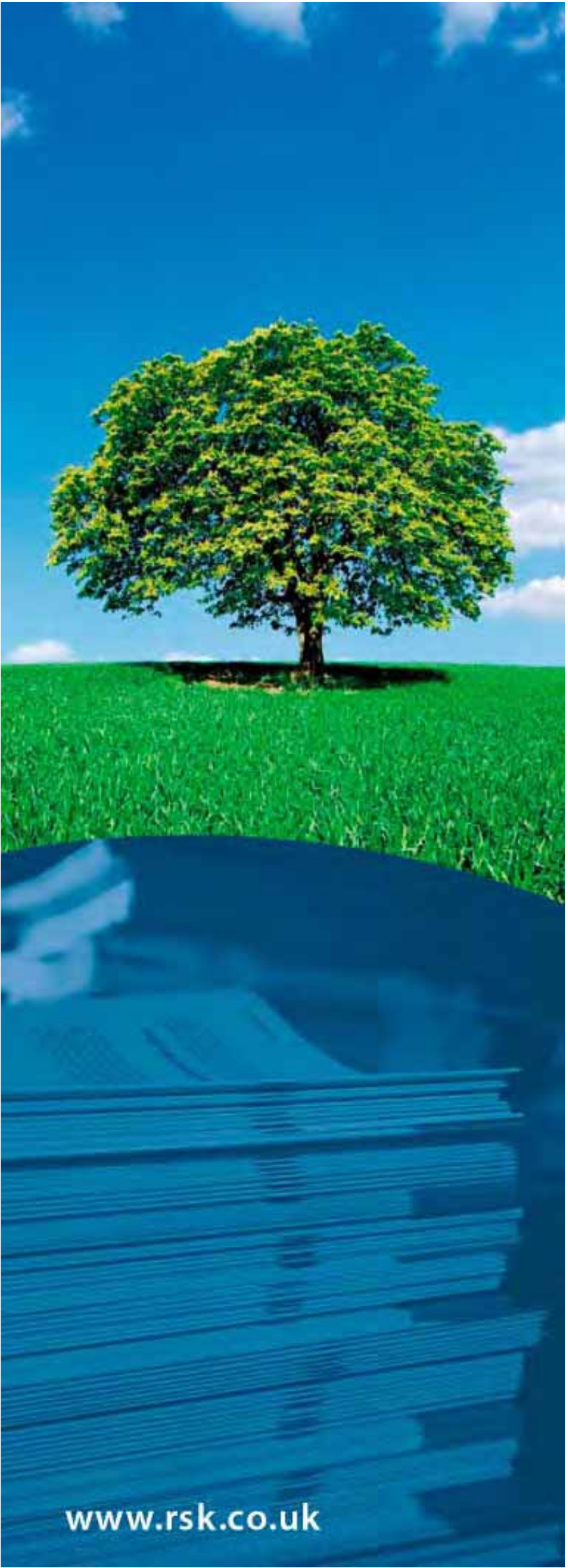

RSK GROUP PLC

GEO-ENVIRONMENTAL SITE ASSESSMENT

GONDAR GARDENS LONDON NW6 1EW

23283-1 (00)

Linden Homes Ltd

December 2009

Safeguarding your business environment

CONFIDENTIAL

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GEO-ENVIRONMENTAL SITE ASSESSMENT
GONDAR GARDENS, LONDON, NW6 1EW

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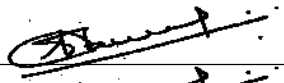
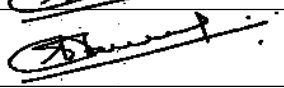
Author	Dr T Navaneethan		December 2009
Project Manager	Dr T Navaneethan		December 2009
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Quality Reviewer	Linda York		December 2009

This report is not to be used for contractual or engineering purposes unless the above is signed where indicated by the author, the project manager and the technical reviewer of the report, and the report is designated “FINAL”.

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1 INTRODUCTION

RSK STATS Geoconsult Limited (RSK) was commissioned by Linden Homes Ltd to carry out a Geo-environmental Site Assessment (GSA) for the site of a Thames Water underground reservoir located on Gondar Gardens, London, NW6 1EW.

This assessment was carried out with the understanding that part of the site is to be redeveloped for a residential end-use whilst the reservoir is to be retained and converted into an underground car park.

1.1 Objectives

The objectives of this assessment are as follows:

- To enable sufficient information regarding ground conditions to be obtained from which risks to end-users and the environment can be assessed; and
- To obtain sufficient information pertaining to ground conditions to assist in the design of foundations and associated infrastructure.

1.2 Scope

The scope of the investigation and layout of this report has been designed with CLR11[(1)] and PPS23 in mind and guidance issued by the Environment Agency in July 2005 for land contamination reports[(2)]. A summary of relevant legislation and government policies applicable to land development is included in Appendix B.

The risk management process comprises up to three stages of risk assessment: preliminary, generic quantitative and detailed quantitative (PRA, GQRA and DQRA). The basis for the risk assessment is a conceptual model that is produced as part of the PRA and is updated throughout the risk management process.

The scope of works for the environmental site assessment includes:

- A PRA involving the review of existing reports, utility location information, geological, hydrogeological and hydrological information, a commercially available database, historical plans, correspondence with appropriate regulatory authorities and site walkover. This information is used to construct an outline conceptual model and consider any possible pollutant linkages (where a receptor may be connected to a source by a viable pathway) that may be present and design intrusive investigation if required;
- Where required, evaluation of possible pollutant linkages by intrusive investigation and laboratory analysis. This information is used to refine the conceptual model;
- GQRA (if required) to assess possible pollutant linkages identified in the PRA and enable outline conceptual model to be refined; and
- Provide recommendations for further works, DQRA and remedial actions of ground and groundwater (if deemed applicable).

The scope of works for the geotechnical assessment includes:

- Intrusive investigation and laboratory analysis to enable soil parameters for geotechnical purposes to be ascertained; and
- Interpretation of ground conditions and geotechnical data to provide recommendations with respect to foundation, floor slabs and infrastructure design.

The results of the site investigation, *in-situ* tests and laboratory analysis pertinent to geotechnical issues are given in Section 7.

1.3 Limitations

The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory (waiting for the results). However, there may be conditions pertaining to the site that have not been disclosed by the investigation and which therefore could not be taken into account. In particular, groundwater levels may vary from those reported due to seasonal, or other, effects.

This report is subject to the RSK service constraints given in Appendix A.

1.4 Previous Work

RSK is unaware of any previous investigations for the site.

2 SITE DETAILS

2.1 Site Location

The site is located in Gondar Gardens, London. The site comprises a former Thames Water buried reservoir constructed circa 1890 located within a residential area of West Hampstead near Shoot Up Hill. The site is rectangular in shape and approximately 1.2ha.

It is of note that the reservoir does not extent beneath the site to the full extent to the east.

The National Grid Reference for the approximate centre of the site is 524840 185310. A site location plan is presented as Figure 1.

2.2 Site Description

The site is at an elevation of approximately 75m AOD and is generally level apart from the boundaries of the site which slope down to residential boundaries that border the site with Gondar Gardens to the west.
To the front bordering Gondar Gardens there are significant trees including an electrical sub-station. Mature trees also present in bordering gardens. A site plan is presented as Figure 3.

2.3 Future Development

Consideration is being given to partial demolition of the reservoir to the front on Gondar Gardens and the construction of three storey terraced housing with partial double basements below. The former reservoir is being considered for underground car parking. The proposed site layout is given in Figure 2.

3 PRELIMINARY RISK ASSESSMENT

The following describes the results of the review of available information for the site and the findings from the site inspection. The information together with that presented in Section 2 has been used to identify potential contaminant sources and sensitive receptors, from which an outline conceptual model has been developed.

3.1 Geology

Published records [5] for the area indicates the geology of the area to comprise the London Clay Formation.
Associated with the reservoir construction, reworked materials (London Clay) are likely to be percent.

The geological information recorded in the Envirocheck reports [4] includes the following:

- No mining, quarrying or land reclamation activities are recorded as having taken place within 2km of the site.

The National Radiological Protection Board information contained within the environmental database indicates that the percentage of homes above the action level is less than 1%. The British Geological Survey information contained within the environmental database information indicated that no radon protective measures are considered necessary for the site.

3.2 Hydrogeology

The Groundwater Vulnerability Map[6] indicates the London Clay Formation to be classified as a non-aquifer. This formation is generally regarded as containing insignificant quantities of groundwater. Groundwater flow, although imperceptible, does take place and needs to be considered in assessing risks associated with persistent pollutants. Some non-aquifers scan yield water in sufficient quantities for domestic use.

3.2.1 Groundwater Abstractions

The Source Protection Zones (SPZ) provides an indication of the potential risk of pollution. Three zones (Inner, Outer and Total Catchment) are usually defined. Information on the Environment Agency website[7] indicates the site is not situated within a groundwater SPZ.

According to the Envirocheck report, there are no abstractions within 2km the site.

3.2.2 Soil Leaching Potential

The London Clay beneath the site is classified as being of negligibly permeability.

3.3 Hydrology

An unknown surface water feature is located 464m northwest of the site.

3.3.1 Surface Water Abstractions

No surface water abstractions have been identified within 2km of the site.

3.3.2 Flooding

Information on the Environment Agency website indicates the site is not situated within a Flood Zone.

3.4 Sensitive Land Uses

The site is not located within a Nitrate vulnerable zone.

A local nature reservoir (Westbere Copse) is located 234m to the west.

A comprehensive evaluation of ecological receptors is outside the scope of this report although there was evidence on site that an ecological survey was being carried out by others.

It is understood that the site is currently designated by the local council as ‘private open space’.

3.5 Site History Review

A review of the site history has been carried out through the study of Ordnance Survey maps dating from the late 1800s onwards. The review is designed to identify potential historic sources of contamination that may have impacted soil or groundwater quality beneath the sites and to identify any potentially contaminative land uses in the area that may have impacted the site.

3.5.1 Historic Maps

A review of the historical development of the site from between 1896 and 2009 was undertaken using map extracts provided within the Landmark Envirocheck report. This information has been summarised in Table 3-1. The historical maps have been produced within this report, Appendix C.

Table 3-1: Historical Map Review

Date Scale	Site Activity	Surrounding area
1896 1:2,500	The site has been developed with a reservoir (named as Grand Junction W.W) It is also understood that the reservoir has been constructed in 1872.	Adjacent to the site, residential developments are indicated to the east and south of the site. Open lands (possible agricultural lands) are indicated to the north and west of the site boundaries. The Hampstead cemetery is located approximately 500m to the north. A clay pit is indicated approximately 600m to the northwest. A railway is located approximately 550m to the southwest.
1915 1:2,500	No significant changes. The reservoir is now referred as Metropolitan Water Board.	The western site boundary is now bordered by Gondar Gardens. The site is generally bounded by residential houses and flats. Allotment gardens are indicated approximately 370m to the northwest of the site.
1935-1936 1:2,500	Two small structures are indicated on the west of the site.	The clay pit and allotment gardens are no longer indicated.
1955 1:2,500	Some infrastructure change is indicated to the front of the reservoir.	No significant changes around the site
1962-1974 1:2,500	A sub-station is indicated in the northwest corner.	No significant changes around the site
1991-1994 1:2,500	No significant changes	No significant changes around the site
2006 1:10 000	No significant changes.	No significant changes around the site
2009 1:10 000	No significant changes.	No significant changes around the site

The historical maps have revealed the site to has been developed with a reservoir since 1896. The reservoir is for the storage of drinking water. There is no evidence of infrastructure or processes associated with water treatment. On this basis the risk of significant contamination being present is considered to be very low.

3.5.2 Database Information

Two discharge consent are identified within 1km of the site. The closed being 158m to the north of the site. This is registered to the Thames Water Utilities Ltd at Shoot Up Hill for the discharge of freshwater.

There are no records of Integrated Pollution and Prevention Controls located within a 2km radius of the site.

There are no records of Local Authority Pollution and Prevention Controls registered within 2km of the site.

There is a single record of Category 3 – minor pollution incidents to controlled waters within 1km of the site, it is located 977m north of the site relating to unknown chemicals.

There are no records of historical landfill sites within 2km of the site.

There is a single record of registered waste transfer sites within 1km, the closed being 786m to the southeast for L.B of Camden, site category.

There are no records of local authority recorded landfill sites within 2km of the site

There are no records of registered landfill sites within 2km of the site.

A single record of registered waste treatment or disposal sites scrapyard within 1km, the closed being 553m to the southeast for T H Beardon & Son Ltd, site category.

The reservoir was decommissioned circa 2000. During its operational period and following decommissioning the facility has been well managed and has remained secure with no evidence of fly tipping or material storage.

3.5.3 Trade Directories

There is ten contemporary trade records within 250m and hundred and eighty four up to 1km of the site. The closest being 58m to the west at 54 Sarre Road, London, classified as carpet, curtain & upholstery cleaners. The status of this is inactive. The second closest 80m to the north at 35 Gondar Gardens, London classified as metal products fabricated, status-active.

Three records of fuel station entries are within 1km of the site. The closest being 322m to the northeast for Fortune Green Service Station, brand-Texaco, status-obsolete.

3.6 Site Walkover

A walkover survey of the site was conducted on the 17 November 2009. The site access via Gondar Gardens. The site is occupied a former Thames Water buried reservoir. The site is generally level apart for the boundaries of the site, which slope down to residential boundaries. The front bordering Gondar Gardens and along the boundaries there are significant trees and shrubs. A sub-station is located at northwest corner.

Infrastructure associated with the reservoir is treated to the front end on the surface of reservoir and to the south.

Apart from the south, the site is bounded by residential houses.

There was evidence of an ecology survey being carried out (carpet tiles scattered on surface of reservoir).

3.6.1 Asbestos

No potential asbestos containing materials were identified during the walkover.

3.6.2 Invasive Non-Native Plants

The Environment Agency considers that the second most significant threat to biodiversity, after habitat destruction, is posed by invasive non-native species. Invasive plants can deprive native plants of nutrients, light and space, can dilute native species by cross-breeding and can alter plant populations.

Japanese Knotweed is an invasive weed that has the potential to damage asphalt surfaces and paved areas and even penetrate substructures and grow into buildings. It is difficult and costly to eradicate. It should be noted that failure to appropriately dispose of any material containing Japanese knotweed is an offence and may lead to prosecution under the Wildlife and Countryside Act 1991.

During the site walkover, Japanese knotweeds were identified at three locations along the northern boundary at the approximate locations are shown in Figure 3. It is recommended that before any site operations are carried out, the site be re-inspected for Japanese knotweed. It should be treated before works commence. Inspections for Japanese knotweed should also be made as a matter of routine.

3.7 Summary of Potential Contaminant Sources

Whilst risks to the site from previous historical land uses is considered to be very low, there are a number of potential sources of contamination associated with made ground if present.

3.7.1 Potential On-Site Sources

- Possible Made ground associated with reservoir construction.

3.7.2 Potential Off-Site Sources

- Possible Made ground (potential source of ground gases);
- Drainage system; and

3.8 Sensitive Receptors

There are a number of receptors that may be affected by potential contamination identified above. These may include:

- Future site workers;
- Future site residents;
- Uptake by vegetation; and
- Adjacent off-site residents.

3.9 Summary of Plausible Pathways

A number of plausible pathways are present that could connect the identified sources and receptors:

- Direct contact (dermal, ingestion and inhalation);
- Inhalation of gases/vapours;
- Root uptake;
- Lateral and vertical migration;
- Migration along drains and backfill around drains; and
- Permeation of plastic pipes.

3.10 Outline Conceptual Model

The information presented in Sections 2 and 3.1-3.9 has been used to compile an outline conceptual model. The identified potential contaminants and receptors have been considered with any possible pathways that may link them. The resulting pollutant linkages are considered in Table 3-2. The risk classification has been estimated in accordance with information in Appendix D.

Table 3-2: Risk Estimation for Potential Pollutant Linkages in Outline Conceptual Model

Potential Source	Potential Receptor	Possible Pathway	Likelihood	Severity	Risk
Made ground, possibly containing TPH, PAH, and heavy metal contaminants	Future construction/ maintenance workers	Direct contact Inhalation (dust and vapours) Dermal contact	Low Likelihood	Minor	**Very Low.** Although there is potential for contact with soil that may be impacted during typical work activities, managing health and safety using H&S and PPE requirements should reduce risks to acceptable levels
	Future occupants	Direct contact/ ingestion (soil, via piped water supply)	Unlikely	Minor	**Very Low.** There is potential for impacted soils and groundwater on site to reach occupants.
	Neighbouring occupants/ workers	Migration and inhalation of dust or vapours via permeable shallow geology	Low likelihood	Minor	**Very Low.** It is possible that construction is planned where dust may be created that could be contaminated.
	Shallow groundwater body - made ground	Leachate migration	Low Likelihood	Minor	**Low.** Shallow groundwater could be impacted by contaminants. Vertical migration and mobilisation of contaminants may occur following infiltration.

	Surface water Unknown watercourse		Low likelihood	Minor	**Very Low.** Shallow groundwater could be impacted by contaminants if present. However no viable pathway to unknown watercourse is believed to exist.
	Plant uptake	Vegetation	Likely	Minor	**Low.** Without remedial works, impacted soils and shallow groundwater could inhibit plant growth
Hazardous ground gases	Construction/ maintenance workers	Migration and inhalation of soil gas via permeable shallow geology.	Likely	Medium	**Moderate.** During construction phase, workers may enter excavations (e.g. laying services) where concentrations of bulk gases may concentrate
	Future residents		Likely	Medium	**Moderate.** Dependent on gas flows, gas migration could occur. Bulk gases may be present that could migrate and be inhaled by residents either indoors or outdoors, indicating that protection measures may need to be incorporated into buildings
	Neighbouring Residents		Likely	Medium	**Moderate.** Concentrations of bulk gases may exist and dependent on gas flows, off-site migration is possible

3.11 Preliminary Risk Assessment Conclusions and Recommendations

The review of information and the construction of the outline conceptual site model highlight potential pollutant linkages. In order to investigate any unacceptable risk presented by these, an intrusive investigation has been carried out. This is detailed in Section 4 of this report.

4 ENVIRONMENTAL SITE INVESTIGATION

RSK carried out an intrusive investigation work between the 17th November 2009.

4.1 Sampling Strategy and Methodology

It was considered that the preferred method of exploration would be the use of drive-in sampler boreholes as these needed minimal access and would cause minimal disruption to the ground surface, allow geotechnical testing to be carried out and also to allow monitoring wells to be installed. This drilling method also allows the best possible sampling for environmental purposes, as potential cross contamination of the recovered soils is minimal.

A single cable percussion borehole was principally utilised to collect geotechnical information to allow foundation design, classify the sulphate class of the subsoil for buried concrete design.

4.1.1 Health and Safety Considerations

All works completed on site were undertaken in line with RSK's Safety, Health, Environmental and Quality Management System (SHEQ MS), which is accredited to ISO9001: 2000 (Quality Management System standard), ISO14001:2004 (Environmental Management System standard) and OHSAS18001:2007 (Occupational Health and Safety Management System standard).

All proposed holes were scanned and cleared by a specialist services scan sub-constructor.

Unexpected services were not encountered during works.

4.1.2 Investigation Locations

Seven probeholes, designated PH1 to PH7, were sunk by percussive means using drive-in sampling techniques. A single borehole, designated BH1 was also sunk by light cable percussion technique. Representative samples were taken from probeholes borehole and returned to the laboratory for analysis. The descriptions of the strata encountered together with comments on groundwater conditions and hole stability are given in the probehole records presented in Appendix E.

35mm diameter perforated standpipes were installed in four probeholes (PH1, PH2, PH3 PH7) to enable future monitoring of groundwater levels and the flow rates, pressures and concentrations of any gas. Installation details are given in the exploratory hole records summarised in Table 4-1.

Table 4-1: Standpipe Installation Detail .....

Location	Response Zone Depth	Targeting Stratum	Diameter
PH1	1.00m to 4.00m	London Clay	35mm
PH2	1.00m to 4.00m	London Clay	35mm
PH3	1.00m to 4.00m	London Clay	35mm
PH7	1.00m to 4.00m	London Clay	35mm

In the absence of any significant areas of concern, the exploratory hole positions were chosen to provide good coverage of the site and with respect to the proposed developments, in particular to areas of soft landscaping. With respect to geo-hazards, a probeholes were sunk to the front of the site to assess for clay desiccation associated with the existing trees. The exploratory hole locations are identified in Figure 3. A summary of the exploratory hole rationale is presented in Table 4-2.

Table 4-2: Exploratory Hole Location Rationale

Exploratory Hole Number	Location (see Figure 3)	Rationale
BH1	Front part of site	For any potential pile foundations

PH1	Front part of the site within proposed footprint areas.	Location of proposed house. Clay desiccation assessment.
PH2	Northwest corner of site	Location of proposed house and private garden. Clay desiccation assessment.
PH3	Northern part of the site	General coverage
PH4	Eastern part of the site	General coverage
PH5	South-eastern part of the site	General coverage
PH6	South of site	General coverage
PH7	Southwest corner of site	Location of proposed road

The depths of the exploratory holes, descriptions of strata encountered, comments on groundwater conditions, samples obtained and installation details are included on the exploratory hole records in Appendix E.

4.1.3 Soil Sampling

In each exploratory hole, at least one soil sample was recovered from each stratum encountered. Samples were collected and stored in accordance with the RSK quality procedures to maintain sample integrity and preservation and to minimise the chance of cross contamination. The samples were transported to the laboratory in chilled cool boxes. Laboratory Chain of Custody Forms can be provided if required.

4.1.4 Groundwater/Gas Monitoring

At the time of writing no groundwater or gas monitoring visits have been carried out.

4.2 Ground Conditions

In general, ground conditions beneath the site were consistent with those anticipated from the available geological information for the area in that the site is underlain by the London Clay.
Made Ground was found to overlie this natural deposit.
The ground conditions are summarised as follows:

Topsoil:

Topsoil was encountered within all locations apart from BH1 and PH1 to a maximum depth of 0.3mbgl. It comprises silty sandy clay with occasional fine to medium gravel and roots.

Made Ground:

Made ground was encountered to a maximum depth of 4.0mbgl and comprised silty sandy clay with fragments of brick, stone, concrete, mudstone, tarmac and roots. Remoulded London Clay was encountered within PH3 to PH5. This material is considered to be reworked London Clay associated with the reservoir construction.

London Clay

Beneath the made ground, the London Clay was encountered to a maximum depth of 20.0mbgl (BH1). The stratum generally comprises firm becoming stiff and very stiff brown mottled grey silty clay with occasional pockets of sand. Very stiff clay was

encountered within the probeholes. Due to tree roots influence, the clay within PH1, PH2, PH6 and PH7 is considered to be desiccated to about 3.0mbgl.

Groundwater

At the time of site work, slight groundwater seepage was encountered at a depth of 13.0mbgl within BH1. Groundwater was not encountered within other locations

4.2.1 Observed Contamination

Contamination was not identified by visual or olfactory means within the soils encountered.

4.3 Analytical Strategy and Methodology

Soil samples were tested for the analyses listed in Table 4-3 below. The analytical schedule was based on a standard suite of potential contaminant. All analysis was undertaken by UKAS and MCERTS certified laboratories. The details of the laboratory certification are included on the certificates in Appendix F.

Table 4-3: Scheduled Soil Analysis.

Exploratory Hole No. & Sample Depth (m bgl)	Analyte	Rationale
PH1 @ 0.30m PH1 @ 0.70m PH2 @ 0.40m PH3 @ 0.50m PH6 @ 0.30m PH7 @ 0.30m	Speciated TPH, USEPA speciated PAH, arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc (metals suite), pH and Asbestos screening	General suite to cover the most likely indicator chemicals based on site history and on site observations

4.4 Chemical Conditions

Soil samples were submitted to Envirolab Ltd for analysis as detailed on the laboratory chain of custody forms (a copy of which can be provided if required). Full analytical certificates for soil samples are provided in Appendix F, respectively. The results are discussed in the GQRA, Section 5.

5 GENERIC QUANTITATIVE RISK ASSESSMENT

Based upon the site history, nature of the site and encountered ground conditions, it is considered there is potentially no unacceptable risk with respect to residential development of the site. A quantitative risk assessment has therefore been carried at with respect to this.

In line with CLR11 [(1)], there are two stages of quantitative risk assessment, generic and detailed. The GQRA comprises the comparison of soil that is appropriate to the linkage being assessed.

The site investigation work and subsequent refinement of the conceptual model indicates that there are relevant pollutant linkages at the site, which require further consideration.

5.1 Relevant Linkages for Assessment

The linkages for assessment are presented in Table 5-1.

Table 5-1: Linkages for Generic Quantitative Risk Assessment

Relevant Pollutant Linkage	GAC
Future residents and maintenance workers (e.g. gardeners) could come into direct and/or indirect contact with contamination via areas of soft landscaping in communal space	Human health GAC for a proposed residential end use with and without private gardens since proposed end use includes residential gardens. Information relating to adopted GAC screening values is presented in Appendix G.
The integrity of drinking water pipes may be compromised via permeation, which could taint supplies.	Chemical test data obtained from the samples of drinking water have been compared to the Water Supply (Water Quality) Regulations 2001, which are protective of drinking water. Information relating to adopted GAC screening values is presented in Appendix H.

5.2 Human Health Assessment

RSK has derived GAC's for the assessment of human health risks for a 'residential with plant uptake' for the new terraced houses taking account of the following pathways (as appropriate, depending on the individual characteristics of potential contaminants):

- Direct soil and dust ingestion;
- Consumption of home grown produce;
- Consumption of soil attached to home grown produce;
- Dermal contact with soil and indoor dust; and
- Inhalation of indoor and outdoor dust and soil gases.

The GAC's for residential end-use with plant uptake are presented in Appendices G, together with the rationale behind their derivation.

5.3 Methodology and Results

The laboratory data has been assessed against Generic Assessment Criteria (GAC) and data from targeted samples compared directly to the GAC.

Data for all results were observed to be less than the GAC for a domestic end-use for soils apart from a single data. A slightly elevated benzo(a)pyrene (2.13mg/kg > 0.95mg/kg) was encountered within PH1 at 0.3mbgl. However, the PH1 is located

beneath a footprint of the proposed building. Therefore, the pathway is broken and an unacceptable risk to human health may be present.

5.3.1 Permeation of Plastic Utilities

The chemical test results have been compared with the GAC presented in Appendix I for this linkage. This indicates that locally some contaminant concentrations do exceed the GAC for water supply pipe protection, particularly within the PH1 (12mg/kg at 0.3mbgl), PH3 (14mg/kg at 0.5mbgl), PH6 (11mg/kg at 0.3mbgl) and PH7 (22mg/kg 0.3mbgl) with regard to arsenic compared to GAC of 10mg/kg.

Depending on the installation proposals for any water supply pipes, contamination resistant pipes may be required. Once the completed design drawings for drinking water supply pipe are known, the potential for contamination resistant pipes can be reviewed.

It is recommended that discussions be held with the appropriate water company to determine the specification of pipe required for adoption at the site should this be required in future.

5.3.2 Ground Gas

At this time ground gas assessment has not been carried out. There is no potential contaminated made ground was encountered during the investigation and no landfill sites within 2kmm of the site. Based upon the PRA and the ground conditions encountered during the investigation, it is considered that the site is very low risk of ground gas issues. It is also considered that no gas precaution measures could be adopted out for potential ground gas although this will be confirm with the EHO. The requirement for gas monitoring will be discussed with the EHO of the local authority.

5.4 Environmental Assessment Conclusions - soils

The laboratory results indicate that the site is at very low risk from contamination. It is considered that remedial measures are not necessary therefore the site is considered suitable for the proposed end-use.

Should any visual or olfactory contamination be encountered during site development then further advice must be sought.

6 WASTE

6.1 Waste Classification

All wastes require pre-treatment prior to disposal at landfill. Pre-treatment must be a physical/thermal/chemical/biological process, including sorting, that changes the characteristics of the waste in order to reduce its volume/reduce its hazardous nature/ facilitate its handling/enhance its recovery. It is best practice to provide your waste collector (or the disposal site) with details of how the waste has been treated. Your waste collector may provide a pre-treatment confirmation form or space on the waste

transfer note to detail the pre-treatment, alternatively a standard form produced by the Environment Agency may be used:

http://www.environment-agency.gov.uk/commondata/acrobat/annex1_1898741.pdf

RSK has developed a waste soils characterisation assessment tool, which follows the guidance within WM2, known as HAZWASTE. The analytical results have been run through this assessment tool for potential off-site disposal of materials in the future.

None of the samples were classified as **hazardous** waste, and would most likely be classified as **non-hazardous**. To determine if the soils could be classified as inert, Waste Assessment Criteria (WAC) testing will need to be carried out. The results of the HAZWASTE assessment have been included in Appendix I.

6.2 Waste Acceptance Criteria

All inert, stable non-reactive hazardous and hazardous wastes must be tested and found to be below the Waste Acceptance Criteria (WAC) leaching limit values for the classification of landfill they are being disposed in. Currently, no WAC is in place for non hazardous waste.

7 GEOTECHNICAL SITE ASSESSMENT

The aim of the geotechnical investigation is to ascertain ground conditions at the site and provide sufficient data regarding the soil parameters to enable the design of foundations, floor slabs and infrastructure to be carried out. This aim was achieved by:

- Exploratory holes – 7No. of probeholes and 1No. borehole;
- *In situ* tests – SPT's and hand vane shear strength tests; and
- Laboratory analysis – Moisture Content, Atterberg Limit, undrained triaxial tests, oedometer tests and BRE Suite for concrete classification.

7.1 Methodology

As outlined in Section 4, exploratory holes also were drilled for geo-environmental purposes. Information from these holes was used together with the in-situ SPT's and hand vane tests to provide geotechnical parameters. The methodology for the geotechnical intrusive investigation is presented in Sections 7.1.1 to 7.1.2.

7.1.1 Intrusive Investigation Undertaken

7.1.1.1 Probeholes

Seven probeholes, designated PH1 to PH7, were sunk by percussive means using drive-in sampling techniques. Representative samples were taken from the sampler tubes and returned to the laboratory for analysis. The descriptions of the strata encountered together with comments on groundwater conditions and hole stability are given in the probehole records presented in Appendix E.