

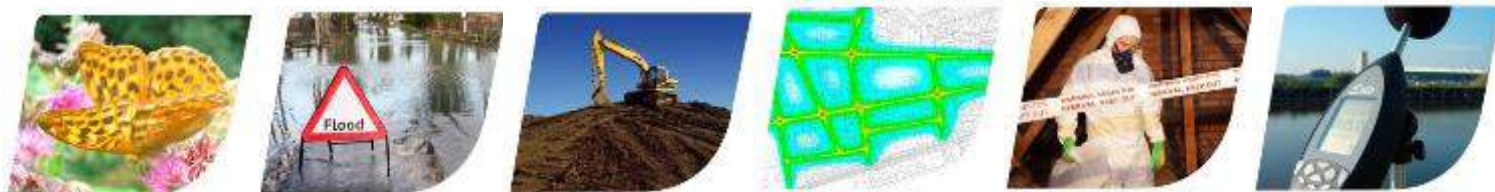
PHASE I TO III GEO-ENVIRONMENTAL SITE INVESTIGATION

Garrard House, 30 Garrard Street, Reading

REC REFERENCE: 20808v1.1

REPORT PREPARED FOR: TITAN PROPERTY DEVELOPMENTS LTD

MARCH 2015



QUALITY ASSURANCE

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EXECUTIVE SUMMARY

Site Address	Garrard House, 30 Garrard Street, Reading, RG1 1NR
Grid Reference	471448,173688
Site Area	0.20 ha
Current Site Use	The subject site consists of a multi-storey former office and mixed commercial/office unit buildings with undercroft parking.
Environmental Setting	Geology – Superficial Deposits of Alluvium and Taplow Gravels overlying a bedrock of Seaford and Newhaven Chalk Formation (Undifferentiated) Aquifers – Principal Aquifer (Chalk) and Secondary (A) Aquifer (Taplow Gravels and Alluvium) Sensitive Land Uses – No sensitive land uses were identified in close proximity to the subject site. Hydrology – There are no surface watercourses within influencing distance of the site.
Site History	Historical maps indicate that the site has been developed since 1879 with a mixture of residential properties, commercial use and stables.
Landfill Sites & Ground Gases	A historical landfill was identified within 500m of the subject site to the west.

Intrusive Ground Investigation

Ground Conditions	Made Ground Made Ground was encountered as either a fine or a coarse grained soil with variable amounts of flint, brick, concrete, wood, chalk fragments and black organic matter. Made Ground was typically deeper within the under croft parking at 29-35 Station Road, with depths of 4.50m and 4.60m bgl recorded, whilst to the rear of Station Road maximum depths of 2.00m bgl and 3.75m bgl were recorded. Superficial Deposits Superficial deposits of Taplow Gravels at the site typically comprised of brown slightly clayey sandy GRAVEL to a maximum depth of 4.80m bgl within WS103b and 3.00m bgl within BH101. The unit was only encountered within these two locations. Bedrock The Seaford and Newhaven Chalk Formation was encountered to a depth of 36.90m bgl with the base of the formation not encountered. The unit was recovered as structureless CHALK with varying amounts of flint. Structured Chalk in inferred from approximately 16.50m where in situ testing identified SPT 'N' values in excess of 35 blows. Groundwater was encountered as very slow ingress at 6.30m bgl within bedrock of chalk and rose to 6.00m bgl.
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Geotechnical Assessment

It is considered that given the proposed development, a piled foundation solution should be adopted with the piles bearing into the structured chalk.

Given the presence of a significant thickness of Made Ground and that piled foundations are likely to be utilised, a suspended floor slab should be adopted.

It is recommended that soak away systems not be adopted at the subject site based on the substantial depths of made ground encountered and the potential of chalk dissolution to occur if soak away systems were to be adopted within the formation, causing a reduction in stability.

It is considered that subsurface concrete can be designed in accordance with Design Sulphate Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1 in accordance with the recommendations provided in BRE Special Digest 1 (2005).

Developed Conceptual Site Model (CSM)

The Tier I Human Health Risk assessment has not identified any concentrations of constituents of concern that exceed the Tier I screening values for the protection of human health.

The subject site is considered unlikely to pose a significant risk to controlled waters receptors.

The ground gas assessment indicates a low risk to future site users.

Recommendations

If any unexpected contamination is encountered during the construction phase, it is recommended that works are stopped in the affected area and that contact is made with a suitably qualified geo-environmental consultant.

TABLE OF CONTENTS

QUALITY ASSURANCE	1
EXECUTIVE SUMMARY	2
<u>TABLE OF CONTENTS</u>	4
1.0 INTRODUCTION	6
1.1 Background	6
1.2 Proposed Development	6
1.3 Objectives	6
1.4 Limitations	7
1.5 Confidentiality	7
2.0 SITE SETTING	8
2.1 Site Details	8
2.2 Current Site Use	8
2.3 Surrounding Area	9
3.0 SITE HISTORY	10
3.1 On-Site Historical Development	10
3.2 Off-Site Historical Development	10
3.3 Planning History	11
4.0 ENVIRONMENTAL SETTING	12
4.1 Geology & Hydrogeology	12
4.2 Geotechnical Data	12
4.3 Hydrology	13
4.4 Radon Risk Potential	13
4.5 Industrial Land Uses	13
4.6 Sensitive Land Uses	13
4.7 Site Sensitivity Assessment	13
5.0 CONSULTATIONS	14
5.1 Local Authority Contaminated Land Officer	14
5.2 Landfill Sites and Waste Treatment Sites	14
5.3 Regulatory Database	14
6.0 INITIAL CONCEPTUAL SITE MODEL (CSM)	15
6.1 Initial CSM	15
6.2 Contaminant Sources	15
6.3 Potential Pathways	15
6.4 Potential Receptors	15
7.0 SITE INVESTIGATION	18
7.1 Site Investigation	18
7.1.1 General	18
7.2. In-Situ Standard Penetration Testing (SPT)	18
7.3 Laboratory Analysis	19
7.3.1 Soil Chemical Analysis	19
7.3.2 Geotechnical Laboratory Analysis	19
8.0 GROUND AND GROUNDWATER CONDITIONS	20

8.1	Ground Conditions	20
8.1.1	Summary of Ground Conditions	20
8.1.2	Made Ground	20
8.1.3	Superficial Deposits	20
8.1.4	Bedrock	20
8.1.5	Encountered Obstructions	21
8.1.6	In-Situ Testing	21
8.1.7	Saturated Moisture Content and Intact Dry Density	22
8.1.8	Particle Size Distribution Tests	22
8.1.9	pH and Sulphate	22
8.2	Groundwater Conditions	22
8.3	Ground Gas	23
9.0	TIER 1 QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT	25
9.1	Human Health Risk Assessment	25
9.2	Further Risk Assessment - Soil	27
9.3	Controlled Waters	27
9.4	Ground Gas	27
9.5	Revised Conceptual Model	28
10.0	GEOTECHNICAL ASSESSMENT	29
10.1	Proposed Development	29
10.2	Summary of Ground Conditions	29
10.3	Foundation Conditions and Bearing Capacity	29
10.4	Ground Floor Slabs	30
10.5	Drainage	30
10.6	Concrete Durability	30
10.7	Excavations	31
10.8	Chalk Dissolution	31
10.9	Construction Activity and Inspection	31

APPENDICES

Appendix I	Limitations
Appendix II	Glossary
Appendix III	Figure
	Figure 1 – Site Location Plan
	Figure 2 – Site Plan
Appendix IV	Photographs
Appendix V	Historical Maps
Appendix VI	REC Exploratory Hole Logs
Appendix VII	Chemical Testing Results
Appendix VIII	Origin of Tier I Generic Assessment Criteria
Appendix IX	Geotechnical testing results

1.0 INTRODUCTION

1.1 Background

REC have been instructed by Titan Property Developments to undertake a Phase I to III Geo-Environmental Site Investigation at Garrard House, 30 Garrard Street, Reading.

1.2 Proposed Development

REC understands that Titan Property Developments proposes to demolish the redundant office block and commercial space at the above site and replace with a twenty two (22) storey building consisting of residential apartments, with no areas of parking. At the time of writing the proposed loadings for the development are not known.

REC has previously undertaken a Phase I Geo-Environmental Site Assessment at the site in August 2014 (ref REC Report 20808v1.1) when the proposed development consisted of a permitted development with the redevelopment of the two-existing office blocks at Garrard Road and Station Road to comprise residential apartments. The Phase I environmental risk assessment considered that “Based on a Part J change of use through refurbishment of the current building and that no structural works will be taking place and that no areas of private gardens are proposed, it is considered the site does not present a risk to future residents”. The development has since changed, to the development detailed above at 29-35 Station Road, Reading.

Given the project now consists of a new build, the identified potential inactive pollution linkages within the report are considered potentially active due to breaking of the ground to build the new apartments. A Part J change of use is for refurbishment of the current structure without breaking ground, therefore enabling the current pollution linkage to be unchanged. When structural works are proposed additional pathways are created, through construction worker contact with potential concentrations, piling to underlying Secondary (A) and Principal Aquifer, creation of enclosed space, and development of new structures on previously open ground.

1.3 Objectives

The objectives of the geo-environmental investigation are to:

-  Review the previous Phase 1 undertaken by REC and update the initial conceptual site model in order to reflect the potential risks from the new build in line with Environment Agency (EA) document Model Procedures for the Management of Contaminated Land (Contaminated Land Report 11 (CLR11));
-  Undertake a preliminary stage of sampling and analysis to provide an overview of environmental issues identified;
-  Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site in relation to the future use of the site and in relation to off-site receptors;
-  Assess the geotechnical information and provide preliminary recommendations in relation to foundations and floor slabs;
-  Provide recommendations regarding future works required.

1.4 Limitations

The limitations of this report are presented in Appendix I.

1.5 Confidentiality

REC has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from REC; a charge may be levied against such approval.

2.0 SITE SETTING

2.1 Site Details

Site Address	29-35 Station Road, Reading, Berkshire, RG1 1NR
National Grid Reference	471448,173688
Site Area	0.20 ha

All acronyms used within this report are defined in the Glossary presented in Appendix II.

A site location map is presented in Appendix III.

2.2 Current Site Use

Site Description

The subject site was accessed on 06th August via Garrard Street from the west. The subject site comprised a six-storey commercial building (29-35 Station Road).

29-35 Station Road was located on the north-east to south-eastern area of the site. The subject site slopes from east to west with a height difference of ~2.20m from the ground floor of Station Road to the ground floor of Garrard House.

On the eastern area of the site the 6-storey building consisted of commercial shops on the ground floor with offices directly above. At the time of the walkover only one shop was occupied (33 Station Road), whilst the other three plots were vacant. The office space above the commercial units were also vacant. On the south-eastern area of the site adjacent to 29 Station Road, there was parking below the building (undercroft), with an approximate 4.00m height clearance. On the north-eastern area of the site at the rear of 35 Station Road, stairs stepped down towards a basement. Access to the former residential plots was noted at the rear of 29-35 Station Road, with metal staircase scaling up the six-storeys.

Selected photographs are presented in Appendix III.

Hazardous Materials Storage

No Above Ground Storage tanks (AST) or Underground Storage Tanks (USTs) were observed at the site; however two delivery pipe points were noted on the northern eastern side of the site (at the rear of Station Road) entering a plant room below the ground floor. The plant room was unable to be accessed during the site walkover.

Polychlorinated Biphenyls (PCBs)

No equipment that may potentially contain PCBs was observed at the site.

Asbestos Containing Material (ACM)

Although no ACMs were identified during the site walkover, given the age of the building, the presence of ACM cannot be discounted. REC recommends that the contractor working on the scheme satisfy themselves that ACMs are not present prior to undertaking any demolition works

Waste Storage

A large industrial waste storage bin was situated within the south-eastern area of the site to the rear of Station Road. A pile of refuse and tipped materials was located at the rear of 29 Station Road.

Drainage Issues

A formal drainage survey has not been completed but both foul and surface water sewers were marked on the northern and southern area of the site. A surface run-off drain was noted to be blocked on the south-eastern area of the site within an area of undercroft underfloor parking.

2.3 Surrounding Area

The surrounding land uses are summarised below:

Direction	Land Use
North	Multi-storey car park and commercial buildings.
East	Malmaison Hotel.
South	Novotel Hotel and Garrard House.
West	Commercial buildings.

3.0 SITE HISTORY

3.1 On-Site Historical Development

A review of historical mapping pertinent to the site is summarised in Table 3.1 below and a selection of historical maps are presented in Appendix IV.

Table 3.1 Summary of Potentially Contaminative Historical Land Uses

Map Edition	Historical Land Use
1879 (1:2,500)	Residential properties are present on the north-western area of the site. There are six buildings that transverse across the southern area to eastern area of the site. Notation on the plan indicates that these buildings are part of the Royal Horse and Carriage Repository. A garden area is situated on the eastern area of the site.
1900 (1:2,500)	No significant change in land use.
1931 (1:2,500)	The buildings situated within the eastern area of the site, appears to have been demolished. Area no longer noted as Horse Repository.
1956-1957 (1:2,500)	The eastern area of the site is now vacant, otherwise no significant change in land use.
1957-1962 (1:2,000)	The eastern part of the site adjacent to Station Road, now appears in its current configuration (29-35 Station Road).
1968-1970 (1:2,000)	No significant change in land use.
1988 (1:2,000)	No significant change in land use.
2002 (1:10,000)	No significant change in land use.
2014 (1:10,000)	No significant change in land use.

3.2 Off-Site Historical Development

A review of potentially contaminative uses identified on historical Ordnance Survey maps within a 250m radius of the site is summarised below in Table 3.2.

Table 3.2 Summary of Potentially Contaminative Off-Site Historical Land Uses

Surrounding Feature	Distance	Dates	Direction
Railway Station	70m	pre-1879 to present	North
Rifle Factory	140m	pre-1879 to 1900	North-West
Smithy	20m 120m	1912 to 1931 1956-1957 to 1968-1970	South-West South-West
Garages	10m 70m	1956-1957 to 1988 1956-1957 to 1988	North-West South-East

Surrounding Feature	Distance	Dates	Direction
	90m 90m	1968-1970 to 1988 1968-1970 to 1988	North South
Coal Yard	70m	1968-1970	West

3.3 Planning History

REC has undertaken a review of on-line planning records held by Reading Borough Council and no environmentally pertinent information has been obtained for the site.

4.0 ENVIRONMENTAL SETTING

4.1 Geology & Hydrogeology

The British Geological Survey (BGS) map for the site, (Sheet 268, 1:50,000, Reading, Solid & Drift edition) indicates that the site is underlain by the following geological sequence:

Geological Unit	Classification	Description	Aquifer Classification
Superficial Deposits	Taplow Gravel	Sand and Gravel	Secondary (A) Aquifer
	Alluvium (northern boundary)	Clay, Silt, Sand and Gravel	
Bedrock	Seaford and Newhaven Chalk Formation (Undifferentiated)	Chalk	Principal Aquifer

The Groundsure report indicates there are ten (10 no.) groundwater abstractions within a 1.00km radius of the site. The closest abstraction is 285m south-west in Cheapside, Reading, the abstraction is for potable use and commercial use. A further potable water abstraction is located 661m north-west at Cardiff Road, Reading. The site is not currently situated within an Environment Agency designated Source Protection Zone (SPZ), however an SPZ 3 – Total Catchment is located 347m north-east of the subject site. The site is classed as having high groundwater vulnerability due to the underlying aquifers and high leaching potential of the superficial deposits.

Based on the local topography and location of surface watercourses it is considered likely that shallow groundwater, if present, will flow in a north easterly direction toward the Source Protection Zone.

4.2 Geotechnical Data

Geotechnical Data presented within the Groundsure report identifies the following ground conditions:

Hazard	Designation
Shrink-Swell Clay	Very Low.
Landslides	Very Low.
Ground Dissolution	Very Low.
Compressible Ground	Moderate.
Collapseable Deposits	Very Low.
Running Sand	Low.

4.3 Hydrology

Surface water features in the vicinity of the subject site are as follows:

Surface Water Feature	Quality*	Distance (m)	Direction
Culvert	N/A	251m	North

*Chemical water quality as classified under the EA's General Quality Assessment (GQA) Scheme

The site is not located within a currently defined flood risk zone.

4.4 Radon Risk Potential

The HPA Indicative Atlas of Radon in England and Wales indicates the site is situated in an area where less than 1% of homes are above the Action Level and that the BGS reports that full radon protective measures are not necessary in the construction of new dwellings or extensions.

4.5 Industrial Land Uses

There are twenty (20 no.) industrial land uses within 250m of the subject site. The report indicates a camera store on-site at 31 Station Road; however at the time of the site walkover the store was vacant. The closest industrial land use is located 40m south-east which is classed as a further camera store. There are nine (9 no.) electrical substations located within 250m of the site, the closest is located 85m east. An obsolete petro and fuel station was located 441m west of the subject site.

4.6 Sensitive Land Uses

No environmentally sensitive land uses have been identified within close proximity to the subject site.

4.7 Site Sensitivity Assessment

The site is considered to be located within a moderate sensitivity setting due to the following reasons:

-  The underlying bedrock geology is classified as a Principal Aquifer;
-  There are several groundwater abstractions within 1.0km of the subject site;
-  The underlying superficial deposits are classified as Secondary (A) Aquifer; and,
-  There are no surface watercourses within influencing distance of the site.

5.0 CONSULTATIONS

5.1 Local Authority Contaminated Land Officer

The Environmental Protection Team at the Reading Borough Council was contacted on Wednesday 06th August 2014 and responded by indicating the subject site did not have a potentially contaminative land use, although an adjacent site did (former garage located 10m north-west of the site).

5.2 Landfill Sites and Waste Treatment Sites

Two (2 no.) historical landfills were located within 1.00km of the subject site. The closest was located 455m west, which was operational in 1869 and was classed as a refuse heap. The second historical landfill was situated 881m north-west of the site and is understood to have accepted commercial, household and liquid sludge waste. No other waste sites were located within 1.00km of the subject site.

5.3 Regulatory Database

The following information has been obtained from a commercially available environmental database. The summary table only includes records not otherwise detailed in the report. A full copy of the database report is provided on the CD at the rear of this report.

Table 5.1 Summary of Groundsure Data

	0-249m	250-500m	Details
Contaminated Land Register Entries and Notices	0	0	Not Applicable (N/A).
Authorised industrial processes (IPC/IPPC/LAPPC).	0	0	N/A.
Fuel Stations Entries	0	0	N/A.
Licensed radioactive substances	0	0	N/A.
Enforcements, prohibitions or prosecutions	0	0	N/A.
Discharge Consents	0	4	Closest is 347m north-east of the site and is a historic trade discharge into the Vastern ditch.
Pollution Incidents	2	0	The two pollution incidents are located north of the site 159m and 160m, relating to spillage of oils and fuels at Reading Train Station. The incident caused a Minor Impact (Category 3) to land quality.
Consents issued under the Planning (Hazardous Substances) Act 1990	0	0	N/A.
Control of Major Accident Hazard (COMAH) sites	0	0	N/A.

6.0 INITIAL CONCEPTUAL SITE MODEL (CSM)

6.1 Initial CSM

In accordance with Environment Agency, CLR 11 (2004) and BSI 10175 (Code of Practice for Investigation of Potentially Contaminated Land), REC Ltd have developed an initial CSM to identify potential contamination sources, migration pathways and receptors within the study area.

6.2 Contaminant Sources

On-site Potential Sources

-  Historic made ground associated with previous and current development of the site.

Off-site Potential Sources

-  Historical landfill (455m west)
-  Nine (9 no.) electrical substations (between 85m to 250m);

Potentially off-site historical contaminative land uses within 250m including:

-  Railway Station (70m north);
-  Rifle Factory (140m north-west);
-  Smithy (20m and 120m south-west);
-  Historic garages (10m to 90m); and,
-  Coal Yard (70m west).

6.3 Potential Pathways

-  Ingestion of contaminated soil;
-  Dermal contact of contaminated soil;
-  Migration into buildings;
-  Inhalation of fibres, vapours and dust; and;
-  Lateral and vertical migration.

6.4 Potential Receptors

-  Future Site Users;
-  Secondary (A) Aquifer; and,
-  Principal Aquifer.

Construction workers are not considered to be a plausible receptor as exposure will be managed through the use of appropriate PPE and hygienic working practices as required under HSE / CDM regulations. Furthermore, the length of any exposure is likely to be for a short duration.

An Initial Conceptual Site Model has been prepared for the site and is presented within Table 6.1.

Table 6.1 Initial Conceptual Site Model

Source	Contaminant	Potential migration pathway	Potential Receptors	Likelihood of Occurrence	Magnitude of Occurrence	Overall Risk Rating	Active/Inactive
On Site							
Historical Made Ground associated with development	Metals (As, Cd, Cr, Pb, Hg, Se, Ni)	Ingestion, inhalation and dermal contact of contaminated soils	Future Site Users	Likely	Medium	Moderate	Potentially Active – Further Investigation
		Vertical migration via preferential pathway	Secondary (A) Aquifer and Principal Aquifer	Likely	Medium	Moderate	Potentially Active – Further Investigation
	Polycyclic Aromatic Hydrocarbons (PAH)	Ingestion, inhalation and dermal contact of contaminated soils	Future Site Users	Likely	Medium	Moderate	Potentially Active – Further Investigation,
	Asbestos Fibres in Soil	Inhalation of fibres	Future Site Users	Likely	Medium	Moderate	Potentially Active – Further Investigation
	Ground Gas (CH ₄ and CO ₂)	Migration into buildings	Future Site Users	Likely	Medium	Moderate	Potentially Active – Further Investigation
	Total Petroleum Hydrocarbons (TPH)	Inhalation of Vapours	Future Site Users	Likely	Medium	Moderate	Potentially Active – Further Investigation
		Vertical migration via preferential pathway	Secondary (A) Aquifer and Principal Aquifer	Likely	Medium	Moderate	Potentially Active – Further Investigation
Off-Site							

Source	Contaminant	Potential migration pathway	Potential Receptors	Likelihood of Occurrence	Magnitude of Occurrence	Overall Risk Rating	Active/Inactive
Potentially contaminative off-site historical land uses within 250m of subject site listed in 6.2.	Ground Gas	Lateral migration onto site via preferential pathway, migration into buildings	Future Site Users	Likely	Low	Low	Potentially Active – Further Investigation
	Total Petroleum Hydrocarbons	Lateral migration onto site via preferential pathway, inhalation of vapours	Future Site Users	Likely	Low	Low	Potentially Active – Further Investigation
Historical Landfill (455m west)	Ground Gas	Lateral migration onto site via preferential pathway, migration into buildings	Future Site Users	Likely	Low	Low	Inactive – It is considered that this pollution linkage is inactive based on the distance to the site and that there are deposits of Alluvium on the northern boundary of the site which are likely to be cohesive in nature and therefore exhibit low permeability.
9 no. Electrical Substations	PCB	Lateral Migration on to the site via preferential pathway	Future Site Users	Unlikely	Medium	Low	Inactive - PCB's have a limited mobility and any contamination is likely to be localised immediately around the substation. It is therefore considered unlikely that lateral migration to the subject site would occur.

7.0 SITE INVESTIGATION

7.1 Site Investigation

7.1.1 General

A ground investigation has been designed based on the findings of the desk study with exploratory holes advanced to target specific potential contaminant sources summarised in Table 6.1. In addition, exploratory holes have also been advanced to provide information on baseline conditions across the site. The investigation has also been used to collect geotechnical information to assist in the design and construction of the development.

Exploratory fieldwork commenced on 28th November and was completed on the 3rd December 2014. The works are summarised in Table 7.1.

Table 7.1 Summary of Fieldwork

Potential Source/Rationale	Location Hole	Type	Maximum Depth (m bgl)	Monitoring Wells Response Zone
Provide baseline geotechnical conditions and confirm or disprove the findings of initial conceptual site model detailed within Table 6.1	BH101	Cable Percussive	36.90	2.00-3.00
	WS101	Window Sample	5.00	N/A
	WS102	Window Sample	5.00	1.00-5.00
	WS103a	Window Sample	1.00	N/A
	WS103b	Window Sample	5.00	1.00-4.00
	WS104	Window Sample	0.40	N/A

Notes

m bgl – metres below ground level.

The window sample holes and cable percussive borehole were designed to provide geotechnical information, and to retrieve environmental samples for chemical testing in order to confirm the findings of the Initial Conceptual Site Model (ICSM).

The ground conditions encountered and details of monitoring well response zones are indicated on the logs which are provided in Appendix VI.

All samples were collected using appropriate PPE and sampling equipment that was cleaned at each sampling location. A detailed copy of REC Ltd sampling methodology, QA procedures and laboratory chain of custody forms can be provided upon request.

Four (4 no.) out of six (6 no.) scheduled return visits were made to monitor installations for groundwater level and gas concentrations.

7.2. In-Situ Standard Penetration Testing (SPT)

In-situ geotechnical testing was conducted within the cable percussive borehole using the Standard Penetration Test (SPT) and where the ground is granular, a 60° cone (SPT(C)) was used instead of the sampling tube. The results are shown in the Logs in Appendix VI and presented in Table 8.3.

7.3 Laboratory Analysis

7.3.1 Soil Chemical Analysis

Selected soil samples were submitted for a range of chemical analysis comprising, metals, pH, total sulphate, water soluble sulphate (2:1 extract), sulphide, cyanide, phenols, speciated poly-aromatic hydrocarbons (PAHs), asbestos, and speciated banded total petroleum hydrocarbons (TPH).

Scientific Analysis Laboratories (SAL) Ltd of Braintree undertook the analytical work, the results of which are included in Appendix VI and discussed in Section 9.

Chemical analysis was undertaken on deeper soil samples and included pH and sulphate (2:1 extraction) analysis to aid concrete design. The results of these tests are included within the soil chemical test data in Appendix VII and discussed in Sections 8 and 10.

7.3.2 Geotechnical Laboratory Analysis

Selected soil samples were submitted to Professional Soil Laboratories (PSL) Ltd of Doncaster, where the following geotechnical tests were undertaken:

-  Particle Size Distributions (Coarse Grading);
-  Intact Dry Density; and,
-  Saturated Moisture Content.

The results of the geotechnical analysis are presented in Appendix XI and discussed in Sections 8 and 10.

8.0 GROUND AND GROUNDWATER CONDITIONS

8.1 Ground Conditions

8.1.1 Summary of Ground Conditions

The ground investigation generally confirms the published geology and identifies the strata set out in Table 8.1 below:

Table 8.1 Summary of Strata

Strata	Min Depth to Top of Strata (m BGL)	Max Depth to Top of Strata (m BGL)	Max Thickness (m)
Made Ground	0.00	0.00	4.60 (WS102)
Taplow Gravels	2.00 (BH101)	3.75 (WS103b)	1.05 (WS103b)
Seaford and Newhaven Chalk Formation	3.00 (VH101)	4.60 (WS102)	33.90 (BH101) – Base not encountered

8.1.2 Made Ground

Made Ground was encountered within all intrusive locations to depths varying from 2.00m (CP101) to 4.60m bgl (WS102). Made Ground was encountered as either a fine or a coarse grained soil with variable amounts of flint, brick, concrete, wood, chalk fragments and black organic matter. Made Ground was typically deeper within the undercroft parking at 29-35 Station Road, with depths of 4.50m and 4.60m bgl recorded, whilst to the rear of Station Road maximum depths of 2.00m bgl and 3.75m bgl were recorded.

8.1.3 Superficial Deposits

Taplow Gravels

Superficial deposits of Taplow Gravels at the site typically comprised of brown slightly clayey sandy GRAVEL to a maximum depth of 4.80m bgl within WS103b and 3.00m bgl within BH101. The unit was only encountered within these two locations.

No superficial deposits of Alluvium were encountered at the subject site.

8.1.4 Bedrock

Seaford and Newhaven Chalk Formation

The Seaford and Newhaven Chalk Formation was encountered to a depth of 36.90m bgl with the base of the formation not encountered. The unit was typically recovered as a melange of CHALK composed of white gravelly SILT and silty GRAVEL with occasional cobbles of flint. Chiseling was undertaken to advance through the flint bands of the unit at depths of 22.60m bgl to 22.80m bgl, 28.80m bgl to 29.90m bgl, 34.60m bgl to 34.80m bgl and 36.80m bgl to 36.90m bgl. Recovery of the melange of was predominantly due to the percussive nature of the cable percussive drilling.

It is noted that grading within the Seaford and Newhaven Chalk has not been determined within the borehole and window sample probeholes due to the percussive action of the drilling method destroying the structure of the chalk. In accordance with guidance given within CIRIA C574,

Structured chalk is assumed where SPTs are greater than 25 blows. For blows less than 25 it is not possible to determine between low density or medium density chalk with the SPT alone.

8.1.5 Encountered Obstructions

A number of obstructions were encountered during the intrusive investigation. The obstructions are presented in Table 8.2 below.

Table 8.2 Summary of Encountered Obstructions

Location Hole	Depth (m bgl)	Obstruction/Termination Reason
BH101	1.70-2.00	A concrete layer within the made ground.
	36.90	Band of flint within the chalk which could only be advanced 100mm after chiseling.
WS104	0.40	Flat concrete slab

8.1.6 In-Situ Testing

Undrained shear strength values of the fine grained soils were determined using in-situ hand shear vane testing, and SPT N values using the theoretical relationship of N value x 4.5. The relative densities of the coarse grained soils were derived from the Standard Penetration Tests. The results of these in-situ tests are presented in Table 8.3 below.

Table 8.3 Summary of Standard Penetration Tests

Location	Depth (m bgl)	Strata	SPT “N” Value	Soil strength (BS5930)	Approximate Undrained Shear Strength (N x 4.5 kN/m ²)	Relative Density	Structured Chalk (N >25)		
CP101	1.20-1.65	MG	>50	Extremely high strength	>225	N/A	N/A		
	2.00-2.45	TG	>50	N/A	N/A	Very Dense			
	3.00-3.45	SANC	35*			N/A	N/A	No*	
	4.00-4.45		48*						
	5.00-5.45		22						No
	6.00-6.45		14						
	7.50-7.95		16						
	9.00-9.45		14						
	10.50-10.95		13						
	12.00-12.45		12						
	13.50-13.95		15						
	15.00-15.45		44*					N/A	Yes
	16.50-16.95		26						
	18.00-18.45		28						
	19.50-19.95		24						
	21.00-21.45		28						
	22.50-22.95		>50						
	24.00-24.45		40						
	25.50-25.95		27						
	27.00-27.45		20						
	28.50-28.95		30						
	30.00-30.45		>50						

	31.50-31.95		48				
	33.00-33.45		34				
	34.50-34.95		>50				
	36.00-36.45		40				

Notes – MG (Made Ground), TG (Taplow Gravels) and SANC (Seaford and Newhaven Chalk Formation). * Considered that flint bands within chalk has affected the test.

8.1.7 Saturated Moisture Content and Intact Dry Density

Three (3 no.) samples of the Seaford and Newhaven Chalk Formation were scheduled for saturated moisture content and intact dry density testing at depths of 7.50m bgl, 15.00m bgl and 24.00m bgl. However testing was unable to be undertaken due to chalk being putty and not intact pieces.

8.1.8 Particle Size Distribution Tests

One (1 no.) particle size distribution test was undertaken on a sample of Taplow Gravels. The result is presented below in Table 8.4.

Table 8.4 Summary of Particle Size Distribution Test

Location	Depth (m bgl)	Lab Strata Description	Granulometric Composition			
			Clay/Silt	Sand	Gravel	Cobbles
BH101	2.00-2.50	Brown slightly sandy slightly silty GRAVEL	1	6	93	0

8.1.9 pH and Sulphate

Chemical analyses for pH and soluble sulphate content contained in Appendix VII (summarised below in Table 8.5), shows that the soils at the site generally meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1 in accordance with BRE Special Digest 1 (2005).

Table 8.5 Summary of pH and Sulphate Data

Location	Depth (m BGL)	SO ₄ in 2:1 water / soil (g/l)	pH Value	Concrete Classification
WS101	0.30-0.40	0.14	8.3	DS-1, AC-1
WS102	0.50-0.60	0.16	8.5	DS-1, AC-1
WS102	2.40-2.50	0.03	7.9	DS-1, AC-1
WS103B	0.70-0.80	0.05	8.3	DS-1, AC-1
WS104	0.30-0.40	0.07	9.7	DS-1, AC-1
BH101	10.00	0.03	9.1	DS-1, AC-1
BH101	20.00	0.02	9.2	DS-1, AC-1
BH101	30.00	0.02	9.3	DS-1, AC-1
BH101	35.50	0.02	9.2	DS-1, AC-1

8.2 Groundwater Conditions

A groundwater strike was encountered as a seepage within BH101. The depth of the seepages and the depth to which groundwater rose are shown on the exploratory hole records and summarised in Table 8.6 below:

Table 8.6 Summary Groundwater Strikes

Location	Depth to strike (m BGL)	Depth to standing water (m BGL)	Notes
BH101	6.50	6.30	Very slow ingress

8.3 Ground Gas

Concentrations of methane (CH₄), carbon dioxide (CO₂) and Oxygen (O₂) were measured using an infra-red gas analyser (GFM435) calibrated to a reference standard (before and after each survey) and gas flow rates were measured using an internal flow pod.

Gas measurements were recorded for a minimum of ninety seconds at each location, at which point the maximum concentration of CH₄ and CO₂ together with the lowest concentration of O₂ were recorded. The results of the ground gas monitoring are presented in Table 8.7 (overleaf).

Table 8.7 Summary of Gas and Groundwater Monitoring Data

Well	Date	CH ₄ Initial %v/v	CH ₄ Steady %v/v	CH ₄ GSV l/hr	CO ₂ Initial %v/v	CO ₂ Steady %v/v	CO ₂ GSV l/hr	O ₂ %v/v	Atmos(mb)	Atmos. Dynamic	Flow (l/hr)	Response Zone (mbgl)	Depth to Base (mbgl)	Depth to Water (mbgl)
BH101	11/12/2014	*	*	*	*	*	*	*	*	*	*	*	*	Dry
	17/12/2014	<0.1	<0.1	<0.0001	0.1	<0.1	<0.0001	19.5	1000	Rising	<0.1	2.00-3.06	3.06	
	06/01/2015	<0.1	<0.1	<0.0001	0.1	0.1	0.0001	19.6	1009	Rising	<0.1	2.00-3.06	3.06	
	16/01/2015	<0.1	<0.1	<0.0001	0.1	0.1	0.0001	19.2	990	Falling	<0.1	2.00-3.06	3.06	
WS102	11/12/2014	<0.1	<0.1	<0.0001	0.1	0.1	0.0001	20.0	1005	Rising	0.1	1.00-5.08	5.08	
	17/12/2014	<0.1	<0.1	<0.0001	0.1	0.1	0.0001	19.9	999	Rising	<0.1	1.00-5.08	5.08	
	06/01/2015	<0.1	<0.1	<0.0001	0.1	0.1	0.0001	19.7	1007	Rising	<0.1	1.00-5.08	5.08	
	16/01/2015	<0.1	<0.1	<0.0001	<0.1	0.2	0.0002	19.5	989	Falling	<0.1	1.00-5.08	5.08	
WS103b	11/12/2014	<0.1	<0.1	<0.0001	0.1	0.1	0.0004	20.1	1005	Rising	0.4	1.00-3.70	3.70	
	17/12/2014	<0.1	<0.1	<0.0001	0.1	0.1	0.0001	19.9	1000	Rising	<0.1	1.00-3.70	3.70	
	06/01/2015	<0.1	<0.1	<0.0001	0.1	0.1	0.0001	19.8	1008	Rising	<0.1	1.00-3.70	3.70	
	16/01/2015	<0.1	<0.1	<0.0001	<0.1	<0.1	0.0001	19.6	989	Falling	<0.1	1.00-3.70	3.70	

Notes - * Inaccessible due to a car being parked over the monitoring installation at the time of visit.

9.0 TIER 1 QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT

REC has undertaken a Tier 1 qualitative risk assessment to determine if any potential contaminants within the underlying soils pose an unacceptable level of risk to the identified receptors.

9.1 Human Health Risk Assessment

At a Tier 1 stage the long term (chronic) human health toxicity of the soil has been assessed by comparing the on-site concentrations of organic and inorganic compounds with reference values published by the EA (Contaminated Land Exposure Assessment (CLEA) Soil Guideline Values (SGV)) and where absent, Generic Assessment Criteria (GACs) published by LQM/CIEH (2nd edition).

The results of this comparison have been summarised within Table 9.1 (overleaf).

Table 9.1 Summary of Inorganic and Hydrocarbon Toxicity Assessment for a Residential End Use

Determinand	Units	GAC	C4SL	n	MC	Loc. of Ex	Pathway	Assessment
Inorganics								
Arsenic	mg/kg	32⁽ⁱ⁾	37	5	52	WS102	1	Further Action
Cadmium	mg/kg	10 ⁽ⁱⁱ⁾	26	5	0.3	N/A	5	No Further Action
Chromium (VI)	mg/kg	4.3 ⁽ⁱⁱⁱ⁾	21	5	<1	N/A	1	No Further Action
Lead	mg/kg	-	200	5	5900	4 loc.	1	Further Action
Mercury	mg/kg	11 ⁽ⁱ⁾	-	5	1.7	N/A	2	No Further Action
Nickel	mg/kg	130 ⁽ⁱ⁾	-	5	34	N/A	1	No Further Action
Selenium	mg/kg	350 ⁽ⁱ⁾	-	5	<3	N/A	1, 5	No Further Action
Copper	mg/kg	2330 ⁽ⁱⁱⁱ⁾	-	5	2000	N/A	1, 5	No Further Action
Zinc	mg/kg	3750 ⁽ⁱⁱⁱ⁾	-	5	160	N/A	5	No Further Action
Cyanide - Total	mg/kg	791 ⁽ⁱⁱⁱ⁾	-	5	<1	N/A	1	No Further Action
Asbestos	-	N.D. ^(iv)	-	4	N.D.	N/A	5	No Further Action
Organics								
Phenols - Total.	mg/kg	210 ⁽ⁱⁱ⁾	-	5	<1.0	N/A	5	No Further Action
Naphthalene	mg/kg	1.5 ⁽ⁱⁱⁱ⁾	-	5	<0.1	N/A	2	No Further Action
Acenaphthylene	mg/kg	170 ⁽ⁱⁱ⁾	-	5	<0.1	N/A	3	No Further Action
Acenaphthene	mg/kg	210 ⁽ⁱⁱ⁾	-	5	<0.1	N/A	1	No Further Action
Fluorene	mg/kg	160 ⁽ⁱⁱⁱ⁾	-	5	<0.1	N/A	1	No Further Action
Phenanthrene	mg/kg	92 ⁽ⁱⁱⁱ⁾	-	5	0.1	N/A	3	No Further Action
Anthracene	mg/kg	2300 ⁽ⁱⁱⁱ⁾	-	5	<0.1	N/A	3	No Further Action
Fluoranthene	mg/kg	260 ⁽ⁱⁱⁱ⁾	-	5	0.4	N/A	3	No Further Action
Pyrene	mg/kg	560 ⁽ⁱⁱⁱ⁾	-	5	0.3	N/A	3	No Further Action
Benzo(a)Anthracene	mg/kg	3.1 ⁽ⁱⁱⁱ⁾	-	5	0.3	N/A	3	No Further Action
Chrysene	mg/kg	6 ⁽ⁱⁱⁱ⁾	-	5	0.3	N/A	3	No Further Action
Benzo(b/k)Fluoranthene	mg/kg	5.6 ⁽ⁱⁱⁱ⁾	-	5	0.3	N/A	3	No Further Action
Benzo(a)Pyrene	mg/kg	0.83 ⁽ⁱⁱⁱ⁾	5	5	0.1	N/A	3	No Further Action
Indeno(123-cd)Pyrene	mg/kg	3.2 ⁽ⁱⁱⁱ⁾	-	5	0.1	N/A	3	No Further Action
Dibenzo(a,h)Anthracene	mg/kg	0.76 ⁽ⁱⁱⁱ⁾	-	5	<0.1	N/A	3	No Further Action
Benzo(ghi)Perylene	mg/kg	44	-	5	0.1	N/A	3	No Further Action
TPH C ₅ -C ₆ (aliphatic)*	mg/kg	30 ⁽ⁱⁱⁱ⁾	-	4	<0.10	N/A	2	No Further Action
TPH C ₆ -C ₈ (aliphatic)*	mg/kg	73 ⁽ⁱⁱⁱ⁾	-	4	<0.10	N/A	2	No Further Action
TPH C ₈ -C ₁₀ (aliphatic)*	mg/kg	19 ⁽ⁱⁱⁱ⁾	-	4	<0.10	N/A	2	No Further Action
TPH C ₁₀ -C ₁₂ (aromatic)*	mg/kg	69 ⁽ⁱⁱⁱ⁾	-	4	<2	N/A	2	No Further Action
TPH C ₁₂ -C ₁₆ (aromatic)*	mg/kg	140 ⁽ⁱⁱⁱ⁾	-	4	<2	N/A	1	No Further Action
TPH C ₁₆ -C ₂₁ (aromatic)*	mg/kg	250 ⁽ⁱⁱⁱ⁾	-	4	<2	N/A	1	No Further Action
TPH C ₂₁ -C ₃₅ (aromatic)*	mg/kg	890 ⁽ⁱⁱⁱ⁾	-	4	<2	N/A	1	No Further Action

Notes

Pathway: 1 = Soil Ingestion, 2 = Vapour Inhalation (indoor), 3 = Dermal Contact & Ingestion, 4 = Dust Inhalation 5 = Consumption of home-grown produce and attached soils

Abbreviations:

GAC = General Assessment Criteria, C4SL = Category 4 Screening Level, n = number of samples, MC = Maximum Concentration; Loc of Ex = Location of Exceedance.

GAC Tier 1 Origin

- (i) 2009 Soil Guideline Value (SGV);
- (ii) LQM/CIEH Generic Assessment Criteria for 1% Soil Organic Matter (SOM);
- (iii) CLEA 1.06 Derived Value;
- (iv) N.D = Not Detected

Referring to Table 9.1, the results of this direct comparison indicates that the screening values have been exceeded for the following determinands:

Inorganics

-  **Arsenic** (CP101a 0.50m, WS102 - 2.40m to 2.50m bgl); and,
-  **Lead** (WS101 – 0.30m to 0.40m bgl, WS102 – 0.50m bgl to 0.60m bgl, WS102 – 2.40m bgl to 2.50m bgl and WS103B – 0.70m to 0.80m bgl).

All these samples originate from the Made Ground at the subject site.

Asbestos was not identified in the four of the soil samples submitted for screening analysis.

9.2 Further Risk Assessment - Soil

The Made Ground at the site in a number of locations have exceedances of the residential end use screening criteria for both arsenic and lead. These exceedances originated from within the made ground at the subject site from depths of 0.40m bgl to 2.50m bgl.

The main pollution pathway for lead and arsenic is soil ingestion, however as the proposed development is to comprise residential apartments with no areas of soft landscaping, there is unlikely to be an active pollution linkage at the subject site based on proposed end use. Therefore it is considered that the site does not present a significant risk to human health.

9.3 Controlled Waters

The subject site is underlain by a Secondary (A) Aquifer within Taplow Gravels and a Principal Aquifer within the Seafood and Newhaven Chalk Formation and has ten (10 no.) groundwater abstractions within 1.00km radius of the subject site. The site however is not considered to pose a significant risk to controlled waters based on the concentrations of mobile total petroleum hydrocarbons at the site all returning concentrations less than the limits of detection. The exceedances within the soil for arsenic and lead are not considered to pose risk based on a pH greater than 7.9 for the soils tested, which indicates that inorganic contaminants are likely to be insoluble and therefore immobile. Furthermore groundwater was only encountered within one location during the ground investigation at a depth of 6.50m bgl within the bedrock of chalk and return monitoring visits identified no groundwater within the made ground or Taplow Gravels. As such it is considered that the site does not present a significant risk to controlled waters.

9.4 Ground Gas

The potential impact on the development from ground gases has been assessed with reference to standards and guidelines published in CIRIA Report 665 (*Assessing risks posed by hazardous ground gases to buildings*, 2007). However, it is recommended that the full ground gas assessment and recommended protection measures are agreed with the local authority prior to their adoption on-site. Furthermore, all protection measures adopted should be validated by a suitably qualified engineer.

The Phase I report and subsequent ground investigation has identified the following potential sources of ground gas:

-  Historic Made Ground associated with historical and current development; and,
-  Historical landfill (455m west of the subject site).

During the monitoring visit completed to date, no significantly elevated concentrations of methane or carbon dioxide were recorded within any of the monitoring installations. The highest recorded concentration of carbon dioxide was 0.2%v/v (WS102) and the highest recorded methane concentration was <0.1v/v (All monitoring installations), these are combined with flow rates of <0.1 l/hr. The monitoring visits were undertaken during rising atmospheric pressure dynamics.

In accordance with the methodology outlined with the CIRIA publication C665, REC have utilised the results of the ground gas monitoring surveys to calculate a tentative Gas Screening Value (GSV). The maximum GSV calculated for methane was <0.0001 l/hr (All monitoring locations) and for carbon dioxide was 0.0004 (WS103b).

The GSV has been compared to the criteria outlined with CIRIA C665 to determine the level of risk to the proposed development and to ensure the appropriate remedial options are incorporated into any future building design in this area.

CIRIA C665 states that the maximum GSV for carbon dioxide and methane is <0.07 l/hr for Characteristic Situation 1 the GSVs for this site fall into this bracket. It is therefore considered that the subject site does not require special gas protection measures based on the monitoring visits undertaken.

This is an interim assessment based on preliminary ground gas readings, the final classification will be supplied as an addendum to this report on completion of the remaining two (2 no.) monitoring visits.

9.5 Revised Conceptual Model

The assessment and revised conceptual model has not identified any potentially significant pollutant linkages based on a residential redevelopment of the site. It is therefore concluded that the site is suitable for redevelopment without the requirement for significant remedial action.

10.0 GEOTECHNICAL ASSESSMENT

10.1 Proposed Development

REC understands that Titan Property Developments proposes to demolish the redundant office block and commercial space at the above site and replace with a twenty two (22) storey building consisting of residential apartments. At the time of writing the proposed loadings for the development are not known. At this point it is not known if undercroft parking is proposed.

10.2 Summary of Ground Conditions

In summary, the ground conditions encountered comprised Made Ground to depths of circa 2.00-4.60 m bgl overlying Taplow Gravels to depths of 3.00-4.80 m bgl overlying bedrock of Seaford and Newhaven Chalk thereafter to a depth of 36.90m bgl (base not encountered).

Groundwater was encountered as very slow ingress within CP101 at a depth of 6.30m bgl.

10.3 Foundation Conditions and Bearing Capacity

Given the proposed number of storeys for the proposed development a piled foundation solution is likely to be adopted for the proposed scheme.

In consideration of prevailing ground conditions alone, a choice of pile type of various lengths and diameters can be designed to bear into the strata encountered beneath the site. However general site conditions, environs and proximity to adjacent extant structures and foundations are all influential in the choice of piling system.

It should be noted that for CFA piles there are certain practical constraints when considering the incorporation of large amounts of pile reinforcement and also their emplacement in the ground with potential obstructions. There is also the risk of collapse or necking of the pile bore should the flights be withdrawn and the hole left unsupported. For these reasons it is recommended that a competent and experienced specialist piling contractor undertakes all piling works, adopting appropriate controls and that their advice should be sought at the earliest opportunity.

For preliminary purposes the following initial pile carrying capacities have been calculated in Table 5.1. When undertaking these preliminary calculations the following parameters have been used:

-  Undrained shear strength (C_u) derived from SPT's, as summarised in Tables 8.3;
-  The relative density of the coarse grained soils derived from SPT's as summarised in Table 8.3, with very dense at 2.00m bgl;
-  The N values of Chalk derived from SPT's, as summarised in Table 8.3, ranging from 12 to 50.
-  Groundwater at a depth of 6.30m bgl;
-  Assumed ground conditions of Made Ground to 2.00mbgl, overlying Taplow Gravels to 3.00 mbgl, overlying the Seaford and Newhaven Chalk Formation to a depth greater than >36.80mbgl;
-  No positive or negative skin friction attributed from the Made Ground;

- Adhesion Factor of 0.45 for CFA piles;
- Factors of safety of 1.5 on side resistance and 3 on base resistance; and,
- Global Factor of safety of 2.5; and,
- A maximum limit for pile base bearing pressure of 1800 kN/m² (for medium/high density structured Chalk) has been assumed with parameters derived from SPT N values and CIRIA C574.

Table 10.1 Preliminary Pile Carrying Capacity

Depth	Pile Carrying Capacity (kN)		
	300mm dia	450mm dia	600mm dia
20.00	470	765	1100
25.00	770	1270	1830
35.00	1115	1810	2590

On the basis of the illustrative calculations, settlements are likely to be within permissible tolerances. Working capacities for pile groups should be assessed when final design details are known, although for preliminary design purposes it is likely that piles spaced at least 3 x pile diameter from other piles in any group will behave as single piles.

The above calculated values are presented for indicative purposes only. Where preliminary and working pile load tests are undertaken it may be appropriate to reduce Safety Factors. Pile design should be undertaken by a specialist contractor in order to confirm the indicative capacities detailed above and in order to select the most efficient piling method for ground conditions of this type. The piling contractor should be made aware that the cable percussive borehole was cased to a depth of 9.00mbgl due to variable ground conditions.

A flint band was identified within the cable percussive borehole at a depth of 36.80mbgl and was the thickness was unable to be confirmed due to refusal within cable percussive borehole. The piling contractor should be made aware of potential obstructions in the ground at the earliest opportunity in the design process.

10.4 Ground Floor Slabs

Given the presence of a significant thickness of Made Ground and that piled foundations are likely to be utilised, a suspended floor slab should be adopted. This would also negate the possibility of differential settlements between the floor and the shell of the proposed development

10.5 Drainage

It is recommended that soak away systems not be adopted at the subject site based on the substantial depths of made ground encountered and the potential of chalk dissolution to occur if soak away systems were to be adopted within the formation, causing a reduction in stability.

10.6 Concrete Durability

It is considered that subsurface concrete can be designed in accordance with Design Sulphate Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1 in accordance with the recommendations provided in BRE Special Digest 1 (2005).

10.7 Excavations

Site observations indicated that excavations should be feasible in the near surface with normal plant, however obstructions were identified in the near surface including former foundations and former floor slabs. It is anticipated that any obstructions will be grubbed out during the reduced level dig for the sub structure works.

Due to the variability of the Made Ground it is considered that all excavations are supported or battered back in accordance with guidance contained in CIRIA RR97.

10.8 Chalk Dissolution

CIRIA C574 draws attention to the fact that dissolution of the chalk can cause zones of metastability (becoming unstable) within the chalk or the overlying superficial deposits, particularly when concentrated groundwater flows, including those from soakaways if considered and leaking water pipes, could be present.

No evidence of chalk dissolution was encountered within the works, but consideration should be given to identifying possible related features during the development process.

10.9 Construction Activity and Inspection

The following activities and inspections should be incorporated in to the site works:

-  Due to the variability of the soils at the site it is recommended that sufficient allowance is made for the inspection of formation and sub formations to foundations and pavement construction;
-  Excavations where access is required should be subject to a risk assessment from a competent person and where appropriate mitigation measures such as benching back the sides or use of support systems in accordance with CIRIA R97 utilised;
-  Where access to confined spaces is required appropriate mitigation measures should be addressed within the Construction Stage Health and Safety Plan. Particular account should be taken of the gas results;
-  The presence of potential contamination and mitigation measures should be addressed as part of the Construction Stage Health and Safety Plan and should include measures to design out the risks, reduce their impact and finally the use of Personnel Protective Equipment (PPE).

END OF REPORT

APPENDIX I
LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between REC Ltd and the Client as indicated in Section 1.2.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not be made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. In addition to the above REC Ltd note that when investigating, or developing, potentially contaminated land it is important to recognise that sub-surface conditions may vary spatially and also with time. The absence of certain ground, ground gas, and contamination or groundwater conditions at the positions tested is not a guarantee that such conditions do not exist anywhere across the site. Due to the presence of existing buildings and structures access could not be obtained to all areas. Additional contamination may be identified following the removal of the buildings or hard standing.
7. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
8. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials this is for indicative purposes only and do not constitute or replace full and proper surveys.
9. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
10. This report presents an interpretation of the geotechnical information established by excavation, observation and testing. Whilst every effort is made in interpretative reporting to assess the soil conditions over the Site it should be noted that natural strata vary from point to point and that man made deposits are subject to an even greater diversity. Groundwater conditions are dependent on seasonal and other factors. Consequently there may be conditions present not revealed by this investigation.
11. REC can not be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by REC is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by REC in this connection without their explicit written agreement there to by REC.
12. Rather, this investigation has been undertaken to provide a preliminary characterisation of the existing sub-surface geotechnical characteristics and make up and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.
13. This investigation has been undertaken to reasonably characterise existing sub-surface conditions and the findings of this study are our best interpretation of the data collected, within the scope of work and agreed budget. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

APPENDIX II

GLOSSARY

TERMS

AST	Above Ground Storage Tank
BGS	British Geological Survey
BSI	British Standards Institute
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CIEH	Chartered Institute of Environmental Health
CIRIA	Construction Industry Research Association
CLEA	Contaminated Land Exposure Assessment
CSM	Conceptual Site Model
DNAPL	Dense Non-Aqueous Phase Liquid (chlorinated solvents, PCB)
DWS	Drinking Water Standard
EA	Environment Agency
EQS	Environmental Quality Standard
GAC	General Assessment Criteria
GL	Ground Level
GSV	Gas Screening Value
HCV	Health Criteria Value
ICSM	Initial Conceptual Site Model
LNAPL	Light Non-Aqueous Phase Liquid (petrol, diesel, kerosene)
ND	Not Detected
LMRL	Lower Method Reporting Limit
NR	Not Recorded
PAH	Poly Aromatic Hydrocarbon
PCB	Poly-Chlorinated Biphenyl
PID	Photo Ionisation Detector
QA	Quality Assurance
SGV	Soil Guideline Value
SPH	Separate Phase Hydrocarbon
Sp.TPH (CWG)	Total Petroleum Hydrocarbon (Criteria Working Group)
SPT	Standard Penetration Test
SVOC	Semi Volatile Organic Compound
UST	Underground Storage Tank
VCCs	Vibro Concrete Columns
VOC	Volatile Organic Compound
WTE	Water Table Elevation

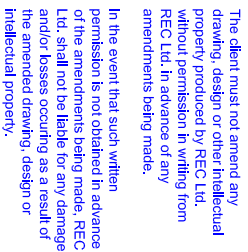
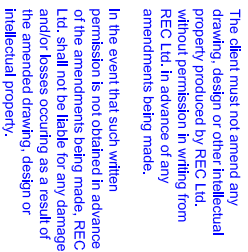
UNITS

m	Metres
km	Kilometres
%	Percent
%v/v	Percent volume in air
mb	Milli Bars (atmospheric pressure)
l/hr	Litres per hour
µg/l	Micrograms per Litre (parts per billion)
ppb	Parts Per Billion
mg/kg	Milligrams per kilogram (parts per million)
ppm	Parts Per Million
mg/m ³	Milligram per metre cubed
m bgl	Metres Below Ground Level
m bcl	Metre Below Cover Level

mAOD	Metres Above Ordnance Datum (sea level)
kN/m ²	Kilo Newtons per metre squared
µm	Micro metre

APPENDIX III

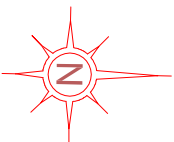
FIGURES



Key

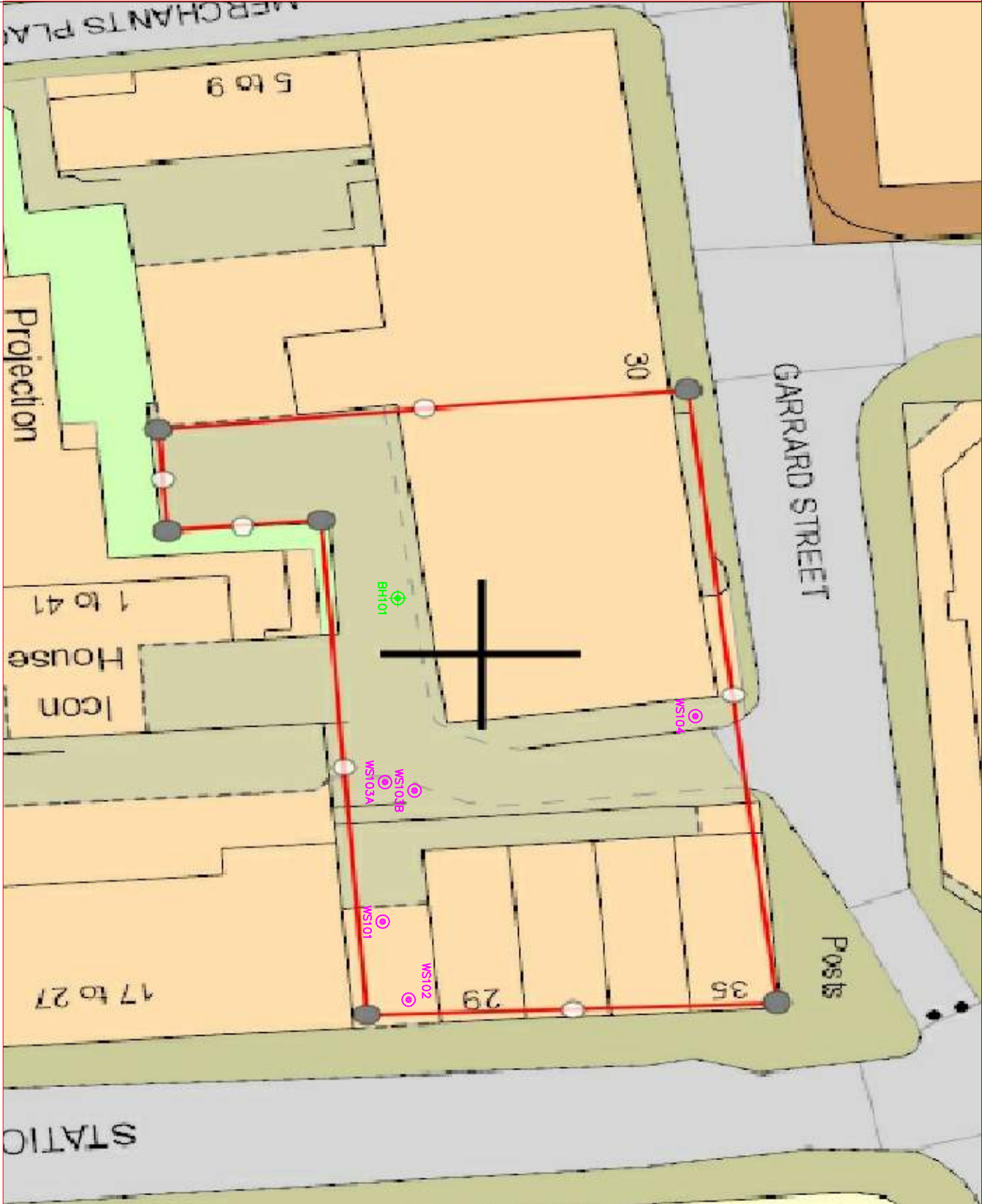
WS101 Approximate Window Sample Probehole Location

BH101 Approximate Cable Percussive Borehole Location



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In the event that such written permission is not obtained in advance of the amendments being made, REC Ltd, shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.



APPENDIX IV
PHOTOGRAPHS



**PLATE 1 –WS101 AND WS102 LOCATED IN UNDERCROFT AREA OF STATION ROAD (FACING
STATION ROAD - 27/11/2014)**

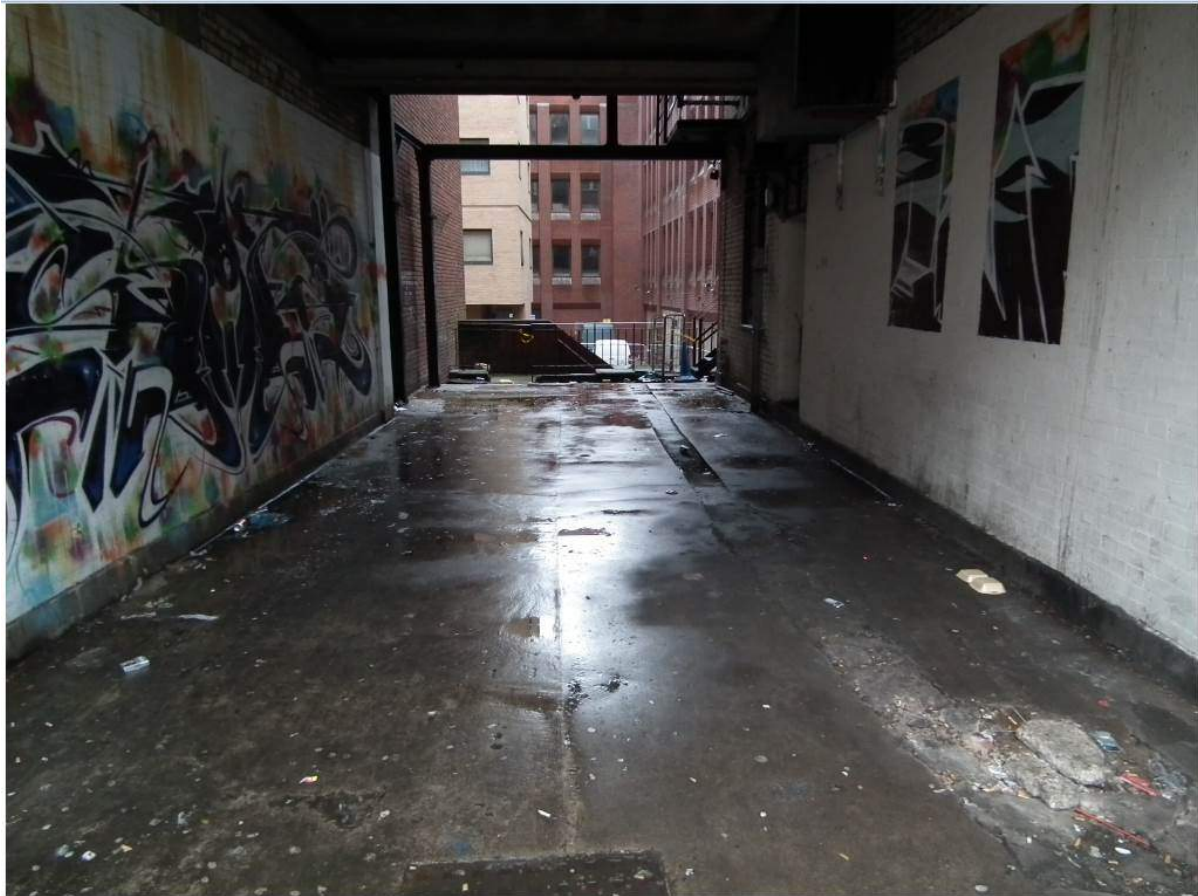


PLATE 2 – UNDERCROFT PARKING FACING GARRARD HOUSE (27/11/2014)

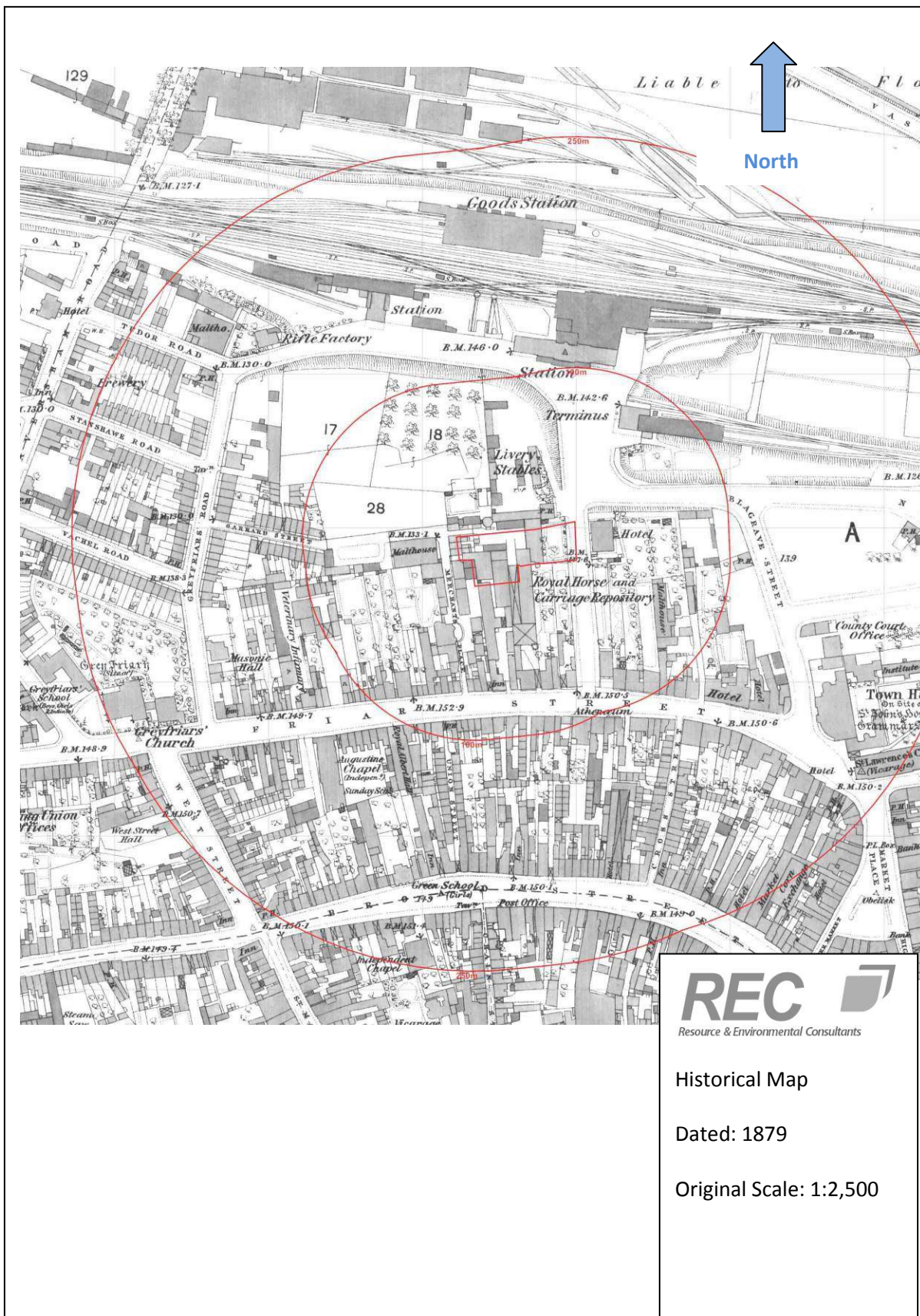


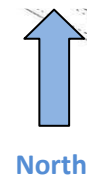
**PLATE 3 – HATCHED AREA MARKING LOCATION OF BH101 TO REAR OF GARRARD HOUSE
(27/11/2014)**



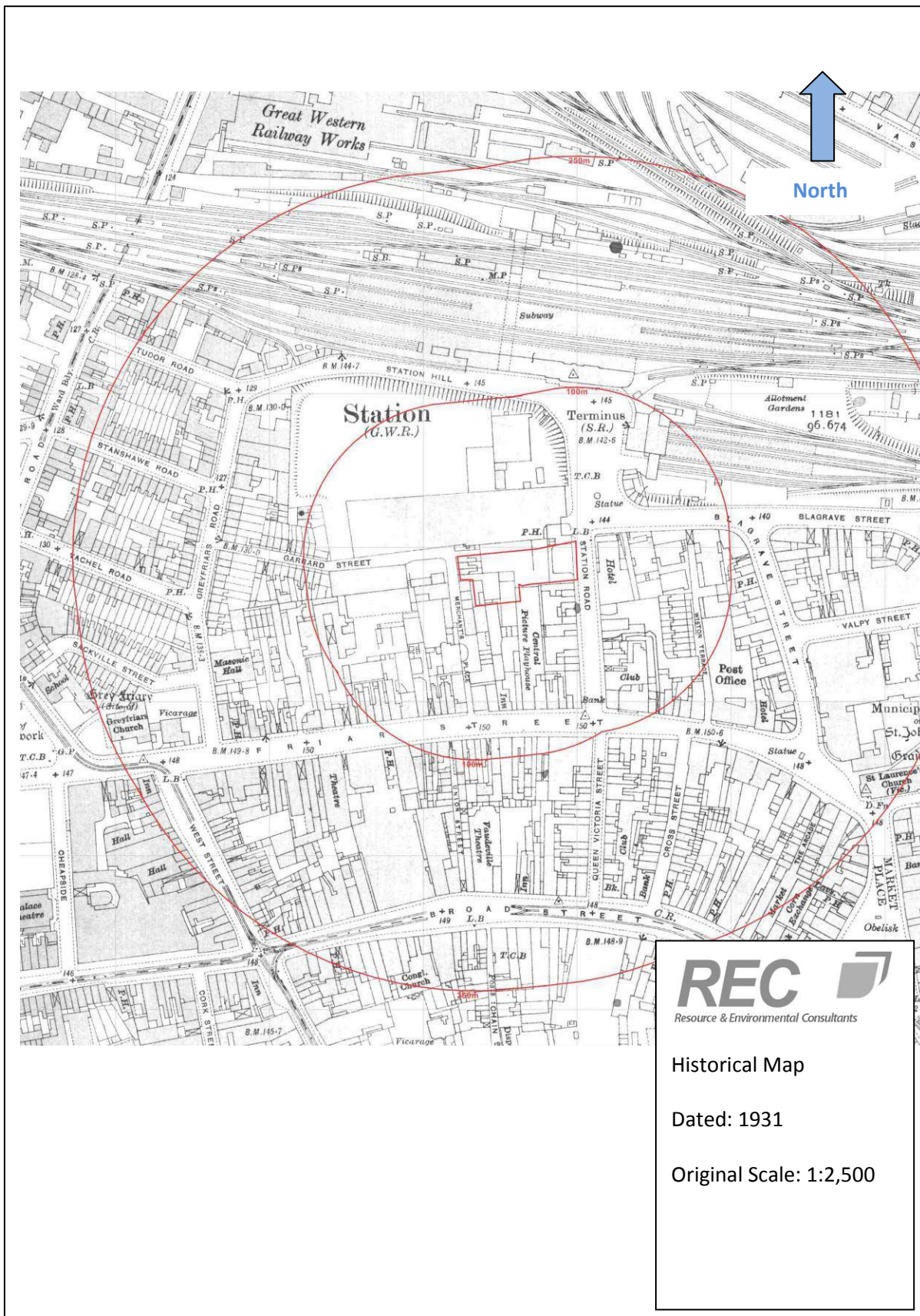
PLATE 4 – REAR OF 29-35 STATION ROAD (FACING EAST – 27/11/2014)

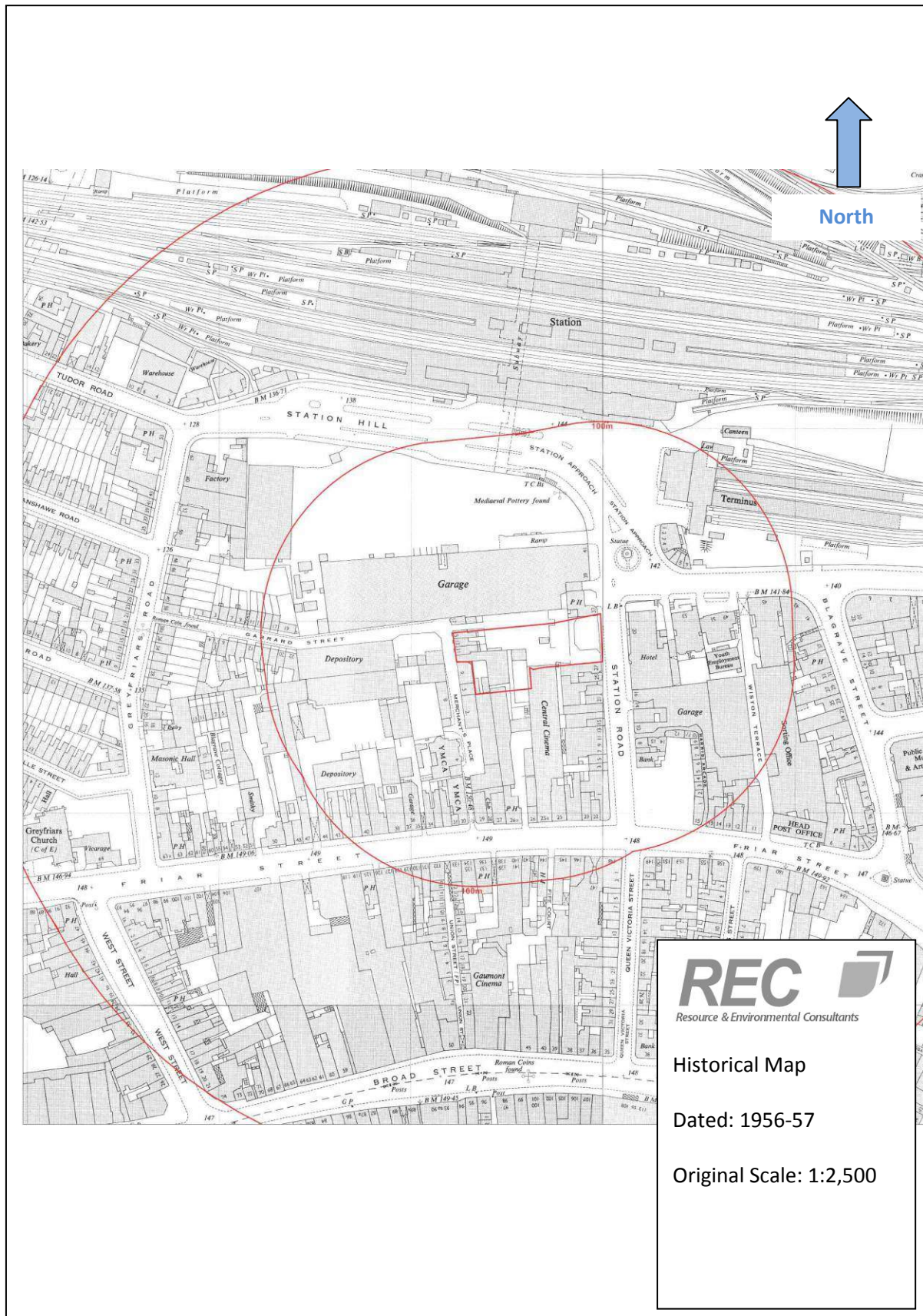
APPENDIX V
HISTORICAL MAPS

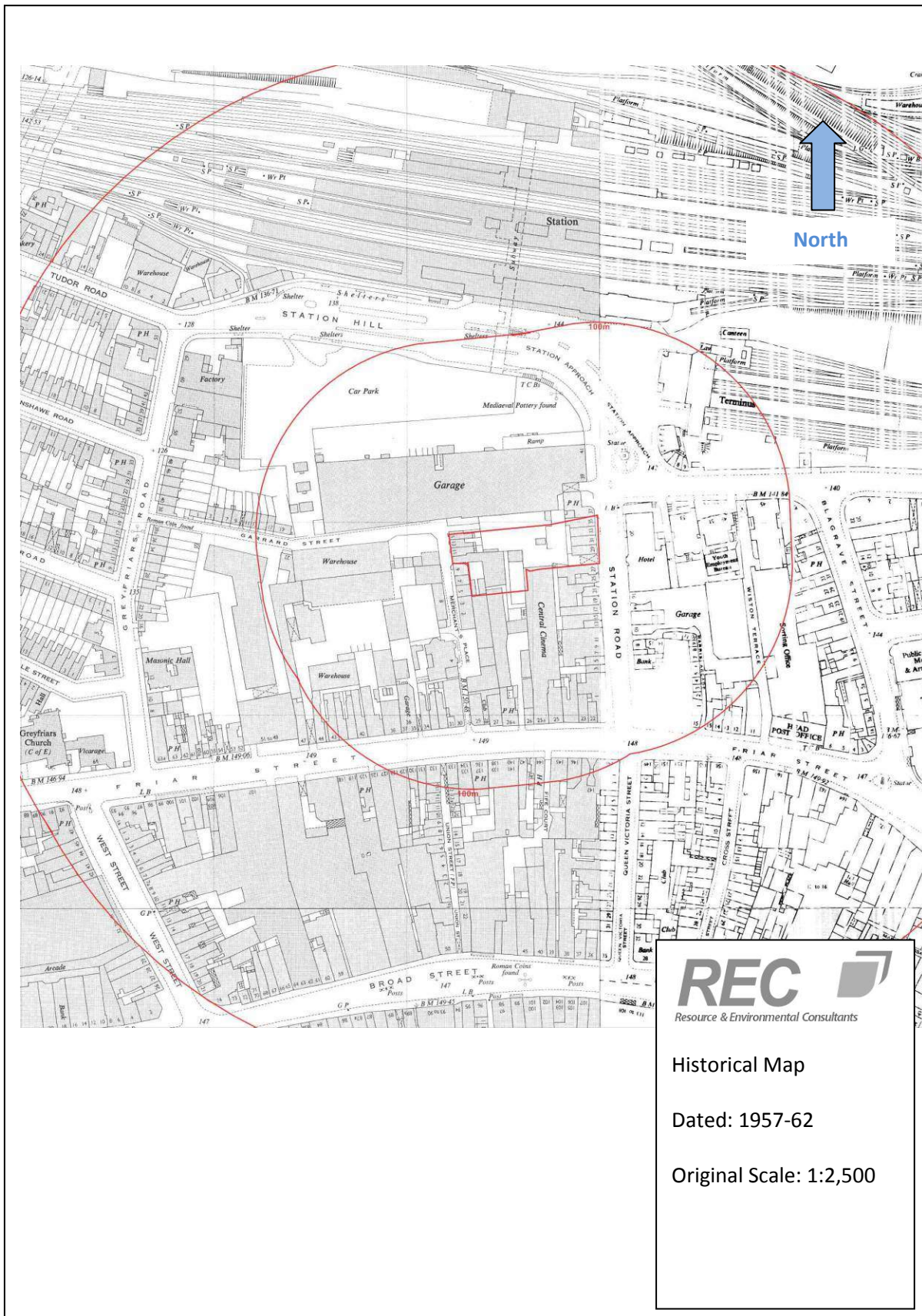


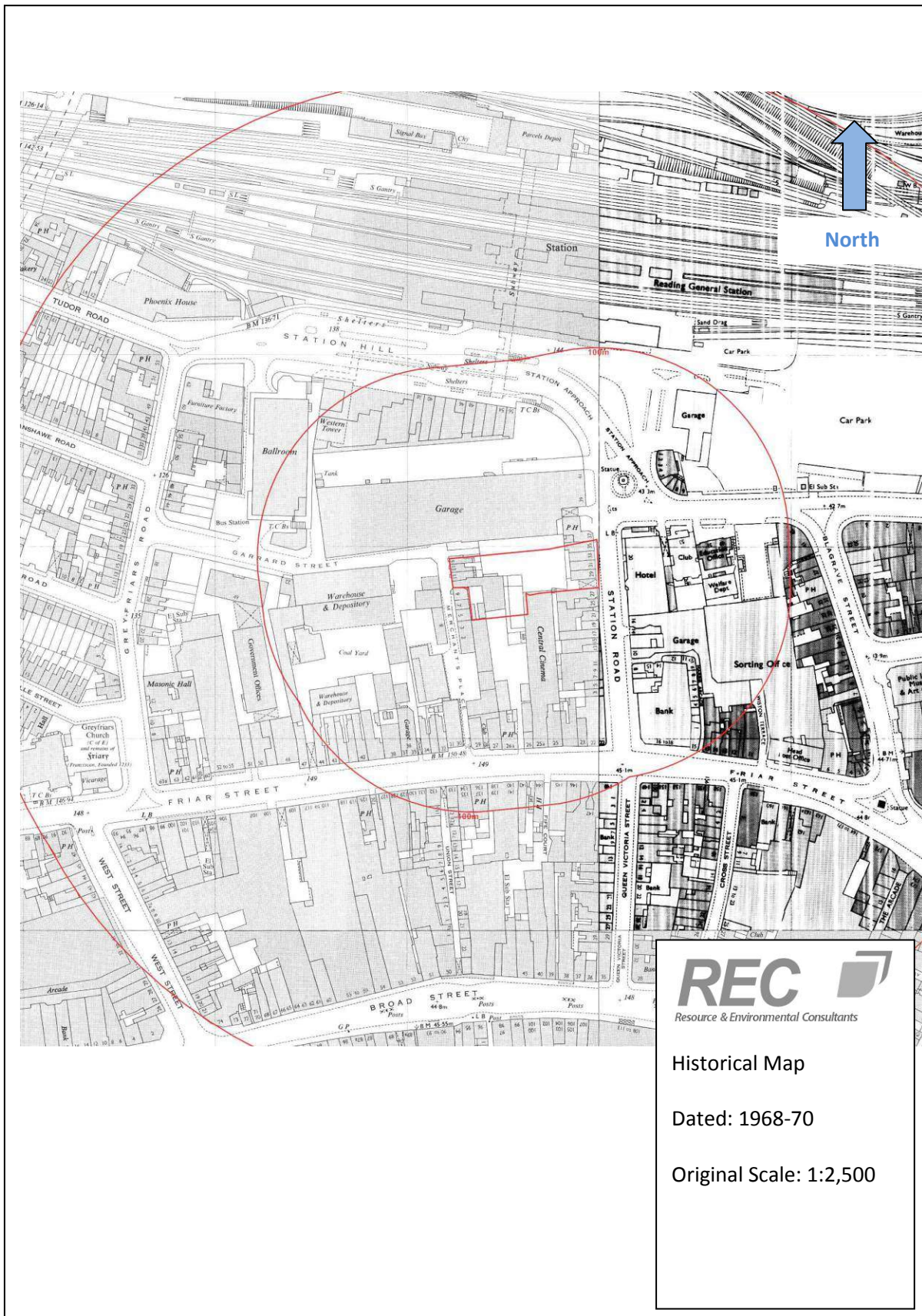


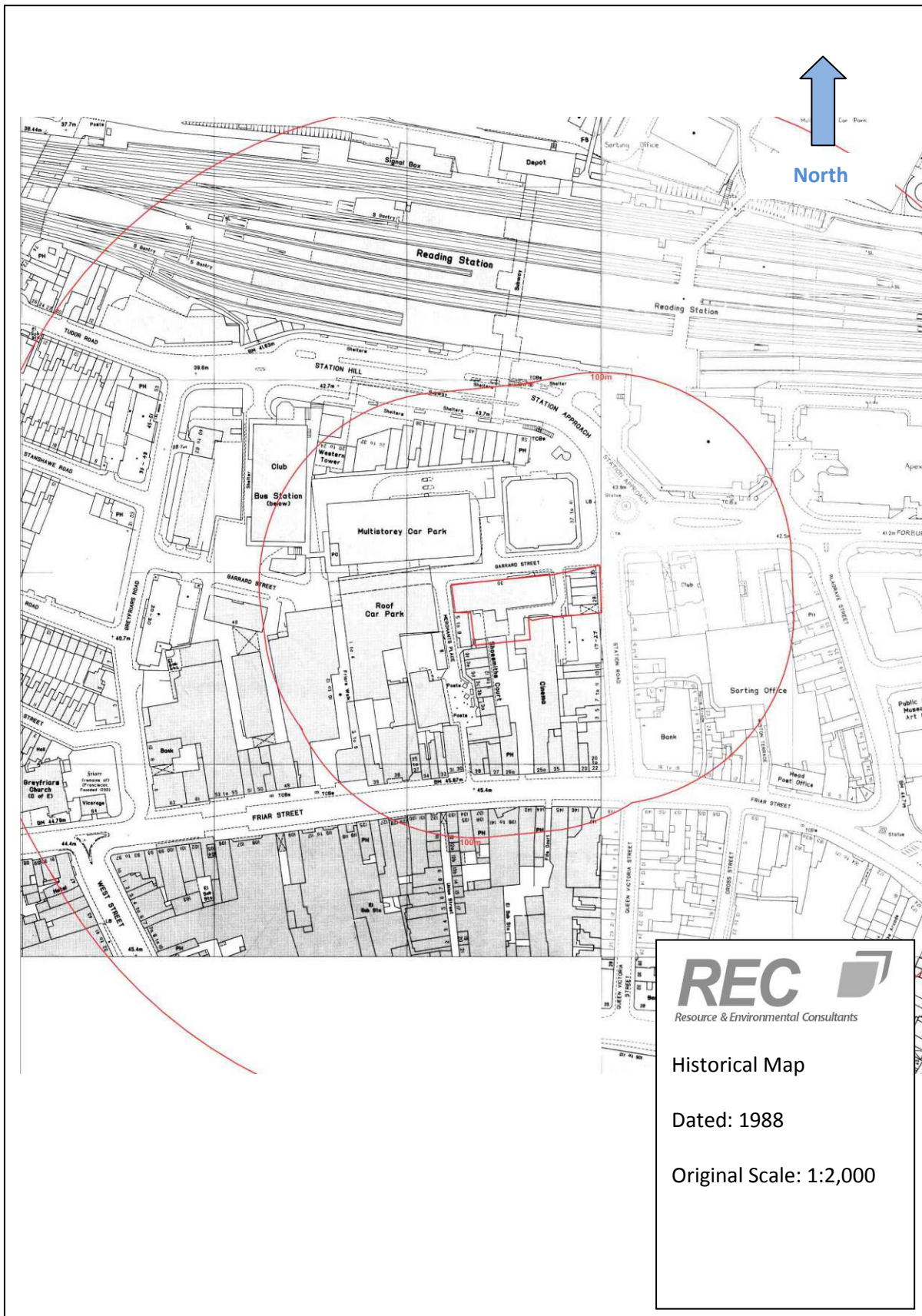
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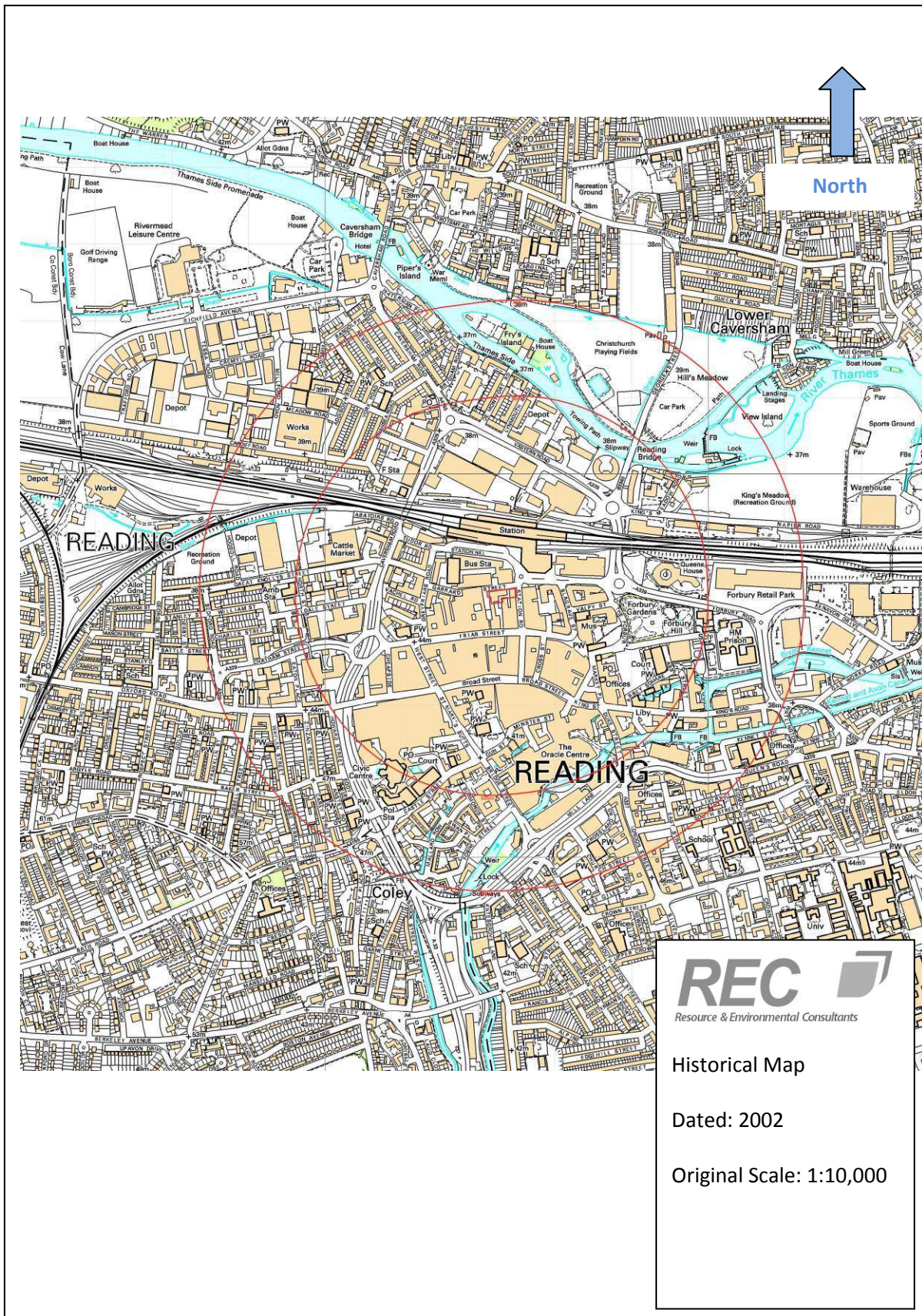












APPENDIX VI

REC EXPLORATORY LOGS

Borehole Log

Borehole No.

CP101

Sheet 1 of 4

Project Name: 29-35 Station Road

Project No.
20808

Co-ords: -

Hole Type
CP

Location: Reading

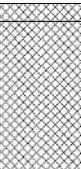
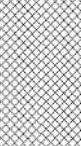
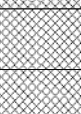
Level:

Scale
1:50

Client: Titan Property Developments Ltd

Dates: 28/11/2014 - 03/12/2014

Logged By
D.Hull

Back fill / Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.12			0.12			Tarmac. (MADE GROUND)	
		0.40	D					Brown to dark brown slightly clayey gravelly SAND. Sand is fine to coarse. Gravel of angular to sub-rounded fine to coarse flint, red brick and concrete with rare plastic, low cobble content of sub-angular red bricks. (MADE GROUND)	
		0.40	B						
		0.40	ES						
		0.80	ES						
		1.20	D		1.20			Soft brown gravelly sandy CLAY. Sand is fine to coarse. Gravel of angular to sub-rounded fine to coarse flint, red brick and concrete with low cobble content of sub-angular red brick. (MADE GROUND)	
		1.20		50 (1,2/50 for 225mm)	1.30				
		1.20	ES						
		1.70			1.70			Concrete layer. (MADE GROUND)	
		2.00		N=50 (3,4/50 for 255mm)	2.00				
		2.00	D		2.00				
		2.00	B					Brown slightly clayey very gravelly SAND. Sand is fine to medium. Gravel of angular to subrounded fine to coarse flint with a low cobble content of sub-angular flint. (TAPLOW GRAVELS)	
		2.80	D						
		3.00		N=35 (4,6/6,8,10,11)	3.00				
		3.00	D		3.00				
		3.00	B					Recovered as: structureless CHALK composed of silty GRAVEL with occasional cobbles of flint. Gravel is weak density, very angular to sub-rounded fine to coarse. Matrix is white. (SEAFORD AND NEWHAVEN CHALK FORMATION)	
		4.00		N=48 (5,7/8,10,14,16)	4.00				
		4.00	D		4.00				
		4.00	B						
		5.00		N=22 (3,5/5,5,6,6)	5.00			Recovered as: structureless CHALK composed of silty GRAVEL with occasional cobbles of sub-angular to sub-rounded flint. Matrix is white. (SEAFORD AND NEWHAVEN CHALK FORMATION)	
		5.00	D						
		6.00		N=14 (2,3/3,3,4,4)	6.00				
		6.00	D						
		7.50		N=16 (1,3/4,4,3,5)	7.50				
		7.50	D						
		9.00		N=14 (2,3/3,3,4,4)	9.00				
		9.00	D						
		10.00	D						

Continued on next sheet

Remarks

Hole terminated at 36.90 due to refusal within cobbles of flint. Groundwater was encountered at a depth of 6.30m bgl and with a very slow ingress rose to 6.00m bgl. Chiselling was undertaken to advance the hole at 1.70 to 2.00m bgl, 2.20m bgl to 2.50m bgl, 2.60m bgl to 2.80m bgl, 2.80 to 29.90m bgl, 34.60m bgl to 34.80m bgl and 36.80m bgl to 36.90m bgl.

Borehole Log

Borehole No.

CP101

Sheet 2 of 4

Project Name: 29-35 Station Road

Project No.
20808

Co-ords: -

Hole Type
CP

Location: Reading

Level:

Scale
1:50

Client: Titan Property Developments Ltd

Dates: 28/11/2014 - 03/12/2014

Logged By
D.Hull

Back fill / Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.50 10.50	D	N=13 (2,2/3,3,3,4)	10.50			...High cobble content of angular to subrounded flint between 10.00m bgl to 11.00m bgl.	11
		11.50	D						
		12.00 12.00	D	N=12 (3,3/2,3,3,4)	12.00				12
		13.00	D					...High cobble content between 13.00m bgl and 16.00m bgl.	13
		13.50 13.50	D	N=15 (2,3/3,4,4,4)	13.50				14
		14.50	D						
		15.00 15.00	D	N=44 (3,4/12,14,8,10)	15.00				15
		16.00	D						16
		16.50 16.50	D	N=26 (3,3/4,6,8,8)	16.50				17
		17.50	D						
		18.00 18.00	D	N=28 (2,3/5,8,7,8)	18.00				18
		19.00	D						19
		19.50 19.50	D	N=24 (4,6/6,8,4,6)	19.50				
		20.00	D					Continued on next sheet	20

Remarks

Hole terminated at 36.90 due to refusal within cobbles of flint. Groundwater was encountered at a depth of 6.30m bgl and with a very slow ingress rose to 6.00m bgl. Chiselling was undertaken to advance the hole at 1.70 to 2.00m bgl, 2.20m bgl to 2.50m bgl, 22.60m bgl to 22.80m bgl, 28.80 to 29.90m bgl, 34.60m bgl to 34.80m bgl and 36.80m bgl to 36.90m bgl.

Borehole Log

Borehole No.

CP101

Sheet 3 of 4

Project Name: 29-35 Station Road

Project No.
20808

Co-ords: -

Hole Type
CP

Location: Reading

Level:

Scale
1:50

Client: Titan Property Developments Ltd

Dates: 28/11/2014 - 03/12/2014

Logged By
D.Hull

Back fill / Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								...very gravelly fine to coarse at 20.00m bgl.	
		21.00 21.00	D	N=28 (3,5/5,7,8,8)	21.00				21
		22.00	D						22
		22.50 22.50	D	50 (4,8/50 for 170mm)	22.50				
		23.00	D					...very gravelly fine to coarse between 23.00m bgl and 25.00m bgl with a high cobble content.	23
		24.00 24.00	D	N=40 (4,5/8,8,10,14)	24.00				24
		25.00	D						25
		25.50 25.50	D	N=27 (3,5/5,7,7,8)	25.50				26
		27.00 27.00	D	N=20 (2,3/4,4,6,6)	27.00				27
		28.00	D						28
		28.50 28.50	D	N=30 (3,5/5,7,8,10)	28.50				29
		30.00		50 (7,8/50 for 200mm)	30.00			Continued on next sheet	30

Remarks

Hole terminated at 36.90 due to refusal within cobbles of flint. Groundwater was encountered at a depth of 6.30m bgl and with a very slow ingress rose to 6.00m bgl. Chiselling was undertaken to advance the hole at 1.70 to 2.00m bgl, 2.20m bgl to 2.50m bgl, 22.60m bgl to 22.80m bgl, 28.80 to 29.90m bgl, 34.60m bgl to 34.80m bgl and 36.80m bgl to 36.90m bgl.

Borehole Log

Borehole No.

CP101

Sheet 4 of 4

Project Name: 29-35 Station Road

Project No.
20808

Co-ords: -

Hole Type
CP

Location: Reading

Level:

Scale
1:50

Client: Titan Property Developments Ltd

Dates: 28/11/2014 - 03/12/2014

Logged By
D.Hull

Back fill / Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		30.00	D					...chalk becomes slightly silty.	
		31.00	D						31
		31.50 31.50	D	N=48 (6,9/9,10,14,15)	31.50				32
		32.50	D					...very gravelly at 32.50m bgl.	
		33.00 33.00	D	N=34 (4,6/6,8,8,12)	33.00				33
		34.00	D		34.00				34
		34.50 34.50	D	50 (25 for 115mm/50 for 150mm)	34.50			Recovered as: structureless CHALK composed of white sandy GRAVEL with angular to subangular cobbles of flint. ((SEAFORD AND NEWHAVEN CHALK FORMATION)	35
		35.50	D						
		36.00 36.00	D	N=40 (5,7/7,8,10,15)	36.00				36
		36.80	D		36.80 36.90			Band of flint GRAVEL. Gravel of very angular to subrounded fine to coarse flint with high cobble content of flint. ((SEAFORD AND NEWHAVEN CHALK FORMATION) End of borehole at 36.90 m	37
									38
									39
									40

Remarks

Hole terminated at 36.90 due to refusal within cobbles of flint. Groundwater was encountered at a depth of 6.30m bgl and with a very slow ingress rose to 6.00m bgl. Chiselling was undertaken to advance the hole at 1.70 to 2.00m bgl, 2.20m bgl to 2.50m bgl, 22.60m bgl to 22.80m bgl, 28.80 to 29.90m bgl, 34.60m bgl to 34.80m bgl and 36.80m bgl to 36.90m bgl.

Borehole Log

Borehole No.

WS101

Sheet 1 of 1

Project Name: 29-35 Station Road

Project No.
20808

Co-ords: -

Hole Type
WS

Location: Reading

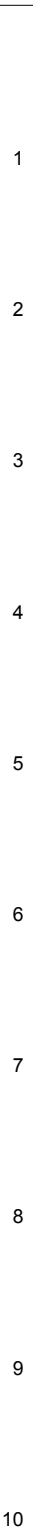
Level:

Scale
1:50

Client: Titan Property Developments Ltd

Dates: 28/11/2014 - 28/11/2014

Logged By
D.Hull

Back fill / Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.22			Concrete: Weak concrete unreinforced with a low gravel content. (MADE GROUND)	
		0.60	ES		0.52			Brown slightly clayey gravelly fine to coarse SAND. Gravel of sub-angular to sub-rounded fine to coarse flint. (MADE GROUND)	
		0.80	ES					Light brown slightly gravelly clayey fine to coarse SAND with frequent bands of sandy CLAY. Gravel of sub-angular fine to medium flint with rare coarse flint. (MADE GROUND)	
		1.50	ES					...chalk fragments encountered from 1.80m bgl.	
		2.30	ES		2.30			Dark brown very clayey fine to medium SAND with rare black staining and black organic matter.	
					2.50			White CHALK gravel fill with frequent brown staining. (MADE GROUND)	
		3.40	ES					Soft to firm dark brown very sandy CLAY with rare chalk fragments. Sand is fine to medium. (MADE GROUND)	
								...Layer of red brick fill.	
								...sand content decreases.	
		4.50	ES		4.50			...Poor recovery.	
					5.00			Recovered as: structureless CHALK composed of white slightly gravelly SILT. (SEAFORD AND NEWHAVEN CHALK FORMATION)	5
								End of borehole at 5.00 m	

Remarks

No groundwater was encountered.

Borehole Log

Borehole No.

WS102

Sheet 1 of 1

Project Name: 29-35 Station Road

Project No.
20808

Co-ords: -

Hole Type
WS

Location: Reading

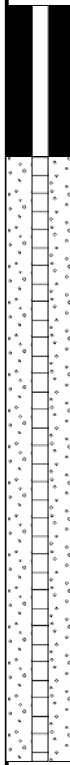
Level:

Scale
1:50

Client: Titan Property Developments Ltd

Dates: 28/11/2014 - 28/11/2014

Logged By
D.Hull

Back fill / Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.19			Concrete: Weak unreinforced concrete with low gravel content. (MADE GROUND)	
		0.50	ES		0.50			Brown slightly clayey gravelly fine to coarse SAND. Gravel of sub-angular to sub-rounded fine to coarse flint. (MADE GROUND)	
		0.90	ES		1.10			Brown to light brown slightly clayey gravelly fine to coarse SAND. Gravel of sub-angular to subrounded fine to coarse flint with rare cobbles of flint. (MADE GROUND)	1
		1.50	D					Soft light brown slightly sandy very gravelly CLAY. Sand is fine to medium. Gravel of very angular to subrounded fine to coarse flint with rare cobbles of flint. (MADE GROUND)	
		1.80	ES					...Bands of chalk fragments.	2
		2.40	ES		2.20 2.30 2.35			Soft to firm dark brown slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel of sub-angular to rounded fine to medium red brick fragments. (MADE GROUND)	
								White CHALK gravel fill. (MADE GROUND)	3
								Soft to firm dark brown to brown slightly sandy slightly gravelly CLAY with frequent chalk fragments and rare black organic matter. (MADE GROUND)	
								...Gravels become of flint below 3.20m bgl, content of red brick fragments decreases.	4
								...Clay becomes very soft.	
		4.70	ES		4.60			Recovered as: structureless CHALK composed of white slightly gravelly SILT with occasional sub-angular medium to coarse flint. (SEAFORD AND NEWHAVEN CHALK FORMATION)	5
					5.00			End of borehole at 5.00 m	

Remarks

No groundwater was encountered.

Borehole Log

Borehole No.

WS103a

Sheet 1 of 1

Project Name: 29-35 Station Road

Project No.
20808

Co-ords: -

Hole Type
WS

Location: Reading

Level:

Scale
1:50

Client: Titan Property Developments Ltd

Dates: 28/11/2014 - 28/11/2014

Logged By
D.Hull

Back fill / Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.40	ES		0.06			Tarmac. (MADE GROUND)	1
					0.40			Brown slightly clayey gravelly fine to coarse SAND. Gravel of angular to sub-rounded fine to coarse flint. (MADE GROUND)	
					1.00			Dark brown to black very sandy GRAVEL. Sand is fine to coarse. Gravel of angular to sub-rounded fine to coarse flint with a low cobble content of sub-angular flint. (MADE GROUND)	
								End of borehole at 1.00 m	
									2
									3
									4
									5
									6
									7
									8
									9
									10

Remarks

Hole collapsed at 1.00m bgl. No groundwater was encountered.

Borehole Log

Borehole No.

WS103b

Sheet 1 of 1

Project Name: 29-35 Station Road

Project No.
20808

Co-ords: -

Hole Type
WS

Location: Reading

Level:

Scale
1:50

Client: Titan Property Developments Ltd

Dates: 28/11/2014 - 28/11/2014

Logged By
D.Hull

Back fill / Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.06			Tarmac. (MADE GROUND)	
		0.40	ES		0.35			Brown slightly clayey gravelly SAND. Sand is fine to coarse. Gravel of sub-angular to sub-rounded fine to coarse flint. (MADE GROUND)	
		0.70	ES		0.90			Dark brown to black sandy GRAVEL. Sand is fine to medium. Gravel of very angular to sub-rounded medium to coarse flint with a medium cobble content of subangular flint. (MADE GROUND)	1
		1.10	ES		1.30			Light brown slightly gravelly very clayey SAND. Sand is fine to medium. Gravel of angular to sub-rounded fine to coarse flint and wood. (MADE GROUND)	2
		1.60	ES		2.40			Soft dark brown slightly gravelly very sandy CLAY. Sand is fine to medium. Gravel of angular to rounded fine to coarse flint and red brick fragments with rare black organic matter. (MADE GROUND)	3
		2.40	ES		3.50			Soft brown slightly gravelly very sandy CLAY. Sand is fine to medium. Gravel of sub-angular to sub-rounded fine to medium flint with rare chalk fragments. (MADE GROUND)	4
		3.40	ES		3.70			Brown slightly silty slightly gravelly SAND. Sand is fine to medium. Gravel of sub-angular to rounded fine to medium flint. (MADE GROUND)	5
		3.70	ES		3.75			White CHALK gravel fill (MADE GROUND)	6
					4.80			Brown slightly clayey gravelly SAND. Sand is fine to medium. Gravel of angular to sub-rounded fine to medium flint. (TAPLOW GRAVELS)	7
					5.00			Recovered as: structureless CHALK composed of white silty GRAVEL with occasional sub-angular gravel of flint. (SEAFORD AND NEWHAVEN CHALK FORMATION)	8
								End of borehole at 5.00 m	9
									10

Remarks

No groundwater was encountered.

Borehole Log

Borehole No.

WS104

Sheet 1 of 1

Project Name: 29-35 Station Road

Project No.
20808

Co-ords: -

Hole Type
WS

Location: Reading

Level:

Scale
1:50

Client: Titan Property Developments Ltd

Dates: 28/11/2014 - 28/11/2014

Logged By
D.Hull

Back fill / Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30	ES		0.12 0.15 0.40 0.40			Red brick paving. (MADE GROUND) Yellow fine to medium SAND. (MADE GROUND) Brown slightly clayey gravelly SAND. Sand is fine to coarse. Gravel of sub-angular to subrounded fine to coarse flint. (MADE GROUND) Concrete slab. (MADE GROUND) End of borehole at 0.40 m	1
									2
									3
									4
									5
									6
									7
									8
									9
									10

Remarks

No groundwater was encountered. Flat concrete slab at 0.40m bgl.

APPENDIX VII
CHEMICAL TESTING



Scientific Analysis Laboratories Ltd

Certificate of Analysis

3 Crittall Drive
Springwood Industrial
Estate
Braintree
Essex
CM7 2RT
Tel : 01376 560120
Fax : 01376 552923

Scientific Analysis Laboratories is a
limited company registered in England and
Wales (No 2514788) whose address is at
Hadfield House, Hadfield Street, Manchester M16 9FE

Report Number: 442277-1

Date of Report: 15-Dec-2014

Customer: Resource Environmental Consultants Ltd
Environment House
Segensworth Business Centre
Segensworth Road (West)
Fareham
PO15 5RQ

Customer Contact: Mr Will Spraggs

Customer Job Reference: 20808

Customer Purchase Order: 20808/14/SO268/DH

Customer Site Reference: Garrard House and Station Road

Date Job Received at SAL: 09-Dec-2014

Date Analysis Started: 10-Dec-2014

Date Analysis Completed: 15-Dec-2014

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with QP22



1650

Report checked
and authorised by :
Miss Claire Brown
Customer Service Manager

Issued by :
Miss Claire Brown
Customer Service Manager

SAL Reference: 442277 Project Site: Garrard House and Station Road Customer Reference: 20808 Bulk Product Analysed as Bulk Product BRE SD1 (SE)								
SAL Reference				442277 006	442277 007	442277 008	442277 009	
Customer Sample Reference				BH101 D11 @ 10.00m	BH101 D25 @ 20.00m	BH101 D37 @ 30.00m	BH101 D44 @ 35.50m	
Date Sampled				28-NOV-2014	02-DEC-2014	02-DEC-2014	03-DEC-2014	
Determinand	Method	Test Sample	LOD	Units				
(Water soluble) Ammonia expressed as NH4	T306	AR	0.01	g/l	<0.01	<0.01	<0.01	<0.01
(Water soluble) Cl-	T426	A40	0.01	g/l	(64) 0.01	(64) <0.01	(64) <0.01	(64) <0.01
Magnesium	T112	A40	1.0	mg/l	1.1	1.0	1.0	1.1
(Water soluble) NO3	T426	A40	0.01	g/l	(64) <0.01	(64) <0.01	(64) <0.01	(64) <0.01
pH	T7	A40			9.1	9.2	9.3	9.2
SO4(Total)	T102	A40	0.01	%	0.04	0.04	0.03	0.04
(Water Soluble) SO4(2:1) expressed as SO4	T242	A40	0.01	g/l	0.03	0.02	0.02	0.02
Sulphur (total)	T6	A40	0.01	%	0.01	0.01	0.01	0.01

SAL Reference: 442277 Project Site: Garrard House and Station Road Customer Reference: 20808 Soil Analysed as Soil REC002 (SE)									
SAL Reference				442277 001	442277 002	442277 003	442277 004	442277 005	
Customer Sample Reference				WS101ES1 @ 0.30-0.40m	WS102 ES2 @ 0.50-0.60m	WS102 ES5 @ 2.40-2.50m	WS103B ES1 @ 0.70-0.80m	WS104 ES1 @ 0.30-0.40m	
Date Sampled				28-NOV-2014	28-NOV-2014	28-NOV-2014	28-NOV-2014	28-NOV-2014	
Determinand	Method	Test Sample	LOD	Units					
Arsenic	T257	A40	2.0	mg/kg	21	25	52	21	14
Cadmium	T257	A40	0.1	mg/kg	0.3	0.2	0.2	0.2	0.3
Chromium	T257	A40	0.5	mg/kg	16	20	16	15	62
Copper	T257	A40	2	mg/kg	42	40	2000	120	57
Lead	T257	A40	2	mg/kg	350	320	5900	320	75
Mercury	T245	A40	1.0	mg/kg	<1.0	<1.0	<1.0	1.7	<1.0
Nickel	T257	A40	0.5	mg/kg	19	19	34	23	33
Selenium	T257	A40	3	mg/kg	<3	<3	<3	<3	<3
Zinc	T257	A40	2	mg/kg	120	120	160	80	120
Asbestos ID	T27	A40			-	Asbestos not detected	Asbestos not detected	Asbestos not detected	Asbestos not detected
Chromium VI	T82	A40	1	mg/kg	<1	<1	<1	<1	<1
pH	T7	A40			8.3	8.5	7.9	8.3	9.7
SO4(Total)	T102	A40	0.01	%	0.09	0.10	0.05	0.06	0.14
(Water Soluble) SO4-- expressed as SO4	T242	A40	0.01	g/l	0.14	0.16	0.03	0.05	0.07
Cyanide(Total)	T4	AR	1	mg/kg	<1	<1	<1	<1	<1
Phenols(Mono)	T221	AR	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0

SAL Reference: 442277 Project Site: Garrard House and Station Road Customer Reference: 20808								
Soil Suite C								
Analysed as Soil								
SAL Reference					442277 002	442277 003	442277 004	442277 005
Customer Sample Reference					WS102 ES2 @ 0.50-0.60m	WS102 ES5 @ 2.40-2.50m	WS103B ES1 @ 0.70-0.80m	WS104 ES1 @ 0.30-0.40m
Date Sampled					28-NOV-2014	28-NOV-2014	28-NOV-2014	28-NOV-2014
Determinand	Method	Test Sample	LOD	Units				
TPH (C5-C6)	T54	AR	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10
TPH (C6-C8)	T54	AR	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10
TPH (C8-C10)	T54	AR	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10
TPH (C10-C12)	T219	AR	2	mg/kg	<2	<2	<2	<2
TPH (C12-C16)	T219	AR	2	mg/kg	<2	<2	<2	<2
TPH (C16-C21)	T219	AR	2	mg/kg	<2	<2	<2	<2
TPH (C21-C35)	T219	AR	2	mg/kg	<2	<2	<2	<2

SAL Reference: 442277 Project Site: Garrard House and Station Road Customer Reference: 20808									
Soil Total and Speciated USEPA16 PAH (SE)									
Analysed as Soil									
SAL Reference					442277 001	442277 002	442277 003	442277 004	442277 005
Customer Sample Reference					WS101ES1 @ 0.30-0.40m	WS102 ES2 @ 0.50-0.60m	WS102 ES5 @ 2.40-2.50m	WS103B ES1 @ 0.70-0.80m	WS104 ES1 @ 0.30-0.40m
Date Sampled					28-NOV-2014	28-NOV-2014	28-NOV-2014	28-NOV-2014	28-NOV-2014
Determinand	Method	Test Sample	LOD	Units					
Naphthalene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	T16	AR	0.1	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	T16	AR	0.1	mg/kg	0.4	0.1	<0.1	<0.1	0.1
Pyrene	T16	AR	0.1	mg/kg	0.3	0.1	<0.1	<0.1	0.1
Benzo(a)Anthracene	T16	AR	0.1	mg/kg	0.3	<0.1	<0.1	<0.1	<0.1
Chrysene	T16	AR	0.1	mg/kg	0.3	0.1	<0.1	<0.1	<0.1
Benzo(b/k)Fluoranthene	T16	AR	0.1	mg/kg	0.3	0.1	<0.1	<0.1	<0.1
Benzo(a)Pyrene	T16	AR	0.1	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Indeno(123-cd)Pyrene	T16	AR	0.1	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(ah)Anthracene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	T16	AR	0.1	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
PAH(total)	T16	AR	0.1	mg/kg	2.0	0.4	<0.1	<0.1	0.2

Index to symbols used in 442277-1

Value	Description
AR	As Received
A40	Assisted dried < 40C
64	Analysis was performed by an alternative technique
S	Analysis was subcontracted
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Method Index

Value	Description
T242	2:1 Extraction/ICP/OES (TRL 447 T1)
T7	Probe
T245	ICP/OES(Aqua Regia Extraction)
T4	Colorimetry
T221	Colorimetry (CE)
T102	ICP/OES (HCl extract)

T6	ICP/OES
T16	GC/MS
T82	ICP/OES (Sim)
T426	2:1 Extraction / IC
T54	GC/MS (Headspace)
T219	GC/FID (SE)
T257	ICP/OES (SIM) (Aqua Regia Extraction)
T27	PLM
T112	ICP/OES (SIM)(Water Extract)
T306	2:1 Extraction / Colorimetry

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
(Water soluble) Ammonia expressed as NH4	T306	AR	0.01	g/l	N	006-009
(Water soluble) Cl-	T426	A40	0.01	g/l	N	006-009
Magnesium	T112	A40	1.0	mg/l	N	006-009
(Water soluble) NO3	T426	A40	0.01	g/l	N	006-009
pH	T7	A40			N	006-009
SO4(Total)	T102	A40	0.01	%	N	006-009
(Water Soluble) SO4(2:1) expressed as SO4	T242	A40	0.01	g/l	N	006-009
Sulphur (total)	T6	A40	0.01	%	N	006-009
Arsenic	T257	A40	2.0	mg/kg	U	001-005
Cadmium	T257	A40	0.1	mg/kg	U	001-005
Chromium	T257	A40	0.5	mg/kg	U	001-005
Copper	T257	A40	2	mg/kg	U	001-005
Lead	T257	A40	2	mg/kg	U	001-005
Mercury	T245	A40	1.0	mg/kg	U	001-005
Nickel	T257	A40	0.5	mg/kg	U	001-005
Selenium	T257	A40	3	mg/kg	U	001-005
Zinc	T257	A40	2	mg/kg	U	001-005
Asbestos ID	T27	A40			SU	002-005
Chromium VI	T82	A40	1	mg/kg	N	001-005
pH	T7	A40			U	001-005
SO4(Total)	T102	A40	0.01	%	U	001-005
(Water Soluble) SO4-- expressed as SO4	T242	A40	0.01	g/l	U	001-005
Cyanide(Total)	T4	AR	1	mg/kg	U	001-005
Phenols(Mono)	T221	AR	1.0	mg/kg	U	001-005
TPH (C5-C6)	T54	AR	0.10	mg/kg	N	002-005
TPH (C6-C8)	T54	AR	0.10	mg/kg	N	002-005
TPH (C8-C10)	T54	AR	0.10	mg/kg	N	002-005
TPH (C10-C12)	T219	AR	2	mg/kg	U	002-005
TPH (C12-C16)	T219	AR	2	mg/kg	U	002-005
TPH (C16-C21)	T219	AR	2	mg/kg	U	002-005
TPH (C21-C35)	T219	AR	2	mg/kg	U	002-005
Naphthalene	T16	AR	0.1	mg/kg	U	001-005
Acenaphthylene	T16	AR	0.1	mg/kg	U	001-005
Acenaphthene	T16	AR	0.1	mg/kg	U	001-005
Fluorene	T16	AR	0.1	mg/kg	U	001-005
Phenanthrene	T16	AR	0.1	mg/kg	U	001-005
Anthracene	T16	AR	0.1	mg/kg	U	001-005
Fluoranthene	T16	AR	0.1	mg/kg	N	001-005
Pyrene	T16	AR	0.1	mg/kg	N	001-005
Benzo(a)Anthracene	T16	AR	0.1	mg/kg	U	001-005
Chrysene	T16	AR	0.1	mg/kg	U	001-005
Benzo(b/k)Fluoranthene	T16	AR	0.1	mg/kg	U	001-005
Benzo(a)Pyrene	T16	AR	0.1	mg/kg	U	001-005
Indeno(123-cd)Pyrene	T16	AR	0.1	mg/kg	U	001-005
Dibenzo(ah)Anthracene	T16	AR	0.1	mg/kg	U	001-005
Benzo(ghi)Perylene	T16	AR	0.1	mg/kg	U	001-005
PAH(total)	T16	AR	0.1	mg/kg	U	001-005

APPENDIX VIII
ORIGIN OF TIER I VALUES

ORIGIN OF REC TIER I VALUES

Constituent	Origin of Risk Assessment Value
Arsenic	2009 SGV
Cadmium	LQM CIEH 2 nd Edition 2009
Chromium	LQM CIEH 2 nd Edition 2009
Lead	Residential Half 2003 EA SGV based on planned target blood lead level reduction to 5µg/l.
	Commercial Calculated using commercial exposure equation within lead SGV 2003 with revised input data from HPA and taking proposed blood lead levels into account.
Mercury	2009 SGV
Nickel	2009 SGV
Selenium	Soil guideline value, DEFRA/Environment Agency
Copper	LQM CIEH 2 nd Edition 2009
Zinc	LQM CIEH 2 nd Edition 2009
Cyanide - Total	CLEA 1.06 Derived Value
Phenols - Total.	LQM CIEH 2 nd Edition 2009 – 1% SOM
Naphthalene	General Assessment Criteria (GAC) developed by CIEH / LQM the using CLEA 1-06 with supporting data from SR3, SR7 and existing Tox report where applicable. 1% SOM
Acenaphthylene	
Acenaphthene	
Fluorene	
Phenanthrene	
Anthracene	
Fluoranthene	
Pyrene	
Benzo(a)Anthracene ⁽ⁱ⁾	
Chrysene	
Benzo(b/k)Fluoranthene ⁽ⁱⁱⁱ⁾	
Benzo(a)Pyrene	
Indeno(123-cd)Pyrene	
Dibenzo(a,h)Anthracene	
Benzo(ghi)Perylene	
TPH C ₅ -C ₆ (aliphatic)	
TPH C ₆ -C ₈ (aliphatic)	
TPH C ₈ -C ₁₀ (aliphatic)	
TPH C ₁₀ -C ₁₂ (aliphatic)	
TPH C ₁₂ -C ₁₆ (aromatic)	
TPH C ₁₆ -C ₂₁ (aromatic)	
TPH C ₂₁ -C ₃₅ (aromatic)	

APPENDIX IX
GEOTECHNICAL TESTING



LABORATORY REPORT



4043

Contract Number: PSL14/6486

Client's Reference:

Report Date: 07 January 2015

Client Name: REC Fareham
Environment House
Segensworth Business Centre
Segensworth Road West
Fareham
PO15 5RQ

For the attention of: Will Spraggs

Contract Title: Garrard House and 29 -31 Station Road, Reading

Date Received: 10/12/2014

Date Commenced: 10/12/2014

Date Completed: 7/1/2015

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson
(Director)

A Watkins
(Director)

M Beastall
(Laboratory Manager)

D Lambe
(Senior Technician)

S Royle
(Senior Technician)

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Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

Professional Soils Laboratory

Compiled by	Date	Checked by	Date	Approved by	Date
	23/12/14		07/01/15		07/01/15
GARRARD HOUSE AND 29-31 STATION ROAD, READING.				Contract No:	PSL14/6486
				Client Ref:	20808

Particle Size Distribution Test

BS1377 : Part 2 : 1990

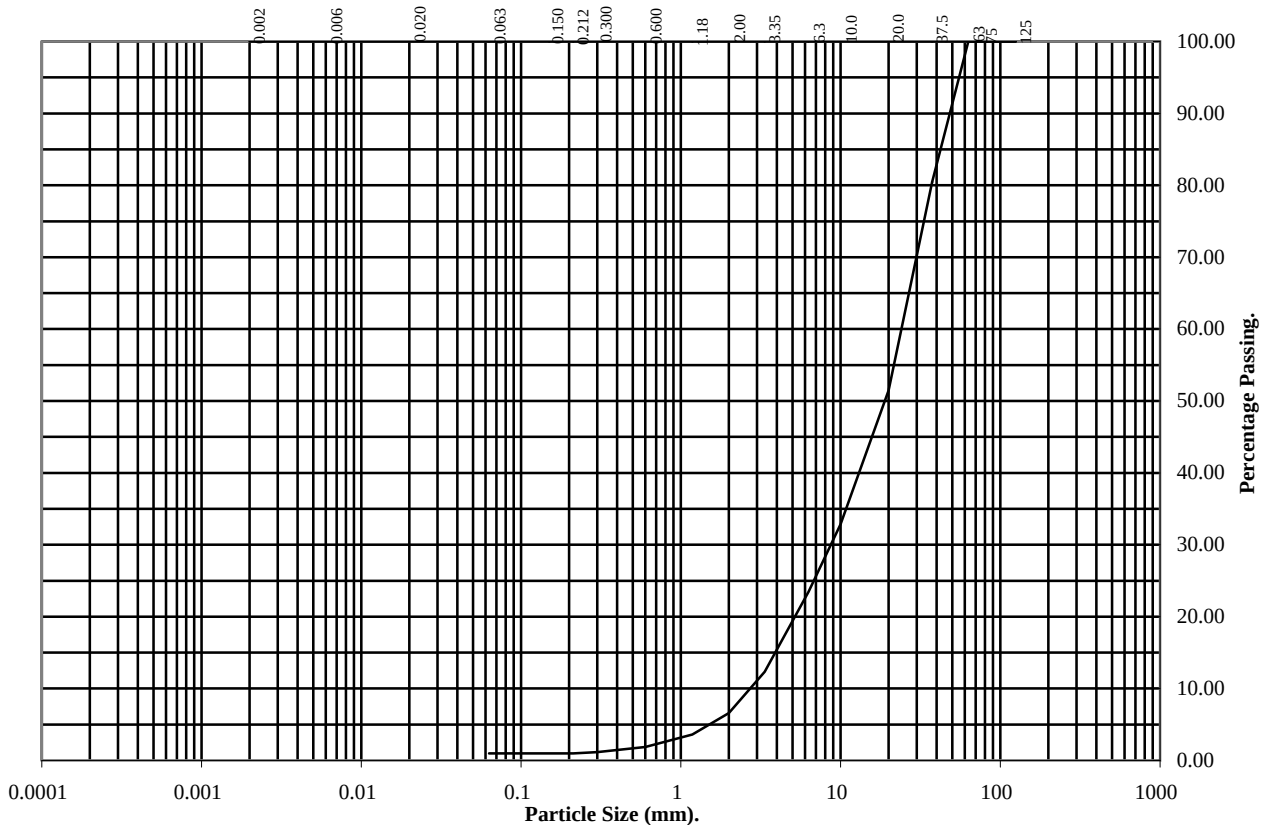
Wet Sieve, Clause 9.2

Hole Number: BH101

Depth (m): 2.00

Sample Number:

Sample Type: B



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	80
20	51
10	33
6.3	23
3.35	12
2	7
1.18	4
0.6	2
0.3	1
0.212	1
0.15	1
0.063	1

Soil Fraction	Total Percentage
Cobbles	0
Gravel	93
Sand	6
Silt / Clay	1

Remarks:
See summary of soil descriptions.

Checked By	Date	Approved By	Date
<i>H. S.</i>	07/01/15	<i>H. S.</i>	07/01/15

PSL

Professional Soils Laboratory

TEST AMENDMENT NOTICE

(Please tick boxes as appropriate)

From: *Natasha Edwards*To: *W. Spraggs*Date: *23 / 12 / 2014*Laboratory Ref: *PSL/4/6486*

Contract Number:

Location: *Garrard House and 29-31
Station Road, Reading*☒ BH ☐ TP Sample NumberDepth (m): *15.00*Sample Type: ☐ U ☐ B☒ D ☐ W ☐ P ☐ C

Test/s:

Saturated Moisture Content

The above sample cannot be tested for the following reasons:

- ☐ The Sample has not been received
- ☐ There is insufficient material for BS1377:1990 testing
 - Maximum Grain Size (Minimum 10%): ☐ Fine ☐ Medium ☐ Coarse
 - Sample Mass (kg):
 - Required Mass (kg):
- ☐ The Sample has been previously tested.
- ☐ The Sample has been misplaced in the Laboratory
- ☒ The Sample is unsuitable for testing because:

No intact pieces of chalk present

Please advise action required:

- ☐ Perform original test on the following alternative Sample:
 - ☐ BH ☐ TP Sample Number: Depth (m)
 - Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C
- ☐ Combine original Sample with the following Sample:
 - ☐ BH ☐ TP Sample Number: Depth (m)
 - Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C
- ☐ Perform the following alternative test/s on the original Sample:
- ☐ Perform non-standard test on material available
(Written Confirmation is required from the Client).
- ☐ Take no further action.

Signed

Date

(Project Engineer)

PSL

Professional Soils Laboratory

TEST AMENDMENT NOTICE

(Please tick boxes as appropriate)

From: Natasha EdwardsTo: W. SpraggsDate: 23/ 12 /2014Laboratory Ref: psu41 6486Contract Number: 20808Location: Garrard House and 29-31
Station Road, Reading☒ BH ☐ TP Sample NumberDepth (m): 7.50Sample Type: ☐ U ☐ B☒ D ☐ W ☐ P ☐ C

Test/s:

Saturated Moisture Content

The above sample cannot be tested for the following reasons:

- ☐ The Sample has not been received
- ☐ There is insufficient material for BS1377:1990 testing
 - Maximum Grain Size (Minimum 10%): ☐ Fine ☐ Medium ☐ Coarse
 - Sample Mass (kg):
 - Required Mass (kg):
- ☐ The Sample has been previously tested. _____
- ☐ The Sample has been misplaced in the Laboratory
- ☒ The Sample is unsuitable for testing because:

No intact pieces of Chalk present

Please advise action required:

- ☐ Perform original test on the following alternative Sample:
 - ☐ BH ☐ TP Sample Number: _____ Depth (m)
 - Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C
- ☐ Combine original Sample with the following Sample:
 - ☐ BH ☐ TP Sample Number: _____ Depth (m)
 - Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C
- ☐ Perform the following alternative test/s on the original Sample:
- ☐ Perform non-standard test on material available
(Written Confirmation is required from the Client).
- ☐ Take no further action.

Signed

Date

_____(Project Engineer)_____

PSL

Professional Soils Laboratory

TEST AMENDMENT NOTICE

(Please tick boxes as appropriate)

From: *Natasha Edwards*To: *W. Spraggs*Date: *23 / 12 / 2014*Laboratory Ref: *B3114/6486*

Contract Number:

Location: *Garard House and 29-31
Station Road, Reading*☒ BH ☐ TP Sample NumberDepth (m): *24.00*Sample Type: ☐ U ☐ B☒ D ☐ W ☐ P ☐ C

Test/s:

Saturated Moisture Content

The above sample cannot be tested for the following reasons:

- ☐ The Sample has not been received
- ☐ There is insufficient material for BS1377:1990 testing
 - Maximum Grain Size (Minimum 10%): ☐ Fine ☐ Medium ☐ Coarse
 - Sample Mass (kg):
 - Required Mass (kg):
- ☐ The Sample has been previously tested.
- ☐ The Sample has been misplaced in the Laboratory
- ☒ The Sample is unsuitable for testing because:

No intact pieces of chalk present.

Please advise action required:

- ☐ Perform original test on the following alternative Sample:
 - ☐ BH ☐ TP Sample Number: Depth (m)
 - Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C
- ☐ Combine original Sample with the following Sample:
 - ☐ BH ☐ TP Sample Number: Depth (m)
 - Sample Type: ☐ U ☐ B ☐ D ☐ W ☐ P ☐ C
- ☐ Perform the following alternative test/s on the original Sample:
- ☐ Perform non-standard test on material available
(Written Confirmation is required from the Client).
- ☐ Take no further action.

Signed

Date

(Project Engineer)