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**Milton Mount Hall
Old Road East
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Kent
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Geo-Environmental Investigation

On behalf of Wakes Ltd



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November 2021

air quality assessment contaminated land ecology environmental audits noise assessment
environmental impact assessments flood risk assessments geotechnical engineering ground investigation
hydrogeology noxious weeds remediation design risk assessments waste management

**Site: Milton Mount Hall, Old Road East, Gravesend, Kent,
DA12 1NQ**

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1 INTRODUCTION

Ground and Environmental Services Ltd (GES) was commissioned by Wakes Ltd (The Client) to undertake a Geo-Environmental Investigation at a proposed development site at Milton Mount Hall, Old Road East, Gravesend, Kent, DA12 1NQ.

It was understood that the proposed development of the site will comprise the construction of a three-storey block of apartments and a row of five three-storey terraced houses with associated driveway and parking areas and also areas of soft landscaping, including private gardens. A current 'as proposed' block plan has been attached to this report at Appendix 1.

The purpose of the ground investigation was to determine the ground profile and to provide guideline recommendations for the design of foundations for new structures on the site, together with floor slab, soakage, and pavement design.

In addition, contamination testing and a soil gas survey were carried out to provide a preliminary assessment of contamination issues based on current Contaminated Land Legislation.

2 SITE LOCATION AND LAYOUT

The application site comprises a rectangular shaped parcel of land of approximately 0.19 hectares, located to the south of Old Road East, approximately 1km to the south of Gravesend Town Centre and is centred on approximate ordnance survey grid reference TQ 649 729.

The site is situated in an urban setting, with the principal land use in the immediate surrounding area being residential, although some commercial units are present within the vicinity.

Access to the site was gained from the north off Old Road East via a brick paved access ramp which slopes downwards along the western boundary of the site. The access ramp was understood to be shared with the residential development to the immediate west of the site. To facilitate access to the investigation area from the bottom of the access ramp a temporary driveway and car parking area was constructed using clean imported hardcore.

At the time of the ground investigation the site was occupied by two buildings. The largest of the two buildings was located on the northern half of the site and comprised an L shaped single storey community building of brick construction. A smaller timber framed office/workshop building was located on the southern half of the site.

The ground levels across the site appear to have been altered significantly to accommodate the existing development on the site with a notable terrace having been formed at the northern end of the site. The terrace area which was located between the

community building and the northern boundary, delineated by a shallow level brick wall, was grass covered and sloped gently downwards to the south. At the north eastern corner of the site within the terraced area was a small dilapidated brick structure. The previous usage of this structure was unknown. Corrugated roofing materials, possibly of asbestos cement construction, were noted in this area.

To the immediate east of the existing building was an area of uneven ground which sloped gently downwards to the south. The ground cover in this area had much brick rubble and plastic fragments in amongst low level vegetation.

The area to the south of the brick built community building sloped very gently downwards to the south and was mainly laid to grass with low level fencing creating small recreational spaces. Small wooden garden sheds were located in the eastern part of this area.

The area around the timber building which was located in the southern half of the site was unkempt with dense vegetation located to its immediate east and south.

A number of tree stumps were observed in the area immediately adjacent to the dilapidated building.

A photographic record taken at the time of our site visit is presented in Appendix 2.

3 SITE HISTORY

A map search was carried out for the site and extracts of the following Ordnance Survey maps were obtained covering the period between 1874 and 2021.

These are presented in Appendix 3 and the relevant historic details are summarised as follows:

Mapping Date Range	On Site	Surrounding Area
1874-1882	The site comprises a tree-covered area of farmland. No significant features are noted on site.	The site is bound to the north by a road and to the east, south and west by open farmland. Land to the immediately southeast is tree-covered. Residential properties are noted approximately 50m north west of the site. A reservoir is noted approximately 200m north.
1896-1897	The site is clear of trees. Two small quare structures are noted in the north-eastern corner of the site.	Three rectangular structures bound the site to the south east, as well was what appears to be a residential dwelling. Residential development has taken place approximately 20m north and north east of the site. A large nursery is noted approximately 75m west of the site.

Mapping Date Range	On Site	Surrounding Area
1908-1909	No significant development is noted on site.	Potential residential development is noted approximately 20m north west of the site. Residential development is noted approximately 100m south west of the site.
1936-1938		Residential development has taken place approximately 40m north west of the site, as well as to the south west.
1954	An orchard is noted on site. The structures in the north eastern part of the site remain.	A row of garages is noted immediately south west of the site. Residential development has taken place immediately south east of the site.
1955	No significant development is noted on site.	Electrical substation is noted immediately east of the site. No further significant development is noted in the surrounding area.
1964-1974	The site is now occupied by two large structures. The structure in the north-eastern half of the site is noted as a Nursery School, whilst the structure in the southern half of the site is noted as a Scout Hut.	No significant development is noted in the surrounding area.
1992-1993	No significant development is noted on site.	
1999		
2021		

4 ENVIRONMENTAL SETTING

4.1 GEOLOGY

Reference to the British Geological Survey geological map of the area indicates that the geology underlying the site comprises the Thanet Sand Formation.

The geological memoir for the area described these strata as follows:

Glauconite-coated, nodular flint at base, overlain by pale yellow-brown, fine-grained sand that can be clayey and glauconitic. Rare calcareous or siliceous sandstones.

4.2 GROUNDWATER

Reference to the British Geological Survey 1:50,000 scale Aquifer Designation Dataset, shows the site to be set upon a Secondary A Aquifer.

Secondary Aquifers include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into two types

Secondary A are permeable layers capable of supporting water supplies at a local scale, and may be an important source of base flow to rivers. These include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage.

The site is situated within an Environment Agency-designated Groundwater Source Protection Zone I – Inner Protection Zone.

4.3 RADON

Reference to the National Radiological Protection Board's "Radon Atlas of England and Wales" indicated that the site is in an Intermediate probability radon area (1 to 3% of houses within the 5 km square which includes the site have radon concentrations above the action level of 200 Bq/m³).

However, no special measures need be incorporated into buildings.

4.4 OTHER ENVIRONMENTAL INFORMATION

Reference was made to the environmental database landmark, extracts from which are provided in Appendix 4. Relevant information relating to the sites environmental sensitivity is summarised as follows:

Dataset		On site	Nearest significant off-site feature
Agency & Hydrological	Discharge Consents	None	367m south west. Storm tank for public sewage overflow.
	Local Authority Pollution Prevention and Controls	None	278m south west. Dry cleaning.
	Nearest Surface Water Feature	None	887m north east.
	Pollution Incidents to Controlled Waters	None	609m north west. Plant / Machinery Failure : Fire / Combustion. 9th July 1999. Category 3 - Minor Incident.
	Water Abstractions	None	206m north. Public water supply.
Waste	Historical Landfill Sites	None	271m west. Deposited Waste included Inert Waste.
	Local Authority Landfill Coverage	Yes	
Geological	BGS Recorded Mineral Sites	None	142m north west. Underground chalk mine. Ceased.
	Man-Made Mining Cavities	None	211m north. Denehole:- vertical shaft having chambers at the base.
	Natural Cavities	None	705m north. Solution Pipe x 20.

Dataset		On site	Nearest significant off-site feature
	Potential for Collapsible Ground Stability Hazards	Very low	
	Potential for Compressible Ground Stability Hazards	No hazard	
	Potential for Ground Dissolution Stability Hazards	Low	
	Potential for Landslide Ground Stability Hazards	Very low	
	Potential for Running Sand Ground Stability Hazards	Low	
	Potential for Shrinking or Swelling Clay Ground Stability Hazards	No hazard	
Industrial Land Use	Contemporary Trade Directory Entries	None	132m north east. Car Breakers & Dismantlers. Inactive.
	Fuel Station Entries	None	778m west. Petrol Station. Open.

5 INTRUSIVE INVESTIGATION

5.1 FIELDWORK

The site works were carried out between the 15th October and the 15th November 2021 and comprised the following:

- Window Sampling;
- Cable Percussion Drilling;
- Falling Head Soakage Testing;
- Dynamic Cone Penetrometer Testing;
- Soil Gas and Groundwater Monitoring.

The positions of the above works on the site are indicated on Figure 1, Exploratory Hole Location Plan.

When considering the sampling strategy for this supplementary investigation, GES consulted current guidance as stipulated within British Standard BS10175 – ‘Investigation of Potentially Contaminated Sites – Code of Practice’.

Window Sample Holes

Six window sample holes (WS1 to WS6) were excavated using a Premier 110 window sampling rig to depths of between 3.0m and 5.0m below existing ground level.



The soils and materials encountered in the holes were logged and representative samples recovered for laboratory analysis. Standard Penetration tests were also carried out at regular intervals using either the split spoon or solid cone attachment.

Upon completion of window sample holes WS1, WS3, and WS6, 35mm diameter dual purpose soil gas and groundwater monitoring standpipes were installed.

Window sample hole logs and installation details are presented in Appendix 5.

Cable Percussion Drilling

One borehole (BH1) was excavated using cable percussion boring methods to a depth of 20m below existing ground level. During boring, temporary steel casing (150mm diameter) was used to support the sides of the bore.

Disturbed (D) soil samples were recovered at regular intervals throughout the borehole for description and subsequent laboratory testing purposes. Standard Penetration tests were also carried out at regular intervals using either the split spoon or solid cone attachment.

Upon completion the borehole was backfilled with a 50mm diameter dual purpose soil gas and groundwater monitoring standpipe installed to a depth of 19m.

A borehole log and installation details are presented in Appendix 6.

Falling Head Soakage Testing

Falling head soakage testing was undertaken in the standpipe installed in window sample holes WS3. The test involved recording the drop in water level with respect to time.

The field test data is summarised below in Section 8.4 below and the results presented in Appendix 7.

Soil Gas Survey

A soil vapour survey was undertaken across the site and comprised the monitoring of the atmosphere within the window sample and borehole standpipes installed at the site. Portable gas monitoring equipment (GA 5000) was used to monitor the boreholes for concentrations of carbon dioxide (CO₂), methane (CH₄) and oxygen (O₂).

The gas monitoring results are presented in Appendix 8.

5.2 GROUNDWATER

Groundwater was not recorded during the intrusive investigation. Post fieldwork monitoring recorded water at 3.87m in WS1 however this coincided with the base of the test hole and maybe water trapped in the end cap at the base of the installation. Borehole BH1 was recorded as dry at 18.8m.

It should be noted that groundwater levels may vary due to seasonal fluctuations in rainfall, but in the shorter term, can be affected by antecedent weather conditions or other causes.

6 LABORATORY TESTING

6.1 GENERAL

During the intrusive investigation, excavated soils were subjected to PID screening techniques in order to determine the presence of Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs) which is considered an appropriate screen for organic contamination.

Confirmatory soil samples were taken from all twelve window sample holes. Headspace analysis to determine VOC concentrations was carried out using a PID on all soil samples retrieved as part of this investigation. The results of the screening indicated that VOC concentrations were below the detection limit of 10 ppm in all samples.

Therefore, no significantly elevated VOCs or SVOCs were encountered and therefore the on-site soil elsewhere on site was deemed to not have been impacted by any potential VOC and SVOC contaminants. These soils would not be deemed to pose any significant risk of significant harm to human health as a result of the presence of volatile hydrocarbons. This is discussed in greater detail later in the report.

6.2 GEOTECHNICAL TESTING

The following range of laboratory tests were scheduled, and the results are presented in Appendix 9.

- i.* Determination of Particle Size Distribution (13 No.).
- ii.* Determination of pH (13 No.).
- iii.* Determination of dry density and saturation moisture content of chalk (1 no.).
- iv.* Determination of water-soluble sulphate (12 No.). See Appendix 10.
- v.* Determination of soil pH (12 no.). See Appendix 10.

6.3 ANALYTICAL TESTING

In the absence of any identifiable significant sources of contamination, six soil samples were selected and scheduled for chemical analysis which was undertaken by DETS Ltd. All soil samples were analysed for a general screening suite of contaminants considered appropriate to the current usage and past history of the site and surrounding area.

Toxic Metals		Phytotoxic Metals	Inorganic Compounds	Organic Compounds
Arsenic	Lead	Water Soluble	Water Soluble	Total Polyaromatic
Barium	Mercury	Boron	Sulphate	Hydrocarbons (PAH)
Beryllium	Nickel	Copper	pH	Mineral oils
Cadmium	Selenium	Nickel	Asbestos	Total Petroleum
Chromium	Vanadium	Zinc		Hydrocarbons (TPH)

In addition, a composite sample was prepared and submitted for testing in accordance with the Environment Agency's waste acceptance criteria.

Soil samples were stored in appropriate containers as specified within BS10175. The containers comprised of 1 kg capacity plastic containers with fitted lids.

Where organic compounds were to be determined, inert containers, which prevent loss by absorption, or volatilization, i.e. wide-mouthed amber glass containers, were used.

Samples were stored in appropriately cooled cool boxes and were transported to the laboratory as quickly as possible in order to minimize any potential for chemical and biological changes to take place.

The results of the analytical testing are presented in Appendix 10.

7 GROUND CONDITIONS AND ENGINEERING PROPERTIES

7.1 GROUND PROFILE

The ground investigation found, beneath a variably layer of Made Ground, soils typical of the Thanet Formation. Chalk of the underlying Lewes Nodular Chalk Formation was found at depth

Made Ground

The Made Ground layer was generally found to depths ranging between 0.5m and 1.1m although locally, at the locations of WS1 and WS6, thicknesses of 3.0m and 2.0m were found respectively. The Made ground materials generally comprised gravelly clayey silt and gravelly clayey sand with the gravel component comprising of varying quantities of brick, concrete and flint.

Thanet Formation

Beneath the Made Ground at all locations were soils typical of the Thanet formation.

The Thanet formation soils generally comprised silty fine to medium sands although towards the top of the sequence a slight gravel and slight clay content was observed within the soil sequence. The soils were found to the base of all window samples which were excavated to depths ranging between 3m and 5m.

At the location of borehole Bh1 the base of the Thanet formation was found at a depth of 15.1m. the base of the Thanet Formation was delineated by a 0.9m thick layer of silty clay with rounded black flints (found between 14.2m and 15.1m). This material is typical of the bullhead bed which is a marker layer for the base of the Thanet formation soil sequence.

Lewes Nodular Chalk Formation

Below the Thanet Formation at the location of borehole BH1 at a depth of 125.1m were chalk materials typical of the Lewes Nodular Chalk Formation.

The chalk was recovered as a chalk gravel in a comminuted silt size matrix with random flints.

The base of the formation was not encountered with a maximum depth of investigation of 20m.



7.2 ENGINEERING PROPERTIES

The engineering properties of the principal strata, as discussed above, can be assessed based upon a combination of the in situ and laboratory test results. A summary of the engineering properties is given below.

Thanet Formation

In situ SPT results recorded N values in the range 5 – 43 (Loose to Dense) although the majority of results were in the range 10 to 25 (medium dense). See Figure 2 for plot of SPT N v Depth. Figure 3 provides a plot of corrected N60 values against depth. The N60 value taking into account an energy ratios (Er) of 77%(WS) and 70%(BH) for the test equipment used.

Particle size distribution testing generally recorded silty to very silty sands with subordinate slightly gravelly silty sand and very sandy silts also encountered. Silt/clay fractions ranged between 25.6 and 50.4%. Hydrometer analysis of the fine fraction which was carried out on selected samples recorded silt contents in the range 28.5 to 45.5% and clay contents in the range 7.0 to 15.9%

For preliminary foundation design purposes the following parameters may be used for consideration of shallow foundations founding below a depth of 1.0m:

SPT N	=	10 (medium dense) (lower bound)
Angle of shearing resistance	=	30° (estimated)

Lewes Nodular Chalk Formation

In situ SPT's indicated this material to be very weak with N values in the range 7 to 11.

Laboratory testing on chalk samples found that the chalk was low to medium density with dry densities ranging between 1.46Mg/m³ and 1.66Mg/m³ and saturation moisture contents ranging between 23% and 31% recorded.

8 ENGINEERING DESIGN

8.1 FOUNDATION DESIGN

At the time of reporting, applied structural loads from the proposed development were unknown. However, it is known that the proposed development comprises the construction of a three-storey block of apartments and row of five three-storey terraced houses. For preliminary foundation design purposes a line load of 80kN/m run has been adopted.

In deliberation of suitable foundation options consideration was given to the geotechnical hazards and risks as presented below:

Geotechnical Hazard	Qualitative Risk & Consequences	Possible Risk Reduction Measures
Variations in stiffness of ground below foundation depth that could give rise to unacceptable total and differential settlement.	Generally Low to Medium High- areas of WS1 and WS6 Large span buildings would be particularly sensitive to differential settlement. Would result in cracking of superstructure if conventional brickwork or brick cladding is used.	Calculate likely magnitude of settlement and determine if within acceptable tolerances. Make foundations act as reinforced beams. Consider ground treatment to improve ground conditions or adopt deep foundation.
Shrinkage/swelling of foundation soils due to action of tree roots.	Low Foundation movement and cracking of brickwork.	None required
Existing underground structures such as service runs and old foundations	Very high Implication for foundation depth and economic feasibility of shallow foundations.	New foundations to be constructed in undisturbed ground or alternatively disturbed ground to be removed and replaced with suitable engineering fill.

Based upon the ground conditions found consideration has been given to founding the proposed new structures on shallow foundations.

Shallow Foundations

Strip footings founded within the Thanet Formation will provide a suitable foundation solution for the proposed new structures. It should be noted that all foundations should be founded within the Thanet Formation, which was generally encountered at depths of between 0.5m and 1.1m although it should be noted that Made Ground was encountered to depths of 2m and 3m in WS6 and WS1 respectively. Further ground investigation work is recommended in these areas to ascertain the lateral extent of the Made Ground and whether it would locally influence the foundation design.

Note that foundation depths will also need to be increased in areas previously disturbed from the existing development on the site. Other forms of disturbance that may affect founding depths are:



- the removal of trees;
- the removal of disused services;
- the relocation of existing services;
- the removal of other underground obstructions.

Based on field observations an allowable bearing pressure of 150kN/m² is recommended for foundations placed within the Thanet Formation. For a typical line load of 80kN/m run it is therefore recommended that a minimum foundation width of 0.55m is adopted.

A settlement analysis was conducted for a net increase in foundation loading of 150 kN/m² using the method of Burland and Burbridge. Based upon the results of the investigation an SPT 'N' value of 10 was adopted in the calculations, this being representative of the worst case ground conditions. The results of the settlement calculations predicted that total settlements would be less than 25mm.

8.2 GROUND FLOORS

NHBC guidance advises that suspended ground floors should be adopted when the plasticity index (PI) of the founding soils is greater than 10%. In addition, where the depth of fill would be greater than 600 mm within a self-contained area, the floor construction over the whole of that area is required to be self-supporting and independent of the fill.

Based upon the results of this ground investigation and in the knowledge the proposed new buildings extend over the footprint of the existing development it is recommended that suspended ground floor slabs should be adopted

8.3 TEMPORARY WORKS

Excavations in excess of 1.2m depth will be required in connection with the proposed development on this site. If there is a requirement for personnel to enter into excavations, then the need for trench side support should be considered for any depth of excavation and, therefore, appropriate equipment should be available on site prior to excavation proceeding. A site specific risk assessment should be carried out where man entry into excavations is required.

The base of foundation excavations should be inspected and any soft loose, organic or otherwise deleterious material at foundation level removed and replaced with lean mix concrete. The soils encountered will be liable to softening/loosening when exposed to surface water infiltration. In order to avoid deterioration of the prepared formation the base of foundations should be blinded with concrete as soon as practical after excavation and particularly if there is delay before placing foundation concrete.

8.4 SOAKAWAYS

The results of the falling head testing is presented in Appendix 7. The results from the testing carried out in WS3 indicated that the soils had a moderate soakage potential with infiltration rates of 8.59×10^{-5} m/s and 6.97×10^{-5} m/s calculated.

Based on the results obtained the use of shallow chamber type soakaways discharging into the Thanet Formation would be feasible for disposal or attenuation of surface water. It is recommended that full scale soakage tests are carried out to obtain final design parameters. This would be best done at enabling stage when excavating plant is available on site.

Should soakaways be considered as part of the development then irrespective of other considerations they should be sited at least 5m away from any foundations. The Environment Agency and Local Authority must be consulted when planning soakaway installations.

8.5 RETAINING WALL PARAMETERS

Based upon the results of the ground investigation the following parameter set is recommended for use in the design of retaining structures on the site:

Thanet Formation

Material	Bulk density	Angle of shearing resistance		Effective cohesion
	(δb kN/m ³)	ϕ' max (°)	ϕ' crit (°)	c'
Silty sands	18	33	30	0

No groundwater was encountered during this ground investigation.

8.6 CHEMICAL ATTACK ON BURIED CONCRETE

The results of the chemical testing indicated a concentration of water-soluble sulphate of between <10 and 338 (mg/l as SO₄). pH values were slightly alkaline and ranged between 7.1 and 7.9 pH units.

In accordance with BRE Special Digest 1 (SD1) entitled 'Concrete in Aggressive Ground' a design sulphate class for the site of DS-1 is recommended. Using SD1 an ACEC (Aggressive Chemical Environment for Concrete) class of AC-1 is recommended.

9 GROUND CONTAMINATION ASSESSMENT

The current guidelines used for this contamination assessment are presented within Appendix 11.

The contaminant concentrations encountered as part of this investigation have been compared against either Land Quality Management Generic Assessment Criteria (LQM GAC) for a residential development, the Chartered Institute of Environmental Health's (CIEH) Suitable for Use Levels (S4USL), or where available against newly published Category 4 Screening Levels (C4SLs) for a Residential (with home-grown produce) end use. Where neither guidelines have limit values, Contaminated Land Exposure Assessment (CLEA) framework guideline limit values have been assessed.

Category 4 Screening Levels (C4SLs) have currently been published for six substances as per the table below.

Substance	Residential (with home- grown produce)	Residential (without home- grown produce)	Allotments	Commercial	Public Open Space 1	Public Open Space 2
Arsenic	37	40	49	640	79	170
Benzene	0.87	3.3	0.18	98	140	230
Benzo(a)Pyrene	5.0	5.3	5.7	77	10	21
Cadmium	22	150	3.9	410	220	880
Chromium VI	21	21	170	49	21	250
Lead	200	310	80	2300	630	1300

All concentrations expressed in mg/kg

This table should be read in conjunction with the Final C4SL R&D Report

9.1 SOIL QUALITY

In terms of any proposed redevelopment of the site, the results of the analysis of the selected soil samples recovered during the site investigation indicated that the concentrations of *metals and metalloids* considered to be potentially toxic to humans were below the respective guideline values in all samples tested with the exception of elevated concentrations of Lead encountered across the site and an isolated slightly elevated beryllium concentration.

Organic contamination across the site was also generally found to be minimal. No significantly elevated organic concentrations were encountered which was consistent with the absence of any evidence of strong hydrocarbon odour and free product within any of the individual excavations during the intrusive works, based on visual and olfactory evidence.

Asbestos contamination was not encountered within any of the soil samples analysed.

A comprehensive description of the soil quality as measured as part of the current intrusive site investigation is given below.

9.1.1 Toxic Metals

Concentrations of toxic metals arsenic, barium, cadmium, chromium, copper, mercury, nickel, selenium, vanadium, and zinc were all below their respective soil guidance values for either a residential development under the CLEA/LQM GAC guidelines and the C4SL/S4USL guideline values for residential (with home-grown produce) where appropriate in all samples tested.

- *Beryllium* – a concentration was slightly above the 1.7 mg/kg S4USL level within the soil sample retrieved from WS1 (0.7m) which had a concentration of 2.4 mg/kg.
- *Lead* – concentrations were above the 200 mg/kg Category 4 Screening Level within soil samples retrieved from WS1 (0.3m), WS1 (0.7m), and WS3 (0.3m) with respective concentrations of 521 mg/kg, 324 mg/kg, and 201 mg/kg.

All other samples had contaminant concentrations of below their relevant guideline values.

9.1.2 Phytotoxic Metals

Concentrations of phytotoxic metals copper, zinc and nickel were compared against the maximum permissible concentration in the Sewage Sludge (Use in Agriculture) Regulations 1989.

Concentrations of all three metals were found to be below the maximum permissible concentration for the relevant pH level in all of the analysed soil samples.

9.1.3 Organic Compounds

Polycyclic Aromatic Hydrocarbons (PAH)

Concentrations of PAH were generally low and were found to be below the inert waste acceptance criteria of 100 mg/kg, as detailed in the EC Landfill Directive 1999/31/EC as applied under the Environmental Permitting (England and Wales) (Amendment) (EU Exit) Regulations 2019 (SI 2019/39) and as defined by the council decision establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC(2003/33/EC), in all of the samples tested.

Benzo(a)pyrene (B(a)P)

B(a)P concentrations were below the C4SL guideline limit value of 5.0 mg/kg for a residential (with home-grown produce) end use in all of the analysed soil samples.

Speciated PAH Compounds

All other speciated PAH compounds, within all of the analysed soil samples, were below their relevant guideline values.

Total Petroleum Hydrocarbons

Concentrations of total TPH were generally very low and were significantly below the inert waste acceptance criteria of 500 mg/kg as detailed within the EC Landfill Directive 1999/31/EC and also within the UK Water Industry Research (UKWIR) in all soil samples tested.

Generic Assessment Criteria (GAC) for total petroleum hydrocarbons according to both their molecular weight and chemical structure and also for a range of soil organic matter (SOM) content values have been derived using CLEA software. The LQM CIEH GACs are presented according to their soil organic matter content and proposed end use of the land.

Comparison of the measured TPH data with the worst-case scenario constituent compounds and their GAC limit values was made to provide a conservative assessment of the organic contamination. The maximum TPH concentration recorded on site during the site investigation was 58 mg/kg within WS5 (0.3m) comprising predominantly of 45 mg/kg within the C21-C35 range and 11 mg/kg within the C16-C21 range which is below the respective absolute worst-case relevant GAC limits of C21-C35 aromatic compounds of 1100 mg/kg and C16-C21 aromatic compounds of 260 mg/kg, based upon the appropriate percentage of Soil Organic Matter contained within the soil sample.

The TPH concentrations recorded on site within WS5, and therefore the other locations across the site, were therefore significantly below the relevant GAC limit for their respective range and would therefore not be considered to pose a significant risk of significant harm to human health.

9.1.4 Inorganic Compounds

Concentrations of water-soluble sulphate ranged from below the analytical detection limit of 10 mg/l to 338 mg/l (as SO₄). The pH values were generally neutral to slightly alkaline with values of 7.1 to 7.9 units.

9.1.5 Asbestos

Asbestos containing material was not detected within any of the soil samples analysed.

9.2 SOIL GAS

Three gas monitoring visits were undertaken between the 21st October and the 15th November 2021.

On each of the visits, a soil vapour survey was undertaken across the site and comprised the monitoring of the atmosphere within the installed Window Sample Hole standpipes. Portable gas monitoring equipment (GA 5000) was used to monitor the standpipes for concentrations of carbon dioxide (CO₂), methane (CH₄) and oxygen (O₂)

For determining the gas protection measures which may be required in low rise buildings with a beam and block floor there is published guidance from the NHBC for use on residential developments which utilises a traffic light system of classification. For larger buildings the guidance in CIRIA 665 and BS8485 is used.

Reference has also been made to the British Standard Code of Practice BS8485:2015, *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings* and regard has been given to the recommendations presented therein. The processes set out in BS8485 represent good practice and is based on the CIRIA C665 document.

In addition, CIRIA document C735, *Good practice on the testing and verification of protection systems for buildings against hazardous ground gases* has also been referenced.

The results obtained from the soil gas survey undertaken indicated that significantly elevated carbon dioxide and methane concentrations were not recorded within the voids tested during the monitoring period and concentrations were therefore all below the relevant action levels of 5% and 1% respectively.

Measurement of both borehole pressure and gas emission rates indicates that no significant gas flows are present. The maximum gas flow rate measured on site was 0.1 l/hr.

The levels of photoionisable compounds measured in the monitoring wells were below 10 ppm at all locations across all rounds of monitoring.

9.3 WATCHING BRIEF AND DISCOVERY STRATEGY

Whilst significantly elevated contaminant concentrations were generally not encountered as part of this site investigation, should discreet hotspots be encountered, which were not previously detected, during the site groundworks, these should be dealt with accordingly, by informing all parties involved with the site and drafting new contamination proposals if necessary. A number of options are available for handling any such material, which include:



- The removal from site and disposal to a suitably licensed landfill of all material suspected of being contaminated.
- Short-term storage of the suspected material while undertaking verification testing for suspected contamination. The storage area should be a contained area to ensure that contamination does not migrate and affect other areas of the site. Depending upon the amounts of material under consideration, this could be either a skip or a lined area.
- Treatment of the identified contamination as discussed above.
- Having a suitably experienced Environmental Engineer either on-call or with a watching brief for the visual and olfactory assessment of the material, and sampling for verification purposes.

Should a new source of contamination be suspected or identified then the relevant local authorities would be informed. A report indicating the nature of contamination and how this is to be dealt with would be submitted to their department and for their agreement. Any necessary remediation would then be detailed and verified in a supplementary remediation statement.

GES can confirm that such a watching brief should exist on this site during enabling and construction works and should any contamination or potentially contaminative sources be discovered during the proposed enabling works, all site works would cease and suitably competent consultants/engineers will attend site.

10 CONTAMINATION RISK ASSESSMENT

This risk assessment has been undertaken with due regard to the advice relating to groundwater as provided in the Environment Agency's "Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources", the advice provided in the Contaminated Land (England) Regulations 2000, and the associated statutory guidance. The guidance defines contaminated land as any land that is in such a condition that by reason of substances in, on or under the land:

- significant harm is being caused or there is a significant possibility of such harm being caused; or
- pollution of controlled water is being, or is likely to be caused.

This definition is based on the principles of risk assessment defined as a combination of the probability (or frequency) of occurrence of a defined hazard and the magnitude (including the seriousness) of the consequences. Central to the risk assessment process is the concept of pollutant linkage, that is a linkage between a contaminant and a receptor by means of a pathway.

Statutory definitions relating to pollution linkage.	
Contaminant	"a substance which is in, on or under the land and which has the potential to cause harm or to cause pollution of controlled waters."
Receptor	"a living organism, a group of living organisms, and ecological system or a piece of property" which meets given criteria. "controlled waters which are, or could be, polluted by a contaminant".
Pathway	"one or more routes or means by, or through, which a receptor: • is being exposed to, or affected by, a contaminant, or • could be so exposed or affected".

The relationship between these components is discussed below in order to identify the existence of any source-pathway-receptor linkage on the site, and hence the potential risks associated with any contamination.

This risk assessment is based on the proposed redevelopment of the site for the construction of a three-storey block of apartments and a row of five three-storey terraced houses with associated driveway and parking areas and also areas of soft landscaping, including private gardens.

The significance of the risks to the receptors/targets identified is based on an evaluation of the potential pathways between the contaminant source and receptors based on the most sensitive end use, i.e. a residential with plant uptake end use.

Potential receptors/targets at the site and in the area in which the site is located include:

- future occupants and the general public;
- construction/maintenance workers;
- groundwater resources;
- underground services in and around the site;
- plants in proposed private gardens and soft landscaped areas.

10.1 CONTAMINANT SOURCES

From the historical maps there are generally no clear signs of significant on-site sources of contamination. The site walkover did not identify any potential sources of significant contamination on site, with the exception of suspected asbestos containing roofing materials to some of the existing on-site structures and also some Corrugated roofing materials, possibly of asbestos cement construction, was also noted upon the ground in the north-eastern corner of the site.

In summary, the following potential contaminant sources have been identified at the site and in the surrounding area:

Potential Source	Source Description	Principal Contaminants of Concern
Current and Historic Site Use	Near surface in-fill/ reworked material of unknown origin used to level areas beneath former buildings and hardstanding. Demolition waste.	PAH, TPH, Metals, ACM
	Hazardous materials used within former on-site buildings	ACM
Current and Historic Surrounding Land Use	Potential Landfill operations.	Ground Gases (Methane and Carbon Dioxide)

In general the analytical testing of soils retrieved as part of the intrusive investigation did not reveal significantly elevated contaminant concentrations although as mentioned in Section 9.1 of this report, slightly elevated heavy metal concentrations were encountered on site, together with potential asbestos containing material within the existing on-site structures' fabric and upon the ground within the north-eastern corner of the site. The risks associated with these contaminants are discussed below.

10.2 RISK TO HUMAN HEALTH

Toxic Metals

Concentrations of toxic metals arsenic, barium, cadmium, chromium, copper, mercury, nickel, selenium, vanadium and zinc were all below their respective soil guidance values for a residential with plant uptake end use in all samples tested in this site investigation, therefore the risks to human health from these contaminants is considered to be low.

Three out of the six soil samples tested contained lead concentrations above the C4SL guidance level of 200 mg/kg.

Similarly, one of the six soil samples tested contained a beryllium concentration above the S4USL guidance level of 1.7 mg/kg.

The test results have been assessed following the CLAIRE/CIEH (2008) guidance for statistical testing of a data set for planning purposes involving the calculation of the sample mean and sample standard deviation, investigation of the normality of the data distribution and investigation of outliers and the calculation of 95th UCL values. The measured concentrations on site have been statistically analysed using the ESI statistics calculator as described above. The 95th UCL of the test results have been used for subsequent comparison with the CLEA SGVs or CIEH GAC values as appropriate.

The application of the above statistical test was run for both the lead and the beryllium datasets.

The lead dataset showed that whilst no outliers were present, the sample mean exceeded the critical concentration, therefore the soil on site, in terms of lead, would be considered to pose a significant risk of significant harm to human health where a potential pathway remained.

This means that if any contaminant source to receptor pathways are to remain present on site, then the soils above could be considered to pose a potential risk of harm to human health in the context of Part 2A.

However, it is noted that suitable growth media for the proposed private gardens and areas of soft landscaping is unlikely to be present on-site following site preparatory works and therefore such would need to be imported.

In order to maintain site levels, the soils currently present across the site including in the proposed soft landscaped areas would have to be removed prior to development. This will allow for the depth of growth media required. This would effectively sever any potential pathway between any contaminated soils not encountered and future receptors.

The beryllium dataset showed that whilst outliers were present, the sample mean did not exceed the critical concentration and there is enough evidence to reject the null hypothesis, therefore the soil on site, in terms of beryllium, would not be considered to pose a significant risk of significant harm to human health where a potential pathway remained.

The test results sheet for the lead and beryllium datasets have been attached to this report at Appendix 12.

Organic Compounds

Organic hydrocarbon concentrations were not significantly elevated and therefore the risks from these contaminants would not be considered to pose a significant risk of significant harm to human health.

Asbestos

Asbestos was not detected in any near surface made ground soils from across the site therefore the risks from asbestos would not be considered to pose a significant risk to human health.

However potential ACM has been identified, as roofing material, upon the existing on-site structures some corrugated roofing materials, possibly of asbestos cement construction, were noted upon the ground in the north-eastern corner of the site.

Any such material is to be removed from site in accordance with the hazardous waste regulations. It is considered likely that a dedicated skip provided by a suitably licensed asbestos handling company would prove sufficient.

On the balance of the toxicological risks posed by the ground contamination encountered as part of the intrusive investigation undertaken by GES, it is considered that the potential risks to site workers and future occupants could be adequately controlled as follows:

Site Workers

- Provision of appropriate personal protective equipment and hygiene facilities.
- Good working practice in line with current legislation when safely handling and disposing of any asbestos material.
- Provision of appropriate dust suppression, to minimise the generation of potentially contaminated suspended particulates during site works.

Future Occupants

- Elevated levels of contaminants have been found at the site which could pose a risk to future occupants if exposed to the material for instance in a garden or area of soft landscaping. Current development proposals include private garden areas and areas of soft landscaping. There is no suitable growth media on site, therefore it would be necessary to excavate the Made Ground material in proposed soft landscaped areas and replace it with clean sub soil and topsoil.
- With regard to the areas which may be set to garden areas in the proposed development it is noted that given the absence of such on site, suitable growth media would need to be imported into these areas of the site. Any such imported growth media would require analytical testing to confirm its suitability as growth media and its compliance with their relevant SGVs.
- Following the enabling works in the proposed garden areas on site material will be excavated and certified clean sub soils and topsoil imported for the garden areas. BRE cover system modelling has been carried out which confirms the thickness of clean soil required and the model results spreadsheet is attached at Appendix 13. Reference to the BRE 465 'Cover Systems for Land Regeneration, Thickness of Cover Systems for Contaminated Land' 2004 document shows that such a cover could reduce the risk of exposure.
- The modelling results indicates that a simple cover system of approximately 410 mm soils would be required to sever the linkage of pollutants in the soil below in the proposed garden areas based on the worst-case contamination recorded on site. It should be noted that this would be considered a conservative approach since most of the contaminated Made Ground indicated in this area will be removed as part of the site enabling works. Typically, 150 mm topsoil over approximately 260 mm clean free draining subsoils would generally be considered sufficient. Where deep rooting shrubs / trees are proposed in any landscaping it may be necessary to locally deepen the clean cover to accommodate a healthy root bowl.

No such clean cover has been laid on site yet and will not be brought to site and placed until the construction phase is completed to avoid over compaction by site plant.

- In areas which are to be covered by either buildings or hard standing, no such clean cover layer is required to sever the contain source to receptor pathway. However, during the enabling works the surface layer will be removed pending either off-site disposal or for reuse below buildings and hardstanding across other areas of the site.
- Following implementation of the aforementioned remedial measures the site would not be considered to pose a potential risk of significant harm to human health in the context of Part 2A.

10.3 RISKS TO WATER RESOURCES

The site is underlain by soils belonging to the Thanet Formation which is designated as a Secondary A aquifer. The site is also located within a groundwater Source Protection Zone and there are no potable water abstractions within a 250m radius of the site.

In addition, significant levels of potentially soluble and therefore mobile organic contaminant sources were not measured on site within the samples tested. Only lead concentrations were found to be significantly elevated as part of the analytical test results, however the leachability of the lead within the on-site soils were not proven to be significant based on the WAC test results.

Furthermore, the underlying aquifer has been proven to be present at a considerable depth, in excess of 20m below existing ground level.

It is therefore considered risks to groundwater resources are considered to be classed as low.

10.4 RISKS TO PLANTS

There is currently no suitable growth media on site. Current development proposals include private gardens and areas of soft landscaping therefore the importation of clean suitable topsoil and subsoil would be necessary. Any material imported to site for use in any proposed soft landscaped areas would require chemical testing to confirm its suitability for use.

This action would ensure any contamination is isolated below the rooting zone of plants, and therefore unavailable for uptake, thus ensuring any source receptor pathways are severed. The risk to plant health posed by the contaminants identified would be considered to be low following implementation of the remedial strategy.

10.5 RISKS TO BUILDINGS & SERVICES

Based on organic contaminant concentrations encountered as part of this investigation within natural soils from likely depths of proposed service runs and within the majority of near surface made ground soils, the risks to buried services from organic contamination such as TPH, which can degrade/permeate plastics and other polymer materials used to supply potable water is considered to be low.

Based on current guidance, the need to protect incoming water supplies, e.g. by the use of barrier pipes, is unlikely given the contaminant levels encountered as part of this investigation however it is always advisable that confirmation from utility suppliers should be sought.

10.6 GAS RISK ASSESSMENT

The levels of soil gas underlying the site have been monitored as part of a short-term soil gas monitoring programme carried out across the site during October/November 2021. The results obtained from the soil gas survey indicate that elevated levels of soil gas, which may require gas protection measures to be incorporated into the development, are not present on site. No significantly elevated gas flow rates were recorded during the monitoring. Furthermore, significant biodegradable material was not encountered in any of the holes excavated at the site.

The highest carbon dioxide concentration encountered on site during this current investigation was measured in WS6 at 1.7% which does not exceed the relevant guideline limits of 5%. Similarly, no elevated methane concentrations were recorded across the site.

Measurement of both borehole pressure and gas emission rates indicates that no significant gas flows are present. The maximum gas flow rate measured on site was 0.1 l/hr which was measured directly with a built-in flow meter. In order to allow for a worst-case scenario, GES have used a gas flow rate across the site of 2.0 l/h in the following calculations.

Based on BS 8485:2015 and C716, we have assessed the site based on the gas monitoring undertaken as part of the site investigation in order to calculate a Characteristic Gas Situation (CS).

Based on the worst-case gas characteristic situation, the worst-case implied CS derived by combining the maximum observed concentrations from different gas monitoring standpipes during any monitoring event and a worst-case flow rate of 2.0 l/h are as follows.

Flow Rate (l/h)	CH4 (%)	CO2 (%)	GSV – CH4 (l/h)	GSV – CO2 (l/h)	Implied CH4 CS	Implied CO2 CS
2.0	0.0	1.7	0.000	0.034	1	1

On the basis of the measurements in the table above, the GSV is taken to be 0.034 l/h, which is the worst case for methane and carbon dioxide. A GSV of 0.034 l/h lies within the GSV values for **CS1** (<0.07 l/h) which has a very low hazard potential.

BS 8485:2015 enables the minimum level gas protection (score) for the site or zones to be determined based on the determined CS and the type of proposed building. Given the proposed end use of the site, a High-risk Type A building has been used for calculating the appropriate gas protection score.



Given that the site has an implied CS1, the minimum gas protection score required for a Type A building is 0, which means that no gas protection measures would be required as part of the proposed development based on current gas concentrations.

10.7 WASTE DISPOSAL

Should an excess volume of soil be required to be disposed of off-site then a waste classification may be required.

For a waste classification to be undertaken, materials may need to be subjected to chemical testing which would give an indication to the contaminants present and, therefore those most toxic to the environment in the waste. Following the assessment of the waste as hazardous or non-hazardous waste acceptance criteria leachate testing allows the appropriate disposal pathway to a suitably licensed disposal facility to be further determined.

Waste acceptance criteria (WAC) leachate testing was carried out on a composite soil sample from the site. The results are attached at Appendix 10 and show that no leachable content in excess of the inert limit values was noted.

As a preliminary waste assessment and based on the results of materials tested to date, it is considered that the majority of any surplus soils requiring off-site disposal would be classified as EWC 17 05 04 non-hazardous and is likely that the soils would be acceptable at a waste facility licenced to accept inert material. The final decision will rest with the waste facility permit holder.

11 CONCEPTUAL SITE MODEL

A conceptual site model (CSM) is a system diagram identifying contaminant sources, routes of exposure (pathways), and which receptors are affected by contaminants moving along those pathways.

The model is produced to identify the zones of the site with different potential contaminations characteristics (e.g. whether contaminants in the soil are likely to be on the surface or at depth, distributed over an entire area or in localised 'hot spots').

The conceptual site model presented in the table below is based on the findings of the site investigation undertaken.

Milton Mount Hall, Old Road East, Gravesend, Kent
Geo-Environmental Investigation



Source	Pollutant	Pathway	Hazard	Receptor	Observations/ Recommendations	Assessed Risk
Contaminated ground	Metals, organic (hydrocarbons) could be present	Direct contact, ingestion, inhalation.	Health risks including skin irritation.	Humans: site workers	Normal health and safety precautions. No significantly elevated contaminant concentrations encountered other than certain heavy metals, namely lead, within near surface made ground soils which are likely to be removed during site clearance or capped as part of proposed development.	Low following site clearance and importation of clean topsoil to proposed gardens and soft landscaped areas.
		Surface run off.	Lateral movement to surface watercourses.	Aquatic resources, ecology and subsequent users including humans.	Significant contamination not encountered on site and there are no surface water courses in immediate vicinity of the site.	Low
		Leaching/Dispersion.	Downward migration to groundwater.	Aquatic resources – Groundwater, abstraction wells) / surface waters.	Significant contamination not present in soils.	Low
		Uptake by plants.	Phytotoxic effects.	Soft landscaped areas / plants.	Significant contamination not generally present in soils however existing soils are not considered to be suitable as growth media and it is therefore recommended that the placement of clean topsoil/subsoil is required in any proposed garden/soft landscaped areas.	Low following recommended remedial works.
		Direct contact	Aggressive chemical attack	Building structures and services	It is considered that protection of services is unlikely to be required on this site however confirmation advice should be sought from Statutory Providers.	Low

Milton Mount Hall, Old Road East, Gravesend, Kent
Geo-Environmental Investigation



Source	Pollutant	Pathway	Hazard	Receptor	Observations/ Recommendations	Assessed Risk
Liquid contaminant sources	Diesel, Petrol and Oils.	→ Direct contact; ingestion, inhalation.	Health risks including skin irritation. Lateral and vertical migration of contaminants.	→ Humans: site workers. Groundwater and surface water.	The intrusive ground investigation proved no significant contamination and no liquid contamination sources were identified on site.	Low
Asbestos	Asbestos fibres within made ground and waste on site	→ Inhalation.	Health risks including asbestosis, mesothelioma, and lung cancer.	→ Humans: site workers and future occupants.	Asbestos has not been identified within soil samples retrieved from site. Appropriate PPE should be worn when working with asbestos and additional on-site ACM is to be safely removed from site and disposed in accordance with current legislation and guidelines.	Low following recommended remedial works
Landfill, made ground,	Ground Gases (CO ₂ , CH ₄)	Inhalation and ingress into buildings	Asphyxiation and explosions	Buildings/humans/ future site users	Significantly elevated ground gases have not been recorded on site. Gas protection measures are not recommended in new development.	Low
Redundant Waste, Demolition Waste		Dermal Contact/ingestion. Potential for migration via surface water run-off	Health Risks	Humans: Site workers	Any unwanted waste on site is to be removed from site during site preparatory works and disposed of in accordance with current legislation. Normal health and safety precautions.	Low

12 CONCLUSIONS AND RECOMMENDATIONS

Based on the site investigation, intrusive works and subsequent data assessment, the following conclusions and recommendations have been drawn in respect of the site at Milton Mount Hall, Old Road East, Gravesend, Kent.

Geotechnical

- The ground profile encountered at the site comprised a highly variably thickness of Made Ground over soils typical of the Thanet Formation. Chalk of the underlying Lewes Nodular Chalk Formation was found at depth.
- At the time of reporting, applied structural loads from the proposed development of the site were unknown. However, for preliminary foundation design purposes a line load of 80kN/m run was adopted.
- Based on field observations, in situ testing and laboratory test results, a maximum allowable bearing of 150kN/m² was recommended for foundations placed at a minimum depth of 1.0m in the Thanet Formation soils. Foundation depths will likely require extending due to the presence of existing structures on the site and the localised thickness of Made ground materials. Further ground investigation works were recommended in the areas of WS1 and WS6 to ascertain the lateral extend of the Made Ground materials.
- For a typical line load of 80kN/m a minimum foundation width of 0.55m was recommended.
- For foundations placed at a minimum depth of 1.0m below existing ground level preliminary settlement calculations indicated total settlement would be in the order of 25mm.
- A suspended ground floor has been recommended.
- Falling head testing recorded a moderate infiltration potential with infiltration rates of 8.59 x10⁻⁵ m/s and 6.97x10⁻⁵ m/s calculated. Based on these results the use of shallow soakaways would likely be a viable option for disposal of surface water. Full scale BRE DG365 testing is recommended at enabling stage to obtain final design parameters.
- In accordance with BRE digest SD1 a design sulphate class of DS-1 and an ACEC class of AC-1 was recommended.

Environmental

- The site is underlain by varying thickness of Made Ground over soils belonging to the Thanet Formation which is designated as a Secondary A aquifer. The site is also located within a groundwater Source Protection Zone and there are no potable water abstractions within a 250m radius of the site.



- The site has historically been used for agricultural purposes prior to most recently being used as a nursery school.
- No visual evidence of significant ground contamination was identified during the historical map search or site walkover, with the exception of suspected asbestos containing roofing material to the fabric of the existing on-site structures a small quantity of corrugated roofing materials, possibly of asbestos cement construction, was noted in the north-eastern corner of the site.
- Concentrations of toxic metals were generally below their respective soil guideline values. However elevated lead concentrations were encountered across the site which is considered to potentially pose a significant risk of significant harm to human health where a potential pollutant pathway remained.
- No significant levels of mobile organic contamination were noted on site.
- Concentrations of PAH and TPH were generally low across the site and would therefore not be considered to pose a significant risk of significant harm to human health.
- Areas of the site to be covered by buildings and hardstanding would not pose a significant risk of significant harm as they would sever any potential pollutant pathway however it is considered that there is a potential risk to human health in proposed private garden and soft landscaped areas.
- The risk to flora on site is generally considered to be low given the absence of significant phytotoxic contamination and the health and vigour of the plants currently on site however in the absence of a suitable growth media on site, it is recommended that certified clean topsoil and subsoil would need to be imported into private gardens and soft landscaped areas to a depth of approximately 410mm. This will also serve to isolate any residual contamination not identified during the site investigation.
- Asbestos containing material was not detected within soil samples retrieved from the site however there is the potential presence of Asbestos Containing Material (ACM) within the fabric of the existing structures and a small quantity upon the floor which was noted in the north-eastern corner of the site which is to be removed from site during demolition/clearance works and in accordance with relevant current waste legislation.
- Following the above recommendations, the risks posed by any residual contamination is considered to be low provided the above remedial works are implemented.
- The risks posed to workers involved in any future redevelopment of the site are not considered significant providing standard health and hygiene practices are adopted.
- Based on concentrations of organic contaminants found at depths likely to correspond with service runs across the site, it is unlikely that any new services will require protection, however it is advisable to seek service provider confirmation of this.



- Based on gas monitoring results, the site has been given a classification of CS1 which has a very low hazard potential, based on BS 8485:2015, and therefore no gas protection measures need be incorporated into any new buildings constructed on the site.
- The risks to groundwater in the underlying aquifer is considered to be low due to the lack of any significant mobile organic contamination and because of the low leaching potential of the overlying on-site soils.
- The majority of any surplus soil material to be removed off site is likely to be classified as non-hazardous and are likely to be acceptable at a facility licensed to accept inert waste.
- It is recommended that a watching brief is implemented on this site during enabling works and should any contamination or potentially contaminative sources be discovered during the proposed enabling works all site works would cease and suitably competent consultants/engineers will attend site to agree a formal remediation strategy.

Based on the principles and definitions outlined under section 57 of the Environment Act 1995, the site would not be considered to be "Contaminated Land" based on its proposed residential redevelopment with plant uptake end use following implementation of the above remedial measures.