CAPITA SYMONDS

Extension to A Block, Site Central

Basement Assessment
12 December 2012

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Quality Management

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Contents

Figures

Appendices

1. Introduction

This report has been prepared to supplement the Planning Application for the Extension of Block A, Site Central, London. It will provide information in respect of the construction of the basement, particularly in relation to the following points

- The impact of the proposals on surface flow and flooding
- The impact of the proposals on ground water flow
- The impact of the proposals on structural stability

It will consider the findings of the ground investigation report in terms of hydrology and the potential to cause localised flooding, together with an assessment of the impact of the basement on the ground conditions in terms of water movement, drainage implications, together with the impact of the construction on adjacent buildings.

The report has been prepared by Andrew Birtles BSc CEng FIStructE MRICS, Senior Associate Director (Structural Engineering) for Capita Symonds with assistance from Dr David Clinton MA MSC SIC PhD CEng MICE Associate Director (Geotechnical and Geo-Environmental Engineering) for Capita Symonds.

2. Proposals

It is proposed to construct a two storey extension to Block A on Site Central of an approximate size of 11m x 22m, located at the north east corner of the existing Block A. The extension will abut a previous extension to the same block and be positioned approximately 1.5m away from the eastern wall of the original building. Reference should be made to the relevant plans submitted with the Planning Application for the setting out of the extension.

In order to accommodate the mechanical plant to support the facilities, it has been necessary to form a basement of an approximate size of 5.5m x 10m below the north east corner of this extension. The basement will be of single storey depth, approximately 3m below the existing ground levels, and a minimum of 5m away from any adjacent buildings on the site.

Being positioned towards the centre of the site, all of the adjacent buildings are the property of MoD and so the proposed basement is a considerable distance away from any privately owned property. It should be noted that some of the other buildings on the site have basements, for example the one located to the north of Block A.

The extension is of steel framed construction with composite decking and concrete floors and roof, with a timber cut roof overlaying the concrete roof deck in order to achieve a similar appearance to the existing buildings. As a result of the ground conditions encountered during the ground investigation report, the foundations to the extension, including the basement, will be constructed on a series of piles and ground beams. The basement itself will be constructed with reinforced concrete walls and floor.

It should be noted that the proposed location for extension is currently an area of tarmac used for parking, site access and general hardstandings. The whole area is of impermeable construction, with surface water discharging from the area into the site drainage system.

3. Ground Investigation

A Desk Study and an Intrusive Ground Investigation including an Interpretive Report was undertaken in the proposed development area in October 2012. The physical investigation included the drilling of four window sample boreholes to a depth of between four and five metres at locations evenly distributed across the site. Samples were taken from each hole to determine the conditions of the strata together with the chemical testing for contaminants.

In summary, the investigation found that:

- Beneath the tarmac surfacing, there was a depth of made ground varying in thickness between 2.1m and 3.2m. As a result of this, piled foundations were recommended.
- No ground water strikes were encountered within any of the exploratory holes during the investigation , although the made ground was noted to be wet at depths of between 1.6m and 2.7m in the boreholes. During the gas monitoring works undertaken in November 2012, a measured ground water level was recorded at 1.82m
- None of the tested potential contaminants were revealed to be in excess of the commercial end use GAC's (Generic Assessment Criteria) and none of the contaminants are of concern
- There were no visual or olfactory signs of contamination noted during the site work.
- No asbestos was detected
- Given the potential for the presence of organic soil in one of the strata, it was recommended that unless gas monitoring proves otherwise, a gas membrane should be installed as part of the construction

The desk study further identified that:

- Collapsible ground and landslide ground stability are classed as a 'very low hazard'
- It identified a 'negligible' hazard in relation to compressible ground and running sand
- The Environment Agency maps shows the site is not in or near to a source protection zone nor are there any groundwater or potable water abstractions within a 500m radius of the site.
- The site is not at risk of flooding

4. Discussion

A full ground investigation and desk study has been undertaken for the proposed development, and on the basis of the information within the report, the construction is considered to present a low risk to other buildings on the site. As any privately owned buildings are even further away, the risk to these arising from the proposed works is considered minimal.

The ground investigation report, summarising the works undertaken together with conclusions is attached in Appendix A. (Please note this does not include the Appendices or the results of the Desk Study – these can be made available upon request). The logs of the window sample boreholes, showing the ground encountered during the investigations are attached in Appendix B. Appendix C is a statement by David Clinton, MA MSc DIC,PhD MICE (Associate Director for Geotechnical and Geo-Environmental Engineering for Capita Symonds), confirming that the proposals will not have an adverse effect on adjacent or neighbouring buildings.

On the basis of these documents, the following observations have been made

Impact of proposals on surface flow and flooding:

The desk study has confirmed that the development is not on a site at risk of flooding.

The proposed construction is located on an area of tarmac currently used for on-site parking, site access roads and general hardstanding areas. These areas are currently drained into the surface water drainage system for the site. There will therefore be no increased rainwater run-off arising from this development, so there will be no increased risk to properties downstream of this site.

Since the rainwater from the roof of the building will connect directly into the surface water drainage system for the site, the surface flow of water on the ground will be reduced, thus improving the current situation.

Impact of proposals on ground water flow:

The ground investigation has indicated that the natural ground (beneath the fill material encountered locally to this development) is a cohesive material, so there is no water flow to consider. Furthermore, none of the boreholes indicated any ground water flow down to a depth of between 4 and 6m.

It is therefore concluded that the development will have no impact on ground water flows.

Impact of the proposals on structural stability:

The basement has been located as far away from the existing buildings as possible for the very reason of ensuring the adjacent buildings are not affected by the works. The basement will be less than 3m in depth, and is located at least 4m from any adjacent building, which will ensure that the works, even during the construction stage, do not undermine the foundations to any of the buildings. It has been ensured that the basement has been positioned outside of the 45 degree load dispersion line from the existing foundations, and so will not interrupt the load path

from the existing foundations. This has currently been based on reasoned assumptions (based on previous knowledge of the site).

At the commencement of development, the foundations to the nearest building, Block A, will be exposed so that the temporary works can be based on accurate, rather than the assumed information.

The neighbouring properties (i.e. those outside of the site) are a considerable distance away from the proposed development and so will not be affected by the works.

It is therefore concluded that the proposed development will not have any adverse effects on the adjacent properties. The neighbouring properties outside the site will not be affected by these proposals.

The technical information considered during this review is summarised as follows:

Desktop Study of existing geology and hydrological conditions

This has been completed and concludes that:

- Collapsible ground and landslide ground stability are classed as a ‘very low hazard’
- There is a ‘negligible’ hazard in relation to compressible ground and running sand
- The Environment Agency maps shows the site is not in or near to a source protection zone nor are there any groundwater or potable water abstractions within a 500m radius of the site.
- The site is not at risk of flooding
- There are no potential sources of contamination from previous site uses

Detailed Engineering study to assess the ground conditions

A geotechnical investigation has been undertaken and a report prepared by a qualified geologist. This has been reviewed by Andrew Birtles, Chartered Structural Engineer, and David Clinton Chartered Civil Engineer and Geotechnical Engineer. On the basis of the information established during the investigations, it is concluded that there is no water movement across the site, and since the natural ground in cohesive in nature, will not be subject to moisture loss resulting in subsidence. The development will therefore have no impact on adjacent properties owned by the MoD, nor on the more distant properties owned by the neighbours of the site.

It should also be noted that other properties on the site also have basement constructions, none of which appear to have adversely affected adjacent buildings.

Appendix C includes a statement by David Clinton, Geotechnical Engineer, in relation to this point.

Construction Methods

The proposed basement has been positioned such that it can be constructed without any adverse effect on the existing buildings. The design has been developed to ensure that it does

not undermine the existing foundations to any of the buildings, and the ground has been assessed as being reasonably stable to suit the temporary condition where the ground is battered back to form the basement. Notwithstanding this, all temporary works will be designed by a chartered engineer with the appropriate experience. Furthermore, the design is such that no additional surface water will discharge into the surface water system when the development is completed – the proposed building replaces an area of fully drained and impermeable hardstanding.

The ground investigation identifies that there will be potential for minor water ingress into the basement excavations during the construction process. This will be dealt with in the usual manner, with the appropriate discharge consents being obtained by the contractor prior to commencement of the works.

A below ground services survey has been completed to identify all the services in the area – those which are to remain will be properly supported during the construction works.

Reference should also be made to Appendix C in relation to construction methods.

Monitoring ground conditions, water movement, subsidence and drainage

The conclusions arising from the investigations completed are that the proposals pose a low risk hazard to the adjacent properties. The basement has been located as far as practically possible from any existing buildings, and the adjacent buildings do not show any evidence of subsidence. The ground investigation did not identify any water movements, and there is no increased run off arising from this development which will adversely affect the drainage systems both on site and offsite. Furthermore, neighbouring (off site) buildings are located a significant distance away from the proposed works and so will be unaffected.

On the basis of the above it will not be necessary to monitor the local ground conditions to any significant degree. However, it is proposed that Chartered Engineers will design any required temporary works as well as inspect the works as they progress on site to ensure adverse conditions do not arise. As with all projects of this nature, a dilapidation survey will be undertaken of adjacent buildings prior to starting work (so that their current conditions can be recorded) and their condition monitored during the construction works.

5. Conclusions

On the basis of the investigations completed and the design and location of the basement, it is concluded that the proposed works will have little impact on adjacent buildings, neighbouring (off site) buildings and surface and ground water flows.

Appendix A Ground Investigation Report (excluding appendices)

Capita Symonds

Regents Park Barracks
Desk Study and Interpretative Site Investigation Report

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Regents Park Barracks
Desk Study and Interpretative Site Investigation Report

CONTENTS PAGE

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1.0 INTRODUCTION

1.1 T&P Regeneration (T&P) was appointed by Capita Symonds and Interserve Construction Ltd to carry out a ground investigation at the site of a proposed development within Regents Park Barracks (the site). The development will comprise an extension to the north eastern corner of an existing building designated as 'Block A' and will provide additional offices and conference rooms.

1.2 A Phase 1 desk study was carried out, followed by a Phase 2 intrusive ground investigation. The objective of the desk study was to research existing information on the site that could affect the ground conditions, considering both geotechnical and contamination issues relevant to the proposed development.

1.3 Factual information for the desk study was obtained from the following sources:

- GroundSure Environmental Insight Report commissioned by T&P;
- Environment Agency website
- Site reconnaissance survey
- Internet based aerial photography
- British Geological Survey (BGS) Map at 1:50 000 scale Sheet 256 – North London
- British Geological Survey website.

1.4 The intrusive investigation comprised four windowless sample probe boreholes with inspection pits were dug by hand to check for services prior to drilling. Selected samples were sent for laboratory testing.

1.5 This report presents the results of the desk study and investigation and provides an evaluation of the data as guidance for design of the project.

2.0 THE SITE

2.1 The site is located adjacent to Block A within Regents Park Barracks in London. It is on the eastern side of the wider barracks complex which is situated between Regents Park to the west and a series of railway lines to the east. The approximate National Grid reference is 528825, 183167. The site location is shown on the plan in Appendix A.

2.2 The investigation location is an area of hardstanding located within the south east corner of Regents Park Army Barracks. The Barracks are made up of a roughly rectangular area and its boundaries are defined by a mixture of two and three storey buildings, brick walls approximately 3m high and existing fence lines. Within this area are 4N^{o} long rectangular buildings covering the majority of the southern half of the site with tarmac road ways running between them and parking bays located in the south east corner of the site. The northern half of the barracks is covered by a parade ground currently used for additional parking and a large multi-storey structure located at the northern end of the site. Access to the site is through an archway located in the western boundary of the site.

2.3 The surrounding area to the north, east and south is predominantly residential with Euston Station located to the south-east of the site and the associated railway lines running past the site to the east. To the west lies the green open space of Regents Park. The buildings in the immediate vicinity of the site are associated with the wider barracks.

3.0 ENVIRONMENTAL SETTING

Geology

3.1 The British Geological Survey map sheet 256 (North London) at 1:50 000 scale shows the site to rest upon the London Clay Formation of Eocene age with superficial deposits reportedly absent. The London Clay generally comprises stiff clay or sandy clay with occasional mudstone nodules.

3.2 According to the GroundSure Report in Appendix B the site is not within an area affected by radon gas.

3.3 The GroundSure Report in Appendix B lists hazards associated with ground conditions. It reports a 'negligible' hazard with respect to compressible ground, running sand and ground dissolution. Collapsible ground and landslide ground stability are classed as 'very low hazard' and the potential for shrinkage/swelling is reported to be 'moderate'.

3.4 Based on the GroundSure Report in Appendix B areas of artificial ground are recorded 76m to the south-east and 155m to the north-east of the site recorded as an 'artificial deposit' and a 'void' respectively. A number of historical ground workings, recorded as canals, are listed to the north-east and east within 50m of the site. All of the noted features where infilled have the potential to generate hazardous gases should any organic or putrescible material have been present within the fill material used to reinstate them.

3.5 No data was available for the area with respect to the BGS Estimated Background Soil Chemistry.

Hydrogeology

3.6 The Environment Agency (EA) operates a classification system to categorise the importance of groundwater resources (aquifers) and their sensitivity to contamination in line with the EA's Groundwater Protection Policy (GP3) and the Water Framework Directive (WFD) and this is based on British Geological Survey mapping. Aquifers are classified as Principal, Secondary A and Secondary B based on the amenity value of the resource. Separate classifications are given for superficial deposits and bedrock.

3.7 The GroundSure Report contained in Appendix B includes a plan showing the bedrock aquifer designation. This shows the bedrock of the site (London Clay) to be unproductive strata.

3.8 To protect drinking water from pollution, the EA has designated groundwater Source Protection Zones around major groundwater abstraction points. The zones restrict the type of activities and development permitted within their boundaries to protect the groundwater reserves.

3.9 The Environmental Agency maps show the site is not in or near to a source protection zone and nor are there any groundwater or potable water abstractions listed within a 500m radius.

3.10 There are no discharge consents recorded within 500m of the site.

Hydrology

3.11 There are no surface water features recorded to be present within 500m of the site.

3.12 According to the GroundSure Report, the site is not in an area at risk of flooding.

Mining, Mineral Extraction and Subsidence

3.13 The site is not in an area affected by coal mining or other mineral extraction. No natural cavities are recorded to exist within the vicinity of the site.

Landfill and Waste Management Activity

3.14 There are no records of landfills or waste management sites within 500m of the site.

Industrial Land Use

3.15 The site is in a predominantly residential area with occasional nearby light industry. No active or obsolete fuel stations, industrial authorisations, incidents or registered processes are recorded to be present by the GroundSure Report within 250m of the site.

Radiological

3.16 No radiological sources are present within 250m of the site although a number of sources are present 262m to the south-west associated with the numerous medical practices on Harley Street.

Sensitive Land Use

3.17 The GroundSure Report indicates that the site is not within or close to any environmentally sensitive areas.

Unexploded Ordnance

3.18 Based on a review of regional unexploded bomb risk areas published by Zetica, an independent database authority, the risk of unexploded bombs within this area of London is reported to be high.

4.0 SITE HISTORY

4.1 The history of the site has been studied based on the mapping details contained in the GroundSure Report in Appendix C.

4.2 The earliest maps in 1870 and 1873 show the site to be part of the Regents Park Cavalry Barracks with part of the officers' quarters and one of the stables encroaching onto the northern and western sections of the site area respectively. A tank is shown within the barracks adjacent to one of the stable blocks roughly 25m to the south-west of the site area. A canal is shown approximately 25m to the east leading to a large rectangular basin / dock 50m to the south-east. A series of railway lines are shown 100m to the east and terminate at Euston Station 500m to the south-east. Regents Park is shown to be present 450m to the west. By 1894 the layout of the site and the wider barracks is shown to have altered and is similar to the current land use. An expansion of the railway network is shown to include additional lines and a carriage shed by 1916.

4.3 The wider area is predominantly residential with few significant changes shown to have occurred during the available mapping period.

4.4 The 1952 map shows a slight alteration to the site layout with an additional building encroaching onto the southern extent. The 1952 map also shows the canal and basin to be allotment gardens and they are therefore believed to have been infilled. The allotment gardens along the path of the former canal and basin are shown to have been replaced by residential plots by 1959 with the former basin area developed partly as a nursery by the issue of the 1976 map.

4.5 Few other changes to the site and surrounding wider area were shown to be present on the remaining maps.

5.0 CONCEPTUAL MODEL

Overview

5.1 The general approach taken to dealing with historic land contamination is one of risk management comprising identification and assessment of risks followed by mitigation and monitoring if required. The procedures used within this report are consistent with those defined within Part IIA Guidance and the Model Procedures for the Management of Land Contamination, Contaminated Land Report (CLR) 11 produced by the Department of Environment, Food and Rural Affairs (DEFRA) and the Environment Agency.

5.2 Within the context of land contamination there are three essential elements to any potential risk:

- A source – substance that is in or under the land and has the potential to cause harm or to cause pollution of Controlled Waters;
- A receptor – in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body; and
- A pathway – a route or means by which a receptor can be expose to, or affected by, a contaminant.

5.3 Each of the above can exist independently, but they create a risk only where they are linked together, so that a particular contaminant affects a receptor through a particular pathway. This kind of linked combination is known as the Source (contaminant) – Pathway – Receptor (SPR) risk assessment model. Formulation of an outline conceptual model allows the identification and assessment of potential contaminant linkages.

Potential Sources

5.4 Made Ground of unknown composition and origin has the potential to be present on site due to the previous developments which may contain contamination and/or have the potential to produce landfill gases.

5.5 The former infilled canal and basin within 50m to the east of the site have the potential to produce landfill gases either as result organic material associated with the former canal or associated with the fill.

5.6 No previous contaminative uses have been identified on the site; the former tank noted pre 1894 is considered unlikely to have contained hydrocarbon and instead is likely to have been for water storage for the adjacent stables.

5.7 The site is not within an area affected by radon gas.

Potential Receptors

5.8 The potential receptors considered in line with the Environmental Protection Act 1990 Part IIA are:

- Human Health
- Controlled waters
- Property in the form of buildings
- Ecology

5.9 Human health includes future and current users of the site such as staff, construction workers and other personnel.

5.10 The site is over Unproductive Strata; therefore the groundwater is not considered to be a potential receptor.

5.11 The buildings and services proposed at the site are potential receptors.

5.12 No surface water receptors were identified within 500m of the site.

Pathways

5.13 Migration pathways are mechanisms by which contaminants can reach a target or receptor, from a potential source. Pathways can be categorised as air, land and water based. The following pathways have been considered:

- migration of contaminants with subsurface infiltration,
- shallow ground water flow,
- gas inhalation,
- direct dermal contact with soil contaminants,
- direct buried structure contact with soil contaminants
- ingestion and/or inhalation of contaminants, and
- plant uptake.

5.14 The site is situated on unproductive strata and therefore shallow groundwater flow and the migration of contaminants with subsurface infiltration have not been considered further.

5.15 The proposed development does not include any soft landscaping and will be entirely covered by hardstanding. Therefore the direct dermal contact, ingestion/inhalation and plant uptake pathways have not been considered further.

Risk Assessment

5.16 The preliminary risk assessment is summarised in Table 5.1. This forms the basis of the outline site conceptual model, which is presented in Appendix D. Qualitative risk estimation has been included in the table below, the risk estimation is as per 'Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66: 2008' found within Appendix E.

5.17 The sources of potential contamination concern are; possible contamination within the Made Ground and landfill gas production/migration from the possible infilled canal.

5.18 The proposed development will comprise an extension to the existing Block A which will comprise offices and conference rooms.

Table 5.1 – Preliminary Source-Pathway-Receptor Risk Assessment

Potential Source	Potential Pathway	Potential Receptor	Potential for a Source-Pathway-Receptor Linkage
Contamination in Made Ground	Direct contact	Buildings, Services	**Low** – No significant contamination suspected. Local geological conditions are not normally aggressive to construction materials.
Infilled former canal 25m to the east.	Inhalation	Human Health	**Low/moderate** – organic or putrescible material may be present within the fill. However, due to the time scale since infilling the potential for gas production is likely to have reduced.

6.0 GROUND INVESTIGATION

6.1 A series of intrusive ground investigation works were carried out by T&P Regeneration Limited on 24th October 2012. The locations of the exploratory holes are shown on the drawing found within Appendix A.

6.2 The site work comprised four windowless sample boreholes with in-situ Standard Penetration Testing (SPT) at 1.0m intervals. Each hole was commenced by hand digging an inspection pit to 1.0m depth to check for services with selected samples taken for chemical and geotechnical testing from each encountered strata as appropriate.

6.3 The windowless sample boreholes were terminated between 4.0 and 6.0m depth with SPT N values ranging between N=3 and N=17 within the natural soils.

6.4 Laboratory testing for contamination was undertaken by The Environmental Laboratory Ltd, a UKAS accredited laboratory, to MCERTS standards and comprised the following:

- Six tests for a general screening suite of potential contaminants.
- Two tests for total petroleum hydrocarbons (CWG speciation).
- Four tests for the presence of asbestos.
- One WAC test for disposal of soil.

6.5 The geotechnical laboratory testing was undertaken by Geo Site Testing Laboratory, a UKAS accredited laboratory and comprised the following:

- Six tests for atterberg limits and moisture contents.
- Four test for SD1 sulphate suite (non pyritic).
- Four tests for pH.
- Four laboratory remoulded CBR's.

7.0 GROUND CONDITIONS AND RESULTS

Ground Conditions

7.1 The results of the ground investigation generally confirm the recorded geology (London Clay) to underlie a veneer of superficial Made Ground. The exploratory hole logs are provided within Appendix F.

7.2 The Made Ground was revealed to be between 2.1m and 3.2m deep comprising a veneer of tarmac locally over loose to medium dense clayey sand and gravel comprising red brick and concrete up to 1.0m deep within WS2 and WS4. The remaining Made Ground comprised soft to firm clay locally noted to include gravel of red brick, pottery and carbonaceous fragments. This may represent material artificially deposited on site either to raise the ground levels to create a level engineered platform or as a means of disposal of the arisings from the excavation of the adjacent canal.

7.3 The natural ground immediately underlying the made ground was revealed to comprise soft to firm organic clay up to 0.4m thick and noted to give a slight organic odour. Given the relatively consistent depth at which the layer was encountered and the organic content it is considered likely to represent a former ground level topsoil profile.

7.4 The deeper natural ground was commonly observed to be soft to firm brown or grey clay to depths of between 3.5 and 4.0m depth with firm or firm to stiff clay encountered beneath within three of the holes to depths of between 4.0 and 6.0m (London Clay). Within WS1 soft to firm clay was noted between 3.2 - 5.0m depth where the borehole was terminated, although recorded SPT N values were similar to those recorded in this material in the adjacent borehole positions.

7.5 The SPT results in clay are indicative only but using Stroud (1974) it is possible to undertake a correlation between the SPT N values and the undrained shear strength. Based upon this the natural clays beneath the former topsoil profile are anticipated to commonly be of medium strength, although in WS4 where the clay is observed to be wet between 2.4 and 3.6m a lower strength is anticipated.

7.6 There were no visual or olfactory signs of contamination noted during the site reconnaissance or site work.

Groundwater

7.7 No groundwater strikes were encountered within any of the exploratory holes during the investigation although the made ground was noted as wet at 2.7m in WS2 and between 1.6 – 2.1m in WS4. The natural strata was also as wet between 2.4 – 3.6m within WS4. During the monitoring works undertaken upon the 26th November 2012 measured groundwater levels of 1.82m were recorded within WS2.

Geotechnical Laboratory Testing

7.8 The geotechnical testing undertaken included six Atterberg Limit tests with one on natural silty clay, showing clay of moderate volume change potential. The remaining five Atterberg Limit tests on the made ground also showed the clay to be of moderate volume change potential. A copy of the results are contained within Appendix G.

7.9 The pH results are in the range 7.2 to 7.8. The measured water soluble sulphate as SO_4 is between 0.02 and 0.08g/l.

7.10 Four laboratory remoulded CBR's were undertaken within the made ground to give indicative values of between 2.2 and 7.4%.

Chemical Laboratory Testing

7.11 Laboratory testing was carried out on selected samples representative of the made ground encountered to provide general screening for potential contaminants and also targeted at potential contamination determined from the outline conceptual model.

7.12 A general suite of testing was undertaken on six soil samples. The results of the general testing suite are summarised in Table 7.1 below. The Generic Assessment Criteria (GAC) are also tabulated and are referred to in section 8 of this report. A copy of the chemical results are contained within Appendix H.

Table 7.1 – Summary of Chemical Test Results

Determinant	GAC Residential without uptake	Source of GAC	Minimum	Maximum	No. of exceedances
Arsenic	640	ATRISK	6.1	14.8	0
Cadmium	230	ATRISK	<0.5	<0.5	0
Chromium	213000	ATRISK	15.2	47.0	0
Lead	6490	ATRISK	41.1	439.2	0
Mercury	3600	ATRISK	<0.5	2.0	0
Nickel	1800	ATRISK	12.2	36.7	0
Copper	109000	ATRISK	19.8	54.8	0
Zinc	46800	ATRISK Residential	36.4	185.4	0
Selenium	13000	ATRISK	0.6	1.3	0
Hexavalent Chromium	330	ATRISK	<2.0	<2.0	0
Water soluble Boron	291	LQM	<0.5	1.9	0
pH (unit)	-	-	8.5	10.6	-
Total Cyanide	34	ATRISK	<1.0	<1.0	0
Total monohydric phenols	686	ATRISK	<1.0	<1.0	0
Soil Organic Matter (%)	-	-	2.0	2.7	-
Naphthalene	8180	ATRISK	<0.5	<0.5	0
Acenaphthylene	170	LQM	<0.5	<0.5	0
Acenaphthene	109000	ATRISK	<0.5	<0.5	0
Fluorene	66800	ATRISK	<0.5	<0.5	0
Phenanthrene	92	LQM	<0.5	1.3	0
Anthracene	536000	ATRISK	<0.5	<0.5	0
Fluoranthene	72300	ATRISK	<0.5	3.1	0
Pyrene	54200	ATRISK	<0.5	3.0	0
Benzo(a)anthracene	131	ATRISK	<0.5	1.7	0
Chrysene	14000	ATRISK	<0.5	1.9	0
Benzo(b)fluoranthene	142	ATRISK	<0.5	1.5	0
Benzo(k)fluoranthene	1430	ATRISK	<0.5	2.2	0
Benzo(a)pyrene	14.3	ATRISK	<0.5	1.7	0
Indeno(1,2,3)pyrene	142	ATRISK	<0.5	1.2	0
Dibenzo(ah)anthracene	14.3	ATRISK	<0.5	<0.5	0
Benzo(ghi)perylene	1440	ATRISK	<0.5	1.5	0

Note – Units are mg/kg unless stated.

7.13 Three samples were tested for total petroleum hydrocarbons (CWG fractionation) with all results below the relevant assessment criteria values.

7.14 Four samples were tested for the presence of asbestos, but none was detected.

8.0 CONTAMINATION ASSESSMENT

Soil

8.1 In line with CLR11 (DEFRA & EA, 2004), a Generic Quantitative Risk Assessment (GQRA) was undertaken to determine the significance of the measured concentrations of contaminants from the chemical analysis undertaken. The GQRA comprises the comparison of the measured concentrations with Generic Assessment Criteria (GACs).

8.2 The GACs used for the assessment of soil concentrations comprise the Atkins ATRISK derived values for a commercial end use using the CLEA model based upon a sandy soil with 1% soil organic matter.

8.3 The proposed development comprises an extension to an existing building. The additional development is however understood to comprise new offices and conference rooms and thus can be considered comparable to a commercial development. The data has therefore been compared with GACs for a commercial end-use. The GACs are provided on Table 7.1 in the previous section for ease of comparison.

8.4 No concentrations were revealed to exceed the GACs for commercial end use. None of the contaminants are of concern.

8.5 None of the results for the TPH banding exceed the GACs. Petroleum Hydrocarbons are not of concern.

8.6 No asbestos was detected.

8.7 In 2010 the UK Water Industry Research (UKWIR) published Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites (Ref. No.10/WM/03/21). This report states that in the majority of cases only organic contaminants pose a potential risk to plastic pipe materials. Table 3.1 in the report provides threshold values for PE and PVC pipes for the organic contaminants of concern.

This information has been incorporated into the table below with any exceedences noted from the chemical testing on site highlighted in bold.

Table 8.9 - Assessment of results against UKWIR criteria				
Determinant	**Pipe material GAC (mg/kg)**		**Laboratory detection limit or recorded concentrations(mg/kg)**	
	PE	**PVC**	**Min**	**Max**
Extended VOC suite *1	0.5	0.125	-	-
BTEX + MTBE *1	0.1	0.03	-	-
SVOCs TIC by purge and trap or head space and GC-MS with TIC (aliphatic and aromatic C_5-C_{10}) *2	2	1.4	<0.5	1.7
Phenols	2	0.4	<1	<1
Cresols and chlorinated phenols *1	2	0.04	-	-
Mineral oil C_{11}-C_{20}	10	Suitable	<0.1	0.1
Mineral oil C_{21} – C_{40}	500	Suitable	1.2	4.9
Corrosive (conductivity, redox and pH)	Suitable	Suitable	-	-
Specific suite identified as relevant following site investigation				
Ethers *1	0.5	1	-	-
Nitrobenzene *1	0.5	0.4	-	-
Ketones *1	0.5	0.02	-	-
Aldehydes *1	0.5	0.02	-	-
Amines *1	Not suitable	Suitable	-	-

(*1) Determinant not tested.
(*2) Based upon BaP values recorded on site.

The wider suite of organic determinants of concern in relation to water supply pipe work were not tested as there was no evidence to suggest the presence of organic contaminants either from a review of the desk study data or during the course of the site investigation. Limited analysis for TPH, PAH and phenols was undertaken as a screen and detailed in the table above. Observed concentrations are not of concern and are consistent with the anticipated site conditions. Due to the depth of made ground is likely that any new buried pipework will be within the made ground although based upon the chemical results PE pipework will be sufficient with all concentrations below the specified values. It is however recommended that consultation with statutory water suppliers is undertaken in order to confirm their acceptance of this assessment as they may require the use of barrier pipework as a precaution against the possible variability of the made ground across the site.

8.8 The presence of contamination in the Made Ground should be brought to the attention of the contractor, and his personnel should take appropriate precautions to ensure personal hygiene is adequate and to prevent inhalation of dust.

Gas

8.9 The results of the desk study indicate that no radon protection measures are necessary at this site.

8.10 The desk study and site investigation have identified both off and on site potential gas sources comprising an infilled canal and a buried organic former topsoil profile respectively. A single gas monitoring visit has been undertaken under low pressure

conditions to give an indicative baseline reading of the gas conditions as presented in the table below.

Table 8.12 – Summary of gas monitoring results

	Flow	Atmospheric pressure	Methane	Carbon Dioxide	Oxygen	Carbon Monoxide	Hydrogen Sulphide	Volatile Organic Compounds
	l/hr	mB	%	%	%	ppm	ppm	ppb
WS2	-0.1	998	0.0	0.0	20.3	0	0	0

8.11 It acknowledged that the monitoring to date is not compliant with current best practice guidance as presented in CIRIA C665 which requires 6-9 visits over a 2-3 month period. As a result of the expedited construction requirements in association with this scheme it is not anticipated that it will be possible to complete this monitoring within the required timescales. Although it is considered likely that any further monitoring will demonstrate that the risk is low it is recommended that upgraded passive gas protection measures are included to facilitate ongoing construction and manage the residual uncharacterised risk associated with this issue and manage likely associated regulatory requirements.

Waste Disposal

8.12 Based upon the chemical analysis results and following liaison with the receiving landfill facility it should be possible to classify any arisings of natural material resulting from the site works as inert waste whilst the made ground is likely to be classified as non-hazardous waste, which may incur the higher landfill tax levy. However this is not guaranteed and will need to be confirmed through discussions with the receiving tip as it may be possible to classify it as inactive non-hazardous material which would avoid the higher landfill tax rate. Waste Acceptance Criteria testing (WAC) undertaken as part of the investigation is likely to be required by the receiving landfill prior to acceptance of the waste.

8.13 If the soils are not classified as inert or “inactive non hazardous waste” by the receiving landfill then following the termination of the landfill tax exemption scheme by the government in November 2008 any material leaving site that is classed as non-hazardous or hazardous waste will be liable to the landfill tax levy, which currently (2012/13) is set at £64/tonne but is due to rise by £8/tonne until 2014 (£80/tonne).

9.0 GEOTECHNICAL EVALUATION AND DESIGN

Proposed Development

9.1 A one or two storey extension is proposed to the existing Regents Barracks Block A.

Geotechnical Evaluation

9.2 The Made Ground was recorded to be between 2.1m and 3.2m deep comprising a veneer of tarmac locally over loose to medium dense clayey sand and gravel comprising red brick and concrete up to 1.0m deep within WS2 and WS4. The remaining Made Ground is composed of soft to firm clay locally noted to include gravel of red brick, pottery and carbonaceous fragments. The natural ground immediately underlying the made ground was revealed to comprise soft to firm organic clay up to 0.4m thick and noted to give a slight organic odour. The deeper natural ground was commonly observed to be soft to firm brown or grey clay to depths of between 3.5 and 4.0m depth with firm or firm to stiff clay encountered beneath within three of the holes to depths of between 4.0 and 6.0m (London Clay). Within WS1 soft to firm clay was noted between 3.2 - 5.0m depth where the borehole was terminated, although recorded SPT N values were similar to those recorded in this material in the adjacent borehole positions.

9.3 Based upon the SPT N values and shear strength correlation (Stroud – 1974) the natural clays are likely to be of medium strength although in WS4 where the clay is observed to be wet between 2.4 and 3.6m a lower strength is anticipated.

9.4 No groundwater strikes were encountered within any of the exploratory holes during the investigation although the made ground was noted as wet at 2.7m in WS2 and between 1.6 – 2.1m in WS4. The natural stratum was also as wet between 2.4 – 3.6m within WS4.

9.5 The test results indicate moderate sulphate content, and the design sulphate class for the location is DS-2 in accordance with BRE Special Digest 1 (2005). Due to the lack of any significant groundwater within the natural ground the recommended ACEC class is AC-1s.

Geotechnical Design

9.6 The natural stratum underlying the site generally comprised soft to firm clay to depths of between 3.5 and 4.0m and locally within WS1 to 5.0m depth and is likely to make the use traditional foundations uneconomic. Strip or pad foundations are therefore not recommended for the proposed extension.

9.7 Piled foundations are likely to provide the most cost effective foundation solution with bored piles likely to be the most suitable so as to minimise the effects of vibration and the risk of disturbance on the adjacent existing building.

9.8 Due to the thickness and variability of the made ground revealed on site the use of a suspended ground floor slab is appropriate although given the age of the fill material a ground bearing floor slab could be utilised where settlement is not sensitive if the superficial soils are removed and replaced with a suitable thickness of compacted fill

material utilising an appropriate engineering compaction specification. Inspection of the formation level by a suitably experienced geotechnical engineer is recommended in order to evaluate the presence of any localised soft spots or fill material of potentially poor quality and ensure local excavation and removal. The incorporation of a basic gas membrane will be required in order to mitigate the residual gas migration risk identified by the desk study and investigation.

9.9 Based upon the observed soil conditions and laboratory analysis it is anticipated that a CBR design value of 2% will be appropriate within the superficial made ground.

10.0 SUMMARY

10.1 An extension to the existing Block A within Regents Barracks is proposed.

10.2 The Made Ground was revealed to be between 2.1m and 3.2m deep. The natural ground immediately underlying the made ground was revealed to comprise organic clay considered likely to represent a former ground level topsoil profile. The deeper natural ground was soft to firm clay to depths of between 3.5 and 4.0m depth with firm or firm to stiff clay encountered beneath. Within WS1 soft to firm clay was noted between 3.2 - 5.0m.

10.3 None of the tested potential contaminants were revealed in excess of the commercial end use GAC's.

10.4 It should be possible to use standard PE water supply pipes although due to the inherent variability of made ground the local water authority should be contacted at the design phase to confirm this.

10.5 The presence of contamination in the Made Ground should be brought to the attention of the contractor, and his personnel should take appropriate precautions to ensure personal hygiene is adequate and to prevent inhalation of dust.

10.6 Piled foundations are recommended for the proposed extension with a suspended ground floor slab although given the age of the fill material a ground bearing floor slab could be utilised where settlement is not sensitive if the superficial soils are removed and replaced with a suitable thickness of compacted fill material utilising an appropriate engineering compaction specification.

10.7 The design sulphate class for the location is DS-2 in accordance with BRE Special Digest 1 (2005) and the recommended ACEC class is AC-1s.

Appendix B Window Sample Borehole Logs

T&P Regeneration
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Borehole No
WS1
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
Regents Park Barracks	REG912		WS
Location: Albany Street, NW1 4AL		Level: -	Scale 1:50
Client: Capita Symonds		Dates: 24/10/2012	Logged By DG

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20			MADE GROUND - Tarmac.
		0.50	ES					MADE GROUND - Soft to firm brown gravelly CLAY. Gravels include angular to subangular medium to coarse red brick and concrete some black carbonaceous fragments. Pottery pipe remains at 2.4m believed to be old service pipe.
		0.50	D					
		0.75	B					
		1.00	SPT	N=4 (1,1,1,1,1,1)				
		2.00	SPT	N=7 (2,3,2,2,1,2)				
		2.50	ES					
		2.50	D		2.60			MADE GROUND - Soft to firm brown CLAY.
		2.70	ES					
		2.70	D		2.90			NATURAL GROUND - Soft to firm medium strength grey with black mottling CLAY. Slight organic vegetation odour. Black mottling possible organic remains.
		3.00	SPT	N=12				
		3.00	D	(2,3,2,3,3,4)	3.20			NATURAL GROUND - Soft to firm medium strength grey silty CLAY.
		4.00	SPT	N=15				
		4.00	D	(2,3,3,3,4,5)				
		5.00	SPT	N=12 (2,2,2,3,3,4)	5.00			End of Borehole at 5.00 m
			Type	Results				

Remarks: 1. Hand dug pit to 1.0m.

AGS

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Borehole No
WS2
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
Regents Park Barracks	REG912		WS
Location: Albany Street, NW1 4AL		Level: -	Scale 1:50
Client: Capita Symonds		Dates: 24/10/2012	Logged By DG

Well	Water Strikes	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.20			MADE GROUND - Tarmac.
		0.45 0.50 0.50	B ES D					MADE GROUND - Loose to medium dense brown clayey angular to subrounded medium to coarse brick and concrete GRAVELS and COBBLES.
		1.00 1.00 1.00	SPT ES D	N=7 (1,1,2,1,2,2)	1.00			MADE GROUND - Firm brown CLAY wet at 2.7m. Locally soft from 2.2m to 2.5m.
		2.00	SPT	N=4 (1,1,1,1,1,1)				
		2.50 2.50	ES D					
		3.00 3.20 3.20	SPT ES D	N=7 (2,1,2,1,2,2)	3.20			NATURAL GROUND - Soft black organic CLAY possibly peaty.
					3.50			Firm to stiff grey CLAY.
		4.00 4.00	SPT D	N=12 (2,2,2,3,3,4)	3.90			NATURAL GROUND - Firm to stiff medium strength brown CLAY.
		5.00	SPT	N=15 (3,3,3,3,4,5)	5.00			End of Borehole at 5.00 m
			Type	Results				

Remarks: 1. Hand dug pit to 1.0m.
2. Becoming wet at 2.7m.

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Borehole No **WS3** Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
Regents Park Barracks	REG912		WS
Location: Albany Street, NW1 4AL		Level: -	Scale 1:50
Client: Capita Symonds		Dates: 24/10/2012	Logged By DG

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20			MADE GROUND - Tarmac.
		0.45	B					MADE GROUND - Soft to firm dark grey gravelly CLAY. Gravels include red brick, concrete and black carbonaceous fragments.
		0.50	ES					
		0.50	D		0.70			MADE GROUND - Soft to firm brown gravelly CLAY.
		1.00	SPT	N=6	1.00			MADE GROUND - Soft to firm brown CLAY.
		1.00	ES	(0,0,2,1,1,2)				
		1.00	D					
		2.00	SPT	N=6 (1,1,1,2,1,2)				
		2.50	ES					
		2.50	D					
		3.00	SPT	N=9	3.00			NATURAL GROUND - Soft to firm low to medium strength grey with black mottling CLAY. Slight organic vegetation odour. Black mottling possible organic remains.
		3.10	D	(2,1,2,2,2,3)				
					3.40			NATURAL GROUND - Soft to firm grey slightly silty CLAY.
		3.60	D					
		4.00	SPT	N=11 (2,2,2,3,3,3)	4.00			NATURAL GROUND - Firm to stiff medium strength brown CLAY with occasional grey mottling.
		5.00	SPT	N=15				
		5.00	D	(3,3,3,3,4,5)				
		6.00	SPT	N=19 (4,3,4,4,5,6)	6.00			End of Borehole at 6.00 m
				Type / Results				

Remarks: 1. Hand dug pit to 1.0m.

AGS

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Borehole No
WS4
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Hole Type
Regents Park Barracks	REG912		WS
Location: Albany Street, NW1 4AL		Level: -	Scale 1:50
Client: Capita Symonds		Dates: 24/10/2012	Logged By DG

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.20			MADE GROUND - Tarmac.
		0.50	ES					MADE GROUND - Loose to medium dense brown coarse SAND andsubangular to subrounded medium to coarse concrete and brick GRAVELS fill.
		0.50	D					
		0.75	B					
		1.00	SPT	N=10				
		1.00	ES	(5,5,4,2,2,2)				
		1.00	D					
					1.60			Becoming wet at 1.5m.
		1.80	D					MADE GROUND - Soft wet brown CLAY.
		2.00	SPT	N=3				
		2.20	ES	(1,0,1,0,1,1)	2.10			NATURAL GROUND - Soft black organic CLAY.
		2.20	D					
		2.30	ES		2.40			NATURAL GROUND - Soft to firm medium strength brown wet CLAY.
		2.30	D					
		3.00	SPT	N=10				
				(2,1,2,2,3,3)				
					3.60			NATURAL GROUND - Firm medium strength grey with black organic CLAY.
		4.00	SPT	N=17	4.00			
		4.00	D	(4,4,4,4,4,5)				End of Borehole at 4.00 m
			Type	Results				

Remarks: 1. Hand dug pit to 1.0m.
2. Noted as wet from 1.6 to 2.1m and 2.4 and 3.6m.

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Appendix C Supplementary Statement by Dr David Clinton,MA MSc DIC PhD CEng MICE, Associate Director Geotechnical and Geo-environmental Engineering, Capita Symonds Limited

Site Central, Regents Park Barracks
Extension to A Block
Basement Construction
Geotechnical Assessment

Introduction

It is proposed to construct an extension to A Block on site Central. A desk study and ground investigation report was carried out by T&P Regeneration Limited which provided guidance for design of foundations. Subsequent to their Brief it was proposed to incorporate a basement, which was not covered by their report. A separate geotechnical assessment has therefore been carried out for the basement.

The proposed basement will be about 3m deep occupying an area of about 5.5m x 10m at the northern eastern corner of the extension. It will be at least 4m to 5m from any existing buildings.

This note provides an assessment of the ground conditions and construction issues relating to the proposed basement.

Ground Conditions

The ground investigation revealed Made Ground between 2.1m and 3.2m deep overlying London Clay. The Made Ground is clayey sand and gravel to about 1m depth over soft to firm clay. The London Clay is brown or grey clay that is soft to firm near its surface becoming firm to stiff with depth.

No groundwater was noted during the investigation, but the clay was recorded to be wet in places.

Subsequent monitoring in a standpipe shows a standing groundwater level at 1.82m depth.

Construction Proposals

Piled foundations are proposed for the building, including below the basement. The basement will be constructed of reinforced concrete walls and floor, suitably tanked.

Geotechnical Assessment

There should be no difficulty in excavating for the new basement, but care must be taken when digging around piles previously installed from ground level.

Although the basement is indicated to be below the standing groundwater level, the clayey nature of the soil will prevent any significant groundwater ingress during construction. It is possible that some seepage may occur at the base of the granular Made Ground where there may be local perched groundwater. There should be no difficulty in pumping out any water ingress.

The basement will need to be fully tanked to prevent the ingress of groundwater. The ground slab and walls should be designed to withstand water pressures and uplift.

The ground conditions comprise clay which is known to be of very low permeability. This is confirmed by the lack of water ingress to boreholes during the investigation. Because of this low permeability the effect of any temporary dewatering will be very limited and the effect on adjacent buildings and surrounding property will be insignificant.

Because of its very low permeability, the clay soil will not permit any significant groundwater flow and the proposed basement will therefore not be significant to the local groundwater regime. No perched water was found in the superficial Made Ground, so any that may be present will be localised and not significant.

The existing foundations are expected to be at least 1m deep and are set back at least 4m from the proposed basement. Even allowing conservatively for 0.5m spread of foundations and 0.5m construction outside the basement line the excavation will be well outside the nominal 45 degree spread of load below the existing foundations. The temporary excavation will therefore not endanger the existing foundations.

It is usually prudent to carry out pre-condition surveys of adjacent buildings, but no additional monitoring is considered necessary for the proposed works.

The sides of the excavation should be either fully supported during construction or battered back to a safe angle. An inclination of about 40 degrees to the horizontal is likely to be suitable for temporary works.

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