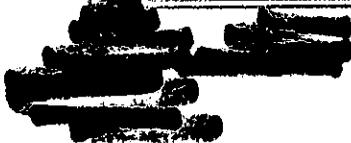


Our ref: 4987br

11F 0427

22 FEB 2011

Basic Site Investigation Report
for land at
Banks Road,
Garston, Liverpool



For : McInerney Homes North West
16 Beecham Court,
Pemberton,
Wigan,
WN3 6PR.

23 February 2009

tel: 01244 348787
fax: 01244 348788
web: www.cooperassociates.co.uk
email: admin@cooperassociates.co.uk

Cooper Associates
2 Vicars Lane
Chester
CH1 1QX



Basic Site Investigation Report for land at
Banks Road, Garston, Liverpool

Document Verification

Project Title	Banks Road, Garston, Liverpool
Project Number	4987
Document Title	Basic Site Investigation Report for land at Banks Road, Garston, Liverpool
Document Number	4987br

This document is not to be used for contractual or engineering purposes unless the document verification sheet is signed where indicated by the approver of the document.

Prepared by

Checked and Approved

B W Hill
BSc (Hons), FGS

And



N Reynolds
BSc (Hons), MSc, FGS



P R Sykes
BSc(Hons), MSc (Eng), FGS

Document Revision

Report Reference	Date	Description	Prepared	Checked and Approved
4987br	23 February 2009	Basic Site Investigation Report	B W Hill / N Reynolds	P R Sykes

This report has been prepared for and on behalf of our client, in accordance with the terms and conditions of the appointment agreement with Coopers. Other than where specifically allowed for in the said appointment agreement, any other party using this report for any purpose whatsoever does so at their own risk and any duty of care to that party is specifically excluded.

**Basic Site Investigation Report for land at
Banks Road, Garston, Liverpool**

Contents

<u>Section</u>	<u>Page No.</u>
Document Verification	1
Contents	1
List of Appendices	3
List of Tables	3
List of Photographs	4
1.0 Introduction	4
2.0 Executive Summary	6
3.0 Site Location	11
4.0 Site Description	11
5.0 Site Boundaries	13
6.0 Site History	14
7.0 Hazardous Installations and Development Constraints	17
8.0 Landfill Sites and Ground Gases	19
9.0 Geology, Hydrology & Hydrogeology	26
10.0 Animal Burial Sites and other Environmental, Archaeological, Ecological and Conservation Issues	29
11.0 Coal Mining	30
12.0 Radon	30
13.0 Trial Pit Explorations	30
14.0 Basis of Assessments	33
15.0 Contamination	33
16.0 Sub Soil Classification	53
17.0 Trees	55
18.0 Ground Floor Slabs	55
19.0 Foundations	56
20.0 Trench Side Stability	62
21.0 Dewatering	63
22.0 Road Sub-Grade	63
23.0 Further Actions	64
24.0 References	66

Basic Site Investigation Report for land at
Banks Road, Garston, Liverpool

List of Appendices

Appendix 1	- Documents regarding Hazardous Installations, Landfill Sites, Groundwater, and Tree Preservation Orders (TPO's)
Appendix 2	- Envirocheck Report
Appendix 3	- Correspondence regarding Animal Burial Sites
Appendix 4	- Summary of Exploratory Hole Findings and Anticipated Foundations - Trial Pit Logs
Appendix 5	- Soil Test Results
Appendix 6	- Sub-Structure Specification for Ready Mix Concrete, Brickwork/Blockwork, Mortar and Drainage Pipework
Appendix 7	- Chemical Test Certificates
Appendix 8	- Tier 1 Threshold Values - Source Signature Double Ratio Plot
Appendix 9	- United Utilities Assessment for Potable Water Supply Pipelines
Appendix 10	- CDM Information
Appendix 11	- Tree Survey
Appendix 12	- Reference Drawings

List of Tables

Table 1: Summary of Site History	Page No. 6 to 10
Table 2: Summary of Initial Conceptual Model Associated with Hazardous Ground Gases	24 and 25
Table 3: Conjectured Foundation Types	62

List of Figures

Figure 1: British Geological Survey GeoIndex Borehole Record	Page No. 28
Figure 2: Heave precautions for ground beams associated with piled foundations from NHBC guidance.	61

Basic Site Investigation Report for land at
Banks Road, Garston, Liverpool

List of Photographs

	Page No.
Photograph 1 - <i>View eastwards of the site from the western corner.</i>	11
Photograph 2 - <i>Showing the mature trees within the northern corner, photograph taken from the south western boundary.</i>	12
Photograph 3 - <i>Showing the access gate from Banks Road, photograph taken from within the site boundary.</i>	12
Photograph 4 - <i>Showing the north western boundary looking north westerly, the 2.5m high brick wall and metal palisade gate can be seen.</i>	12
Photograph 5 - <i>Showing the suspected infilled air raid shelter beyond the south eastern boundary, looking westerly.</i>	13
Photograph 6 - <i>Showing the south eastern boundary, looking south easterly, with the residential housing beyond it.</i>	14
Photograph 7 - <i>Aerial image of historical landfill (now woodland) situated off Banks Road. Image derived from internet searches.</i>	20
Photographs 8 - <i>Showing the nature of the former gasworks located off Banks Road. Photograph obtained from internet searches.</i>	23
Photograph 9 - <i>Bankfield House in the background (painted light blue) and the Community Centre in the left midground. Photograph obtained from the internet with the photographer standing on Banks Road looking west.</i>	35

1.0 Introduction

- 1.1 This report is a basic site investigation of the ground conditions, some engineering aspects and anticipated foundation requirements for a proposed residential development on land at Banks Road, Garston, Liverpool. This report was prepared on instructions received from our client, McInerney Homes, 16 Beecham Court, Pemberton, Wigan, WN3 6PR.
- 1.2 The copyright of this report and the associated plans/documents prepared by Coopers is solely owned by Coopers. Consequently neither this report nor the associated plans/documents may be reproduced, published or adapted without the express written approval of Coopers. Complete copies of this report may, however, be made and distributed by our client as an expedient in dealing with matters directly related to its commission.
- 1.3 The accuracy of map extracts cannot be guaranteed and it should be recognised that different conditions on/adjacent the site may have existed between and subsequent to the various map surveys.
- 1.4 Where data supplied by others, including that from previous investigations, has been used it has been assumed that the information is correct. No responsibility can be accepted by Coopers for inaccuracies within the data supplied by others. We would advise that our clients makes their own detailed enquiries to the Local Authorities to determine any additional planning constraints which may be applied to this site and which have not been identified within this report.
- 1.5 The results of the trial pit explorations are based upon the facts established from observations and field tests. It should be recognised that strata may vary considerably from point to point and the groundwater regime may be influenced by seasonal or other factors. While every attempt is made to assess the likelihood and extent of such variations, conditions may nevertheless exist which are undisclosed by this investigation.

Basic Site Investigation Report for land at
Banks Road, Garston, Liverpool

- 1.6 This report has been prepared in accordance with the requirements of the revised NHBC Standard Chapter 4.1 which was effective from July 2003. The scope of this report complies with the criteria for certification under the Initial Assessment including the Desk Study (D1), the Walkover Survey (D2), and the Basic Investigation (D4).
- 1.7 The further actions deemed necessary to be completed prior to development of the proposed site for residential development have been listed in Section 23.0 of this report. The full extent of further actions may not be limited to those issues stated and, during the course of the development, additional further actions may be required.
- 1.8 **The report should be read in its entirety, including all associated drawings and appendices. Coopers cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context.**
- 1.9 Arboricultural Survey and advice on arboricultural issues are considered to be outside the scope of this report except for their effect on the foundations to the proposed buildings. Where identification of any species is made, especially invasive plants such as Japanese Knotweed, Himalayan Balsam or Giant Hogweed, this should only be considered as a preliminary assessment and subject to confirmation by a professional Arboriculturist. Coopers takes no responsibility for failing to identify, or the incorrect identification, of any tree or plant species on site.
- 1.10 This report is prepared and written in the context of the purposes stated above and should not be used in a different context. Furthermore, new information, improved practices and legislation may necessitate an alteration to this report in whole or in part after its submission. Therefore with any change in circumstances or after the expiry of one year from the date of this Report, the report should be referred to Coopers for reappraisal.

**Basic Site Investigation Report for land at
Banks Road, Garston, Liverpool**

2.0 Executive Summary

Grid Reference	SJ 408 838 (Refer to Drawing No. 4987/L1)
Approximate Areas	0.36 hectares (0.88 acres)
Site Investigation Data (Appendix 4)	12 No. trial pits excavated by Coopers on 22 January 2009.
Site Location, Description and Boundaries (Sections 4.0 and 5.0)	<p>The site is located adjacent to adjacent to Banks Road, and Brunswick Street, in Garston, approximately 9km south east of Liverpool City Centre.</p> <p>The site is surrounded by predominantly residential houses, with a community centre situated on the opposite side of Brunswick Street.</p> <p>The site comprised of rough open ground of the demolished, former Bankfield House Community Centre with areas of immature to mature trees around the boundary.</p> <p>The site topography was relatively level with only minor variations present.</p> <p>Fragmented cement asbestos sheeting was recorded at surface in one location.</p> <p>Minor fly-tipped waste was present within the site, including car tyres, gas bottles and refuse bags.</p> <p>The south western boundary comprised of a combination of brick wall and concrete post/panel fence which retained the site by 1m to 1.5m. The concrete post/panel fence showed signs of slight bulging and instability.</p> <p>The south eastern boundary is in variance to the showed development area with the existing boundary encroaching into the adjacent land (gardens). Within the encroached boundary is the remnants of an Anderson bomb shelter.</p> <p>No hazardous or notifiable plant species were recorded on site during the walkover, although may have died back during the winter months.</p>
Site History (Section 6.0)	<p>Historical maps identify the site to be formerly agricultural ground from 1850 with a ditch running along the south eastern boundary. By 1893 the site was developed as Bankfield House, situated in the northern part of the site with several outbuildings located on the western part of the site. The site was subsequently referenced as a Day Nursery on the 1927 map edition. The first post-war map (1953) recorded parts of the site as ruins and a section of one of the buildings was absent.</p> <p>The main building was extended to the east and south west by 1968 and referenced as a Community Centre, with conjectured garages situated within the southern part of the site.</p> <p>The surrounding area contained a mixed, primarily industrial heritage.</p> <p>The land to the north/north west and south west were recorded as a combination of sandpits and brickfields prior to development as gas works and associated grounds (320m from the site), a landfill (240m from the site) and open ground associated with a matchworks (350m from the site). The industrial units associated with Liverpool Airport were located 30m to the east of the site from 1936.</p>
Hazardous Installations and Development Constraints (Section 7.0)	<p>Based on the findings of our desk study, we do not anticipate that the site is likely to be detrimentally affected by documented hazardous installations although we are awaiting further information to be supplied by Liverpool City Council – Planning Department.</p> <p>The historical maps after the war (1953) recorded some of the buildings on the site as ruins and one corner of a building was absent, which indicates the potential for buildings to have been damaged by bombs or unexploded ordnance (UXO). Historical records detail numerous phases of air raids and accounts of unexploded ordnance in the vicinity of the site. We are awaiting copies of the RAF post war (1946/1948) aerial photographs which should allow better verification of the nature of building damage and associated UXO potential.</p> <p>Fragmented cement asbestos sheeting was recorded at surface during site walkover. Chrysotile asbestos (associated with cement asbestos sheeting) was recorded within a sample of demolition rubble. An investigation into the extent and nature of the asbestos should be undertaken across the site by a specialist contractor and recommendations for appropriate removal and treatment should be submitted to the statutory bodies for approval.</p>
Utility Locations (Section 7.0)	<p>Consultations with utility providers should be undertaken where plans to divert, abandon or re-use services. It would be prudent to obtain a complete set of service records, and survey, if not done so already, all drains, manholes and subterranean structures to confirm their line and depth prior to commencing site redevelopment.</p>
Landfill Sites & Ground Gases (Section 8.0)	<p>The conceptual model has identified that hazardous gases sourced from offsite landfills and onsite deep fills are potential sources of hazardous gas which could impact upon receptors onsite.</p> <p>No onsite ground gas monitoring has been completed, although land to the north was investigated and monitored by Coopers and others between 1997 and 2002 prior to development as residential houses. The monitoring identified that the site require passive venting and proprietary methane resistant membranes which equated to Characteristic Situation 3 (CS3) in CIRIA 149 (superseded by C659, then C665).</p>

Basic Site Investigation Report for land at
Banks Road, Garston, Liverpool

Landfill Sites & Ground Gases (Section 8.0)	<p>No onsite ground gas monitoring has been completed, although land to the north was investigated and monitored by Coopers and others between 1997 and 2002 prior to development as residential houses. The monitoring identified that the site require passive venting and proprietary methane resistant membranes which equated to Characteristic Situation 3 (CS3) in CIRIA 149 (superseded by C659, then C665). Subject to statutory approval, it is proposed that placement of Characteristic Situation 2 (CIRIA 665), or Amber 1 (NHBC) gas protection measures are to be placed on all plots as a conservative assessment. Placement of monitoring wells and completion of a ground gas monitoring survey may reduce the scope of proposed protective measures.</p> <p>The site specific gas protection measures are designed to provide a passive vented layer beneath the floor slab and proprietary methane resistant, reinforced gas membrane with an aluminium core to inhibit the migration of hazardous gases through the floor slab which is also sufficient to withstand the construction process. Typical gas protection measure details for each floor slab type are provided within Appendix 12. The local authority will require an engineers report to verify the gas protection measures have been completed in accordance with the design. A method statement of inspections based upon slab type should be provided prior to development. Coopers can provide this service upon request.</p>
Geology, Hydrology & Hydrogeology (Section 9.0)	<p>Drift – Shirdley Hill Sand Formation overlying Glacial Till Bedrock – Chester Pebble Beds of the Sherwood Sandstone Group, which is of Triassic age. Faults –None affecting the site. Groundwater – Major Aquifer (Triassic bedrock) overlain by high leaching potential (urban) soils and intervening layer of low permeability drift. Shirdley Hill Sand Formation considered minor aquifer. Site within outer zone of a Groundwater Source Protection Zone. No discharge consents within a 1km radius of the site. No groundwater abstractions within 500m of the site. Flood Risk – Unaffected. Compressible Ground and Subsidence Hazards – No hazard. No special precautions with regard to foundations anticipated.</p>
Animal Burial Sites and other Environmental, Archaeological, Ecological and Conservation Issues (Section 10.0)	<p>Site unlikely to be affected by animal burial sites – No special precautions anticipated. No invasive or notifiable plant species identified within the site.</p>
Coal Mining and Brine Subsidence (Section 11.0)	<p>Site is unaffected by shallow coal mining. No special precautions regarding foundations recommended.</p>
Radon (Section 12.0)	<p>Unaffected – no special precautions required.</p>
Ground Conditions (Section 13.0)	<p><u>General</u> All parts of the site were accessible at the time of the ground investigation, 12 No. trial pits excavated by Coopers on 22 January 2009.</p> <p><u>Buried Structures</u> The majority of the former building lines contained remnant brick walls present typically from 0.2m below ground level (bgl), although in places present at surface. The remnant walls of the original building were present to depths of typically 1.25m bgl with no concrete footings or stepped bricks. The newer phases of buildings (post war) were constructed with concrete footings up to 0.3m thick encountered at a typical depth of 0.7m bgl.</p> <p>A suspected basement is situated in the northern part of the site to a depth of >2.5m. The extent and depth of basement as well as nature of remnant structures requires confirmation prior to commencing construction (after asbestos investigation/remediation).</p> <p>Concrete floor slabs associated with garages were recorded to be present at a depth of 0.6m bgl and was 0.15m thick.</p> <p><u>Ground Conditions</u> The typical soil profile for the site comprises:</p> <ul style="list-style-type: none"> • Topsoil typically thin to absent, with an area of buried topsoil between 0.4m to 2.0m bgl within trial pit TP9. • Fill depths varied between 0.6m bgl (Trial pit TP2) to 2.9m bgl (TP1). Fill consists of predominantly sand fill with variable inclusions of clinker, shale, coal, redundant electric cable, steel and wire fragments, whole and fragmented brick and glass. Lesser areas of Rubble fill/demolition (fragmented brick and concrete) fill, clay fill, and ash/clinker fill were recorded. <p>Natural strata consisted of predominantly stiff clay (glacial till) located beneath fill strata. Intermittent layers of pockets of silt and sand present within the clay at depths of >1.8m bgl. Bedrock not encountered on site. Recorded approximately 30m to the north of the site as sandstone at a depth of 3.4m to 6m depth.</p>

**Basic Site Investigation Report for land at
Banks Road, Garston, Liverpool**

<p>Landfill Sites & Ground Gases (Section 8.0)</p>	<p>No onsite ground gas monitoring has been completed, although land to the north was investigated and monitored by Coopers and others between 1997 and 2002 prior to development as residential houses. The monitoring identified that the site require passive venting and proprietary methane resistant membranes which equated to Characteristic Situation 3 (CS3) in CIRIA 149 (superseded by C659, then C665). Subject to statutory approval, it is proposed that placement of Characteristic Situation 2 (CIRIA 665), or Amber 1 (NHBC) gas protection measures are to be placed on all plots as a conservative assessment. Placement of monitoring wells and completion of a ground gas monitoring survey may reduce the scope of proposed protective measures.</p> <p>The site specific gas protection measures are designed to provide a passive vented layer beneath the floor slab and proprietary methane resistant, reinforced gas membrane with an aluminium core to inhibit the migration of hazardous gases through the floor slab which is also sufficient to withstand the construction process. Typical gas protection measure details for each floor slab type are provided within Appendix 12. The local authority will require an engineers report to verify the gas protection measures have been completed in accordance with the design. A method statement of inspections based upon slab type should be provided prior to development. Coopers can provide this service upon request.</p>
<p>Geology, Hydrology & Hydrogeology (Section 9.0)</p>	<p>Drift – Shirdley Hill Sand Formation overlying Glacial Till Bedrock – Chester Pebble Beds of the Sherwood Sandstone Group, which is of Triassic age. Faults –None affecting the site. Groundwater – Major Aquifer (Triassic bedrock) overlain by high leaching potential (urban) soils and intervening layer of low permeability drift. Shirdley Hill Sand Formation considered minor aquifer. Site within outer zone of a Groundwater Source Protection Zone. No discharge consents within a 1km radius of the site. No groundwater abstractions within 500m of the site. Flood Risk – Unaffected. Compressible Ground and Subsidence Hazards – No hazard. No special precautions with regard to foundations anticipated.</p>
<p>Animal Burial Sites and other Environmental, Archaeological, Ecological and Conservation Issues (Section 10.0)</p>	<p>Site unlikely to be affected by animal burial sites – No special precautions anticipated. No invasive or notifiable plant species identified within the site.</p>
<p>Coal Mining and Brine Subsidence (Section 11.0)</p>	<p>Site is unaffected by shallow coal mining. No special precautions regarding foundations recommended.</p>
<p>Radon (Section 12.0)</p>	<p>Unaffected – no special precautions required.</p>
<p>Ground Conditions (Section 13.0)</p>	<p><u>General</u> All parts of the site were accessible at the time of the ground investigation, 12 No. trial pits excavated by Coopers on 22 January 2009.</p> <p><u>Buried Structures</u> The majority of the former building lines contained remnant brick walls present typically from 0.2m below ground level (bgl), although in places present at surface. The remnant walls of the original building were present to depths of typically 1.25m bgl with no concrete footings or stepped bricks. The newer phases of buildings (post war) were constructed with concrete footings up to 0.3m thick encountered at a typical depth of 0.7m bgl.</p> <p>A suspected basement is situated in the northern part of the site to a depth of >2.5m. The extent and depth of basement as well as nature of remnant structures requires confirmation prior to commencing construction (after asbestos investigation/remediation). Concrete floor slabs associated with garages were recorded to be present at a depth of 0.6m bgl and was 0.15m thick.</p> <p><u>Ground Conditions</u> The typical soil profile for the site comprises:</p> <ul style="list-style-type: none"> • Topsoil typically thin to absent, with an area of buried topsoil between 0.4m to 2.0m bgl within trial pit TP9. • Fill depths varied between 0.6m bgl (Trial pit TP2) to 2.9m bgl (TP1). Fill consists of predominantly sand fill with variable inclusions of clinker, shale, coal, redundant electric cable, steel and wire fragments, whole and fragmented brick and glass. Lesser areas of Rubble fill/demolition (fragmented brick and concrete) fill, clay fill, and ash/clinker fill were recorded. <p>Natural strata consisted of predominantly stiff clay (glacial till) located beneath fill strata. Intermittent layers of pockets of silt and sand present within the clay at depths of >1.8m bgl. Bedrock not encountered on site. Recorded approximately 30m to the north of the site as sandstone at a depth of 3.4m to 6m depth.</p>

Basic Site Investigation Report for land at
Banks Road, Garston, Liverpool

Ground Conditions...Continued (Section 13.0)	<p><u>Groundwater</u> Groundwater on site was restricted to seepages anticipated to derive from confined or semi-confined granular lenses within the clay. There was not sufficient water to sample. Based upon the nature of cohesive strata on the site the placement of traditional soakaways is considered unlikely to be sufficient for storm water drainage.</p>
Basis of Assessment (Section 14.0)	<p>Planning layout showing the future development of the site will comprise of 21 No. residential dwellings no greater than 2 storeys in height. No external works drawings provided to confirm regrading or slab levels. Site reported to be raised by 0.3m for purposes of generic assessment.</p>
Contamination (Section 15.0)	<p>Madeground similar to topsoil – Not analysed. Limited volume. Should be stockpiled and analysed during strip of site. Assume 100% topsoil requires importing. Fill – Elevated concentrations of benzo(a)pyrene, vanadium, arsenic and zinc. Asbestos also encountered. Asbestos investigation required to determine extent of this contamination by specialist contractor required. Natural Strata – Uncontaminated. Remediation – Inert cover for all properties comprising 0.1m remediation break layer, overlain by either 0.4m inert cover (front garden) or 0.6m inert cover (rear garden). Validation required regarding the investigation of the asbestos as well as the application of inert cover. Ground gas mitigation measures required within all properties. Strata encountered to date are predominantly considered as non-hazardous waste. Asbestos bearing waste and upper fill strata within trial pit TP2 anticipated being hazardous waste. Waste Acceptance Criteria (WAC) analysis of stockpiles may be required to reduce the disposal classification. Pre-treatment may be required within fill from trial pits TP1 and TP7 due to TOC >6%. This is anticipated to be due to coal fragments and may be removed by froth flotation within hub sites with soil washing facilities. Alkathene potable water supply anticipated with the requirement of a sterile trenches.</p>
Sub-Soil Classification (Section 16.0)	<p><u>Concrete Classification (Based on BRE Special Digest 1 (2005))</u> Clay – DS-1, AC-1s, DC-1 Granular Fill – DS-1, AC-1, DC-1 Cohesive Fill – DS-1, AC-1s, DC-1 <u>Shrinkage Potential</u> Clay – Low shrinkage potential. <u>Frost Susceptibility</u> Assume all site materials frost susceptible.</p>
Trees (Section 17.0)	<p>Immature to mature trees are located primarily around the periphery of the site. No Tree Preservation Orders applied to trees on or near the site. Site is underlain by clay or moisture susceptible strata at shallow depth which is adversely affected by trees. A tree survey was undertaken by qualified arboriculturalist in February 2009 recording species types and heights. Coopers assessed the affects of the trees in accordance with NHBC Standards, Chapter 4.2. The affect of trees in relation to the proposed planning layout are shown on Drawing No. 4987/FDZ in Appendix 12. It should be noted that these are based upon provision proposals for tree retention and are subject to confirmation of proposed regrading.</p>
Ground Floor Slabs (Section 18.0)	<p>For those plots not affected by existing trees or faults - cast in situ suspended floor slabs should be adopted (assume 13 No. for budget purposes). Plots considered to be subject to heave due to shallow clay strata and trees require precast suspended floor slabs (assume 6 No. for budget purposes). Plots within 10m of the fault in the western corner of the site require raft foundations. Consideration of adjacent plots is required when determining build order as foundation excavations within close proximity to the raft may destabilise the consolidated stone blanket. (Raft foundations/slabs assumed for 2 No. Plots for budget purposes). Subject to statutory approval, it is proposed that placement of Characteristic Situation 2 (CIRIA 665), or Amber 1 (NHBC) gas protection measures in lieu of completing ground gas monitoring. Additional monitoring may reduce the scope of proposed protective measures. Gas measures incorporate passive venting and placement of proprietary methane resistant, reinforced gas membrane with an aluminium core to inhibit the migration of hazardous gases through the floor slab which is also sufficient to withstand the construction process. Typical gas protection measure details for each floor slab type are provided within Appendix 12.</p>

Basic Site Investigation Report for land at Banks Road, Garston, Liverpool

<p>Anticipated Foundations (Section 19.0)</p>	<p><u>General</u> Foundation assessment is subject to approval of planning layout and confirmation of regrading proposals, and tree retention. For purposes of assessment the developer has indicated that site levels will be raised by 0.3m from levels current at the time of investigation. Given the potential instability of the boundary fences/walls along the south western boundary which retain the site by 1m to 1.5m and the proposals to further raise the site levels, it is anticipated that this boundary will require removal and replacement with designed retaining structures. Remnant walls, footings, and floor slabs should be grubbed up and replaced with suitably compacted granular fill prior commencing construction. Verification of the presence of a conjectured basement floor slab, along with surveying of the depth and extent is required prior to finalising foundation assessment. For budget purposes it is assumed the basement floor slab will require through breaking (but left in situ) to permit either raft or piled foundations. If raft foundations are considered in the area of the basement the infill material should consist of suitably consolidated granular fill, placed in layers not exceeding 0.225m thick. Where founding strata is >2m our client has indicated that piled foundations become economically viable options, and this has been incorporated into the foundation proposals for this site. All foundations and floor slabs should be specifically designed by a Structural Engineer once the planning layout and slab level requirements have been finalised.</p> <p><u>Bearing Strata</u> Bearing strata assumed to be a minimum depth of 0.75m (excluding raft foundations) onto natural clay, recorded as predominantly stiff, in places firm, firm to stiff, or very stiff. Bearing capacity of 100kN/m² for firm clay, 125kN/m² for firm to stiff clay, 150kN/m² for stiff clay and >150kN/m² for very stiff clay. Bearing capacity of 50kN/m² for consolidated stone blanket. Pile types and depths are subject to confirmation by specialist contractors but are assumed to be continuous/displacement flight auger (cfa/dfa) and end bearing within Triassic sandstone at a depth of between 5m and 10m.</p> <p><u>Foundation Types</u> The following foundation types are based upon generic depths of fill identified during investigation to date and may vary based upon the findings of additional exploratory holes, or commercial decisions associated with the foundation types.</p> <ul style="list-style-type: none"> • Traditional strip footing (0.5% by area). • Trenchfill/deep reinforced strip footing (42% by area). • Trenchfill with heave precautions/semi-stiff raft foundation on consolidated stone blanket (6% by area). • Piles and ground beams/semi-stiff raft foundation on consolidated stone blanket in areas affected by deep fill (40% by area), remnant basement (4% by area), and deep foundations due to >2m depth of heave affect by trees (4% by area with heave protection). • Semi-stiff raft foundation on consolidated stone blanket over area affected by fault (3.5% by area). <p>Based upon existing layout the conjectured foundations types by number of plots are as follows:</p> <ul style="list-style-type: none"> • Piles and ground beams 7 Plots (1 x 3 block, 1 x 4 block) • Piles and ground beams with heave precautions 2 Plots (1 x semi) • Semi-stiff raft foundation on consolidated stone blanket 2 Plots (1 x semi) • Trenchfill with heave precautions 4 Plots (1 x 4 block) • Trenchfill/deep reinforced strip footing 6 Plots (1 x 4 block, 1 x semi) <p>Refer to Coopers Drawing No. 4987/FDZ in Appendix 12 which shows the foundation types within different zones in relation to planning layout.</p>
<p>Dewatering and Trench Side Stability (Section 20.0 and 21.0)</p>	<p>Dewatering anticipated for the service excavations where perched waters over cohesive strata may be present or where land drains are breached. It is anticipated that any excavations within areas of deeper fill will be required to be fully supported or, if space allows, battered back to the safe angle of repose. Battering of excavations should be avoided in the proximity of existing trees and boundary structures without engineering assessment.</p>
<p>Road Sub-Grade (Section 22.0)</p>	<p>Road/car park formation materials anticipated to comprise of predominantly sand fill with lesser areas of clay fill. Remnant brick walls present along the majority of the former building lines to be grubbed up prior to commencing road construction (after asbestos investigation and removal). Areas of clay fill likely to softened or subject to differential settlement and therefore require removal and replacement with suitably consolidated granular fill. Sand fill CBR of 5 % after proof rolling.</p>

**Basic Site Investigation Report for land at
Banks Road, Garston, Liverpool**

Further Actions (Section
23.0)

Further action which may be required to progress the investigation to Detailed Report (D5) status could include, but not necessarily be limited to: -

- Due to the presence of services within or adjacent to the site, consultations are recommended with service providers to divert or abandon the services. It would be prudent to obtain a complete set of service records, and survey all drains, manholes and subterranean structures to confirm their line and depth prior to undertaking any construction works.
- Coopers are awaiting receipt of historical aerial photos from 1946/1948 and a subsequent detailed desk study should be undertaken if unexploded ordnance is considered potentially present within the site.
- Provide copy of Site Investigation Report to statutory bodies for approval.
- Due to the presence of services within or adjacent to the site, consultations with service providers to divert or abandon the services are recommended. It would be prudent to obtain a complete set of service records, and survey all drains, manholes and subterranean structures to confirm their line and depth prior to undertaking any construction works.
- Coopers are awaiting receipt of historical aerial photos from 1946/1948 and a subsequent detailed desk study should be undertaken if unexploded ordnance is considered potentially present within the site.
- Investigation of potential asbestos present on site by a specialist contractor. Report to be forwarded to Liverpool City Council/HSE for approval.
- Remediation/removal of asbestos from the site. Provide validation of the works for approval to Liverpool City Council/HSE.
- Further investigation of the buried topsoil within trial pit TP9 to delineate this feature.
- Further investigate the hotspot associated with trial pit TP2, once the asbestos affected soils have been removed to determine if elevated zinc and vanadium are localised or widespread contaminants.
- Verify the requirements for disposal of materials to enable developer to produce Site Waste Management Plan (SWMP).
- Validation will be required for the following:-
 - 1) Asbestos investigation and removal (as required or recommended by the surveys findings).
 - 2) Ground gas mitigation measures.
 - 3) Garden remediation (installation of inert cover).
- Install monitoring wells and undertake ground gas monitoring, or confirm that placement of robust gas protection measures is acceptable with statutory bodies in lieu of in situ monitoring.
- Any gas protection measures constructed will require an engineers inspection report to verify the suitable construction for approval by the local authority.
- If gas protection measures are constructed a site specific method statement of gas inspections should be drafted and submitted for approval prior to commencing development. Coopers can provide this service upon request.
- The extent of the basement, remnant structures, and nature of the infill will require confirmation prior to commencing construction.
- Where remnant structures are present they are likely to require thorough breaking out and suitable consolidation of granular derived materials fills. This must be completed after the investigation and removal of fragmented asbestos sheeting from demolition derived fills by a specialist contractor.
- Produce external works drawings, and finalise assessment of requirements for foundations, and inert cover.
- Provide copy of Site Investigation Report to statutory bodies for approval.
- Design of retaining measures in areas of existing retaining wall along the south western boundary.

This Basic Site Investigation should not be assumed to represent a complete account of all the potential geoenvironmental and geotechnical issues that may exist at the site. As such it is strongly recommended that the Detailed Report, once prepared and issued, should be read in its entirety.