



Client:

Quantum Star Ltd
Hoof Hall
Ripponden Road
Denshaw
Oldham
OL3 5UN

Principal Contractor

Whittaker Design
169 St John Street
Lees
Oldham
OL4 3DS

Phase II Contaminated Land Risk Assessment

Land Adjacent Spring Inn, Broad Lane, Rochdale

Jan 2017

**Site Ref: 5843/LSC-CLRA
v1.00**

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1. Introduction	3
2. Description of the Site	3
3. Review Of Previous Reports	4
4. Intrusive Investigation	4
4.1 Intrusive Investigation objectives	4
4.2 Intrusive Investigation Strategy	4
4.3 Methods Used For Forming Exploratory Holes	4
4.4 Exploratory Hole Programme	5
4.5 Field Sampling and Testing	5
5. Laboratory Investigation	6
5.1 Contamination Testing	6
6. Subsurface Stratigraphy	7
7. Groundwater	7
8. Ground Gas	7
9. Part IIA Legislation	7
9.1 Assessment Methodology	8
9.2 Soils	8
9.3 Subsoil Deposits	9
9.4 Discussion	9
10. Conceptual Model	10
11. Conclusions	11
11.1 Supplementary Recommendations	11
Appendices	
A1. Site Plan with Exploratory Hole Locations	
B1. Exploratory Hole Logs	
C1. SAL Chemical Test Results	
C2. Analysis of Results with Assessment Criteria	

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Phase II Contaminated Land Risk Assessment

1. Introduction

This report is an account of a Phase II Contaminated Land Risk Assessment carried out by GeoAssist Limited at the request Quantum Star Ltd as owner and developer of site for the Land Adjacent Spring Inn, Broad Lane, Rochdale.

The work was commissioned following the receipt of instruction to proceed issued by Whittaker Design on behalf of the Client on the 23rd November 2016.

The purpose of this Phase II investigation is to provide information following the conclusions of the phase I report produced by GeoAssist Ltd and dated November 2016 to ensure that the site:

- Is assessed in accordance with the methodology outlined in CLR11
- Satisfies the relevant requirements of the National Planning Policy Framework March 2012
- Is suitable for the intended proposed land use. In this case, as a Residential Development

The approximate grid reference for the centre of the site is 390980, 411410 and the total area of the site is approximately 2,900m². The area of the site scheduled for investigation is outlined with a solid red line on the site plan in Appendix A1. The positions of exploratory holes are also indicated on the plan.

2. Description of the Site

The site is located to the eastern side of Broad Lane, Rochdale in a residential area. The site forms an irregular shape and is elevated above the level of Broad Lane by approximately 2.00m. The general topography of the site can be described as irregular with several notable small spoil piles being present. The site is covered with grass and scrub undergrowth. It is assumed that these mounds were constructed from arisings following the construction of the relatively new neighbouring housing estate to the east. The site is bounded by a new housing estate to the east, A public house with associated beer gardens and carparking to the south, Broad Lane to the west and a residential property to the north. No obvious visual or olfactory observations of contaminants were noted during the site walkover.

3. Review Of Previous Reports

It is understood that previous intrusive investigations have not been undertaken on this site. The issues to be covered in the present investigation are to provide information in respect of any potentially unacceptable geo-environmental risks arising from previous land uses in the immediate area and the potential for any sources of contamination to impact both present and future receptors, including:

- Human
- Controlled waters via established pathways
- Property
- Adjoining land

4. Intrusive Investigation

4.1 Intrusive Investigation objectives

The objectives of the site investigation are to collect data to confirm whether or not the soils beneath site in their current state pose a risk by reason of substances within or under the land that;

- § Significant harm is being caused or there is significant possibility of such harm being caused; or
- § Pollution of controlled waters is being, or is likely to be, caused.

Data to describe the following parameters has been collected at a suitable spatial resolution in accordance with BS10175, 2011:

- § Soil Characteristics including type of material
- § Chemical profile of the soil.

These data will be used to refine a conceptual site model and confirm the existence of any established pollutant linkages in accordance with Contaminated Land Report 11 Model Procedures for the Management of Land Contamination, 2004 as well as The Environment Agency Requirements for Land Contamination Reports, 2005.

4.2 Intrusive Investigation Strategy

The ground investigation was carried out in accordance with British Standard 5930: 1999 Code of Practice for Site Investigations and BS BS10175: 2011 Investigation of potentially contaminated sites.

All fieldwork was supervised by suitably qualified GeoAssist Limited Environmental Engineers.

The contamination testing was carried out in an independent UKAS accredited Laboratory.

4.3 Methods Used For Forming Exploratory Holes

The exploratory holes undertaken across the site as part of this investigation were established using windowless drive sample excavation methods. Information obtained from the Phase I Preliminary Contaminated Land Risk Assessment was used to inform a decision on the actual exploratory hole locations whilst taking account of positions that could be reasonably accessed with minimal preparation works using the drilling and excavation plant available. The location of services was also considered during the positioning of the exploratory holes along with the proposed soft landscaping areas. A plan showing the

locations of the exploratory holes established as part of the investigation forms Appendix A1 to this report.

4.4 Exploratory Hole Programme

In total five exploratory holes for sample recovery were established across the site. The details of the strata in the exploratory holes were recorded by a suitably qualified Professional Engineer. Upon completion of the fieldwork a gas/groundwater monitoring installation was formed in exploratory hole WS1 with a length of plain pipe with a cement/bentonite surround, connected to a length of slotted pipe with a filter sock and pea gravel surround. The headworks comprised of a gas valve and lockable steel cover set in concrete, flush with the surrounding ground.

The remaining exploratory holes were backfilled in accordance with the specification and the surface reinstated.

All intrusive work was carried out in accordance with:

- British standard 5930: 1999 Code of Practice for Site Investigations
- British Standard 10175: 2011 where applicable

The fieldwork was completed on the 12/12/2016 and the 14/14/2016 in mixed weather conditions.

4.5 Field Sampling and Testing

A non-targeted borehole layout was selected as the most appropriate strategy for this site as the Phase I report had highlighted that the precise location and nature of any potential contaminants of concern was unknown. Representative samples were taken of all the strata encountered in the exploratory holes. Once exposed, samples to be subjected to chemical analysis were immediately placed into a suitable container and stored in a cool dark sample box prior to submission to the laboratory in order to prevent alteration of the composition of the samples. In all cases 500ml wide necked amber glass jars were used with a teflon faced foamed polyethylene cap liner that offers excellent chemical resistance with the compressibility and sealing properties of polyethylene foam. These containers were filled with sample, sealed and delivered to the laboratory for testing. Samples for volatile compounds were placed into appropriate containers with a screw cap and pierceable septum as supplied by the testing laboratory specifically appropriate to the determinand. These containers were filled with sample sealed and delivered to the laboratory for testing. Observations of groundwater conditions were recorded throughout the fieldwork operations. All other samples were stored in airtight containers and returned to the laboratory for examination and geotechnical testing where necessary.

5. Laboratory Investigation

5.1 Contamination Testing

In total 5 soil samples were collected and subjected to elements of the suite of chemical testing as outlined below. All tests were conducted by Scientific Analysis Laboratories under UKAS Testing No 1549. The results of all the chemical analysis tests are given in Appendix C1.

Table 5.1 Analytical Determinands

Soils	
Arsenic	Acenaphthene
Boron (water-soluble)	Acenaphthylene
Cadmium	Anthracene
Chromium	Benzo(a)Anthracene
Chromium VI	Benzo(a)Pyrene
Copper	Benzo(b/k)Fluoranthene
Cyanide(Total)	Benzo(ghi)Perylene
Cyanide(free)	Chrysene
Lead	Dibenzo(ah)Anthracene
Mercury	Fluoranthene
Nickel	Fluorene
pH	Indeno(123-cd)Pyrene
Phenols(Mono)	Naphthalene
Selenium	Phenanthrene
SO4(Total)	Pyrene
Sulphide	
Sulphur(Free)	Asbestos Identification
Thiocyanate	
Zinc	

6. Subsurface Stratigraphy

The subsoil profile obtained from the exploratory holes consists of Topsoil over sands and gravels with brick fragments made ground over sands interbedded with gravel horizons at depth.

The made ground extends to between 0.60m and 1.80m depth and is generally very loose in state of compaction. The sands with gravels are generally medium dense in state of compaction with irregular loose and dense horizons.

Further details of the subsurface stratigraphy can be found in the exploratory hole log sheets which form Appendix B1 to this report.

Table 6.0 Subsoil Profile Summary

Strata	Depth of Strata (m) below ground level	
	Top	Base
Topsoil/Made Ground Variable mixed granular	Ground Level	0.60 to 1.80
Superficial Natural Deposits Medium dense silty Sands with gravel	0.60 to 1.80	>6.00

7. Groundwater

Seepage groundwater was encountered in the exploratory holes at depths between 1.40m and 3.00m during the course of the fieldwork. The groundwater conditions entered on the exploratory hole logs are those observed at the time of the investigation and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken. Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.

8. Ground Gas

An intrusive gas risk assessment will form a separate report.

9. Part IIA Legislation

Part IIA of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) provides a new regime for the control of specific threats to health or the environment from existing land contamination. In accordance with the Act and the statutory guidance document on The Contaminated Land (England) Regulations 2000, the definition of contaminated land is intended to embody the concept of risk assessment. Within the meaning of the Act, land is only "contaminated land" where it appears to the regulatory authority, by reason of substances within or under the land that

- § Significant harm is being caused or there is significant possibility of such harm being caused; or
- § Pollution of controlled waters is being, or is likely to be, caused.

The guidance defines "risk" as the combination of

- § The probability, or frequency, of occurrence of a defined hazard (for example, exposure of a property to a substance with the potential to cause harm); and
- § The magnitude (including the seriousness) of the consequences.

For a risk of pollution or environmental harm to occur as a result of ground contamination, all of the following elements must be present:

- § A source, i.e. a substance that is capable of causing pollution or harm;
- § A receptor (or target). i.e. something which could be adversely affected by the contaminant; and
- § A pathway, i.e. a route by which the contaminant can reach the receptor.

If one of these elements is missing there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

9.1 Assessment Methodology

In order to assess the environmental risk posed by potential contaminants within the near surface soils considering the final levels of the scheme, GeoAssist Limited undertook an initial screen of the laboratory results using GeoAssist Limited Generic Assessment Criteria (GACs) and where applicable Category 4 Screening Levels or Suitable 4 Use Levels as given as part of Appendix C2.

The GeoAssist Limited GACs and Category 4 Screening levels (C4SLs and S4UL herein) are generated in consideration of the proposed end use of the site, in this case as Residential land. Contaminant concentrations below the GACs and or C4SLs levels are considered not to warrant further risk assessment. Concentrations of potential contaminants above the GACs and C4SLs levels require further consideration of the potential pollutant linkages. It should be noted that exceedance of the GACs and or C4SLs levels does not necessarily mean that the site requires remediation, although this is dependent on the nature, type and depth of the contaminant and further justification may be required.

9.2 Soils

For assessment of the soil analysis results with regard to potential human health risks, GeoAssist Limited GACs are selected from the following sources which represent minimal risk to site users:

CLEA Soil Guideline Values (SGVs). These values have been developed by the Department of the Environment, Food and Rural Affairs (DEFRA) and the Environment Agency (EA) using the Contaminated Land Exposure Assessment (CLEA) Model, and are considered to be protective of human health (considered to be a potential receptor on site). To date, SGVs have been published for only a limited suite of contaminants, with SGVs derived for each contaminant for three different land use scenarios namely:

- § residential
- § allotments
- § commercial and industrial.

The proposed assessment of this site is as Residential land as this is considered to be the most appropriate land use scenario for the current and proposed situation on site.

Chartered Institute of Environmental Health Generic Assessment Criteria (LQM CIEH GAC) have been used where available and where CLEA SGVs have not yet been published.

Where CLEA or LQIM CIEH GAC values are not available, Atkins at Risk GAC values have been selected as appropriate all of which represent a minimal risk to receptors.

C4SLs have been used in conjunction with the above GAC and these represent a Low Level of Toxicological Concern (LLTC herein). LLTC represent an intake of low concern that remains suitably protective of health, and definitely does not approach an intake level that could be defined as Significant Possibility of Significant Harm.

The CLEA guidelines state that for each contaminant, apart from lead, the upper 95th percentile of the mean measured concentration should be calculated where appropriate and this value should be compared to the applicable screening value (defined here as the GeoAssist Limited GACs). For Lead impacts the geometric mean should be calculated and compared to the GAC or C4SL.

The CLEA model states that, 'the contamination is assumed to be at or within 1 m of the surface (CLR10 page 10 now withdrawn).' It is considered that at depths greater than 1m, the probability of human exposure via the direct contact pathways are significantly reduced, leaving inhalation of volatile compounds as the dominant pathway. Typically, volatile compounds only significantly affect the indoor inhalation pathway.

9.3 Subsoil Deposits

The contaminants that were identified above the GeoAssist Limited GACs, SGVs or C4SLs for a Residential end use from the GeoAssist Limited investigations are summarized below:

Table 9.3 Summary identified impacts.

Determinand	GAC (mg/kg) Resi With Plant Uptake	No of tests	No samples exceeding SGV/GAC/ C4SL	of	Max Value (mg/kg)	Treat as a Hotspot	US95 or Geometric Mean (for Lead)	Value (for Lead)	Further action required
None Identified									

The assessment of chemical analysis summarised in table 9.3 has not identified any potential risks to end users of the site from elevated levels of anthropogenic contamination within the soils on the site. The presence of asbestos fibre was not detected in any of the samples submitted for analysis. The results of all the chemical laboratory analytical tests form appendix C1 to this report and the analysis of the results forms appendix C2 to this report.

9.4 Discussion

The assessment of the chemical laboratory analytical tests has identified that the soils on this site pose a low risk to end users when assessed in accordance with the current UK methodology. Consequently, the risk to end user receptors from ground contamination is classified as low given a residential end use scenario.

The risk to construction workers and site users during the construction phase is assessed to be low if standard PPE & RPE precautions are employed at the site strip stage including the use of disposable coveralls, particulate masks and damping down to suppress airborne dust where conditions dictate.

The results of the chemical analysis also indicate that the underlying aquifer beneath the site or any close

by controlled waters are highly unlikely to be at risk from the passage of water through the site.

10. Conceptual Model

The updated conceptual model based on the information and test results presented in this report including contamination sources, pathways and receptors is presented below.

Table 10.0 Amended Conceptual Site Model based on information as presented within this report.

Potential Source / Hazard	Nature of Hazard (Risk Level to site given a commercial end use)	Contaminants Associated with Source	Potential Pathway	Potential Receptor
<i>Previous ON SITE Land uses:</i>				
1. Previous and Present Site Use Open Land Small Spoil Piles/bunds	Ground contamination Low Risk	None	Dermal Contact Ingestion Inhalation	Site Users Construction workers
	Gas from in-filled ground On Going		Vertical and Lateral Migration	Site Users Future Buildings & Services
<i>Previous OFF SITE land uses within 250m as indicated by Historical Plans Including:</i>				
2. Coal Workings & Brine Extraction	Geotechnical Hazard Low Risk	None	Ground Collapse Subsidence	Humans (site users) Future Buildings & Services
	Ground contamination Low Risk	None	None	Site Users Services
	Mine Gas Low Risk	None	None	Humans (site users) Future Buildings & Services

Only sources that have not been present on site in the past or currently are considered within the off site category. Unless the information is deemed to be pertinent to the analysis.

11. Conclusions

Evidence presented elsewhere within this report indicates that the ground on this site presents a Low risk to end user receptors.

Elsewhere,

- § The controlled waters (groundwater) beneath the site are unlikely to become impacted by the passage of water through the soils on site.
- § The site is unlikely to be defined as contaminated land within the context of part IIA.
- § The site, in its present condition, does not represent a significant risk to the environment and is unlikely to become an environmental liability in the future.
- § The risk to building and services from chemical attack is likely to be negligible and as such no special precautions are required to protect the building fabric or services entering the buildings. However, this should be confirmed by a competent person once service routes and locations have been decided.
- § An intrusive ground gas investigation and associated gas risk assessment is ongoing, the results of which will form a separate report.

11.1 Supplementary Recommendations

- § It is recommended that sampling of the spoil piles on site is conducted to confirm the nature and of the materials contained within. Testing should be undertaken if these deviate from the natural ground found on site as part of the present investigation.
- § It is recommended a watching brief by a suitably qualified person be maintained during any subsequent site preparation works. If during these site works suspected ground contamination, not previously identified, is found to be present on the site then an appropriate, suitably Qualified Person should inspect the site and prepare a report outlining what measures, if any, are required to remediate the land. The local planning authority should be informed.
- § Validation testing for imported soils for garden areas is a standard requirement of local planning authorities and documentary evidence should be presented to the local authority upon completion of the proposed development. Validation testing should be undertaken at a rate agreed by the Local Authority.



Matthew Benson BSc
Geotechnical/Environmental Engineer



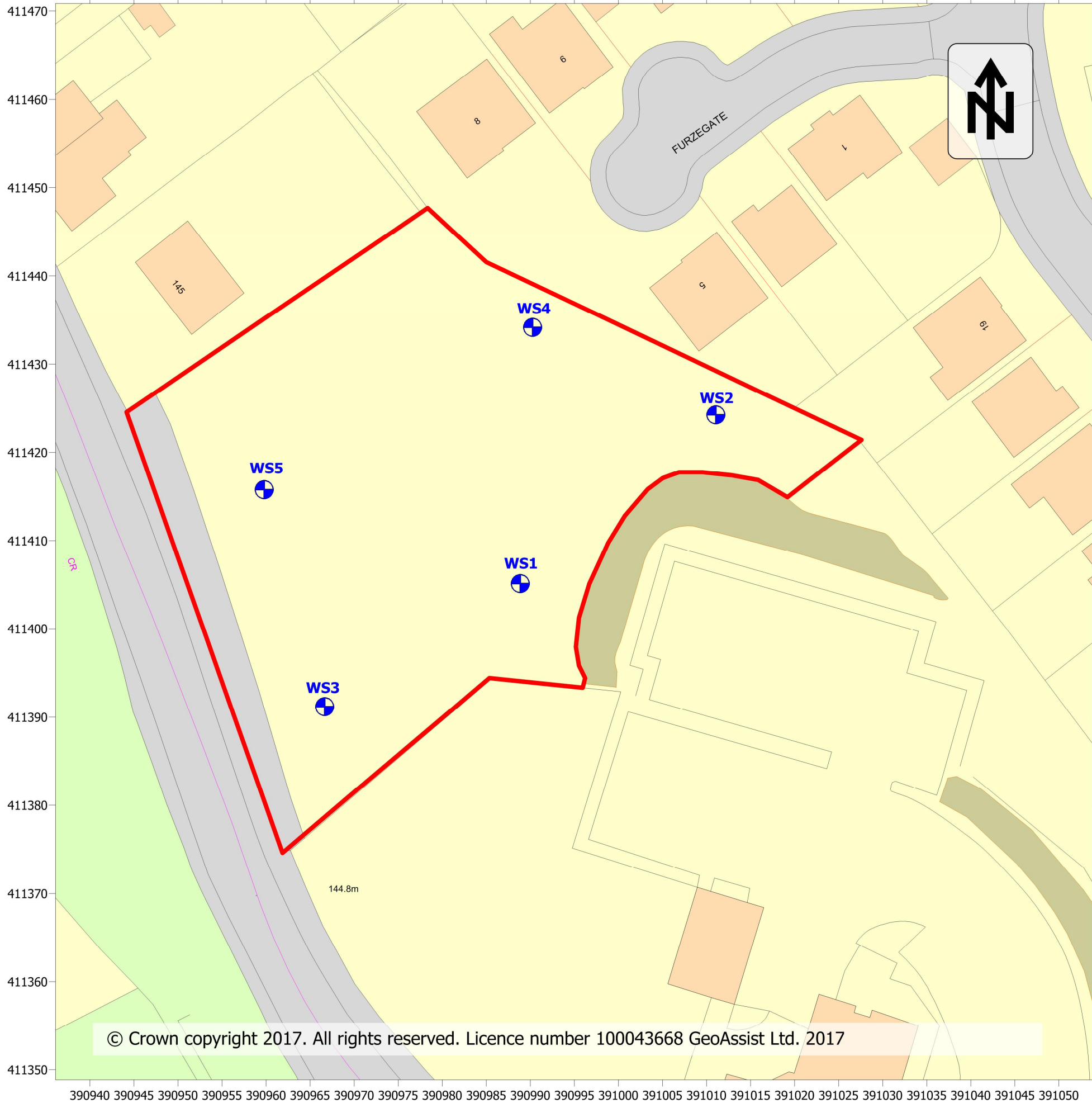
Mark Richardson MSc CEng MICE
Technical Director

Field investigations have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions are, and can be, variable and have only been tested at isolated locations across the site. Therefore the potential exists for ground conditions to be encountered which are different to those considered in this report. Chemical analysis was conducted for a number of parameters based on an expert understanding of the historical and operational data available at the time and it should not be inferred or otherwise, that other chemical species are not present.

This report has been prepared by GeoAssist Limited with all reasonable professional skill, care and diligence within the terms of the contract with Quantum Star Ltd. The report is confidential to Quantum Star Ltd, their/the named persons advisors and bankers, and GeoAssist Limited accepts no responsibility of whatever nature to third parties to whom this report may be divulged. GeoAssist Limited owns the copyright in this report. All rights are reserved and unauthorised use is prohibited. Quantum Star Ltd may use the report for their/her/his own purposes.

Appendix A

A1 Site Plan & Exploratory Hole Locations



A1

Exploratory Hole
Location Plan

Site Name	Land Adjacent Spring Inn
Location	Broad Lane, Rochdale
GeoAssist Ref	5843LSC
Client	Quantum Star Ltd
	Hoof Hall Ripponden Road Denshaw Oldham OL3 5UN
Planning Consultant	
NGR (centre of site)	390980,411410
Production Date	Jan 2017
Survey Method	
Surveyor	Others
Status	Final v1.00
Base Survey	OSGB36

Appendix B

B1 Exploratory Hole Logs

Appendix C

- C1 SAL Chemical Test Results**
- C2 Analysis of Results with Assessment Criteria**

Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
Hadfield Street
Combrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 622290-1

Date of Report: 09-Jan-2017

Customer: Geoassist Ltd
Unit 4
Sheffield Street
Heaton Norris
Stockport
SK4 1RU

Customer Contact: Mr Mark Richardson

Customer Job Reference: 5843 LSC

Customer Site Reference: Land Adjacent Spring Inn, Broad Lane,
Rochdale

Date Job Received at SAL: 16-Dec-2016

Date Analysis Started: 19-Dec-2016

Date Analysis Completed: 09-Jan-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with SAL SOPs

All results have been reviewed in accordance with Section 25 of the SAL Quality Manual



Report checked
and authorised by :
Aleksandra Pacula
Project Manager

Issued by :
Aleksandra Pacula
Project Manager

Validity unknown
Digitally signed by Aleksandra
Pacula
Date: 2017.01.09 13:57:38 GMT
Reason: Issue
Location: SAL

SAL Reference: 622290									
Project Site: Land Adjacent Spring Inn, Broad Lane, Rochdale									
Customer Reference: 5843 LSC									
Soil					Analysed as Soil				
ICRCL (Maxi)									
SAL Reference					622290 001	622290 002	622290 003	622290 004	622290 005
Customer Sample Reference					WS1-C1-0.50	WS2-C1-0.40	WS3-C1-0.50	WS4-C1-0.40	WS5-C1-0.60
Date Sampled					14-DEC-2016	14-DEC-2016	14-DEC-2016	14-DEC-2016	14-DEC-2016
Determinand	Method	Test Sample	LOD	Units					
Chromium VI	T6	AR	1	mg/kg	<1	<1	<1	<1	<1
Arsenic	T6	A40	1	mg/kg	7	16	6	3	7
Boron (water-soluble)	T6	AR	1	mg/kg	<1	<1	<1	<1	<1
Cadmium	T6	A40	1	mg/kg	<1	<1	<1	<1	<1
Chromium	T6	A40	1	mg/kg	9	15	11	8	12
Copper	T6	A40	1	mg/kg	20	38	14	7	16
Cyanide(Total)	T4	AR	1	mg/kg	<1	<1	<1	<1	<1
Cyanide(free)	T4	AR	1	mg/kg	<1	<1	<1	<1	<1
Lead	T6	A40	1	mg/kg	24	100	15	10	29
Mercury	T6	A40	1	mg/kg	<1	<1	<1	<1	<1
Nickel	T6	A40	1	mg/kg	12	15	13	8	12
pH	T7	A40			8.6	7.5	7.6	7.6	7.3
Phenols(Mono)	T4	AR	1	mg/kg	<1	<1	<1	<1	<1
Selenium	T6	A40	3	mg/kg	<3	<3	<3	<3	<3
SO4(Total)	T6	A40	0.01	%	0.02	0.13	0.03	0.01	0.05
Sulphide	T4	AR	10	mg/kg	<10	<10	<10	<10	<10
Sulphur(Free)	T2	AR	500	mg/kg	<500	<500	<500	<500	<500
Thiocyanate	T4	A40	10	mg/kg	<10	<10	<10	<10	<10
Zinc	T6	A40	1	mg/kg	43	86	44	20	46

SAL Reference: 622290									
Project Site: Land Adjacent Spring Inn, Broad Lane, Rochdale									
Customer Reference: 5843 LSC									
Soil		Analysed as Soil							
Total and Speciated USEPA16 PAH									
SAL Reference		622290 001	622290 002	622290 003	622290 004	622290 005			
Customer Sample Reference		WS1-C1-0.50	WS2-C1-0.40	WS3-C1-0.50	WS4-C1-0.40	WS5-C1-0.60			
Date Sampled		14-DEC-2016	14-DEC-2016	14-DEC-2016	14-DEC-2016	14-DEC-2016			
Determinand	Method	Test Sample	LOD	Units					
Naphthalene	T149	AR	0.01	mg/kg	0.01	0.07	<0.01	<0.01	0.01
Acenaphthylene	T149	AR	0.01	mg/kg	<0.01	0.01	<0.01	<0.01	<0.01
Acenaphthene	T149	AR	0.01	mg/kg	<0.01	0.33	<0.01	<0.01	0.01
Fluorene	T149	AR	0.01	mg/kg	<0.01	0.21	<0.01	<0.01	<0.01
Phenanthrene	T149	AR	0.01	mg/kg	0.01	1.9	0.01	0.01	0.06
Anthracene	T149	AR	0.01	mg/kg	<0.01	0.37	<0.01	<0.01	0.01
Fluoranthene	T149	AR	0.01	mg/kg	0.03	2.3	0.01	0.02	0.11
Pyrene	T149	AR	0.01	mg/kg	0.03	1.8	0.01	0.02	0.09
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	0.02	0.88	0.01	0.02	0.06
Chrysene	T149	AR	0.01	mg/kg	0.01	0.95	0.01	0.01	0.05
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	0.02	1.2	0.01	0.01	0.07
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	0.01	0.74	<0.01	0.01	0.03
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	0.01	0.31	<0.01	0.01	0.03
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	<0.01	0.06	<0.01	<0.01	<0.01
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	0.01	0.38	<0.01	<0.01	0.02
PAH(total)	T149	AR	0.01	mg/kg	0.16	12	0.06	0.11	0.55

Index to symbols used in 622290-1

Notes

Method Index

Accreditation Summary

Produced by Scientific Analysis Laboratories Ltd, Hadfield House, Hadfield Street, Cornbrook, Manchester, M16 9FE

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Fluoranthene	T149	AR	0.01	mg/kg	U	001-005
Pyrene	T149	AR	0.01	mg/kg	U	001-005
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	U	001-005
Chrysene	T149	AR	0.01	mg/kg	U	001-005
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	U	001-005
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	U	001-005
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	U	001-005
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	U	001-005
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	U	001-005
PAH(total)	T149	AR	0.01	mg/kg	U	001-005



Soils Risk Assessment

Site Reference: 5843 LSC
 Project Site: Land Adjacent Spring Inn
 Project Location: Broad Lane, Rochdale
 Client: Quantum Star Ltd

SAL Reference	0	622290.001	622290.002	622290.003	622290.004	622290.005
Customer Sample Ref:	C4SL / S4UL	WS1-C1-0.50	WS2-C1-0.40	WS3-C1-0.50	WS4-C1-0.40	WS5-C1-0.60
	SOM 1%	14/12/16	14/12/16	14/12/16	14/12/16	14/12/16
Determinand	GAC LQM II					
Arsenic	37	7	16	6	3	7
Boron (water-soluble)	291	1	1	1	1	1
Cadmium	26	1	1	1	1	1
Chromium	3000	9	15	11	8	12
Chromium VI	21	1	1	1	1	1
Copper	2330	20	38	14	7	16
Cyanide(Total)	-	1	1	1	1	1
Cyanide(free)	34	1	1	1	1	1
Lead	200	24	100	15	10	29
Mercury	170	1	1	1	1	1
Nickel	130	12	15	13	8	12
pH	-	8.6	7.5	7.6	7.6	7.3
Phenols(Mono)	780	1	1	1	1	1
Selenium	350	3	3	3	3	3
SO4(Total)	-	0.02	0.13	0.03	0.01	0.05
Sulphide	-	10	10	10	10	10
Sulphur(Free)	-	500	500	500	500	500
Thiocyanate	-	10	10	10	10	10
Zinc	3750	43	86	44	20	46
Acenaphthene	1000	0.01	0.33	0.01	0.01	0.01
Acenaphthylene	850	0.01	0.01	0.01	0.01	0.01
Anthracene	9200	0.01	0.37	0.01	0.01	0.01
Benzo(a)Anthracene	5.9	0.02	0.88	0.01	0.02	0.06
Benzo(a)Pyrene	5	0.01	0.74	0.01	0.01	0.03
Benzo(b/k)Fluoranthene	10	0.02	1.2	0.01	0.01	0.07
Benzo(ghi)Perylene	47	0.01	0.38	0.01	0.01	0.02
Chrysene	9.3	0.01	0.95	0.01	0.01	0.05
Dibenzo(ah)Anthracene	0.9	0.01	0.06	0.01	0.01	0.01
Fluoranthene	670	0.03	2.3	0.01	0.02	0.11
Fluorene	780	0.01	0.21	0.01	0.01	0.01
Indeno(123-cd)Pyrene	4.2	0.01	0.31	0.01	0.01	0.03
Naphthalene	8.7	0.01	0.07	0.01	0.01	0.01
Phenanthrene	380	0.01	1.9	0.01	0.01	0.06
Pyrene	1600	0.03	1.8	0.01	0.02	0.09
PAH(total)	500	0.16	12	0.06	0.11	0.55
Asbestos	N.D -	N.D.	N.D.	-	-	-

All Units mg/kg unless otherwise stated Indicates Exceedance of Applicable Level

EXPLORATORY HOLE RECORD SHEET

Ref No. **WS1**

Sheet **1** of **1**

Consultant:
Whittaker Design
Client:
Quantum Star Ltd

PROJECT : Land Adjacent Spring Inn
LOCATION : Broad Lane, Rochdale

EQUIPMENT:
Archway Dart Rig

Casing
Dia. Depth
(mm) (m)
100 2.00

Ground Level : m. AOD
Co-ordinates E (m)
N (m)
Dates 12/12/2016 to 12/12/2016

Field Records	Samples/Tests			Drilling Foreman : M Walton Engineer/Geologist : M Benson	Depth (Thick) (m)	Reduced Level (m AOD)	Strata Legend
	Depth (m) from to	Sample Type & No	Blow Count (N)/U				
Wet from 1.40m				Grey clayey TOPSOIL	(0.15)		
	0.50 0.60	C1		Very loose brown/grey gravelly silty sand with brick fragments - MADE GROUND	0.15		
	0.80 0.90	D1					
	1.00	CP1	(3)		(1.65)		
	1.50 1.60	D2					
	2.00	CP2	(9)	Medium dense brown/grey slightly gravelly silty fine to medium SAND	1.80		
	2.50 2.60	D3					
	3.00	CP3	(12)		(2.00)		
	4.00	CP4	(30)	Dense brown slightly gravelly silty fine to medium SAND	3.80		
	5.00	CP5	(33)		(1.20)		
12/12/2016: On completion of exploratory hole at 6.00m. Casing at 2.00m. Standing water level Nil. On withdrawal of casing gas/groundwater standpipe installed to 4.00m depth with response zone from 1.00 to 4.00m	5.90	CP6	(36)	Dense slightly gravelly silty fine to medium SAND - Interpreted stratum	5.00		
				Borehole complete	(1.00)		
					6.00		

REMARKS :

Logged : M Benson
Date : 14/12/2016
Checked : M Richardson
Date : 16/01/2016
Site Ref : 5843 LSC

Scale 1:25

EXPLORATORY HOLE RECORD SHEET

Ref No. **WS2**

Sheet **1** of **1**

Consultant:
Whittaker Design
Client:
Quantum Star Ltd

PROJECT : Land Adjacent Spring Inn
LOCATION : Broad Lane, Rochdale

EQUIPMENT:
Archway Dart Rig

Casing
Dia. Depth
(mm) (m)
100 3.00

Ground Level : m. AOD
Co-ordinates E (m)
N (m)
Dates 12/12/2016 to 12/12/2016

Field Records	Samples/Tests			Drilling Foreman : M Walton STRATUM DESCRIPTION Engineer/Geologist : M Benson	Depth (Thick) (m)	Reduced Level (m AOD)	Strata Legend
	Depth (m) from to	Sample Type & No	Blow Count (N)/U				
Wet from 1.50m	0.40	0.50	C1	Dark grey clayey TOPSOIL	(0.20)		
				Dark grey organic very silty clay - MADE GROUND	0.20		
					(0.70)		
	1.00		CP1 (21)	Medium dense grey/brown silty very gravelly SAND	0.90		
	1.30	1.40	D1				
	1.70	1.80	D2				
	2.00		CP2 (27)		(2.10)		
	3.00		CP3 (18)	Medium dense gravelly silty SAND - Interpreted stratum	3.00		
12/12/2016: On completion of exploratory hole at 6.00m. Casing at 3.00m. Standing water level 1.00m. On withdrawal of casing exploratory hole backfilled and reinstated.	4.00		CP4 (18)		(3.00)		
	5.00		CP5 (18)				
	5.90		CP6 (21)	Borehole complete	6.00		

REMARKS :

Logged : M Benson
Date : 14/12/2016
Checked : M Richardson
Date : 16/01/2016
Site Ref : 5843 LSC

Scale 1:25

EXPLORATORY HOLE RECORD SHEET

Ref No. **WS3**

Sheet **1** of **1**

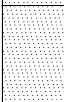
Consultant:
Whittaker Design
Client:
Quantum Star Ltd

PROJECT : Land Adjacent Spring Inn
LOCATION : Broad Lane, Rochdale

EQUIPMENT:
Archway Dart Rig

Casing
Dia. Depth
(mm) (m)
100 2.00

Ground Level : m. AOD
Co-ordinates E (m)
N (m)
Dates 14/12/2016 to 14/12/2016

Field Records	Samples/Tests			Drilling Foreman : M Walton STRATUM DESCRIPTION Engineer/Geologist : M Benson	Depth (<i>Thick</i>) (m)	Reduced Level (m AOD)	Strata Legend	
	Depth (m) from to	Sample Type & No	Blow Count (N)/U					
Wet from 1.80m	0.50 0.60	C1	(9)	Loose brown/grey gravelly silty sand - MADE GROUND	(0.60)			
	0.50 0.60	CP1			0.60			
	0.60 0.70	C1		Medium dense brown/grey slightly gravelly silty SAND with occasional cobbles				
	0.90 1.00	D1	(18)					
	1.00	CP2						
	1.50 1.60	D2			(1.70)			
	2.00	CP3	(12)					
				Medium dense brown gravelly silty fine to medium SAND	2.30			
					(0.70)			
	3.00	CP4	(28)	Medium dense gravelly silty fine to medium SAND - Interpreted stratum	3.00			
14/12/2016: On completion of exploratory hole at 6.00m. Casing at 2.00m. Standing water level 2.30m. On withdrawal of casing exploratory hole backfilled and reinstated.	4.00	CP5	(27)					
	5.00	CP6	(18)					
	5.90	CP7	(18)					
				Borehole complete	6.00			

REMARKS :

Logged : M Benson
Date : 14/12/2016
Checked : M Richardson
Date : 16/01/2016
Site Ref : 5843 LSC

Scale 1:25

EXPLORATORY HOLE RECORD SHEET

Ref No. **WS4**

Sheet **1** of **1**

Consultant:
Whittaker Design
Client:
Quantum Star Ltd

PROJECT : Land Adjacent Spring Inn
LOCATION : Broad Lane, Rochdale

EQUIPMENT:
Archway Dart Rig

Casing
Dia. Depth
(mm) (m)
100 2.00

Ground Level : m. AOD
Co-ordinates E (m)
N (m)
Dates 14/12/2016 to 14/12/2016

Field Records	Samples/Tests			Drilling Foreman : M Walton Engineer/Geologist : M Benson	Depth (Thick) (m)	Reduced Level (m AOD)	Strata Legend
	Depth (m) from to	Sample Type & No	Blow Count (N)/U				
Wet from 3.00m	0.40 0.50	C1		Grey/brown sand and gravel - MADE GROUND	(0.90)		
	1.00 1.10	CP1 D1	(12)	Medium dense brown gravelly silty fine to medium SAND	0.90		
	1.70 1.80	D2					
	2.00	CP2	(15)		(3.10)		
	3.00	CP3	(27)				
	4.00	CP4	(21)	Medium dense to dense gravelly silty fine to medium SAND - Interpreted stratum	4.00		
	5.00	CP5	(36)		(1.40)		
14/12/2016: On completion of exploratory hole at 6.00m. Casing at 2.00m. Standing water level Nil. On withdrawal of casing exploratory hole backfilled and reinstated.	5.40	CP6	(12)	Loose to medium dense gravelly silty fine to medium SAND - Interpreted stratum	5.40		
	5.90	CP7	(9)	Borehole complete	(0.60)		
					6.00		

REMARKS :

Logged : M Benson
Date : 14/12/2016
Checked : M Richardson
Date : 16/01/2016
Site Ref : 5843 LSC

Scale 1:25

EXPLORATORY HOLE RECORD SHEET

Ref No. **WS5**
Sheet **1** of **1**

Consultant:
Whittaker Design
Client:
Quantum Star Ltd

PROJECT : Land Adjacent Spring Inn
LOCATION : Broad Lane, Rochdale

EQUIPMENT:
Archway Dart Rig

Casing
Dia. Depth
(mm) (m)
100 2.00

Ground Level : m. AOD
Co-ordinates E (m)
N (m)
Dates 14/12/2016 to 14/12/2016

Field Records	Samples/Tests			Drilling Foreman : M Walton STRATUM DESCRIPTION Engineer/Geologist : M Benson	Depth (Thick) (m)	Reduced Level (m AOD)	Strata Legend
	Depth (m) from to	Sample Type & No	Blow Count (N)/U				
14/12/2016: On completion of exploratory hole at 6.00m. Casing at 2.00m. Standing water level Nil. On withdrawal of casing exploratory hole backfilled and reinstated.	0.50	CP1	(3)	Grey clayey TOPSOIL with rootlets	(0.20)		
				Grey/brown clayey sand and gravel - MADE GROUND	0.20		
	0.90 1.00	D1 CP2	(6)	Very loose dark grey/brown silty fine to medium sand - MADE GROUND	(0.30) 0.50		
	1.50 1.50 1.60	CP3 D2	(12)	Loose to medium dense brown with grey slightly silty SAND and GRAVEL	(0.50) 1.00		
	2.00	CP4	(15)	Medium dense brown gravelly silty fine to medium SAND	(1.00) 2.00		
	3.00	CP5	(33)	Dense gravelly silty fine to medium SAND - Interpreted stratum	(1.00) 3.00		
	4.00	CP6	(30)		(2.10)		
	5.00	CP7	(30)	Medium dense gravelly silty fine to medium SAND - Interpreted stratum	5.10		
	5.90	CP8	(12)		(0.90) 6.00		
				Borehole complete			

REMARKS :

Logged : M Benson
Date : 14/12/2016
Checked : M Richardson
Date : 16/01/2016
Site Ref : 5843 LSC

Scale 1:25