APPLiED GEOLOGY

REPORT ON
DESK STUDY
AT
TUNSTALL ROAD,
BIDDULPH

REPORT STATUS SHEET

Client:	Strata Housing Services Ltd
Report Title:	Report on Desk Study at Tunstall Road, Biddulph
Report Type:	Desk Study/Phase I Geoenvironmental Risk Assessment
Report Number:	AG2309-15-X07
Report Status:	Validated Issue 1
Date:	September 2015

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APPENDICES

1.0 INTRODUCTION

An area of land at the former Meadows Community Special School, Biddulph is being considered for redevelopment by Strata Housing Services Ltd, (the Client). The proposals for the site comprise construction of an ExtraCare development, together with associated access road, car parking, landscaped gardens and associated facilities. This report presents the results of a desk study/Phase I Geoenvironmental Risk Assessment, undertaken on behalf of the Client.

The desk study/Phase I assessment was undertaken to:

- Permit formulation of an opinion, as to the potential for hazardous substances or conditions to exist on, at or near the site at levels or in a situation likely to warrant mitigation or consideration appropriate to the intended end use proposed by the Client and as stated above.

- Establish geological conditions to aid safe and economic development design.

- Accompany a planning application.

The terms of reference/brief for the works were mutually developed between Copeland Wedge Associates (the Engineer) and Applied Geology Limited and are outlined in our proposal (Ref: AG15-4928let002) and estimate [Ref: AG15-4928-02) of the 12th August 2015. Limitations and Exceptions of the report are presented in Section 6.

More specifically, the services provided are summarised below and detailed in the following Sections.

- A site inspection and walkover survey to identify indicators (as defined in later sections) of the existence of hazardous substances or conditions on and in the vicinity of the site.

- A review of the following sources to provide data on likely ground conditions, geohazards and features which may affect development and to obtain information about the potential for hazardous substances to exist at and in the vicinity of the site:

  - GroundSure – Geoinsight and Environmental Reports
  - GroundSure – Historical maps
  - BGS - Published Information & Borehole Database
  - Coal Authority Mining Report (ref: 51000978850001) and Interactive Map Viewer
  - Environment Agency Web Site
  - MAGIC Web Site

- Assessment and reporting of the results of the works.

2.0 SITE LOCATION AND DESCRIPTION

2.1 General

The site is located at the former Meadows Community Special School, adjacent to the A527 Tunstall Road, approximately 1.15km to southwest of Biddulph town centre. The Ordnance Survey grid reference for the centre of the site is approximately SJ 879569 as shown on the Site Location Plan in Appendix A.

The site currently comprises the partly demolished Meadows Community Special School, with associated areas of landscaping access road and car parking.

The site is irregular in shape covering an area of approximately 1ha. The topography of the site generally slopes downhill from the east, towards the west, from approximately 98m AOD to approximately 95m AOD.

The site is bounded to the north by playing fields, to the south by Jacksons Plant Nursery, to the east by the A527 Tunstall Road and to the west by agricultural land.

2.2 Walkover Survey

A walkover survey was carried out by Applied Geology Ltd as part of the ground investigation on the 14th September 2015. Access to the site was via Tunstall Road.

The site comprised the partly demolished Meadows Community Special School. The existing floor slab was still present including associated recreational court and car parking, areas of soft landscaping and an access road. It is understood that the former school was destroyed by fire in 2004. Former hard-standing playgrounds were present across the western part of the site, with playing fields to the north. The eastern boundary of the site generally comprised an area of soft landscaping with semi-mature trees. The central section of the site was generally level, with elevation increasing towards the east along the access road.

View south across former car park, with landscaped area to the east

View east across former playground, with existing floor slab to the north

No visual or olfactory evidence of surface contamination or sources of contamination were identified during the walkover.

It should be noted that Applied Geology Limited does not provide arboricultural surveys or specialist surveys for the detection of invasive plant species (such as Japanese Knotweed) or protected species of wildlife. Whilst no Japanese Knotweed

or other controlled or invasive species was noted it is recommended that if required, separate investigation by specialists be undertaken to confirm this.

2.3 Proposed Development

The proposals for the site comprise construction of an ExtraCare development, together with associated access road, car parking, landscaped gardens and associated facilities as shown on the site layout plan, Drawing No: 1826-110 Rev E, dated 31st October 2014, by Barrie Newcombe Associates, which is presented in Appendix A.

3.0 DESK STUDY INFORMATION

3.1 Site History

Historical maps were obtained in order to determine any significant past activity or land usage. Copies of these maps are presented in Appendix B of this report and are described below:

Table 1 – Site History Summary

Map Date	On The Site	In The Vicinity Of The Site
1878-1880	The site comprises a field with scattered trees. A possible drainage ditch is shown across the north-eastern corner.	A railway line is shown 100m to the west. A colliery and associated shafts are shown approximately 50m east and 200m southeast of the site. Shafts are also shown approximately 100m to the northwest and 200m to the southwest of the site. A clay pit is shown approximately 250m to the northeast. Several collieries and associated shafts are shown at greater distances from the site, generally to the west and northwest between approximately 300m and greater than 1km. Several unmarked building are shown immediately south of the site, with a school shown approximately 100m to the south. A road is shown on the eastern boundary of the site, at the present day location of the A527.
1897-1900	Trees no longer shown.	The colliery 50m east of the site is no longer shown. The majority of collieries across the surrounding areas are no listed as 'old'.
1922-1925	A possible drainage ditch is shown across the south-western corner of the site. The possible drainage ditch previously shown across the north-eastern corner is no longer shown.	Urban expansion shown from approximately 100m north of the site, referenced as Biddulph.
1947-1950	No significant changes.	Some urban development shown approximately 100m southeast of the site, adjacent to the present day A527.
1953-1959	No significant changes.	A farm is shown immediately south of the southern site boundary. A surgery and tennis court are shown approximately 50m southeast of the site. The A527 is listed.
1965-1969	No significant changes. The possible drainage ditch on the south-western boundary is no longer shown.	A small irregular shaped building is shown immediately southwest of the site. Significant urban expansion is shown to the west of the A527. Collieries and associated shafts across the surrounding areas no longer shown.

Map Date	On The Site	In The Vicinity Of The Site
1974	A large L-shaped building is shown at the approximate centre of the site and listed as a school.	A nursery is shown immediately south of the site. The railway to the west of the site is listed as dismantled.
1981-1984	No significant changes.	No significant changes.
1993	No significant changes.	No significant changes.
2002	No significant changes.	No significant changes.
2010	No significant changes.	No significant changes.
2014	No significant changes.	No significant changes.

Summary

From the earliest map editions (1878) the site generally comprised a field with a possible drainage ditch on the north-eastern boundary. The possible drainage ditch is shown until the 1920's, when a further possible drainage ditch is shown on the south-western boundary. The possible drainage ditch on the south-western boundary is shown until the late 1960's. A school is first shown at the site from 1974 and is still shown to be present on the most recent published maps dated 2014. It is however understood that the school was destroyed by fire in 2004 and largely demolished since then.

Since at least 1878, the surrounding area has seen extensive coal mining until the late 1960's, with the majority of workings located to the west of the site. To the north, south and east, the site has seen substantial urban expansion, predominantly comprising residential estates.

3.2 Anticipated Geology

Reference to the published 1:50,000 scale British Geological Survey (BGS) map, Sheet 110, indicates the site to be underlain by Glacial Till (typically firm to stiff sandy gravelly clays with cobbles and boulders). Solid geology of the Pennine Lower Coal Measures Formation (typically mudstone, siltstone and sandstone with coal seams) is shown to underlie the superficial strata.

The Cockshead coal seam is shown to sub-crop beneath the superficial deposits across the western boundary of the site. A further coal seam (Banbury coal seam) is shown immediately west of this. The coal seams are shown to dip towards the west, away from the site at an angle of 25 degrees. The Bullhurst and Winpenny coal seams are shown to sub-crop beneath superficial deposits approximately 90m to the east of the site, dipping at an angle of 25 degrees towards the west and as such are likely to be present beneath the site.

A variable thickness of Made Ground is anticipated to present, associated with the previous land use as a school.

The BGS online archive was checked and there are no suitable records for relevant archived boreholes in close proximity to the site.

3.3 Mining History/Geological Cavities

Consultation of the Coal Authority's/Law Society's Coal Mining Searches Directory indicates that the site lies in an area for which a standard mining report is required

for new development. A copy of the Coal Authority report dated 26th August 2015 is presented in Appendix B.

Reference to the report indicates that the property is within the likely zone of influence at the surface from workings in two seams of coal at 30m to 130m depth, which were last worked in 1879, and indicates any movement should have stopped by now. The Coal Authority report also indicates that the site is located within an area where there is coal at or close to the surface which may have been worked at some time in the past. The Coal Authority has no knowledge of any mine entries on the site or extending 20m beyond the site boundary. The property is not located within 800m of a boundary for which the Coal Authority is determining to grant a license to extract coal by underground or open cast methods. The Coal Authority has not received a damage notice or claim for the site or any property within 50m of the site boundary since October 1994. The Coal Authority report states that if development proposals are being considered, then technical advice relating to both the investigation of coal and former coal mines and their treatment should be obtained before beginning work on site.

Reference to the Coal Authority interactive map viewer indicates numerous mine entries beyond the western site boundary, approximately 100m to the west. Mine entries are also shown approximately 80m to the southeast of the site. The site is shown to be outside of the zone of influence of these mine entries. The interactive map viewer indicates that land immediately east and west of the site are in development high risk areas and in areas of probable shallow coal mine workings.

The published geological mapping shows that the Cockshead coal seam sub-crops beneath superficial deposits across the western boundary of the site, dipping at an average angle of 25 degrees towards the west, away from the site. Depending on the precise location of the coal seam, it may be present at depths of less than 20m beneath the site. The Banbury coal seam is shown immediately west of the Cockshead coal seam, dipping at the same angle towards the west and is unlikely to be present beneath the site. The Bullhurst and Winpenny coal seams are shown to sub-crop beneath superficial deposits approximately 90m to the east of the site, dipping at an average angle of 25 degrees towards the west and as such are likely to be present beneath the site. At an average dip angle of 25 degrees towards the west, it is expected that the Bullhurst and Winpenny coal seams may be present at a depth of less than 40m beneath the site.

Reference to the Department of the Environment (now DEFRA) “Review of Mining Instability in Great Britain” indicates the site is located in an area of recorded non-coal mining activities, referring to possible rare and localised mining for iron ore.

A review of the DoE regional reports for Natural Underground Cavities in Great Britain (1993) indicates the site is not located in an area of recorded natural cavity formation.

3.4 Radon

Reference to the GroundSure report indicates that the site does not lie in an area where the geological strata may be susceptible to radon emissions. Hence, no precautions against ingress of radon into new buildings are considered necessary.

3.5 Hydrology

The nearest surface watercourse is an unnamed stream 115m northwest of the site and flows towards the north.

There is no Environment Agency General Quality Assessment (GQA) classification data for this watercourse.

According to the GroundSure report there are no surface water abstractions within 1km of the site. There are no active licensed discharge consents within 500m of the site.

The Environment Agency indicates that the site is at very low risk of flooding from rivers. This report, however, is not intended to be a full hydrological study and if a flood risk assessment is needed, additional analysis by others is recommended to confirm this aspect of the development.

3.6 Hydrogeology

According to the Groundwater Vulnerability Map produced by the Environment Agency, the Glacial Till beneath the site is classified as unproductive strata. The Pennine Lower Coal Measures Formation are classified as a 'Secondary A' aquifer.

There are no groundwater abstraction licenses within 1km of the site.

3.7 Ecology

Information from environmental and ecological datasets was obtained from a review of the MAGIC (Multi-Agency Geographic Information for the Countryside) website and the GroundSure report, which indicates that the site is within a nitrate vulnerable zone. Apart from this the site is not shown to be located within and environmentally sensitive area.

If a full assessment of Environmental or Ecological aspects is required, it is recommended that other specialists are consulted.

3.8 Environmental Searches

Information pertaining to environmental issues was obtained from the GroundSure report, commissioned by Applied Geology Limited, dated 16th June 2015. This database contains sets of data corresponding to the databases held by a number of sources including the Environment Agency (EA), British Geological Survey (BGS), Public Health England, the Coal Authority (CA), and the Local Authorities (LAs). A copy of the report is included in Appendix B.

There are no recorded current or historical landfills, or waste treatment, transfer or disposal sites within 250m of the site.

There are no areas designated as contaminated land or recorded pollution incidents within 500m of the site.

There are no NIHHS or COMAH sites in the local vicinity.

3.9 Industrial Site Data

The following table summarises the contemporary Trade Directory (of currently operating and potentially contaminative businesses) entries within 250m of the site.

Table 2 – Summary of Contemporary Trade Directories

Trade	Distance from site (m)	Principal Potential contaminants
Distribution and Haulage	45m SE	Hydrocarbons/ oils, solvents, acids, metals, asbestos
Electrical Features	69 SE, 234 SE	Oils, solvents, metals, PCBs, Acids, Asbestos
Vehicle Repair, Testing and Servicing	106 S	Hydrocarbons/ oils, solvents, acids, metals, asbestos

4.0 CONCEPTUAL MODEL

In developing a Conceptual Model for the site, pollutant linkages are determined by identifying likely sources of contamination from previous and current site uses, possible targets such as site users, neighbouring site users and Controlled Waters and linkages between them. These are discussed below together with a diagrammatic representation of the potential pollutant linkages for this site, which is included in Appendix A.

4.1 Summary of Site History

From the earliest map editions (1878) the site generally comprised a field. Possible drainage ditches are shown until the 1960's. A school is first shown at the site from 1974 and still shown to be present on the most recent published maps dated 2014. It is understood that the school was destroyed by fire in 2004. The surrounding area has seen extensive coal mining until the late 1960's, with the majority of workings located to the west of the site.

4.2 Summary of Anticipated Geology

It is anticipated that a variable thickness of Made Ground will be present across the site overlying Glacial Till, over bedrock strata of the Pennine Lower Coal Measures Formation. The potentially worked Cockshead and Banbury coal seams are anticipated to be present at shallow depth beneath the site.

4.3 Potential Source - Pathway – Receptor Pollutant Linkages

4.3.1 Sources

<u>On-site</u>

Any Made Ground present on the site may contain elevated concentrations of contaminants such as, heavy metals and polyaromatic hydrocarbons, associated with the former school.

Potentially deep Made Ground associated with infilling of possible former drainage ditches on the north-eastern and south-western site boundaries and possible

shallow coal mine workings underlying the site are a potential source of harmful ground gas and mine gas.

The type of fuel heating system used for the former school is unknown. However, it may have been coal fired and, possibly later, an oil fuelled system. Localised hydrocarbon contamination may therefore be present at the site, associated with former heating systems.

Asbestos may be present in the Made Ground, particularly in the location of the former school, although appropriate surveys and asbestos removal prior to demolition (assuming they were undertaken), would reduce the likelihood of it being present in near surface soils.

Elevated sulphates may be present in the Made Ground and natural soils underlying the site.

Off-site

Potential ground gas associated with any Made Ground off site.

4.3.2 **Pathways**

On-site

Migration via Leaching and Groundwater Flow

Mobile or leachable contaminants within any Made Ground may migrate laterally and vertically via granular lenses within the Glacial Till and Pennine Lower Coal Measures Formation underlying the site.

Dermal Contact, Ingestion and Inhalation

End users could be at risk from dermal contact, ingestion and inhalation pathways if elevated concentrations of contaminants or ground gas were present in sufficient concentrations.

Direct Contact with Buried Concrete and Water Supply Pipes

Buried concrete could be affected by direct contact with soils if these contain elevated levels of sulphate. Water supply pipes could be affected by direct contact with hydrocarbon contamination should any be present.

4.3.3 **Receptors**

End Users

End users, including residents and workers of the proposed care home development may be at risk from mobile contamination and ground gas, should any be present.

Controlled Waters

The Secondary 'A' Aquifer of the Pennine Lower Coal Measures Formation is a potential receptor to any mobile contamination at the site.

Buried Concrete

Elevated concentrations of sulphates may pose a potential risk to buried concrete such as foundations on the site.

Water Supply Pipes

Water supply pipes could be affected by hydrocarbon contamination should any be present.

4.3.4 Diagrammatic Representation:

The diagrammatic representation of the Conceptual Model described above is presented in Appendix A as Drawing No: AG2309-15-02 and is summarised below.

Table 3 – Initial Conceptual Site Model

Source	Pathway	Receptor	Risk*
Potential contaminants within any Made on or off site.	Inhalation, ingestion, dermal contact.	End users.	Low - Medium
	Leaching or migration	Pennine Lower Coal Measures (Secondary 'A' Aquifer).	Low
	Direct contact	Water supply pipes	Low
Potential elevated sulphates in the Made Ground and natural soils.	Direct contact	Buried concrete	Low - Medium
Soil gas from Made Ground and possible shallow coal mine workings both on site and off site sources (methane, carbon dioxide, carbon monoxide, hydrogen sulphide)	Migration into buildings and any excavations	End users, buildings, adjacent residents	Low – Medium

*** Definition of Risk Categories**

Negligible - Contaminants that might have unacceptable impact on key receptors, are unlikely to be present, or, no pathway is envisaged.

Low Risk: Contaminants may be present but are unlikely to be at levels to have unacceptable impact on key receptors, or pathways are likely to be minimal.

Medium Risk: Contaminants are probably present and might have an unacceptable impact on key receptors. Pathways may also be present therefore remedial measures may be necessary to reduce the risks.

High Risk: Contaminants probably or certainly present and pathways are probably also present. Therefore contaminants are likely to have an unacceptable impact on key receptors and therefore remedial measures are likely to be necessary to reduce risks to acceptable levels.

The overall risk of soil contamination being present and requiring remedial action is considered to be low to medium.

5.0 DISCUSSION

5.1 Geoenvironmental Issues

No obvious sources have been identified for soil contamination at the site.

It is possible that localised concentrations of contamination are present, associated with the former school e.g. former fuel storage for heating system and car parking areas etc. Also any infilled possible drainage ditches on the north-eastern and south-western boundaries of the site may be a source of contamination and ground gas. Mine gas associated with shallow coal mine workings is also a possible issue.

5.2 Geotechnical Issues

The published geological mapping shows that the Cockshead coal seam sub-crops beneath superficial deposits across the western boundary of the site, which may be present at depths of less than 20m beneath the site. The Bullhurst and Winpenny coal seams are shown to sub-crop beneath superficial deposits approximately 90m to the east of the site, dipping at an average angle of 25 degrees towards the west and as such may be present at depths of less than 40m beneath the site. Generally a cover of at least 15m of sound rock above any worked seam, or ten times the seam thickness if this is greater, is commonly recommended to prevent a potential risk of crown hole formation at rock head or surface associated with former workings. Given the anticipated shallow depth of coal seams underlying the site and the likelihood of possible unrecorded shallow workings beneath the site, there may be a risk from the collapse of shallow coal mine workings.

It is recommended that a series of boreholes are carried out utilising rotary techniques to investigate the possible presence of shallow coal seams beneath the site. Should shallow coal seams be present beneath the site, a programme of drilling and grouting may be required and any shallow foundations may need to be designed to cater for possible residual mining movement. Such foundations may typically comprise reinforced strips/ring beam foundations or semi-rafts with suspended/integral floor slabs.

If there is no risk of shallow mining, and only shallow Made Ground is encountered, traditional shallow/trench fill foundations may be suitable, placed on competent strata within the Glacial Till. Where significant thicknesses of Made Ground are encountered e.g. if cellars/ basements are present, deeper foundations are likely to be required.

Considering the likely presence of cohesive Glacial Till, soakaway drainage is unlikely to be a viable option for the discharge of surface water across the site. However, this will be subject to the findings of a ground investigation.

5.3 Recommendations

It is recommended that a ground investigation is undertaken to confirm the conceptual site model derived from the Phase 1 Desk Study and to derive parameters for foundation design purposes.

In the areas of the proposed development driven continuous sampling boreholes and machine excavated trial pits should be carried out. This will enable soil samples

to be taken for subsequent contamination analysis and geotechnical testing to include in-situ and laboratory testing to determine engineering properties. The boreholes should be installed with standpipes to enable gas and groundwater monitoring. In addition to the shallow investigation, deeper rotary boreholes should be carried out at the site in order to determine the depth, thickness of rock cover and presence of possible workings in the underlying potentially shallow coal seams, to assess the potential requirements for drilling and proof grouting.

Engineering laboratory testing including classification and BRE Special Digest 1 concrete classification tests should be carried out to aid foundation design.

Routine chemical testing to include a suite of heavy metals, polyaromatic hydrocarbons, TPH, pH, asbestos screen and soil organic matter should be carried out on selected soil and groundwater samples recovered during the ground investigation and the results assessed again relevant screening criteria.

6.0 LIMITATIONS AND EXCEPTIONS OF ASSESSMENT

Strata Housing Services Ltd (the Client) has requested that a Phase I Geoenvironmental Risk Assessment be performed for submission with a planning application. The report is not a comprehensive site characterisation and should not be construed as such.

The investigation was conducted and this report has been prepared for the sole internal use and reliance of Strata Housing Services Ltd. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Applied Geology limited. If any unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The findings and opinions conveyed via this report are based on information obtained from a variety of sources as detailed within this report, and which Applied Geology Limited believes are reliable. Nevertheless, Applied Geology Limited cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

The most recent site inspection/walkover survey was performed by Applied Geology on 14th September 2015. Strata Housing Services Ltd is advised that the conditions observed by Applied Geology Limited are subject to change. Certain indicators of the presence of hazardous substances may have been latent at the time of the most recent site reconnaissance and may subsequently have become observable.

It is possible that Applied Geology Limited's researches, while fully appropriate for a Phase I Geoenvironmental Risk Assessment, failed to indicate the existence of important information sources. Assuming such sources actually exist, their information could not have been considered in the formulation of Applied Geology Limited's findings and opinions.

Applied Geology Limited believes that providing information about limitations is essential to help Strata Housing Services Ltd identify and thereby manage its risks. These risks can be mitigated - but they cannot be eliminated, through additional research. Applied Geology Limited will on request advise Strata Housing Services Ltd of the additional research opportunities available, their impact on risk, and their cost.

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September 2015

GENERAL NOTES

A) The assessment made in this report is based on the site terrain and ground conditions revealed by the various field investigations undertaken and also any other relevant data for the site including previous site investigation reports (if available) and desk study data. There may be special conditions appertaining to the site, however, which have not been revealed by the investigation and which have not, therefore, been taken into account in the report. The assessment may be subject to amendment in the light of additional information becoming available. It must be recognised that many of the Environmental Searches obtained during the course of the desk study are often lengthy. Applied Geology have, where appropriate and in the interests of simplicity, only reproduced the summary of the searches within the report. A full copy of all the search data is held at the Applied Geology office and is available for inspection if required.

B) Where any data supplied by the Client or other external source, including that from previous site investigations, has been used it has been assumed that the information is correct. No responsibility can be accepted by Applied Geology for inaccuracies within this data.

C) Whilst the report may express an opinion on possible configurations of strata between or beyond the exploratory locations, or on the possible presence of features based on either visual, verbal or published evidence this is for guidance only and no liability can be accepted for the accuracy.

D) Comments on groundwater (and landfill gas) conditions are based on observations made during the course of the present and past investigations or with reference to published data unless otherwise stated. It should be noted, however, that groundwater (and landfill gas) levels vary due to seasonal (or atmospheric conditions) or other effects.

E) The copyright of this report and other plans and documents prepared by Applied Geology is owned by Applied Geology and no such report, plan or document may be reproduced, published or adapted without the written consent of Applied Geology. Complete copies of the report may, however, be made and distributed by the Client as an expedient in dealing with matters related to its submission.

F) This report is prepared and written in the context of the proposals stated in the introduction to the report and should not be used in a differing context. Furthermore, new information, improved practices and legislation may necessitate an alteration to the 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 the report, the report should be referred to Applied Geology for re-assessment and if necessary, re-appraisal.

G) The survey was conducted and this report was prepared for the sole internal use and reliance of the Client. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Applied Geology. If an unauthorised third party comes into possession of this report they rely on it at their peril and Applied Geology owes them no duty of care and skill.

H) Ground conditions should be monitored during the construction of the works and the recommendations of the report re-evaluated in the light of this data by the supervising geotechnical or geo-environmental engineers.

I) Unless specifically stated, the investigation has not taken into account the possible effects of mineral extraction.

J) The economic viability of the proposals referred to in the report, or of the solutions put forward to any problems encountered, depends on very many factors in addition to geotechnical considerations and hence its evaluation is outside the scope of this report.

K) Applied Geology operates as a Consultancy and does not operate it's own laboratory for soil testing, this work being sub contracted to known and respected, generally UKAS accredited, laboratories. Applied Geology can therefore not be held responsible for the testing carried out.