Air management plan
# Phase two consultation documentation

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- Customer overview leaflet

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- Needs Report
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- Chambers Wharf
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- Cremorne Wharf Depot
- Deptford Church Street
- Dormay Street
- Earl Pumping Station
- Falconbrook Pumping Station
- Greenwich Pumping Station
- Hammersmith Pumping Station
- Heathwall Pumping Station
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- King George's Park
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- Putney Bridge Foreshore
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List of abbreviations

CSO    combined sewer overflow
Defra  Department of Environment, Food and Rural Affairs
H₂S    hydrogen sulphide
NPS    national policy statement
OCU    odour control unit
PEIR   preliminary environmental information report
SOM    site operating manual
STW    sewage treatment works
1 Introduction

1.1.1 The older areas of the London sewer system are combined sewers that carry foul flow and rainwater runoff. When it rains, the combined sewer system often becomes overloaded and excess sewage discharges from combined sewer overflows (CSO) into the rivers Lee and Thames. CSOs are required to reduce the risk of sewer flooding, limit damaging surcharging of the sewer system and overloading of the Beckton and Crossness sewage treatment works (STW).

1.1.2 The Environment Agency has determined that 36 of the 57 CSOs that discharge into the River Thames and River Lee are unacceptable and require control to meet the requirements of the Urban Waste Water Treatment Directive and to limit the pollution to the river and subsequent effects on human and ecological health of the river. The CSOs discharge approximately 50 times per year, with a combined discharge of about 39 million cubic metres in a typical year.

1.1.3 The overall London Tideway Improvements includes modifications to five main treatment works that discharge to the Thames Tideway and the Lee Tunnel from Abbey Mills to Beckton STW. The proposed Thames Tunnel project would complete the overall planned improvements and would consist of a main tunnel from Acton Storm Tanks to Abbey Mills. The main tunnel would connect to the Lee Tunnel at Abbey Mills. Combined sewage controlled by the tunnel system would be stored and transferred to Beckton STW for treatment before discharging to the River Thames.

1.1.4 The purpose of this Air management plan is to define how air from the proposed Thames Tunnel project is vented into and out of the tunnel system and how air releases are controlled and treated. It outlines operational and management procedures for controlling air movement, and treatment of air to meet regulatory requirements and limit the extent of nuisance odours. The plan covers the Thames Tunnel project from Acton Storm Tanks to Abbey Mills (with extension to the changed operation of facilities being built by the Lee Tunnel). A separate odour management plan exists for the Abbey Mills Pumping Station\textsuperscript{1} and Beckton Sewage Treatment Works\textsuperscript{2}.

1.1.5 This Air management plan particularly focuses on the 23 locations that air can enter and exhaust from the system. As the tunnel system controls combined sewer overflows, it would receive flow intermittently, depending on rainfall. It is estimated that in a typical year of rainfall, the tunnel would be empty for about 70–75% of the time, with no air emissions from the majority of sites during this time. When the tunnel is filling, a limited amount of air would be exhausted at sites, depending on how full the tunnel becomes. Air exhausted would be treated to ensure acceptable air quality. In a typical year, most sites would have emissions for five to 50 hours in total, spread over one to 15 events.


1.1.6 It should be emphasised that the evaluations performed to design facilities and outlined in this plan are based on conservative input parameters and produce a robust and reliable system, with low risk of nuisance odours.

1.1.7 The format for the document, in general, follows that of previous documents related to odour control for other Thames Water sites, but as the Thames Tunnel project has intermittent and variable operations at multiple sites, some deviation from previous reporting is required.

1.1.8 Consultation is ongoing with environmental health officers at the 14 London boroughs potentially affected by the Thames Tunnel project, feedback from which is – and will continue to be – reflected in the Air management plan. The Air management plan will be reviewed and updated as appropriate.
2 Site information

2.1 Site locations

2.1.1 There are 22 sites at which air would be managed. The locations are listed in Table 2.1 and Figure 2.1, based on the 21 preferred sites being presented at phase two consultation, plus Beckton STW. Individual site plans are shown in Appendix A. The Lee Tunnel project will construct three shafts, all of which will have active air treatment plants. These plants are included in the overall air management plan for the CSO control system.

Table 2.1 Site information

<table>
<thead>
<tr>
<th>CSO ID</th>
<th>Site location</th>
<th>Address (nearest road)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS01X</td>
<td>Acton Storm Tanks</td>
<td>Canham Road</td>
</tr>
<tr>
<td>CS04X</td>
<td>Hammersmith Pumping Station</td>
<td>Chancellor’s Road</td>
</tr>
<tr>
<td>CS05X</td>
<td>Barn Elms</td>
<td>Home Way</td>
</tr>
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<td>CS06X</td>
<td>Putney Bridge Foreshore</td>
<td>Lower Richmond Road</td>
</tr>
<tr>
<td>CS07A</td>
<td>Dormay Street</td>
<td>Dormay Street</td>
</tr>
<tr>
<td>CS07B</td>
<td>King George’s Park</td>
<td>Neville Gill Close</td>
</tr>
<tr>
<td>No CSO</td>
<td>Carnwath Road Riverside</td>
<td>Carnwath Road</td>
</tr>
<tr>
<td>CS09X</td>
<td>Falconbrook Pumping Station</td>
<td>York Road</td>
</tr>
<tr>
<td>CS10X</td>
<td>Cremorne Wharf Depot</td>
<td>Lots Road</td>
</tr>
<tr>
<td>CS14X</td>
<td>Chelsea Embankment Foreshore</td>
<td>Chelsea Embankment</td>
</tr>
<tr>
<td>No CSO</td>
<td>Kirtling Street</td>
<td>Kirtling Street</td>
</tr>
<tr>
<td>CS16X</td>
<td>Heathwall Pumping Station</td>
<td>Nine Elms Lane</td>
</tr>
<tr>
<td>CS17X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS19X</td>
<td>Albert Embankment Foreshore</td>
<td>Albert Embankment</td>
</tr>
<tr>
<td>CS20X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS22X</td>
<td>Victoria Embankment Foreshore</td>
<td>Victoria Embankment</td>
</tr>
<tr>
<td>CS27X</td>
<td>Blackfriars Bridge Foreshore</td>
<td>Victoria Embankment/Blackfriars Underpass</td>
</tr>
<tr>
<td>No CSO</td>
<td>Chambers Wharf</td>
<td>Chambers Street</td>
</tr>
<tr>
<td>CS29X</td>
<td>King Edward Memorial Park Foreshore</td>
<td>The Highway</td>
</tr>
<tr>
<td>CS31X</td>
<td>Earl Pumping Station</td>
<td>Croft Street</td>
</tr>
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<td>CS32X</td>
<td>Deptford Church Street</td>
<td>Deptford Church Street</td>
</tr>
<tr>
<td>CS33X</td>
<td>Greenwich Pumping Station</td>
<td>Greenwich High Road</td>
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## Site information

<table>
<thead>
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<th>Site location</th>
<th>Address (nearest road)</th>
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<tbody>
<tr>
<td>CS35X</td>
<td>Abbey Mills Pumping Station</td>
<td>Lee Tunnel – Abbey Lane</td>
</tr>
<tr>
<td>No CSO</td>
<td>Connection Shaft – Beckton STW</td>
<td>Lee Tunnel – Beckton STW</td>
</tr>
<tr>
<td>CS81X</td>
<td>Overflow Shaft – Beckton STW</td>
<td>Lee Tunnel – Beckton STW</td>
</tr>
</tbody>
</table>
Figure 2.1 Thames Tunnel phase two consultation preferred sites
2.2 Site receptors

2.2.1 The draft National Policy Statement for Waste Water (NPS) suggested an odour standard and that this standard should be applied at sensitive receptors such as housing, hospitals and schools. The draft NPS also advises that consideration should be given to the impacts and effects of odour on surrounding uses of land and development, including commercial premises, recreational facilities and open spaces. The standard suggested and being applied herein is $1.5\text{ouE/m}^3$ for the 98th percentile of hourly average values in a year. However, the final NPS may modify or remove this standard and numerical values. Defra advises in its guidance to local authorities that this standard provides a useful means to allow local authorities to assess and control the odour impact of new developments through the planning control regime, and this can be a very effective means of protecting amenity, therefore preventing or controlling future statutory nuisance from odours at the planning stage. The odour standard referred to derives from the Environmental Permitting Regime, and is believed to be intended for continually operating sewage facilities and not specifically to intermittent conditions, such as from CSO control schemes. The application of this standard therefore provides a high level of protection from nuisance odours from the intermittently operating Thames Tunnel project scheme.

2.2.2 The type of receptor determines the sensitivity to odour\(^3\), with residential properties, hospitals and schools being classed as high sensitivity, commercial/industrial premises and parks as medium sensitivity and footpaths as low sensitivity. The distance at each air release site to each of the receptor types will be identified as part of the odour risk assessment process undertaken. This will include any major new developments expected to come forward on the vicinity of the sites in future years.

2.3 Overview of air management processes

2.3.1 Air in the tunnel would normally be managed by creation of a small, negative pressure by fans at active control (air ventilation and treatment) plants at shafts at the ends of the Thames Tunnel project and Lee Tunnel. It is proposed that the three facilities constructed as part of the Lee Tunnel project would continue in use and three new active control plants would be built as part of the Thames Tunnel project. Air exhausted from these active control plants would pass through and be treated by odour control units (OCUs).

2.3.2 Overall, there are 23 shaft locations (on 22 sites) with either ‘passive’ or ‘active’ control treatment plants:

a. Active control is through forced air plants controlled by extraction fans with air exhaust treated using carbon filters (odour control units (OCUs)). There would be active control plants at six locations: Acton Storm Tanks, Carnwath Road Riverside, Greenwich Pumping Station, Abbey Mills Pumping Station, Beckton Connection Shaft and Beckton

\(^3\) The sensitivities were derived from the draft NPS for Waste Water.
Overflow Shaft. The scheme indicates continuous operation at Acton Storm Tanks, Carnwath Road Riverside and Abbey Mills to maintain a continuous air intake and airflow throughout the tunnel system.

b. The 17 sites with passive plants would treat the limited amount of air that could be discharged whenever the tunnel fills. Passive sites are also the main location for air intake. Both air intake and exhaust is controlled by dampers and exhausted air is passed through passive carbon filters.

2.3.3 The locations of the active control plant and passive plant are shown in Figure 2.2 below.
Figure 2.2   Location of active ventilation and passive filters

Abbey Mills Pumping Station

Beckton Sewage Treatment Works

Greenwich connection tunnel

EALING
HOUNSLOW
HAMMERSMITH & FULHAM
KENSINGTON & CHELSEA
CITY OF WESTMINSTER
CITY OF LONDON
TOWER HAMLETS
NEWHAM

Types of ventilation
- Active ventilation
- Passive filters containing activated carbon

Sites
- Action Storm Trench
- Hammersmith Pumping Station
- Barn Elms
- Putney Bridge Foreshore
- King George’s Park
- Ormeau Street
- Camnurth Road Riverside
- Foakirbrook Pumping Station
- Camrnesse Wharf Depot
- Chelsea Embankment Foreworks
- King Street
- Hoozlethorpe Pumping Station
- Albert Embankment Foreworks
- Victoria Embankment Foreworks
- Billingham Bridge Forework
- Cliffs Wharf
- East Pumping Station
- Bigham Church Street
- Severnwhitch Pumping Station
- King Edward Memorial Park Forework
- Abbey Mills Pumping Station
- Beckton Sewage Treatment Works
- Tideway Pumping Station
- Beckton Sewage Treatment Works overflow shaft

*We will make use of ventilation equipment installed as part of the Lee Tunnel project, there is no new ventilation building.
2.3.4 The active plant sites have ventilation columns generally set at 15m above ground level to ensure adequate dispersion. The ventilation columns are to be made up of multiple vents from each OCU and a separate bypass vent. The bypass vent would release untreated air in the rare case when the air displaced from the tunnel exceeds the treatment capacity. A separate vent structure with weighted dampers to relieve pressure is also provided for rapid tunnel filling events. This is designed to operate about once in 15 years.

2.3.5 Passive sites have ventilation columns set at a height of 4m to comply with hazardous zoning requirements, in accordance with Thames Water standards.\(^4\) As for active plants, there are weighted pressure relief dampers that would generally be incorporated into the vent boxes. Louvres would also be incorporated into the structure to allow air intake at active and passive sites. The arrangement of ventilation structures and above-ground facilities will be architecturally designed to limit the visual impact of such structures while maintaining the air management function.

2.3.6 The type of ventilation structure at each site and the expected hours of treated air exhausted during a typical year are shown in Table 2.2. During the empty tunnel conditions (about 70 to 75% of the typical year), plant at Acton Storm Tanks, Carnwath Road Riverside and Abbey Mills Shaft F would operate at a low level to maintain an exchange of fresh air within the tunnel. When the tunnel fills with wastewater, the operation of the main ventilation plant varies depending on the level of filling.

<table>
<thead>
<tr>
<th>Site location</th>
<th>Ventilation structure</th>
<th>No. of hours of air exhaust (typical year)</th>
<th>No. of hours of untreated exhaust (typical year)</th>
<th>% time treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acton Storm Tanks</td>
<td>3 vents (2 OCUs/1 bypass)</td>
<td>Full year treated ventilation</td>
<td>13 (released over 9 separate events)</td>
<td>99.9%</td>
</tr>
<tr>
<td>Hammersmith Pumping Station</td>
<td>Low level vent</td>
<td>7</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Barn Elms</td>
<td>Low level vent</td>
<td>10</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Putney Bridge Foreshore</td>
<td>Low level vent</td>
<td>12</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Dormay Street</td>
<td>Low level vent</td>
<td>5</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>King George’s Park</td>
<td>Low level vent</td>
<td>6</td>
<td>0</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Site location</th>
<th>Ventilation structure</th>
<th>No. of hours of air exhaust (typical year)</th>
<th>No. of hours of untreated exhaust (typical year)</th>
<th>% time treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carnwath Road Riverside</td>
<td>3 vents (2 OCUs/1 bypass)</td>
<td>Full year treated ventilation</td>
<td>34 (released over 14 separate events)</td>
<td>99.6%</td>
</tr>
<tr>
<td>Falconbrook Pumping Station</td>
<td>Low level vent</td>
<td>14</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Cremorne Wharf Depot</td>
<td>Low level vent</td>
<td>14</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Chelsea Embankment Foreshore</td>
<td>Low level vent</td>
<td>18</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Kirtling Street</td>
<td>Low level vent</td>
<td>16</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Heathwall Pumping Station</td>
<td>Low level vent</td>
<td>20</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Albert Embankment Foreshore</td>
<td>Low level vent</td>
<td>22</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Victoria Embankment Foreshore</td>
<td>Low level vent</td>
<td>19</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Blackfriars Bridge Foreshore</td>
<td>Low level vent</td>
<td>24</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Chambers Wharf</td>
<td>Low level vent</td>
<td>40</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>King Edward Memorial Park Foreshore</td>
<td>Low level vent</td>
<td>51</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Earl Pumping Station</td>
<td>Low level vent</td>
<td>27</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Deptford Church Street</td>
<td>Low level vent</td>
<td>27</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Greenwich Pumping Station</td>
<td>Low level vent</td>
<td>27</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Thames Tunnel Shaft (Abbey Mills)</td>
<td>Low level vent (bypass)</td>
<td>0</td>
<td>0</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Included as part of the Lee Tunnel project:**

| Abbey Mills Lee Tunnel Shaft F  | 4 vents (3 OCUs/1 bypass) | Full year treated ventilation | 12 (released over 12 separate events) | 99.9% |
## Site information

<table>
<thead>
<tr>
<th>Site location</th>
<th>Ventilation structure</th>
<th>No. of hours of air exhaust (typical year)</th>
<th>No. of hours of untreated exhaust (typical year)</th>
<th>% time treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection shaft</td>
<td>2 vents (1 OCU/1 bypass)</td>
<td>212</td>
<td>30 (released over 25 separate events)</td>
<td>99.7%</td>
</tr>
<tr>
<td>Overflow shaft</td>
<td>2 vents (1 OCU/1 bypass)</td>
<td>227</td>
<td>30 (released over 25 separate events)</td>
<td>99.7%</td>
</tr>
</tbody>
</table>

### 2.3.7 During a CSO event, the tunnel would follow a cycle of:

a. filling with combined sewage: The main tunnel is estimated to fill completely four times in a typical year. The system would receive flow and fill, or partially fill, for about 2,450 hours\(^5\) in a typical year

b. temporary storage of the combined sewage: Simulations indicate that the average event storage time is 13 hours, with the longest storage duration in the typical year of about 49 hours

c. emptying the stored combined sewage by pumping to the Beckton STW for treatment.

### 2.3.8 Each part of this CSO control cycle has different air management requirements:

a. As noted above, about 70–75% of the time, the tunnel would be empty and the active plants would operate at a low rate to exchange the air in the system at least once per day. Air would be exhausted at three sites, with primary air intake at Blackfriars Bridge Foreshore and Greenwich Pumping Station.

b. During tunnel filling, the ventilation system operates similarly as during empty tunnel ventilation, until the shaft at the downstream end of the reach is drowned. Air within the drowned shafts would then be displaced by the rising wastewater. Shafts at the downstream, eastern end of the tunnel would be drowned out more frequently (about 25 to 50 hours during the typical year), compared with shafts at the western end (about 5 to 15 hours during the typical year).

c. When the tunnel is storing or emptying, air management allows air inflow, with reversion to empty tunnel ventilation when shafts become open to the tunnel.

### 2.3.9 To ensure the integrity of the system and mitigate possible adverse air releases, additional features are included in the air management facilities. Under unusual and infrequent rapid tunnel filling conditions, displaced air could exceed the capacity of the odour treatment units. Under these conditions, air would be released through a bypass vent, which is

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\(^5\) Based on 900 hours of inflow and 1,550 hours of pump-out.
nominally combined with the odour unit vent as one structure. It is not practical, or recommended, to size facilities to accommodate this infrequent and short duration maximum air exhaust rate.

2.3.10 Under very extreme conditions (about once every 15 years), generally associated with rapid tunnel filling, air displacement rates can be high and exceed the design airflow rate of the air management facilities. This high pressure air would be released via weighted dampers and exhausted to the atmosphere for a short time, estimated to be less than ten minutes. The pressure relief is incorporated into the design of all shafts, including active and passive sites.

2.3.11 At locations with passive odour treatment, air intake and air release would be regulated by weighted dampers or modular passive filters. No air is released until rising wastewater during tunnel filling seals the shaft and the pressure rises within the shaft to open the weighted dampers/passive filters leading to the OCUs. Displaced air is released through the dampers/passive filters into an underground chamber containing OCUs.

2.3.12 As a further precaution against possible adverse air releases when the system is full and CSOs revert to the river, small diameter vents similar to current sewer vents will be included in the design of the interception chambers. These air vents would allow the intake of air to the interception chamber and could possibly result in air discharge, depending on river levels and CSO flow rate. Possible short duration air discharge could occur (on average for a total of about ten hours in a typical year at about half the sites discharged over separate short-term events) whenever CSOs have reverted to the river.

2.3.13 Figure 2.3 below provides schematic diagrams of how the air management system works in different tunnel scenarios.
Figure 2.3 Air management system operation
2.4 Odour sources

2.4.1 Air would be released from the system at the 22 sites (23 shaft locations) identified above. For 99.7% of the time, this would be treated air and therefore would not be odorous. For rare occasions, associated with heavy rain, a portion of air releases would bypass treatment and vent to the atmosphere. The quality of the air released would be similar to the air quality that is associated with the current CSO discharges and would not cause odour nuisance or problems.

2.4.2 Also associated with sewage is the generation of hydrogen sulphide (H$_2$S, AKA rotten egg smell). Both odour and H$_2$S generation is based on the amount of odour-forming constituents in combined sewage and how air moves through the system and is exhausted. Air movement is a function of how the tunnel system fills and empties and how air is therefore displaced. With simulation of air displacement and the quality of air based on odour and H$_2$S generated, estimates of exhaust rates and quality can be produced. These rates and quality of release are based on conservative input parameters to meet a design objective of a robust and reliable system, with low risk of nuisance odours.

2.4.3 The draft National Policy Statement for Waste Water has set an impact exposure standard to be applied at sensitive receptors such as housing, hospitals and schools of 1.5ouE/m$^3$ for the 98th percentile of hourly average concentrations. The Environment Agency has set the same standard for the processes it regulates but applies it at the site boundary, unless the nearest sensitive receptor is some distance away. The odour concentrations at ground level and at elevation beyond the site boundary at each site have been modelled in relation to the 98th percentile of hourly odour concentrations in a year and also the concentrations at buildings where people could be exposed. The preliminary modelling results are presented in volumes 7–28 of the Preliminary environmental information report (PEIR). The PEIR also reports the number of hours in a year with concentrations above 1.5ouE/m$^3$.

2.4.4 The modelling results presented in the PEIR demonstrate that with the air management system developed, there would be no significant risk of nuisance odours associated with the Thames Tunnel project. All of the sites would achieve the 98th percentile odour criterion.

2.4.5 Three sites would operate continuously to ensure good air quality within the tunnel, and vented air would meet the conservative air quality requirements and would not produce nuisance odours.
3 Critical plant operation, maintenance and monitoring procedures

3.1 Identification of critical plant (risk assessment)

3.1.1 As part of the design process, an additional detailed risk assessment will be finalised (in 2012 and after completion of phase two consultation) for each of the locations that air could leave or enter the tunnel system. This assessment will rely on the existing quality of water data collected through the system and detailed models that have simulated the operation of the tunnel, how air moves through the tunnels and shafts, and how air would disperse from release locations. The information developed through these data collection and modelling efforts have been used to inform the design of facilities and to formulate the risk assessment.

3.1.2 The risk assessment will be undertaken in the following manner:

a. Each part of the treatment process will be considered under different operating modes, eg, normal, abnormal and emergency. An abnormal event would be an event out of the ordinary that is not expected to occur during a typical year, eg, carbon filter overloaded or exhausted. An emergency event would be a serious event that is not expected to occur during a typical year, eg, carbon filter flooded. The normal operating mode is used to assess compliance with the odour standard.

b. Representative receptors will be selected that could be affected by air release and potential adverse odour.

c. The likely frequency and duration of occurrence for each operating mode will be identified.

d. A score will be assigned to the severity (0 – 5) of odour under each operating mode.

e. A score will be assigned to the likelihood (0 – 5) of causing an odour nuisance for each operating mode. An odour nuisance is taken to be an odour event that interferes with a person’s enjoyment of their property or of an amenity.

f. The severity of odour will be multiplied by the likelihood of causing odour to generate an ‘odour emission risk’ score. The scores range between 0 (zero risk) and 25 (maximum risk).

g. The need for operational mitigation and customer communication will be identified on the basis of the ‘odour emission risk’ scores identified for each site.

3.1.3 The risk assessment is an ongoing process, due to changes, both operational and structural, in the tunnel and the treatment plant. The risk assessment will be regularly reviewed in accordance with a defined timetable.
3.2 Operational baseline control measures

3.2.1 A site operating manual (SOM) will be created for each site. The SOM will identify the operational procedures to be followed in order to maintain and operate plant to agreed company standards. This SOM will likely also contain operating practices for other operation and control components at the site, such as flow monitors and penstocks.

3.2.2 These practices will include housekeeping procedures, which ensure that generation of odour is kept to a minimum.

3.2.3 The main air management, odour control and abatement practices for the Thames Tunnel project are the passive and active ventilation systems and odour control units, as described in Section 2.3.

3.3 Performance checks

3.3.1 The following routine monitoring procedures for the odour control system would be used:

a. Quarterly assessment of odour abatement performance at each location in terms of H2S generation and capture. The performance would be assessed based on records on H2S before and after treatment. These records would be analysed to determine how the system is performing and used to determine if any remedial action is required. It is proposed that record inspection and analysis would be conducted for at least three years after start of operation and, if records indicate good performance, such inspection and analysis would be discontinued.

b. Quarterly inspection of the active odour control units to confirm proper operation. Any actions necessary to maintain the performance of the units and the required frequency of media replacement would be implemented through the maintenance system developed for the project.

c. In addition, there would be continuous recording of H2S levels in air extracted from the tunnel (see Section 3.5 below). It is proposed that H2S monitoring would be maintained for at least three years after start of operation and, if records indicate good performance, such H2S monitoring would be discontinued.

3.4 Maintenance and inspection of plant and processes

3.4.1 In addition to the routine operational tasks, planned preventative and defect maintenance of all plant would be carried out. Maintenance requirements will be documented in the SOM and preventative maintenance or defect repairs records would be fully captured in the Thames Water system.

3.4.2 An inspection and maintenance regime would be established for the new ventilation and odour control systems to be installed as part of the
scheme. The ventilation and odour control units at each site would receive, as a minimum:

a. monthly check of duty/standby fan and motors
b. annual checks on residual lifetime of OCU media
c. retention of critical spares for each OCU (required spares to be confirmed with the supplier).

3.4.3 The condition of the media in the OCU would be monitored by performance checks (see Section 3.3) and by additional testing, as required. The life of the carbon filters will depend upon the H₂S loading of the tunnel air, the capacity of the filter and the volume of tunnel air that the carbon filter treats. The expected life of the filter at each site during a typical year has been calculated to be greater than three years. A three-year cycle of replacement is, however, assumed.

3.4.4 It is expected that the active OCU sites would be visited once a week, and the passive OCU sites would be visited quarterly for inspection and maintenance.

**Fault reporting**

3.4.5 Faults identified in the routine inspections would be reported to the Air Management System Manager, who would determine the severity of the fault and the appropriate response time, in accordance with the odour risk assessment, as normal, abnormal or emergency.

3.4.6 Normal and abnormal faults would be rectified within 48 hours.

**Emergency**

3.4.7 For an emergency condition, 24-hour maintenance cover would be available, and under control and discretion of the System Manager. Less urgent repairs are assessed for criticality and dealt with during normal working hours.

3.4.8 An emergency would involve the failure of an OCU or the unexpected blockage of a vent. It would be identified through monitoring or during the periodic maintenance and performance checks (see Section 3.3 and above).

3.4.9 With regard to emergency fault/breakdown and incident response procedures, responses to failures of the ventilation sites will be covered in the *Disaster Recovery Plan* documents for each site, which cover scenarios including:

a. failure of control: Failure of telemetry, sensor, or control systems
b. electrical failure: Failure of grid supply
c. prolonged non-access to site due to event at site or local to the site (eg, bomb scare, fire, flood or emergency services controlled incident).
3.5 Monitoring

3.5.1 The active odour control plant would have sufficient instrumentation and telemetry to allow any faults to be detected remotely at a central operations control station. Signals which would be recorded include:

a. logging of carbon unit hours of operation
b. pressure loss across the carbon unit
c. logging of H₂S levels in the inlet and exhaust air
d. fail/healthy signal for the fans
e. status of the fans and operational hours
f. fail/healthy signal for any motorised dampers
g. position indication of the motorised dampers
h. alarms for unauthorised access.

3.5.2 Alarms would be in place to indicate a ‘fault’ to one of the components of the air management system. This fault indication would then be further interrogated to determine which component is at fault.

3.5.3 This monitoring would be undertaken for three years, after which the need to continue monitoring would be reviewed.

3.5.4 Additionally, H₂S measurements would be made at the sites continuing the sampling regime that began in late summer 2011.

3.6 Operator training

3.6.1 All technicians/operators involved in maintenance and monitoring would receive training appropriate to their grade. If they have the Wastewater Treatment NVQ, they would have received training in the control of odour. All records of staff training would be held on a central training database.

3.7 Record keeping

3.7.1 Records of OCU monitoring, maintenance and media replacement would be kept at a central location and, when appropriate, for operation and maintenance on site at active control sites.
4 Public communications

4.1 Public complaints process

4.1.1 Although not fully developed, it is envisaged that the public would contact Thames Water Customer Services at the Central Customer Centre. Details of the different communication routes are summarised in Figure 4.1. Members of the public are encouraged to communicate via the Customer Centre to ensure all contacts are recorded and followed up.

4.1.2 All locally received complaints would be redirected or forwarded to the Customer Centre.

Figure 4.1 Complaints structure

4.2 Complaint validation

4.2.1 Complaints received would be checked and validated by Thames Water. This may be done with reference to site inspection, visit to complainant, site activities and weather conditions.

4.2.2 All contacts would be recorded by Thames Water on the Complaint Database.
4 Public communications
## Appendix A: Site plans

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Figure A.1 Acton Storm Tanks

- Ventilation column
- Ventilation building
- Secondary access for maintenance vehicles
- Existing footpath to be widened
- New line of boundary fencing
- Replacement fencing to be provided
- Main access to Acton Storm Tanks
- Area to be reinstated following construction works
- Hardstanding area
- Grassed area
- Modifications to above ground chamber
- Existing car parking
- New fencing to match existing
- Remaining storm tanks to be taken out of use
- Northern two storm tanks filled with excavated material from shaft construction
- Canham Road
- Secondary access for maintenance of ventilation column
- Building set back from boundary by approximately 3m

Air management plan
Figure A.2 Hammersmith Pumping Station

- Access for maintenance vehicles
- New boundary wall
- Hammersmith Pumping Station
- Electrical and control equipment located within existing building
- Existing sewer structure
- Ventilation structures adjacent to existing sewer structure
- Residential development (by others)
- Landscaping of shaft and access covers to be completed by others as part of development
Figure A.3 Barn Elms
Figure A.4 Putney Bridge Foreshore

- New riverwall with vertical fenders
- New Putney Bridge CSO outlet
- Recycled timber fenders as seating for viewing bridge
- Existing stone cobbles to be protected or removed during construction, stored and reinstated
- Bicycle stand relocated along footpath
- Removable bollards for access for maintenance vehicles
- Existing bollards to be refurbished and relocated
- New cobbles to match existing
- Ventilation column
- Electrical and control kiosk incorporating biodiverse roof and stone cladding to match existing wall
- Ventilation column
- Interception chamber below bridge arch to capture existing CSO
Figure A.5 Dormay Street

- Ventilation column
- Structural improvements to flood defence walls
- Electrical and control kiosk combined with ventilation structure with biodiverse roof
- Planting reinstated after construction
- Proposed vehicle parking area for local authority depot
- Access for maintenance vehicles using local authority depot entrance
- Low maintenance planting or natural plant growth
- Site reinstated for use as local authority depot
Figure A.6  King George’s Park

- New raised platform over and around CSO drop shaft, overlooking lake
- Wildflower planting
- Timber seating
- Access for maintenance vehicles, sliding gate to match existing fence
- Electrical and control kiosk with biodiverse roof
- New path improving links through park
- Ventilation columns
- Provision for small retail kiosk
Figure A.8  Falconbrook Pumping Station

- Existing sewer structure
- Electrical and control equipment within existing building
- Ventilation structures within compound
- Ventilation column
- Railings to be reinstated to match existing
- Existing bus stop to be reinstated
- Raised planter over CSO drop shaft
- Timber seating
- Falconbrook Pumping Station wall to be reinstated
Figure A.10 Chelsea Embankment Foreshore
Figure A.13 Albert Embankment Foreshore

- New Clapham Storm Relief and Brixton Storm Relief CSO outlets
- Display case for possible archaeological finds set into ground
- Open balustrade towards central London views
- Widened Thames Path
- Timber seating
- Vauxhall Bridge deck omitted for clarity
- Ventilation columns
- Electrical and control kiosk beneath Vauxhall Bridge
- Floodable terraces over Clapham Storm Relief CSO connection pipe
- Foreshore interception structure for Clapham Storm Relief CSO
- Maintenance vehicle access via existing Locks Dock accessway
Figure A.15  Blackfriars Bridge Foreshore
Figure A.16 Chambers Wharf
Figure A.17  King Edward Memorial Park Foreshore

Football pitch access  Relocated children’s play area  Memorial Park benches relocated on line with Memorial  Relocated bandstand  Electrical and control kiosk against existing brick wall

The Highway

Bowling green

Football pitch  Tennis courts  New gated entrance to park and Thames path  Activity/fitness zone  Seating area  Ventilation columns  Grassed area around relocated bandstand  New North East Storm Relief CSO outlet

Thames Path widened and improved. Provides maintenance access to shaft
Figure A.18  Earl Pumping Station

- Proposed valve chamber extending above ground level
- Access for maintenance vehicles
- Ventilation column
- Electrical and control equipment located inside existing pumping station
- Brickwall reinstated
- New gates to compound
- Biodiverse roof to drop shaft
- Temporary hoarding around site for future development (by others)
- Stairs up to roof accessed from within pumping station compound
- Drop shaft extending approximately 3m above ground level with 1m brick parapet
- Ventilation structures on roof
- Publicly accessible paved area for shared use with future development
- Removable bollards for maintenance access around drop shaft

EarlPumping Station
Chilton Grove
Venman Street
Figure A.20 Greenwich Pumping Station
Figure A.21 Abbey Mills Pumping Station

- Fence around Lee Tunnel and Thames Tunnel shafts
- Ventilation columns
- Access for maintenance vehicles from existing road within Abbey Mills Pumping Station site
- Fans and filters for odour treatment provided by Lee Tunnel project
- Lee Tunnel shaft
- Grassed area
- Three Mills Studios
- Channel Road
Figure A.22 Beckton Sewage Treatment Works
Phase two consultation (Autumn 2011)

For further information see our website: www.thamestunnelconsultation.co.uk or call us on 0800 0721 086