Intended for
Berkeley Homes (Southern) Limited

Date
January 2024

Project Number
1620013887-004

WORTHING GASWORKS ODOUR MANAGEMENT PLAN

RAMBOLL

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Project No.	**1620013887-004**
Issue No.	**2.0**
Date	**29/01/2024**
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Version Control Log

Revision	Date	Made by	Checked by	Approved by	Description
1.0	22/01/2024	AM	GH/CC	LC	Draft Issue to Client
2.0	29/01/2024	AM	GH/CC	LC	Second Issue to Client

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1. INTRODUCTION

1.1 Background

Ramboll UK Limited ("Ramboll") has been instructed by Berkeley Homes (Southern) Ltd. (the "Client"), hereafter referred to as 'Berkeley', to produce an Odour Management Plan (OMP) for the proposed redevelopment of Worthing Gasworks, Park Road, Worthing in West Sussex (the 'Site'). The Site location is shown in Figure 1-1.

The proposed development comprises demolition of existing on-site structures, partial removal of boundary walls, and the construction of a residential development spread across five blocks with associated access, parking, open space, and landscaping.

The Site is a former Gas Works Site where historic activities have resulted in a degree of soil and groundwater contamination. Remediation and enabling earthworks will be required to prepare the Site for redevelopment and it is likely that hotspots of soil contamination will be present. These works may therefore generate volatile organic compound (VOC) emissions and odours.

1.2 Objectives

The purpose of this plan is to provide guidance that a contractor can follow to implement proactive measures to control odour from the Site during earthworks (i.e., remediation, enabling works, groundworks and piling); specifically, regarding VOCs and associated odours.

1.3 Site Setting

The Site is a plot of land of 1.12 hectares (ha) in size situated on the corner of Park Road and Lyndhurst Road in Worthing, at National Grid Reference 515244, 102971. The Site location is shown in Figure 1-1.

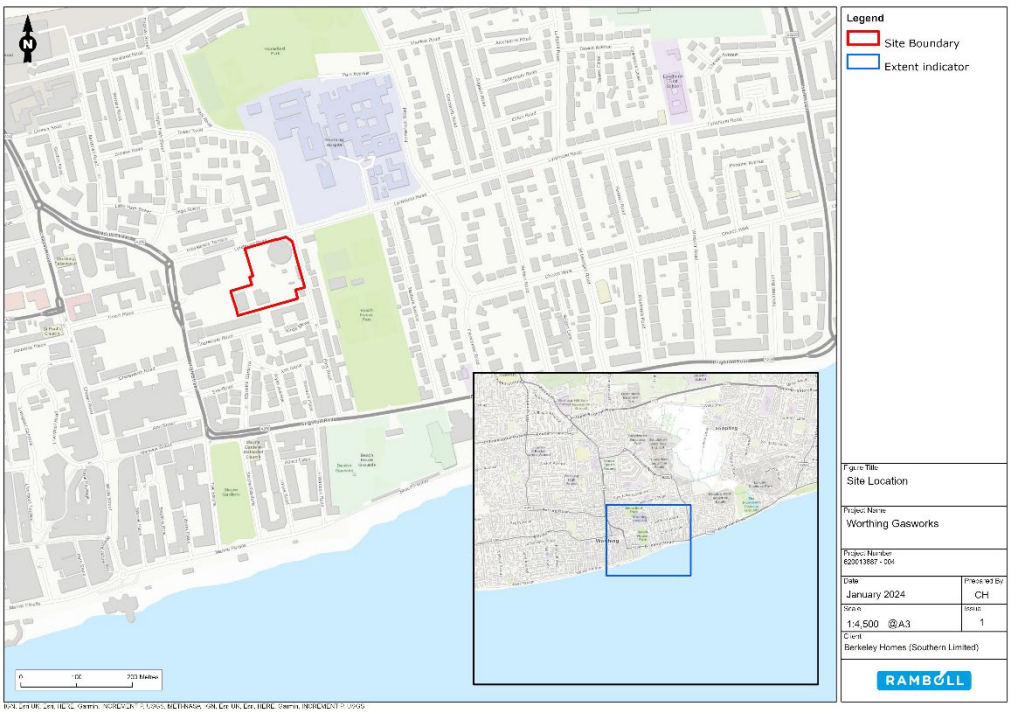


Figure 1-1 Site Location

The Site occupies a parcel of land previously occupied by the Worthing Gasworks which contained three gasholders and their associated equipment and buildings. Permanent structures remain on the Site including a warehouse with shallow pitched roof to the southwestern corner and a single storey structure with flat roof to the east of this known as Link House. A smaller single storey structure to the north of the existing access point on Park Road was used as a depot and store by Southern Gas Networks (SGN). The leases for the properties have expired and these properties are now vacant. Several containers are located within the Site on the eastern side with car parking in the south / central part of the Site.

1.4 Surrounds

Land surrounding the Site is predominantly residential with a supermarket to the west. Adjacent and surrounding land uses are detailed in Table 1.1 below.

Table 1-1 Adjacent and Surrounding Land Uses

Direction	Occupant	Activities	Distance
North	Residential – Lyndhurst Road	Residential area, terraced housing.	Adjacent to northern Site boundary
	Sawmill Place Birch Tree Court	Residential area	Residential housing from approx. 35m north of Site boundary
South	Residential properties	Residential area	Adjacent to southern Site boundary
	Kings Hall	Residential area	
East	Residential – Park Road.	Residential area	Adjacent to eastern Site boundary
	Beech House Park	Ornamental Gardens and Bowling Green	Approximately 40m southeast of Site boundary
West	Waitrose Supermarket and car park	Commercial	Adjacent to western Site boundary

Nearby off-Site receptors identified as potentially sensitive to odour emissions from the Site are presented in Section 2.3.1.

1.5 Planning Condition 11

Adur and Worthing Council (A&WC) has granted permission for the redevelopment of the Site (ref. AWDM/1459/21) subject to several planning conditions. Condition 11 relates to the management of odours: "*Requirement for the submission of an Odour Management Plan with regard to the Environment Agency H4 Odour Management (2011) and the IAQM Guidance on the assessment of odour for planning 2018. Timeframe Prior to development and adhered to during development.*"

Ramboll's OMP is intended to support the discharge of this condition.

It is important to note that this report is only intended to describe the proposed approach for mitigation and monitoring measures in relation to odours and VOC emissions arising from earthworks and remediation. Measures for management of other air quality considerations (e.g., dust, particulate matter) are considered elsewhere.

1.6 Context: Odour vs Air Quality

It should be noted that whilst air quality and odour are related, there are distinctions between these two subjects:

- Odour is largely a potential 'nuisance' issue; an odour assessment would consider the level of potential nuisance that an activity has caused or has the potential to cause. Whilst the level of odour may be related to the concentration of chemicals in the air, odour impacts are subjective and are different from air quality impacts and are assessed differently.
- Air Quality impacts typically focus on the concentrations of chemicals or of particulates present in air, and whether these represent a risk of harm to receptors (such as human health or ecology).

Odours are not normally considered a risk to human health (beyond being a potential 'nuisance'), and just because there is an odour, this does not necessarily mean that the concentrations of contaminants present represent a toxicological health risk.

1.7 Report Structure

Ramboll's proposed approach to air quality and odour management is set out across subsequent sections of this report as follows:

Section 2. Odour Risk Assessment

Section 3. Odour Monitoring Plan

Section 4. Preventative Odour Management Measures

Section 5. Roles and Responsibilities

Section 6. Regulatory Liaison

1.8 Definition of Roles

For the purposes of this management plan, key roles are defined as follows:

- 'Berkeley Homes (Southern) Ltd' is the Client and Developer.
- 'The Contractor' is any contractor responsible for earthworks (including remediation, enabling works, groundworks and piling).
- 'The Monitoring Provider' is a monitoring service provider independent from The Contractor(s).
- 'Ramboll' is the Client's Environmental Consultant.

1.9 General Limitations and Reliance

This report has been prepared by Ramboll UK Limited ("Ramboll") exclusively for the intended use by Berkeley Homes (Southern) Ltd (the "Client") in accordance with the agreement (proposal reference number REH2022N00423 – Worthing Gasworks), dated 4th October 2023 between Ramboll and the client defining the purpose, the scope and the terms and conditions for the services. No other warranty, expressed or implied, is made as to the professional advice included in this report or in respect of any matters outside the agreed scope of the services or the purpose for which the report and the associated agreed scope were intended, or any other services provided by Ramboll.

In preparation of the report and performance of any other services, Ramboll has relied upon publicly available information, information provided by the client and information provided by third parties. Accordingly, the conclusions in this report are valid only to the extent that the information provided to Ramboll was accurate, complete, and available to Ramboll within the reporting schedule.

Ramboll's services are not intended as legal advice, nor an exhaustive review of Site conditions and/or compliance. This report and accompanying documents are initial and intended solely for the use and benefit of the client for this purpose only and may not be used by or disclosed to, in whole or in part, any other person without the express written consent of Ramboll. Ramboll neither owes nor accepts any duty to any third party, unless formally agreed by Ramboll through that party entering into, at Ramboll's sole discretion, a written reliance agreement.

Unless otherwise stated in this report, the scope of services, assessment and conclusions made assume that the Site will continue to be used for its current purpose and end-use without significant changes either on-Site or off-Site.

This report is only intended to describe mitigation and monitoring measures in relation to odours and VOC emissions arising from earthworks and remediation. Measures for management of other air quality considerations (e.g., dust, particulate matter) and noise are not considered by this report.

This report is not intended to assess risks to the health of construction workers working on Site. Appropriate H&S management precautions will need to be developed and implemented by The Contractors in line with relevant legislation and guidance.

2. ODOUR RISK ASSESSMENT

2.1 Methodology

A qualitative odour assessment of emissions from the Site enabling works and remediation at individual representative sensitive receptor locations was undertaken following IAQM odour guidance[1]. This included considering relevant ground contamination, risk assessment and remediation reports for the Site[2,3], the odour generating potential of Site enabling and remediation activities and the effectiveness of the pollutant pathway to predict the risk of odour exposure (impact). Finally, the existing likely magnitude of odour effects at sensitive receptors was determined.

The likely existing odour effect at sensitive receptors and professional judgement were used to estimate the likely overall odour effect on the surrounding area considering the different magnitude of effects at different receptors and the number of receptors likely to experience these different effects. Full details of the assessment methodology are provided in **Appendix 1**.

2.2 Baseline Odour Conditions

Significant off-site odour sources were not identified from a desktop study, and the Site itself is currently vacant with car parking in the southern/central part of the Site.

A review of the Preliminary Risk Assessment for the Site[2] indicates that:

- Local Authority records relating to the subject Site comprise five complaints of odour during decommissioning of a former gasholder on-Site in April 2018.
- Local Authority records in the near surrounds include accumulation of waste and noise (associated with construction and demolition).
- There are no Part A(2), or Part B Environmental Permits licensed to the Site or adjoining properties.

2.3 Odour Assessment

2.3.1 Sensitive Receptors

Land surrounding the Site is predominantly residential where users would expect to enjoy a high level of amenity and would be present regularly for extended periods. Occupants of these properties would be considered high sensitivity receptors in accordance with IAQM guidance. The supermarket and car park to the east of the Site and retail units at 40-48 High Street would be considered medium sensitivity receptors, and the Worthing Hospital Trust car park to the northeast of the Site would be considered a low sensitivity receptor. The locations of receptors surrounding the Site are shown in Figure 2-1 and receptors are described in Table 2-1.

[1] Bull et al (2018). IAQM Guidance on the assessment of odour for planning – version 1.1, Institute of Air Quality Management, London
[2] Ramboll, November 2023, Land at Former Worthing Gasworks Site, Park road, Worthing, Preliminary Risk Assessment.
[3] Ramboll, November 2023, Former Gasworks, Park Road, Worthing Remediation Options Appraisal and Outline Remediation Strategy

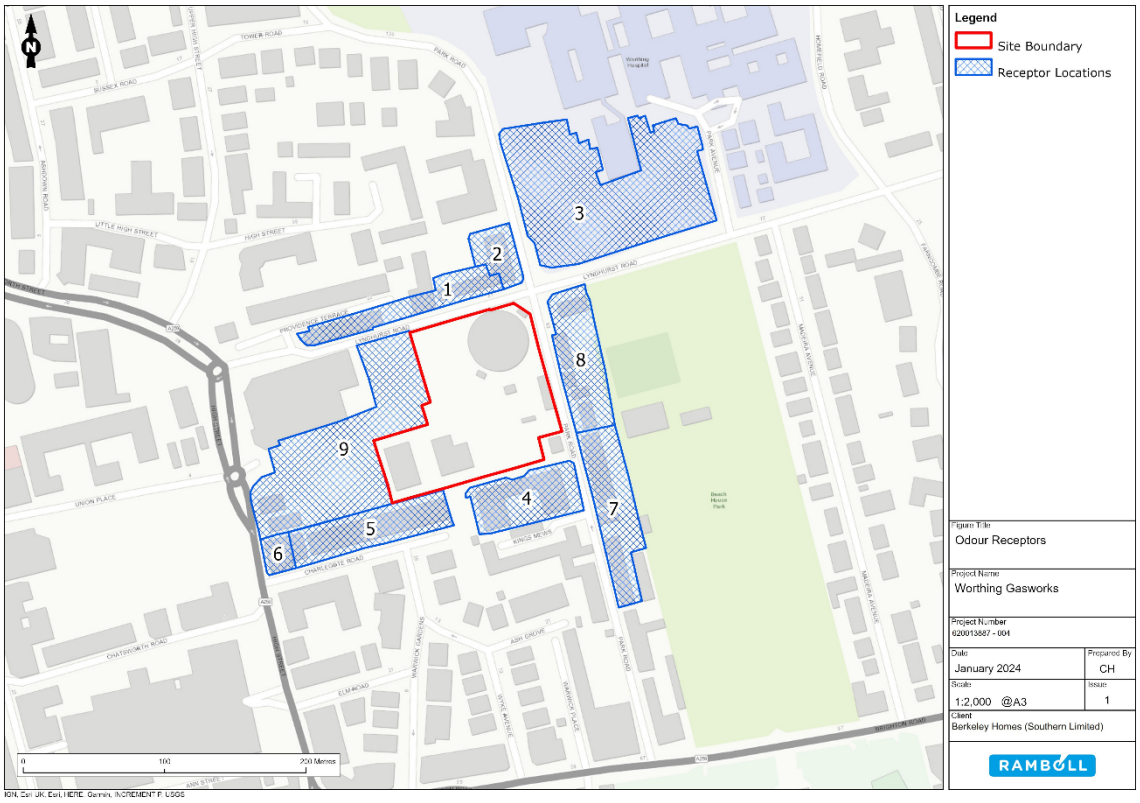


Figure 2-1 Sensitive Receptors

Table 2-1 Sensitive Receptors

Receptor	Location	Description	Sensitivity to Odours
1	Lyndhurst Road 6 to 60	Residential	High
2	Park Road 89 - 99	Residential	High
3	Worthing Hospital Trust Parking	Car Park	Low
4	Kings Hall	Residential (Sheltered/Retirement)	High
5	Charlecote Road	Residential	High
6	40 - 48 High Street	Retail/Commercial	Medium
7	32 - 80 Park Road	Residential	High
8	82 - 92 Park Road	Residential	High
9	Waitrose and Car Park	Retail and Car Park	Medium

2.3.2 Potential Odour Sources

The ground contamination Preliminary Risk Assessment for the Site[2] identified potential existing on-site contamination sources including gas holders, liquor tanks, tar tanks, a retort house, tar dehydration plant, above ground tanks, interceptors, coal storage area, boiler house, garage, stores, and workshops. An historical layout plan is shown in Figure 2-2.

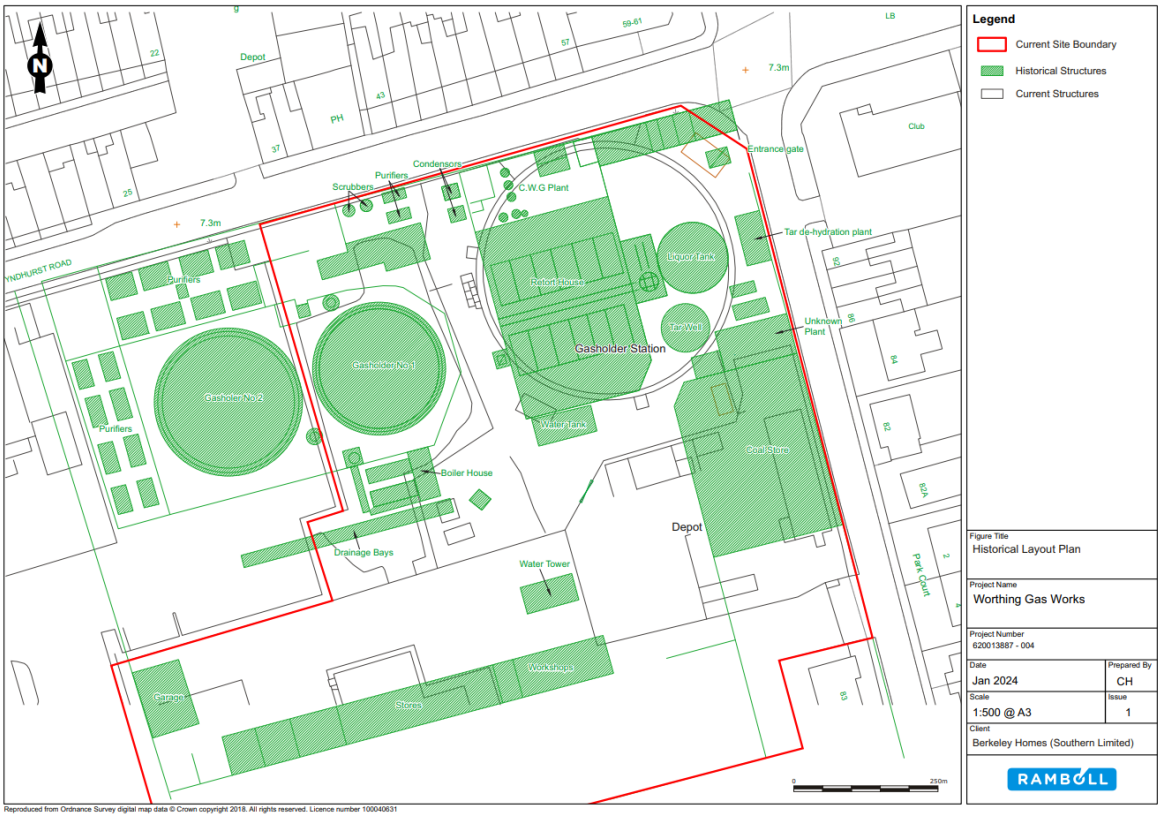


Figure 2-2 Historical layout plan

A summary of areas where previously identified soil contamination have been encountered based on information from the Remediations Options Appraisal and Outline Remediation Strategy Report[4] prepared for the Site is provided in Table 2-2 and shown in Figure 2-3 below:

Table 2-2 Previously Identified Contamination

Investigation Location	Description of Location	Description of Previously Identified Contamination
WS14 (Ramboll 2020)	South of site	Elevated concentrations of hydrocarbons in shallow Made Ground
TP08 (Ramboll 2020)	Centre/east of site	Soil contamination associated with an underground structure
BH14 (Ramboll 2020)	Within footprint of former gasholder in north-east of site	Tarry deposits were noted in the Made Ground beneath the base of Gasholder No.3
BH02 (Ramboll 2020)	Adjacent to eastern site boundary	Lenses/pockets of black tar were noted at depths below 2.9m within deposits of clay
WS1 (Waterman 1995)	Surrounding Large gas holder footprint.	Slight hydrocarbon odour in Made Ground.

[4] Ramboll, November 2023, Former Gasworks, Park Road, Worthing Remediation Options Appraisal and Outline Remediation Strategy

Investigation Location	Description of Location	Description of Previously Identified Contamination
WS2 (Waterman 1995)	Distinction between locations unconfirmed.	Moderate to strong coal tar in Made Ground and to 4.55m in Superficial Deposits.
WS3 (Waterman 1995)		Moderate to very strong coal tar odour from 2.5-4.7m Superficial Deposits.
WS4 (Waterman 1995)		Strong hydrocarbon odour and blue staining in the Made Ground.
WS5 (Waterman 1995)		Slight coal tar odour in the Made Ground.
WS05 (Hydrock 2017)	East of large gasholder footprint	Creosote odours and free phase tar was recorded in the Made Ground.



Figure 2-3 Investigation Locations

Table 2-2 and Figure 2-3 indicate the presence of ground contamination with odour generating potential in the north-eastern part of the Site.

The Remediation Strategy acknowledges that remediation activities can be a source of odour, however it states that '*no large-scale remediation excavations or on-site soil remediation treatment is planned*'.

2.3.3 Meteorological Conditions

Shoreham meteorological site is the nearest representative recording station to the Site. 2018 – 2022 data from the Shoreham meteorological station was analysed to determine the prevailing wind direction at the Site. Wind roses for the 2018 - 2022 meteorological data are provided in Appendix 2, which show that between 2018 and 2022 the prevailing wind directions at the Site were from the southwest and north, with the strongest wind speeds from the southwest.

The percentage frequency of wind blowing from the Site towards downwind sensitive receptors is shown in Table 2-3. There is a higher percentage frequency of wind blowing towards Receptors 1,2,3 and 9 than receptors 4,5,6,7 and 8.

Table 2-3 Percentage Frequency of Wind Blowing from the Site towards downwind Receptors.

Receptor	Description	Range of Wind Angle (°)	Total Frequency	% time odour pathway to each receptor
1	Lyndhurst Road 6 to 60	83 - 200	10465	24
2	Park Road 89 - 99	148 - 243	15979	36
3	Worthing Hospital Trust Parking	170 - 250	16311	37
4	Kings Hall	46 - 288	16218	19
5	Charlecote Road	16 - 353	4661	11
6	40 - 48 High Street	60 - 29	3206	7
7	32 - 80 Park Road	283 - 355	8347	19
8	82 - 92 Park Road	265 - 320	4588	10
9	Waitrose and Car Park	170 - 355	16318	37

2.3.4 Risk of Odour Exposure

A Remediation Options Appraisal and Outline Remediation Strategy has been prepared for the Site[5]. The four approaches to the environmental remediation works considered by the options appraisal were all in-situ (i.e. 'in ground') techniques and are considered to have a relatively low odour generating potential::

- Combined in-situ chemical oxidation and in-situ bioremediation of dissolved phase contamination in groundwater;
- Reactive Treatment Zone/Permeable Reactive Barrier;
- Enhanced Monitored Natural Attenuation; and
- In-Situ Stabilisation to treat DNAPL.

Only a small number of piles (12 in total to approximately 20m depth) will be installed in the northern part of the Site where more elevated concentrations of contamination occur but outside of the worst affected area. Piling in the southern half of the Site may also occur[6].

Considering the following factors:

- Minimal odour potential from on-site remediation activities;

[5]Ramboll, January 2024, Remediation Options Appraisal and Outline Remediation Strategy for the Former Worthing Gasworks
[6] Ramboll UK Limited, 17.1.24, Technical Note to Berkeley Homes (Southern) Limited

- Small number of piles proposed in the northern part of the Site;
- Effective odour control measures in place;

It is likely that the scale (magnitude) of odour release from the Site would be small in accordance with IAQM guidance.

The odour generating potential of Site remediation activities (assuming effective mitigation measures are in place) and the effectiveness of the pollutant pathway as the transport mechanism for odour through the air to the receptor versus the dilution in the atmosphere were considered to determine the risk of odour exposure at sensitive receptor locations. The likely odour effects at sensitive receptors were then determined (considering their sensitivities) and are summarised in in Table 2-4.

Receptors where there is a high frequency of wind blowing from the Site in their direction (Receptor references 1 and 2) are at higher risk of odour exposure than those located upwind. Although odour mitigation/control measures will be in place some residual odour is likely to remain which may lead to slight adverse odour impacts at sensitive receptors along Lyndhurst Road and Park Road.

Table 2-4 Likely Odour Effects at Sensitive Receptor Locations

Receptor	Description	Sensitivity to Odours	Pathway effectiveness	Source odour potential	Risk of odour exposure	Likely Odour Effect
1	Lyndhurst Road 6 to 60	High	Highly Effective	Small	Low	Slight Adverse
2	Park Road 89 - 99	High	Highly Effective	Small	Low	Slight Adverse
3	Worthing Hospital Trust Parking	Low	Highly Effective	Small	Low	Negligible
4	Kings Hall	High	Moderately Effective	Small	Negligible	Negligible
5	Charlecote Road	High	Moderately Effective	Small	Negligible	Negligible
6	40 - 48 High Street	Medium	Ineffective	Small	Negligible	Negligible
7	32 - 80 Park Road	High	Moderately Effective	Small	Negligible	Negligible
8	82 - 92 Park Road	High	Moderately Effective	Small	Negligible	Negligible
9	Waitrose and Car Park	Medium	Highly Effective	Small	Low	Negligible

3. ODOUR MONITORING PLAN

3.1 Baseline Monitoring

Baseline odour monitoring will be undertaken prior to the start of work on-site by Berkeley over six visits at varying times of day and at least a week apart to account for changes in meteorological conditions. On and off-site monitoring will be undertaken including 'sniff tests' (field-based checks for sources of odours) and spot check monitoring for the presence of VOCs using a Portable Photoionization Detectors (PID).

Baseline monitoring results will provide a benchmark against which construction stage monitoring results can be compared and will be used to assist with setting appropriate PID threshold values for VOCs in agreement with Adur & Worthing Council.

3.2 Construction Stage Monitoring

This section sets out requirements for odour monitoring to be undertaken by The Contractor during all earthworks including, remediation, enabling works, piling and other groundworks. For clarity, all of this Section is the responsibility of The Contractor and Monitoring Provider to undertake and organise. As the Developer it is Berkeley's responsibility to ensure The Contractor's compliance with the responsibilities set out herein.

3.2.1 PID Monitoring – Point of Work

The Contractor will be required to provide a suitably qualified supervising engineer to undertake regular 'spot check' monitoring for VOCs at points of work (e.g., near to the excavation faces, stockpiles, and pile locations) and at ten locations identified in Appendix 3 Figure A3.1 using portable PID (Photo-Ionisation Detector) type monitors sensitive to 1ppb (parts per billion), calibrated to isobutylene and with data logging capability. Records of field PID readings recorded during odorous works will be kept in a Site diary by The Contractor.

3.2.2 PID Monitoring – Site Boundary

Continuous PID monitors operated by an independent Monitoring Provider will be installed prior to commencement of work on site at two locations on the Site boundary (see Appendix 3, Figure A3.1) for the duration of remediation and earthworks. The monitors will be installed for a minimum period of one month prior to commencement of groundworks to facilitate collection of baseline data. The monitors will provide automated alerts to the Site management team should exceedances of agreed threshold criteria be recorded. It will be the responsibility of Berkeley and The Contractor to respond to these alerts and document any associated investigative or corrective actions.

The Monitoring Provider will produce a weekly 'dashboard' report including a summary of the previous week's monitoring data and details of any threshold level exceedances recorded. Berkeley and The Contractor will provide details of responses to exceedances where required.

Berkeley will be responsible for procuring the services required to undertake the monitoring described in this section.

Site boundary 'Monitor', 'Alert' and 'Warning' thresholds (as a measurement of total VOCs in ppm/v) will be utilised to bring detections of elevated concentrations of VOCs to the attention of The Contractor. These will be set at levels protective of odour nuisance. Appropriate PID threshold values for VOC monitoring will be confirmed following completion of baseline monitoring and agreed with Worthing Council.

3.3 Odour Monitoring

Monitoring of odours will be undertaken by The Contractor twice daily. Odour intensity should be recorded using the VDI scale of 1 (no odour/not perceptible) to 6 (very strong) as referenced within Environment Agency Guidance Document H4[7]. The Contractor will develop an odour monitoring proforma based on the same EA guidance. The odour description, source (if evident), atmospheric conditions including temperature, precipitation, wind speed and direction will be recorded. The odour monitoring data will be tabulated and kept on file for the duration of the project.

The odour monitoring will be undertaken at locations at/around the Site boundaries and between the Site boundary and nearby sensitive receptors, consistent with the baseline monitoring (see Appendix 3, Figure A3.1).

Table 3-1 Worthing Gasworks Odour Thresholds

Odour Threshold	VDI scale	ACTION
Alert Level	Odours recorded at 4/6 on VDI scale	**Take measures to reduce concentrations**
Warning Level	Odours recorded **of 5 or 6** on VDI scale	**Cease works** investigate source and implement appropriate mitigation measures.
Odour monitoring <u>should not be undertaken</u> by Site personnel who are likely to become desensitised from exposure during the works.		

Where 'strong' odours of intensities greater than 4/6 are recorded for periods of greater than five minutes, works will cease on-Site whilst the source of the odour is investigated. Appropriate mitigation measures will be employed and agreed with The Principal Contractor before works can resume. ***Note****: the actions associated to odour intensity referenced above is only in relation to the on-site earthworks. If odours are detected that are clearly attributable to an off-Site source this should be noted but should not impinge on on-Site works.*

PID readings will also be recorded at each odour monitoring location. However, it should be noted that PID readings provide a measure of total VOCs and are not an accurate measure of odour (some VOCs are more odorous than others).

Odour monitoring <u>should not be undertaken</u> by Site personnel who are likely to become desensitised from exposure during the works. In addition, checks should be carried out to ensure that the person undertaking the odour monitoring has an acceptable range of odour sensitivity.

In addition to the above, Ramboll recommends that consideration is given to independent odour monitoring 'sniff tests' being undertaken by acuity tested individuals to provide independent verification of odour conditions. Records of monitoring results could then be compared with the results of contractor's monitoring to check for consistency and assist with substantiation of any complaints received.

3.4 Odour Monitoring Report

Records of the VOC sampling and odour monitoring undertaken during the works will be kept and presented in a final 'Air Quality and Odour Verification Report' to be prepared by The Contractor.

[7] Environmental permitting: H4 odour management - GOV.UK (www.gov.uk)

This will include a summary of the monitoring undertaken, any exceedances of relevant thresholds and how these were managed.

4. PREVENTATIVE MANAGEMENT MEASURES

The Contractor will take a preventative approach to air quality and odour management to control the generation of VOCs and associated odours at source rather than responding reactively should nuisance to receptors occur. Ultimately it is for The Contractor to select appropriate control measures for their activities on-Site. These will be decided by The Contractor when designing the earthworks and remediation considering the findings of the Site Investigations. Proposed control measures are described in greater detail below.

4.1 Management of VOCs and Odour Nuisance

4.1.1 Operations

Operational control measures to be implemented by The Contractor will include but not necessarily be limited to those listed below:

Controls for all Earthworks (including remediation, enabling works, groundworks and piling)

- Daily discussion of planned works and potential VOC/odour implications at the Principal Contractor's morning briefings.
- Excavation and transport of odorous material will be planned to consider wind direction and strength. Remediation excavations will not be undertaken in unfavourable wind conditions (i.e., when the wind is blowing towards receptors).
- A supervising engineer will be present at the face of all excavations and will advise on how best to handle materials to reduce odour emissions.
- The Contractor will act proactively to ensure odour mitigation measures are in place before commencing work in areas of known contamination or where deeper excavations enter visually impacted material.
- Temporary cover systems will be utilised to reduce the potential for odour generation from exposed excavation faces/bases/malodourous stockpiles and these will be covered overnight and on weekends.
- Excavation, processing, or haulage of contaminated soils will not be undertaken during outside of typical construction working hours.
- Stockpiling of excavated waste soils on-site will be minimised (e.g., by loading straight to HGVs for off-site disposal as far as possible). In the unlikely event that on-site stockpiling is required odorous stockpiles would be covered and/or mechanically sealed and located away from sensitive receptors as far as practicable.
- Covered lorries will be utilised for off-Site disposal of contaminated materials by road haulage. Consideration will be given to identification of appropriate haulage routes avoiding sensitive receptors (e.g., schools and residential areas) as far as practicable.

Additional Controls for Remediation and Management of Odorous Works

Taking into account the findings of previous site investigations, the following measures will also be implemented during remediation excavations and other odorous earthworks, where necessary:

- Placement of fixed or mobile odour suppression units (e.g., water misting with an appropriate suppressant or neutralising additive) at the point of work and down-wind of excavations.
- Use of other suppression measures (e.g., odour suppressant foam on open excavation faces/bases).
- Using sealed vessels to contain any odorous liquids stored on-site (e.g., contaminated water from de-watering activities).

- Taking a selective/controlled approach to excavation of material in areas of known contamination to reduce VOC generation potential (e.g., reducing the surface area of excavations open at any one-time etc).
- Consideration will also be given to off-site vehicle movements with regards to transportation/removal of soils with regards to off-Site sensitive receptors. Regulatory or planning requirements regarding limitation of vehicle movements should be considered.

Additional Controls for Implementation During Piling

The final piling solution has not yet been confirmed. The Client's design team are working on piled and non-piled foundation solutions for each block. Foundation piling will disturb contaminated soils and groundwater at or below the water table (typically encountered at depths between 1.09m and 7.1m below ground level (1.3m and 6.8m AOD)). This has potential to generate emissions of VOCs and associated odours. In addition to the measures above, the Contractor will also implement the following measures during piling:

- The piling works programme will be designed to reduce potential odour and VOC emissions (e.g., to avoid operation of multiple rigs in areas of known contamination concurrently etc).
- Contaminated pile arisings will be contained and segregated to prevent cross-contamination and ground protection will be used to prevent leaching of odorous contaminants to the ground surface and underlying shallow soils.
- Stockpiling of contaminated pile arisings on-Site will be minimised (e.g., by loading straight to HGVs for off-Site disposal as far as possible). In the unlikely event that on-Site stockpiling is required, odorous stockpiles would be covered and located away from sensitive receptors as far as practicable.
- Additional controls as described above for remediation and other odorous earthworks as necessary.

It will be the Contractor's responsibility to design and implement the relevant management measures referenced above.

4.2 Communication Strategy

- Berkeley has developed a separate Communications Strategy setting out its approach to communication with the local community and stakeholders during site clearance, remediation, and construction, which has been submitted to Worthing Borough Council alongside this report.
- The name and contact details of persons accountable for air quality and odour issues will be displayed at the entrance to the development Site (e.g., the Site Environmental Co-ordinator) as well as general contact information for Berkeley.

4.3 Complaints and Incident Procedure

Berkeley is responsible for recording, investigating, and responding to any complaints regarding air quality or odour issues arising from the works. Berkeley will nominate a 'Site Environmental Co-ordinator' who will be responsible for:

- Maintaining a complaints register including the date and time of the complaint as well as contact details for the complainant. The origin of the complaint will also be recorded (e.g., direct or via local or other regulatory authority). Details recorded will include a description of the emission/nuisance, duration, if it is constant or intermittent and whether the source is identifiable.
- Investigating complaints by undertaking site inspections and recording site activities, mitigation measures employed and implementing remedial measures where necessary.

- Investigating potential alternative (e.g., off-site) sources of VOCs/odours and recording evidence of these (i.e., photos) if identified.
- Responding to complainants with details of the findings of any investigations undertaken and any remedial measures implemented.
- Informing site operatives of any complaints received, reporting of investigation findings, and briefing on any remedial measures to be implemented.
- Notifying Berkeley and the Local Authority of any complaints received, subsequent investigation findings and any remedial measures employed.
- The complaints register will be made available for review by the Local Authority if requested.

5. ROLES AND RESPONSIBILITIES

Key roles and responsibilities in relation to monitoring and management of odour issues are summarised in Table 5-1

Table 5-1 Roles and Responsibilities

Role	Responsibility
Director The Developer – Berkeley Homes (Southern) Ltd.	Overall responsibility for implementing the air quality and odour management plan. Reviewing roles and responsibilities.
Site Managers Principal Contractor – *TBC*	Ensure The Contractors works are carried out in compliance with the odour management plan. Ensure staff are aware of the requirements of environmental plans and procedures. Ensure appropriate Site documentation (e.g., records of monitoring, method statements and risk assessments) is produced and records maintained. Ensure The Contractors adhere to implementing the threshold and screening levels as described in this management plan.
Site Environmental Co-ordinator The Developer – *TBC*	Document, investigate and respond to any complaints received in relation to odours and record findings in a 'complaints register'.
Environmental Consultant – Ramboll	Provide an odour and air quality (VOC) management plan for implementation by Berkeley and others. Undertake periodic reviews of The Contractors implementation of the AQOMP and monitoring data if required by Berkeley. Undertake independent 'odour verification' monitoring if required by Berkeley. Audit The Contractor's working practices in terms of air quality and odour management if required by Berkeley.
The Contractor(s)	Design the remediation and earthworks considering the Site's potential to generate odour and implement control measures as appropriate. Prepare an 'Environmental Management and Monitoring Plan' detailing how the requirements of this OMP and other relevant documents (e.g., Remediation Strategy and AQDMP will be met). Undertake PID monitoring at points of work and Site boundaries, respond to and notify Berkeley. of any exceedances of threshold levels. Undertake off-Site (Site boundary) odour monitoring during remediation and earthworks twice daily, record the results in an 'odour diary' report form.
All Personnel	Adhere to good brownfield development practices and relevant Health and Safety requirements and the requirements of environmental plans and procedures described by the Principal Contractor.

5.1 Contractor Requirements

A summary of key contractor requirements is provided in Table 5-2 for ease of reference:

Table 5-2 Key Contractor Requirements

Item	Description	Frequency	Duration	Responsible Party
Monitoring				
PID Monitoring	Point of Work PID Monitoring	Daily	All earthworks and piling	Contractor
On-Site Odour Monitoring	Site Boundary Odour Monitoring	Twice daily	All earthworks and piling	Contractor
Odour Monitoring	Off-Site Odour Monitoring	Twice daily	All earthworks and piling	Contractor
Reporting				
Dashboard Report	Summary of PID boundary monitoring and details of any exceedances of the boundary thresholds recorded.	Weekly	All earthworks and piling	Contractor
Odour Diaries	Issue of daily off-Site odour monitoring diaries.	Weekly	All earthworks and piling	Contractor
Environmental Management and Monitoring Plan	Provision of plan including details of all environmental management and monitoring to be undertaken.	Issue prior to commencement	NA	Contractor
Please note that this list is not exhaustive and should be considered in the context of the detailed requirements specified elsewhere in this OMP document.				

6. REGULATORY LIAISON

6.1 Liaison with Local Authority

6.1.1 Odour Monitoring Report

Records of the odour monitoring undertaken during the works will be kept and presented in a final verification report to be prepared by The Contractors. This will include details of any exceedances of relevant thresholds and how these were managed.

The Contractors will make the results of any odour monitoring undertaken available to the Local Authority if required. This will be managed by Berkeley.

6.1.2 Weekly 'Dashboard' Report

The Monitoring Provider will prepare a weekly 'dashboard' report summarising the results of the previous week's PID boundary monitoring and providing details of any exceedances of the boundary thresholds recorded. The Principal Contractor and Contractors will provide input to explain how exceedances were responded to and remedied (if required). These reports will be produced for the duration of earthworks and published on the development website.

APPENDIX 1
ODOUR ASSESSMENT

Assessment Methodology

The potential odour impacts of the existing and proposed Site operations have been determined using the IAQM odour guidance[1]. Full details of the methodology are set out in the guidance document and summarised below:

- the Source Odour Potential is determined, which considers the magnitude of the odour release considering any mitigation measures, how odorous the compounds are and the unpleasantness of the odour;
- the Pathway Effectiveness needs to be estimated, considering the effectiveness of the pollutant pathway as the transport mechanism for odour through the air to the receptor;
- the next step combines the Source Odour Potential and the Pathway Effectiveness to predict the risk of odour exposure at the receptor location; and
- the final step is to estimate the effect, ranging from negligible to substantial adverse, of that odour on the exposed receptor, taking its sensitivity into account.

Assessment Criteria

IAQM odour guidance on criteria for assessing receptor sensitivity to odour (**Table A1.1**) and determining the risk of odour exposure (impact) at a receptor location (**Table A1.2**) and the potential magnitude of odour effect at sensitive receptor locations (**Table A1.3**) were used for this assessment.

Table A1.1 Receptor Sensitivity to Odours

Receptor sensitivity	Applicable locations/surrounding land where:
High Sensitivity Receptor	Users can reasonably expect enjoyment of a high level of amenity; and people would reasonably be expected to be present here continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. *Examples may include residential dwellings, hospitals, schools/education and tourist/cultural.*
Medium Sensitivity Receptor	Users would expect to enjoy a reasonable level of amenity, but wouldn't reasonably expect to enjoy the same level of amenity as in their home; or people wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. *Examples may include places of work, commercial/retail premises, and playing/recreation fields.*
Low Sensitivity Receptor	The enjoyment of amenity would not reasonably be expected; or there is transient exposure, where the people would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. *Examples may include industrial use, farms, footpaths, and roads.*

Factors affecting the transport of odour through the air to sensitive receptor locations include distance from source to receptor, the direction of receptor from source with respect to the prevailing wind, the effectiveness of any odour mitigation, the effectiveness of dispersion/dilution in reducing transport of odour to the receptor, topography and terrain. These factors were considered together to categorise the pollutant pathway from source to receptor as ineffective, moderately effective, or highly effective. Sources of odour potential and pathway effectiveness were considered together to predict the risk of odour exposure (impact) at receptor locations (**Table A1.2**).

Table A1.2 Risk of Odour Exposure (impact) at Sensitive Receptors

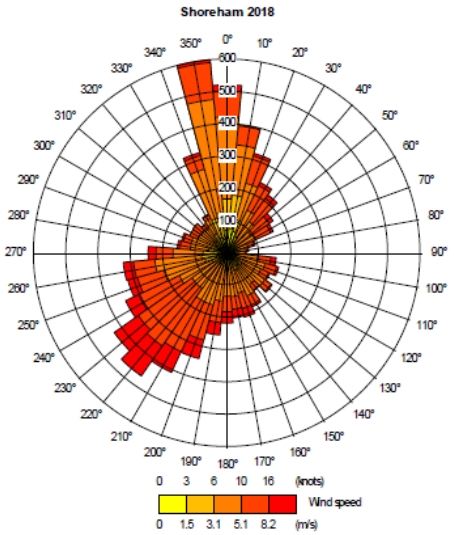
Pathway effectiveness	Source odour potential		
	Small	**Medium**	**Large**
Highly effective pathway	Low Risk	Medium Risk	High Risk
Moderately effective pathway	Negligible Risk	Low Risk	Medium Risk
Ineffective pathway	Negligible Risk	Negligible Risk	Low Risk

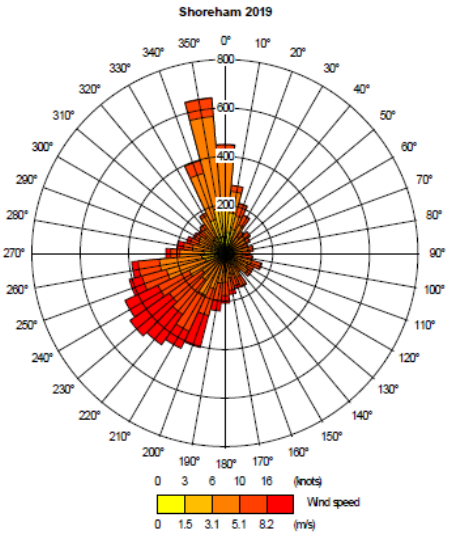
Table A1.3 Likely Magnitude of Odour Effect at Sensitive Receptors

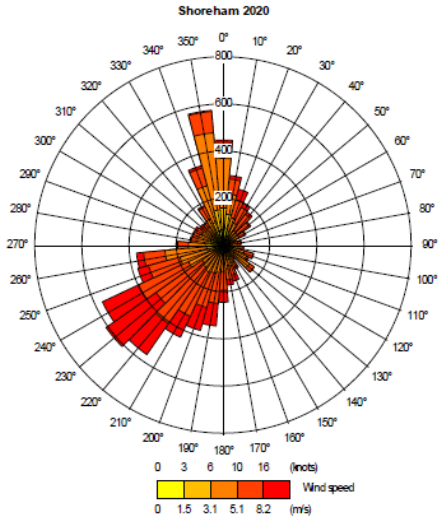
Risk of odour exposure	Receptor sensitivity		
	Low	**Medium**	**High**
High Risk of Odour Exposure	Slight Adverse Effect	Moderate Adverse Effect	Substantial Adverse Effect
Medium Risk of Odour Exposure	Negligible Effect	Slight Adverse Effect	Moderate Adverse Effect
Low Risk of Odour Exposure	Negligible Effect	Negligible Effect	Slight Adverse Effect
Negligible Risk of Odour Exposure	Negligible Effect	Negligible Effect	Negligible Effect

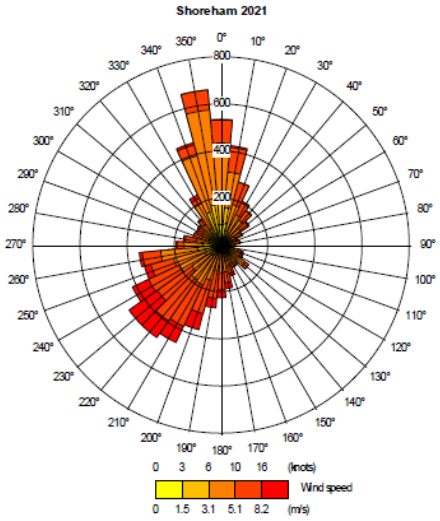
APPENDIX 2
SHOREHAM METEOROLOGICAL DATA 2018-2022

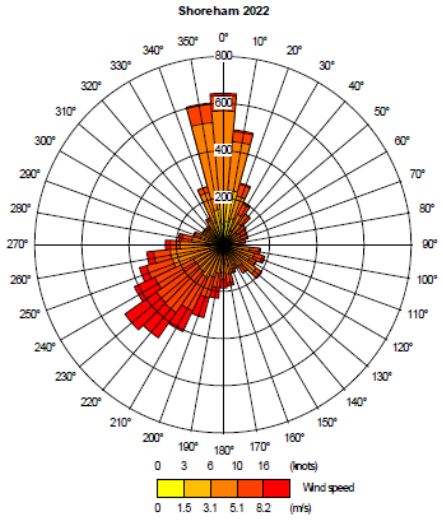
Shoreham Meteorological Data 2018 – 2022











APPENDIX 3
CONSTRUCTION STAGE MONITORING LOCATIONS

Figure A3.1 Construction Stage Monitoring Locations

