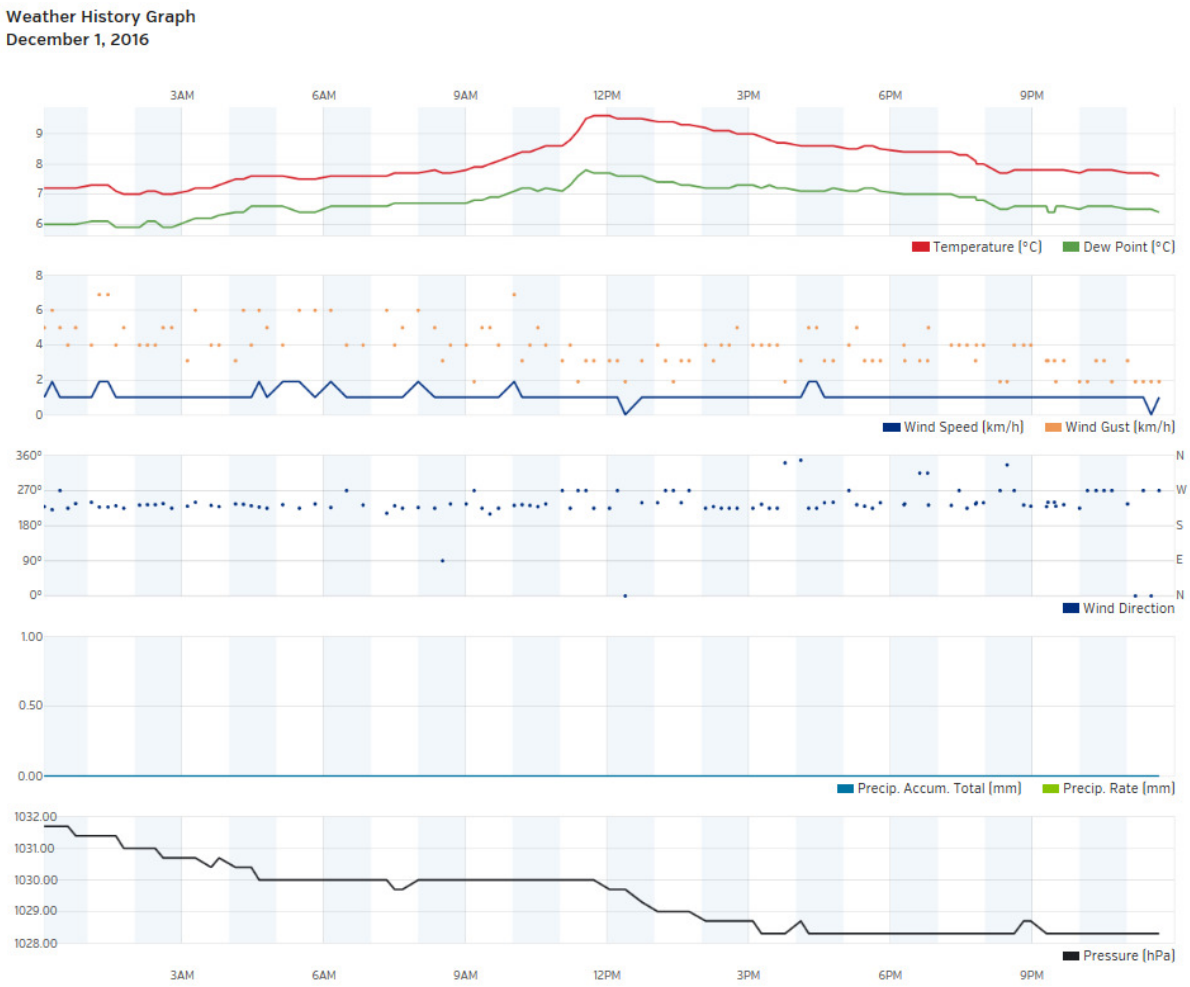



**Figure 4-2**
**Assessment Number 2 – Summary of Meteorological Conditions, 1st December 2016**

From the graphical presentations in Figure 4-1 and Figure 4-2, sniff test assessment survey periods coincided with prevailing / frequent north and westerly winds, ensuring that wind was blowing from across WwTW in the direction of the development site.

Temperatures during each survey period were a minimum of approximately 6°C, with maximum temperatures recorded at the survey locations reaching 9°C. As the development site was downwind of the WwTW for the duration of the survey periods, there would be a higher potential for odour exposure at the location of the proposed development site.

It is noted that no rainfall occurred during the assessment period, or in the 24-hours prior to the 1st December assessment period. Therefore, it is considered that inflows to the Darwen works were low resulting in a relatively high potential for odour generation i.e. inflows were not diluted by stormwater. In the 24-hours prior to the 23rd November assessment period a cumulative 4mm of rainfall was recorded[12]. This level of rainfall is not considered to result in a high level of stormwater inflows into the WwTW.

[12] Meteorological data taken from the observation station at Oarwen, Gillbrand Street, located approximately 400m south of the Site. Sourced from: https://www.wunderground.com/personal-weather-station/dashboard?ID=IOARWEN2#history/s20161122/e20161122/mdaily accessed December 2016.

Figure 4-1 and Figure 4-2 indicate that wind speeds ranged between 0km/hour and 2 km/hour during the survey periods. The average wind speeds during the survey equated to a Beaufort Scale factor of 1, corresponding to a 'Light Air'. Overall the winds were low for the duration of the survey, reducing the likelihood of enhanced dispersion of odour and therefore a higher potential for WwTW related odour to be detected at the location of the proposed development.

Overall, the meteorological conditions both prevailing and during the survey are considered to be stable. The low wind speeds and the zero rainfall are all contributing factors to increase the potential for agricultural odours to be detected during the surveys.

## 4.2 Results

The results of the sniff test survey recorded during each period are detailed in this section.

Surveys were undertaken at locations throughout the development site, starting at locations within the southern area of the site and moving north towards the WwTW. This is to ensure that personnel undertaking the assessment were not de-sensitised to the potential odour in accordance with the IAQM guidance. In order to provide greater confidence in the assessment results, the same locations were surveyed during each assessment period.

Surveys were undertaken throughout the proposed development site to assess potential exposure. Locations were selected based on the schematic site layout[13], provided by Gleeson Developments, and the majority of survey locations represent locations of potential future exposure. The survey locations are shown in Drawing AQ1.

As described within the IAQM methodology, the results from the sniff test are used to assess the risk of odour exposure and effect at the assessed location. A significant odour effect is generally considered as those with an effect of '*Moderate Adverse*' or '*Substantial Adverse*'.

### 4.2.1 Results Summary

An overview summary of the maximum odour effect and associated significance effect from each survey period is presented in Table 4-1.

**Table 4-1**
**Summary of Maximum Odour**

| Date | Maximum Odour Effect | Overall Significance of Effect |
|---|---|---|
| 23rd November 2016 | Negligible | Not Significant |
| 1st December 2016 – AM | Negligible | Not Significant |
| 1st December 2016 - PM | Negligible | Not Significant |

A full presentation of results from each assessment period is detailed in the following subsections.

### 4.2.2 Sensory Sniff Test Results – 23rd November 2016

The WwTW is not visible from any of the survey locations. As such, it is unknown whether any extra activity, in addition to 'normal' operation, was taking place during the odour survey.

A weak 'sewage' odour was detected at survey location 18 on the development site. The odour detected at this location was considered to be of a VDI intensity of 2 ('slight / weak')

[13] 2895-0-001 – Schematic Site Layout, November 2016.

and was only detected once for a short period of time during the assessment period. The pleasantness of the odour based on the short term exposure was described as being *'neutral'*.

A weak 'vegetative' odour was detected at location 19 on the development site. The odour detected at this location was considered to be of a VDI intensity of 2 ('slight/ weak') and was only detected once for a short period of time. The pleasantness of the odour based on the short-term exposure was described as being *'neutral'*. The assessor noted that source of this 'vegetative' odour was not distinguishable between the treatment processes at the WwTW and the site and its immediate surroundings which are vegetated.

No WwTW odour was reported at any other surveyed locations.

Full survey results are presented within Appendix AQ3.

**Table 4-2**
**Summary of Sniff Test – 23rd November 2016**

| Assessment Location | Time | Average VDI | Odour Exposure | Risk of Exposure | Odour Effect |
|---|---|---|---|---|---|
| 1 | 09:50 – 09:55 | 0 | 0% | Negligible | Negligible (A) |
| 2 | 09:58 – 10:03 | 0 | 0% | Negligible | Negligible (A) |
| 3 | 10:05 – 10:10 | 0 | 0% | Negligible | Negligible (A) |
| 4 | 10:13 – 10:18 | 0 | 0% | Negligible | Negligible (A) |
| 5 | 10:18 – 10:23 | 0 | 0% | Negligible | Negligible (A) |
| 6 | 10:23 – 10:28 | 0 | 0% | Negligible | Negligible (A) |
| 7 | 10:29 – 10:34 | 0 | 0% | Negligible | Negligible (A) |
| 8 | 10:35 – 10:40 | 0 | 0% | Negligible | Negligible (A) |
| 9 | 10:42 – 10:47 | 0 | 0% | Negligible | Negligible (A) |
| 10 | 10:50 – 10:55 | 0 | 0% | Negligible | Negligible (A) |
| 11 | 10:58 – 11:03 | 0 | 0% | Negligible | Negligible (A) |
| 12 | 11:05 – 11:10 | 0 | 0% | Negligible | Negligible (A) |
| 13 | 11:11 – 11:16 | 0 | 0% | Negligible | Negligible (A) |
| 14 | 11:17 – 11:22 | 0 | 0% | Negligible | Negligible (A) |
| 15 | 11:24 – 11:29 | 0 | 0% | Negligible | Negligible (A) |
| 16 | 11:29 – 11:34 | 0 | 0% | Negligible | Negligible (A) |
| 17 | 11:35 – 11:40 | 0 | 0% | Negligible | Negligible (A) |
| 18 | 11:41 – 11:46 | 0 | 0% | Negligible | Negligible (A) |
| 19 | 11:46 – 11:51 | 0 | 0% | Negligible | Negligible (A) |
| 20 | 11:52 – 11:57 | 0 | 0% | Negligible | Negligible (A) |

Note:
VDI: Scale used to define odour intensity, see Table AQ1-1 in Appendix 1.
(A) Based upon a 'high' sensitivity, corresponding to residential dwelling.

In accordance with IAQM guidance, based on the sniff test survey results the worst-case risk of exposure at the proposed development site is classed as 'negligible'. Therefore, the overall odour effect is considered to be 'not significant'.

### 4.2.3 Sensory Sniff Test Results – 1st December 2016

The WwTW is not visible from any of the survey locations. As such, it is unknown whether any extra activity, in addition to 'normal' operation, was taking place during both the AM and PM odour surveys.

*AM Survey*

A 'sewage' odour was detected at survey location 18 on the development site. It was reported as being *'not distinct'*. The odour detected at this location was considered to be of a VDI intensity of 2 ('slight / weak') and was only detected for a short period of time during the assessment period. The pleasantness of the odour based on the short-term exposure was described as being *'neutral'*.

A 'burnt wood' odour was detected at survey location 5 on the development site. The odour detected at this location was considered to be of a VDI intensity of 2 ('slight/ weak') and was only detected once and for a short period of time. The pleasantness of the odour based on the short term exposure was described as being *'neutral'*. It is not believed that this odour was related to the WwTW and is more likely to be related to a one-off task undertaken within the area surrounding the development.

A 'vegetative' odour was detected at location 19 on the development site. The odour detected at this location was considered to be of a VDI intensity of 2 ('slight / weak') and was only detected once for a short period of time. The pleasantness of the odour based on the short-term exposure was described as being *'neutral'*. The assessor noted that the source of this 'vegetative' odour was not distinguishable between the WwTW treatment processes and the site and its immediate surroundings which are vegetated.

No WwTW odour was reported at any other surveyed locations.

Full survey results are presented within Appendix AQ3.

**Table 4-3**
**Summary of Sniff Test – 1st December 2016 – AM Assessment**

| Assessment Location | Time | Average VDI | Odour Exposure | Risk of Exposure | Odour Effect |
|---|---|---|---|---|---|
| 1 | 10:35 – 10:40 | 0 | 0% | Negligible | Negligible [A] |
| 2 | 10:43 – 10:48 | 0 | 0% | Negligible | Negligible [A] |
| 3 | 10:49 – 10:54 | 0 | 0% | Negligible | Negligible [A] |
| 4 | 10:55 – 11:00 | 0 | 0% | Negligible | Negligible [A] |
| 5 | 11:00 – 11:05 | 0 | 0% | Negligible | Negligible [A] |
| 6 | 11:05 – 11:10 | 0 | 0% | Negligible | Negligible [A] |
| 7 | 11:10 – 11:15 | 0 | 0% | Negligible | Negligible [A] |
| 8 | 11:15 – 11:20 | 0 | 0% | Negligible | Negligible [A] |
| 9 | 11:20 – 11:25 | 0 | 0% | Negligible | Negligible [A] |
| 10 | 11:25 – 11:30 | 0 | 0% | Negligible | Negligible [A] |
| 11 | 11:30 – 11:35 | 0 | 0% | Negligible | Negligible [A] |
| 12 | 11:35 – 11:40 | 0 | 0% | Negligible | Negligible [A] |
| 13 | 11:40 – 11:45 | 0 | 0% | Negligible | Negligible [A] |
| 14 | 11:45 – 11:50 | 0 | 0% | Negligible | Negligible [A] |
| 15 | 11:50 – 11:55 | 0 | 0% | Negligible | Negligible [A] |
| 16 | 11:55 – 12:00 | 0 | 0% | Negligible | Negligible [A] |
| 17 | 12:00 – 12:05 | 0 | 0% | Negligible | Negligible [A] |
| 18 | 12:05 – 12:10 | 0 | 0% | Negligible | Negligible [A] |
| 19 | 12:10 – 12:15 | 0 | 0% | Negligible | Negligible [A] |
| 20 | 12:15 – 12:20 | 0 | 0% | Negligible | Negligible [A] |

Note:
VDI: Scale used to define odour intensity, see Table AQ1-1 in Appendix 1.

| Assessment Location | Time | Average VDI | Odour Exposure | Risk of Exposure | Odour Effect |
|---|---|---|---|---|---|
| (A) Based upon a 'high' sensitivity, corresponding to residential dwelling. | | | | | |

In accordance with IAQM guidance, based on the sniff test survey results the worst case risk of exposure at the proposed development site is classed as 'negligible'. Therefore, the overall odour effect is considered to be 'not significant'.

*PM Survey*

A 'sewage' odour was detected at survey locations 2, 6, 12 and 15 on the development site. It was reported as being *'not distinct'*. The odour detected at this location was considered to be of a VDI intensity of 2 ('slight / weak') and was only detected for a short period of time for no longer than 10 seconds. The pleasantness of the odour based on the short-term exposure was described as being *'neutral'*.

No WwTW odour was reported at any other surveyed locations.

Full survey results are presented within Appendix AQ3.

**Table 4-4**
**Summary of Sniff Test – 1st December 2016 – PM Assessment**

| Assessment Location | Time | Average VDI | Odour Exposure | Risk of Exposure | Odour Effect |
|---|---|---|---|---|---|
| 1 | 12:22 – 12:27 | 0 | 0% | Negligible | Negligible (A) |
| 2 | 12:27 – 12:32 | 0 | 0% | Negligible | Negligible (A) |
| 3 | 12:32 – 12:37 | 0 | 0% | Negligible | Negligible (A) |
| 4 | 12:37 – 12:40 | 0 | 0% | Negligible | Negligible (A) |
| 5 | 12:40 – 12:45 | 0 | 0% | Negligible | Negligible (A) |
| 6 | 12:45 – 12:50 | 0 | 0% | Negligible | Negligible (A) |
| 7 | 12:50 – 12:55 | 0 | 0% | Negligible | Negligible (A) |
| 8 | 12:55 – 13:00 | 0 | 0% | Negligible | Negligible (A) |
| 9 | 13:00 – 13:05 | 0 | 0% | Negligible | Negligible (A) |
| 10 | 13:06 – 13:11 | 0 | 0% | Negligible | Negligible (A) |
| 11 | 13:11 – 13:16 | 0 | 0% | Negligible | Negligible (A) |
| 12 | 13:16 – 13:21 | 0 | 0% | Negligible | Negligible (A) |
| 13 | 13:21 – 13:26 | 0 | 0% | Negligible | Negligible (A) |
| 14 | 13:26 – 13:31 | 0 | 0% | Negligible | Negligible (A) |
| 15 | 13:31 – 13:36 | 0 | 0% | Negligible | Negligible (A) |
| 16 | 13:36 – 13:41 | 0 | 0% | Negligible | Negligible (A) |
| 17 | 13:41 – 13:56 | 0 | 0% | Negligible | Negligible (A) |
| 18 | 15:46 – 13:51 | 0 | 0% | Negligible | Negligible (A) |
| 19 | 13:51 – 13:56 | 0 | 0% | Negligible | Negligible (A) |
| 20 | 13:56 – 14:01 | 0 | 0% | Negligible | Negligible (A) |

Note:
VDI: Scale used to define odour intensity, see Table AQ1-1 in Appendix 1.
(A) Based upon a 'high' sensitivity, corresponding to residential dwelling.

In accordance with IAQM guidance, based on the sniff test survey results the worst case risk of exposure at the proposed development site is classed as 'negligible'. Therefore, the overall odour effect is considered to be 'not significant'.

## 5.0 FUTURE BASELINE CONDITIONS

UU has submitted an EIA request for Screening Opinion to BwDC (planning application reference: 10/15/0101) relating to proposed changes to the Darwen WwTW. The proposals include the rationalisation of Darwen WwTW and the construction of a new underground pipeline to transfer the flows currently received by the Darwen WwTW up to a connection point for the Blackburn Network. Flows will then be passed on to the Blackburn WwTW.

As part of the rationalisation works, most the treatment sources of then Darwen WwTw will be decommissioned. The treatment sources / plant to be made redundant, include:

- inlet screens and detritors;
- percolating filters;
- humus tanks; and
- sludge lagoons, sludge holding tanks and sludge drying beds.

The primary settlement tanks and storm tanks will be retained as part of the rationalisation works. An additional storm tank is proposed to be constructed, in close proximity to the location of the existing percolating filters, approximately 325m from the northern boundary of the proposed Gleeson development site.

It is not currently known when the decommissioning of the Darwen WwTW will begin. However, the UU EIA Scoping Report submitted to BwDC states:

> *'Through appropriate design, construction methods and mitigation United Utilities consider that there will not be significant environmental effects associated with the proposed project. Pollution prevention methods will be incorporated throughout and measures to minimise the environmental impacts of the scheme will be adopted. '*

It is recognised within DEFRA's Odour Guidance for Local Authorities[14] that the potential for odours are greater for some parts of the WwTW treatment process than for others. Those elements of the WwTW that deal with influent, particularly when septic, and sludges have a far greater propensity for creating malodours. This accords to the findings of R&D document P4-095/TR[15] and Water UK's consultation response to DEFRA on the CoP for odour control at WwTW[16].

### 5.1 Development Layout – Considerations Regarding Odour

The rationalisation of the Darwen WwTW and particularly the decommissioning of the inlet screens and detritors, and the sludging operations will remove a large source of potential malodour and the associated emission in the future baseline year. It is considered that the overall potential for odour generation from the WwTW will reduce in comparison to the existing base case.

[14] DEFRA (2010) Odour Guidance for Local Authorities.

[15] Environment Agency (2002) Assessment of Community Response to Odorous Emissions, R&D Technical Report P4-095/TR.

[16] Water UK response to the consultation on the Code of Practice on Odour Nuisance from Sewage Treatment Works and the Accompanying Local Authority Guide, accessed from: http://www.water.org.uk/home/policy/statements-and-responses/comment-draft-code-of-prcatice/water-uk-response-to-odour-cop-and-lag-4--apr-05.doc

A period of odour sniff-tests determined a ‘not significant’ effect on odour at the location of the proposed residential development site, as a result of operational odour from the Darwen WwTW.

## 6.0 DISCUSSION AND CONCLUSION

A series of odour survey sniff tests were undertaken, in accordance with the IAQM odour guidance[17] methodology, at the proposed development site located at the former Darwen Hollins Paper Mill. This was to assess odour from the nearly Darwen WwTW and potential impacts upon the development site.

Prevailing winds for the duration of the survey periods, which took place on the 23rd November 2016 and 1st December 2016, were mainly from the north and west and of a low speed, reducing the likelihood of enhanced dispersion of WwTW odour and therefore a higher potential for WwTW related odour to be detected at the location of the proposed development at downwind locations.

Weak 'sewage' odour was detected at a number of assessment locations on the proposed development site boundary, during each of the assessment periods. Additionally, a 'vegetative' odour was also detected at location 19 during 2 of the 3 surveys.

However, the overall risk of exposure at the proposed development site based on the sniff test results is classed as '*negligible',* corresponding to a '*not significant*' odour effect. On the basis of the sniff test survey periods, odour from the Darwen WwTW is not significant at the location of the proposed development site and is not considered to represent a development constraint.

It is noted that the majority of treatment stages comprising the Darwen WwTW, including those with the potential to generate high levels of offensive odour, are to be decommissioned. Therefore, once decommissioning works are complete it is considered that the overall potential for odour generation from the WwTW will reduce in comparison to the existing base case.

As such, it is not considered that odour a material constraint to the development proposals, which conform to the principles of National Planning Policy Framework and National Planning Practice Guidance.

[17] *Guidance on the assessment of odour for planning.* Institute of Air Quality Management, London. www.iaqm.co.uk/text/guidance/odour-guidance-2014.

## 7.0 CLOSURE

This report has been prepared by SLR Consulting Limited with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of Gleeson Developments Ltd; no warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

## Appendix AQ1 – IAQM Sniff Test Methodology

**Sniff Test Sampling Procedure**

The sensory test is completed at each test location over a standard observation time, typically five minutes.

***Step 1***

The assessor breathes normally, inhaling ambient air samples through the nose at regular intervals (typically every 10 seconds to give 30 samples over a 5 minute observation period).

***Step 2***

For each sample, the odour intensity (VDI Scale, 0-6) is recorded.

**Table AQ1-1**
**VDI Scale 3940[18] Odour Intensity Scale**

| Odour Strength | Intensity Level | Comments |
|---|---|---|
| No odour / not perceptible | 0 | No odour when compared to a clean site |
| Slight / very weak | 1 | There is probably some doubt as to whether the odour is actually present |
| Slight / weak | 2 | The odour is present but cannot be describes using precise words / terms |
| Distinct | 3 | The odour character is barely recognisable |
| Strong | 4 | The odour character is easily recognisable |
| Very Strong | 5 | The odour is offensive. Exposure to this level would be considered undesirable |
| Extremely Strong | 6 | The odour is offensive. An instinctive reaction would be to mitigate against further exposure |

***Step 3***

At the end of the observation period at the test location, the odour unpleasantness is noted down by classifying it as unpleasant, neutral or pleasant. This assumes that at least some of the 30 samples were of intensity 3 or more (i.e. the odour is "barely recognisable").

***Step 4***

The odour descriptor should also be noted: odours can be described using standardised categories and reference vocabulary.

***Step 5***

Next, the pervasiveness / extent of the odour at this test location is assessed. This can be calculated as the percentage odour time, which is the number of samples where odour was recognisable divided by the total number of samples (i.e. 30). Note that 'recognisable odour' is where the odour strength exceeds the recognition threshold and is definitely recognisable

[18] VDI 3940: 1993, Determination of Odorants in Ambient Air by Field Inspection, Pub. Verein Deutscher Ingenieure, Dusseldorf. Available from Beuth Verlag GmbH, Berlin.

by the assessor, i.e. the assessor is definitely identifying it quality / character, which corresponds to a VDI of 4 or more.

***Step 6***

The average odour intensity over the test period of calculated and the maximum intensity observed is noted.

The above procedure is then repeated at the next test location, remembering that the character of an odour mixture can change over distance, as the particular components may become diluted below their individual detection thresholds at different distances.

**Table AQ1-2**
**Matrix to Assess Odour Exposure**

| Average Intensity | Percentage Odour time during the test | | | | |
|---|---|---|---|---|---|
| | 10% | 11-20% | 21-30% | 31-40% | >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:
- Average Intensity should be rounded to the nearest whole number;
- If the mean is 0 then the odour effect can for practical purposes be considered negligible; and
- If the mean is 1 but the percentage odour time is 0, then the odour effect can for practical purposes be considered negligible.

***Assessment of Odour Effect***

The potential effect of the calculated odour exposure is dependent upon the sensitivity of the receptor in question. The proposed receptors at the development site are residential and therefore considered high in sensitivity to odours. Once the overall risk of exposure has been assessed at each sampling location, the IAQM guidance provides a matrix to describe the effect of the assessed exposure level based upon the sensitivity of the receptor.

**Table AQ1-3**
**Matrix to Assess the Odour Effect at Individual Receptors**

| Overall Odour Exposure | 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 |

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

***Quality Assurance / Quality Control***

Due to the subjective approach of the sensory sniff test, general quality assurance / quality control is of high importance. The main QA/QC factors are as follows:

**Table AQ1-4**
**Matrix to Assess the Odour Effect at Individual Receptors**

| | |
|---|---|
| **Suitably Qualified Odour Assessor** | The field surveyor for the Silver Street odour assessment has more than 8 years in experience of undertaking ambient air quality assessments and is a member of both the Institute of Environmental Science and of the Institute of Air Quality Management. |
| **Objective methods of measuring odours** | Use of VDI Scale (see TableAQ1-2) |
| **Standard monitoring practices** | Survey transects and sampling locations set out and marked during initial walkover survey and followed during each subsequent assessment using GPS equipment |
| **Standard data collection and reporting forms** | Sample of field sample collection form in Appendix AQ3. |
| **Additional safeguards undertaken** | Odour assessor shall not :<br>• have a cold / sore throat;<br>• be hungry or thirsty;<br>• smoke or consume strongly flavoured food or drink within half an hour of each survey;<br>• consume confectionary or soft drinks for at least half an hour before the survey;<br>• use scented toiletries on the day of the survey;<br>• use any vehicles with deodorisers |

## Appendix AQ2 – Example Field Sample Sheet

| Date: | | Time: | | X Coord | |
|---|---|---|---|---|---|
| | | | | Y Coord | |

**Location Comments**

| | | | |
|---|---|---|---|
| Wind Speed | | Temperature | |
| Wind Direction | | Rainfall | |
| Pressure | | | |

| Sample | VDI (0-6) | Sample | VDI (0-6) | Sample | VDI (0-6) |
|---|---|---|---|---|---|
| 1 | | 11 | | 21 | |
| 2 | | 12 | | 22 | |
| 3 | | 13 | | 23 | |
| 4 | | 14 | | 24 | |
| 5 | | 15 | | 25 | |
| 6 | | 16 | | 26 | |
| 7 | | 17 | | 27 | |
| 8 | | 18 | | 28 | |
| 9 | | 19 | | 29 | |
| 10 | | 20 | | 30 | |

| If >1 VDI > 3 Intensity | Pleasant | Neutral | Unpleasant |
|---|---|---|---|

**Other Comments**

| Odour Strength | Intensity Level | Comments |
|---|---|---|
| No odour / not perceptible | 0 | No odour when compared to a clean site |
| Slight / very weak | 1 | Probably doubt over presence of odour |
| Slight / weak | 2 | Odour present but cannot be described |
| Distinct | 3 | Odour character is barely recognisable |
| Strong | 4 | Odour character is easily recognisable |
| Very Strong | 5 | Odour is offensive, exposure undesirable |
| Extremely Strong | 6 | Odour is offensive, instinct to mitigate against further exposure |

## APPENDIX AQ3 – Full Odour Sniff-test Monitoring Results

| Date | 23rd November 2016 | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Time | 09:50 | 09:58 | 10:05 | 10:13 | 10:18 | 10:23 | 10:29 | 10:35 | 10:42 | 10:50 | 10:58 | 11:05 | 11:11 | 11:17 | 11:24 | 11:29 | 11:35 | 11:41 | 11:46 | 11:52 |
| VDI Results | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 9 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 27 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Maximum Intensity* | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 2 | 0 | 1 | 1 | 0 | 2 | 2 | 1 |
| Average Intensity | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| % Number VDI >3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Odour Exposure | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible |
| Odour Effect | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible |
| Pleasentness | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral |

## Odour Assessment Results: 23rd November 2016

| Date | 1st December 2016 | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Time | 10:35 | 10:43 | 10:49 | 10:55 | 11:00 | 11:05 | 11:10 | 11:15 | 11:20 | 11:25 | 11:30 | 11:35 | 11:40 | 11:45 | 11:50 | 11:55 | 12:00 | 12:05 | 12:10 | 12:15 |
| VDI Results | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Maximum Intensity* | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 1 | 1 | 0 | 2 | 0 | 1 | 1 | 0 | 2 | 0 | 1 | 2 | 1 |
| **Average Intensity** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **% Number VDI >3** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| **Odour Exposure** | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible |
| **Odour Effect** | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible |
| **Pleasentness** | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral |

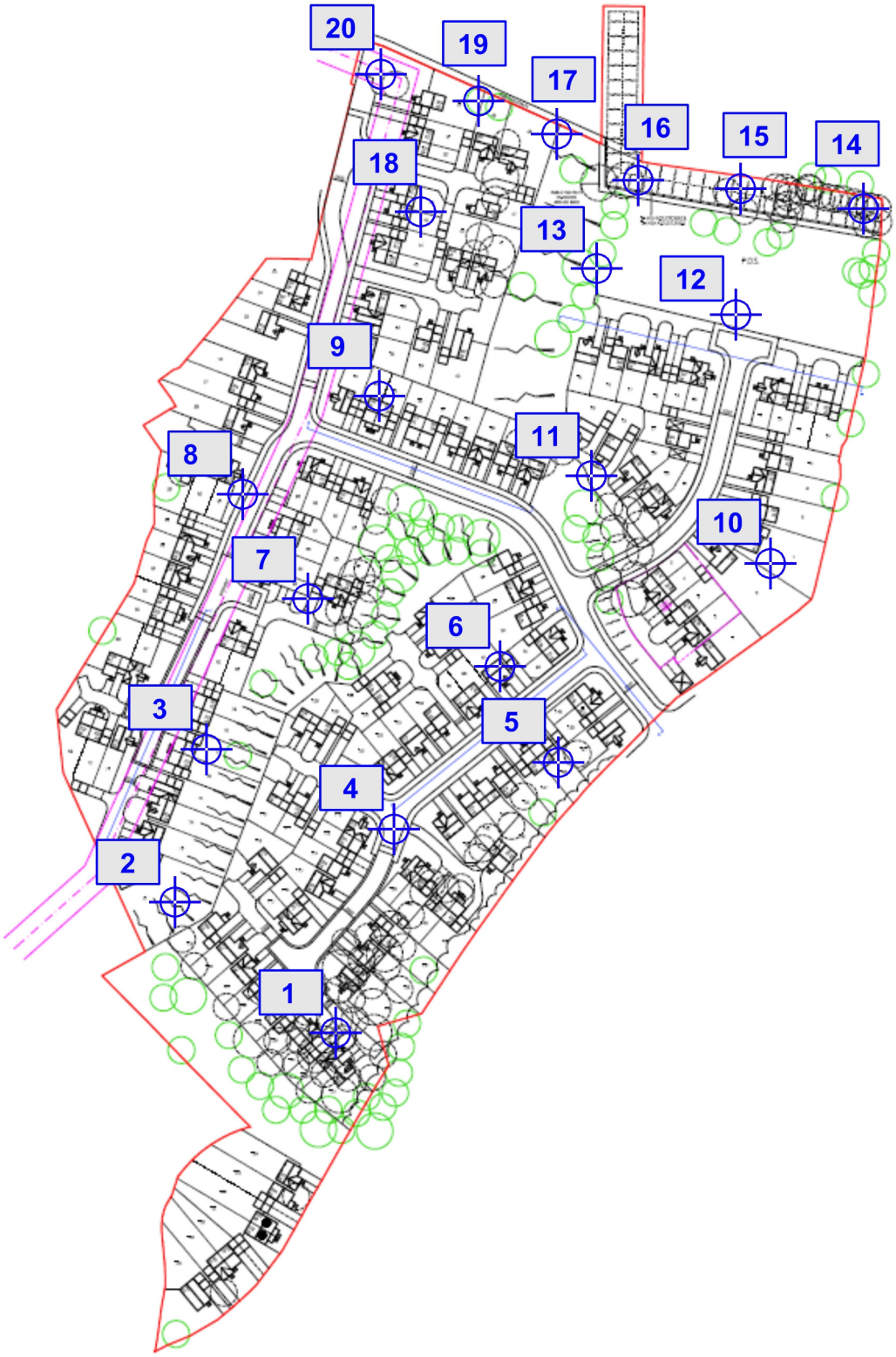
## Odour Assessment Results: 1st December 2016 – AM Assessment Period

| Date | 1st December 2016 | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Time | 12:22 | 12:27 | 12:32 | 12:37 | 12:40 | 12:45 | 12:50 | 12:55 | 13:00 | 13:06 | 13:11 | 13:16 | 13:21 | 13:26 | 13:31 | 13:36 | 13:41 | 13:46 | 13:51 | 13:56 |
| VDI Results | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 14 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 15 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Maximum Intensity* | 1 | 2 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 2 | 1 | 1 | 0 | 1 | 1 |
| Average Intensity | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| % Number VDI >3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Odour Exposure | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible |
| Odour Effect | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible | Negligible |
| Pleasentness | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral | Neutral |

## Odour Assessment Results: 1st December 2016 – PM Assessment Period

## Drawings

**Drawing AQ1 – Odour Sniff Test Assessment Locations**



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