Land off Rampton Road, Cottenham

Ground Conditions Desk Study

Final Report for

May 2016
Hydrock Ref: R/14878/001 Issue 3
This page has been left blank intentionally
Hydrock Consultants Limited has prepared this report in accordance with the instructions of the above named client for their sole and specific use. Any third parties who may use the information contained herein do so at their own risk.
Contents

1.0 INTRODUCTION ................................................................................................................................. 1
2.0 PRELIMINARY INVESTIGATION (PHASE 1 STUDY) .......................................................................... 2
3.0 PRELIMINARY RISK ASSESSMENT ...................................................................................................... 9
4.0 DESK STUDY CONCLUSIONS ............................................................................................................ 14
5.0 UNCERTAINTIES AND LIMITATIONS ................................................................................................. 15
6.0 RECOMMENDATIONS FOR FURTHER WORK ..................................................................................... 16
7.0 REFERENCES ....................................................................................................................................... 17

Appendices

Appendix A Drawings
Appendix B Site Walkover Photographs
Appendix C Historical Ordnance Survey Maps
Appendix D Desk Study Research Information
Appendix E Hydrock Methodology
This page has been left blank intentionally
# Executive Summary and Conceptual Site Model

<table>
<thead>
<tr>
<th>SITE INFORMATION AND SETTING</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Report Purpose</strong></td>
<td>Phase 1 desk study and preliminary risk assessment.</td>
</tr>
<tr>
<td><strong>Client</strong></td>
<td>Gladman Developments Ltd (Gladman).</td>
</tr>
<tr>
<td><strong>Site</strong></td>
<td>Land off Rampton Road, Cottenham, Cambridgeshire.</td>
</tr>
<tr>
<td><strong>Site Location</strong></td>
<td>Off Rampton Road, Cottenham, Cambridgeshire. The nearest post code is CB24 8TJ and the approximate National Grid Reference for the site centre is 544007E 267403N.</td>
</tr>
<tr>
<td><strong>Current Land Use and Description</strong></td>
<td>The study site is currently agricultural land which forms the northeastern part of a much larger arable field. The site slopes gently down towards the northwest, although there is a break of slope running northeast-southwest across the middle of the site where the gradient of the slope increases. The surrounding land use is a mixture of residential and agricultural. Residential properties bound the site to the east. Open farmland and paddocks bound the site to the north, west and south.</td>
</tr>
<tr>
<td><strong>Development</strong></td>
<td>The proposed development is for up to 200 traditional housing units with gardens, access roads and associated infrastructure, and up to 70 apartments with care (C2).</td>
</tr>
<tr>
<td><strong>Site History</strong></td>
<td>The historical map evidence indicates that the study site has been agricultural land since at least 1887. A small orchard is mapped in the southeastern part of the site between 1938 and 1974. Historically land use in the areas immediately surrounding the site has been a mixture of agricultural and residential. Two windmills were present 120 and 170m to the east of the site from the earliest mapping until 1938. A gas works was formerly located approximately 660m to the east but had been redeveloped for housing by 1950. No potentially significant contaminative historical land uses have been identified either at the site or in the areas immediately surrounding it.</td>
</tr>
<tr>
<td><strong>Unexploded Ordnance</strong></td>
<td>The Zetica UXB map shows low bomb risk, and no further consideration of UXO is required.</td>
</tr>
<tr>
<td><strong>Geology</strong></td>
<td>The underlying geology comprises the Kimmeridge Clay (mudstones) in the northwestern half of the site and the Woburn Sands Formation (sandstone) in the southeastern part of the site. No superficial deposits or Made Ground are indicated to underlie the site.</td>
</tr>
<tr>
<td><strong>Mining and Ground Stability</strong></td>
<td>The site is not located within an area of coal mining or brine abstraction, and there is no evidence that mining or quarrying has occurred at the site or in its near vicinity. There is a low risk of running sands within the Woburn Sands Formation and the Kimmeridge Clay has a low to moderate volume change potential.</td>
</tr>
<tr>
<td><strong>Hydrogeology</strong></td>
<td>The Kimmeridge Clay is classified as Unproductive Strata and the Woburn Sands Formation is classified as a Principal Aquifer. The study site is not located in a SPZ. There is one groundwater abstraction licence within 1000m of the site, located 918m to the northwest for farming and domestic use.</td>
</tr>
<tr>
<td><strong>Hydrology</strong></td>
<td>A series of drains are located to the north and northwest of the study site, the nearest being the Catch Water Drain, located 158m to the northwest. There are no surface water abstractions within 1000m of the site, and no licensed discharge consents within 500m of the site.</td>
</tr>
<tr>
<td><strong>Flood Risk</strong></td>
<td>The site is in Flood Zone 1, with low probability of flooding, and is within 50m of an area susceptible to groundwater flooding within unconfined aquifers (Clearwater flooding).</td>
</tr>
<tr>
<td><strong>Radon</strong></td>
<td>No radon protective measures are necessary in any buildings constructed at the site, according to current guidance.</td>
</tr>
</tbody>
</table>
Soakaways

Soakaway drainage is considered to be potentially viable option for the southeastern part of the site, subject to the permeability of the Woburn Sands and the depth to the groundwater.

Waste Management

No waste management sites are recorded within 1000m of the site. There is a record of a Category 3 or 4 Radioactive Substances Licence 210m to the south east of the site. It is considered unlikely that radioactive waste was disposed of at the site in question.

Geotechnical Hazards from Desk Study

Potential geotechnical hazards based on the expected ground conditions are listed below:
- Uncontrolled Made Ground – excessive settlement (creep and inundation settlement or differential settlement of foundations, roads and infrastructure elements).
- Attack of buried concrete by aggressive ground conditions – the development site may contain unknown Made Ground and potentially sulfate bearing soils.
- Shrink / swell of clay – settlement / heave of foundations when located within the influence of trees and vegetation.
- Running sands and shallow groundwater in the Woburn Sands Formation, leading to difficulty with excavation due to trench collapse.

Possible Contaminant Linkages of Moderate or Greater Risk Level - From Desk Study

The possible pollutant linkages on an un-remediated site determined by desk study and walk-over are summarised below for risk levels of moderate or greater.

<table>
<thead>
<tr>
<th>Source(s)</th>
<th>Potential Impact On</th>
<th>Receptor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No potentially significantly contaminative land uses have been identified at either the site or in the areas surrounding it, and no significant pollutant linkages have been identified.

Conclusions

Based on historic land uses and its current operational use, the overall risk from land contamination at the site is considered to be **very low to low** for both the current development and redeveloped site. However, this assessment would need to be confirmed by appropriate intrusive investigation, chemical soil and water testing and risk assessment.

It is considered that it is unlikely that the site would be classified as Contaminated Land under Part 2A of the EPA 1990.

Based on the available desk study and walk-over information, the following geotechnical issues need to be addressed in exploratory investigation:
- determine the presence, nature and depth of any Made Ground across the site;
- determine the strata and soil strength profile beneath the site; and
- assess the sulfate concrete classification required.

Further Work

In order to confirm the actual risks to receptors and confirm the ground conditions with respect to potential geotechnical and geo-environmental risks, an appropriate intrusive investigation will need to be undertaken. Based on the current data, this site investigation is proposed to comprise:
- the excavation of trial pits to allow collection of samples for geotechnical and chemical analysis, to assess trench stability, over break potential and “digibility”;
- soil infiltration rate testing, targeting the Woburn Sands Formation present across the southeastern site, to determine the suitability and location of future soakaways;
- dynamic sampling to allow collection of samples for geotechnical and chemical analysis of shallow soils and allow in-situ testing (SPTs) to be undertaken to assess density of the shallow soils to aid in foundation design, and to allow the installation of groundwater monitoring wells;
- TRL Dynamic Cone Penetration tests to correlate to CBRs for pavement design;
- groundwater level monitoring;
- geotechnical testing of soils and rock; and
- contamination analyses of soil and groundwater.

This Executive Summary forms part of Hydrock Consultants Limited report number R/14878/001 (Issue 3) and should not be used as a separate document.
1.0 INTRODUCTION

1.1 Terms of Reference

In October 2014, Hydrock Consultants Limited (Hydrock) was commissioned by Gladman Developments Ltd (Gladman) to undertake a desk study at Land off Rampton Road, Cottenham, Cambridgeshire.

The site covers approximately 14.16ha and is currently agricultural land which forms the northeastern part of a much larger arable field. The developable area is 6.23ha.

The proposed development is for up to 200 traditional housing units with gardens, access roads and associated infrastructure, and up to 70 apartments with care (C2).

This report has been prepared on behalf of Gladman Developments Ltd (GDL) in support of an outline planning application for the residential development of Land off Rampton Road, Cottenham. This application is a resubmission of application S/1818/15/OL, which was refused by the Planning Committee on the 11th May 2016.

A site location plan (Drawing 14878/D001) and a site features plan (Drawing 14878/D002) are presented in Appendix A.

1.2 Objectives

The objectives of this investigation are to assess the potential ground and groundwater conditions to provide initial (desk based) geotechnical design recommendations from the readily available information at the site. From this it will be possible to carry out a preliminary assessment of potential contamination risk and geotechnical hazards.

1.3 Scope

The scope of work for this commission comprises:

- a desk study and site walk-over reconnaissance to determine the nature of the site and its surroundings, including current and former land uses, geology, hydrogeology, hydrology and geo-environmental data; and
- reporting on findings.

See Appendix E for detailed reporting methodology.

1.4 Provided Information

The following has been provided to Hydrock by Gladman Developments Ltd (Gladman) for use in the preparation of this report:

- Gladman Developments Ltd (Gladman). “Land off Rampton Road, Cottenham: Development Framework”.
2.0 PRELIMINARY INVESTIGATION (PHASE 1 STUDY)

A number of desk study sources have been used to assemble the following information, including a proprietary environmental data report which has been obtained for the site (dated 27th October 2014) and is presented in Appendix D.

2.1 Site Referencing

The site is referenced in Table 2.1.

Table 2.1: Site Referencing Information

<table>
<thead>
<tr>
<th>Item</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site name</td>
<td>Land off Rampton Road, Cottenham.</td>
</tr>
<tr>
<td>Site location and National Grid Reference</td>
<td>To the south of Rampton Road, Cottenham, Cambridgeshire. The nearest post code is CB24 8TJ and the approximate National Grid Reference of the site centre is 544007E 267403N.</td>
</tr>
</tbody>
</table>

A site location plan is provided in Appendix A (Drawing 14878/D001).

2.2 Site Description and Walk-Over Survey

A walk-over reconnaissance survey was undertaken on the 28 October 2014 to confirm the findings of the desk study and assess visually any potential hazards and receptors. Photographs are presented in Appendix B.

The current study site conditions are summarised in Table 2.2.

Table 2.2: Site Description

<table>
<thead>
<tr>
<th>Item</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site access</td>
<td>Vehicle access is via a double gate off Rampton Road in the northeast of the site.</td>
</tr>
<tr>
<td>Land area</td>
<td>Approximately 14.16 ha, of which 6.23ha is developable.</td>
</tr>
<tr>
<td>Elevation, topography etc.</td>
<td>The study site slopes gently to the northwest. There is a break of slope running northeast southwest across the middle of the site, where the gradient of the slope increases.</td>
</tr>
<tr>
<td>Site boundaries</td>
<td>The northeastern boundary follows Rampton Road, the northern quarter of which consists of a hedge. The rest of the northeast boundary is defined by the rear gardens of the adjacent houses. The northwestern and southeastern boundaries follow the hedge boundaries between the fields. The southwestern boundary is undefined.</td>
</tr>
<tr>
<td>Present land use</td>
<td>The study site currently comprises the northeastern part of a larger arable field. Some minor amounts of litter were noticed across the site. An overhead telephone cable crosses the site entrance.</td>
</tr>
</tbody>
</table>
Vegetation
At the time of the walkover the study site was covered in crops. Hedgerows, locally including mature trees, form some of the site boundaries, and many trees and shrubs are present in the gardens of the adjacent residential gardens to the northeast. All vegetation appeared to be healthy, as would be expected given the site’s current use. There was no evidence noted during the walk over for the presence of invasive species, such as Japanese Knotweed. However, this report should not be considered a formal survey of such species.

General site sensitivity
The site is located in a mixed agricultural and residential setting, with the village of Cottenham to the east. There are no designated environmentally sensitive sites within 500m of the site.

Surrounding land
Residential properties and Rampton Road bound the site to the northeast. Open farmland and paddocks bound the site to the north, west and south.

### 2.3 Site History

A study of historical Ordnance Survey maps (Appendix C) has been undertaken to identify any former land uses at the site and surrounding areas which may have geotechnical or geo-environmental implications for the proposed development and is summarised in Table 2.3.

#### Table 2.3: Key Features from Historical Mapping

<table>
<thead>
<tr>
<th>Map Edition and Scale</th>
<th>Key Features on Site</th>
<th>Key Features off Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>1887 (1:10,560) &amp; 1888 (1:2,500)</td>
<td>The site is shown to form part of three adjoining fields of unequal size. A trig station is shown in the western half of the central field.</td>
<td>The study site is surrounded by fields. The village of Cottenham, surrounded by orchards, lies 500m to the east. Two windmills used to grind corn lie to the east of the site. The first is 120m to the east and is indicated to have included an engine house, pump and well. The second lies 170m to the east. A cemetery is located 490m to the east. A Gas Works is located 660m to the east of the site. A number of named drains lie to the north and northwest of the site. They include the Catch Water Drain (180m northwest), the Smity Fen Engine Drain (390m northwest) and the New Cut (700m north).</td>
</tr>
<tr>
<td>1901 (1:10,560) &amp; 1902 (1:2,500)</td>
<td>No significant change.</td>
<td>The gas works to the east is no longer marked as such, although the buildings and ancillary structures remain in situ.</td>
</tr>
<tr>
<td>1938 (1:2,500)</td>
<td>The internal field boundaries are no longer marked. A narrow orchard runs northeast-southwest through the southeastern part of the site.</td>
<td>A row of houses is shown immediately to the northeast. The two windmills and associated buildings are no longer shown and the sites have been redeveloped for residential properties.</td>
</tr>
<tr>
<td>1950 (1:10,560)</td>
<td>No significant change.</td>
<td>More houses are shown along Rampton Road to the east and 130m to the south of the study site. Allotments are shown 90m to the east. The site of the gas works to the east appears to have been developed for residential use.</td>
</tr>
<tr>
<td>Map Edition and Scale</td>
<td>Key Features on Site</td>
<td>Key Features off Site</td>
</tr>
<tr>
<td>----------------------</td>
<td>----------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>1974 (1:2,500)</td>
<td>The orchard is no longer shown.</td>
<td>More houses are shown along Rampton Road immediately to the east of the site.</td>
</tr>
<tr>
<td>1978-1979 (1:10,000)</td>
<td>No significant change.</td>
<td>Rampthill Farm is shown for the first time immediately to the east of Rampton Road. A school and associated playing field are shown 210m to the east of the study site. There has been further residential development in Cottenham.</td>
</tr>
<tr>
<td>1990 &amp; 1994 (1:2,500)</td>
<td>No significant change.</td>
<td>No significant change.</td>
</tr>
<tr>
<td>2002 (1:10,000)</td>
<td>No trees are shown on the study site.</td>
<td>There has been further residential development in Cottenham.</td>
</tr>
<tr>
<td>2010 and 2014 (1:10,000)</td>
<td>No significant change.</td>
<td>No significant change.</td>
</tr>
</tbody>
</table>

In summary, the historical map evidence indicates that the study site has been agricultural land since at least 1887. A small orchard is mapped in the southeastern part of the site between 1938 and 1974.

Historically land use in the areas immediately surrounding the site has been a mixture of agricultural and residential. Two windmills were present 120 and 170m to the east of the site from the earliest mapping until 1938. A gas works was formerly located approximately 660m to the east but had been redeveloped for housing by 1950.

No potentially significant contaminative historical land uses have been identified either at the site or in the areas immediately surrounding it.

2.4 Unexploded Ordnance/Bombs

In general accordance with CIRIA report C681 (Stone et al 2009) a non-UXO specialist screening exercise has been carried out for the site. The Zetica UXB map (Cambridgeshire) indicates the site to be in an area where the bomb risk is low.

A copy of the Zetica map is presented in Appendix D.

2.5 Geology

The general geology of the site area is shown on the British Geological Survey (BGS) 1:50,000 geological map of Cambridge (Sheet 188) and is summarised in Table 2.4.
Table 2.4: Geology

<table>
<thead>
<tr>
<th>Location</th>
<th>Age</th>
<th>Stratigraphic Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Site</td>
<td>Lower Cretaceous</td>
<td>Woburn Sands Formation (Lower Greensand Group)</td>
<td>Fine to coarse sandstone (or loose sand). It is commonly silty with few clay seams or wisps, cross-bedded, with some pebbles and phosphatic nodules at the base. It is typically grey or greenish grey, weathering to a yellowish brown. Minor lignite and pyrite.</td>
</tr>
<tr>
<td>On Site</td>
<td>Upper Jurassic</td>
<td>Kimmeridge Clay</td>
<td>Mudstones (calcareous or kerogen-rich or silty or sandy); thin siltstone and cementstone beds; locally sands and silts.</td>
</tr>
</tbody>
</table>

The BGS maps indicate that superficial deposits and Made Ground are absent from beneath the site.

There are no faults shown running beneath or within influencing distance of the site.

2.6 Mining or Mineral Extraction

The site is not within areas of recorded coal mining or brine extraction. Whilst the Kimmeridge Clay Formation could provide a potential source of clay for brick manufacture there is no evidence on the historical plans of any brick pits or brick and tile works having existed in the near vicinity of the site.

2.7 Ground Stability

There is a low risk of running sands within the Woburn Sands Formation and the Kimmeridge Clay has a low to moderate volume change potential.

2.8 Hydrogeology

The aquifer designations given in Table 2.5 are based on the Environment Agency interactive aquifer designation map. Additional information on the hydraulic characteristics of the geological units has been abstracted from Allen et al (1997) and Jones et al (2000).

Table 2.5: Hydraulic Characteristics of Strata

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Aquifer Designation</th>
<th>Hydraulic Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woburn Sands Formation</td>
<td>Principal aquifer</td>
<td>Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale.</td>
</tr>
<tr>
<td>Kimmeridge Clay</td>
<td>Unproductive strata</td>
<td>Dominated by low permeability clay, these are rock layers that have negligible significance for water supply or river base flow.</td>
</tr>
</tbody>
</table>

Reference to the Environment Agency website shows the following groundwater body beneath the site and the current chemical status (Table 2.6).
Table 2.6: Groundwater Body

<table>
<thead>
<tr>
<th>Category</th>
<th>Label / Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterbody ID</td>
<td>GB40501G445700</td>
</tr>
<tr>
<td>Waterbody name</td>
<td>Cam and Ely Ouse Woburn Sands</td>
</tr>
<tr>
<td>River basin district</td>
<td>Anglian</td>
</tr>
<tr>
<td>Current quantitative status</td>
<td>Good</td>
</tr>
<tr>
<td>Current chemical status</td>
<td>Good</td>
</tr>
<tr>
<td>Upward chemical trend</td>
<td>No</td>
</tr>
<tr>
<td>2015 predicted qualitative status</td>
<td>Good</td>
</tr>
<tr>
<td>2015 predicted chemical status</td>
<td>Good</td>
</tr>
<tr>
<td>Overall risk</td>
<td>At Risk</td>
</tr>
<tr>
<td>Protected area</td>
<td>Yes</td>
</tr>
</tbody>
</table>

The site is not within a Source Protection Zone (SPZ).

There is one licensed groundwater abstraction within 1000m of the site. The licence, Ref. 6/33/35/*G/004, was originally issued on 01/01/1966 and relates to the abstraction of groundwater from a point 918m to the southeast for general farming and domestic use.

2.9 Hydrology and Flooding

The surface water features in the vicinity of the site are listed in Table 2.7.

Table 2.7: Surface Water Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Location Relative to Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catch Water Drain (Secondary River)</td>
<td>158m northwest</td>
</tr>
<tr>
<td>Smithy Fen Engine Drain (Secondary River)</td>
<td>372-380m northwest-west</td>
</tr>
<tr>
<td>Drain (Tertiary River)</td>
<td>380m southwest</td>
</tr>
</tbody>
</table>

There are no surface water abstractions within 1000m of the site, and no licensed discharge consents within 500m of the site.

The site is in Flood Zone 1, with low probability of flooding\(^1\).

---

\(^1\) Note that the probabilities of flooding and the risk designations differ between the Environment Agency and the Technical Guidance to the National Planning Policy Framework (DCLG March 2012) and that the published flood map only relates to flooding from rivers, estuaries and the sea and does not include other potential sources such as surface water, groundwater, sewers, canals and reservoirs. Note also that the presence on the map of flood defences, or areas benefiting from flood defences, should not be taken to imply that a proposed development in these areas is acceptable, see Appendix E for details.
The site is within 50m of an area susceptible to groundwater flooding within unconfined aquifers (Clearwater flooding).

No further consideration of flood risk is undertaken in this report. Specialist flood risk advice should be sought with regards to drainage and flooding.

2.10 Soakaways

The geological and hydrogeological characteristics of the study area are such that soakaway drainage is considered to be potentially viable option for the southeastern part of the site, subject to the permeability of the Woburn Sands and the depth to the groundwater. Future infiltration tests are therefore recommended across this part of the site.

2.11 Waste Management and Hazardous Substances

No waste management sites are recorded within 1000m of the site.

There are no records relating to the storage of radioactive materials within 500m of the site. However there is a record of a Category 3 or 4 Radioactive Substances Licence 210m to the south east of the site. The permit, Ref. AM6455, related to the disposal of radioactive waste by Bayer Cropscience Ltd and was approved on 14/06/1994, effective from 22/07/1994 and last updated on 01/07/2014. The status of the permit is recorded as revoked/cancelled, and it is assumed that no radioactive waste was disposed of at the site in question.

There are no records of prosecutions relating to authorised processes in the vicinity of the site.

There is no Local Authority Pollution Prevention and Controls, COMAH sites, NIHHS sites, or Planning Hazardous Substance consents or enforcements within 500m of the site.

There are no known industrial / commercial premises operating in the immediate vicinity of the site.

2.12 Previous Evidence of Known Contamination Events

There are no records of pollution incidents on, or in the vicinity of, the site.

2.13 Natural Soil Chemistry

Information contained within the environmental data report (Appendix D) gives indicative natural concentration values (estimated) for the natural soils at the site for a selection of Contaminants of Potential Concern. These have been reproduced in Table 2.8.
Table 2.8: Natural Soil Chemistry

<table>
<thead>
<tr>
<th>Contaminants of Potential Concern</th>
<th>Estimated Concentrations (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>&lt;15 - 35</td>
</tr>
<tr>
<td>Cadmium</td>
<td>&lt;1.8</td>
</tr>
<tr>
<td>Chromium</td>
<td>60 - 90</td>
</tr>
<tr>
<td>Lead</td>
<td>&lt;150</td>
</tr>
<tr>
<td>Nickel</td>
<td>15 - 45</td>
</tr>
</tbody>
</table>

The values presented in Table 2.8 may act as guidance, indicating expected natural background concentration levels, and thereby provide a baseline estimate that can be used to assess the significance of the results of any chemical soil testing data acquired during future ground investigations at the site.

2.14 Radon

Reference to the Indicative Atlas of Radon in England and Wales (Miles et al 2007) and BR 211 (Scivyer 2007) indicates that the site is not in a Radon Affected Area and no radon protection measures are required in any buildings that may be constructed at the site.

2.15 BGS Borehole Archive

There are no logs available from the BGS archive for exploratory holes in the vicinity of the site.
3.0 PRELIMINARY RISK ASSESSMENT

3.1 Preliminary Ground Model

The findings of the Phase 1 investigation indicate that the study site is currently agricultural land which forms the northeastern part of a much larger arable field.

The historical map evidence indicates that the study site has been agricultural land since at least 1887. A small orchard is mapped in the southeastern part of the site between 1938 and 1974.

Historically land use in the areas immediately surrounding the site has been a mixture of agricultural and residential. Two windmills were present 120 and 170m to the east of the site from the earliest mapping until 1938. A gas works was formerly located approximately 660m to the east but had been redeveloped for housing by 1950.

No potentially significant contaminative land uses have been identified either at the site or in the areas immediately surrounding it.

The underlying geology comprises the Kimmeridge Clay (mudstones) in the northwestern half of the site and the Woburn Sands Formation (sandstone) in the southeastern part of the site. No superficial deposits or Made Ground are indicated to underlie the site.

The Kimmeridge Clay is classified as Unproductive Strata and the Woburn Sands Formation is classified as a Principal Aquifer. The study site is not located in a SPZ. There is one groundwater abstraction licence within 1000m of the site, located 918m to the northwest for farming and domestic use.

A series of drains are located to the north and northwest of the study site, the nearest being the Catch Water Drain, located 158m to the northwest. There are no surface water abstractions within 1000m of the site, and no licensed discharge consents within 500m of the site.

The site is in Flood Zone 1, with low probability of flooding, and is within 50m of an area susceptible to groundwater flooding within unconfined aquifers (Clearwater flooding).

No waste management sites are recorded within 1000m of the site. There is however a record of a Category 3 or 4 Radioactive Substances Licence 210m to the south east of the site. The licence was awarded to Bayer Cropscience Ltd for the disposal of radioactive waste. The licences current status is: revoked/cancelled. It is assumed that no radioactive waste was disposed of on site.

There are no records of pollution incidents on, or in the vicinity of, the site.

The proposed development is for up to 200 traditional housing units with gardens, access roads and associated infrastructure, and up to 70 apartments with care (C2).

3.2 Preliminary Exposure Model

The preliminary exposure model is used for geo-environmental hazard identification and establishing potential contaminant linkages in line with the Statutory Guidance to Part 2A of the Environmental Protection Act 1990, also known as ‘potential pollution linkages’ in the Model.
Procedures of CLR11 (Environment Agency, 2004). This is based on the contaminant-pathway-
receptor linkage approach.

### 3.2.1 Potential Contaminants

For the purpose of this assessment the potential contaminants have been separated according
to whether they are likely to have originated from on-site or off-site sources.

**Potential On-Site Sources of Contamination**

- Made Ground possibly including elevated concentrations of metals, metalloids, and PAHs;
- Potentially persistent pesticides from historic agricultural usage; and
- Elevated concentrations of metals within natural soils.

Although it is possible that the degradation of organic material in any Made Ground beneath
the site may lead to the generation of methane and carbon dioxide, it is considered unlikely
that significant quantities of Made Ground are present. Consequently, the risks posed by
ground gases from this source are considered to be very low and are not considered further in
this assessment.

**Potential Off-Site Sources of Contamination**

No potential off-site sources of contamination have been identified in the near vicinity of the
site.

It should be noted that ground gases from offsite sources have been excluded as there are no
landfills within 1000m of the site.

### 3.2.2 Potential Receptors

- Humans (neighbours, site end users).
- Development end use (buildings, utilities and landscaping).
- Groundwater: Principal Aquifer status of the Woburn Sands Formation.
- Surface water: Drains 158m-380m to the northwest and north.

It should be noted that health and safety risks to site construction workers have not been
assessed and will need to be considered separately.

### 3.2.3 Potential Pathways

- Humans: ingestion, skin contact, inhalation of dust and outdoor air;
- Plant life: root uptake;
- Underlying groundwater: migration of contaminant via leachate dispersion;
- Underlying groundwater: migration of contaminants through the Woburn Sands Formation
  (Principal Aquifer);
- Surface water: overland flow;
- Surface water: drainage discharge; and
- Surface water: base flow from groundwater.

### 3.2.4 Summary of Potential Contaminant Linkages

Table 3.1 lists the plausible contaminant linkages which have been identified. These are considered as potentially unacceptable risks in line with guidelines published in CLR 11 and additional risk assessment is required.

Linkages has been assessed in general accordance with guidance in CIRIA Report C552 (Rudland et al. 2001) but with the addition of a ‘no linkage’ category. More details are given in Appendix E including descriptions of typical examples of probability and consequences.

It should be noted that whilst the risk assessment process undertaken in this report may identify potential risks to site demolition and redevelopment workers, consideration of occupational health and safety issues is beyond the scope of this report and need to be considered separately in the Construction Phase Health and Safety Plan.

<table>
<thead>
<tr>
<th>Probability</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Severe</td>
</tr>
<tr>
<td>High Likelihood</td>
<td>Very high risk</td>
</tr>
<tr>
<td>Likely</td>
<td>High risk</td>
</tr>
<tr>
<td>Low Likelihood</td>
<td>Moderate risk</td>
</tr>
<tr>
<td>Unlikely</td>
<td>Low risk</td>
</tr>
<tr>
<td>No Linkage</td>
<td>No risk</td>
</tr>
</tbody>
</table>
## Table 3.1: Exposure Model – Preliminary Risk Assessment of Source-Pathway-Receptor Contaminant Linkages

<table>
<thead>
<tr>
<th>Source(s)</th>
<th>Possible Pathway(s)</th>
<th>Receptor(s)</th>
<th>Probability</th>
<th>Consequence</th>
<th>Risk Level</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Made Ground possibly including elevated concentrations of metals, metalloid and PAH, as well as elevated concentrations of metals and metalloids in the natural soils.</td>
<td>Ingestion, inhalation or direct contact.</td>
<td>End-users of the site.</td>
<td>Unlikely</td>
<td>Medium</td>
<td>Very low</td>
<td>It is unlikely that significant quantities of Made Ground underlie the site, although this would need to be confirmed by intrusive ground investigation.</td>
</tr>
<tr>
<td></td>
<td>Root uptake.</td>
<td>New planting.</td>
<td>Unlikely</td>
<td>Mild</td>
<td>Very low</td>
<td>The site comprises agricultural land and vegetation on site was not noted as showing any signs of physical distress.</td>
</tr>
<tr>
<td></td>
<td>Inhalation of fugitive dust.</td>
<td>Neighbours.</td>
<td>Unlikely</td>
<td>Medium</td>
<td>Very low</td>
<td>Residential properties are located close to some of the site boundaries and occupiers might be affected by migration of dust, particularly during development. However, the risks associated with any dust generated from the site are considered to be negligible.</td>
</tr>
<tr>
<td></td>
<td>Surface run-off.</td>
<td>Surface water.</td>
<td>Unlikely</td>
<td>Medium</td>
<td>Very low</td>
<td>Significant soil contamination is unlikely to be present at the site, although this would need to be confirmed through intrusive investigation and chemical testing. The nearest surface water features are the drains 158m to the northwest of the site.</td>
</tr>
<tr>
<td></td>
<td>Leaching through unsaturated zone and groundwater discharge points.</td>
<td>Groundwater and possible abstractors.</td>
<td>Unlikely</td>
<td>Medium</td>
<td>Very low</td>
<td>It is considered unlikely that significant quantities of contaminated soils are present at the site. However, groundwater quality and potential impacts will need to be assessed by intrusive ground investigation, monitoring and chemical testing.</td>
</tr>
<tr>
<td>Pesticides from historic agricultural usage, which may be persistent</td>
<td>Ingestion, inhalation or direct contact.</td>
<td>End-users of the site.</td>
<td>Low likelihood</td>
<td>Medium</td>
<td>Low</td>
<td>The presence of possible pesticides from agricultural use is unknown and, whilst considered low risk, will need to be confirmed by ground investigation and chemical testing.</td>
</tr>
<tr>
<td></td>
<td>Root uptake.</td>
<td>New planting.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inhalation of fugitive dust.</td>
<td>Neighbours.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Leaching through unsaturated zone and groundwater discharge</td>
<td>Groundwater and possible abstractors.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Surface run-off.</td>
<td>Surface water.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.3 Geotechnical Hazard Identification

Potential geotechnical hazards based on the expected ground conditions are listed below:

- Uncontrolled Made Ground – excessive settlement (creep and inundation settlement or differential settlement of foundations, roads and infrastructure elements).
- Attack of buried concrete by aggressive ground conditions – the development site may contain unknown Made Ground and potentially sulfate bearing soils.
- Shrink / swell of clay – settlement / heave of foundations when located within the influence of trees and vegetation.
- Running sands and shallow groundwater in the Woburn Sands Formation, leading to difficulty with excavation due to trench collapse.
4.0 **DESK STUDY CONCLUSIONS**

Table 3.1 is a summary of the geo-environmental risks identified and the overall risk associated with the site has been designated using qualitative judgement according to the risk categories given in Table 4.1.

Based on historic land uses and its current operational use, the overall risk from land contamination at the site is considered to be **very low to low** for both the current development and for a redeveloped site. However, this assessment would need to be confirmed by appropriate intrusive investigation, chemical soil and groundwater testing and risk assessment.

It is considered that it is unlikely that the site would be classified as Contaminated Land under Part 2A of the EPA 1990.

**Table 4.1: Assessed Overall Risk Categories for the Site from Land Contamination**

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High Risk</td>
<td>A significant contaminant linkage, including actual evidence of significant harm or significant possibility and significant harm, is clearly identifiable at the site (e.g. from visual or documentary evidence) under current conditions, with potential for legal and/or financial consequences for the site owner or other Responsible Person. Remediation advisable based on acute impacts being likely. Immediate action should be considered.</td>
</tr>
<tr>
<td>High Risk</td>
<td>A contaminant linkage is identifiable at the site under current and future use conditions. Although likely, there is no obvious actual evidence of significant harm or significant possibility and significant harm under current conditions. Extent of risk is therefore subject to confirmation by investigation and risk assessment and most likely to be deemed significant. Realisation of the risk is likely to present a substantial liability to the site owner or other Responsible Person. Remediation required for redevelopment and may also be required under Part 2A for existing receptors.</td>
</tr>
<tr>
<td>Moderate Risk</td>
<td>A contaminant linkage is identifiable at the site under current and future use conditions. However, it is not likely to be a significant linkage under current conditions. It is either relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely, that the harm would be relatively mild. Actual extent of risk subject to confirmation by additional investigation and risk assessment and most likely to lie between no possibility of harm (under current conditions) and significant possibility of significant harm (under conditions created by new use). Remediation may be required for redevelopment.</td>
</tr>
<tr>
<td>Low Risk</td>
<td>Potential pathways and receptors exist but history of contaminative use or site conditions indicates that contamination is likely to be of limited extent and below the level of possibility of harm. It is unlikely that the site owner or other Responsible Person would face substantial liabilities from such a risk. Precautionary investigations and risk assessment advisable on change of use. Any subsequent remedial works are likely to be relatively limited.</td>
</tr>
<tr>
<td>Very Low Risk</td>
<td>No contaminant linkage likely to exist under current or future conditions, but this cannot be completely discounted. If harm is realised, it is likely at worst to be mild or minor. Site not capable of being determined under Part 2A where the Local Authority inspects the site. No further action recommended.</td>
</tr>
<tr>
<td>No Risk</td>
<td>No contaminant linkage exists.</td>
</tr>
</tbody>
</table>
5.0 UNCERTAINTIES AND LIMITATIONS

5.1 General Comments

This report details the findings of work carried out in May 2016. The report has been prepared by Hydrock on the basis of available information obtained during the study period. Although every reasonable effort has been made to gather all relevant information, all potential environmental constraints or liabilities associated with the site may not have been revealed.

The report has been prepared for the exclusive benefit of Gladman Developments Ltd (Gladman) and those parties designated by them for the purpose of providing geotechnical and geo-environmental recommendations for the site. The report contents should only be used in that context. Furthermore, new information, changed practices or new legislation may necessitate revised interpretation of the report after the date of its submission.

Information provided by third parties has been used in good faith and is taken at face value; however, Hydrock cannot guarantee its accuracy or completeness.

The work has been carried out in general accordance with recognised best practice as detailed in guidance documents such as the CLR 11 Model Procedures (Environment Agency 2004), BS 5930:1999 +A2:2010 and BS 10175:2011+A1:2013. Important aspects of the risk assessment process are transparency and justification. The rationale behind the assessments carried out for this report is given in Appendix E. Unless otherwise stated, no assessment has been made for the presence of radioactive substances or unexploded ordnance. Where the phrase “suitable for use” is used in this report, it is in keeping with the terminology used in planning control and does not imply any specific warranty or guarantee offered by Hydrock.

Unless otherwise stated, the chemical testing carried out for this report was not scoped to comply with the requirements of the water supply company and further work may be required.

The preliminary risk assessment process may identify potential risks to site demolition and redevelopment workers. However, consideration of occupational health and safety issues is beyond the scope of this report.

Please note that notwithstanding any site observations concerning the presence or otherwise of archaeological sites, asbestos-containing materials or invasive weeds such as Japanese Knotweed, this report does not constitute a formal survey of these potential hazards.

Any site boundary line depicted on plans does not imply legal ownership of land.
6.0 RECOMMENDATIONS FOR FURTHER WORK

In order to confirm the actual risks to receptors and confirm the ground conditions with respect to potential geotechnical and geo-environmental risks, an appropriate intrusive investigation will need to be undertaken. Based on the current data, this site investigation is proposed to comprise:

- the excavation of trial pits to allow collection of samples for geotechnical and chemical analysis, to assess trench stability, over break potential and “digability”;
- soil infiltration rate testing, targeting the Woburn Sands Formation present across the southeastern half of the site, to determine the suitability and location of future soakaways;
- dynamic sampling to allow collection of samples for geotechnical and chemical analysis of shallow soils and allow in-situ testing (SPTs) to be undertaken to assess density of the shallow soils to aid in foundation design, and to allow the installation of groundwater monitoring wells;
- TRL Dynamic Cone Penetration tests to correlate to CBRs for pavement design;
- groundwater level monitoring;
- geotechnical testing of soils and rock; and
- contamination analyses of soil and groundwater.
7.0 REFERENCES


This page has been left blank intentionally
Appendix A

Drawings

Drawings included in this report:
14878/D001 – Site Location Plan
14878/D002 – Site Features Plan
This page has been left blank intentionally
LAND OFF RAMPTON ROAD, COTTENHAM

Site Location Plan

Drawing Title:

Hydrock Job No: C/14878

Drawing No: 14878/D001

Architect:

Hydrock Consultants Ltd
4 Lakeside
Festival Park
Stoke-on-Trent
ST1 5RY
T +44 (0)1782 261919
stoke@hydrock.com
www.hydrock.com

Contains Ordnance Survey data © Crown copyright and database right 2014
This drawing is the copyright of Hydrock Consultants Ltd

Scale = 1:15,000

Site Location Plan

Drawing Status: FINAL

Drawing Date: 27/10/14
Check Date: 29/10/14
Scale @ A4: AS SHOWN

Minor amendments
09/06/2015
A

Scale = 1:150,000

COTTENHAM

SITE LOCATION
This page has been left blank intentionally
This page has been left blank intentionally
Appendix B

Site Walkover Photographs
This page has been left blank intentionally
Figure 1: Looking southwest across the study site from the northern end of the northeast boundary.

Figure 2: Looking southwest along the northwest boundary from the northern corner of the study site.
This page has been left blank intentionally
Figure 3: View east from the northwest boundary, looking towards the northeastern boundary.

Figure 4: View southeast across the study site from the northwest boundary.
This page has been left blank intentionally
Figure 5: Image of a large bird box halfway along the southwest boundary.

Figure 6: View northeast along the southeast boundary towards the houses on Rampton Road.
This page has been left blank intentionally
Figure 7: View west across the study site from the northeast boundary.

Figure 8: Looking southeast along the northeast boundary. Note the gardens bordering the site.
This page has been left blank intentionally
Figure 9: Looking northwest along the northeast boundary.

Figure 10: Looking northeast towards the site entrance.
This page has been left blank intentionally
Appendix C

Historical Ordnance Survey Maps
This page has been left blank intentionally