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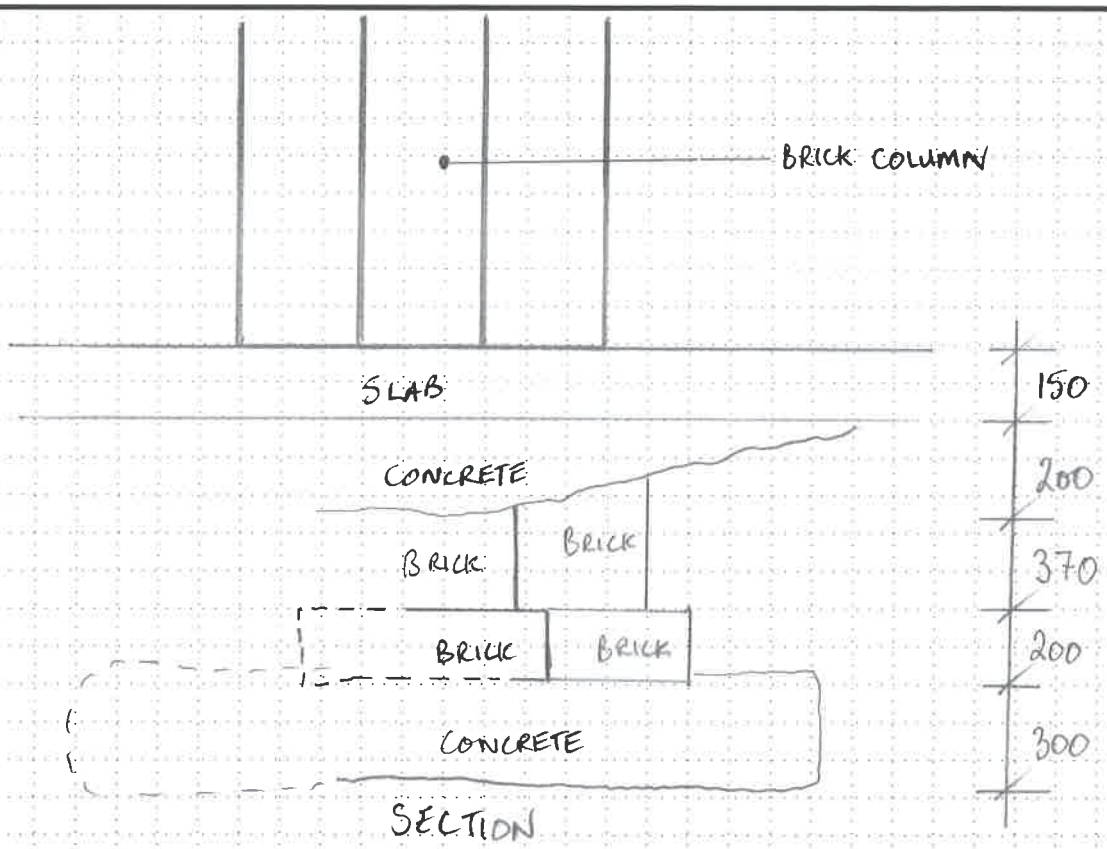
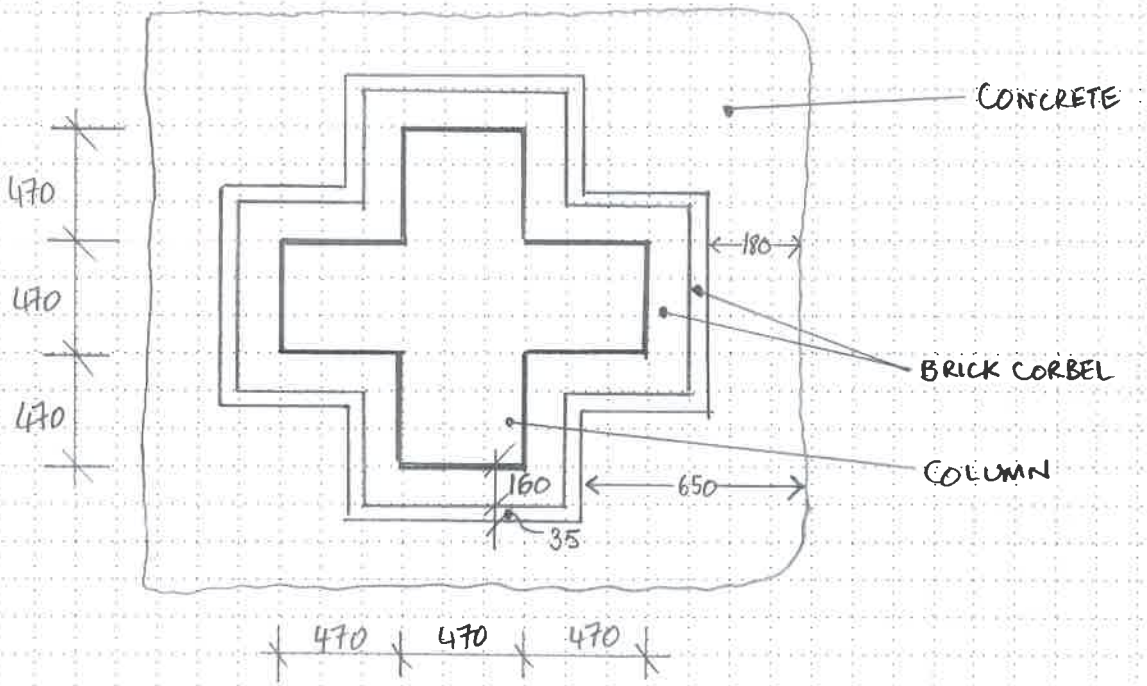
TRIAL PIT 1.



SECTION



PLAN

Client :	Site :	Date : 23-3-17	Job No. 288627
WATERMAN STRUCTURES	GONDAR GARDENS	Prep. by : MR	Fig. No.

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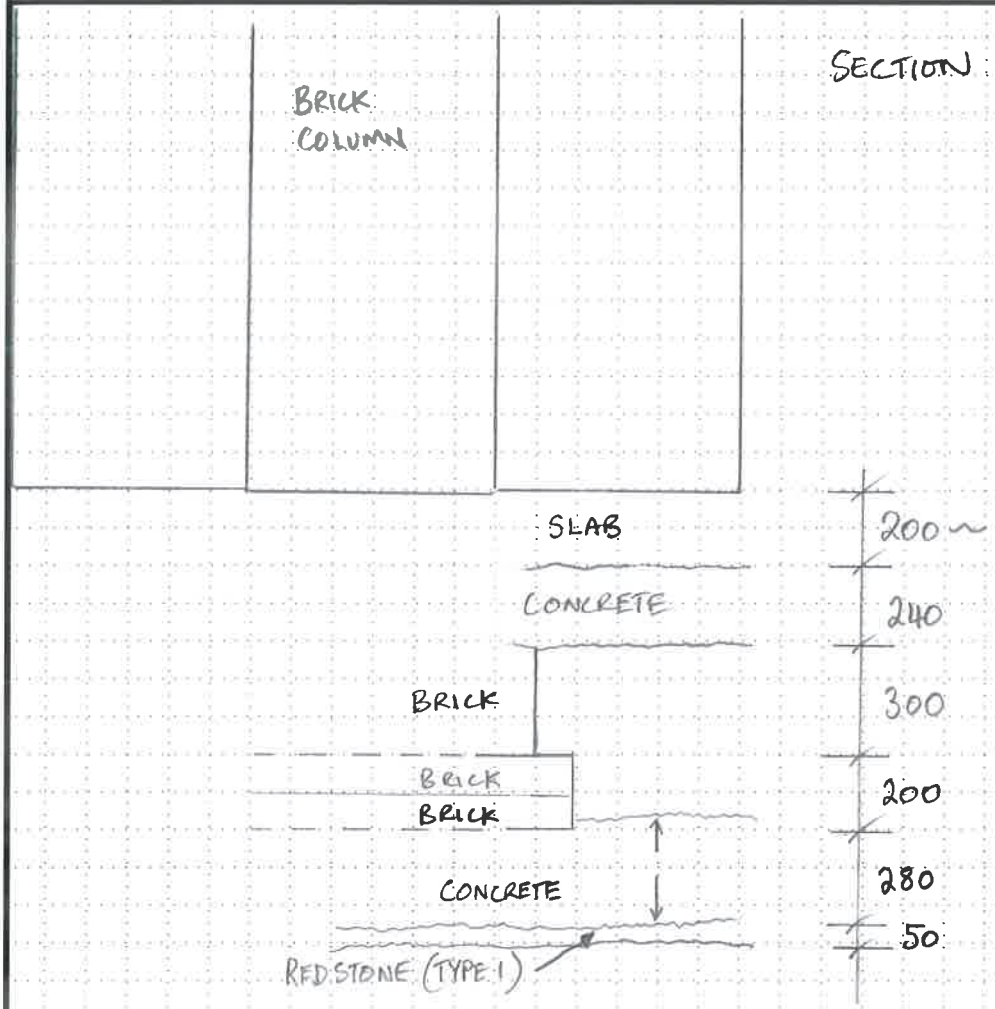
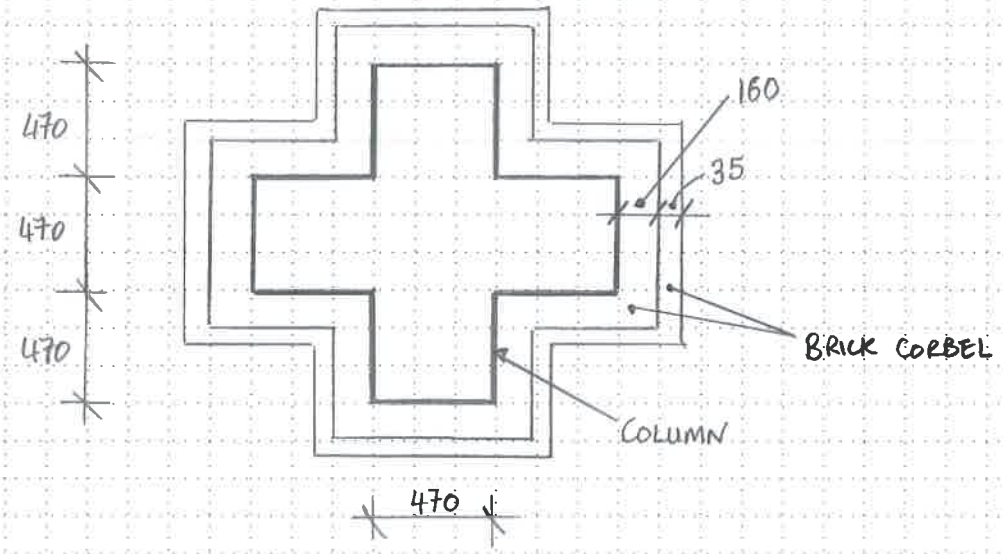
TRIAL PIT 2.





Client :	Site :	Date : 23-3-17	Job No. 288627
WATERMAN STRUCTURES	GONDAR GARDENS	Prep. by : MR	Fig. No.

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HAND / SHEAR VANE

PEAK	RESIDUAL	
TRIAL PIT 2		
42	7	—— 500mm BELOW BOTTOM OF PIT
76	11	—— 800mm – 900mm BELOW
115	15	—— 1·5m BELOW
TRIAL PIT 1		
50	8	—— 500mm BELOW BOTTOM OF PIT
115	12	—— 800mm – 900mm BELOW
125	22	—— 1·5m BELOW

Client :	Site :	Date : 23-3-17	Job No. 288627
WATERMAN STRUCTURES	GONDAR GARDENS	Prep. by : MR	Fig. No.

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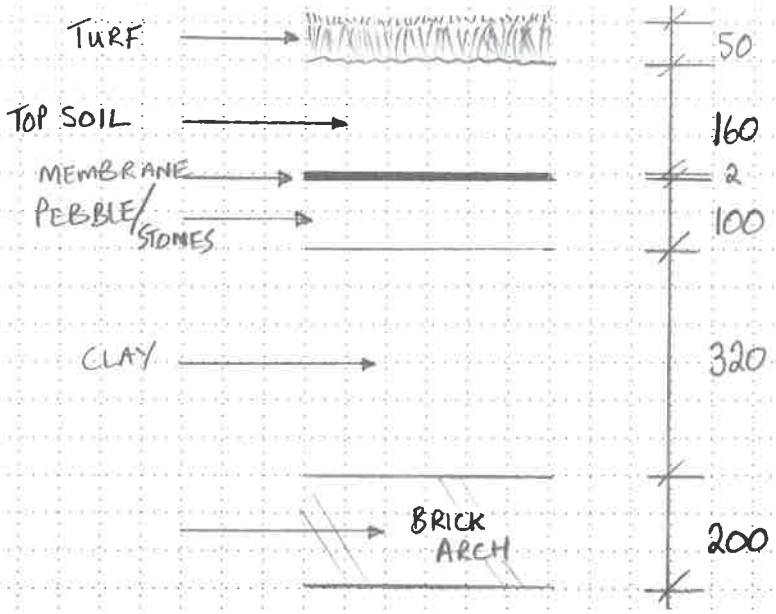
ARCH THICKNESS



Client :	Site :	Date : 21-3-17	Job No. 288627
WATERMAN STRUCTURES	GONDAR GARDENS	Prep. by : MR	Fig. No.

APPENDIX C -
SELECTED SITE PHOTOGRAPHS

This appendix contains 8 pages, including this one.

Plate 1: General view of brickwork.

Plate 2: Brick and mortar samples B2 & M2 extracted from column.

Plate 3: Column where brick and mortar samples B2 & M2 were extracted.

Plate 4: Brick and mortar samples B5 & M5.

Plate 5: Column where brick & mortar samples B5 & M5 were extracted.

Plate 6: Brick and mortar samples B10 & M10.

Plate 7: Column where brick and mortar samples B10 & M10 were extracted.

Plate 8: General view of trial pit 1.

Plate 9: View of trial pit 1.

Plate 10: View of brick corbel sitting on concrete pad in trial pit 1.

Plate 11: General view of trial pit 2.

Plate 12: View inside trial pit 2.

Plate 13: View of Brick corbel sitting on concrete pad.

APPENDIX D - CERTIFICATES OF TEST

RSK Certificate of test 288627/57241 – Compressive Strength of Masonry Units
RSK Certificate of test 288627/57331 – Mix Proportions of Mortar

This appendix contains 5 pages, including this one.

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UKAS TESTING
0278

Compressive Strength of Masonry Units
BS EN 772-1: 2011+A1:2015

288627 Gondar Gardens

Client Details
Waterman Structures Limited Pickfords Wharf Clink Street London SE1 9DG

Sample Details			
Sample type	Clay masonry units		
Sampled by	RSK	Sampling date	21/03/17
RSK batch no.	17237	No. of samples	10
Receipt date	22/03/17	Test date	29/03/17

Sample Description		
RSK Sample Reference	Location	Description
17237/B1	Brick column – see location plan	Yellow, coarse, clay, regular, single frog bricks.
17237/B2		
17237/B3		
17237/B4		
17237/B5		
17237/B6		
17237/B7		
17237/B8		
17237/B9		
17237/B10		

Methods	
Test	Compressive strength was determined in accordance with BS EN 772-1: 2011. Ten recovered masonry units were tested following conditioning to the air dry condition using the oven method in Clause 7.3.2 b) and in an as laid orientation. Capping mortar, which reached a strength of 26.4 N/mm², was used for surface preparation and frog filling.
Deviations	None.

Results
Results are reported on page 2 of this certificate

Certification			
Certificate prepared by  Clive Rayner Principal Technician		Certificate reviewed by  Dr David B Crofts Director	
Testing by	CR	Certificate issue date	29/03/17

The results given in this certificate relate only to those samples submitted and specimens tested and to any materials properly represented by those samples and specimens. Any opinions and interpretations expressed herein are outside the scope of our UKAS accreditation.

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Results

RSK ref	Client ref	Length (mm)	Width (mm)	Height (mm)	Sectional Area (mm²)	Failure Load (N)	Compressive Strength (N/mm²)	Normalised Compressive Strength (N/mm²)
17237/B1	B1	217	102	67	22134	125300	5.7	4.8
17237/B2	B2	214	100	68	21400	282300	13.2	11.4
17237/B3	B3	215	101	67	21715	324800	15.0	12.8
17237/B4	B4	218	101	67	22018	159200	7.2	6.2
17237/B5	B5	212	104	68	22048	299300	13.6	11.6
17237/B6	B6	216	99	69	21384	339300	15.9	13.8
17237/B7	B7	211	102	67	21522	359400	16.7	14.3
17237/B8	B8	215	103	66	22145	266000	12.0	10.2
17237/B9	B9	215	101	67	21715	244300	11.3	9.6
17237/B10	B10	214	105	67	22470	157000	7.0	5.9
						Mean Compressive Strength (N/mm²)	11.7	10.1
						Standard Deviation	3.9	3.4
						Coefficient of variation	0.3	0.3

End of Certificate

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UKAS TESTING
0278

Mix Proportions of Mortar
BS 4551: 2005 + A2: 2013

288627 Gondar Gardens

Client details

Life Care Residences Limited
Sherwood House
Forest Road
Kew
TW9 3BY
Contact name Neville Cook

Sample details

Sample type	Mortar		
Sampled by	RSK	Sampling date	21/03/17
RSK batch no.	17237	No. of samples	10
Receipt date	22/03/17	Test date/period	05-19/04/17

Methods

Test: The samples were dried at 105°C and on cooling were prepared and chemically analysed by the methods specified in BS 4551:2005. The interpretation of our analytical data has been made on the basis of calculations described in BS 4551:2005 using the following assumptions:

Soluble silica content of the cement = 20.5 %
Calcium oxide content of the cement = 64.5 %
Water of hydration = 23 %
Bulk density of sand = 1675 kg/m^3
Bulk density of cement = 1450 kg/m^3
Bulk density of lime = 575 kg/m^3

Deviations: None.

Precision: Repeatability limits from duplicate testing for cement content as % mass of sample 1.3 % and 0.8 % from soluble silica and calcium oxides, respectively. BS 4551 estimates repeatabilities of 2.2 % and 0.8 %, respectively.

Results

The results are reported on page 2 of this certificate.

Certification

Certificate prepared by

Ben Stainton
Principal Chemistry Technician
Testing by BJS

Certificate reviewed by

Dr David B Crofts
Director
Certificate issue date 20/04/17

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Details of samples			
RSK reference	**Mass [g]**	**Description**	**Location**
17237/M1	149	Damp, red, very soft and friable mortar.	Mortar from brick columns. See Location plan.
17237/M2	325	Damp, red, moderately soft and friable mortar.	
17237/M3	230	Damp, red, moderately soft and friable mortar.	
17237/M4	256	Damp, red, moderately soft and friable mortar.	
17237/M5	255	Damp, red, moderately soft and friable mortar.	
17237/M6	196	Damp, red, moderately soft and friable mortar.	
17237/M7	220	Mixture – red, very soft and friable mortar. red, moderately soft and friable mortar. yellow, moderately soft and friable mortar.	
17237/M8	289	Brown, moderately soft mortar.	
17237/M9	216	Damp, red, very soft and friable mortar.	
17237/M10	222	Red, moderately soft mortar.	

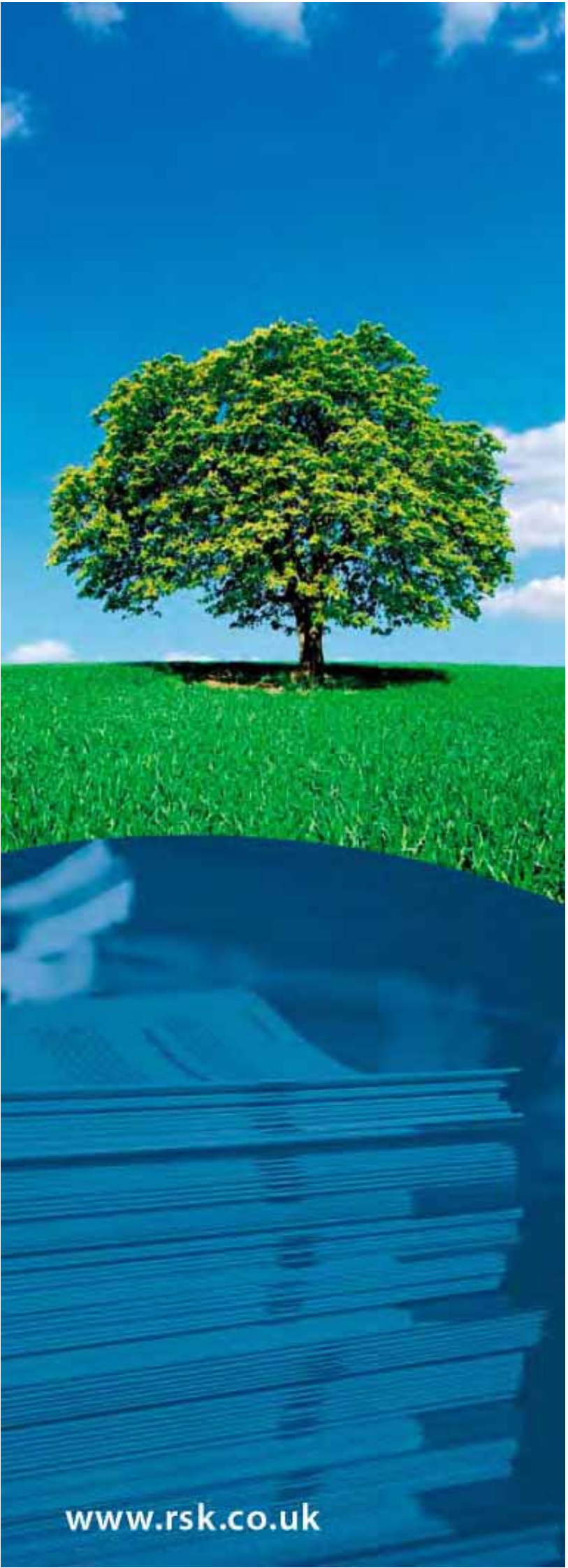
Determined values	**% by mass on dry mass**		
Sample reference	**Insoluble residue**	**Soluble silica**	**Calcium oxide**
17237/M1	80.1	4.30	6.13
17237/M2	77.4	4.81	7.27
17237/M3	74.4	6.21	8.30
17237/M4	76.9	5.63	8.26
17237/M5	82.2	3.40	6.75
17237/M6	82.3	4.42	5.41
17237/M7	83.9	3.51	5.71
17237/M8	84.0	2.85	6.18
17237/M9	83.8	3.65	5.71
17237/M10	81.1	3.52	7.08

Calculated composition (% by mass on dry mass)			
Assuming cement:sand mix			
Sample reference	**Portland cement**	**Mortar designation**	**Approximate mix proportions by volume (Portland cement:sand)**
17237/M1	9.5	iv and v	1:7 to 8 or 1:8
17237/M2	11.5	iii and iv	1:5 to 6 or 1:7 to 8
17237/M3	13.0	iii	1:5 to 6
17237/M4	13.0	iii	1:5 to 6
17237/M5	10.5	iv and v	1:7 to 8 or 1:8
17237/M6	8.5	iv and v	1:7 to 8 or 1:8
17237/M7	9.0	iv and v	1:7 to 8 or 1:8
17237/M8	9.5	iv and v	1:7 to 8 or 1:8
17237/M9	9.0	iv and v	1:7 to 8 or 1:8
17237/M10	11.0	iv and v	1:7 to 8 or 1:8

Remarks

Mortar designations were assigned by comparison of the measured cement contents with Table 4 in BS 4551: 2005.

End of Certificate



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

REPORT NO: 23283-1 (00)

Client: LINDEN HOMES LTD
GUARDS AVENUE
CATERHAM
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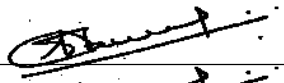
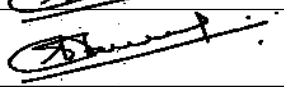
DOCUMENT ISSUE STATUS

Report Issue	**FINAL**		
Reference Number	**23283-1 (00)**		
Title	**Name**	**Signature**	**Date**
Author	Dr T Navaneethan		December 2009
Project Manager	Dr T Navaneethan		December 2009
Technical Reviewer	John Pulsford		December 2009
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.

In situ standard penetration tests were carried out to assess the relative density or consistency of the strata encountered. The values of penetration resistance (N values) are given in the probehole records.

7.1.1.2 Borehole

A single borehole, designated BH1, was sunk by light cable percussion techniques. The depth of the borehole, descriptions of the strata encountered and comments on groundwater conditions are given in the borehole records presented in Appendix E.

100mm diameter undisturbed samples were taken in the cohesive soils and representative disturbed samples were taken throughout the full depth of boring. These were returned to the laboratory for examination and testing.

Standard penetration tests were carried out at regular intervals to assess the relative density, consistency or hardness of the strata encountered. The values of penetration resistance (N values) are given in the borehole records.

7.1.2 Monitoring Installations

34mm diameter perforated standpipes were installed in four probeholes (PH1 to PH3 and PH7) to enable future monitoring of groundwater levels and the flow rates, pressures and concentrations of gas.

The standpipes were installed in the probeholes and surrounded with pea gravel and sealed at the surface with bentonite. Valves were fixed to the top of the installations, which were protected with a metal cover and sealed at the surface with concrete.

Details of the installations are given on the respective records presented in Appendix E.

7.1.3 Laboratory Analysis

The geotechnical testing has generally been carried out in accordance with the methods given in BS 1377[(10)]

The natural moisture contents, natural wet densities and shear strengths of 7No. 100mm diameter undisturbed samples were determined by undrained triaxial compression tests.

One-dimensional consolidation (Oedometer test) tests of 3No. were determined.

The natural moisture contents of 11No. samples and liquid and plastic limits of 4No. samples of the cohesive soils were determined.

This assessment of the potential for chemical attack on buried concrete based on current BRE guidance[(11)] was carried out.

The results of all the geotechnical testing are given in Appendix J.

7.2 Foundation Design

7.2.1 Residential terraced houses

It is understood that consideration is being given to partial demolition of the reservoir to the front and the construction of 3 storeys terraced housing with partial double basements. Given the nature of the proposed structure the adoption of spread type foundation is not considered to be a practical proposition, on this basis it is recommended that a piled foundation solution should be considered for the proposed structures. Continuous flight auger or continuous helical displacement piles are considered appropriate for the site.

Based on the cable percussive borehole completed to date, illustrative load carrying capacities have been calculated for a single bored pile of various lengths and diameters. The working load of the pile has been derived assuming an overall factor of safety of 2.5 and 3.0.

The results for allowable load carrying capacities are given in Table 7-1 and are based on the SPT-N values from soil conditions given in the borehole logs (Appendix E), laboratory shear strengths and the undrained shear strength profile (Appendix K). An adhesion factor ($\propto$) of 0.60 was utilised throughout pile lengths. It has been assumed that little or no positive skin friction will be obtained from the made ground, which has been taken to be 0.5m thick.
Due to the influence of trees, the findings of the investigation indicate that relatively deep-seated desiccation is present beneath the footprint of the proposed buildings.

It is understood that the trees are to be removed prior to construction. Whilst this would allow rehydration of the ground to occur, the time scale for this would be prohibitive in terms of time scale for construction. Depending upon weather conditions, rehydration may take several years, possibly up to 10 years.

To overcome heave on piles the adoption of slip membranes may be considered or the incorporation of additional reinforcement.

Table 7-1: Illustrative Load Carrying Capacities

Depth of pile (m)	Diameter of pile (m)	Shaft Friction F_s (kN)	End bearing Q_b (kN)	Ultimate Pile Capacity (kN)	Allowable Pile Capacity (kN) FoS = 2.5	Allowable Pile Capacity (kN) FoS = 3.0
12	0.30	650	64	714	286	238
	0.35	759	87	845	338	282
	0.40	867	113	980	392	327
	0.45	975	143	1119	447	373
	0.50	1084	177	1261	504	420

13	0.30	721	80	801	320	267
	0.35	841	108	949	380	316
	0.40	961	141	1103	441	368
	0.45	1081	179	1260	504	420
	0.50	1202	221	1423	569	474
14	0.30	797	86	883	353	294
	0.35	930	117	1047	419	349
	0.40	1063	153	1216	486	405
	0.45	1196	193	1389	556	463
	0.50	1329	239	1567	627	522
15	0.30	879	92	972	389	324
	0.35	1026	126	1151	461	384
	0.40	1172	164	1336	535	445
	0.45	1319	208	1527	611	509
	0.50	1466	256	1722	689	574
16	0.30	966	98	1064	426	355
	0.35	1127	133	1261	504	420
	0.40	1289	174	1463	585	488
	0.45	1450	220	1670	668	557
	0.50	1611	272	1883	753	628
17	0.30	1059	101	1160	464	387
	0.35	1236	138	1373	549	458
	0.40	1412	180	1592	637	531
	0.45	1589	228	1816	727	605
	0.50	1765	281	2046	818	682
18	0.30	1158	104	1262	505	421
	0.35	1350	142	1492	597	497
	0.40	1543	185	1729	692	576

It should be noted that the behaviour of pile/pile groups under working loads should be determined as part of the detailed design work. The carrying capacity of piles will depend to a large extent on the method and care taken during their installation. It is therefore recommended that the advice of a specialist-piling contractor be sought as to the most suitable type of pile for the prevailing ground conditions and also as to their lengths and diameters to support the required working loads.

7.2.2 Floor Slab

Suspended floor slabs will be required where the new buildings overlap the footprints of the existing structure, area of thick made ground and previously removed/to be removed trees/shrubs, as specified in the NHBC Standards Chapter 5.2, Suspended Ground Floors: 2001[(13)].

7.2.3 Basement Construction

Based on the proposed construction, it is envisaged that a sheet pile wall or contiguous piles may be incorporated into planned excavations and aiding in groundwater control (if encountered). The advice of a specialist contractor should be sought on the design of proposed sheet pile walls or contiguous piles where incorporated into the development.
For the basement structure, consideration should be given to the adoption of a concrete reinforced ground bearing slab with downstand thickening of the slab beneath load bearing walls and columns with the ground and basement floors designed as structural props.
Given the anticipated depth of basement construction i.e. about 6.0m below current site levels, the formation sub-soils of the basement will generally comprise stiff silty clay. For likely loaded columns/walls, a net allowable bearing pressure of 125kN/m^2 can be assumed at this level although for heavy loads, piled foundations will be necessary.
Basement construction/heavy excavation will result in some heave of the basement sub-soils. It is recommended that any retaining wall design should consider appropriate negative skin friction or heave protection for the retaining structures and foundations and from any heave associated with the removal of trees.

7.2.4 Excavation Stability

It is considered that excavations within the shallow made ground and clay sub-soils will be relatively stable in the short term although excavations requiring manned entry, including excavations in the underlying deeper clay, will require closely boarded side support and/or support gained from the permanent piled walled for proposed basement.

It should be noted that a health and safety risk assessment must be undertaken for any excavations, which have to be entered by site operatives. In any event, excavations over 1.20m deep must be provided with side support before any entry is permitted.

7.3 Infrastructure

7.3.1 Road Construction

It is understood that a new road is proposed to assess the rear of the properties and the underground reservoir. It is anticipated that the formation soils for the road will comprises reworked London Clay. At this time, the engineering characteristics of such material are unpredictable and the CBR value of made ground does not predict overall settlements that may occur.

Due to the nature of the made ground and the proposed ground level change, it would be prudent to assume the material to be frost susceptible throughout thus a minimum pavement thickness of 450mm would be appropriate. Notwithstanding the above, it would be prudent at this stage, to allow for a CBR value of 2% for initial design purposes.

Following construction, it is recommended that the proposed formation be tested to confirm design parameters.

It is recommended that all soft, organic topsoil be removed from beneath the pavement construction. Any pockets of soft or loose material at formation level should be removed and replaced with well-compacted granular material. All formations should be compacted to make good any disturbance caused by excavation. It is recommended that the formation be not exposed for any period of time during inclement weather.

7.3.2 Gravity Retaining Walls

It is understood that the proposed new road will be constructed at various levels and consideration should be given to the adoption of reinforced concrete gravity retaining walls (RGRW). Given the anticipated formation level of the RGRW i.e. about 2-3m below current site levels, the formation sub-soils of the RGRW will generally comprise firm/stiff silty clay. Suitable soil parameters for retaining wall design are given in Table 7-2.

Table 7-2: Retaining Wall Soil Parameters

Soil type	c′	ϕ′,	Allowable bearing pressure
London Clay	0	22°	100kN/m^2

7.4 Soakaway Design

Below a cover of made ground the natural soils at this site were generally found to comprise silty clay of very low permeability. In these conditions, it is considered that soakaway drainage would not be feasible and therefore consideration should be given to discharging surface water into main drainage.

7.5 Chemical Attack on Buried Concrete

The assessment of the potential for chemical attack on buried concrete is based on current BRE guidance. The desk study and site walkover indicates that, for the purposes of this assessment of the aggressive chemical environment, the site may be considered as a Brownfield development where disturbance of pyrite-bearing ground could result in additional sulphate.

Moreover, where buried concrete is placed resulting in ground disturbance this will likely be restricted within the top 1.5m, and within soil types of low potential pyrite (made ground). Based on these assumptions, any impact due to pyritic conditions can be discounted.

The recommendation therefore is that all buried concrete to be placed on site can be assessed similarly whether placed in the made ground or London Clay. Subsequently, the mean of the highest 20% of water soluble sulphate on the chemical analyses undertaken on 12No. samples has been calculated at 2.007g/l (i.e. mean of 2.10g/l, 2.00g/l and 1.92g/l). This equates to a design sulphate class of **DS–3**. Based on static ground water conditions assumed within the London Clay and the mean of the lowest 20% of the pH results (i.e. mean of 7.6, 7.9 and 8.1) calculated at 7.87, the aggressive chemical environment for concrete (ACEC) classification is indicated at **AC-2s**.

8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Environmental

Based upon the PRA, site investigation and laboratory results indicate that the site is at very low risk from contamination. It is considered that no remedial measures are necessary and that the site is considered suitable for proposed residential development.

Consideration should be given to the treatment and eradication of knotweed observed at the site.

However, the following measures should be implemented:

- Consultation with the Environment Agency and Environmental Health Department of the Local Borough Council to confirm that the conclusions and recommendations of this report are acceptable;
- Should any soil be imported to site then this should be validated at source to confirm its suitability;
- Should olfactory or visually impacted contamination be encountered during site development then further advice must be sought; and
- Adoption of health and safety measures during the development works on site should be undertaken e.g. provision of cleaning facilities, dust suppression measures, when required.

8.2 Waste

RSK has developed a waste soils characterisation assessment tool, which follows the guidance within WM2, known as HAZWASTE. The available 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.

8.3 Geotechnical

Detailed comments in relation to geotechnical issues associated with the site are presented in Section 7.

The geotechnical recommendations not outlined above can be summarised as follows:

- *It is recommended that a piled foundation solution should be considered for the proposed structures taking into account any effects from desiccation etc. Continuous flight auger or continuous helical displacement piles are considered appropriate for the site.*
- *It is considered that suspended floor slabs are adopted throughout the development.*
- *Roads and pavements are initially designed on a CBR value of between 2% for clay formation. Following construction, it is recommended that the proposed formation be tested to confirm design parameters.*
- *With respect to the design of buried concrete, Design Sulphate Class of DS-3 and an Aggressive Chemical Environment classification of AC-2s were determined.*

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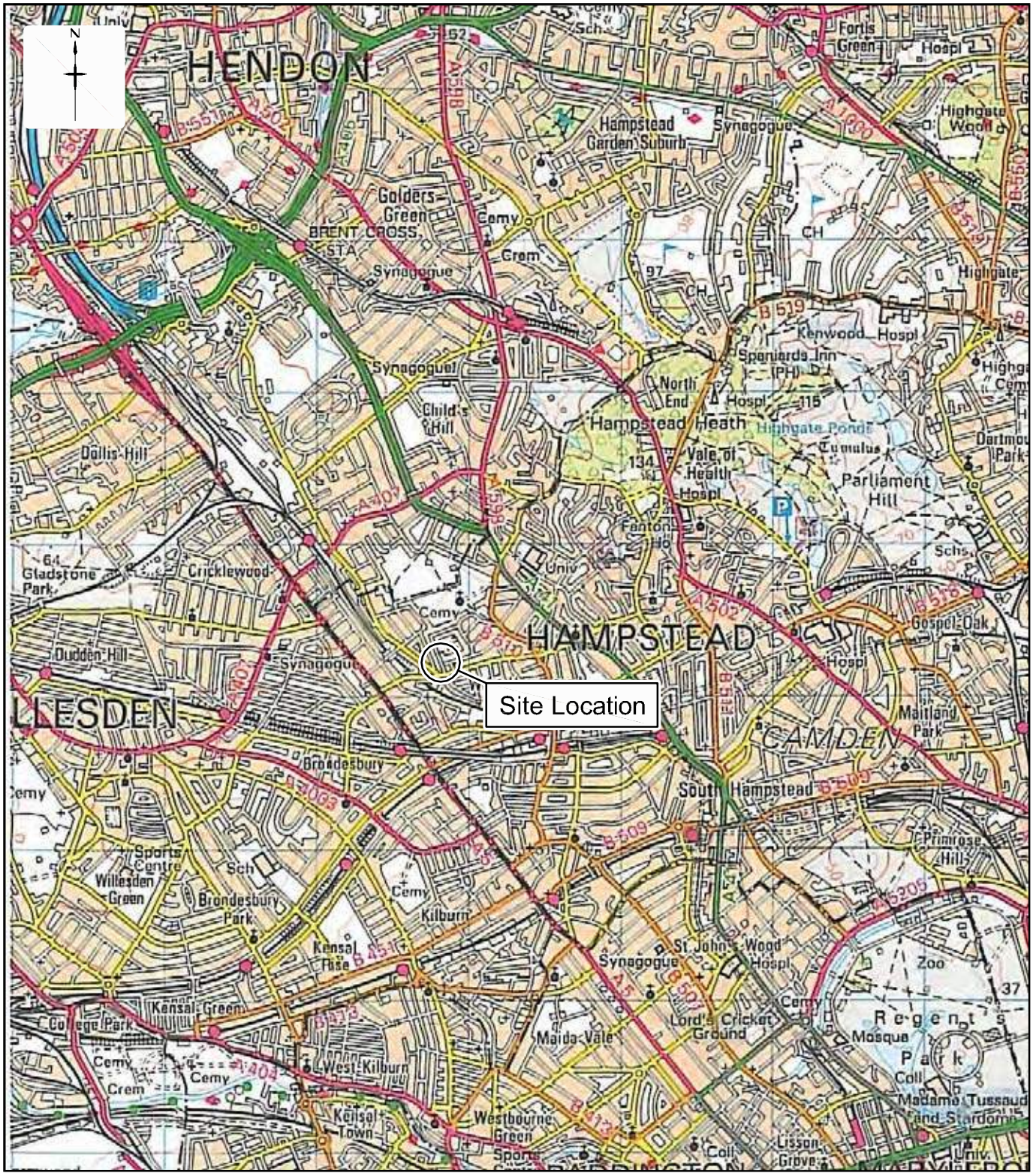
FIGURES



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Client: LINDEN HOMES LIMITED

Project Title: GONDAR GARDENS, LONDON

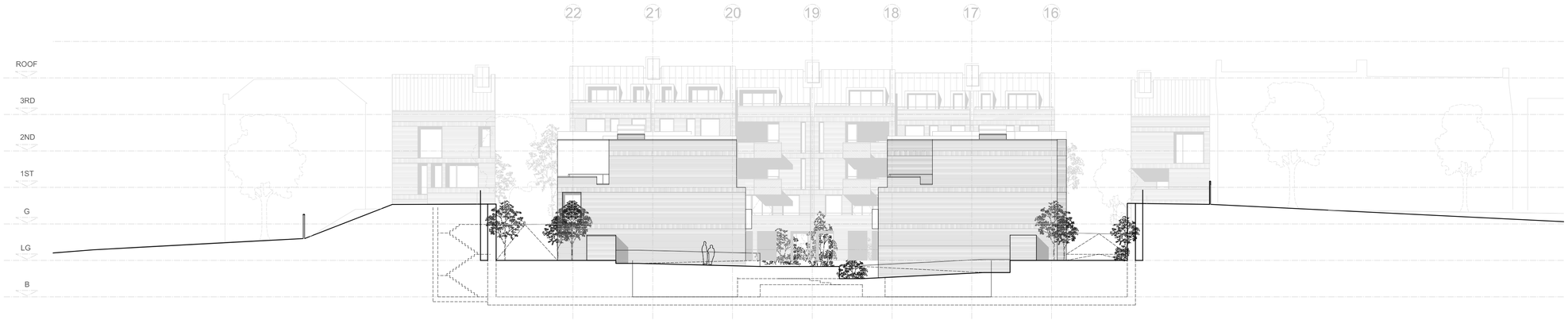
Drawing Title: SITE LOCATION MAP

Rev	Drawn	Date	Checked	Date	Approved	Date
00	MDW	23.11.09	NT	23.11.09	NT	23.11.09

Dimensions	Scale	Original Size
m	1:50,000	A4

Project Number	Drawing File	Drawing Number
23283	23283 - Fig 1 SLP.dwg	FIGURE 1

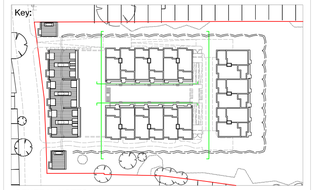
West Reservoir Elevation



East Ramp Elevation

North Reservoir Elevation

South Reservoir Elevation



GENERAL NOTES:

Rev	Date	Description	By	Chk	App
01	31.03.15	Consultant issue	MB	JH	

Metropolitan Workshop LLP

14-16 Cowcross Steet, London EC1M 6DG
Tel. 00 44 (0) 20 7566 0450
www.metwork.co.uk

Client:
Linden Homes / Wates

Project:
Gondar Gardens
London NW6 1HD

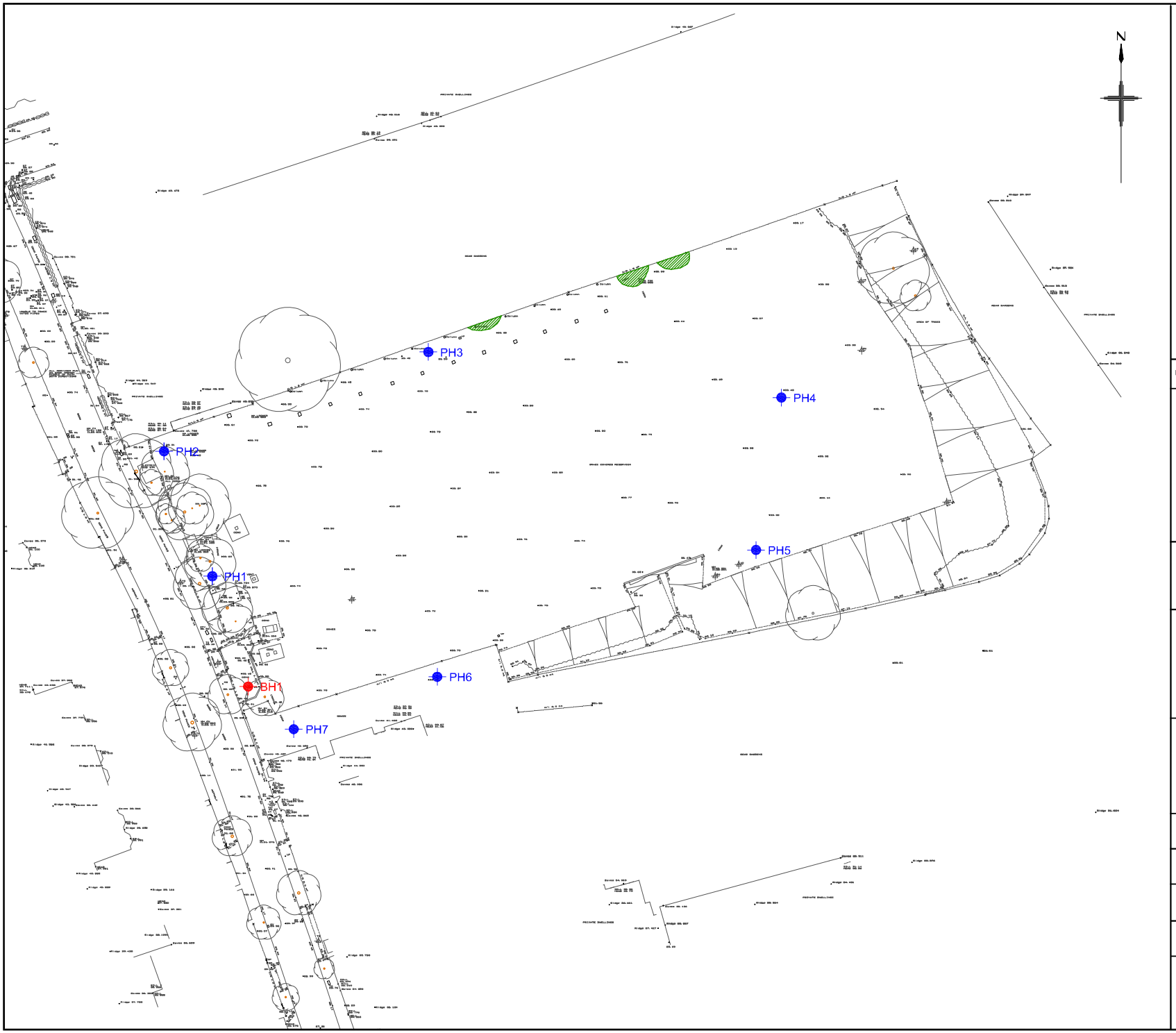
Title:
Proposed Elevations

Scale: 1:200 @ A1

Date: March 2015

Issue Status: Information

Job No.	Status	Package	Drawing No.	Revision
1319	S	102	002	01



LEGEND

- Borehole Location
- Probehole Location
- Japanese Knotweed Identified

Rev.	Date	Amendment	Drawn	Chkd.	Appd.
P1	23.11.09	FIRST ISSUE	MDW	NT	NT

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Client

LINDEN HOMES LIMITED

Project Title

GONDAR GARDENS, LONDON

Drawing Title

SITE PLAN

Drawn	Date	Checked	Date	Approved	Date
MDW	23.11.09	NT	23.11.09	NT	23.11.09

Scale	Orig Size	Dimensions
1:750	A3	m

Project No.	Drawing File
23283 (L01)	23283 (L01).dwg

Drawing No.	Rev.
FIGURE 3	P1

Scale 1 : 750

0 10 20 30 40 50m

APPENDIX A

Service Constraints

RSK STATS GEOCONSULT LIMITED
SERVICE CONSTRAINTS

1. This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by RSK STATS Geoconsult Limited (RSK) for Linden Homes Ltd (Urban Living) (the "client") in accordance with the terms of a contract between RSK and the "client". The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.
2. Other than that expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. **Any such party would be** well advised to seek independent advice from a competent environmental consultant and/or lawyer.
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK 's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date hereof, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.
7. The Services are based upon RSK's observations of existing physical conditions at the Site gained from a walk-over survey of the site together with RSK's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely. The Services clearly are limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the walk-over survey. Further RSK was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.
8. The phase II or intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined borehole and soil vapour locations based on the operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.
9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site.

APPENDIX B

Summary of Legislation and Policy Relating to Contaminated Land

Summary of legislation and policy relating to contaminated land

Part IIA of the Environmental Protection Act (EPA) and its associated Contaminated Land Regulations 2000 (SI 2000/227), which came into force in England on 1 April 2000, are the basis for the current regulatory framework and form the statutory regime for the identification and remediation of contaminated land.

Part IIA of the EPA 1990 defines contaminated land as 'any land which appears to the Local Authority in whose area it is situated to be in such a condition by reason of substances in, on or under the land, that significant harm is being caused, or that there is significant possibility of significant harm being caused, or that pollution of controlled waters is being or is likely to be caused'. Controlled waters, defined by the Water Resources Act, are considered all groundwater, inland waters and estuaries.

The intention of the EPA 1990 Part IIA is to deal with contaminated land issues that are considered to cause significant harm, on land that is not undergoing development, (see circular 2-2000 for definitions of what is significant harm, website link - http://www.defra.gov.uk/environment/land/contaminated/circ2-2000/index.htm).

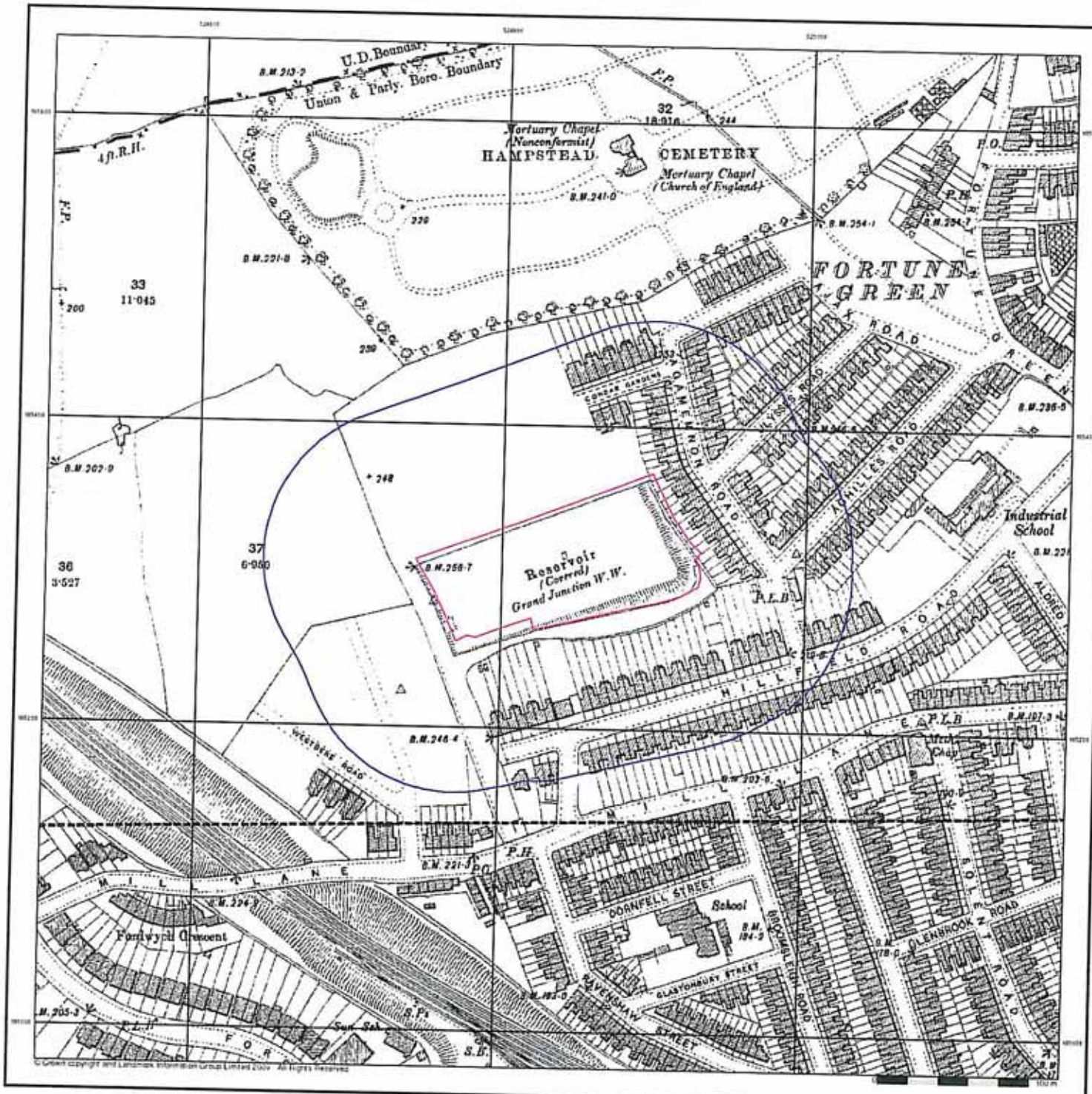
The Water Framework Directive 2000/60/EC (WFD) legislation aims to deliver long-term protection of the water environment and to improve the quality of all water bodies, including rivers, wetlands, coasts, estuaries, lakes, man-made structures and groundwater.

The Water Resources Act 1991 introduces an offence to cause or knowingly permit pollution of controlled waters. The Act provides the Environment Agency with powers to implement remediation necessary to protect controlled waters and recover all reasonable costs of doing so. The Groundwater Regulations, 1998, aim to complement EPA 1990. These regulations give the Environment Agency the power to *prevent* the discharge of List I substances and *restrict* the discharge of List II substances to groundwater.

Contaminated land is often dealt with through planning because of land redevelopment. This approach is documented in Planning Policy Statement: Planning and Pollution Control PPS23, which states that it remains the responsibility of the landowner and developer to identify land affected by contamination and carry out sufficient remediation to render the land suitable for use. The overall aim of the planning and pollution control policy is to promote the sustainable and beneficial use of land (in particular, encouraging reuse of previously developed land in preference to greenfield sites). Within this aim, polluting activities that are necessary for society and the economy should be so sited and planned, and subject to such planning conditions, that their adverse effects are minimised and contained to within acceptable limits.

APPENDIX C

Selected Historical Maps



RSK GROUP PLC

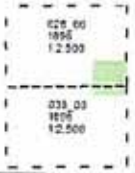
London

Published 1896

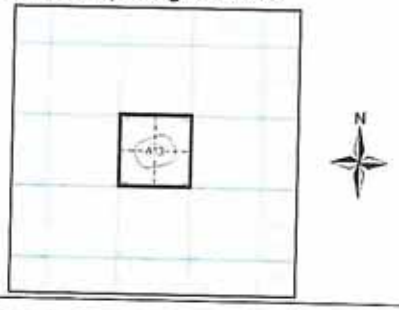
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	29328636_1_1
Customer Ref:	23283
National Grid Reference:	524840, 185310
Slice:	A
Site Area (Ha):	1.2
Search Buffer (m):	100

Site Details

1 Gondar Gardens, LONDON, NW6 1EW