

Land at Ford Airfield. Further Response to Phlorum.

Introduction.

This Technical Note has been prepared by Hoare Lea with the support of Isopleth Ltd following the virtual meeting held on Microsoft Teams on Friday 17th December 2021. The meeting was attended by Hoare Lea, Isopleth Ltd, Barton Willmore, Arun District Council (ADC) and Phlorum to discuss the review of the Hoare Lea odour assessment (ref: REP-1010502-5A-20211019-Ford Airfield Odour-R7) undertaken by Phlorum (ref: Phlorum, Odour Assessment Review, Land at Ford Airfield, Ford, West Sussex, November 2021, Report number 11050) on behalf of ADC and the subsequent response from Hoare Lea (ref: DOC-1010502-5A-CS-20211207-Ford Airfield-Response to Phlorum Odour Review and Southern Water Comments-R2).

This Technical Note provides some further responses to the points raised by Phlorum on behalf of ADC during the virtual meeting.

General Approach.

Phlorum has accepted that the general approach and assessment tools (dispersion modelling, site sampling and offsite odour audits) are appropriate.

Odour Criteria.

Phlorum has accepted that the use of a $C_{98} 1\text{-hour } 30\mu\text{E}/\text{m}^3$ limit criterion is appropriate. This is consistent with the previous view of ADC, as confirmed by Fiona Fitzgerald (Senior Environmental Health Officer, Environmental Health) on 20th July 2021.

Number of Audits and Acuity.

Phlorum has accepted that the number of offsite odour audits (six audits on three separate visits) meets the requirements of the Institute of Air Quality Management (IAQM) Guidance¹ (minimum of three audits). Phlorum has requested confirmation that the audits were undertaken by persons with a defined acuity to odour (BS:EN13725) and the acuity certificates for Matt Stoaling who undertook all six surveys and for Charlotte Smith who assisted during walkover 1 have been provided in Appendix 1 of this Technical Note. As noted in Hoare Lea's previous response, Matt Stoaling has an above average sensitivity to n-butanol, the reference odour used in the standard odour acuity tests, but this does not exclude him from undertaking sniff tests.

Audit Locations.

Odour audits are subject to practical constraints such as weather (wind speed and direction), site operation and access permission. Hoare Lea is in general agreement that it would have been ideal if additional locations (such as directly to the north, where the Grundon Waste Management facility is located) had been accessible.

The land to the south west was only accessible on market day (Thursday) and this would need to have corresponded with low wind speeds (for example $<6\text{m/s}$, 13 mph) from the direction approximately 20° to 50°. These meteorological conditions only occur for 6.3% of the period of the year when odour audits are recommended (April to September). Fortunately, these conditions did occur within sampling the period (Walkover 3) but only once, as would be expected given the low probability.

For all of the reasons given above, the majority (five of six) of the audits were completed on the freely accessible land to the east north east of the Ford Wastewater Treatment Works (WwTW). In relation to the Proposed Development area to the west of the WwTW, the main survey area to the east north east is:

- 1) Closer to the sludge cake sources;
- 2) Equidistant from the Activated Sludge Plant; and

¹ Institute of Air Quality Management (2018) Guidance on the assessment of odour for planning. Available at: <https://www.iaqm.co.uk/text/guidance/odour-guidance-2014.pdf>

3) Further from the odour control (OC) systems (main OC and imported sludge OC).

It should be noted that at no point was odour perceived from the imported sludge OC, even when standing next to the unit. This is understandable given that the odour sampling results for this unit showed a geometric mean outlet concentration of 402 ouE/m³ and flow of 1.7m³/s as detailed in Appendix A of the Hoare Lea odour assessment submitted (ref: REP-1010502-5A-20211019-Ford Airfield Odour-R7). The modelled concentration of 2000 ouE/m³ was subsequently requested by Atkins, Southern Water's representatives.

Odour Audits: Results.

Section 6 of the Hoare Lea odour assessment (ref: REP-1010502-5A-20211019-Ford Airfield Odour-R7) presents the results of the odour audits, with only those locations where the maximum intensity was 4 or above presented in the tables (full results were presented in Appendix E). For each sample location, the average odour intensity (I_{mean}) over the test period is calculated and the maximum intensity observed is noted. Table 3.1 of the Hoare Lea odour assessment, taken from the IAQM Guidance¹, is reproduced below.

Odour Strength	Intensity Level	Comments
No odour/not perceptible	0	No odour when compared to the 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 described using precise words or terms
(barely) Recognisable	3	The odour character is barely recognisable
(easily) Recognisable	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

The average intensity and percentage of time that "recognisable odour" (i.e. scores of 4 or above) must then be compared with the IAQM odour exposure table. During the six odour audits, the following odours were recognisable:

- 1) Activated Sludge Process (ASP)
- 2) Chlorine from the main OC;
- 3) Sludge cake (from the cake storage area).

As noted in the Hoare Lea odour assessment, the stack sampling and odour audit results confirm that the primary odour from the main odour control unit is a chlorine-type odour from the odour control dosing chemicals (hypochlorite). This odour dominated the emission, indicating that the unit is being significantly over-dosed at the present time, something confirmed by the REDOX values on site at the Ford WwTW. This situation is something that Southern Water should resolve, the operation of the unit being highly atypical in our experience. This point was raised with Atkins, Southern Water's representatives during the site visit to the Ford WwTW.

The sludge cake odours were being emitted from open doors on the site. Atkins confirmed on behalf of Southern Water that this was due to a broken door mechanism (due to be fixed) and indeed all doors must be kept shut.

It is important to note not only the audit locations where a valid result was obtained, but also the locations where one was not. For example there were 3 audit locations for Walkover 1 where a valid result was obtained out of 36 locations in total. These audit locations were all downwind of Ford WwTW. As part of Phlorum's review of the Hoare Lea odour assessment, three specific points in relation to the results of the sniff testing were made and were raised again during the virtual meeting on the 17th December 2021. The text below in *italics* has been taken from Phlorum's review of the Hoare Lea odour assessment following which a response has been provided:

'2.30 During walkover/sniff test 1, strong odours could be detected transiently but regularly up to 120m from the WwTW boundary, and at least 300m from the most odorous part of the WwTW, i.e., the main works odour

control unit. The three locations where strong odours could be detected were not the three closest, as is suggested in the report, suggesting that a plume from the OCU might be grounding there.'

Hoare Lea is in agreement with this statement in respect of Locations 21 and 22 (chlorine odour). At location 24 there was an ASP odour 'recognisable' (rather than 'strong') for 60% of the samples at that audit location. In total these 'recognisable' odours were detectable at three audit locations out of the 36 locations surveyed.

'2.31 Nevertheless, there is consistency in the results of the sniff tests (i.e., that the area within 100m of the WwTW to the NW is regularly exposed to strong odours that could be "regarded as 'substantial adverse' for a residential receptor and 'moderate adverse' at a commercial receptor". This area is at least 300m from the most odorous part of the WwTW, i.e., the main works OCU.'

Recognisable odours (i.e. score of 4) were detectable at a total of 60 of 218 audit locations on days which were considered most ideal for odour detection. Chlorine was recognisable in 9 of the 218 samples, sludge cake in 9 samples and ASP in 46 (including all recognisable odours on Walkover days 2 and 3). As such whilst it is agreed that the area within 100m is regularly exposed to 'recognisable' (mainly ASP) odours when the wind is blowing towards that location, there were only very few of the 218 audit locations where chlorine odour was 'recognisable'.

It is agreed however that chlorine odours from the main OCU are indeed detectable on occasion at this distance as a result of the overdosing of the OCU.

'2.32 During sniff test 3, strong odours could regularly be detected along the WwTW southern boundary (locations 5 to 14); however, strong odours quickly dissipated when sampling at locations 22-29, which were circa 70m to the south. The sniff test did not sample at greater distances to the south. It is, therefore, unknown whether odours could be detected at 300m distance from the main OCU, as they could be to the north-east of the WwTW. This is a possibility given the height and design of the OCUs, which would allow odorous air to ground at greater distances from the facility.'

During walkover 3 all of the recognisable odours were from the ASP, which was located approximately 30m from the nearest sampling point. The ASP is a ground level source. Notwithstanding this, it is acknowledged that if any main OCU odours were detectable they may have been in the area not accessible on the day of audit.

As requested by Phlorum in the virtual meeting, contours showing a distance band of 300m from the main OC unit, the sludge import OC unit and the ASP have been produced and overlayed onto the latest parameter plan (provided by Barton Willmore, ref: 23885-RG-123L-Land Use and Density PARAMETER Plan (1-5000@A1)) to provide a visual representation of the distances from the potential odour sources across the Ford Airfield development. These have been provided in Appendix 2.

It is important to note that whilst the full 300m radius is provided, this should not be read as a fixed radius within which unacceptable odour would likely be present. The likelihood of odour at 300m in any direction is informed by meteorological conditions such as wind speed and wind direction. Crucially, within the odour plume identified by the modelling, which incorporates such conditions, there is no residential development proposed within 300m of the main OC unit, sludge OC unit or ASP. Furthermore, where potential residential development is proposed to the west of the WwTW within 300m of the odour sources, wind from the north north east to the east would blow in the direction of these properties. Wind from these directions occurs for approximately 15% of the year based on the 5-year meteorological data set from Shoreham, shown in Figure 5-1 in the Hoare Lea odour assessment and reproduced below. Therefore, the amount of time in which there is potential for unacceptable odour to occur at this location is minimal, and odour complaints are unlikely. Furthermore, as noted above, odours at a distance of 300m were chlorine, as a result of overdosing the main OC unit which indicates the WwTW is not currently operating effectively.

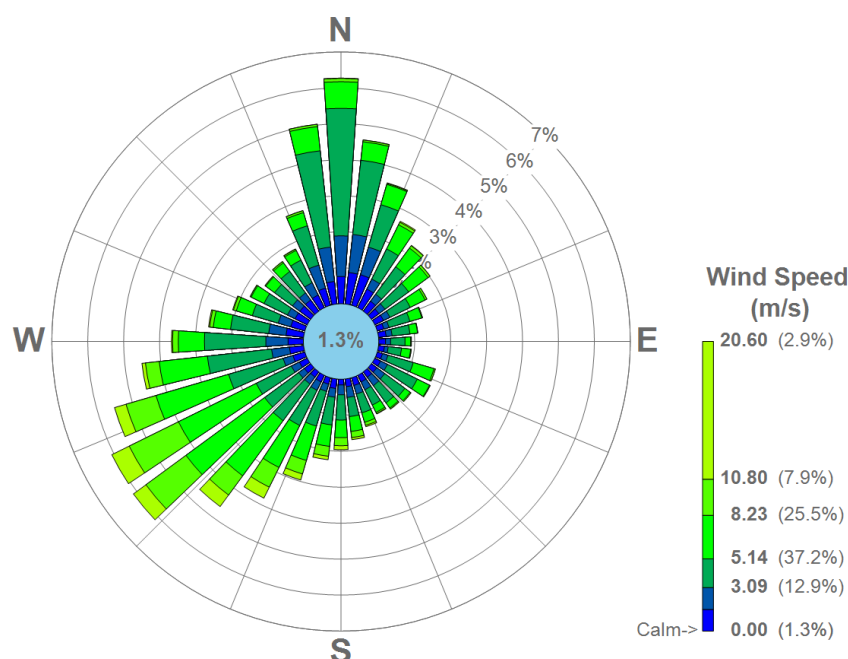


Figure 1: Shoreham Data: Windrose 2013-2017

Odour Audits: Comparison vs Modelling.

A multi-tool assessment approach has been used:

- Odour sampling at source
- Detailed dispersion modelling; and
- Odour audits.

Phlorum has accepted that this general approach is appropriate. However, there remains some disagreement regarding interpretation of the results (i.e. the relative importance of each) in the context of Masterplanning (i.e. for the 'Parameter Plan' that has been produced for the scheme). It remains that odour audits can give a measure of odour at specific locations under the conditions prevailing at the times and days of the sampling, but cannot cover all receptor locations under every meteorological condition over a typical year (i.e. they are 'snapshots'). With unlimited odour audits and access to all land surrounding a site it is clear that a very robust indication of site constraints would be available. Complementing dispersion modelling and odour audits provides greater spatial and temporal coverage and the reasonableness of the estimates from the model can be compared with the observed (i.e. monitored) levels over year(s) and all meteorological conditions, including those where odour audits would not be valid.

For this reason the 'snapshot' of an individual audit, or at a single audit location over a period of 5-10 minutes cannot be directly compared with the C_{98} 1-hour $30\mu\text{E}/\text{m}^3$ limit criterion that results from modelling.

The benefits of the multi-tool assessment approach are particularly to highlight any issues which may not be picked up in the modelling, such as process abnormalities, very short term odour events or detection of odour at distances which significantly differ from those predicted in the modelling. For example, where an audit picks up a transient odour at a distance outside the C_{98} 1-hour $30\mu\text{E}/\text{m}^3$ isopleth it could not be concluded that the model is 'wrong'. Similarly as the dispersion modelling is based on a 98th percentile, the detection of odours during an audit when all of the conditions are ideal for that odour to be detected is not to be unexpected.

For the above reasons:

- Hoare Lea does not consider the odour modelling and odour audits to conflict with each other, providing, as they do, evidence to allow the full picture of short and longer term odour impacts to be determined.

- The Hoare Lea odour assessment does not state that the WwTW itself or the areas within the Parameter Plan will be 'odour free'. The audits show that, assuming that the main OC residual chlorine emissions remain abnormally high and that sludge handling doors are left open in conflict with the WwTW site operational controls, there will be odour offsite. This odour will be from the ASP (which would be considered inoffensive and below the $C_{98,1\text{-hour}} 30\text{UE}/\text{m}^3$ limit) as well as the other two sources should they not be resolved by this point.

The final detailed layout for the Proposed Development must take the findings of the odour modelling and surveys into account, keeping the most sensitive land uses away from the WwTW and siting the less sensitive uses closer to the WwTW. It is clear from the odour audits that odours from the WwTW will be detectable within the Proposed Development area, as concluded in the Hoare Lea report:

'It is recommended that receptors should be sited outside the $C_{98,1\text{-hour}} 30\text{UE}/\text{m}^3$ limit shown on the attached drawings. This is considered to be a reasonable criterion given the nature of the odour from the sources at the Ford WwTW which are not odour controlled (i.e. the aeration lanes and final tanks). This does not mean that residents would never experience odours from the works, rather that this criterion is considered appropriate for a site such as the Ford WwTW.'

Odour Modelling: Meteorological Data.

Phlorum highlighted that the odour model results in an unusually shaped 98th percentile odour isopleth, skewed heavily towards the south west of the WwTW. The Phlorum report states in relation to this that:

'The report recognises the inherent uncertainties in modelling and the input parameters by carrying out extensive sensitivity testing, including the use of an additional 5 years of meteorological data from Thorney Island. This is excellent practice.'

Complaints.

Odour complaints data was obtained from ADC and Southern Water and is summarised in Section 4.1 of the Hoare Lea odour assessment. ADC was not able to provide any location data for the complaints, only stating that they were in postcode areas BN17 or BN18 (see maps in Appendix 3) Alongside this information from ADC was the additional information from Southern Water also summarised in Section 4.1 of the Hoare Lea report, which presents their view that the complaints were related to abnormal process driven issues, the main odour control and the flare not lighting (i.e. biogas release). As these complaints were related to one-off incidents and none of the complaints were verified by ADC, the complaints data does not require further exploration.

Closure.

We trust the explanation above provides the additional clarification required. However, should ADC or Phlorum have any further queries, we would be happy to discuss.

Appendix 1: Odour Acuity Certificates.



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Acuity Test Certificate

Organisation	Isopleth Ltd
Contact	Matt Stoling
Address	Ulverston 53 Englishcombe Lane Bath BA2 2EE
Telephone	01225 356274
Participant Name	Matt Stoling
Date	11/08/2021

Criteria Assessed	Acceptable Range	Participants Results
Average of ITE (10^{ITE})	$20 \leq 10^{ITE} \leq 80$	19.07
Standard deviation of ITE (10^{SITE})	$10^{SITE} \leq 2.3$	1.66

Participants Acuity Result	Not Qualified
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Result clarification:

Acuity testing was carried out in accordance with standard BS EN 13725:2003 'Air quality – Determination of odour concentration by dynamic olfactometry'. The test was carried out over one day, which is the only variation to the standard.

Assessor Matt Stoling did not qualify as a panel member because of a high sensitivity to the reference material n-butanol which fell outside the defined bandwidth according to BSEN 13725 guidelines; although the repeatability of his responses resulted in a standard deviation that was below the limit specified.

Scott Martin

Laboratory Manager





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Acuity Test Certificate

Organisation	Hoare Lea
Contact	Charlotte Smith
Address	Royal Exchange Manchester M2 7FL
Telephone	0161 834 4754
Participant Name	Charlotte Smith
Date	14/12/2020

Criteria Assessed	Acceptable Range	Participants Results
Average of ITE (10^{ITE})	$20 \leq 10^{ITE} \leq 80$	35.15
Standard deviation of ITE (10^{SITE})	$10^{SITE} \leq 2.3$	2.20

Participants Acuity Result	Qualified
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Result clarification:

Assessor Charlotte Smith qualified as a panel member as her sensitivity to the reference material n-butanol fell within the defined bandwidth according to BSEN 13725 guidelines; also the repeatability of her responses resulted in a standard deviation that was below the limit specified.

Acuity testing was carried out in accordance with standard BS EN 13725:2003 'Air quality – Determination of odour concentration by dynamic olfactometry'. The test was carried out over one day, which is the only variation to the standard.

Amber Simm

Laboratory Manager



Appendix 2: Distance Buffers from Odour Sources at the Ford WwTW.



Figure 2: 300m Radius from the Main Odour Control Unit. Parameters Plan provided by Barton Willmore (ref: 23885-RG-123L-Land Use and Density PARAMETER Plan (1-5000@A1)). Contains Ordnance Survey Data © Crown Copyright 2022.

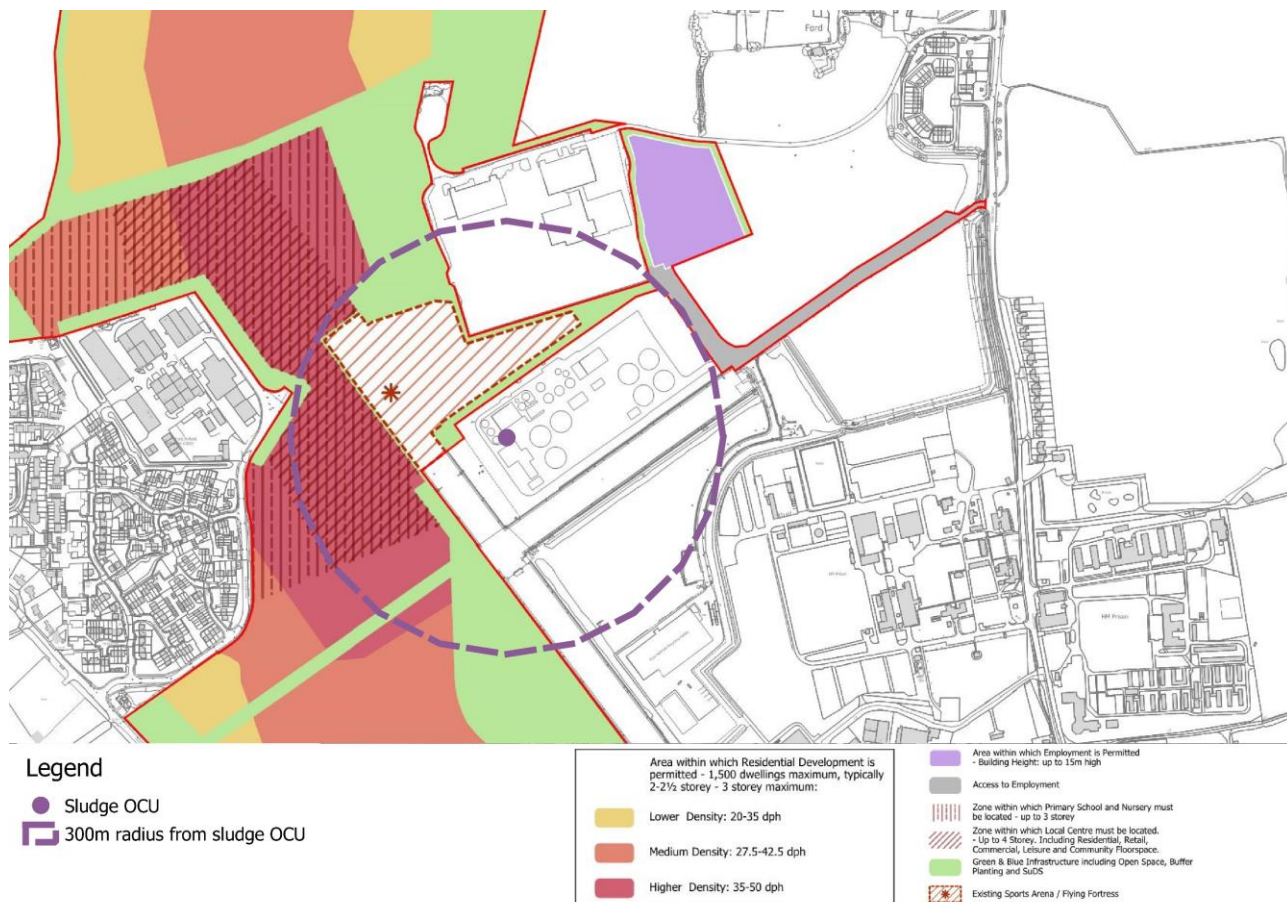


Figure 3: 300m Radius from the Sludge Odour Control Unit. Parameters Plan provided by Barton Willmore (ref: ref: 23885-RG-123L-Land Use and Density PARAMETER Plan (1-5000@A1)). Contains Ordnance Survey Data © Crown Copyright 2022.

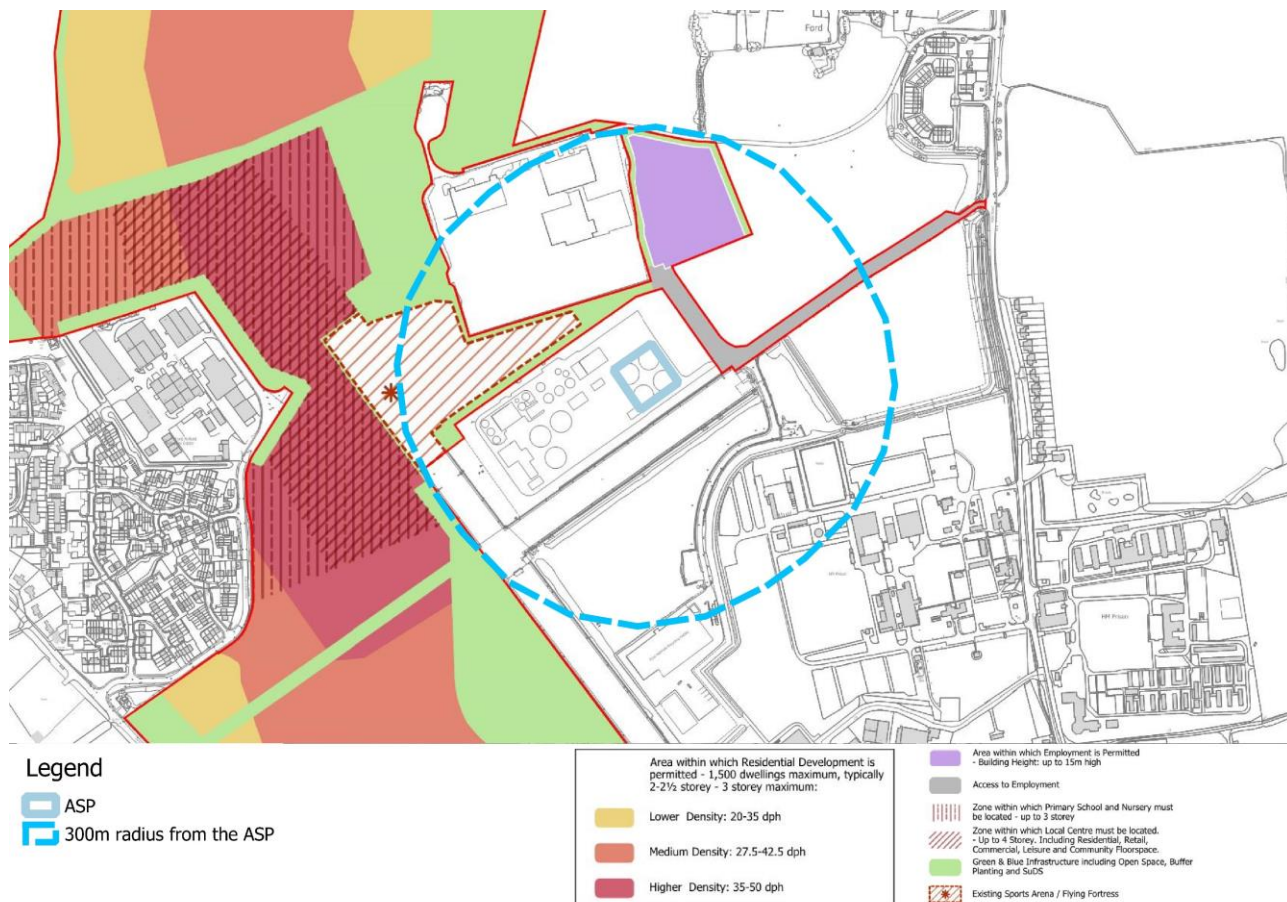


Figure 4: 300m Radius from the Activated Sludge Process. Parameters Plan provided by Barton Willmore (ref: ref: 23885-RG-123L-Land Use and Density PARAMETER Plan (1-5000@A1)). Contains Ordnance Survey Data © Crown Copyright 2022.

Appendix 3: Complaints Postcode Areas.

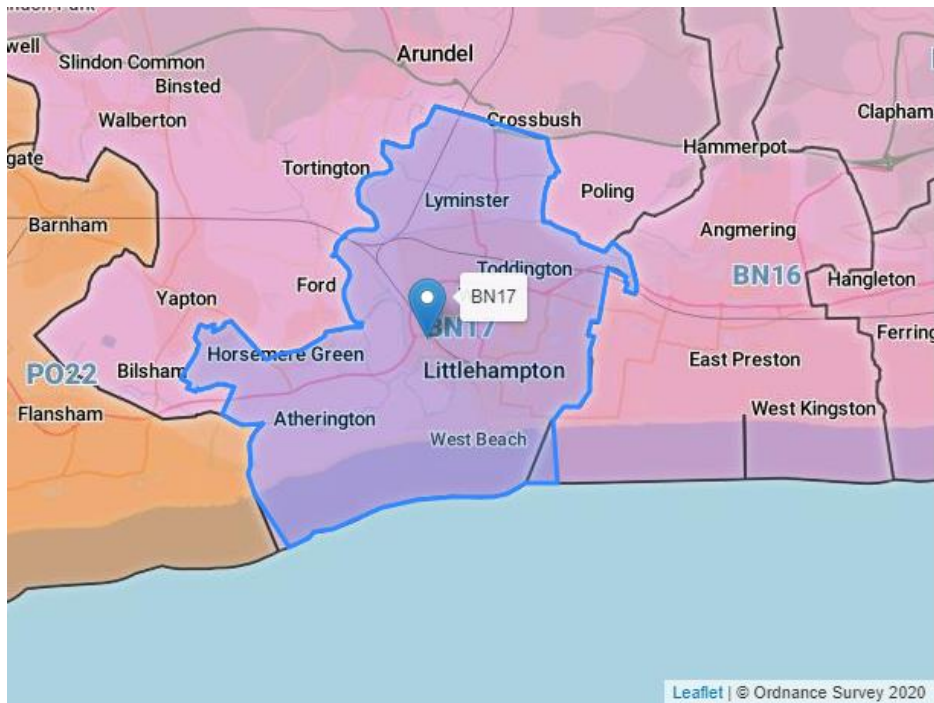


Figure 5: BN17 Postcode Area. Contains Ordnance Survey Data © Crown Copyright 2022.

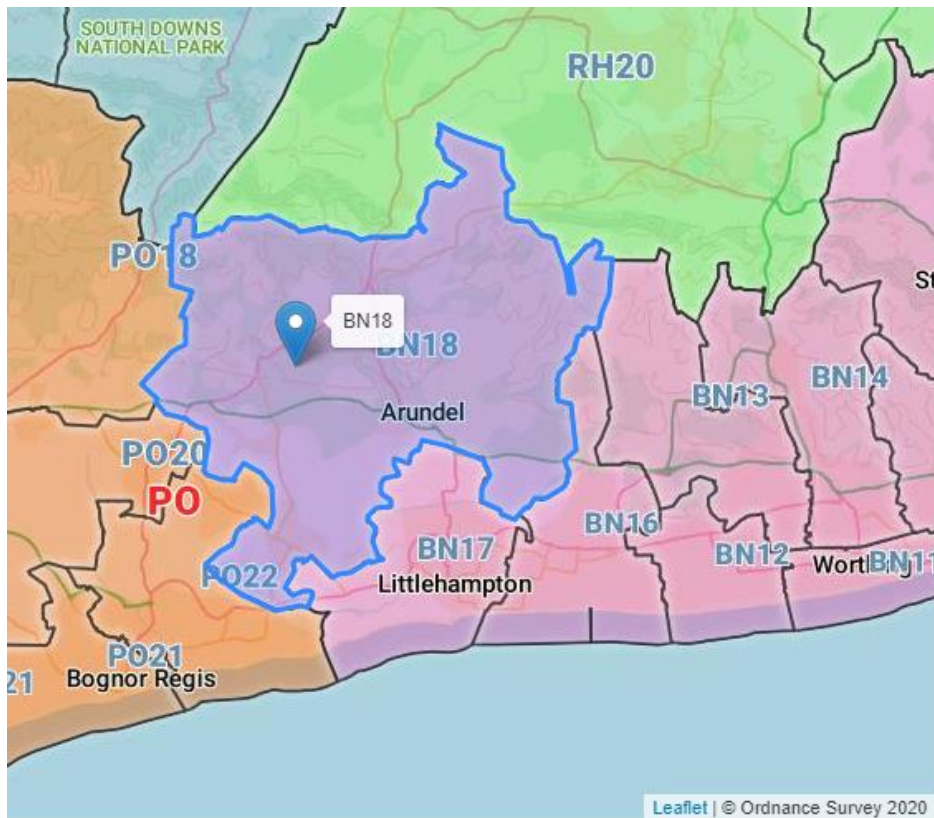


Figure 6: BN18 Postcode Area. Contains Ordnance Survey Data © Crown Copyright 2022.