T J BOOTH ASSOCIATES

CONSULTING CIVIL & GEOTECHNICAL ENGINEERS

PHASE 1 & 2 ENVIRONMENTAL AUDIT.
Peel Street, Rochdale. OL12 6PS.

Client:	Mr Javed Sadiq.
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1. INTRODUCTION.

T. J. Booth Associates have been appointed by Mr Javed Sadiq to undertake a Phase 1 & 2 Environmental Audit to the above Development Site to support a Town & Country planning application for development.

The Application Site comprises a vacant piece of brownfield land to the SE corner of Peel Street, Rochdale. As part of the proposal, a pair of semidetached residential dwellings will be constructed with on street parking and gardens/yards to the rear. The Site coordinates are E: 389213, N: 413725.

This report provides a desk based environmental study local to the site on the potential for contamination via the source-pathway-receptor methodology using current environmental databases. A site walkover is also undertaken, in line with current guidance. Recommendations in line with current best practice shall be put forward at the end of the report.

2. PROPOSED DEVELOPMENT.

The proposed development is for the erection of a 2No. two-storey, semidetached residential dwellings.

The dwellings will be situated to the rear of the existing pavement in line with existing properties on the road, and will have patio and garden areas to the rear.

3. MAP REVIEW.

3.1. Historic Maps.

Historic maps were obtained from Landmark at nominally 1:2500 and 1:10560 scale of the Site and the surrounding area. They were reviewed, tabulated below & appended.

DATE	ON-SITE	OFF-SITE/SURROUNDING AREA
c1851	Site is part of agricultural land.	The local area is predominantly agricultural/undeveloped, however there are some buildings/commercial works in the vicinity of Spotland Road, to the S, and Toad Lane to the N.
c1893	Site boundary noted as current. Building noted to the NW, and SE corners. Road access noted to the N side of the Site.	Much of the local area developed with terraced residential housing to the N, E, & W and a public house to the S side. Timber yard and chimney noted within 100m of the Site.
c1910	Pathway or similar noted to the S side of the Site.	Complete urban infill. Engineering works, soap mill, cotton wash mill, livery stables, and joinery mill all noted within 250m of the Site.
c1930	Building noted to the SW corner of the Site.	No overall change.
c1959	Building now extends across the S side	No overall change.

	of the Site.	
c1960	No change.	No overall change.
c1972-90	Buildings to the rear of the Site noted to be separate buildings/dwellings.	Peel Street isolated from Sherriff Street. Falinge Flats re-development to E.
c1978-90	No change.	Demolition of terraced dwellings to the N side of development.
c1992	No change.	No overall change.

3.2. Present Day Maps.

Present day maps comprise both paper & digital/online resources such as google maps, topographic surveys, OS etc.

PRESENT DAY MAPPING DATA SUMMARY	
Site Boundaries, Outlines of Structures and Buildings:	The Site is bound by Peel Street to the N, Sherriff Street to the E. There is an alleyway to the W, and the yard to the former public house to the S side. The Site is currently vacant and comprises a hardcore surface.
Ground Contours, Natural Drainage Features:	The Site itself is relatively level although land elevation falls to the S & E over the wider area to the Roch Valley. The local area is fully developed and comprises sewerage systems taking foul surface water. UU plans show there is a 375dia VC combined sewer in Peel Street.
Water Courses:	The closest watercourse is the River Roch 350m SW.
Below Ground Obstructions:	None noted.

3.3. BGS Geological Map Review.

The local geology was accessed via the BGS digital online mapping data service, and paper copies of Rochdale Sheet 76, 1:50000 Series (solid & superficial), refer to appendix for Geological Maps.

GEOLOGY DATA SUMMARY	
Bedrock Geology:	The site is underlain by undifferentiated Carboniferous Westphalian Coal Measures, generally comprising interbedded sandstone and mudstone. The local stratigraphic dip is approx 10 degrees SSW.
Superficial Geology:	The BGS maps show sand & gravel underlying the Site although the boundary between this and glacial clay till is approx 100m NE. Thus the Site is underlain by sand & gravel over clay.
Coal Seams/Faults.	There Arley Coal is known to subcrop to the SW of the Site nominally 160m distant.

4. ENVIRONMENTAL DATA SEARCH.

4.1. Landmark Envirocheck Report.

The Landmark Envirocheck Report comprises a detailed environmental dataset for the site and the surrounding local area.

The summary assessment tables give an account of the environmental issues on site, within 0-250, and between 250-500m of the site (refer to appendix for summary tables). For this location an area

up to 250m of the site boundary is critical for environmental purposes and each section of the summary tables is commented on below.

4.1.1. Agency & Hydrological

Discharge Consents – No records within a 250m radius of the Site.

Pollution Incidents to Controlled Waters – 3 records within a 250m radius of the Site.

Groundwater Vulnerability – Classified soils as high leaching potential.

Bedrock Aquifer Designation – Secondary A Aquifer.

Superficial Aquifer Designation – Secondary A Aquifer.

Source Protection Zones – Not within a Source Protection Zone.

Flooding from Rivers & Sea – Not within a flood zone.

4.1.2. Waste.

No records within 250m of the Site.

4.1.3. Hazardous Substances.

No records noted within a 250m radius of the Site.

4.1.4. Geological.

Coal Mining Area – in an area that may be affected by coal mining.

Potential for Collapsible Ground Stability Hazards – very low.

Potential for Compressible Ground Stability Hazards – no hazard.

Potential for Ground Dissolution Stability Hazards – no hazard.

Potential for Landslide Ground Stability Hazards – very low.

Potential for Running Sand Ground Stability Hazards – very low.

Potential for Shrinking or Swelling Clay Ground Stability Hazards – no hazard.

Radon Potential/Radon Affected Areas – the property is in a low Probability Radon Area where <1% of homes are estimated to be at or above the action level.

Radon Potential/Radon Protection Measures – no radon protection measures are necessary in the construction of new dwellings or extensions.

4.2. BGS Boreholes Records.

One BH recorded adjacent to the Site (sewer record), ref No. Sd81SE525 indicated that ground comprises made ground to 700mm depth, medium dense sand & gravel to 4m depth and stiff clay to 6m depth.

4.3. Coal Authority.

Information was obtained from the Coal Authority interactive digital online mapping service. Data tabulated below.

COAL AUTHORITY DATA SUMMARY	
Mine Shafts, Pits, Adits/Entries:	Closest pit to the Site is approximately 460m SW of the Site boundary.
Past/Present Recorded Underground Mining.	The Coal Authority data indicates that no recorded working exist beneath the Site.

Probable/Potential Shallow Underground Workings & Outcrops:	The Coal Authority data indicates that no unrecorded shallow workings potentially exist beneath the Site.
Outcrops:	The closest seam is the Arley Coal nominally 160m SW. The seam dips to the SW and so does not underlie the Site.
Development High Risk Area:	The Site is not within a Development High Risk Area.

5. FIELDWORK.

5.1. Site Reconnaissance.

A Site reconnaissance was undertaken in February 2018.

SITE RECONNAISSANCE SUMMARY	
Details of Existing Structures:	The Site was accessed from Peel Street, Rochdale. It comprised a vacant plot of land surrounded by dilapidated timber fencing to the N, E & W sides, and a masonry boundary wall to the S. The Site surface comprised a hardcore finish, and the only structures of note were a small shipping container to the rear, and a concrete precast unit to the front of the Site which appeared to have been used to store landscaping material. There was some vegetation to the SW corner and littering had occurred. A manhole (combined) was noted to the front of the path adjacent the W side (between the Site and No.57). The flow ran from S via a 150dia pipe to the combined sewer in Peel Street, at a depth of 1.52m deep (CL-IL).
Adjacent Properties:	Residential dwellings noted to the W, Peel Street toi the N, Sheriff St to the E, and the yard to the public house to the S.
Water Levels, Directions of Flow and Rates in Rivers:	None noted locally.
Old Mine or Quarry Workings:	None noted.
Obvious/Immediate Hazards to Health/Safety:	None noted.
Areas of Discoloured Soil, Polluted Water, Vegetation, and Significant Odours:	Made ground noted on Site.
Relevant Ground Levels, Ground Water Levels, Positions of Wells and Springs:	Site is relatively level.

5.2. Site Investigations.

Site investigations were undertaken in February 2018 to assess the ground for contamination purposes. Investigations comprised 2No. machine excavated trial holes (THs1-2), undertaken with a 3.5t back acting excavator. The trial holes were located nominally to the centre rear & centre front of the Site to gain an insight in to the potential for made ground and general stratigraphy; and are tabulated below:

TH1	
0-100	20mm Limestone chippings, (MADE GROUND).
100-350	Grey-brown sand & gravel with brick & stone inclusions, (MADE GROUND).
350-750	Ashy fill, (MADE GROUND). (S1)
750-950	Black/brown slightly sandy firm clay/silt (MADE GROUND).
950-2450	Orange/brown medium dense very silty, slightly gravelly fine SAND, comprising dense pockets & occasionally reworked coal interlaminated at depth.

TH1		
0-150	20mm Limestone chippings, (MADE GROUND).	
100-300	Black-brown stiff clay/silt, (MADE GROUND).	(S2)
300-600	Ashy fill, (MADE GROUND).	
600-1200	Black/brown slightly sandy firm clay/silt (MADE GROUND).	
1200-2550	Orange/brown medium dense very silty, slightly gravelly fine SAND, becoming dense from 1600.	

2No. soil samples (S1-2) were taken in the upper made ground to as indicated above to assess the presence of shallow contamination.

The samples were sealed in 1kg white plastic snap top containers & amber jars, and sent to Concept Life Sciences Ltd to be tested for metals, speciated PAH, inorganics & sulphates, SOM, and asbestos screening; contaminants. No visual or olfactory evidence of hydrocarbon contamination was noted within the Site soil and thus no testing for such contaminants was warranted.

On return the samples were assessed by TJ Booth Associates to common threshold comparison data, specifically the Defra Category 4 Screening Levels (C4SLs), then to LQM/CIEH (S4ULs).

The LQM/CIEH S4UL data is the most current and comprehensive list of contaminant exposure level based on proposed end use, however, contaminant levels within S4ULs are considered 'low risk' and exceedance of S4ULs may warrant further analysis to ensure suitability for the specified end use.

The C4SL data relates to updated DEFRA Statutory Guidance under Part 2A of the Environmental Protection Act 1990 (Part 2A). The guidance introduces a 4 category system in which Category 4 is of the least concern and levels falling within this risk category are considered as 'acceptably low'.

As the S4ULs are considered more conservative than C4SLs, any contaminant levels exceeding a S4UL although not considered 'low risk' can still be considered 'acceptably low' for use within the planning regime as long as it is still within the C4SL risk category. Thus Site data is firstly held to C4SLs where available, and then to S4ULs thereafter.

5.3. Soil Testing Analysis.

Sample results indicated that made ground is contaminated with arsenic and mercury above that for residential usage, exceeding both the C4SLs, and S4UL threshold data.

Refer to TJ Booth Associates Soil Analysis Table and Concept Life Sciences sample certification in the appendix

6. CONCEPTUAL MODEL.

6.1. Summary.

Historic records of the Site indicate the Site has been developed previously and is a brownfield plot of land. Only small buildings have ever stood on the Site, however, the location number and size of these has varied through time. The most recent structures were to the rear of the Site.

Owing to the Site location, the local area has seen much development over the years also. Predominantly the area has been residential, although there have been commercial premises within 250m of the Site such as warehouses, mills, and engineering works historically. The area was developed between 1850-1890.

Upon site reconnaissance & site investigations made ground was noted to the upper ground stratigraphy. Soil sampling confirmed the upper made ground is unsuitable for residential usage.

No landfill sites have been noted within a 250m radius of the Site.

The Site is not noted to be in a radon area and there are no coal seams at shallow depth beneath the Site.

6.2. Potential Contaminants.

The desk study/site reconnaissance has revealed the following sources (not an exhaustive list but a summary of the main points):

SOURCE/S	CONTAMINANT/S	PRESENT
Made ground	Metals, PAH, sulphates, inorganics, asbestos.	YES

6.3. Potential Pathways.

The potential pathways to/from the Development Site include (not an exhaustive list but a summary of the main points):

PATHWAY	MEDIA	PRESENT
Soil and dust ingestion	Soil and indoor dust	YES
Consumption of home grown fruit and vegetables	Produce	YES
Skin contact (indoors)	Indoor dust	YES
Skin contact (outdoors)	Soil	YES
Inhalation of dust (indoors)	Air	YES
Inhalation of dust (outdoors)	Air	YES
Vapours (indoors)	Air	NO
Vapours (outdoors)	Air	NO

6.4. Potential Receptors.

Receptors mainly comprise workers in the construction phase, and residents for the proposed end use.

6.5. Potential Pollutant Linkages.

Below is a tabulated form of the conceptual model:

	SOURCE	PATHWAY	RECEPTOR	RISK
1	On site surface soils.	Direct ingestion, aerial ingestion, dermal contact, drinking water.	Site construction operatives & future occupants.	HIGH RISK.
2	Subsoils.	Contact with potential hazards.	Site buildings.	LOW RISK.
3	Ground gas from geological strata.	Diffusion through soil, aerial inhalation.	Future occupants. Explosion, suffocation.	LOW RISK.
4	Ground gas from waste, landfill or other sources in made ground.	Diffusion through soil, aerial inhalation.	Future occupants. Explosion, suffocation.	LOW RISK.
5	Contaminated ground and surface water. Controlled Waters.	Permeation through soils into excavations / basements, dermal contact & ingestion.	Site construction operatives & future occupants.	LOW RISK.
6	Aerial contaminants.	Dermal contact & aerial inhalation.	All site users / occupants.	LOW RISK.

6.6. Contaminant Risk Assessment.

Regarding potential pollutant linkage 1 & 2, made ground was noted to the upper ground surface across the Site. Soil sampling confirmed shallow contamination comprising elevated metals in the made ground horizon. No sulphates or other contaminants were noted that could have a negative effect on buildings or services. Due to the above, a pollutant linkage is noted that will have to be broken by physical barriers, or removal and replacement as necessary to mitigate the risk.

Regarding potential pollutant linkage 3, contaminant sources from local geology are thought to pose a low risk to the Development. The local area is not within a radon protection zone (BGS/HPA Class 1 Area). No recorded coal mining has been noted at or close to the surface although there are potential workings locally to the S. All risks from this pollutant linkage are discounted.

Ground gas sources such as waste & landfill sites in potential pollutant linkage 4 comprise a low risk. No sources were noted within 250m of the Site boundaries. All risks from this pollutant linkage are discounted.

Regarding potential pollutant linkage 5, potential impact on ground/surface water is considered low. The local area is underlain by clay, there are no watercourses nearby, the bedrock & superficial aquifers are secondary, and it is not within a Source Protection Zone.

Potential pollutant linkage 6 is considered to pose a low risk. Present legislation regarding the release of aerial contaminants is regulated although past contamination which was unregulated would now be recorded in potential pollutant linkage 1 as shallow ground contamination.

7. RECOMMENDATIONS/SITE INVESTIGATION STRATEGY.

7.1. Contamination Risk:

BS10175:2011+A1:2013 & R&D TECHNICAL REPORT P5-066/TR considers the upper 500mm of ground is sufficient to categorise the site soils with respect to:

- human/animal intake arising from ingestion and dermal contact
- potential for wind entrainment leading to inhalation (of contaminated soils and dusts) or deposition onto neighbouring land
- surface water run-off (e.g. due to flash flooding)

- uptake by shallow rooting plants (e.g. crops, ornamental and wild species)
- surface leaching to groundwater.

Soil test results have confirmed that the existing upper MADE GROUND profile contains contaminant levels above threshold limits for action against a residential end use setting. Virgin ground was noted below which is considered clean.

Made ground where it exists beneath garden areas should EITHER be covered with permanent hard standings (such as flags/pcc paviours, concrete/macadam etc); OR be removed to 600mm below final finished levels (unless the made ground thickness is less than this), and be replaced with a clean inert imported soil free from common contaminants.

Should imported soil be required, validation testing will need to be undertaken in accord with RMBC sampling ratios for such materials. Soil import should be clean/inert, and free from deleterious materials & be able to pass the contamination suites noted below with regard to a residential end use setting; and should be suitable for use in a residential end use setting.

Validation samples will be tested for contamination suites: metals, inorganics, PAH USEPA16 speciated, and asbestos screening. Results will be analysed against Defra Category 4 Screening Levels (C4SLs) where available, and then to the LQM/CIEH (S4ULs) thereafter, for use in a residential end use setting.

7.2. Gas Risk:

No legitimate sources of gas were noted in the local area, and gas risk to the development is not considered a viable pollutant linkage. Gas protection measures are not required in the development.

7.3. Additional Notes:

Should any suspected unidentified contamination be encountered throughout the groundworks or construction phase of the development, the suspect area/s should be isolated, advice sought from a suitable qualified environmental professional, and the LPA informed.

A final Site Validation Report should be undertaken following completion of remedial measures and include any subsoil/topsoil import sample results. The report should be submitted to the LPA to obtain full discharge of the environmental planning condition.

Before any further work is undertaken, this report should be submitted to and agreed by the Rochdale MBC Contaminated Land Team.

We trust that the above clear, but should you require further advice please contact the undersigned.

Signed…….

D.S.Slattery BSc (Hons).

T J Booth Associates.

Authorised…….

T J Booth BSc (Hons), C. Eng. C. Env. MICE.

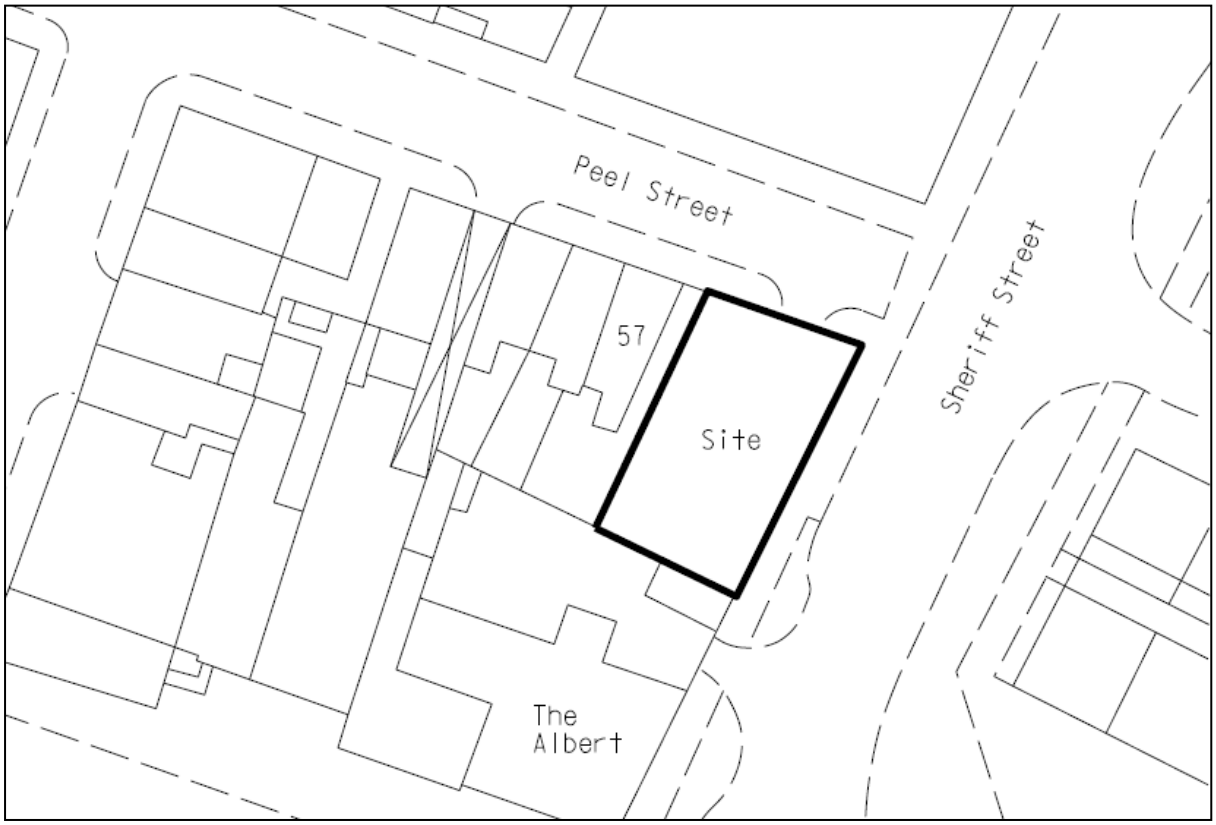
T J Booth Associates.

8. REFERENCES.

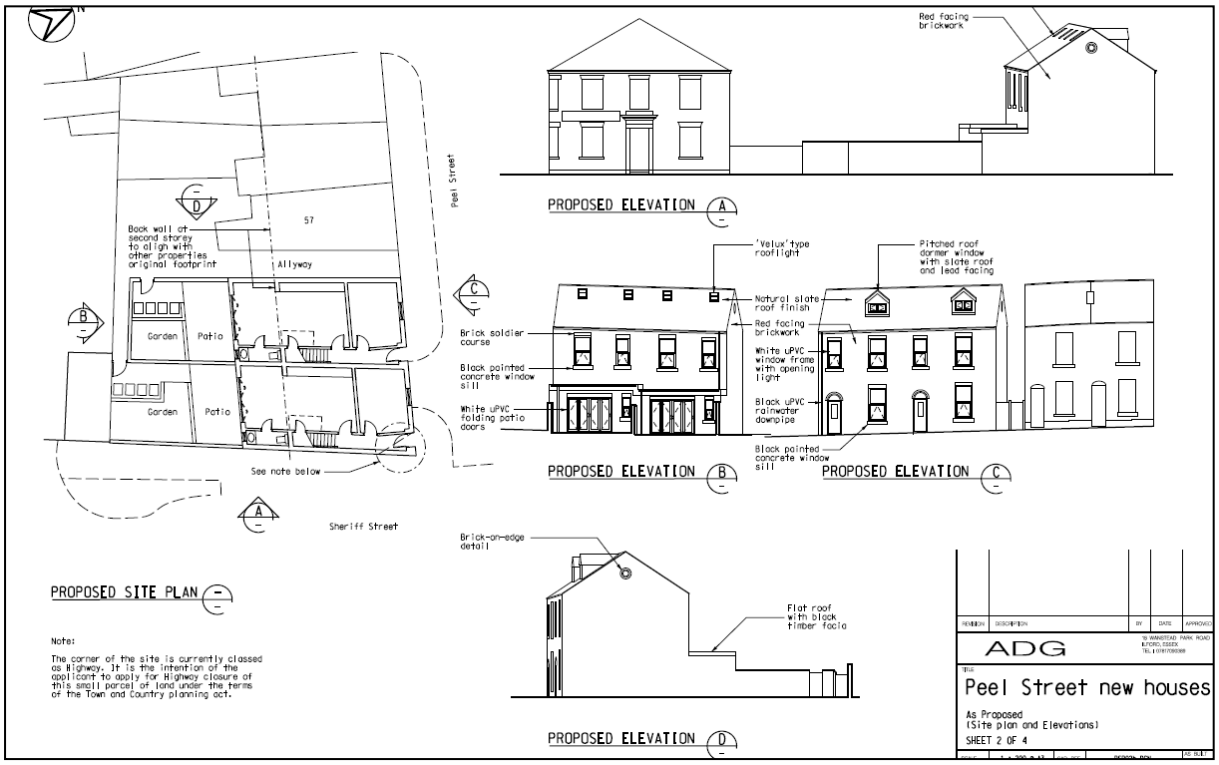
- BSI. 2013. BS 10175:2011+A1:2013. Investigation of Potentially Contaminated Sites – Code of Practice.
- Environment Agency. 2005. Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination. R&D Technical Report P5-066/TR.
- CL:AIRE. 2012. Research Bulletin-RB17-A Pragmatic Approach to Ground Gas Risk Assessment.
- NHBC. 2007. Guidance on Evaluation of Development Proposals on Sites Where Methane and Carbon Dioxide are Present.
- CIRIA. Report C665.
- CIRIA. Report 130.
- CIRIA. Report SP32.
- BRE 414. 2001. Protective Measures for Housing on Gas Contaminated Land.
- ICE Manual of Geotechnical Engineering Volume I. 2012.

9. APPENDIX A: FIGURES.

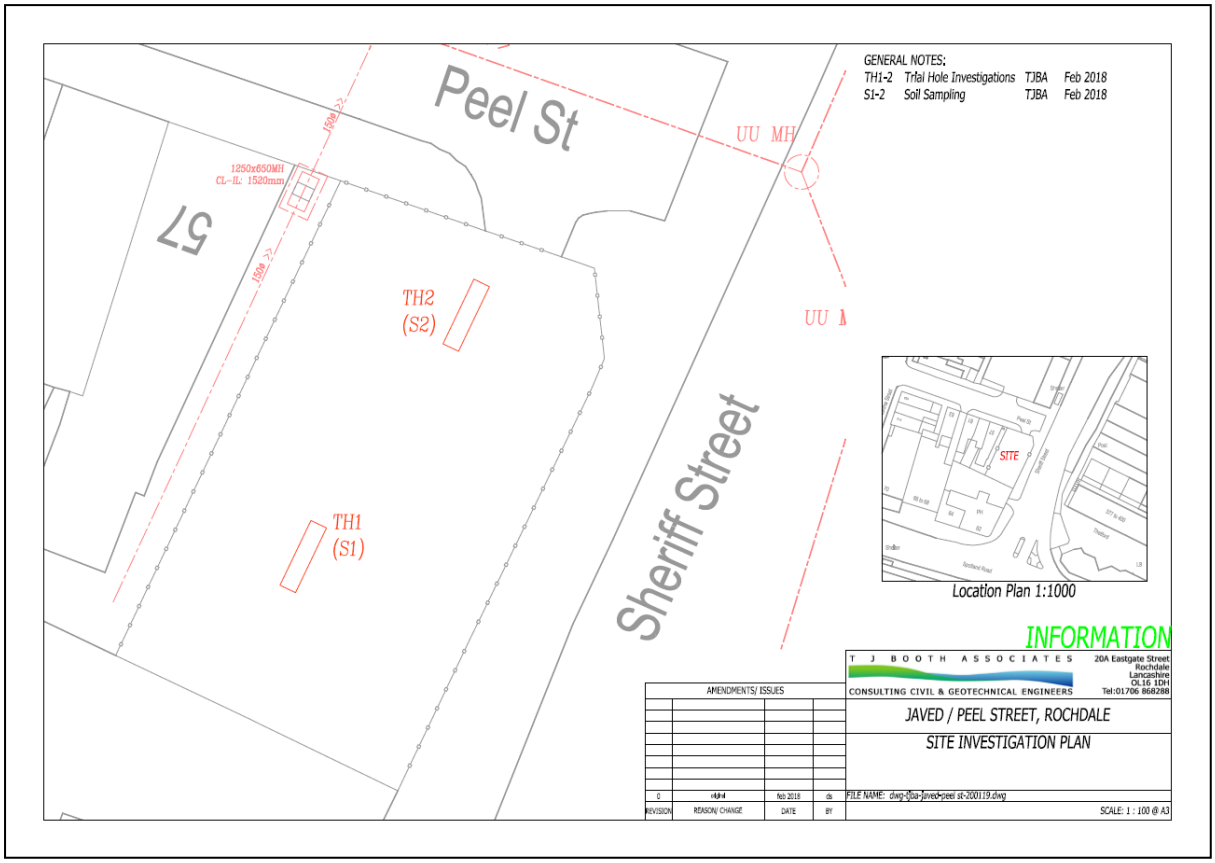
9.1. Location Plan.



9.2. Proposed Development.



9.3. Site Investigation Plan.



9.4. TJBA Soil Contamination Testing Analysis.

Client / Site	***Javed - Peel Street, Rochdale.***
Sampling Date	***13th February 2019***

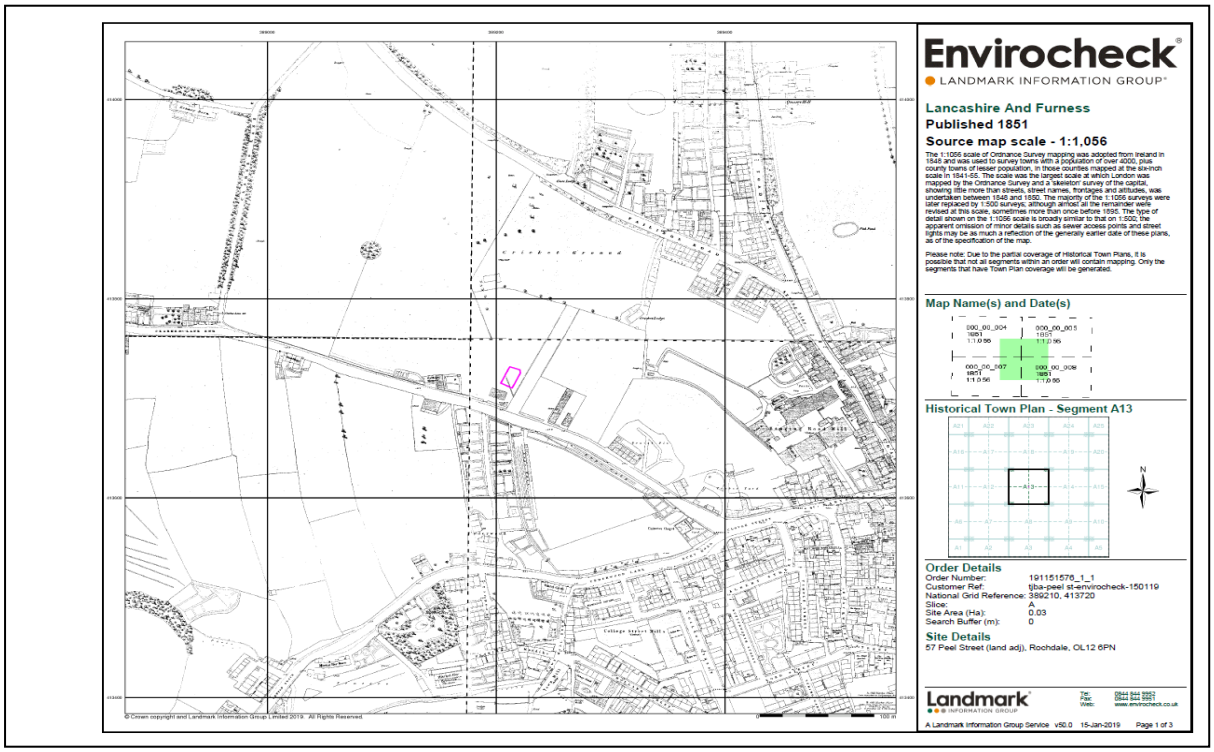
Comparison of Contamination Test Results with Thresholds (mg/kg)

Contaminant		No	Max	Mean	t 95	RESIDENTIAL (with or without plant uptake)		
							Pass/Fail	Comment
METALS	Arsenic as As, dry weight	2	39	32	38.3	37	FAIL	
	Boron as B, hot water sol dw	2	1	1	1	290	PASS	
	Cadmium as Cd, dry weight	2	1	1	1	22	PASS	
	chromium as Cr(III) dry weight	2	15.00	14.00	14.90	910	PASS	
	Chromium as Cr(VI), dry weight	2	1	1	1	21	PASS	
	Copper, as Dry Weight	2	150	125	147.5	2400	PASS	
	Lead, as Dry Weight	2	160	150	159	200	PASS	
	Mercury as Hg, dry weight	2	3	2	2.9	1.2	FAIL	
	Nickel as Ni, dry weight	2	85	75	84	130	PASS	
	Selenium as Se, dry weight	2	3	3	3	250	PASS	
	Zinc as Zn, dry weight	2	86	84.5	85.85	3700	PASS	
INORGANIC	Cyanide (Total)	2	1	1	1	2.5	PASS	
	Sulphate (Total) as SO4	2	0.01	0.01	0.01	0.24	PASS	
	Sulphide	2	10	10	10	250	PASS	
	pH	2	7.7	7	7.63	6 to 8	NORMAL	
	Sulphur (Elemental)	2	500	500	500	100	comment	
	Asbestos Identification	2	0	0	0	0	PASS	
ORGANIC	SOM	2	6	6	6			
PAH	acenaphthene	2	0.01	0.01	0.01	1100	PASS	
PAH	acenaphthylene	2	0.01	0.01	0.01	920	PASS	
PAH	anthracene	2	0.02	0.015	0.02	11000	PASS	
PAH	benz[a]anthracene	2	0.06	0.045	0.059	13	PASS	
PAH	benzo[a]pyrene	2	0.05	0.035	0.049	5	PASS	
PAH	benzo[b]flouranthene	2	0.05	0.035	0.049	3.7	PASS	
PAH	benzo[g,h,i]perylene	2	0.03	0.02	0.029	350	PASS	
PAH	benzo[k]flouranthene	2	0.04	0.03	0.039	100	PASS	
PAH	chrysene	2	0.08	0.06	0.078	27	PASS	
PAH	dibenz[ah]anthracene	2	0.01	0.01	0.01	0.3	PASS	
PAH	flouranthene	2	0.1	0.07	0.097	890	PASS	
PAH	flourene	2	0.01	0.01	0.01	860	PASS	
PAH	indeno[123-cd]pyrene	2	0.03	0.02	0.029	41	PASS	
PAH	napthalene	2	0.09	0.07	0.088	13	PASS	
PAH	phenanthrene	2	0.14	0.105	0.137	440	PASS	
PAH	pyrene	2	0.1	0.07	0.097	2000	PASS	
PAH	PAH (Total - SUM EPA16)	2	0.83	0.605	0.808	1	PASS	
SVOC	phenol	2	1	1	1	380	PASS	

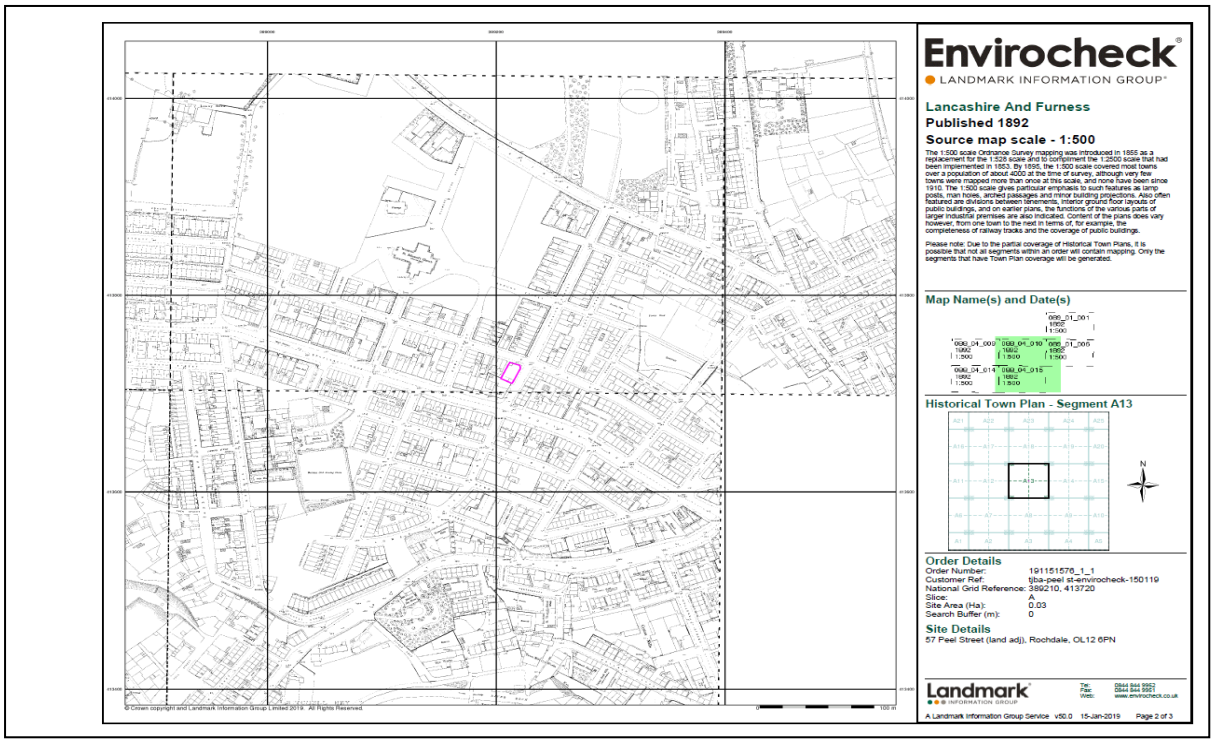
10. APPENDIX B: MAPS.

10.1. Landmark Historic Maps.

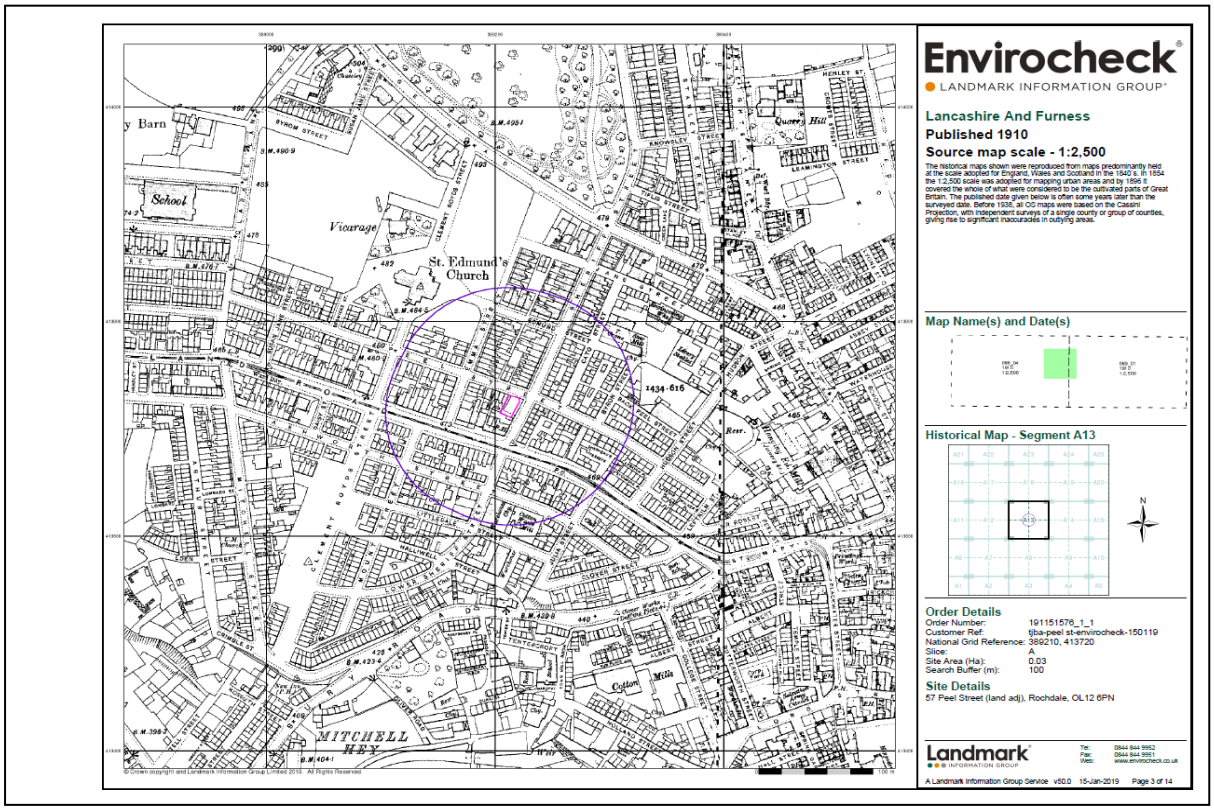
10.1.1. Ordnance Survey c1851



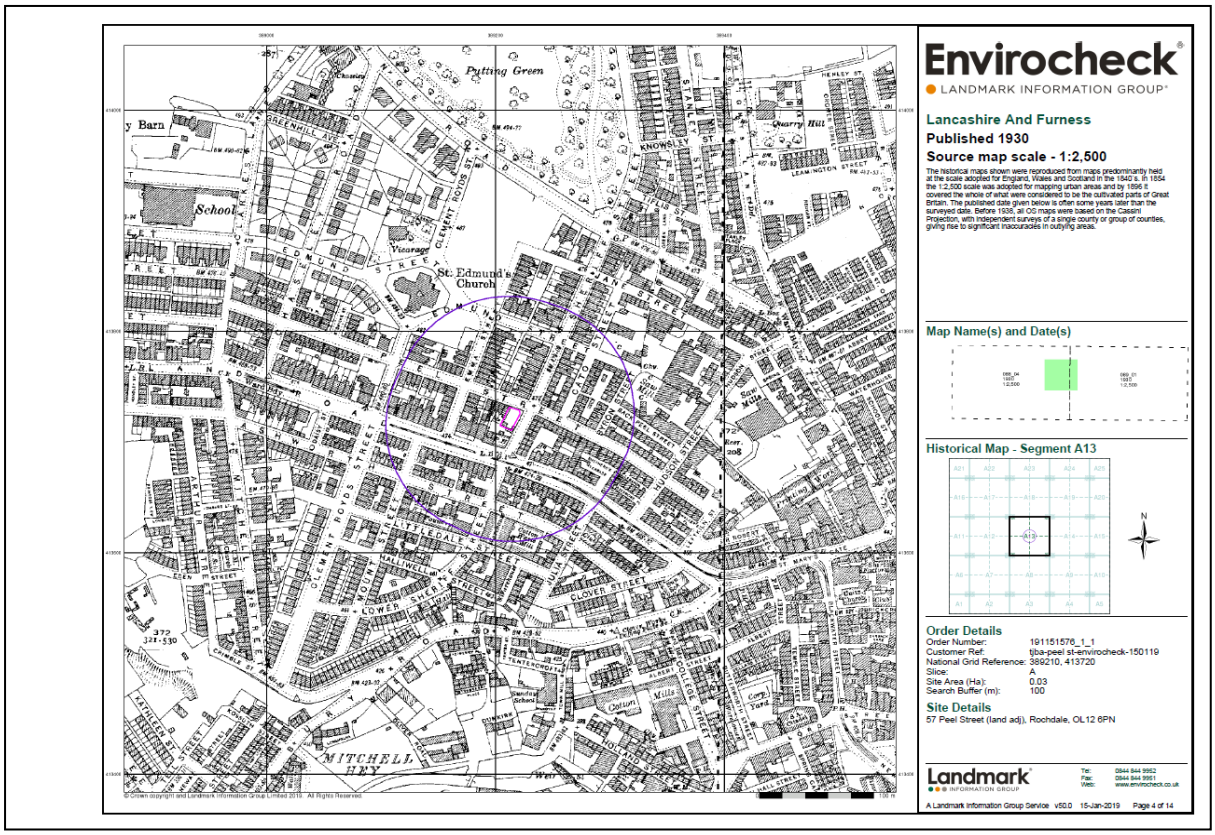
10.1.2. Ordnance Survey c1893



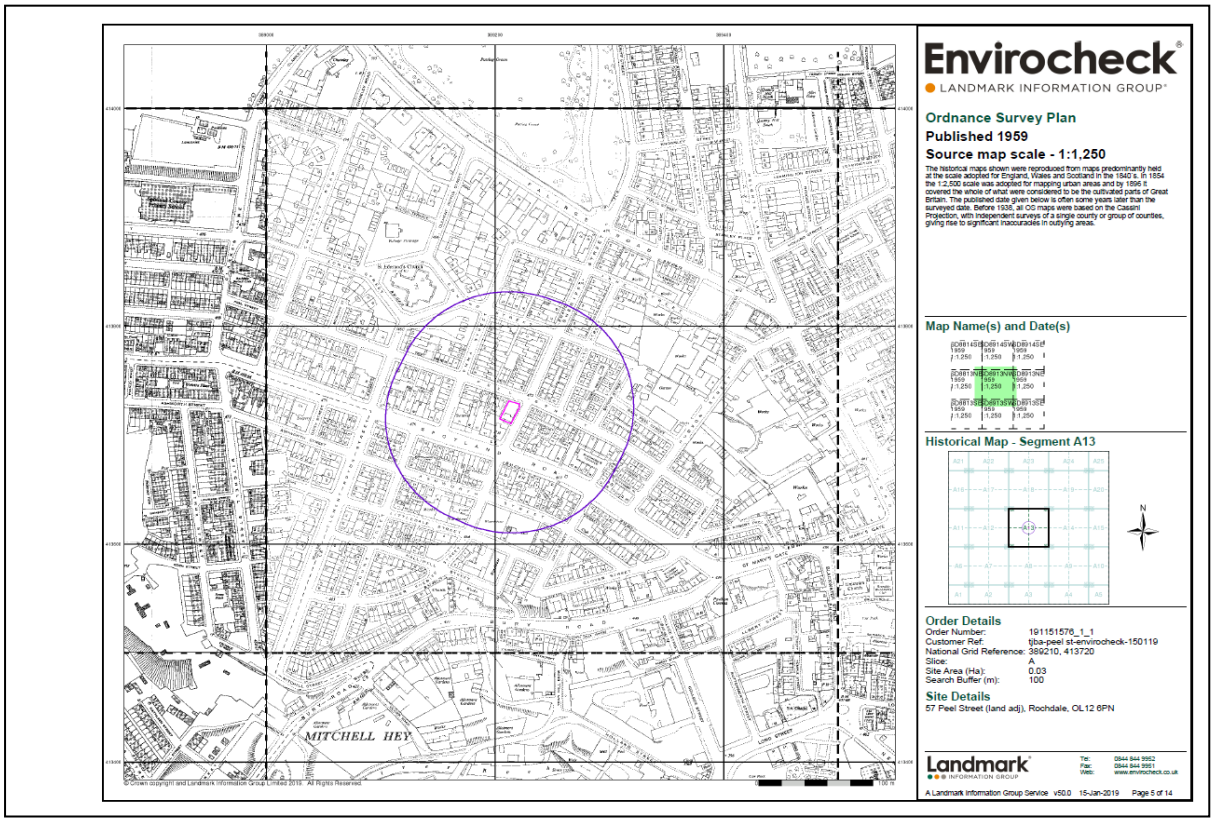
10.1.3. Ordnance Survey c1910



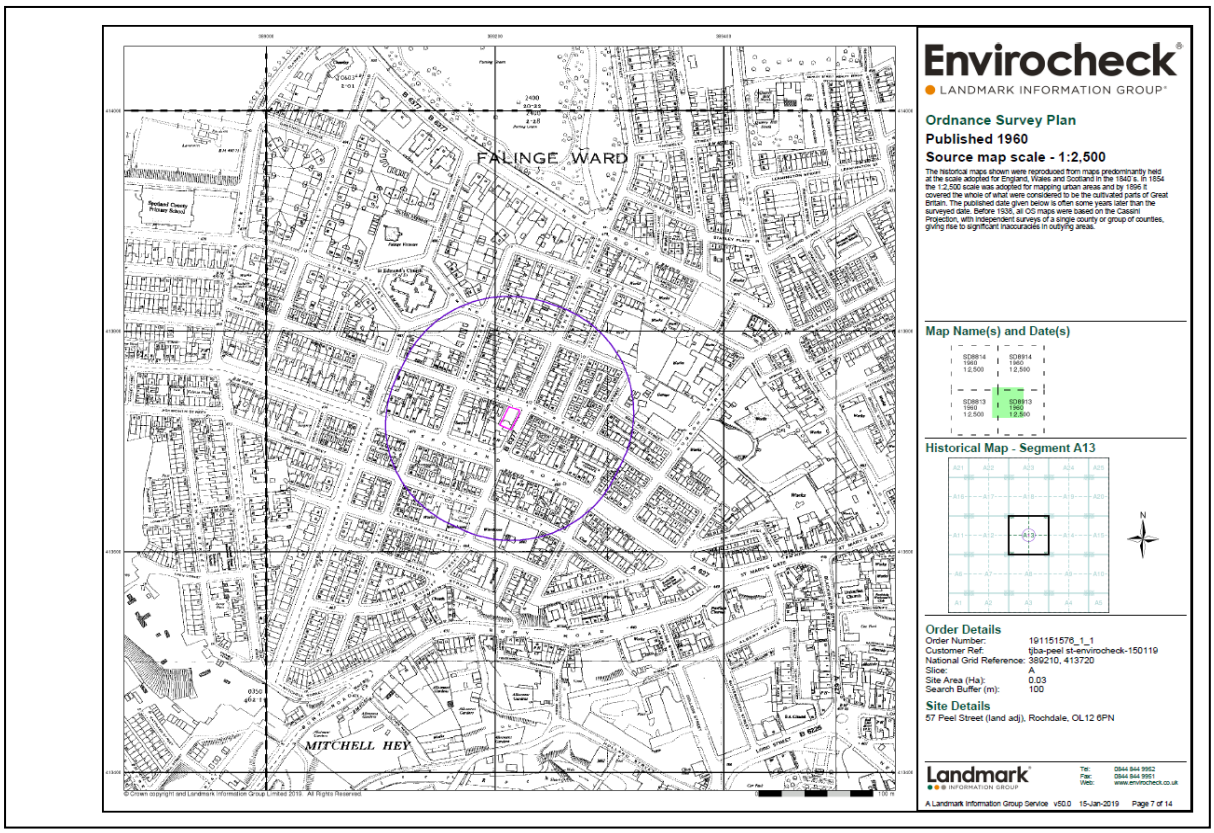
10.1.4. Ordnance Survey c1930



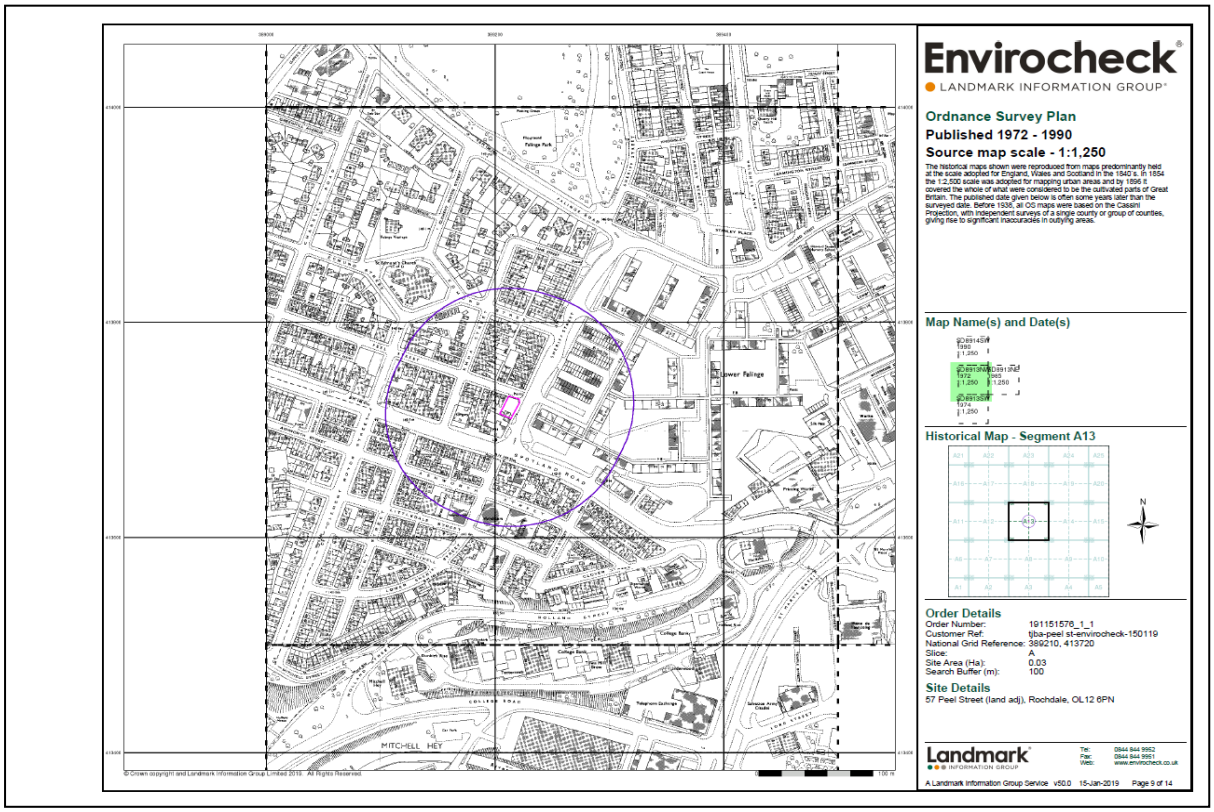
10.1.5. Ordnance Survey c1959



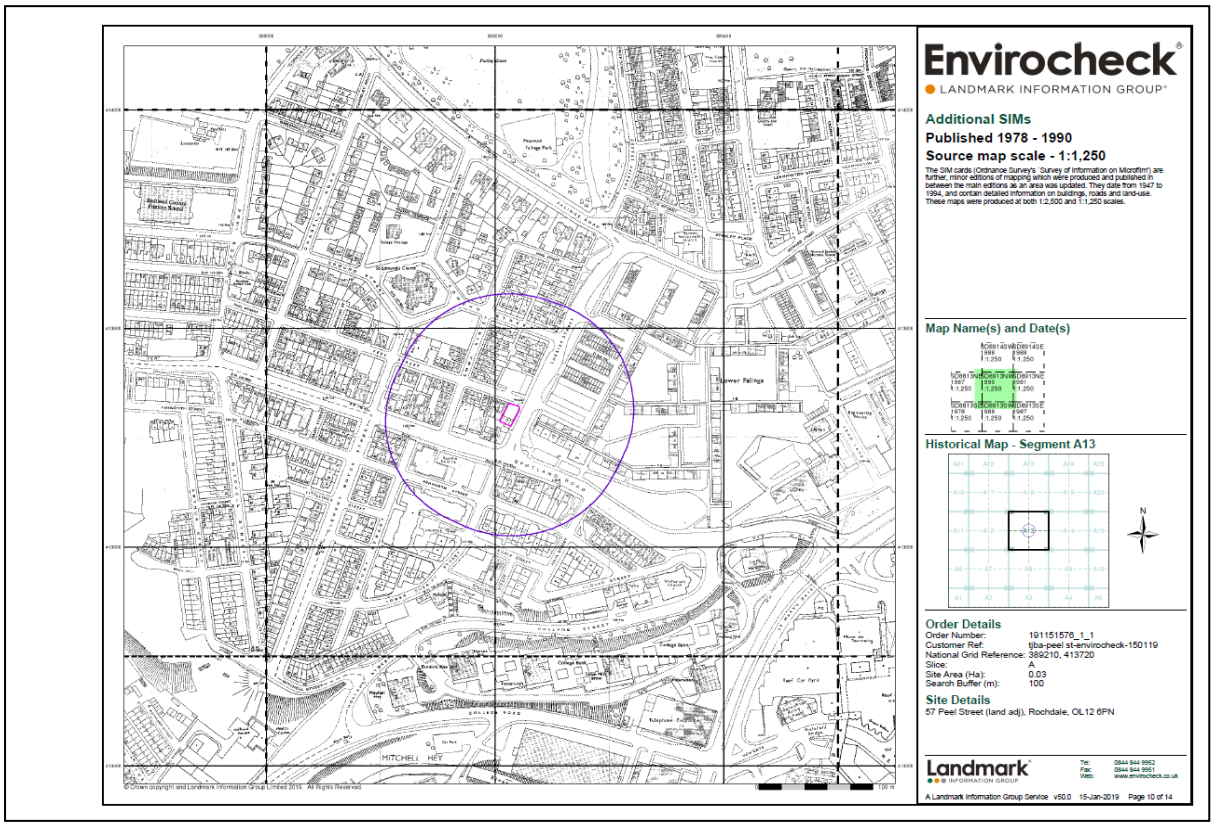
10.1.6. Ordnance Survey c1960



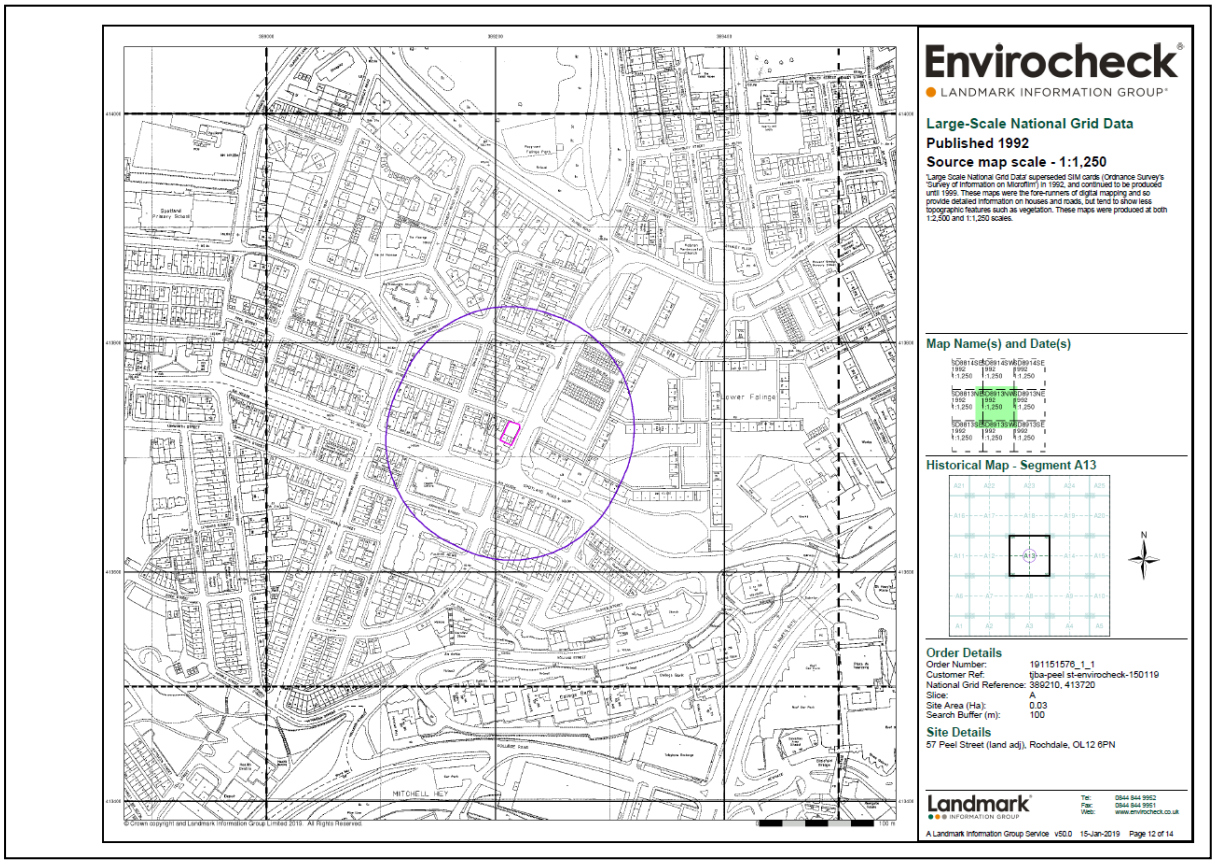
10.1.7. Ordnance Survey c1972-90



10.1.8. Ordnance Survey c1978-90



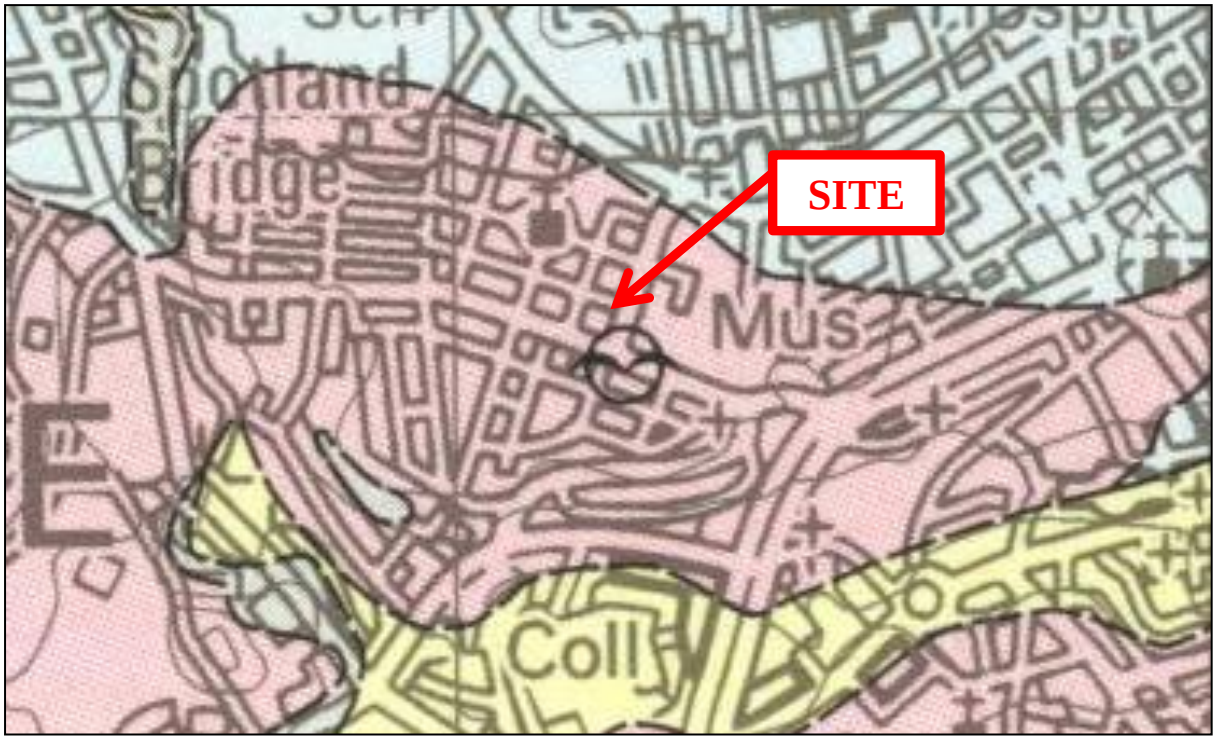
10.1.9. Ordnance Survey c1992



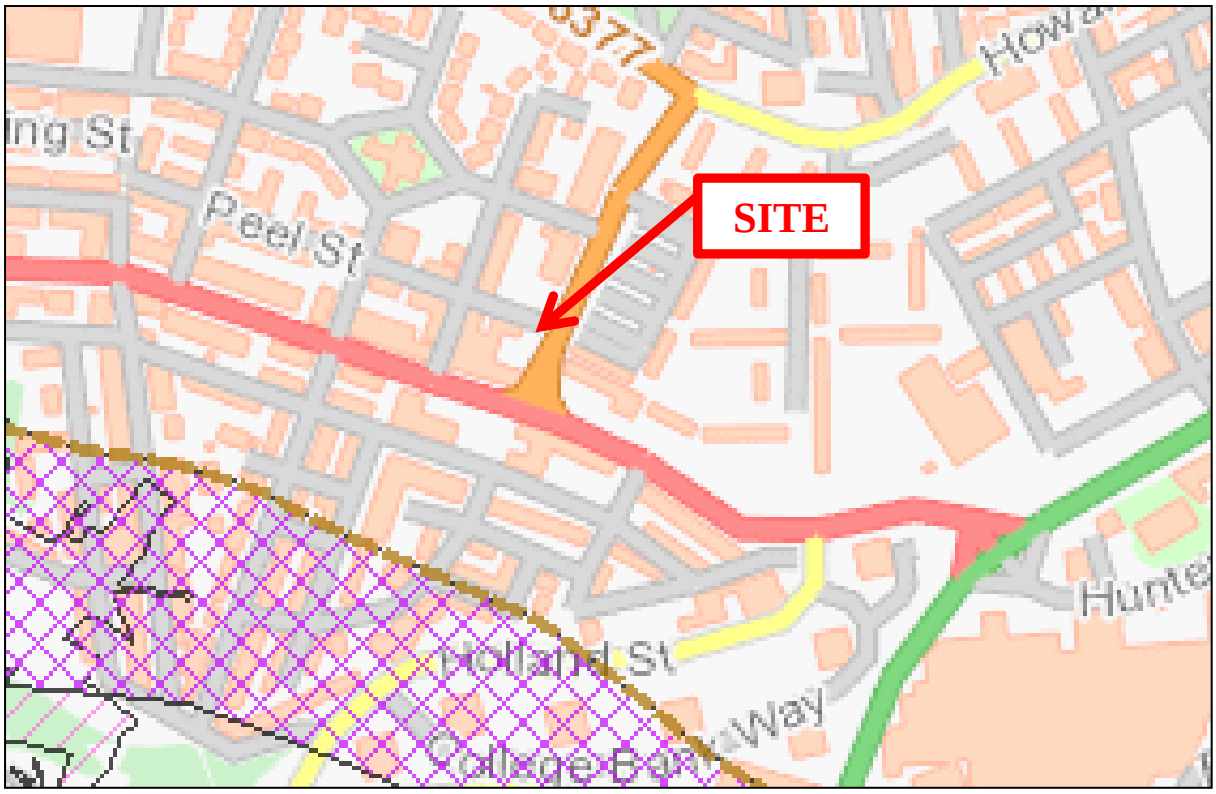
10.2. BGS Geological Map (Solid).



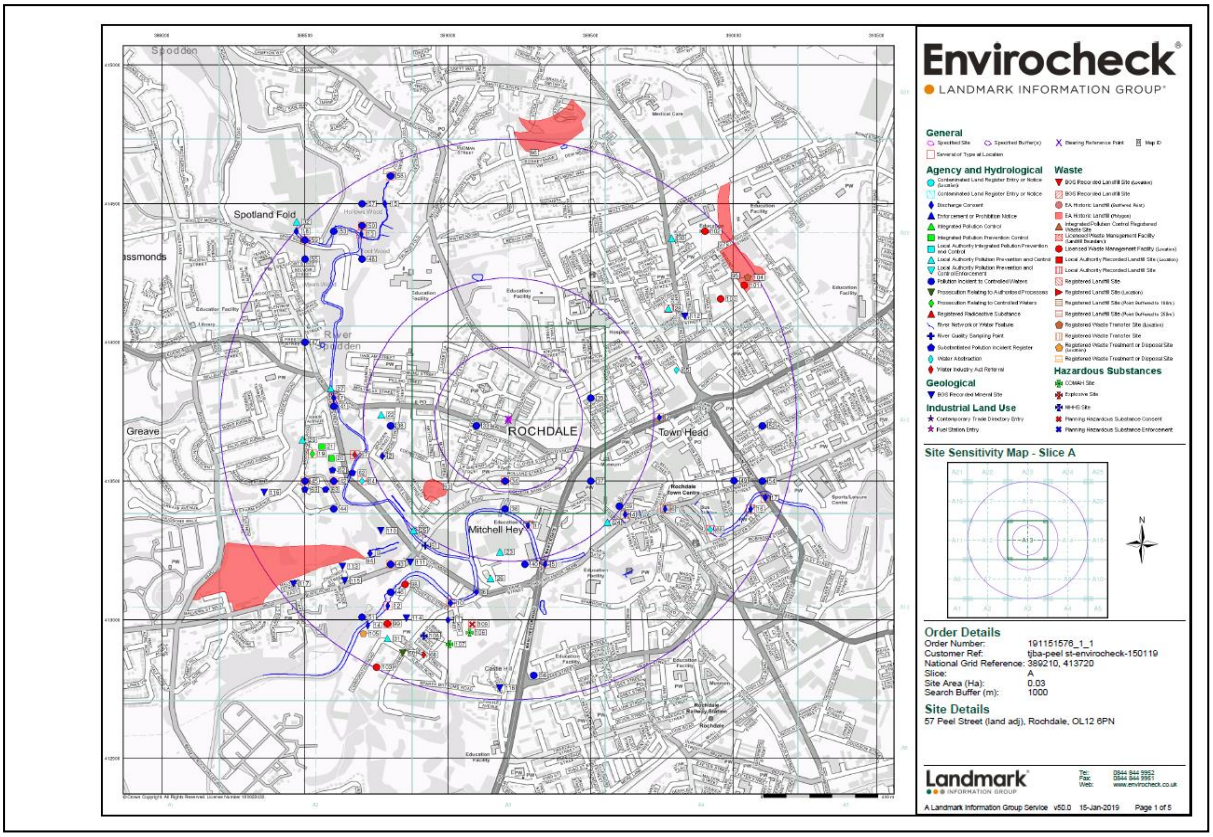
10.3. BGS Geological Map (Superficial).



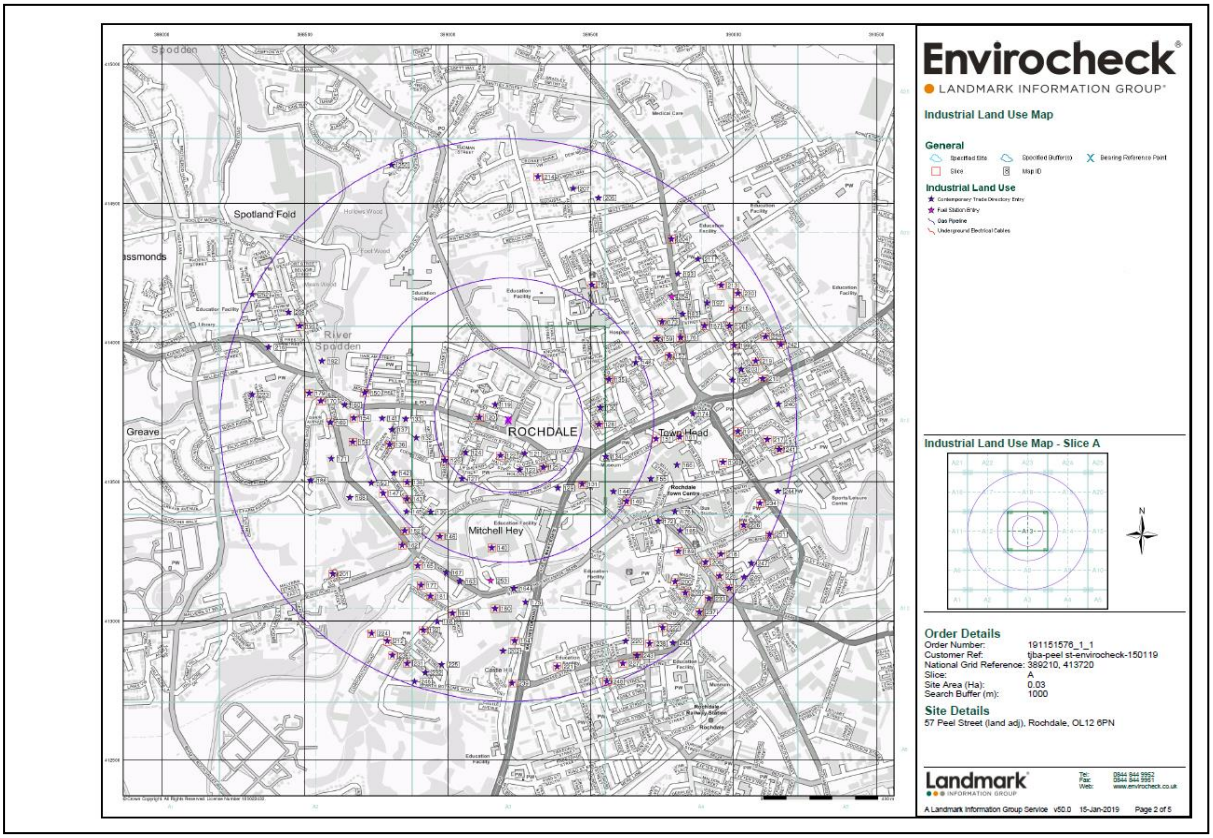
10.4. Coal Authority Map.



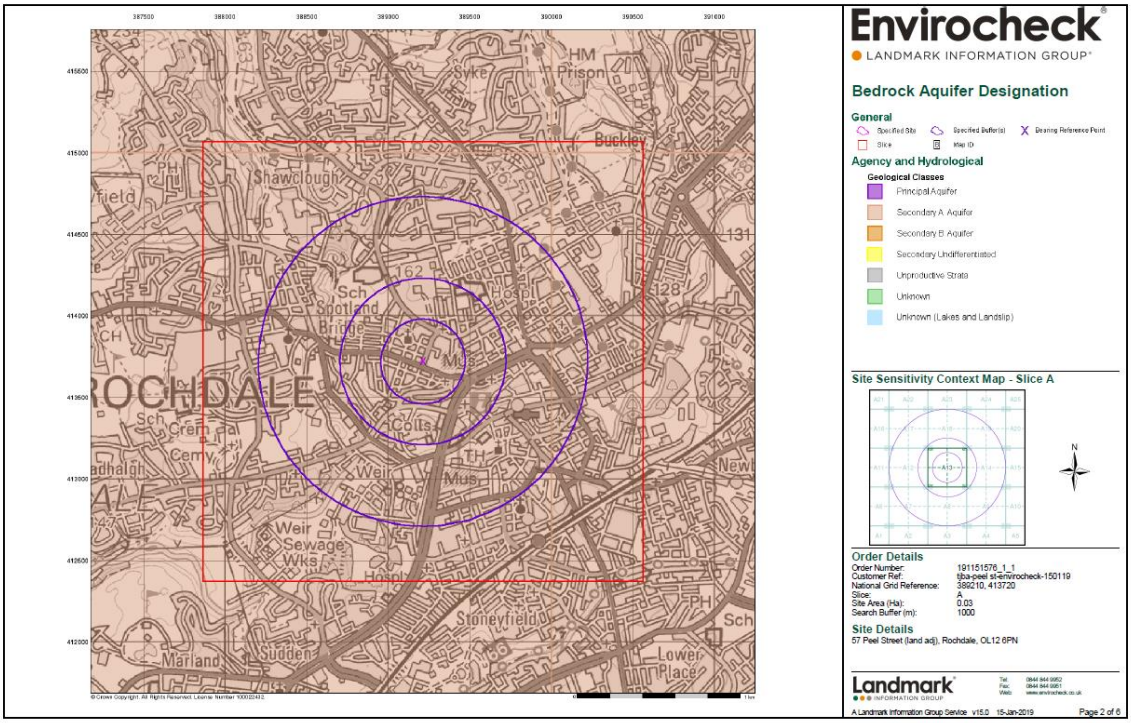
10.5. Landmark Agency, Hydrological & Waste Land Use Map.



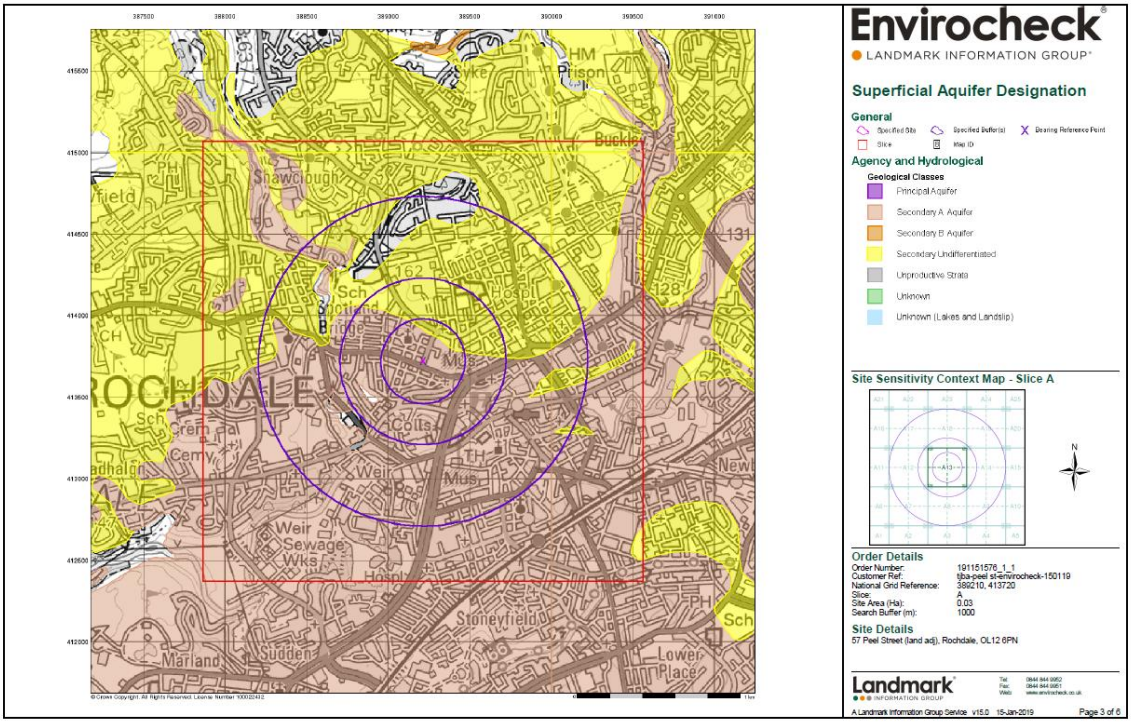
10.6. Landmark Industrial Land Use Map.



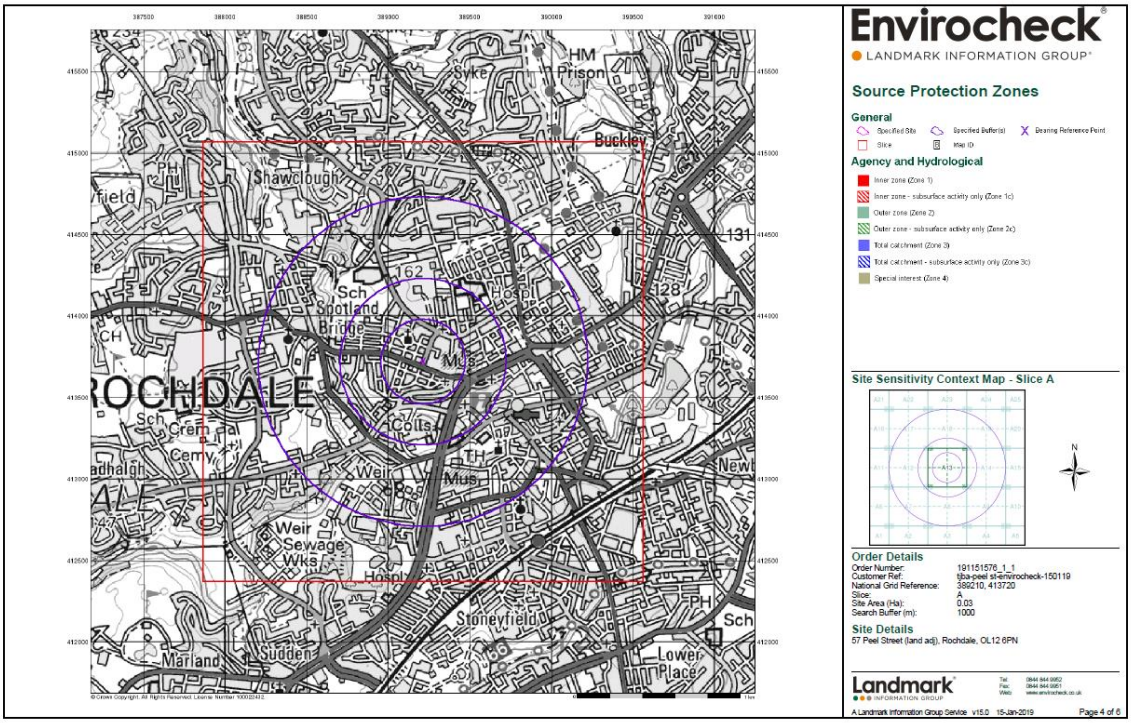
10.7. Landmark Bedrock Aquifer Map.



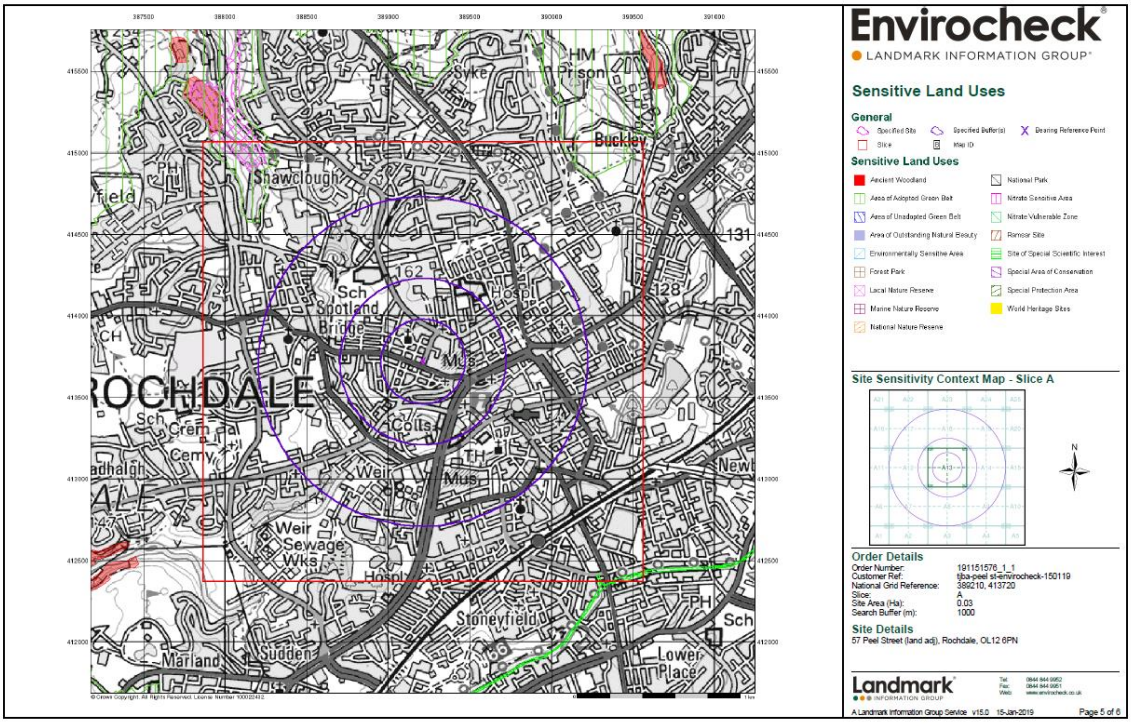
10.8. Landmark Superficial Aquifer Map.



10.9. Landmark Source Protection Zone Map.



10.10. Landmark Site Sensitivity Map.



11. APPENDIX C: SITE REPORTS & CERTIFICATES.

11.1. Concept Life Sciences - Soil Certificates.

CONCEPT LIFE SCIENCES
DELIVERING SCIENCE

Concept Life Sciences is a trading name of Concept Life Sciences Analytical & Development Services Limited registered in England and Wales (No 2514788)

Concept Life Sciences

Certificate of Analysis

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

Report Number: 802819-1

Date of Report: 26-Feb-2019

Customer: T J Booth Associates
20A Eastgate
Rochdale
OL16 1DH

Customer Contact: Mr Daniel Slattery

Customer Job Reference:
Customer Purchase Order: javed-peel st-CLS-130219
Customer Site Reference: javed - Peel Street, Rochdale
Date Job Received at Concept: 14-Feb-2019
Date Analysis Started: 15-Feb-2019
Date Analysis Completed: 26-Feb-2019

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 Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING
1549

Report checked
and authorised by :
Aneta Dybek-Echtermeyer
Customer Service Advisor

Issued by :
Aneta Dybek-Echtermeyer
Customer Service Advisor

Page 1 of 4
802819-1

Concept Reference: 802819
Project Site: javed - Peel Street, Rochdale
Customer Reference:

Soil Analysed as Soil
ICRCL (Maxi)

					Concept Reference	802819 001	802819 002
					Customer Sample Reference	S1	S2
					Date Sampled	13-FEB-2019	13-FEB-2019
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Chromium VI	T6	A40	1	mg/kg		<1	<1
Arsenic	T6	A40	1	mg/kg		39	25
Boron (water-soluble)	T6	A40	1	mg/kg		<1	<1
Cadmium	T6	A40	1	mg/kg		<1	<1
Chromium	T6	A40	1	mg/kg		13	15
Copper	T6	A40	1	mg/kg		100	150
Cyanide(Total)	T4	AR	1	mg/kg		<1	<1
Cyanide(free)	T4	AR	1	mg/kg		<1	<1
Lead	T6	A40	1	mg/kg		140	160
Mercury	T6	A40	1	mg/kg		3	1
Nickel	T6	A40	1	mg/kg		85	65
pH	T7	A40				6.3	7.7
Phenols(Mono)	T4	AR	1	mg/kg		<1	<1
Selenium	T6	A40	3	mg/kg		<3	<3
SO4(Total)	T6	A40	0.01	%		<0.01	<0.01
Sulphide	T4	A40	10	mg/kg		<10	<10
Sulphur(Free)	T2	AR	500	mg/kg		<500	<500
Thiocyanate	T4	A40	10	mg/kg		<10	<10
Zinc	T6	A40	1	mg/kg		86	83

Concept Reference: 802819
Project Site: javed - Peel Street, Rochdale
Customer Reference:

Soil Analysed as Soil
Total and Speciated USEPA16 PAH

					Concept Reference	802819 001	802819 002
					Customer Sample Reference	S1	S2
					Date Sampled	13-FEB-2019	13-FEB-2019
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Naphthalene	T149	AR	0.01	mg/kg		0.05	0.09
Acenaphthylene	T149	AR	0.01	mg/kg		<0.01	<0.01
Acenaphthene	T149	AR	0.01	mg/kg		<0.01	0.01
Fluorene	T149	AR	0.01	mg/kg		0.01	0.01
Phenanthrene	T149	AR	0.01	mg/kg		0.07	0.14
Anthracene	T149	AR	0.01	mg/kg		0.01	0.02
Fluoranthene	T149	AR	0.01	mg/kg		0.04	0.10
Pyrene	T149	AR	0.01	mg/kg		0.04	0.10
Benzo(a)Anthracene	T149	AR	0.01	mg/kg		0.03	0.06
Chrysene	T149	AR	0.01	mg/kg		0.04	0.08
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg		0.04	0.10
Benzo(a)Pyrene	T149	AR	0.01	mg/kg		0.02	0.05
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg		0.01	0.03
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg		0.01	0.01
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg		0.01	0.03
PAH(total)	T149	AR	0.01	mg/kg		0.38	0.83

Concept Reference: 802819
Project Site: javed - Peel Street, Rochdale
Customer Reference:

Soil Analysed as Soil
Miscellaneous

					Concept Reference	802819 001	802819 002
					Customer Sample Reference	S1	S2
					Date Sampled	13-FEB-2019	13-FEB-2019
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Asbestos ID	T27	A40				N.D.	N.D.
Soil Organic Matter	T287	A40	0.1	%		36	30
Benzo(b)fluoranthene	T149	AR	0.01	mg/kg		0.02	0.05
Benzo(k)fluoranthene	T149	AR	0.01	mg/kg		0.02	0.04

Index to symbols used in 802819-1

Value	Description
AR	As Received
A40	Assisted dried < 40C
N.D.	Not Detected
S	Analysis was subcontracted
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Asbestos testing was subcontracted.

Method Index

Value	Description
T287	Calc TOC/0.58
T2	Grav
T27	PLM
T149	GC/MS (SIR)
T4	Colorimetry
T6	ICP/OES
T7	Probe

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Chromium VI	T6	A40	1	mg/kg	N	001-002
Arsenic	T6	A40	1	mg/kg	U	001-002
Boron (water-soluble)	T6	A40	1	mg/kg	N	001-002
Cadmium	T6	A40	1	mg/kg	U	001-002
Chromium	T6	A40	1	mg/kg	U	001-002
Copper	T6	A40	1	mg/kg	U	001-002
Cyanide(Total)	T4	AR	1	mg/kg	U	001-002
Cyanide(free)	T4	AR	1	mg/kg	U	001-002
Lead	T6	A40	1	mg/kg	U	001-002
Mercury	T6	A40	1	mg/kg	U	001-002
Nickel	T6	A40	1	mg/kg	U	001-002
pH	T7	A40			U	001-002
Phenols(Mono)	T4	AR	1	mg/kg	U	001-002
Selenium	T6	A40	3	mg/kg	U	001-002
SO4(Total)	T6	A40	0.01	%	N	001-002
Sulphide	T4	A40	10	mg/kg	N	001-002
Sulphur(Free)	T2	AR	500	mg/kg	N	001-002
Thiocyanate	T4	A40	10	mg/kg	N	001-002
Zinc	T6	A40	1	mg/kg	U	001-002
Naphthalene	T149	AR	0.01	mg/kg	U	001-002
Acenaphthylene	T149	AR	0.01	mg/kg	U	001-002
Acenaphthene	T149	AR	0.01	mg/kg	U	001-002

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Fluorene	T149	AR	0.01	mg/kg	U	001-002
Phenanthrene	T149	AR	0.01	mg/kg	U	001-002
Anthracene	T149	AR	0.01	mg/kg	U	001-002
Fluoranthene	T149	AR	0.01	mg/kg	U	001-002
Pyrene	T149	AR	0.01	mg/kg	U	001-002
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	U	001-002
Chrysene	T149	AR	0.01	mg/kg	U	001-002
Benzo(b/k)Fluoranthene	T149	AR	0.01	mg/kg	U	001-002
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	U	001-002
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	U	001-002
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	U	001-002
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	U	001-002
PAH(total)	T149	AR	0.01	mg/kg	U	001-002
Asbestos ID	T27	A40			SU	001-002
Soil Organic Matter	T287	A40	0.1	%	N	001-002
Benzo(b)fluoranthene	T149	AR	0.01	mg/kg	U	001-002
Benzo(k)fluoranthene	T149	AR	0.01	mg/kg	U	001-002

12. APPENDIX D: PUBLICATIONS.

12.1. CIRIA SP 78, TABLE 15, Contaminant Hazards Related to End Use.

	Targets and associated hazards[1]						
	1	2	3	4	5	6	7
	Site works	Water resources	Buildings and services	Buildings and services	Garden amenities	Allotments, agriculture	Plant growing
Critical Contamination[2]	Harm to workers[3]	Leachate pollution[4]	Fire and explosion	Corrosion or expansion damage[4]	Harm to children[5]	Crop uptake of contaminant[4]	Phyto-toxicity[4]
Arsenic	O	O			●	O	
Cadmium		O			●	●[15]	
Lead		O		O[11]	●	●[15]	
Cyanide	O	●			●[14]		
PAH[6]	●		O		●		O
Phenols	●	●		●	●		O
Copper		O		O[11]	O		●[16]
Nickel		O		O[11]			●[16]
Zinc		O		O[11]			●[16]
Sulphate		●		●[12]	●		O
Sulphide		O		●			
Chloride		O		●			O
Mineral oils	●[8]	O	O	●	O		
Ammonium ion				●			
Methane	O[9]		●[9]				O
Sulphur			●	O[13]			
Combustibles	O		●[7]				
Oily, tarry substances	●	O	O	●			O
Asbestos	●	O[10]					
Radioactive materials	●	O			O	O	
Soluble metals		●		O	O		
pH	O	●		●		●	●
Solvents and organics	O	O	O				
Boron		O					O
Expansives				O[17]			

● Listed contamination hazards (from BS,DD 175 1988, and ICRCL Note 59/83 2nd edition 1987).

O Non-listed contamination hazards.

Notes.
1. Combinations of hazards may need investigation.
2. Local factors may involve other contaminants.
3. Workers at risk from contact, inhalation, explosion, fire and ground pH.
4. Soil pH affects incidence of these hazards.
5. Children at risk from inhalation, ingestion and contact.
6. PAH polynuclear aromatic hydrocarbons.
7. Combustibles include coal, oils, tars, refuse, rubber, etc Determine calorific value, loss on ignition, ash and volatile contents, total organic carbon.
8. Mineral oils are industrial hygiene problem, with or without PCB contamination.
9. Continuous on-site monitoring.
10. Hazard if run-off carries friable asbestos into streams.
11. Electrolytic action if free metal present.
12. Total and soluble sulphate (See also Section 1 1.4.4).
13. Corrosion induced by sulphur consuming bacteria.
14. Free' cyanide.
15. Total and 'plant-available' metals.
16. Total, 'plant-available' and 'zinc equivalent' values.
17. Expansives include: blast-furnace and steel slags, mining spoils and pyritic materials. Determine: total sulphur and acid soluble sulphate, calcite, and calcium as CaO.

12.3. CIRIA (Report c665) Wilson and Card Classification.

Modified Wilson and Card classification

	Characteristic situation (CIRIA R149)	Comparable classification in DETR *et al* (1999)	Risk classification	Gas screening value (GSV) (CH_4 or CO_2) (l/hr)[1] Threshold	Additional factors	Typical source of generation
	1	A	Very low risk	<0.07	Typically methane <1 % and/or carbon dioxide <5 %. Otherwise consider increase to Situation 2	Natural soils with low organic content "Typical" made ground
	2	B	Low risk	<0.7	Borehole air flow rate not to exceed 70l/hr. Otherwise consider increase to characteristic Situation 3	Natural soil, high peat/organic content. "Typical" made ground
	3	C	Moderate risk	<3.5		Old landfill, inert waste, mineworking flooded
	4	D	Moderate to high risk	<15	Quantitative risk assessment required to evaluate scope of protective measures.	Mineworking – susceptible to flooding, completed landfill (WMP 26B criteria)
	5	E	High risk	<70		Mineworking unflooded inactive with shallow workings near surface
	6	F	Very high risk	>70		Recent landfill site

Notes on the use of Table 8.5

1 Gas screening value: (Litres of gas/hour) is calculated by multiplying the maximum gas concentration (%) by the maximum measured borehole flow rate (l/hr) – see Glossary.

2 Site characterisation should be based on gas monitoring of concentrations and borehole flow rates for the minimum periods defined in Table 5.5.

3 Source of gas and generation potential/performance should be identified.

4 Soil gas investigation should be in accordance with guidance provided in Chapters 4 to 6.

5 If there is no detectable flow, use the limit of detection of the instrument.

6 The boundaries between the Partners in Technology classifications do not fit exactly with the boundaries for the CIRIA classification.

12.4. CIRIA (Report c665) Wilson and Card Protective Measures.

Typical scope of gas protective measures

Characteristic situation	Residential building (not those which belong to Situation B)[1]		Office/commercial/industrial development	
(From Table 8.5)	Number of levels of protection	Typical scope of protective measures	Number of levels of protection	Typical scope of protective measures
1	None	No special precautions	None	No special precautions
2	2	a. Reinforced concrete cast *in situ* floor slab (suspended, non-suspended or raft) with at least 1200 g DPM and underfloor venting. b. Beam and block or pre-cast concrete and 2000 g DPM/ reinforced gas membrane and underfloor venting. All joints and penetrations sealed.	1 to 2	a) Reinforced concrete cast *in situ* floor slab (suspended, non-suspended or raft) with at least 1200 g DPM. b) Beam and block or pre cast concrete slab and minimum 2000 g DPM/reinforced gas membrane. c) Possibly underfloor venting or pressurisation in combination with a) and b) depending on use. All joints and penetrations sealed.
3	2	All types of floor slab as above. All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space.	1 to 2	All types of floor slab as above. All joints and penetrations sealed. Minimum 2000 g/reinforced gas proof membrane and passively ventilated underfloor sub-space or positively pressurised underfloor sub-space
	3	All types of floor slab as above. All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated underfloor subspace or positively pressurised underfloor sub-space, oversite capping or blinding and in-ground venting layer.	2 to 3	All types of floor slab as above. All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space with monitoring facility.
	4	Reinforced concrete cast *in situ* floor slab (suspended, non-suspended or raft). All joints and penetrations sealed. Proprietary gas resistant membrane and ventilated or positively pressurised underfloor sub-space, oversite capping and in-ground venting layer and in-ground venting wells or barriers.	3 to 4	Reinforced concrete cast in-situ floor slab (suspended, non-suspended or raft). All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space with monitoring facility. In ground venting wells or barriers.
	5	Not suitable unless gas regime is reduced first and quantitative risk assessment carried out to assess design of protection measures in conjunction with foundation design.	4 to 5	Reinforced concrete cast in-situ floor slab (suspended, non-suspended or raft). All joints and penetrations sealed. Proprietary gas resistant membrane and actively ventilated or positively pressurised underfloor sub-space with monitoring facility, with monitoring. In ground venting wells and reduction of gas regime.

Note:

1 For low rise traditional housing with ventilated clear underfloor void (ie Situation B. See Table 8.7, Box 8.4 and Section 8.3.2).

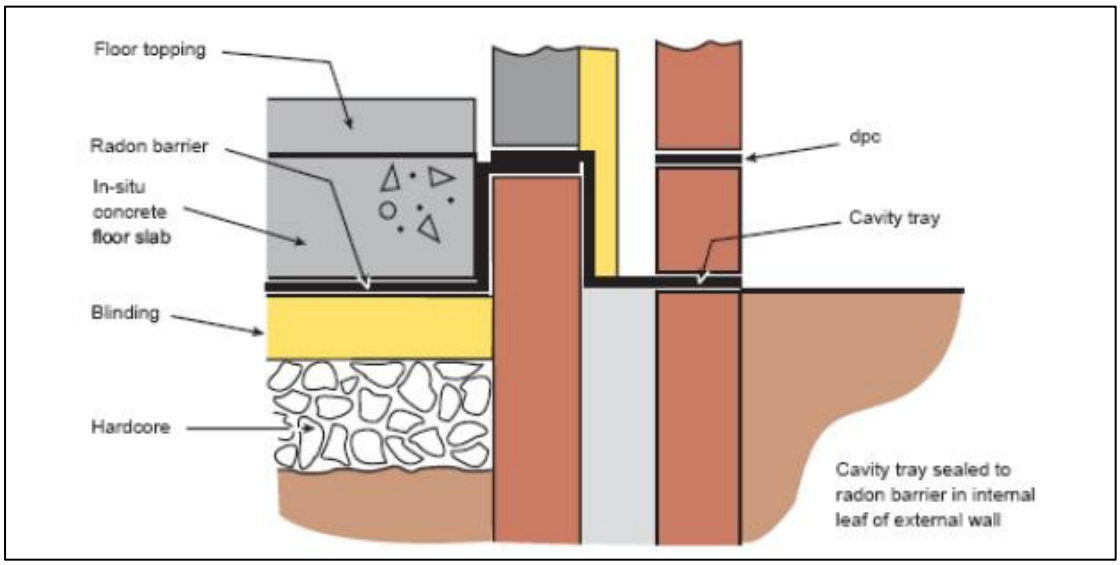
12.5. BGS/HPA report IR/11/044 – Radon Potential Class.

Radon Potential Class*	Is the property in a Radon Affected Area?	Additional information
1	No	The property is in a Lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level). The property is not in a radon affected area.
2	Yes	The property is in an Intermediate probability radon area (1 to 3% of homes are estimated to be at or above the Action Level). The property is in a radon affected area.
3	Yes	The property is an Intermediate probability radon area (3 to 5% of homes are estimated to be at or above the Action Level). The property is in a radon affected area.
4	Yes	The property is in an Intermediate probability radon area (5 to 10% of homes are estimated to be at or above the Action Level). The property is in a radon affected area.
5	Yes	The property is in a Higher probability radon area (10 to 30% of homes are estimated to be at or above the Action Level). The property is in a radon affected area.
6	Yes	The property is in a Higher probability radon area (more than 30% of homes are estimated to be at or above the Action Level). The property is in a radon affected area.

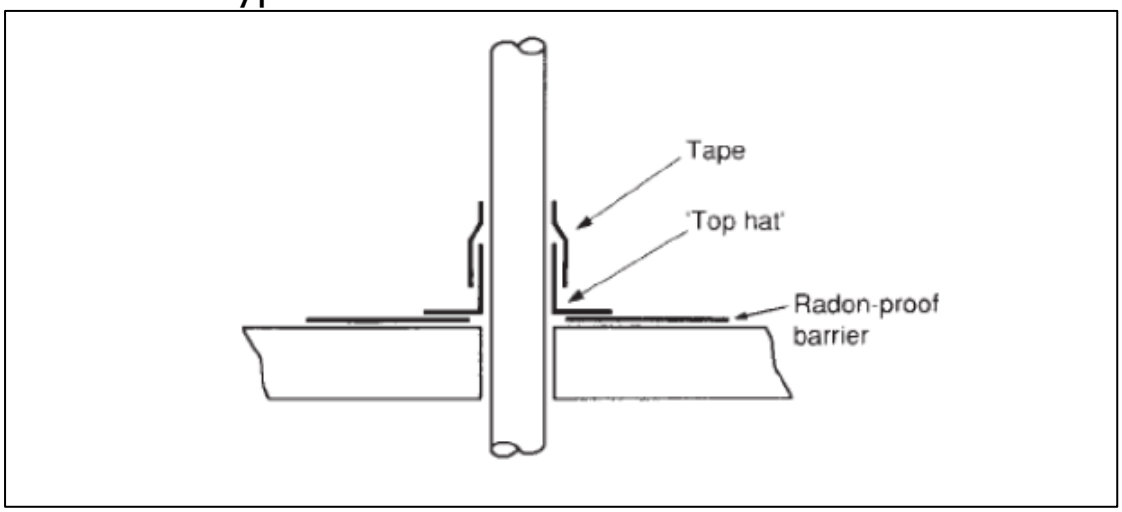
12.6. BGS/HPA report IR/11/044 – Radon Potential Class/Protection Measures.

Radon Potential Class*	What level of radon protective measures are required for new buildings in England and Wales?	What level of radon protective measures are required for new dwellings in Scotland?
1	None**	None**
2	None	Stage 1
3	Basic	Stage 1
4	Basic	Stage 1
5	Full	Stage 2
6	Full	Stage 2

BRE 211 – Typical Ground Bearing Slab, Membrane/Cavity Tray Detail.



BRE 211 – Typical Service Penetration Detail.



12.7. CIRIA C552, 2001 – Tables 6.3-6.6, Risk Matrices.

Table 6.3 *Classification of consequence*

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem, or organism forming part of such ecosystem (note: the definitions of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied.
Medium	Chronic damage to Human Health ("significant harm" as defined in DETR, 2000). Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem, or organism forming part of such ecosystem. (note: the definitions of ecological systems within Draft Circular on Contaminated Land, DETR , 2000).	Concentrations of a contaminant from site exceed the generic, or site-specific assessment criteria. Leaching of contaminants from a site to a major or minor aquifer. Death of a species within a designated nature reserve.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ("significant harm" as defined in the *Draft Circular on Contaminated Land*, DETR, 2000). Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater. Damage to building rendering it unsafe to occupy (eg foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc). Easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discoloration of concrete.

Table 6.4 *Classification of probability*

Classification	Definition
High likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term

Table 6.5 *Comparison of consequence against probability*

Probability	Consequence: Severe	Medium	Mild	Minor
High likelihood	Very high risk	High risk	Moderate risk	Moderate/ low risk
Likely	High risk	Moderate risk	Moderate/ low risk	Low risk
Low likelihood	Moderate risk	Moderate/ low risk	Low risk	Very low risk
Unlikely	Moderate/ low risk	Low risk	Very low risk	Very low risk

Table 6.6 *Description of the classified risks and likely action required*

Very high risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High risk	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term
Moderate risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, if is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term
Low risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very low risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.