CST Environmental &
Acoustic Consultants

Geo - environmental Assessment

(Combined Stage 1 & 2)

Land to the rear of 52/54 Tarring Road (Orme Road)

Worthing
BN11 4ET

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Issue 1.0

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Report Prepared by: [redacted]

Checked by: LDS

Date: 20th January 2014

1.0 Introduction

1.1 The site lies within an established residential area and is to be found at approximate grid reference North **514170** East **103300**. It comprises open land immediately to the rear of 54 Tarring Road. It also includes an associated single storey brick built commercial property which is currently used for motor vehicle repair servicing. The whole site covers an area of approximately 116m2 and is best described as being of rectangular shape.

1.2 Planning permission was granted by Worthing and Adur Council in 2010 (10/0517/FUL) to demolish the existing workshop and erect 3No. x 1 bedroom town cottages.

1.3 An extract of the site layout plan together with an aerial view of the site is to be found at appendix 1 to this report.

1.4 The objective of this report is to provide a risk assessment of the site with a focus on human health and controlled waters. Both on site and off site risks are considered. This report has been prepared using information supplied as part of a Landmark Sitecheck report as well as the results of intrusive soil sampling and a site walk over. These data have also been supplemented by a desk top study of historical and geological maps for the area, together with information available from the Environment Agency (EA) and a study of local Worthing street directories. Plausible risks are considered and evaluated using a conceptual model. A full copy of the Sitecheck report forms a stand alone supplement to this report.

1.5 This assessment provides information on:

- the expected geology and hydrogeology underlying the site
- historic use of the site
- potential sources of on site and off site contamination
- the potential for on site migration of contamination from off site sources
- potential plausible pollutant linkages

1.6 The general methodology adopted for this assessment follows advice and guidance contained in a number of published authoritative documents. These include:

- BS10175:2001 Investigation of Potentially Contaminated Sites - Code of Practice;
- Government publication CLR11 - Model Procedures for the Management of Land Contamination;
- PPS23 Planning and Pollution Control

- Environment Agency (EA) Research and Development Publication 20, 1999 "Methodology for the Derivation of Remedial Targets for Soil and Groundwater to protect water resources".

2.0 Site Geology

2.1 Reference to the British Geological Survey 1:50,000 series scale map - Sheet 318/33 (Brighton & Worthing) indicates that the expected geology for the site is:

(i) Superficial deposits – Head (The Head deposits generally comprise silty clay with variable amounts of gravel, chalk and flint intermixed).

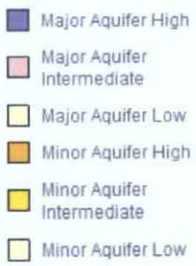
(ii) Bedrock - White Chalk

3.0 Controlled Waters - Vulnerability

3.1 Ground Water Current Environment Agency groundwater vulnerability maps have been interrogated. These confirm the Site check advice that the site show that the site lies over a Minor Aquifer of high permeability. An extract of the Environment Agency map for the area is shown below:

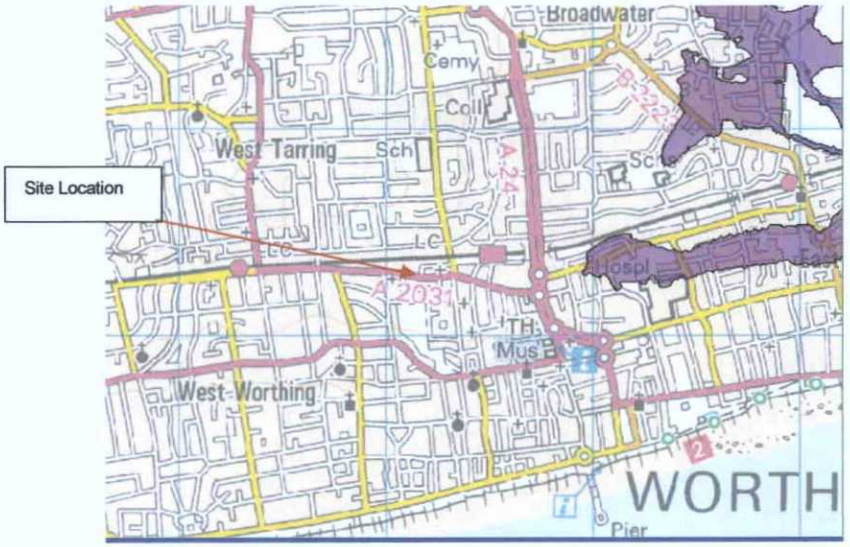


Extract of EA Groundwater Vulnerability Map



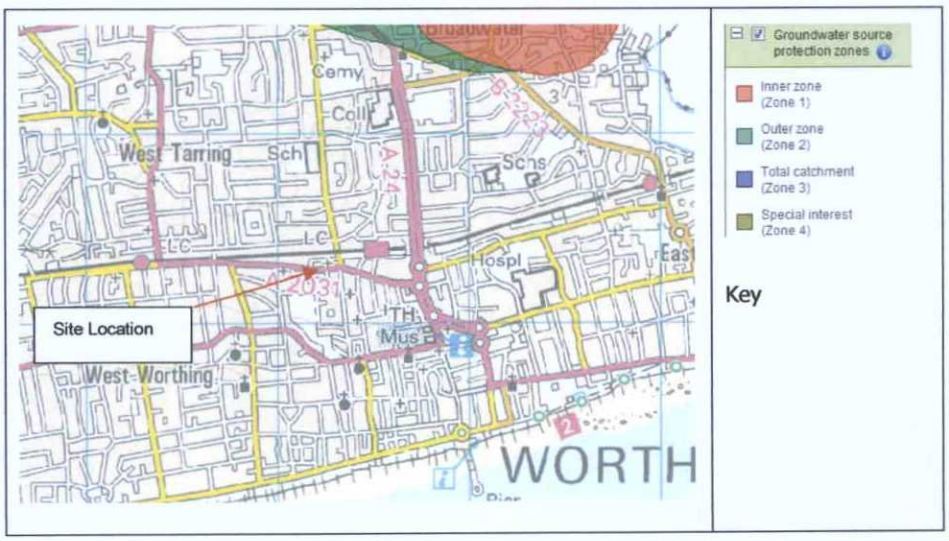
3.2 Flow through the chalk is predominantly through fissures which can facilitate rapid flow rates with the potential for rapid spread of pollutants although the Head deposits are known to provide some protection to the aquifer.

3.3 Surface Water - Flood Risk - The site lies outside the nearest area designed by the Environment Agency as suffering from flooding. An extract from the EA flood risk map for the area is shown below:



Key: Areas where Flood Alerts issued

3.4 Ground Water - Source Protection Zones



Extract of EA Source Protection Zone Map

3.5 The EA has defined Source Protection Zones (SPZs) for groundwater sources such as wells, boreholes and springs used for public drinking water supply. The zones are used to show the risk of contamination from any activities that might cause pollution to groundwater in the area. Reference to the above map confirms that the site lies outside the boundary of the nearest designated SPZ.

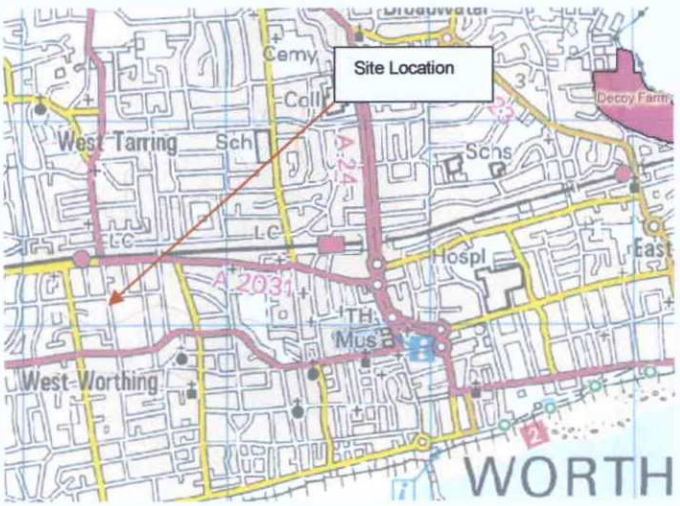
4.0 OFF SITE CONTAMINATION

4.1 The Interrogation of the EA pollution incident database reveals no recent incidents that would be considered likely to impact on the development site. The Site search report identified a number of off site potentially contaminative uses associated with the former Brooklands Trading Estate which was located to the north west of the site. The trading estate was redeveloped for housing in 2008 with planning conditions which included a requirement to investigate and remediate any on site contamination.

4.2 Off site contamination - Landfill

4.3 The development site is approximately 1800m from the nearest recorded historic landfill sites. These are Decoy Farm, Meadow Road and Brooklands.

4.4 The location of the nearest landfill site (Decoy Farm) can be seen below from an extract of the relevant EA landfill map for the area:



Extract of EA - Landfill Map (1:15000)

4.5 The nearest confirmed landfill site is the ex corporation rubbish tip at Decoy Farm. This was one of three sites formerly used by Worthing BC until each site in turn became full. The table below summarises the historic information on these facilities:

Site Name	Distance from site	Description / Waste Types
Decoy Farm	1800m	Operational circa 1970 to 1977 Commercial, Household and Insert Waste accepted.
Meadow Road	2300m	Operational circa 1953 to 1970 Commercial, Industrial, household, industrial and leacheate.
Brooklands	2800m	Operational circa 1950 - 1962 commercial, industrial, household, industrial and leacheate.

4.6 Local records relating to possible landfill gas emission are incomplete. Elevated gas concentrations (methane and carbon dioxide) have previously been identified in the ground immediately south of the northern part of the Brooklands site[1]. Further investigations in 1985 also indicated the presence of high yield landfill gas, possibly due to the amount of sewage sludge that had been accepted at this location.

4.7 A 1990 ground gas survey for the Decoy Farm site identified production of methane and carbon dioxide within the landfill, but little evidence of gas migration outside the landfill boundary, with the exception of an area to the west of the Decoy Farm, where elevated methane concentrations were recorded. However at the distances involved between source and receptor it is not considered that there is a plausible source / pathway/ receptor link.

5.0 Historical Land Use

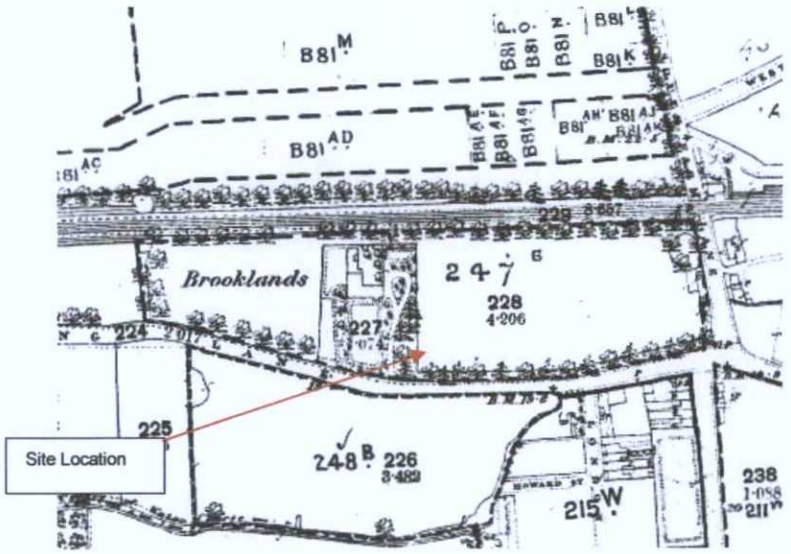
5.1 Summary of Historic Land Use

5.2 The Sitecheck report provides an overview of historical 1:2,500 and 1:10,000 scale maps. In summary the review indicates that the site remained undeveloped, existing as open land until around 1890 following which it was occupied by residential gardens and partially covered residential properties. Subsequent mapping shows that the site remained the same until around 1953 when a new unidentified building was erected on site. According to the 2013 map edition the site has not changed since 1953.

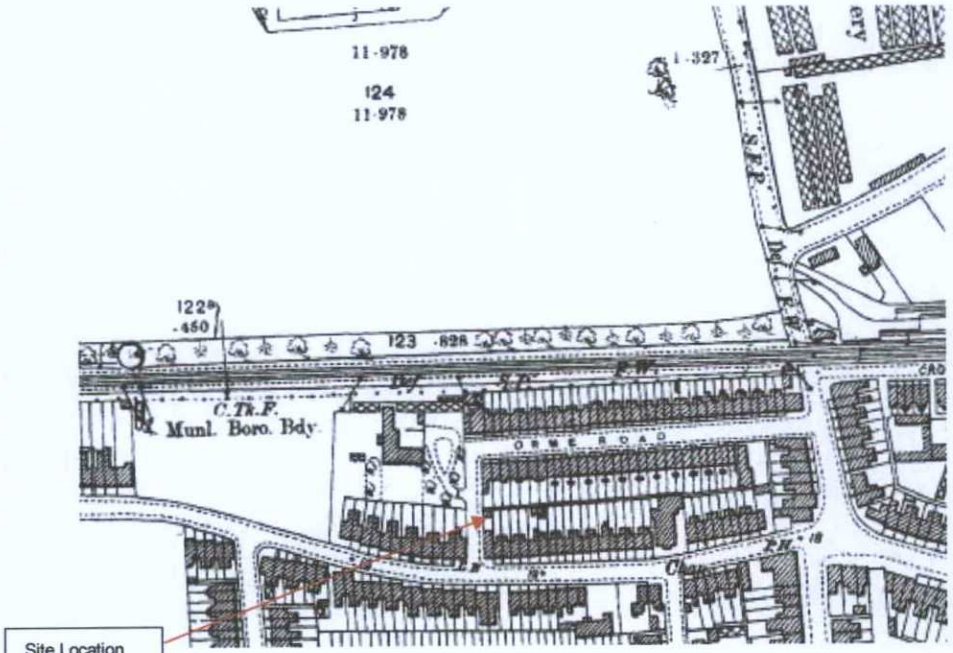
5.3 The following map extracts provides additional detail.

1 1997 Study

- The earliest map reviewed (dated 1876) shows the area to be mainly open countryside and no development on the site. A large dwelling house and Garden (Brooklands) is located immediately to the north west of the site.

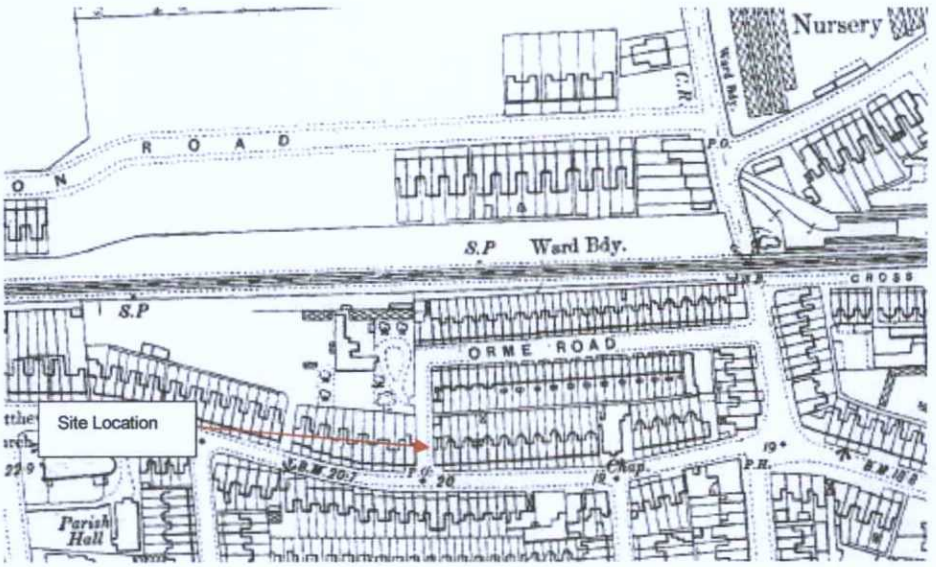


1876 Map



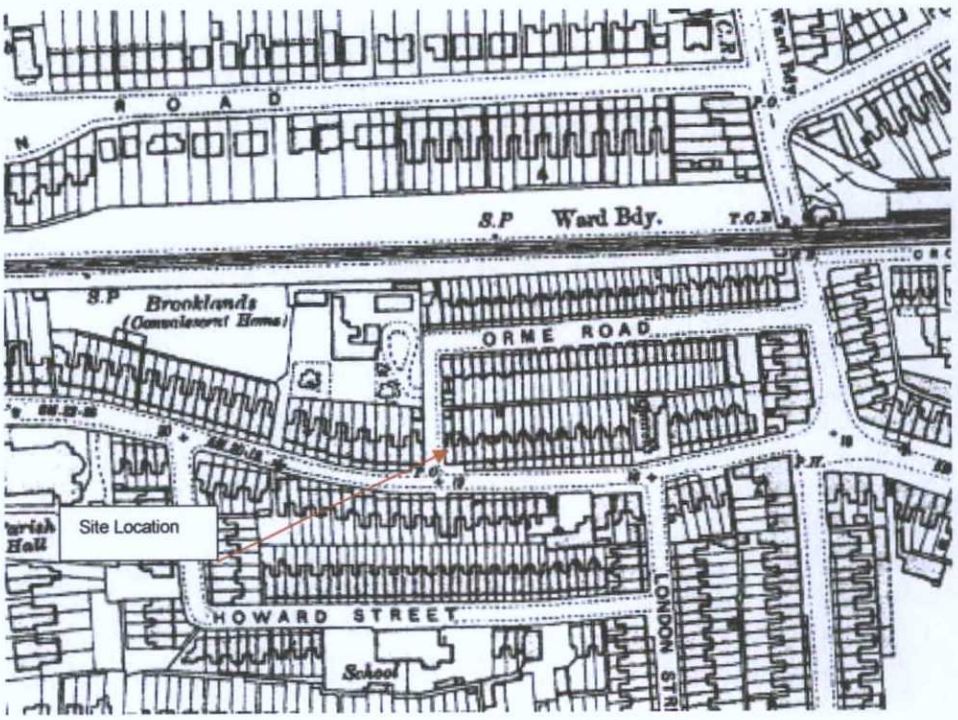
1898 Map

- 1898 – Development has now occurred and the site developed. A small garden structure can be seen at boundary of 54 Tarring Road.



1912 Map

- 1912 - Further local development has taken place. Reference to the 1910 Worthing Street Directory shows that at 54 Tarring Road was occupied by Mr. G Harling who ran a general store.



1939 – (Pre WW 2) Map

- 1939 – Map shows no change to the site although "Brooklands" to the north west is now identified as a Convalescent Home. Reference to the 1938 Worthing Street Directory reveals that a MR F Goddard operated a wardrobe dealing business from 54Tarring Road



1954 Map

- 1954 – An unidentified structure has been erected at the end of the garden of 54 Tarring Road. The footprint of this building is similar in size and location to the commercial store/ garage currently on site. Reference to post war Worthing Street directories reveals that in 1960 No.54 Tarring Road was occupied by Worthing Relay Vision who were television repairers.

- 1990 – 2014 Garage Services use on the site

6.0 Preliminary Risk Assessment

6.1 Contamination

6.2 The Sitecheck report identified 2No. potential sources of contamination (PSCs) within 24m of the site. These are:

PSC1 (On site) - Potential for contamination to ground and near ground from historic garage services undertakings from sub surface.

PSC 2 (On site) - Radon Gas from subsurface.

6.3 PSC 1 Garage Services - Reference to the Sitecheck report suggests that around the early 1950s the original garden store to the rear of 54 Tarring Road was demolished and replaced with a purpose built workshop constructed in brick under a steel and asbestos cement pitched roof. Reference to the 1960 Worthing Street Directory indicates that a for a time this workshop was

used as a store and workshop associated with a television hire and rental business (Worthing Relay Vision) before being used for motor car valeting and general garage repairs, the current use.

6.4 PSC2 - Radon – The Site check report advises that the site lies within an area where statistically between 1% and 3% of properties can expect to have levels of Radon gas above the recommended action level for human exposure.

6.5 A conceptual model constructed from the desk top study confirmed the findings of the Sitecheck report which identified possible pollutant linkages. It is normally considered that if a linkage is considered possible, this represents a potentially 'unacceptable risk' and therefore requires further consideration. This may be through remediation or mitigation or through further tiers of investigation and assessment. It was therefore decided to move directly to Stage 2 assessment which would involve intrusive testing on site.

7.0 Stage 2 Assessment

7.1 A total of 6No. soil samples were taken in total over the site (3 locations) by a Geotechnical Engineer from Terratec Services SI Ltd. locations of the samples are shown at appendix 3. Borehole logs are also set out at appendix 3. The samples were obtained using a window sampler and best practice was followed regarding chain of custody for the samples which were divided into sample jars on site and kept in a cold box pending delivery to Scientific Analysis Laboratories Ltd (SAL) who hold the appropriate MCERTS accreditation for this work.

8.0 Assessment Criteria

8.1 The proposed redevelopment is for 3No. town cottages, no private gardens or soft landscaping that could be used for cultivation is to be provided. Appendix 5 compares the soil test results with published Soil Guideline Values (SGVs) where these exist and otherwise by reference to the CIEH /Land Quality Management Ltd (LQM) Generic Assessment Criteria (GACs) for residential use.

9.0 Results

9.1 No exceedances of the adopted general acceptance criteria were reported for any of the selected determinands. Poly Aromatic Hydrocarbons (PAHS) were all reported as being at or below the limits of laboratory detection. There was some indication of the presence of BTEX across all locations but levels marginally above the level of detection which were not considered to present a risk to human health of controlled waters. The results are set out in spreadsheet format at appendix 5 and electronic copies of the test reports are attached at appendix 6.

9.2 The sample locations and borehole logs are attached at appendix 3.

10.0 Conclusions and Recommendations

10.1 A combined Stage 1 & 2 risk assessment has been carried out.

10.2 From an analysis of local geological data and historic maps possible pollutant linkages were identified for human health only. These related to heavy metals, solvents, PAHs and hydrocarbons. A potential linkage for Radon was also identified.

10.3 The risk associated with any one linkage was at worst assessed as Medium for this site but it was considered that all the linkages were capable of being addressed through mitigation and / or remedial measures.

10.4 Stage 2 objective sampling and analysis found no evidence of on site contamination. No remediation work for the site is considered necessary.

10.5 There is a statistical risk according the findings of the British Geological Survey which reports that between 1% and 3% of homes in the local area may have naturally occurring Radon levels above the "action level". Discussions with Public Health England (the former Health Protection Agency) confirm that the standard residential Radon Test kit which has a 3 month exposure window has not been validated for use unless the residential accommodation concerned is occupied as a normal dwelling. It is therefore recommended a Radon protective dpm be incorporated at ground floor level for basic Radon protection as part of the construction phase.

11.0 Appendix 1 - Photographs



Site - Aerial View (2007)

Photograph 1 – Existing Workshop



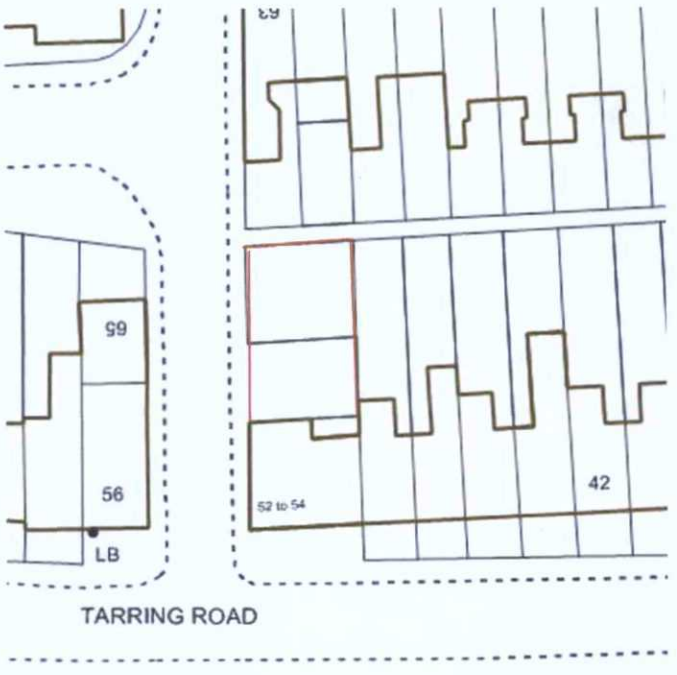
View – south east towards Tarring Road



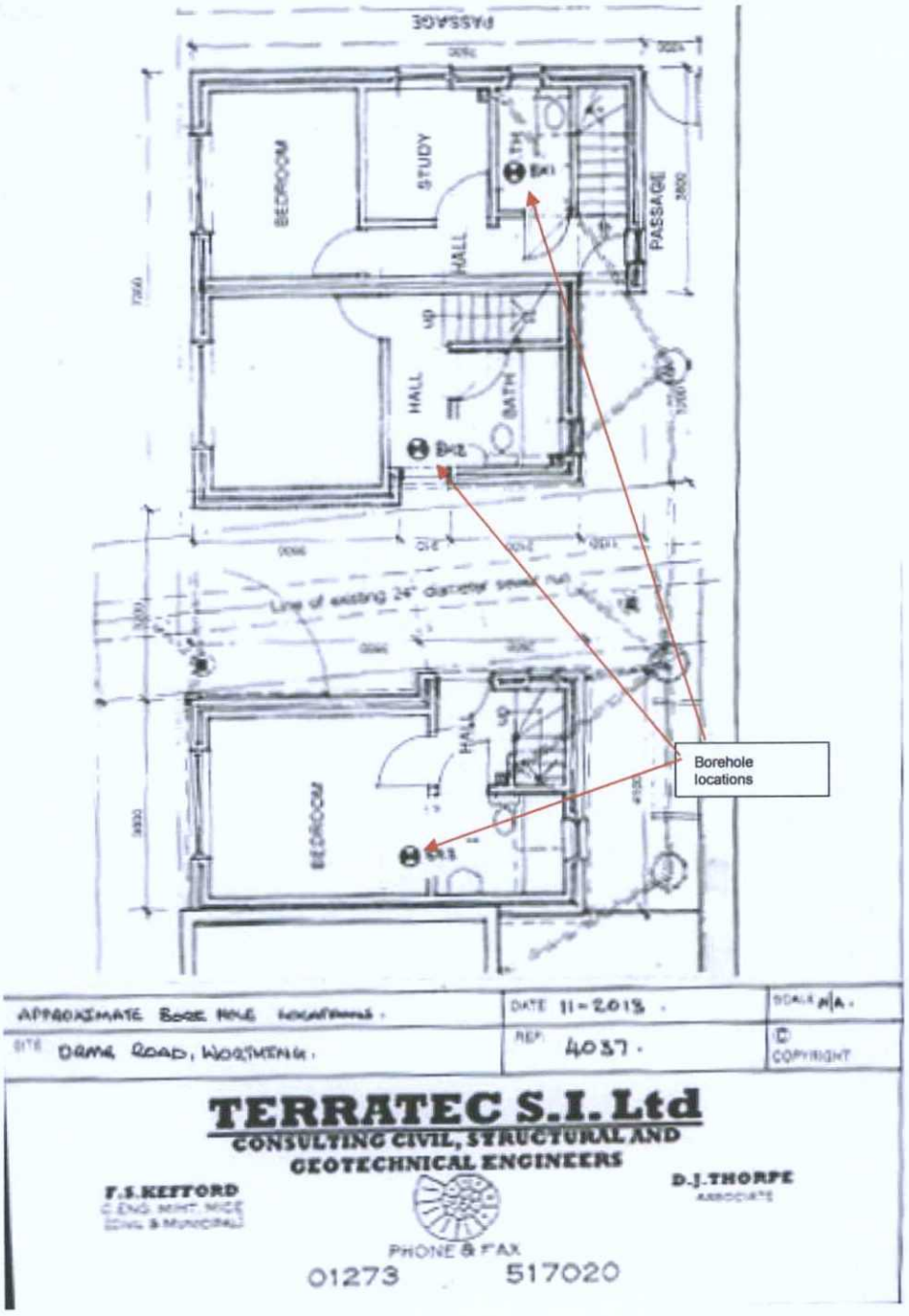
Photograph 2

View – looking east: showing additional land to the side of the existing workshop which is included in the development proposals

12.0 Appendix 2 - Site Layout (proposed scheme)



13.0 Appendix 3 - Intrusive Sampling Details



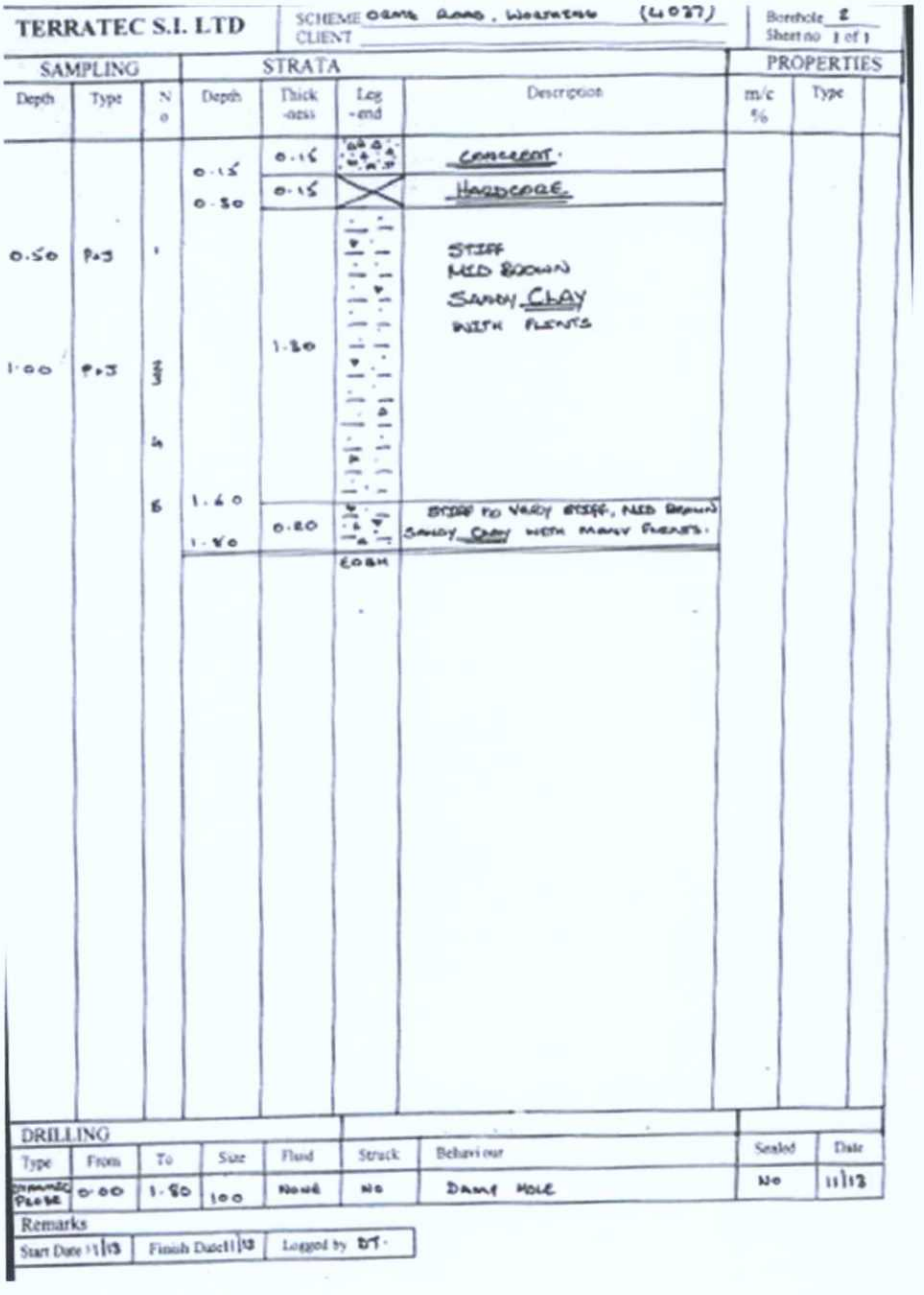
TERRATEC S.I. LTD	SCHEME Grove Road, Wheathampstead (4037) CLIENT	Borehole 1 Sheet no 1 of 1

SAMPLING			STRATA				PROPERTIES	
Depth	Type	No	Depth	Thickness	Legend	Description	m/c %	Type Dynamic Probe
			0.13	0.13		[illegible]		
			0.30	0.37		HARDCORE		
0.50	PvS	1				STIFF, MED BROWN SANDY CLAY WITH FLINTS		
1.00	PvS	2		1.35				
			1.65					
					ROAM			

DRILLING								
Type	From	To	Size	Fluid	Struck	Behaviour	Sealed	Date
Dynamic Probe	0.00	1.65	100	None	No	Dense Gravel	No	11/13

Remarks

Start Date 11/13	Finish Date 11/13	Logged by DT



TERRATEC S.I. LTD

SCHEME Ogmore Road, Worcester (4027)
CLIENT

Borehole 2
Sheet no 1 of 1

SAMPLING			STRATA				PROPERTIES		
Depth	Type	No	Depth	Thickness	Leg-end	Description	m/c %	Type	
			0.15	0.15		CONCRETE.			
			0.30	0.15		HARDCORE			
0.50	P.3	1		1.30		STIFF MED BROWN SANDY CLAY WITH FLINTS			
1.00	P.3	2							
		3							
		4	1.60	0.30		STIFF TO VERY STIFF, MED BROWN SANDY CLAY WITH MANY FLINTS.			
			1.90			EOBH			

DRILLING								
Type	From	To	Size	Fluid	Struck	Behaviour	Sealed	Date
DYNAMIC PROBE	0.00	1.80	100	None	No	Damp Hole	No	11/13

Remarks

Start Date 11/13 | Finish Date 11/13 | Logged by DT.

TERRATEC S.I. LTD	SCHEME Orme Road, Worthing. (4037) CLIENT	Borehole 3 Sheet no 1 of 1

SAMPLING			STRATA				PROPERTIES		
Depth	Type	No	Depth	Thick-ness	Leg-end	Description	m/c %	Type Dynamic Probe	
			0.15	0.15		CONCRETE			
			0.30	0.15		HARDCORE			
0.50	P+S	1		0.80		STIFF MED BROWN SANDY CLAY WITH FLINTS.			
0.80	P+S	2							
			1.10		BOSH				

DRILLING								
Type	From	To	Size	Fluid	Struck	Behaviour	Sealed	Date
Dynamic Probe	0.00	1.00	100	None	No	Damp Hole	No	11/13

Remarks

Start Date 11/13	Finish Date 11/13	Logged by DT.

14.0 Appendix 4 - Conceptual Site Model

Conceptual Site Model (October 2013 – Updated December 2013)				
Information Source	**Contaminant Source**	**Potential Pathways**	**Potential Targets**	**Assessment of Risk**
Local searches / site sensitivity data / Site	On site - Surface and near ground material from spills / leaks resulting from previous site use for garage services. Potential Contaminants: • Heavy Metals • Solvents • PAHs • Hydrocarbons	Direct Contact / Ingestion, Windblown dust, Migration through soils, vapour migration Groundwater/Surface water	Humans - Construction workers and end users construction materials Future residents, Groundwater	Risk very low for ground workers Risk Medium for residents Risk low for Groundwater (shallow and deep)
Public Health England / BGS	On site - Potential emission of Radon gas from the subsurface as a result of the radioactive decay of Radium. between 1% and 3% of homes in the area may have naturally occurring Radon levels above the "action level" (200 Bq m^{-3})	Sub surface - migration through soils, vapour migration	Humans - future residents	Risk Low

12.0 Appendix 5 - Results Summary

Demo Road, Worthing
382987
403/
Analysed as
Soil

| Method | Sample Test | Units | LOD | | |

LAND TO THE REAR OF 52/54 TARRING ROAD WORTHING BN11 4ET

Project Site: Crème Road, Worthing
Customer Reference: 4027

Analysed as Soil

Soil (CWG)

TPH (CWG)

SAL Reference

Customer Sample Reference

| Determinand | Method | Test Sample | LOD | Units | Date Sampled | | |

SAL Reference: 380827
Project Site: Orme Road, Worthing
Customer Reference : 4037

Analysed as Soil

Total and Speciated USEPA16 PAH (GC)

SAL Reference												
Customer Sample Reference				380827 001 BH1 @ 0.50m	380827 002 BH1 @ 1.00m	380827 003 BH2 @ 0.50m	380827 004 BH2 @ 1.00m	380827 005 BH3 @ 0.50m	380827 008 BH3 @ 0.80m			
Determinand	Method	Test Sample	LOD	Units	Date Sampled	04-Nov-13	04-Nov-13	04-Nov-13	04-Nov-13	04-Nov-13	04-Nov-13	SGV / GAC
												Mg/kg
Naphthalene	T16	AR	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	2.3
Acenaphthylene	T16	AR	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	400
Acenaphthene	T16	AR	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	3.8
Fluorene	T16	AR	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	400
Phenanthrene	T16	AR	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	200
Anthracene	T16	AR	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	2400
Fluoranthene	T16	AR	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1000
Pyrene	T16	AR	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	400
Benzo(a)Anthracene	T16	AR	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	7.4
Chrysene	T16	AR	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	400
Benzo(bk)Fluoranthene	T16	AR	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	36
Benzo(a)Pyrene	T16	AR	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	48
Indeno(123-cd)Pyrene	T16	AR	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	500
Dibenzo(ah)Anthracene	T16	AR	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.86
Benzo(ghi)Perylene	T16	AR	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	3.2
PAH(total)	T16	AR	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.83
												8400
												1000
												400
												3800
												400
												200
												2

SAL Reference: 359287
Project Site: Orme Road, Worthing
Customer Reference : 4037

Soil
VOC (SE)

Analysed as
Soil

SAL Reference						359287 001	359287 003	359287 005	
Customer Sample Reference						BH1 @ 0.50m	BH2 @ 0.50m	BH3 @ 0.50m	
					Date Sampled	04-Nov-13	04-Nov-13	04-Nov-13	
Determinand	Method	Test Sample	LOD		Units				
1,1,1,2-Tetrachloroethane	T54	AR		5	ug/kg	<5	<5	<5	
1,1,1-Trichloroethane	T54	AR		5	ug/kg	<5	<5	<5	
1,1,2,2-Tetrachloroethane	T54	AR		5	ug/kg	<5	<5	<5	
1,1,2-Trichloroethane	T54	AR		5	ug/kg	<5	<5	<5	
1,1,2-Trichloroethylene	T54	AR		5	ug/kg	<5	<5	<5	
1,1-Dichloroethane	T54	AR		5	ug/kg	<5	<5	<5	
1,1-Dichloroethylene	T54	AR		5	ug/kg	<5	<5	<5	
1,1-Dichloropropene	T54	AR		5	ug/kg	<5	<5	<5	
1,2,3-Trichlorobenzene	T54	AR		5	ug/kg	<5	<5	<5	
1,2,3-Trichloropropane	T54	AR		5	ug/kg	<5	<5	<5	
1,2,4-Trichlorobenzene	T54	AR		5	ug/kg	<5	<5	<5	
1,2,4-Trimethylbenzene	T54	AR		5	ug/kg	<5	<5	<5	
1,2-Dibromo-3-Chloropropane	T54	AR		10	ug/kg	<10	<10	<10	
1,2-dibromoethane	T54	AR		5	ug/kg	<5	<5	<5	
1,2-Dichlorobenzene	T54	AR		5	ug/kg	<5	<5	<5	
1,2-Dichloroethane	T54	AR		5	ug/kg	<5	<5	<5	
1,2-Dichloropropane	T54	AR		5	ug/kg	<5	<5	<5	
1,3,5-Trimethylbenzene	T54	AR		5	ug/kg	<5	<5	<5	
1,3-Dichlorobenzene	T54	AR		5	ug/kg	<5	<5	<5	
1,3-Dichloropropane	T54	AR		5	ug/kg	<5	<5	<5	
1,4-Dichlorobenzene	T54	AR		5	ug/kg	<5	<5	<5	
Ethyl-2-Methylbenzene	T54	AR		5	ug/kg	<5	<5	<5	
2,2-Dichloropropane	T54	AR		5	ug/kg	<5	<5	<5	
2-Chlorotoluene	T54	AR		5	ug/kg	<5	<5	<5	
4-Chlorotoluene	T54	AR		5	ug/kg	<5	<5	<5	
Benzene	T54	AR		1	ug/kg	<1	<1	<1	
Bromobenzene	T54	AR		5	ug/kg	<5	<5	<5	
Bromochloromethane	T54	AR		5	ug/kg	<5	<5	<5	
Bromodichloromethane	T54	AR		5	ug/kg	<5	<5	<5	
Bromoform	T54	AR		5	ug/kg	<5	<5	<5	
Bromomethane	T54	AR		5	ug/kg	<5	<5	<5	
Carbon tetrachloride	T54	AR		5	ug/kg	<5	<5	<5	
Chlorobenzene	T54	AR		5	ug/kg	<5	<5	<5	
Chlorodibromomethane	T54	AR		5	ug/kg	<5	<5	<5	
Chloroethane	T54	AR		5	ug/kg	<5	<5	<5	
Chloroform	T54	AR		5	ug/kg	<5	<5	<5	
Chloromethane	T54	AR		5	ug/kg	<5	<5	<5	
Cis-1,2-Dichloroethylene	T54	AR		5	ug/kg	<5	<5	<5	
Cis-1,3-Dichloropropene	T54	AR		5	ug/kg	<5	<5	<5	
Dibromomethane	T54	AR		5	ug/kg	<5	<5	<5	
Dichlorodifluoromethane	T54	AR		5	ug/kg	<5	<5	<5	
EthylBenzene	T54	AR		1	ug/kg	<1	<1	<1	
Hexachlorobutadiene	T54	AR		5	ug/kg	<5	<5	<5	
Isopropyl benzene	T54	AR		5	ug/kg	<5	<5	<5	
m/p ethyl toluene	T54	AR		5	ug/kg	<5	<5	<5	
M/P Xylene	T54	AR		1	ug/kg	2	2	1	
Methyl tert-Butyl Ether	T54	AR		1	ug/kg	<1	<1	2	
n-Butylbenzene	T54	AR		10	ug/kg	<10	<10	<10	
n-Propylbenzene	T54	AR		5	ug/kg	<5	<5	<5	
O Xylene	T54	AR		1	ug/kg	<1	<1	1	
p-Isopropyltoluene	T54	AR		5	ug/kg	<5	<5	<5	
S-Butylbenzene	T54	AR		5	ug/kg	<5	<5	<5	
Styrene	T54	AR		5	ug/kg	<5	<5	<5	
T-Butylbenzene	T54	AR		5	ug/kg	<5	<5	<5	
Tertiary amyl methyl ether	T54	AR		5	ug/kg	<5	<5	<5	
Tetrachloroethene	T54	AR		5	ug/kg	<5	<5	<5	
Toluene	T54	AR		1	ug/kg	<1	<1	<1	
Trans-1,2-Dichloroethene	T54	AR		5	ug/kg	<5	<5	<5	
Trans-1,3-Dichloropropene	T54	AR		5	ug/kg	<5	<5	<5	
Trichlorofluoromethane	T54	AR		5	ug/kg	<5	<5	<5	
Vinyl chloride	T54	AR		5	ug/kg	<5	<5	<5	

Scientific Analysis Laboratories is a limited company registered in England and Wales (No 2514788) whose address is at Hadfield House, Hadfield Street, Manchester M16 9FE

Scientific Analysis Laboratories Ltd

Certificate of Analysis

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Report Number: 359287-1 Supplement 1

Date of Report: 07-Aug-2014

Customer: Terratec Services
Home Lodge
Piddinghoe Mead
Newhaven
East Sussex
BN9 9RN

Customer Contact: Mr Dave Thorpe

Customer Job Reference: 4037
Customer Site Reference: Orme Road, Worthing
Date Job Received at SAL: 05-Nov-2013
Date Analysis Started: 06-Nov-2013
Date Analysis Completed: 18-Nov-2013

The results reported relate to samples received in the laboratory
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 QP22

UKAS TESTING
1650

Report checked and authorised by :
Sarah Watt-Roy
Project Manager

Issued by :
Miss Claire Brown
Customer Service Manager [redacted]

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SAL Reference: 359287
Project Site: Orme Road, Worthing
Customer Reference: 4037

Soil Analysed as Soil
Miscellaneous

SAL Reference					359287 001	359287 002	359287 003	359287 004	359287 005	359287 006
Customer Sample Reference					BH1 @ 0.50m	BH1 @ 1.00m	BH2 @ 0.50m	BH2 @ 1.00m	BH3 @ 0.50m	BH3 @ 0.80m
Date Sampled					04-NOV-2013	04-NOV-2013	04-NOV-2013	04-NOV-2013	04-NOV-2013	04-NOV-2013
Determinand	Method	Test Sample	LOD	Units						
TPH (C10-C40)	T219	AR	10	mg/kg	<10	<10	<10	<10	<10	<10

SAL Reference: 359287
Project Site: Orme Road, Worthing
Customer Reference: 4037

Soil Analysed as Soil
CLEA Metals

SAL Reference					359287 001	359287 002	359287 003	359287 004	359287 005	359287 006
Customer Sample Reference					BH1 @ 0.50m	BH1 @ 1.00m	BH2 @ 0.50m	BH2 @ 1.00m	BH3 @ 0.50m	BH3 @ 0.80m
Date Sampled					04-NOV-2013	04-NOV-2013	04-NOV-2013	04-NOV-2013	04-NOV-2013	04-NOV-2013
Determinand	Method	Test Sample	LOD	Units						
Arsenic	T257	A40	2.0	mg/kg	4.1	5.9	2.8	5.8	5.8	5.0
Boron (water-soluble)	T82	A40	1	mg/kg	1	1	1	1	2	2
Cadmium	T257	A40	0.1	mg/kg	0.4	0.2	0.5	0.3	0.4	0.3
Chromium	T245	A40	0.5	mg/kg	7.3	11	4.6	12	20	12
Copper	T257	A40	2	mg/kg	6	7	3	7	5	7
Lead	T257	A40	0.5	mg/kg	48	170	14	110	19	66
Mercury	T245	A40	1.0	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel	T257	A40	0.5	mg/kg	6.1	7.4	4.5	7.9	14	8.4
Selenium	T257	A40	3	mg/kg	<3	<3	<3	<3	<3	<3
Vanadium	T257	A40	0.1	mg/kg	9.8	15	7.5	16	24	16
Zinc	T257	A40	0.5	mg/kg	54	44	21	40	30	46
Retained on 2mm	T2	A40	0.1	%	5.2	6.2	<0.1	<0.1	<0.1	<0.1

SAL Reference: 359287
Project Site: Orme Road, Worthing
Customer Reference: 4037

Soil Analysed as Soil
TPH (CWG)

					SAL Reference	359287 001	359287 002	359287 003	359287 004	359287 005	359287 006
					Customer Sample Reference	BH1 @ 0.50m	BH1 @ 1.00m	BH2 @ 0.50m	BH2 @ 1.00m	BH3 @ 0.50m	BH3 @ 0.80m
					Date Sampled	04-NOV-2013	04-NOV-2013	04-NOV-2013	04-NOV-2013	04-NOV-2013	04-NOV-2013
Determinand	**Method**	**Test Sample**	**LOD**	**Units**							
Benzene	T54	AR	1	µg/kg	(13) <1	(13) <1	(13) <1	(13) <1	(13) <1	(13) <1
EthylBenzene	T54	AR	1	µg/kg	<1	1	<1	1	<1	<1
M/P Xylene	T54	AR	1	µg/kg	2	3	2	2	1	1
O Xylene	T54	AR	1	µg/kg	<1	2	<1	1	1	1
Toluene	T54	AR	1	µg/kg	<1	<1	<1	<1	<1	<1
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	<1	<1	<1	<1	2	1
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C6-C7 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C6-C8 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
TPH (C10-C12 aliphatic)	T8	AR	1	mg/kg	<1	<1	<1	<1	<1	<1
TPH (C10-C12 aromatic)	T8	AR	1	mg/kg	<1	<1	<1	<1	<1	<1
TPH (C12-C16 aliphatic)	T8	AR	1	mg/kg	<1	<1	<1	<1	<1	<1
TPH (C12-C16 aromatic)	T8	AR	1	mg/kg	<1	<1	<1	<1	<1	<1
TPH (C16-C21 aliphatic)	T8	AR	1	mg/kg	<1	<1	<1	<1	<1	<1
TPH (C16-C21 aromatic)	T8	AR	1	mg/kg	<1	<1	<1	<1	<1	<1
TPH (C21-C35 aliphatic)	T8	AR	1	mg/kg	<1	<1	<1	<1	<1	<1
TPH (C21-C35 aromatic)	T8	AR	1	mg/kg	<1	<1	<1	<1	<1	<1

SAL Reference: 359287
Project Site: Orme Road, Worthing
Customer Reference: 4037

Soil Analysed as Soil
Total and Speciated USEPA16 PAH (SE)

					SAL Reference	359287 001	359287 002	359287 003	359287 004	359287 005	359287 006
					Customer Sample Reference	BH1 @ 0.50m	BH1 @ 1.00m	BH2 @ 0.50m	BH2 @ 1.00m	BH3 @ 0.50m	BH3 @ 0.80m
					Date Sampled	04-NOV-2013	04-NOV-2013	04-NOV-2013	04-NOV-2013	04-NOV-2013	04-NOV-2013
Determinand	**Method**	**Test Sample**	**LOD**	**Units**							
Naphthalene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)Anthracene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b/k)Fluoranthene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)Pyrene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(123-cd)Pyrene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(ah)Anthracene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
PAH(total)	T16	AR	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

SAL Reference: 359287
Project Site: Orme Road, Worthing
Customer Reference: 4037

Soil Analysed as Soil
VOC (SE)

				SAL Reference	359287 001	359287 003	359287 005
				Customer Sample Reference	BH1 @ 0.50m	BH2 @ 0.50m	BH3 @ 0.50m
				Date Sampled	04-NOV-2013	04-NOV-2013	04-NOV-2013
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
1,1,1,2-Tetrachloroethane	T54	AR	5	µg/kg	<5	<5	<5
1,1,1-Trichloroethane	T54	AR	5	µg/kg	<5	<5	<5
1,1,2,2-Tetrachloroethane	T54	AR	5	µg/kg	<5	<5	<5
1,1,2-Trichloroethane	T54	AR	5	µg/kg	<5	<5	<5
1,1,2-Trichloroethylene	T54	AR	5	µg/kg	<5	<5	<5
1,1-Dichloroethane	T54	AR	5	µg/kg	<5	<5	<5
1,1-Dichloroethylene	T54	AR	5	µg/kg	<5	<5	<5
1,1-Dichloropropene	T54	AR	5	µg/kg	<5	<5	<5
1,2,3-Trichlorobenzene	T54	AR	5	µg/kg	<5	<5	<5
1,2,3-Trichloropropane	T54	AR	5	µg/kg	<5	<5	<5
1,2,4-Trichlorobenzene	T54	AR	5	µg/kg	<5	<5	<5
1,2,4-Trimethylbenzene	T54	AR	5	µg/kg	<5	<5	<5
1,2-Dibromo-3-Chloropropane	T54	AR	10	µg/kg	<10	<10	<10
1,2-dibromoethane	T54	AR	5	µg/kg	<5	<5	<5
1,2-Dichlorobenzene	T54	AR	5	µg/kg	<5	<5	<5
1,2-Dichloroethane	T54	AR	5	µg/kg	<5	<5	<5
1,2-Dichloropropane	T54	AR	5	µg/kg	<5	<5	<5
1,3,5-Trimethylbenzene	T54	AR	5	µg/kg	<5	<5	<5
1,3-Dichlorobenzene	T54	AR	5	µg/kg	<5	<5	<5
1,3-Dichloropropane	T54	AR	5	µg/kg	<5	<5	<5
1,4-Dichlorobenzene	T54	AR	5	µg/kg	<5	<5	<5
Ethyl-2-Methylbenzene	T54	AR	5	µg/kg	<5	<5	<5
2,2-Dichloropropane	T54	AR	5	µg/kg	<5	<5	<5
2-Chlorotoluene	T54	AR	5	µg/kg	<5	<5	<5
4-Chlorotoluene	T54	AR	5	µg/kg	<5	<5	<5
Benzene	T54	AR	1	µg/kg	(13) <1	(13) <1	(13) <1
Bromobenzene	T54	AR	5	µg/kg	<5	<5	<5
Bromochloromethane	T54	AR	5	µg/kg	<5	<5	<5
Bromodichloromethane	T54	AR	5	µg/kg	<5	<5	<5
Bromoform	T54	AR	5	µg/kg	<5	<5	<5
Bromomethane	T54	AR	5	µg/kg	<5	<5	<5
Carbon tetrachloride	T54	AR	5	µg/kg	<5	<5	<5
Chlorobenzene	T54	AR	5	µg/kg	<5	<5	<5
Chlorodibromomethane	T54	AR	5	µg/kg	<5	<5	<5
Chloroethane	T54	AR	5	µg/kg	<5	<5	<5
Chloroform	T54	AR	5	µg/kg	<5	<5	<5
Chloromethane	T54	AR	5	µg/kg	<5	<5	<5
Cis-1,2-Dichloroethylene	T54	AR	5	µg/kg	<5	<5	<5
Cis-1,3-Dichloropropene	T54	AR	5	µg/kg	<5	<5	<5
Dibromomethane	T54	AR	5	µg/kg	<5	<5	<5
Dichlorodifluoromethane	T54	AR	5	µg/kg	<5	<5	<5
EthylBenzene	T54	AR	1	µg/kg	<1	<1	<1
Hexachlorobutadiene	T54	AR	5	µg/kg	<5	<5	<5
Isopropyl benzene	T54	AR	5	µg/kg	<5	<5	<5
m/p ethyl toluene	T54	AR	5	µg/kg	<5	<5	<5
M/P Xylene	T54	AR	1	µg/kg	2	2	1
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	<1	<1	2
n-Butylbenzene	T54	AR	10	µg/kg	<10	<10	<10
n-Propylbenzene	T54	AR	5	µg/kg	<5	<5	<5
O Xylene	T54	AR	1	µg/kg	<1	<1	1
p-Isopropyltoluene	T54	AR	5	µg/kg	<5	<5	<5
S-Butylbenzene	T54	AR	5	µg/kg	<5	<5	<5
Styrene	T54	AR	5	µg/kg	<5	<5	<5
T-Butylbenzene	T54	AR	5	µg/kg	<5	<5	<5
Tertiary amyl methyl ether	T54	AR	5	µg/kg	<5	<5	<5
Tetrachloroethene	T54	AR	5	µg/kg	<5	<5	<5
Toluene	T54	AR	1	µg/kg	<1	<1	<1
Trans-1,2-Dichloroethene	T54	AR	5	µg/kg	<5	<5	<5
Trans-1,3-Dichloropropene	T54	AR	5	µg/kg	<5	<5	<5
Trichlorofluoromethane	T54	AR	5	µg/kg	<5	<5	<5

SAL Reference:	359287
Project Site:	Orme Road, Worthing
Customer Reference:	4037
Soil	Analysed as Soil
VOC (SE)	

				SAL Reference	**359287 001**	**359287 003**	**359287 005**
				Customer Sample Reference	**BH1 @ 0.50m**	**BH2 @ 0.50m**	**BH3 @ 0.50m**
				Date Sampled	**04-NOV-2013**	**04-NOV-2013**	**04-NOV-2013**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Vinyl chloride	T54	AR	5	µg/kg	<5	<5	<5

Index to symbols used in 359287-1 Supplement 1

Value	Description
A40	Assisted dried < 40C
AR	As Received
13	Results have been blank corrected.
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Samples 002, 004 and 006 submitted for GC/MS (Headspace) analysis were submitted in inappropriate containers. It is possible therefore that the results provided may be compromised
Supplement 1 - Report re issued to amend site reference

Method Index

Value	Description
T8	GC/FID
T245	ICP/OES(Aqua Regia Extraction)
T257	ICP/OES (SIM) (Aqua Regia Extraction)
T54	GC/MS (Headspace)
T2	Grav
T82	ICP/OES (Sim)
T16	GC/MS
T219	GC/FID (SE)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
TPH (C10-C40)	T219	AR	10	mg/kg	U	001-006
Arsenic	T257	A40	2.0	mg/kg	U	001-006
Boron (water-soluble)	T82	A40	1	mg/kg	N	001-006
Cadmium	T257	A40	0.1	mg/kg	U	001-006
Chromium	T245	A40	0.5	mg/kg	U	001-006
Copper	T257	A40	2	mg/kg	U	001-006
Lead	T257	A40	0.5	mg/kg	U	001-006
Mercury	T245	A40	1.0	mg/kg	U	001-006
Nickel	T257	A40	0.5	mg/kg	U	001-006
Selenium	T257	A40	3	mg/kg	U	001-006
Vanadium	T257	A40	0.1	mg/kg	U	001-006
Zinc	T257	A40	0.5	mg/kg	U	001-006
Retained on 2mm	T2	A40	0.1	%	N	001-006
Benzene	T54	AR	1	µg/kg	U	001-006
EthylBenzene	T54	AR	1	µg/kg	U	001-006
M/P Xylene	T54	AR	1	µg/kg	U	001-006
TPH (C5-C6 aliphatic)	T54	AR	0.010	mg/kg	N	001-006
TPH (C6-C7 aromatic)	T54	AR	0.010	mg/kg	N	001-006
TPH (C6-C8 aliphatic)	T54	AR	0.010	mg/kg	N	001-006
TPH (C7-C8 aromatic)	T54	AR	0.010	mg/kg	N	001-006
TPH (C8-C10 aliphatic)	T54	AR	0.010	mg/kg	N	001-006
TPH (C8-C10 aromatic)	T54	AR	0.010	mg/kg	N	001-006
TPH (C10-C12 aliphatic)	T8	AR	1	mg/kg	N	001-006
TPH (C10-C12 aromatic)	T8	AR	1	mg/kg	N	001-006

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
TPH (C12-C16 aliphatic)	T8	AR	1	mg/kg	N	001-006
TPH (C12-C16 aromatic)	T8	AR	1	mg/kg	N	001-006
TPH (C16-C21 aliphatic)	T8	AR	1	mg/kg	N	001-006
TPH (C16-C21 aromatic)	T8	AR	1	mg/kg	N	001-006
TPH (C21-C35 aliphatic)	T8	AR	1	mg/kg	N	001-006
TPH (C21-C35 aromatic)	T8	AR	1	mg/kg	N	001-006
Naphthalene	T16	AR	0.1	mg/kg	U	001-006
Acenaphthylene	T16	AR	0.1	mg/kg	U	001-006
Acenaphthene	T16	AR	0.1	mg/kg	U	001-006
Fluorene	T16	AR	0.1	mg/kg	U	001-006
Phenanthrene	T16	AR	0.1	mg/kg	U	001-006
Anthracene	T16	AR	0.1	mg/kg	U	001-006
Fluoranthene	T16	AR	0.1	mg/kg	N	001-006
Pyrene	T16	AR	0.1	mg/kg	N	001-006
Benzo(a)Anthracene	T16	AR	0.1	mg/kg	U	001-006
Chrysene	T16	AR	0.1	mg/kg	U	001-006
Benzo(b/k)Fluoranthene	T16	AR	0.1	mg/kg	U	001-006
Benzo(a)Pyrene	T16	AR	0.1	mg/kg	U	001-006
Indeno(123-cd)Pyrene	T16	AR	0.1	mg/kg	U	001-006
Dibenzo(ah)Anthracene	T16	AR	0.1	mg/kg	U	001-006
Benzo(ghi)Perylene	T16	AR	0.1	mg/kg	U	001-006
PAH(total)	T16	AR	0.1	mg/kg	U	001-006
1,1,1,2-Tetrachloroethane	T54	AR	5	µg/kg	U	001,003,005
1,1,1-Trichloroethane	T54	AR	5	µg/kg	U	001,003,005
1,1,2,2-Tetrachloroethane	T54	AR	5	µg/kg	U	001,003,005
1,1,2-Trichloroethane	T54	AR	5	µg/kg	U	001,003,005
1,1,2-Trichloroethylene	T54	AR	5	µg/kg	U	001,003,005
1,1-Dichloroethane	T54	AR	5	µg/kg	U	001,003,005
1,1-Dichloroethylene	T54	AR	5	µg/kg	U	001,003,005
1,1-Dichloropropene	T54	AR	5	µg/kg	U	001,003,005
1,2,3-Trichlorobenzene	T54	AR	5	µg/kg	U	001,003,005
1,2,3-Trichloropropane	T54	AR	5	µg/kg	U	001,003,005
1,2,4-Trichlorobenzene	T54	AR	5	µg/kg	U	001,003,005
1,2,4-Trimethylbenzene	T54	AR	5	µg/kg	U	001,003,005
1,2-Dibromo-3-Chloropropane	T54	AR	10	µg/kg	U	001,003,005
1,2-dibromoethane	T54	AR	5	µg/kg	U	001,003,005
1,2-Dichlorobenzene	T54	AR	5	µg/kg	U	001,003,005
1,2-Dichloroethane	T54	AR	5	µg/kg	U	001,003,005
1,2-Dichloropropane	T54	AR	5	µg/kg	U	001,003,005
1,3,5-Trimethylbenzene	T54	AR	5	µg/kg	U	001,003,005
1,3-Dichlorobenzene	T54	AR	5	µg/kg	U	001,003,005
1,3-Dichloropropane	T54	AR	5	µg/kg	U	001,003,005
1,4-Dichlorobenzene	T54	AR	5	µg/kg	U	001,003,005
Ethyl-2-Methylbenzene	T54	AR	5	µg/kg	U	001,003,005
2,2-Dichloropropane	T54	AR	5	µg/kg	U	001,003,005
2-Chlorotoluene	T54	AR	5	µg/kg	U	001,003,005
4-Chlorotoluene	T54	AR	5	µg/kg	U	001,003,005
Bromobenzene	T54	AR	5	µg/kg	U	001,003,005
Bromochloromethane	T54	AR	5	µg/kg	U	001,003,005
Bromodichloromethane	T54	AR	5	µg/kg	U	001,003,005
Bromoform	T54	AR	5	µg/kg	U	001,003,005
Bromomethane	T54	AR	5	µg/kg	U	001,003,005
Carbon tetrachloride	T54	AR	5	µg/kg	U	001,003,005
Chlorobenzene	T54	AR	5	µg/kg	U	001,003,005
Chlorodibromomethane	T54	AR	5	µg/kg	U	001,003,005
Chloroethane	T54	AR	5	µg/kg	U	001,003,005
Chloroform	T54	AR	5	µg/kg	U	001,003,005
Chloromethane	T54	AR	5	µg/kg	N	001,003,005
Cis-1,2-Dichloroethylene	T54	AR	5	µg/kg	U	001,003,005
Cis-1,3-Dichloropropene	T54	AR	5	µg/kg	U	001,003,005
Dibromomethane	T54	AR	5	µg/kg	U	001,003,005
Dichlorodifluoromethane	T54	AR	5	µg/kg	N	001,003,005
Hexachlorobutadiene	T54	AR	5	µg/kg	U	001,003,005
Isopropyl benzene	T54	AR	5	µg/kg	U	001,003,005
m/p ethyl toluene	T54	AR	5	µg/kg	U	001,003,005
Methyl tert-Butyl Ether	T54	AR	1	µg/kg	U	001-006
n-Butylbenzene	T54	AR	10	µg/kg	U	001,003,005
n-Propylbenzene	T54	AR	5	µg/kg	U	001,003,005
O Xylene	T54	AR	1	µg/kg	U	001-006
p-Isopropyltoluene	T54	AR	5	µg/kg	U	001,003,005

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
S-Butylbenzene	T54	AR	5	µg/kg	U	001,003,005
Styrene	T54	AR	5	µg/kg	U	001,003,005
T-Butylbenzene	T54	AR	5	µg/kg	U	001,003,005
Tertiary amyl methyl ether	T54	AR	5	µg/kg	U	001,003,005
Tetrachloroethene	T54	AR	5	µg/kg	U	001,003,005
Toluene	T54	AR	1	µg/kg	U	001-006
Trans-1,2-Dichloroethene	T54	AR	5	µg/kg	U	001,003,005
Trans-1,3-Dichloropropene	T54	AR	5	µg/kg	U	001,003,005
Trichlorofluoromethane	T54	AR	5	µg/kg	U	001,003,005
Vinyl chloride	T54	AR	5	µg/kg	U	001,003,005