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AtkinsRéalis



Gravesend Groundwater Monitoring and Mitigation Plan

Ferrovial Construction - Bemo Joint Venture

18 July 2025

100116608

TILBURY TO GRAIN TUNNEL

Notice

This document and its contents have been prepared and are intended solely as information for Ferrovial Construction and Bemo Joint Venture and use in relation to the proposed shaft construction associated with the Gravesend Shaft.

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1. Introduction

1.1 Background

AtkinsRéalis UK Limited (AtkinsRéalis) has been commissioned by Ferrovial Construction (UK) Limited and Bemo Tunnelling UK joint Venture (FBJV) (the client) to provide geo-environmental consultancy support for the proposed Gravesend Shaft (the site), associated with the Grain to Tilbury Project for National Grid Electricity Transmission (NGET).

At the request of Gravesham Borough Council, a groundwater monitoring and mitigation plan (GWMMP) is required to monitor the groundwater quality at the site through the construction works of the Gravesend Shaft. The GWMMP is required to discharge planning condition 5, Groundwater Monitoring and Maintenance Plan, as per the Gravesham Borough Council Decision Notice, Reference 20231313, 04/03/25. The planning condition states:

“No development approved by this permission shall take place until a groundwater monitoring and maintenance plan in respect of contamination, including a timetable of monitoring (pre-, during and post-construction) and submission of reports to the local planning authority, has been submitted to, and approved in writing by, the Local Planning Authority. Reports as specified in the approved plan, including details of any necessary contingency action arising from the monitoring, shall be submitted to, and approved in writing by, the Local Planning Authority. The development shall be carried out in accordance with the approved details.”

The site is located approximately 150 m south of the Eastcourt Marshes Electricity Substation, Gravesend, DA12 2HN.

The structure of the report includes:

- Section 2: a summary of the site and proposed shaft works and methodology;
- Section 3: a summary of the environmental baseline conditions;
- Section 4: presentation of the groundwater monitoring plan;
- Section 5: presentation of the derivation of alert and trigger levels;
- Section 6: presentation of contingency planning and actions; and
- Section 7: presentation of requirements of verification reporting.

1.2 Scope

The Gravesend Shaft is proposed to be completed via Vertical Shaft Machine (VSM). The purpose of this GWMMP is to detail the requirements for groundwater monitoring and maintenance reporting during preconstruction, construction and post-construction.

A groundwater monitoring strategy is presented to enable the assessment of the potential impact on groundwater resources as a result of the construction of the Gravesend shaft. This report will be updated throughout the design and construction phases of the works. Potential updates, for example changes to the sampling method or test suite, will be captured in verification reports submitted to the regulator

1.3 Information sources

A list of the key sources of information for the proposed scheme are as follows:



- AECOM, Environmental Statement Volume VI Appendix 13.1 Water Framework Directive Assessment (Revision 1), 2024 [1];
- Ferrovial Construction, RAMs - shaft sinking with VSM, 2025 [2];
- SOCOTEC, Ground Investigation Report (Factual), 2023 [3];
- BakerHicks, Geotechnical Interpretive Report, 2023 [4];
- AtkinsRéalis, Groundwater Risk Assessment, 2025 [5];
- AtkinsRéalis, Surface Water Risk Assessment, 2025 [6];
- AtkinsRéalis, Piling Risk Assessment, 2025 [7];
- Mott Macdonald, Ground Investigation Specification, 2025, GRR-MOT-XX-PWIDE-Z3-GZ-000002-P03 [8];
- FBJV, Addendum to Ground Investigation Specification, 2025, received via email 25/04/25.

1.4 Assumptions and limitations

The findings, opinions and recommendations presented in this report are based on information obtained from a variety of third-party sources as detailed within this report. AtkinsRéalis has not independently verified third-party information and for the purposes of this assessment has assumed that such information is accurate and complete. Therefore, whilst this report and the opinions contained herein are accurate to the best of AtkinsRéalis' knowledge and belief, AtkinsRéalis cannot and does not guarantee the completeness, reliability or accuracy of the descriptions or conclusions based on supplied third-party information.

No responsibility can be accepted by AtkinsRéalis for the inaccuracies in the data supplied by any other party.

This report has been carried out under current guidance and legislation (Land Contamination Risk Management (LCRM) [9]), if these are revised in the future, then the report may also need to be updated. This report does not advise on measures to manage risks associated with asbestos, where present. Detailed advice should be sought from a specialist contractor.

As with any physical ground investigation involving discrete sampling, test results will only be representative of the point sampled and further investigation and analysis may be required should ground conditions differ from those reported. Therefore, this report cannot guarantee against unexpected ground conditions occurring between the sampling points.

Constraints relating to geotechnical hazards, ecology, heritage, flooding/drainage, utilities, air quality and noise are beyond the remit of this report.

Ground gas and groundwater conditions are based on observations made at the time of the ground investigations and monitoring programmes, and may be subject to variation due to atmospheric, seasonal or other effects.

The report shall be read as one complete document. Sections (or figures/data/appendices) of the report cannot be used without full reference to other elements of the report and any previous works referenced within the report (and associated limitations).

The opinions given in this report are relevant only for the purpose for which the report was commissioned.



2. Site summary

2.1 Site location and description

The site is located in Gravesend at postcode DA12 2HN, centred on approximate Ordnance Survey Grid Reference (OSGR) 567436, 174136. The site is part of the Grain to Tilbury Project for National Grid. The site is located to the south of the River Thames and comprises an area of undeveloped land located south of the Eastcourt Marshes Substation and west of Milton Rifle Range.

The site dips with ground elevation across the site decreasing from approximately 6.0 (m) above ordnance datum (AOD) in the north to 2.0 m AOD in the south. A site boundary plan and layout is provided in Figure 2-1.

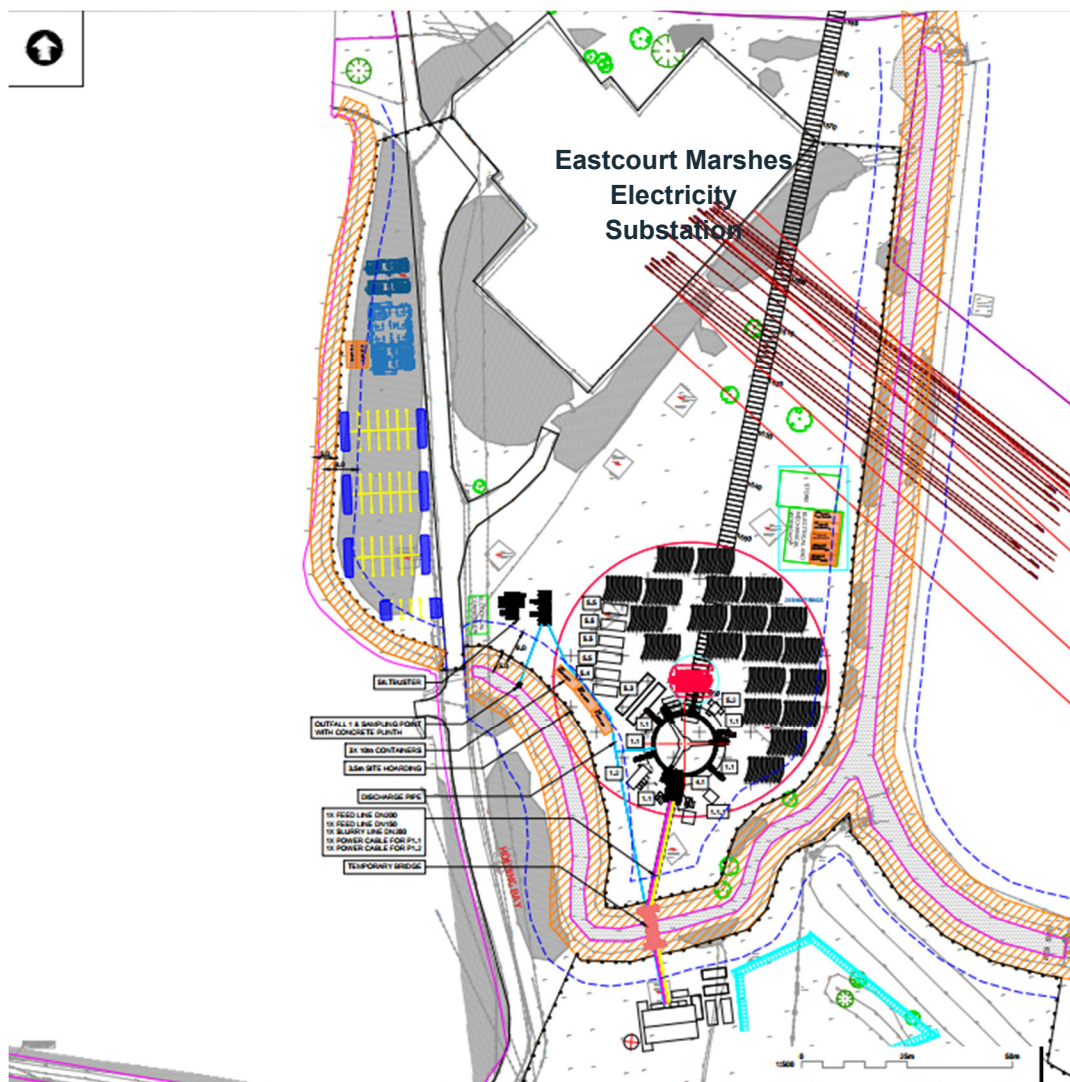


Figure 2-1 – Site boundary plan – extracted from GRR-FBJ-XX-GRRS4-DA-ZE-000002 (DRAFT), adapted

2.2 Proposed shaft

The methodology for the VSM is presented in the VSM Risk Assessment Method Statement (RAMS) [2]. A high-level summary of the methodology is presented below.

The design comprises 35 cast in-situ concrete Continuous Flight Auger (CFA) piles of 750-millimetre (mm) diameter. The proposed lengths of the piles are 18.0 m which are likely to terminate near the base of the superficial deposits / top of the Chalk bedrock. These piles will be completed in a ring around the location of the shaft for geotechnical purposes.

Risk associated with the initial CFA piles have been assessed within a piling risk assessment [7].

Once the piling is complete, assembly of the VSM will be undertaken, allowing the excavation of the shaft itself. The shaft will have a 15 m internal diameter, and approximate 39 m depth [2]. The VSM requires initial excavation and temporary dewatering to allow the assembly of the launching and capping beam (shaft collar). These two initial shaft rings would require an excavation 2.5 m deep. Following completion of the initial excavation and set up of the VSM, the inside of the shaft will be filled with water to match the natural water table, therefore no dewatering will be required during this process. The shaft is excavated/dropped into the ground surrounded by a curtain of bentonite suspension, used as lubrication.

Following completion of the shaft sinking to the proposed target depth, -44 m AOD, the VSM excavation machinery is removed, the base of the shaft sealed via concrete and the internal water pumped out. The bentonite surrounding the shaft is also replaced with a cementitious grout.

Risk associated with the VSM Shaft have been assessed within a groundwater risk assessment [5].



3. Shaft environmental setting

3.1 Introduction

The information presented in this section has been collated from the environmental information, ground investigations, and other sources listed in the sources of information, unless otherwise specifically cited.

3.2 Ground conditions

3.2.1 Published geology

British Geological Survey (BGS) mapping [10] indicates that the site is underlain by superficial deposits of Alluvium. The Alluvium is reported as consisting of soft to firm consolidated silty clay, which may contain layers of silt, sand, peat and gravel. The bedrock underlying the site is mapped as chalk of the Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation. Made Ground is not mapped at the site but may be present, related to historical development at the site and adjacent sites. Made Ground is mapped to the north and south of the site.

3.2.2 Ground investigation

Ground investigation (GI) at the site was completed by SOCOTEC in 2023 [3]. The GI comprised 3 boreholes, 10 trial pits, and 7 Cone Penetration Test (CPT). The maximum depth of the investigation was 72.00 m bgl. A borehole location plan is presented in Figure 3-1. Following the GI, BakerHicks completed an interpretive report [4] on the SOCOTEC data as well as available historical data for the site.

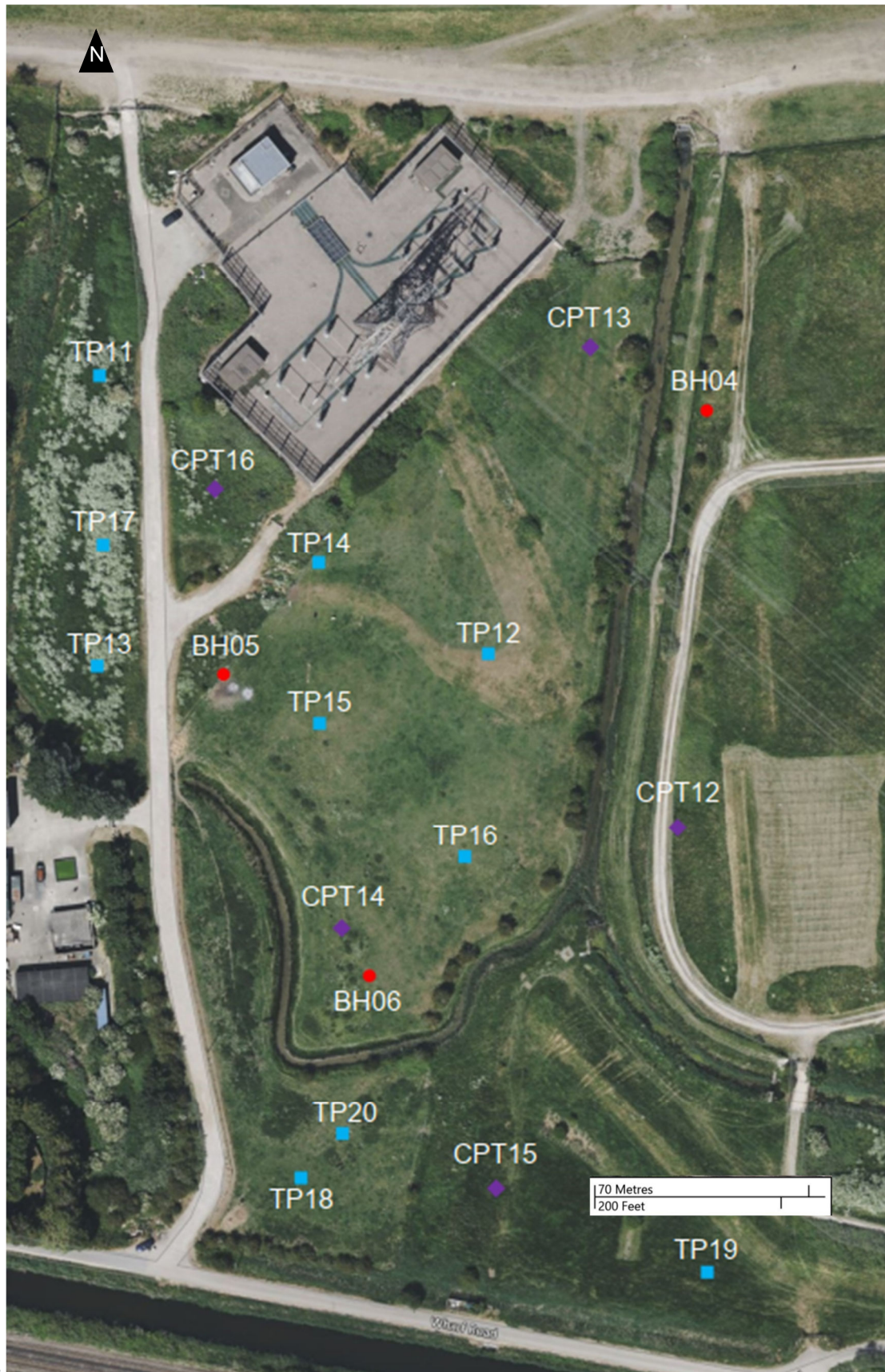


Figure 3-1 – SOCOTEC Trial pit and Borehole locations, extracted from SOCOTEC factual report [3].

The ground conditions identified during the SOCOTEC GI at the site as summarised in Table 3-1, below.

Table 3-1 – SOCOTEC GI encountered ground conditions

Geology	Strata	Elevation Range Encountered (mAOD)	Maximum Thickness (m)
-	Topsoil	2.49 to 1.63	0.50
-	Made Ground	2.42 to -0.22	2.30
Superficial	Alluvium	2.10 to -14.40	15.00
	River Terrace Deposits	-11.10 to -17.72	6.00
Bedrock	Seaford Chalk Formation	-16.71 to -68.41	51.70
	Lewes Nodular Chalk Formation	-42.15, base unproven	Unproven

Topsoil was identified as soft to firm, slightly sandy to gravelly clay with grass and occasional rootlets. Topsoil was identified at most locations across the site - BH04, BH06, CPT13, CPT14, CPT16 and all trial pits (TP11 to TP20).

Made Ground was identified in all SOCOTEC boreholes and was identified as orange, grey and bluish soft to firm, slightly sandy to gravelly sandy silt or clay. Occasional gravel sized fragments of chalk or limestone and rare brick were also reported within the Made Ground. Alluvium was reported as soft to firm slightly sandy clayey silts with some fine to medium sand towards the base. Sand towards the base was described as brownish grey silt and dark orangish brown gravelly fine to medium sand with occasional sandy silty clay. Peat was reported in BH04 with a thickness of 0.98 m and was identified as plastic dark brown amorphous peat. River Terrace Deposits (RTD) were identified below the Alluvium in the three deep boreholes, reported as brown speckled black or brownish grey fine to coarse sand and subangular to subrounded fine to coarse gravel of flint.

Bedrock of Seaford Chalk Formation was identified in the three deep boreholes, reported as between 1.30 m and 3.00 m of structureless chalk, recovered as sandy gravelly clay or sandy silty gravel, over 27.9 m to 48.7 m of CIRIA grade B4 to A1 structured chalk described as extremely weak to weak medium density chalk. Some fracture sets were reported in the structured chalk. Bedrock of Lewes Nodular Chalk Formation was identified below the Seaford Chalk Formation in boreholes BH04, BH05 and BH06. The Lewes Nodular Chalk Formation was reported as very weak to weak medium density white chalk, CIRIA grade A2 to fractureless with frequent black nodular flint. No notable layers of flint were reported.

3.3 Hydrogeology

The superficial Alluvium is classified as a secondary (undifferentiated) aquifer. RTD strata are classified as a secondary A aquifer. The Seaford Chalk Formation and Lewes Nodular Chalk Formation are classified by the Environment Agency as principal aquifers.

Online information [11] indicates that there are no groundwater source protection zones (SPZ) on or within 500 m of the site. North Kent Medway Chalk water body (GB40601G500300) underlies the Site.

The SOCOTEC 2023 investigation installed monitoring boreholes at locations BH04, BH05 and BH06. The boreholes were installed with dual installs in superficial and bedrock geology. No groundwater strikes were reported due to the use of water flush during drilling.



The reported groundwater monitoring results from the SOCOTEC GI at the site as summarised in Table 3-2, below.

Table 3-2 – SOCOTEC GI encountered groundwater levels

Borehole ID	Base of borehole (m bgl)	Response zone depth range (m bgl)	Response zone strata	Groundwater depth range (m bgl)	Groundwater elevation range (m AOD)
BH04	48.00	15.00 to 16.00	Alluvium	1.33 to 2.07	0.87 to 0.13
		42.00 to 44.00	Seaford Chalk Formation	1.76 to 2.18	0.44 to 0.02
BH05	68.02	16.00 to 19.00	River Terrace Deposits	0.81 to 1.87	1.67 to 0.61
		50.00 to 53.00	Seaford Chalk Formation	0.80 to 1.96	1.68 to 0.52
BH06	69.51	5.00 to 7.50	Alluvium	1.05 to 1.30	1.44 to 1.19
		34.50 to 27.50	Seaford Chalk Formation	1.09 to 1.66	1.40 to 0.83

The groundwater elevation data suggests that the superficial and bedrock aquifers are in hydraulic continuity.

3.4 Hydrology

The estuarine River Thames is located approximately 50 m to the north, flowing in an easterly direction. A number of drainage ditches are present adjacent and in the vicinity of the site however these are understood not to directly connect to the River Thames [12].

3.5 Environmental sensitivity

Online information [11] indicates presence of RAMSAR sites and Sites of Special Scientific Interest (SSSI) approximately 50 m to the south of the site and 450 m to the east of the site. There is also a Special Protection Areas (SPA) located approximately 600 m to the north-east of the site. There are no Special Areas of Conservation (SAC), or Local Nature Reserves (LNR) present within 1 km of the site.

3.6 Land contamination

Data from the 2023 SOCOTEC GI was assessed by BakerHicks and reported in their Interpretive Report [4]. The report presented human health, ground gas and controlled waters risk assessments on available data from the 2023 GI at the site.

3.6.1 PID monitoring

Photo-ionisation detection (PID) headspace testing was undertaken on 64no. samples across the site. All reported values were between 0.1 to 0.3 ppm. No visual or olfactory evidence of contamination were reported at the site.



3.6.2 Geo-environmental Sampling

SOCOTEC completed geo-environmental sampling which included 12 soil samples and three groundwater samples [3].

3.6.3 Human health risk assessment

The BakerHicks report completed a human health assessment on available site data (34 samples). No exceedances of selected screening criteria (commercial end use scenario) were reported.

3.6.4 Ground gas risk assessment

The BakerHicks report discussed ground gas at the site and reported that monitoring identified slightly elevated ground gas levels for methane, carbon monoxide and carbon dioxide. It was also noted that the data collected did not represent an assessment of the Made Ground at the site. The data gap associated with the lack of data for the Made Ground was conservatively given a high risk. Migration of gas off-site through preferential pathways (underground services, trenches, pipelines) was reported as possible and appropriate mitigation measures for asphyxiation or explosion in below ground excavations should be implemented. The reported high risk was specifically associated with the data gap and lack of representative data from Made Ground.

3.6.5 Groundwater risk assessment

The BakerHicks report completed a controlled waters risk assessment on the three groundwater samples collected during the GI. Screening of the available data reported exceeding concentrations of chloride (3200 mg/l, DWS 250 mg/l), boron (1.99 mg/l, DWS of 1.0 mg/l) and arsenic (0.014 mg/l, DWS of 0.01 mg/l) above DWS. Additionally, chromium (0.002 mg/l, EQS of 0.0006 mg/l), zinc (0.017 mg/l, EQS of 0.0079 mg/l) and fluoranthene (0.01 ug/l, EQS of 0.0063) was detected above EQS. The identified exceedances of chloride, maximum concentration 3200 mg/l, was inferred to be related to the proximity of the site to the estuarine River Thames. The majority of the rest of the concentrations were marginal exceedances above the criteria.

No soil-leachate laboratory analysis was completed during the GI and so no soil-leachate data was available for screening.

The BakerHicks report concluded that the potential leaching and downward migration of contaminants represented an active pollutant linkage at the site. Based on the screening undertaken, BakerHicks reported that the superficial deposits and chalk were likely to be in hydraulic continuity. Overall, BakerHicks assessed the risk from leaching of contaminants into groundwater as moderate/low. Recommendations comprised monitoring of groundwater during the works to ensure no deterioration of quality, appropriate treatment and/or disposal of any water derived from dewatering activities along-side an environmental watching brief during the works.

3.6.6 Ground aggressivity

Ground aggressivity was also assessed in the 2023 BakerHicks report, reported as design sulphate (DS) class 2 and ACEC (AC) class 2 for the Alluvium, and DS-1 and AC-1 for Made Ground, River Terrace Deposits, Seaford Chalk Formation and Lewes Nodular Chalk Formation.



4. Groundwater monitoring plan

4.1 Monitoring locations

Groundwater monitoring is proposed to be undertaken in all boreholes progressed as part of the proposed 2025 GI. Boreholes planned as part of the current GI specification [8] (and addendum) at the Gravesend site are anticipated to be:

- BH107 – 50 mm dual groundwater monitoring installation targeting superficial deposits and bedrock;
- BH108 – 50 mm groundwater monitoring installation targeting bedrock; and
- BH109 – multiple Vibrating wire piezometers (VWPs) targeting shallow superficial deposits, shallow bedrock and deep bedrock.

A borehole location plan for the proposed locations as per the available GI specification [8] is presented in Figure 4-1.

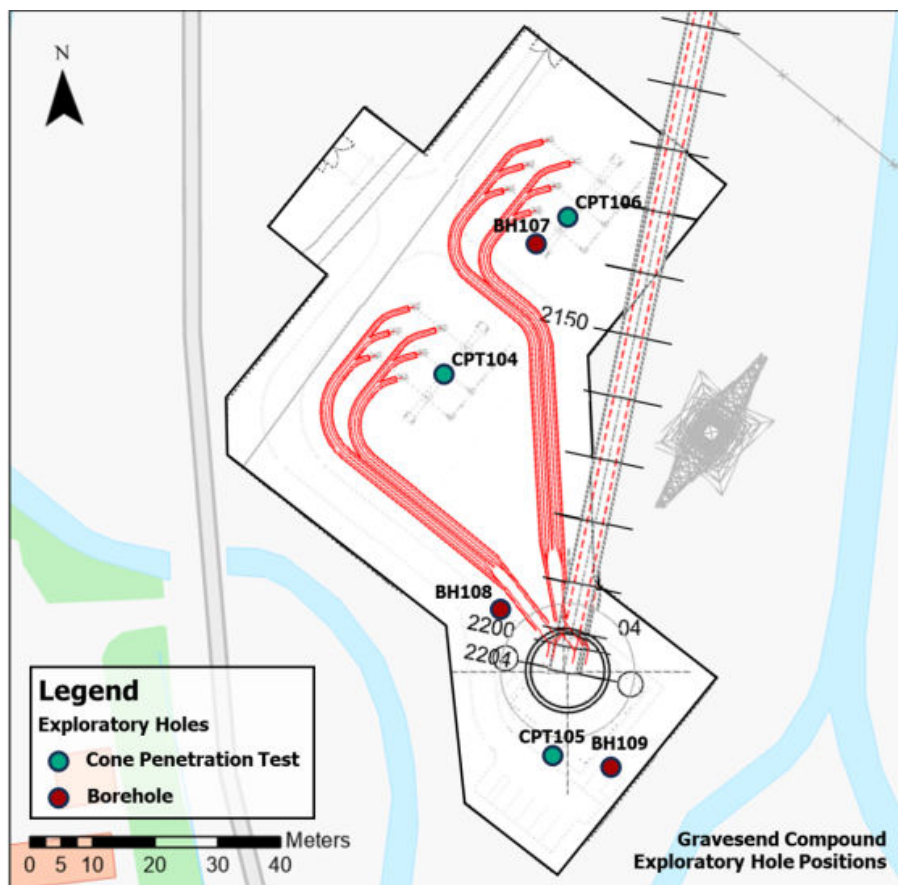


Figure 4-1 - GI borehole location plan [8]

4.2 Monitoring frequency

Proposed monitoring frequencies for all locations across the phases of work at the site are summarised in Table 4-1, below. The monitoring requirements have been based on a review of the conceptual site model (CSM) and findings of the existing risk assessments. Exact dates and durations of each phase are not currently known and so the proposed frequency of monitoring will be reviewed once this data is available. The proposed frequencies will be reviewed following completion of the 2025 GI and factual reporting as well as following any update in relevant risk assessments.

Table 4-1 – Monitoring frequency

Construction Phase	Groundwater Monitoring required	Frequency/Duration
Pre-Construction	Level and quality	Bi-weekly, minimum 3 rounds
Piling activities	Level	Two in first week then weekly
	Quality	Monthly
Initial dewatering/VSM construction	Level	3 readings in first week then weekly
	Quality	Monthly
Shaft excavation	Level	Weekly for 4 rounds then monthly
	Quality	Monthly
Post-shaft Construction	Level and quality	Monthly, minimum 3 rounds

Use of groundwater elevation data loggers is considered suitable for elevation/level monitoring at the site and therefore recommended. Loggers would allow for continuous data collection compared to manual well dipping providing a better data set for the review of the potential impact of proposed construction activities. Should loggers be used, they would be installed in each borehole, following an approved methodology. A barometric logger would also be required to allow for atmospheric compensation of data. Loggers should be downloaded monthly to align with proposed monthly quality monitoring.

4.3 Monitoring methodology

Groundwater monitoring will comprise measurement of resting groundwater levels and depth to the base of the monitoring wells using an oil/water interface probe, followed by measurement of the groundwater quality parameters detailed in Table 4-2. Micro-purging and low flow sampling will be used. The pump will be set at a rate that minimises drawdown in the monitoring well. Prior to sampling, the extracted groundwater should be monitored at three-minute intervals using a multi-parameter probe via a flow cell, until three consecutive water quality readings are within the continuity thresholds outlined in Table 4-2. Should low flow sampling not be suitable at the site, alternate suitable methods of pumping will be undertaken, along with suitable purging of the groundwater well before sampling.

Table 4-2 – Summary of In-situ Groundwater Parameters and Continuity Thresholds

Parameter	Units	Continuity Threshold
Dissolved Oxygen	Percent (%)	± 10%
pH	-	± 0.2
Temperature	Degrees Celsius (°C)	± 3%



Parameter	Units	Continuity Threshold
Electrical Conductivity	Microsiemens per centimetre (µS/cm)	± 3%
Redox Potential	Millivolt (mV)	± 10mV
Turbidity	Percent (%)	± 10%
Groundwater depth	Metres (m) (3 decimal places)	N/A

4.4 Chemical Testing

Groundwater samples will be stored in accordance with BS 10175 and shall be sent for testing to an MCERTS/UKAS accredited laboratory within 24 hours. The chemical testing suite for testing of groundwater and the method detection limit is provided in Table 4-3. Following interpretation of initial groundwater monitoring results, and derivation of relevant screening criteria (as per Section 5), the suite for analysis may be updated/reduced to key determinands only.

Table 4-3 – Summary of Chemical Testing Suite

Determinand	Method detection level
pH value	0.1 pH units
Hardness	2 mg/l
Arsenic	1 µg/l
Cadmium	0.5 µg/l
Chromium III	1 µg/l
Chromium IV	1 µg/l
Copper	0.5 µg/l
Iron	1 µg/l
Lead	1 µg/l
Mercury	0.05 µg/l
Nickel	1 µg/l
Selenium	1 µg/l
Zinc	1 µg/l
Antimony	1 µg/l
Beryllium	1 µg/l
Vanadium	1 µg/l
Ammoniacal nitrogen as N	0.1 mg/l
Free Ammonia	0.015 mg/l
Chloride	1 mg/l
Cyanide - total	5 µg/l
Cyanide - free	5 µg/l
Phenols – speciated and total	1 µg/l
Dissolved organic carbon (DOC)	2 mg/l
Calcium	0.1 mg/l
Manganese	10 µg/l
Nitrate as NO ₃	0.5 mg/l
Sodium	0.5 mg/l



TPH CWG	10 µg/l (for each individual band)
BTEX	1 µg/l
Speciated Polycyclic Aromatic Hydrocarbons (16 USEPA)	0.0001 µg/l (for each species)



5. Alert and Trigger Levels

5.1 Groundwater Elevation Alert and Trigger Levels

The proposed methodology for the development of groundwater level Alert and Trigger levels, is set out below.

Alert and Trigger Levels will be determined based on available baseline groundwater elevation and chemical monitoring, as outlined in Section 3.

Alert and Trigger Levels are to be determined on an individual well basis to account for normal variation in groundwater level, both spatially and between the identified aquifers.

5.1.1 Methodology

Minimum and maximum groundwater elevations have been identified as requiring elevation Alert and Trigger Levels based on the proposed construction methodology including piling, dewatering of the initial excavation and shaft construction.

The Alert Level elevations are to be calculated assuming that the proposed activities will have minimal impact on groundwater level [5] [7].

Maximum and minimum groundwater elevation data from the baseline data set will be utilised, including a factor of error of 1.5 to allow for seasonal and tidal fluctuations, to provide groundwater elevations for Alert Levels.

No highly sensitive groundwater elevation receptors have been identified in the immediate vicinity of the site. As such Trigger Levels will be calculated as an additional 1.5 times the respective values used in the alert levels.

5.2 Groundwater Quality Alert and Trigger Levels

The proposed methodology for the development of groundwater quality Alert and Trigger levels, and the determinands which are proposed to be monitored, is set out below.

Alert and Trigger Levels are to be determined based on the results of the pre-construction monitoring works. Pre-construction monitoring, as outlined in Section 4, will be used as baseline groundwater quality and level data for individual wells. Alert and Trigger Levels will be determined on an individual well basis to account for normal variation in groundwater quality, both spatially and between the identified strata. Where pre-construction monitoring results are not available Alert and Trigger Levels will be derived following a minimum of three monitoring rounds. These will be presented in the subsequent relevant reporting (for further information see Section 7).

5.2.1 Alert and Trigger Parameters

It is proposed that Alert and Trigger Levels are developed for a selection of parameters which can be used to evaluate impacts to groundwater quality caused by the construction of the Gravesend Shaft. The parameters which have currently been selected are based on the historical data set, have been identified as potential risk drivers (turbidity) or are designated hazardous by the Joint Agencies Groundwater Advisory Group (JAGDAG). The proposed parameters which will have alert and trigger levels developed are presented in Table 5-1 and will be reviewed and updated in line with the results of the proposed 2025 GI at the site.

Table 5-1 - Summary of Determinands Proposed for Alert and Trigger Levels

Parameter
Physical: Turbidity
Inorganics: Total Cyanide, Ammoniacal Nitrogen as N, chloride, Nitrate as NO ₃
Metals: Arsenic, Chromium, Lead, Mercury and Zinc
Total Petroleum Hydrocarbons (TPH CWG)
Phenol (total)

5.2.2 Alert Level Methodology

Alert levels are to be calculated on an individual monitoring well basis, using the following approach:

- Where concentrations of selected analytes have been reported as below laboratory detection limits within the baseline monitoring set, the alert level has been set as the limit of detection (LOD);
- Where results of the baseline monitoring period are above the detection limit with a data set of more than 3 samples, the maximum value (excluding outliers) plus 40% is assigned as the Alert Level;
- Where results of the baseline monitoring period are above the detection limit with a data set of less than 3 samples, the maximum value (excluding outliers) plus 80% is assigned as the Alert Level.

5.2.3 Outliers

In line with the Grubbs Test methodology presented in CL:AIRE [13], outliers will be considered as follows:

- If the value of the outlier was greater than or equal to five times the mean value of the sample set, including LOD values. This would indicate that the value was high compared to the sample data set; and
- If there were at least three samples with values greater than the detection limit in the sample data set for a particular determinand. At least three samples above the detection limit were considered necessary to be able to identify an outlier within the samples which were above the detection limit.

5.2.4 Trigger Level methodology

Trigger Levels are to be calculated for monitoring wells listed within Section 4.1. Trigger Levels will be developed separately for hazardous and non-hazardous substances as outlined below.

- Hazardous Substances: The Trigger Level for hazardous substances is to be set as 1.2 times the Alert Level.
- Non-Hazardous Substances: For determinands not listed as hazardous substances, the Trigger Level will be set as 1.5 times the Alert Level.

Where relevant quality standards (environmental quality or drinking water) are above the alert level but lower than the proposed trigger level as per the trigger level methodology stated above, the Trigger level will instead be set as the applicable quality standard. Where background concentrations are identified in baseline monitoring as above the water quality standards this will not be applicable.



6. Contingency Planning

6.1 Contingency Action Plan

The contingency action plan for the construction of the Gravesend Shaft will consist of the following measures.

Alert Levels are intended to draw the attention of site management to the potential of adverse trends in monitoring data. The comparison of monitoring data to Alert Levels will indicate the departure from baseline conditions. The Alert Levels will be treated primarily as an early warning system to enable appropriate investigative to be implemented, particularly where there is the potential for a Trigger Levels to be breached. If an Alert Level is breached on a single occasion the following actions will be taken:

- notify Site Management Team;
- repeat sampling/monitoring round if no routine sampling is planned within fourteen days; and
- report in next monitoring report.

If an Alert Level is breached on three consecutive sampling/monitoring rounds or if the annual review process identifies significant adverse trends in four sampling/monitoring rounds, further assessment will be required as follows:

- characterise observed issues (desk-based data review), including:
 - parameter(s) involved;
 - magnitude of exceedance(s);
 - frequency of exceedance(s);
 - spatial pattern; and
 - temporal trends.
- review relevant site activities;
- review potential cause(s) for observed results;
- review monitoring plan for adequacy;
- undertake additional investigation or sampling/monitoring (if required) to better characterise issue; and
- identify likely cause(s) for observed results.

If the observed issue is considered to relate to the project, the following actions will be taken by the Contractor:

- consult with regulator(s)/stakeholders (as appropriate);
- review significance of potential risks to receptors;
- implement mitigation measures (as appropriate) to try and halt or reverse adverse trends and/or manage risks for receptors; and
- carry out ongoing sampling/monitoring at an increased frequency and review to confirm effectiveness of measures implemented. The assessment findings and actions will be reported in the next monitoring report.

6.2 Trigger Levels

If a Trigger Level is breached on a single occasion:

- notify Site Management Team in writing;
- repeat sampling/monitoring round if no routine sampling/monitoring is planned within fourteen days;
- undertake Assessment of Significance (desk-based data review):
 - parameter(s) involved;
 - magnitude of exceedance(s);



- frequency of exceedance(s);
- spatial pattern;
- temporal trends; and
- risks to nearby receptors; and
- prepare notification report and inform key stakeholders.

If a Trigger Level breach occurs on two consecutive sampling/monitoring rounds and is part of a significant adverse trend or is considered to indicate an immediate and significant risk to nearby receptors, FB JV will undertake the following additional actions:

- prepare a notification report and inform key stakeholders (e.g., Environment Agency, National Grid, Local Council as appropriate), as soon as possible;
- notify other relevant stakeholders within one week as appropriate, e.g., other abstractors;
- review relevant activities occurring on site;
- review potential cause(s) for observed results;
- review existing monitoring plan for adequacy;
- undertake additional targeted sampling/monitoring or investigation (if required) to characterise the issue better; and
- identify likely cause(s) for observed results.

If the observed issue is considered to relate to the project:

- review significance of risks to nearby receptors;
- develop strategy within one week of the Trigger Level exceedance being confirmed by the laboratory, to mitigate and/or remediate issue(s) in consultation with key stakeholders;
- implement mitigation and/or remedial measures (as appropriate) to reduce risk of future breaches affecting project or nearby receptors; and
- ongoing sampling/monitoring and review to confirm effectiveness of measures implemented.
- The assessment findings and actions will be reported in a Notification Report, as described in Section 7.2.

6.3 Emergency Measures

Additional groundwater monitoring may be required in the event of a pollution incident accidentally occurring at or near the site. The client will propose any such additional monitoring for the approval of the Environment Agency. The scope of any such additional monitoring should be targeted to reflect the nature of the pollution incident and potential risks. This cannot be readily defined in advance of any incident occurring. Instead, the Contingency Action Plan will include a phased process by which the necessary scope of additional monitoring will be proposed in consultation with the Environment Agency, following a pollution incident. In the event of a pollution incident, the client will inform the relevant regulator(s)/stakeholders as soon as practicably possible and complete the following actions:

- review significance of risks to nearby groundwater receptors;
- notify other relevant stakeholders within one week as appropriate, e.g., other nearby abstractors;
- review this groundwater monitoring plan for adequacy;
- design additional targeted sampling/monitoring or investigation (if required) to better characterise the issue; consult with the Environment Agency and other stakeholders as appropriate;
- undertake additional targeted sampling/monitoring or investigation (if required) and review results;
- develop strategy to mitigate and/or remediate issue(s) in consultation with key stakeholders;
- implement mitigation and/or remedial measures (as appropriate) to reduce risk of future breaches affecting project or nearby receptors; and



- ongoing sampling/monitoring and review to confirm effectiveness of measures implemented.
- The assessment findings and actions will be reported in Notification Report as described in Section 7.2.



7. Verification Reporting

The client will report groundwater monitoring results during construction and these will be included within future updates of the GWMMP. The reports will be produced for relevant regulator(s) and stakeholders and will comprise:

- annual reports; and
- notification reports (if required).

7.1 Annual Report

Annual monitoring reports shall be prepared by the client annually. Minimum annual report requirements are as follows:

- self-audit of compliance with monitoring plan requirements;
- up-to-date register of monitoring network;
- groundwater level data in tabular and graphical form;
- spatial contour plots of groundwater levels, if sufficient groundwater elevation data is available;
- laboratory certificates;
- groundwater quality data in tabular and graphical form for agreed indicator species including trend analysis of data;
- analysis of changes in the ratio of major cations (Na/Ca) within groundwater to chloride;
- breaches of Alert Levels in tabular form;
- breaches of Trigger Levels in tabular form;
- summary of QA/QC checks e.g. ionic balance calculations;
- review of key groundwater issues and patterns (in context of existing conceptual model and baseline dataset);
- update or refinement of conceptual model (if appropriate);
- likely causes of identified groundwater issues;
- influence of site activities on groundwater (level and quality);
- influence of off-site/third party activities on local and regional groundwater;
- assessment of risk to nearby receptors;
- identification of any data gaps at the site;
- proposed modification to monitoring plan (if required);
- proposed changes to monitoring network, monitoring frequency, sampling methodology or analytical suite (if required);
- mitigation and/or remedial measures (if required) to manage groundwater-related risk to project or nearby receptors; and
- other proposed modifications to site activities to better manage risk to/from groundwater (if appropriate).

7.2 Notification report

Notification reports will be used to disseminate information regarding breaches of Trigger Levels or pollution incidents. These reports will provide clear, concise information and carry a recommendation for action (or describe action taken). Notification reports will include:

- date and time of issue of report;
- name, position and contact information for person issuing report;



- date and time of monitoring surveys or observations that confirm the breach of a compliance limit, or an actual pollution incident;
- pollution incident recorded or Trigger Level breached; and,
- details of any emergency contingency actions implemented.
- In instances where assessment criteria or compliance limits are breached regularly and action is being implemented by the site operator (e.g. where remedial measures are underway or where the source of contamination to groundwater is being investigated), alternative ongoing reporting procedures will be agreed with the Regulator to avoid unnecessary duplication of notification reports.



8. References

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- [8] Mott Macdonald, "Gravesend Reach Tunnel (GRRT4) - 400kV Cable Tunnel - Ground Investigation Specification, GRR-MOT-XX-PWIDE-Z3-GZ-000002-P03," 2025.
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- [11] DEFRA, "Multi Agency Geographic Information for the Countryside (MAGIC)," 2025. [Online]. Available: <https://magic.defra.gov.uk/>. [Accessed March 2025].
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- [13] CL:AIRE, "Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration," 2020.



AtkinsRéalis

