

Cambridge Waste Water Treatment Plant Relocation Project



Preliminary Environmental Information
February 2022

Odour

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Environmental Information Paper: Odour

Summary

We recognise that odour from the operation of the proposed Waste Water Treatment Plant (WWTP) is a key stakeholder concern and that odour can have a notable effect on wellbeing and amenity. In response to this concern, steps have been taken to embed odour mitigation into the design of the proposed WWTP with the intent to reduce odour releases at source. These mitigations are in accordance with best practice and include covered processes and effective odour management systems. Management of odour at the proposed WWTP will be strictly controlled through an Odour Management Plan, required under the Environmental Permit for the site. We have also committed to, at worst, a 'negligible' effect on all known receptors from odour impacts, as defined by the Institute of Air Quality Management (IAQM).

The potential for odour impacts during the decommissioning activities at the existing Cambridge WWTP and Waterbeach Water Recycling Centre (WRC) and commissioning activities at the proposed WWTP will be mitigated through the odour control management systems currently in place at the existing Cambridge WWTP and Waterbeach WRC and those included within the incorporated design at the proposed WWTP. These processes would be temporary, so the potential for odour release would be limited. The Environmental Permits will also regulate odour from the existing Cambridge WWTP and the proposed WWTP during the decommissioning and commissioning processes.

The location of the proposed WWTP means that there are few dwellings which could be affected by odour nearby; preliminary odour modelling we have undertaken for the design proposals shows that the effect of operation on sensitive receptors is expected to be 'negligible' and therefore the overall effect would not be significant.

Document purpose

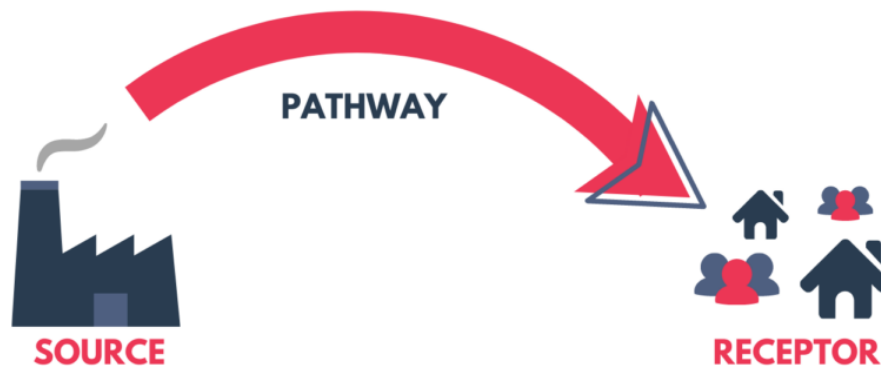
This information paper describes the potential changes in odour associated with the construction and operation of the relocated waste water treatment plant ('Proposed WWTP'). The paper sets out the preliminary findings of the odour assessment, comprising a review of the existing environment and identification of potential impacts. It sets out how we intend to develop our proposals to avoid and minimise odour impacts including how the final assessment will be completed and how it takes into account the requirements of the National Policy Statement (NPS) for Waste Water (section 4.3).

The Environmental Information Papers for **Air Quality**, **Community** and **Recreation** should also be referred to.

Overview of odour sources in the study area

Odour is created by chemicals that interact to produce a smell that people can detect. Odours can be pleasant, neutral or unpleasant (the unpleasantness or pleasantness of an odour is also known as the 'hedonic tone') depending on the type of odour and the person who is experiencing it. Odour is subjective and whilst a certain smell might cause an annoyance for one person, it may not for another.

In order for odour exposure to occur and cause an effect, all three links in the source-pathway-receptor model (**Figure 1**) must be present.



Source: Olfasense

Figure 1: Source-pathway-receptor model

The impact of an odour on a receptor also relies on numerous factors, such as:

- frequency of exposure to odour
- strength/intensity of the odour
- duration of exposure to odour over time
- the character/unpleasantness of the odour (hedonic tone)
- location of the odour, whether it can be expected in a location

We have considered our development proposals in the context of odour, in doing so we have identified:

- existing odour sources at the location of the proposed WWTP and the surrounding area
- existing odour conditions in the surrounding area
- receptors that are sensitive to odour close to our development proposals, up to a maximum distance of 3km
- new odour sources introduced by the Proposed Development

Our Proposed Development is located in a semi-rural location to the north-east of Cambridge, where existing agricultural practices could be expected to cause intermittent odours. The River Cam has the potential to produce odour through natural decomposition processes, although this is expected to be low and intermittent. Existing odour in the wider area is generally not an issue, however there are some localised areas close to the existing Cambridge WWTP that experience intermittent odours from the operation of the existing Cambridge WWTP. The Waterbeach Waste Management Park and the Milton Landfill also

have the potential to generate odour of a similar hedonic tone to the proposed WWTP. Preliminary modelling for the proposed WWTP (detailed in the below sections) illustrates that odour effects will be unlikely to extend beyond 600m from the Draft Scheme Order Limits; when compared against historical odour modelling undertaken for the existing Cambridge WWTP there was no overlap of the contours of odour effects for both WWTPs. Although modelling has not been undertaken for the Waterbeach Waste Management Park and the Milton Landfill, the odour potential from these sites would be similar to that of the existing WWTP; as these sites are over 2km from the Proposed Development, further than the existing Cambridge WWTP, it is unlikely that they would cause a combined effect. For further information, please refer to the section below: *How will the proposed relocation of the Cambridge Waste Water Treatment Plant change odour during operation?* The above odour sources are identified in **Figure 2**.

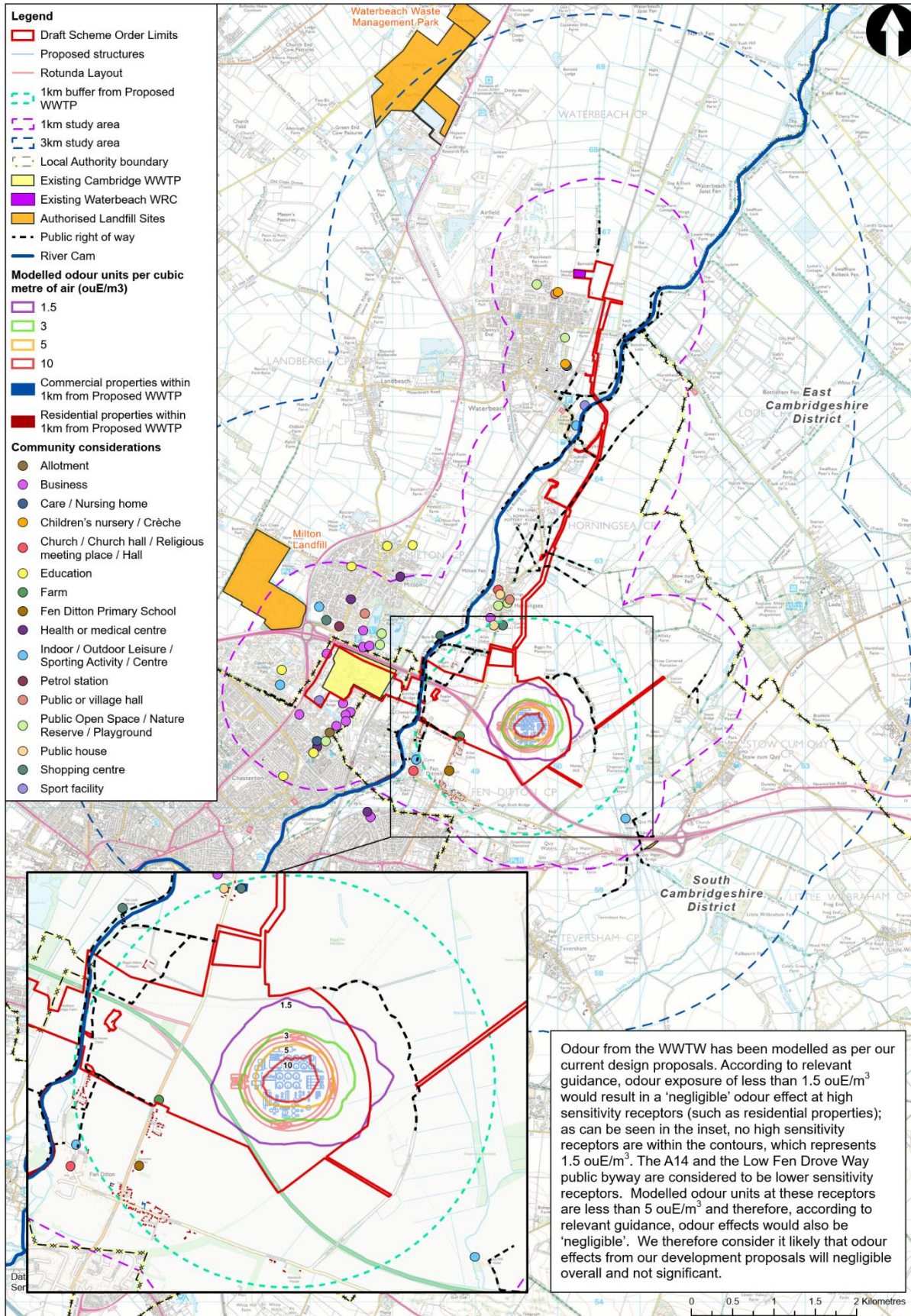


Figure 2: Predicted odour concentration contours for the proposed WWTW

Places that may be sensitive to odour include places where people spend long periods such as homes, schools and workplaces. They can also include places where people spend shorter periods such as shops or places of recreation like footpaths, parks and play areas.

A wind rose for Cambridge Airfield (with missing data supplemented from RAF Mildenhall¹ for 2020) is presented in **Figure 3**; this illustrates that the prevailing wind direction is south westerly. The majority of potential receptors, located to the west in Cambridge and to the north in Horningsea, are not located downwind of the proposed WWTP. Odour would therefore be blown away from most receptors during the most dominant conditions.

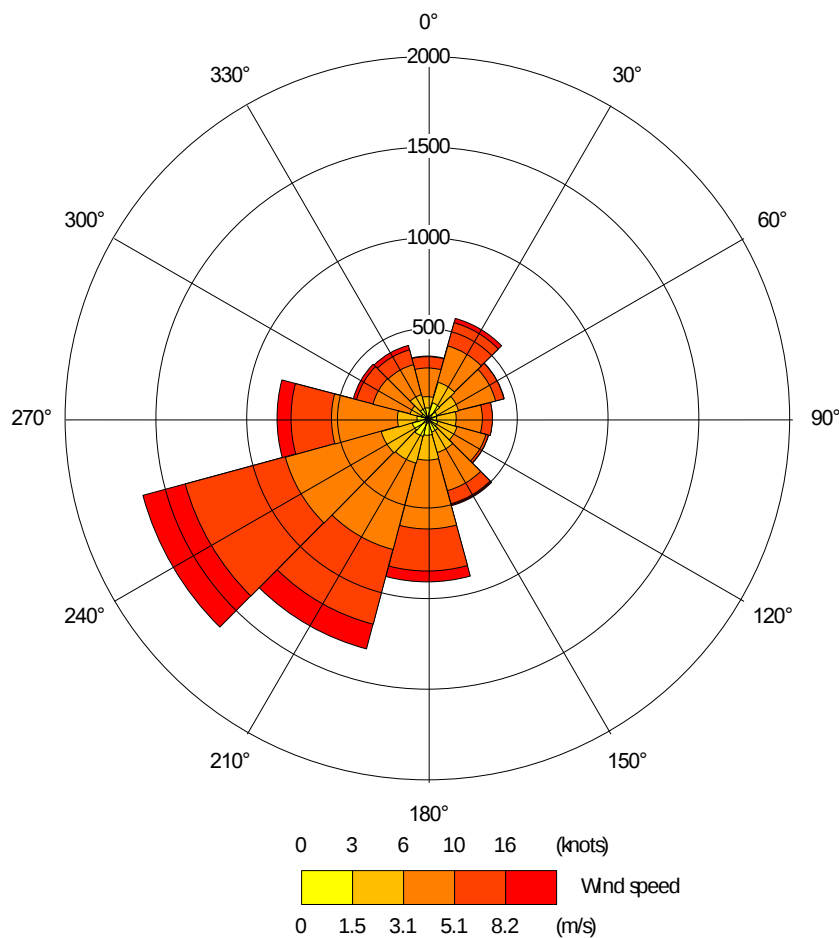


Figure 3: Wind rose for Cambridge Airfield and Mildenhall (2020)

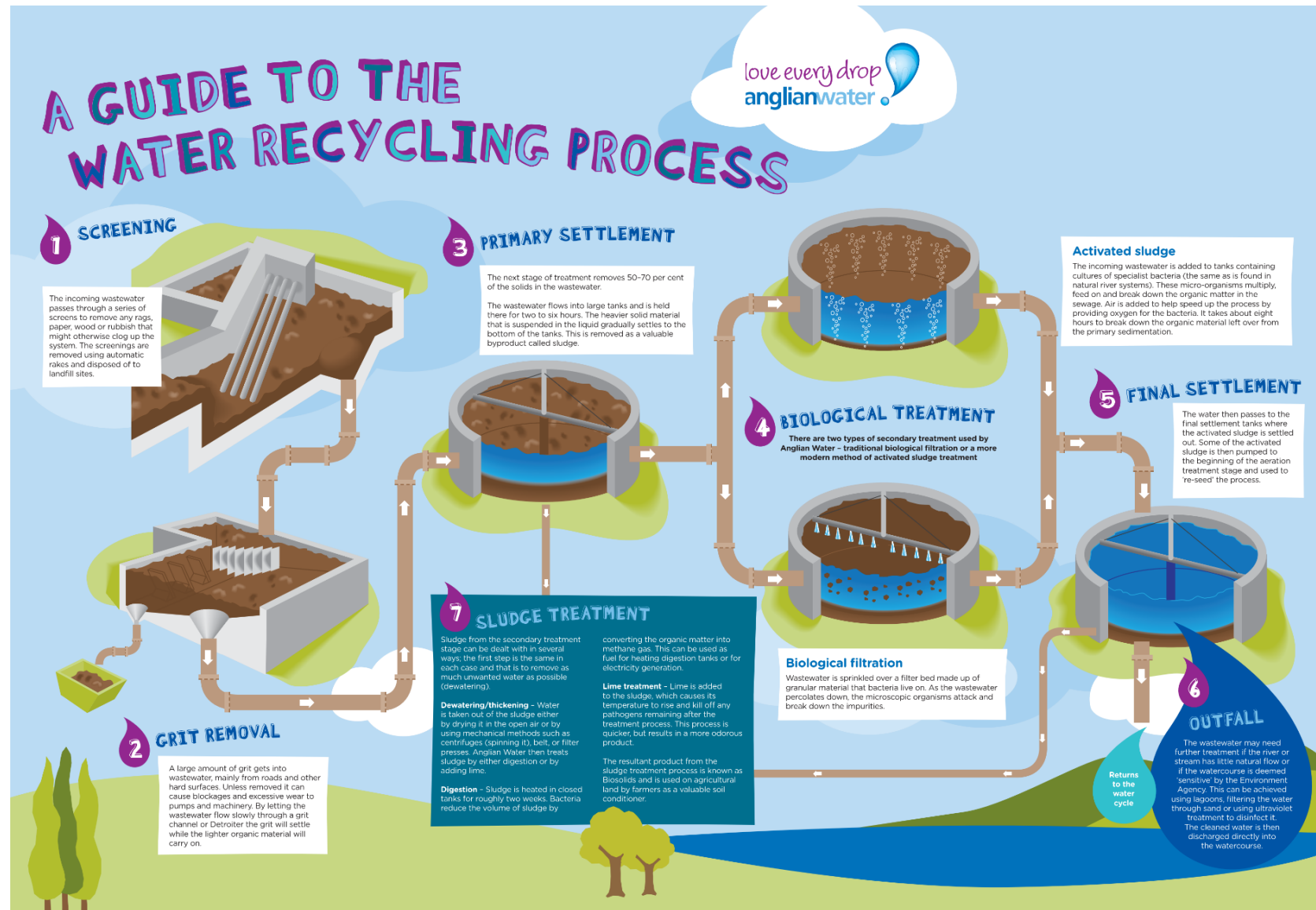
Our Proposed Development has the potential to cause odour, primarily in the operation of the proposed WWTP due to the reception of waste water and from the processes used to treat it. This includes the treatment of sludge (solids removed from the waste water) which is processed using biological treatment (also called digestion, see Box 7 in **Figure 4**). Biological treatment encourages bacterial activity and works to decompose substances within the waste water. This releases odorous gases such as hydrogen sulphide (H₂S), which

¹ No night-time data is available for Cambridge Airfield, so data for Mildenhall (the next closest meteorological site) has been patched into the data to provide night-time values.

smells similar to rotten eggs and gases such as ammonia (NH_3) and volatile organic compounds (VOCs).

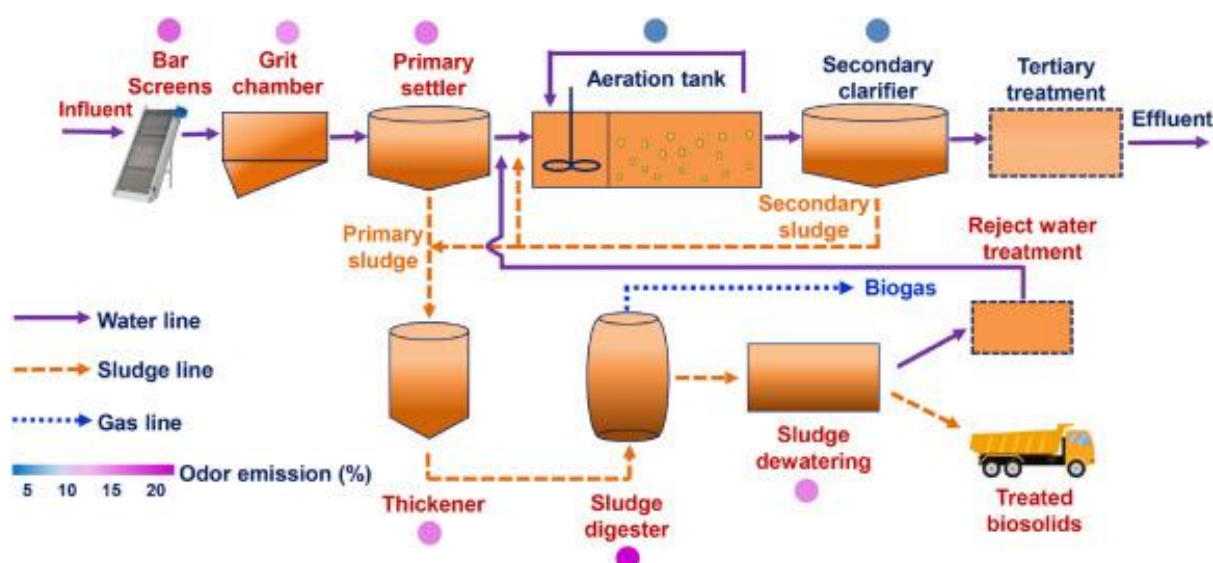
When these gases are produced in the sludge treatment phase, they are captured along with other gases, which are collectively referred to as 'biogas'. The biogas then can be combusted in onsite energy plant to make energy, or the biogas can be treated and input into the national gas grid. A summary of the waste water treatment process is provided in **Figure 4**.

The unmitigated potential for release of odour to air varies as the treatment process progresses, as is shown in **Figure 5**. As demonstrated within the figure the areas of the highest risk are at the start of the treatment process at the Bar Screens and towards the end of the process from the Sludge Digester.



Source: Anglian Water

Figure 4: Guide to the water recycling process



Source: Fan, F. et al, 'Application of activated sludge for odor control in wastewater treatment plants: Approaches, advances and outlooks' ScienceDirect. Accessed: <https://www.sciencedirect.com/science/article/abs/pii/S0043135420304528>

Figure 5: Odours from waste water treatment

Odour is one of the main areas of concern from stakeholders that has emerged through the consultation process. Avoiding and minimising odour effects to stakeholders has been one of our primary considerations when designing the proposed WWTP. Whilst we recognise that waste water and sludge treatment can be odorous processes if unmanaged, developments in treatment and abatement technology, and the way waste water treatment facilities are operated and managed means that the impacts from odour can be mitigated so that the effects to people are reduced.

We have committed to a 'negligible' effect from odour impacts on all known receptors, (negligible as defined by the Institute of Air Quality Management (IAQM) (see Table 7 of the IAQM odour guidance²)). Guidance from the IAQM provides best-practice methods for assessing odour for planning applications. The guidance provides several methods for the assessment of odour and emphasises the importance of combining assessment tools where possible to minimise uncertainty and increase confidence in the results. This is how we will approach the odour assessment in the Environmental Impact Assessment (EIA).

How will the proposed relocation of the Cambridge Waste Water Treatment Plant change odour during construction?

Normal construction activities that will be undertaken for the Proposed Development, such as earthmoving, construction of infrastructure and movement of materials will create

² Table 7 provides the odour effect descriptors for "Moderately Offensive" odours. 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".

minimal odour, as is the case for construction activities associated with other infrastructure projects.

Odour may be released when we connect the new transfer tunnel to the existing sewer network and when the existing waste water flows are diverted to the proposed WWTP during construction. The action of opening up existing sewers to the open air may result in new odour releases which may be smelt at nearby receptor locations. Any odour releases would be temporary and would occur for no more than 4 weeks in total in each location. This activity would release odours primarily from fresh sewage which has had less time to decompose and is less odorous, so the potential for odour impacts is considered to be low. The likely odour effect would be, at worst, 'negligible' at the nearest receptor locations, due to the short duration of any effects. Nevertheless, we will mitigate the risk of odour through an air extraction system and a mobile odour filtration unit located adjacent to the sewer shafts. For details on mitigation please refer to the section below *How will we manage the proposed relocation of the Cambridge Waste Water Treatment Plant to avoid or moderate the potential for odour?*.

The shutdown and 'decommissioning' of waste water processes at the existing Cambridge WWTP and existing Waterbeach WRC may lead to temporary odour emissions at these locations. Decommissioning activities will likely include the draining down, cleaning and dismantling of waste water storage tanks and equipment and disposal and treatment of any waste that could not be transferred to the proposed WWTP. The odour control measures at the existing Cambridge WWTP and existing Waterbeach WRC will remain in place to minimise any impacts and a decommissioning plan will also be implemented to control odour during decommissioning activities not covered by the existing odour control measures, such as cleaning of tanks and removal of sludge (further detail on this is provided below). With these mitigation measures in place, odour effects during decommissioning are anticipated to be similar to current conditions at the existing Cambridge WWTP and Waterbeach WRC and would not cause new odour effects at receptors.

Once the proposed WWTP is fully constructed and installation complete, the start-up ('commissioning') phase will begin. After the equipment has been tested electrically and mechanically ('dry commissioning') to ensure everything is working correctly, the process and equipment will be tested with waste water ('wet commissioning'). During this process the tanks are filled, gradually loaded with waste water and the plant can go into operation. Wet commissioning of the proposed WWTP may therefore lead to the creation of odour emissions during the introduction of sludge, taken from the existing Cambridge WWTP (this process is called 'seeding') is put into process tanks and undergoes sludge treatment at the proposed WWTP. Odour control systems will be in place to mitigate this (please refer to the section below *How will we manage the proposed relocation of the Cambridge Waste Water Treatment Plant to avoid or moderate the potential for odour?*).

We expect there to be a period of approximately 17 months where the commissioning and decommissioning activities may occur in parallel. The odour control mitigations included within the proposed WWTP design will be operational during commissioning and are expected to mitigate odour during commissioning activities as they would during normal

site operation at the proposed WWTP; it is anticipated that odour effects will therefore be negligible, in line with our consultation commitments.

How will the proposed relocation of the Cambridge Waste Water Treatment Plant change odour during operation?

There is potential for odour from the operational processes of the proposed WWTP, however through embedding mitigation measures into the design and implementing appropriate management, the odour effect will be 'negligible'. Further detail on the design measures that we are proposing and have been carefully considered to reduce odour impacts are described in the mitigation section below.

In addition to normal operational processes on the Proposed Development site, odour has the potential to be produced during operation from other sources which include:

- the transfer tunnel from the existing Cambridge WWTP to the proposed WWTP,
- sewer air valves within the Waterbeach pipeline (which are located below ground under manhole covers),
- ancillary activities associated with the project, for example, the transport of sludge, and
- abnormal operations such as accidents or emergencies.

Emissions from sources from abnormal operations have not yet been assessed but they will be considered within the ES.

A preliminary odour assessment of the Proposed Development site during normal operation has been undertaken and this has been used to help inform the design. The assessment has been undertaken using computer modelling³ based on the current design proposals. The computer modelling for odour will be updated as part of the Environmental Statement (ES) once our design proposals are finalised. The modelling undertaken has been used to produce our preliminary assessments and ongoing design, to capture the realistic worst-case odour scenario. We have:

- modelled all potentially odorous on-site sources under normal operation, regardless of the magnitude or nature of the odour omitted from them,
- modelled five years of historical meteorological data to cover a large range of weather conditions and reported on the worst-case year, and
- analysed the meteorological data used in the assessment against Numerical Weather Prediction data; both weather data sources were modelled to confirm that the odour results correlated and use of the meteorological data is robust.

The modelling has considered a number of scenarios and the worst-case model results are presented as odour contours in **Figure 2**. The odour contours indicate what the concentrations of odour will be in odour units per cubic metre ($\text{ou}_\text{E}/\text{m}^3$) around the

³ The AERMOD dispersion model.

Proposed Development, taking into account releases from the process and local weather conditions.

According to the IAQM guidance (set out within Table 7 of the IAQM odour guidance⁴), odour exposure of less than 1.5 ouE/m³ would result in a 'negligible' odour effect at high sensitivity receptors such as residential dwellings and schools. **Figure 2** shows that high sensitivity receptors would experience an odour concentration of less than 1.5 ouE/m³, so the effect at these locations would be described as 'negligible' and not significant.

Low sensitivity receptors are described in the IAQM guidance as locations where people would only be expected to be present for a short time and the enjoyment of amenity would not reasonably be expected. Examples of such receptors are footpaths, roads and farms. Low sensitivity receptors where the odour exposure is less than 5 ouE/m³, are considered to also be 'negligible' (as shown in Table 7 of the IAQM odour guidance⁴) and not significant. This is the case for the A14 and the Low Fen Drove Way public byway which are not predicted to experience an odour concentration above 3.0 ouE/m³. The proposed walking and cycling pathway within the Landscape Masterplan, located to the northeast of the proposed WWTP, is also likely to experience a 'negligible' odour effect during operation of the proposed WWTP.

Based on the initial modelling that has been undertaken, we consider it unlikely that odour released from the existing Cambridge WWTP, the Waterbeach Waste Management Park or the Milton Landfill would act in combination with odour from the proposed WWTP to produce a cumulative effect. The preliminary modelling indicates that odour effects will be limited to within 600m of the Proposed Development. A review of the 2018 odour assessment report for the existing Cambridge WWTP⁵ has been undertaken which confirms that the odour contours from the existing Cambridge WWTP are unlikely to overlap those from the proposed WWTP (**Figure 2**). The existing Cambridge WWTP is 1.4km away from the proposed WWTP. The Milton Landfill and Waterbeach Waste Management Park are at a distance of 2.4km and 6.5km respectively, so there is minimal likelihood of overlap of effects. It is also worth noting that the existing Cambridge WWTP and the proposed WWTP will not be operating at full capacity in parallel, as the proposed WWTP will replace the existing one. Once the existing WWTP is fully decommissioned, this will effectively remove this odour source, which is located in an area with numerous receptors nearby.

The final output of waste water treatment is the release of the cleaned effluent back into the water cycle. Treated effluent from the proposed WWTP will be released into the River Cam; the outfall will be located to the north of the A14, over 200m from the nearest property. As this water has been fully treated to remove sludge, the odour potential of this

⁴ Table 7 within the IAQM Guidance on the assessment of odour for planning, provides the odour effect descriptors for "Moderately Offensive" odours. This 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'.

⁵ Odournet UK Ltd. 2018. Odour impact assessment for Cambridge Water Recycling Centre.

effluent is low, and the odour effect would likely be ‘negligible’ and not significant. No further mitigation is considered necessary on this basis.

When we complete the odour assessment for EIA, an additional source-pathway-receptor risk assessment will also be undertaken in addition to updating the dispersion modelling. By undertaking this risk assessment and by doing computer modelling we will be following the approach set out in the IAQM ‘Guidance on the assessment of odour for planning’ in using multiple assessment tools to provide a robust overall assessment.

As well as existing and proposed receptors, committed developments and specific developments detailed in the South Cambridgeshire Local Plan will also be included within the assessment where relevant, to confirm that any future receptors will also not experience significant effects from odour as a result of our development proposals.

How will we manage the proposed relocation of the Cambridge Waste Water Treatment Plant to avoid or moderate the potential for odour?

We recognise that odour is of particular concern for people that live or work near to the area affected by the proposed WWTP. The control of odour has been a fundamental consideration during the design process for the Proposed Development. The control of odour relates to the siting and design and ultimately how we intend to operate the proposed WWTP.

The **PEI Introductory Paper** explains how the Development Consent Order (DCO) will place an obligation on us to deliver mitigation. Mitigation will be secured through the requirements of the DCO, which grants permission of the Proposed Development to be built. Furthermore, our activities would be subject to specific regulations for some activities in construction as well as the Environmental Permits required for us to be able to operate. The control of odour is one element that will be subject to specific permit conditions.

This section sets out our proposed mitigation for odour.

In construction

Secondary mitigation (foreseeable)

Best practice mitigation such as good housekeeping and cleaning on site, will reduce the likelihood of odour effects at nearby receptors during normal construction activities; the outline of our **Code of Construction Practice (CoCP)**, included within the mitigation information as part of the PEI, will provide more information on how we intend to manage our activities during construction and decommissioning.

The main potential sources of odour during construction will come from the commissioning and decommissioning processes, rather than from physical construction works. To minimise odour during commissioning of the proposed WWTP, the odour ventilation and treatment processes designed to reduce odour during operation will be fully operational. Any sludge that is required to begin biological treatment will be delivered in sealed tankers and pumped into the tanks through a closed process, reducing the likelihood of odour release.

During the decommissioning process at the existing Cambridge WWTP, tanks will be drained through the existing treatment process as far as reasonably practical. The digestion process relies on tanks being full to overflow the waste water into the next stage of the process, so unavoidably some sludge will remain in the digesters at the end of decommissioning that is not fully digested and will require further treatment. Any residual sludge within the primary settlement tanks, aeration tanks or final settlement tanks that cannot be pumped to the sludge treatment process will be removed via suction pump and either taken offsite for treatment or treated onsite via a process such as a quick lime dosing plant. These processes would be sealed; however, when dosing with lime the resulting sludge cake (also known as biosolids, please see **Figure 4** for more information) would be odorous. The sludge cake will be stored on site for as little time as possible and odour suppression equipment, such as fogging/misting systems, will be used where appropriate to minimise any offsite impacts. These decommissioning processes will require relatively short interventions so the potential for odour release would be limited.

Tertiary mitigation (inexorable - regulation)

In addition to the requirements of the CoCP, construction will also be subject to specific regulatory requirements. Those of relevance to odour are:

- the regulatory control mechanisms within the Statutory Nuisance provisions of Environmental Protection Act 1990
- pollution control regimes under the Environmental Permitting (EP) Regulations

In operation

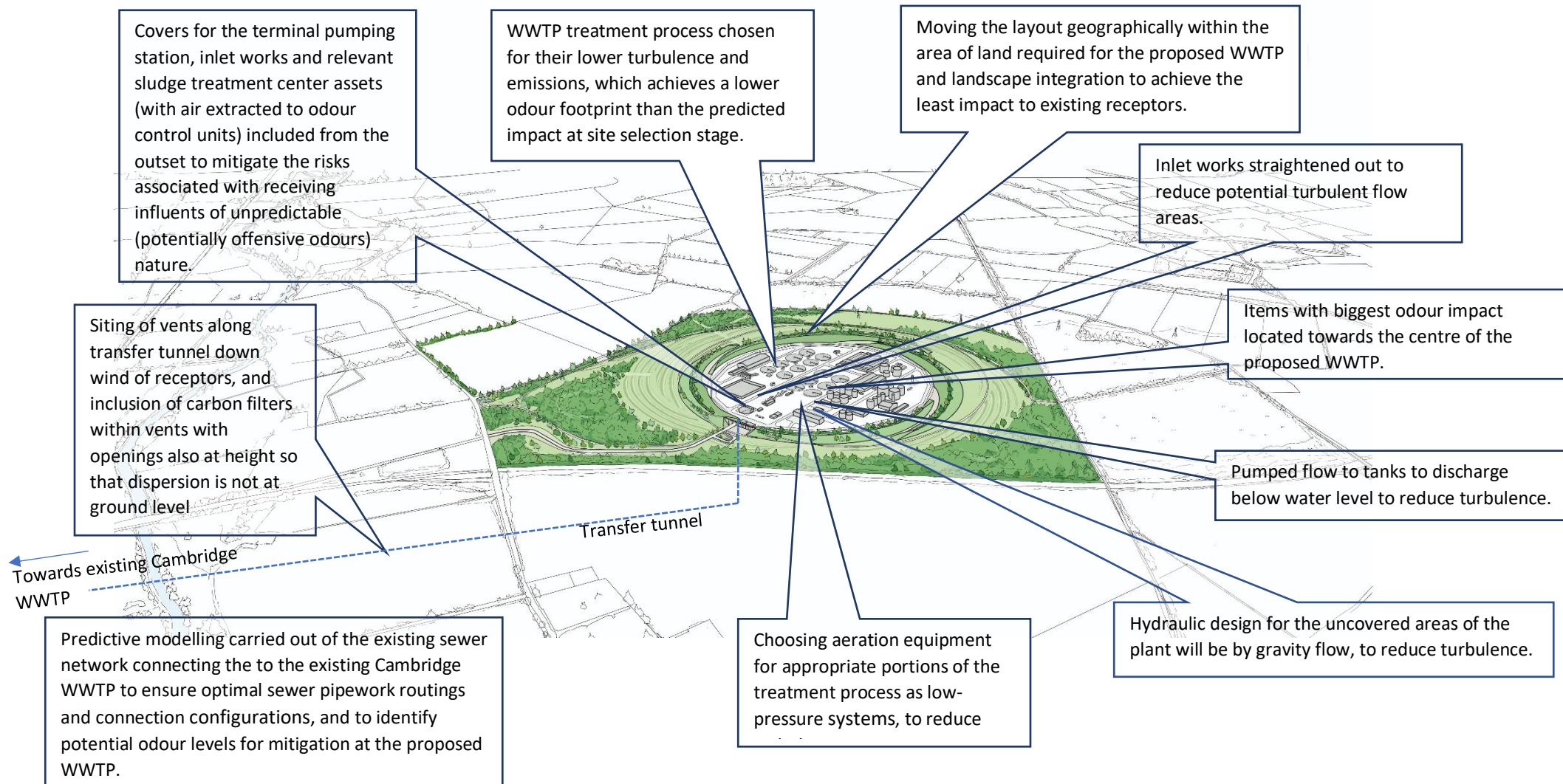
Primary mitigation (embedded mitigation)

The mitigation measures included within the design intended to avoid or reduce odour emissions during operation include:

- selecting 'low odour' processes and technologies,
- selection of a site for the proposed WWTP in an area furthest away from people and ecological receptors,
- locating processes with treated effluent (which has unoffensive odours) near the boundary and odorous processes nearer to the centre of the proposed WWTP
- reducing turbulence in the process to minimise odour dispersion (more turbulence can result in more odour),
- designing odour control facilities (which are considered critical equipment) to operate continuously in all conditions. Their power supply will be protected, and standby equipment will be brought online automatically should equipment fail,
- installing an odour control plant within the Sludge Treatment Centre to mitigate odour impacts. This is likely to comprise bio trickling filters followed by an activated carbon polishing unit,
- covering of reception areas, such as the Terminal Pumping Station, Inlet Works and Sludge Tanks and the air from these areas vented through the odour control plant,
- reducing the overall footprint of the inlet works, primary tanks and sludge tanks so it covers a smaller area,

- using computer modelling to inform the design and effectiveness of mitigation,
- diverting excess stormwater flows to the stormwater storage and treatment plant to avoid discharge of raw sewage, and
- inclusion of carbon filters within vent shafts and siting the vent shaft emission point at height to maximise dispersion.

An infographic presenting the intended areas for minimising odour at source at the proposed WWTP can be seen in the **Phase Two Community Consultation Leaflet (June 2021)**. This has been updated and is shown in **Figure 6** below.



Source: RMA, @One and MottMacDonald

Figure 6: Operational odour mitigation summary

The operation procedures of the proposed WWTP will be clearly defined and include integrated odour management measures. During operation, sludge will be imported to the proposed WWTP; all imported sludge will arrive via sealed articulated tankers and pumped into reception areas that will be covered, as detailed above. Processed sludge cake will be 'dewatered' and digested using biological treatment, which reduces the potential for odour (see **Figure 4**). The dried sludge cake will be transported away from the site in articulated skips with a pull-over cover used during transit.

A tunnel will be built to transfer and divert waste water from the existing Cambridge WWTP to the proposed WWTP. In the case of potential odour from the ventilation shafts associated with the transfer tunnel, the design, location and height of vents will be modified to mitigate against odour impacts where possible, and a suitable maintenance regime will be put in place to minimise the potential for odour. Under our current proposals, there are three ventilation shaft locations: one adjacent to the B1047 Horningsea Road and the Poplar Hall Farm access road, one close to Red House Close, Fen Ditton and the third located within the existing Cambridge WWTP. The closest high sensitivity receptor to the ventilation shafts is Red House Close, which has the potential to be within 10m of the shaft; the shaft is located to the east, so is downwind of this dwelling. The odour potential from the ventilation shafts would be of a similar tone to odours from nearby agricultural practices and the River Cam. Small and infrequent odour releases are anticipated at the shafts and odour impacts would be minor. Effects from odour from the ventilation shafts would be 'negligible' and the overall effect on local receptors not considered to be significant.

The new pipeline connecting from Waterbeach to the proposed WWTP will require sewer air valves, which are designed to release air when the system is under high pressure, which assists in maintaining flows and pressures within the transfer pipeline. Releases of air from the sewer air valves would cause very localised, infrequent odour at the location of surface manholes in Waterbeach. Sewer air valves are installed in sewers across the UK and the small amount of odour released would be identical to that experienced occasionally in any typical street. The odour effect is therefore not considered to be significant and further mitigation would not be required.

[Secondary mitigation \(foreseeable\) / Tertiary mitigation \(inexorable - regulation\)](#)

The operation of the proposed WWTP would require an Environmental Permit, which will be issued and regulated by the Environment Agency. The Environmental Permit for the proposed WWTP will require the operator to have a written Environmental Management System (EMS), which includes a set of plans and procedures describing measures to avoid, reduce and eliminate potential environmental impacts associated with the activities covered by the permit. This will include an **Odour Management Plan (OMP)**, which will detail how site operations are to be managed to minimise odour impacts. The OMP will be a 'living document' with regular revision and updates and will outline operational odour management, monitoring and reporting measures and include controls to be implemented in the event of an incident such as a spillage, so odour can be mitigated as far as possible. The document will also outline how to record odour events and respond to complaints.

Under the Environmental Permit, the operator would be legally required to continually monitor treatment performance, prevent and respond to any on-site issues at the earliest opportunity.

What might the likely significant odour effects be in relation to the proposed relocation of Cambridge Waste Water Treatment Plant?

Construction activities such as earth-moving and building of infrastructure are not anticipated to lead to significant effects from odour with best practice site management in place.

The potential for odour impacts during the decommissioning and commissioning activities will be mitigated through incorporated design and the odour control management systems. Any odour during these processes will likely be over short timeframes and will be mitigated using additional methods if required. The Environmental Permits will regulate odour from the existing Cambridge WWTP and the proposed WWTP during the decommissioning and commissioning processes. Based on the above, we consider it unlikely that significant effects from odour would occur.

The design and management of the proposed WWTP and the transfer tunnel vents is expected to mitigate against adverse odour impacts and minimise the likelihood of significant effects. The location of the proposed WWTP means that there are very few properties nearby; preliminary odour modelling we have undertaken for the design proposals shows that the effect of operation on existing sensitive receptors would likely be negligible (as shown in **Figure 2**) and therefore the effect would not be significant.

The above assumptions of significance will be fully assessed and confirmed within the EIA.

References

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