

PHASE 1 & 2 ENVIRONMENTAL REPORT

Land at Langton Terrace

Sudden

Rochdale

OL11 3QE

Author: Daniel Slattery
Client: Mr Majid Kahn
Reference: rep-tjba-kahn-langton terrace-phs 1&2
env-180221.docx

Revision	Date	Reason
0	Feb 2021	Original for Planning.

T J Booth Associates.
20A Eastgate St,
Rochdale,
Lancs,
OL16 1DH.
Tel: 01706 868288.
Email: office@tjba.co.uk

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1. INTRODUCTION

T. J. Booth Associates have been appointed by Mr Majid Khan to undertake a Phase 1 & 2 Environmental Audit to support a planning/building regulations application for residential development.

The Site is a vacant plot of land to the rear of Langton Terrace/Worcester Street in Sudden, Rochdale situated on the edge of a residential housing estate. The site was previously public open space.

Planning permission (application ref No. 20/00244/FUL), was obtained in September 2020 for a "Residential development – 3 detached dwellings". The permission detailed conditions, of which condition 10 related to environmental assessment. See below for particulars:

PLANNING PERMISSION GRANTED

APPLICATION REFERENCE: 20/00244/FUL

Name and address for correspondence:	Applicant name:
Mr FRANK SMITH JAMES CAMPBELL ASSOCIATES LTD CAMPBELL HOUSE 173 ROCHDALE RD FIRGROVE, MILNROW ROCHDALE OL16 3BN	Mr MAJID KHAN

Part I - Particulars of Application

Date of Application: 6 July 2020

Proposal:	Residential development - 3 detached dwellings
Location:	Land Rear Of Langton Terrace, Rochdale

- 10 No development shall take place until a site investigation and risk assessment (in addition to any assessment provided with the planning application) has been submitted to and approved in writing by the Local Planning Authority. The assessment shall investigate the nature and extent of any contamination on the site (whether or not it originates on the site). The assessment shall be undertaken by competent persons and a written report of the findings submitted to and approved in writing by the Local Planning Authority before any development takes place. The submitted report shall include:
- i) a survey of the extent, scale and nature of contamination
 - ii) an assessment of the potential risks to:
 - human health,
 - property (existing or proposed) including buildings, crops, livestock, pets, woodland, and service lines and pipes,
 - adjoining land,
 - groundwaters and surface waters,
 - ecological systems,
 - archaeological sites and ancient monuments;
 - iii) where unacceptable risks are identified, an appraisal of remedial options and proposal of the preferred option(s) to inform a remediation strategy for the site.
- If the risk assessment includes a remediation strategy for the site, no dwelling shall be occupied until a verification report for that plot has been submitted to and approved in writing by the Local Planning Authority.

This report provides a desk-based study & intrusive ground investigation based on current UK guidance for environmental investigation within the construction industry. Principal to the assessment is the potential for contamination pollutant linkages via the CLR-11 source-pathway-receptor methodology. Assessment of potential pollution linkages is primarily undertaken in strict accordance with BS5930:2015 BS 10175:2011+A2:2017 CIRIA C665 and BS 8485:2015+A1:2019 et al.

2. PROPOSED DEVELOPMENT

The proposal is for a 3No. detached residential dwellings with associated driveways and surrounding soft landscaping.

There is a central access road that leads to the garages of Plots 1 & 2.

3. HISTORIC MAPS

DATE	ON-SITE	OFF-SITE/SURROUNDING AREA
c1851	Site is part of vacant land in a field adjacent to the Castleton Hall main curtilage, and is presumably part of the Castleton Hall estate.	Castleton Hall to the north west nominally 100m with immediate landscaped grounds surrounding the main building. Lancashire-Yorkshire Railway noted immediately to the south east of the Site. There is a sandpit nominally 150m north east beyond the railway. Castleton Old Mill is noted 150m south east with Sudden Brook flowing west to east beneath the mill and railway.
c1890-93	No change.	Further residential development to the north. Castleton Old Mill now noted as Union Mill. Old sand pit noted to the south west beyond Union Mill.
c1910	No change.	Much residential infill to the north of the local area. Valley Ring Mill noted beyond Union Mill to the south east.
c1930	Some infill noted to the south west boundary of the Site.	Castleton Hall/Farm and associated gardens etc now demolished and replaced with residential housing estate. Worcester Street and Langton Terrace form the north and west boundaries to the Development Site. The infill noted to the south west side of the Development Site is the edge of the fill zone between what is now Ribble Street and Edinburgh Way. Dunlop Mills noted to the south west 200m distant.
c1938	No change.	No overall change.
c1957-58	Allotment gardens noted to the north part of the Site.	No overall change.
c1964-75	Multiple small buildings noted on Site – assumed to be garages for local dwellings.	No overall change apart from Edinburgh Way now constructed through the south part of the area including the culverting of Sudden brook.
c1992	Garages by now removed in all but the north east corner of the Site. An access Road still noted through the centre.	No overall change.
c1996	No change.	Valley Mill to the south east by now demolished.
c2000	No change.	Commercial development noted to the immediate south west between the Site and Edinburgh Way. Sandbrook Part by now constructed with all previous mills etc to the south east demolished and the Site landscaped.
c2005	Site access through to garages at the north east corner remains with the remainder of the Site vegetated.	No change.
c2013	Garages demolished and Site as in the present day.	No change.

4. PRESENT DAY MAPS

Paper & digital/online resources such as google maps, topographic surveys, OS etc.

Site Boundaries, Outlines of Structures and Buildings:	Present day maps show the site to be vegetated with scrub and juvenile/semi-mature trees noted to the south east and north boundaries. The former access road through the site remains. There are no other features to note.
Ground Contours, Natural Drainage Features:	The Site is relatively level with a gentle fall to the south west. Locally the area falls to the south east and to the west beyond the adjacent railway.
Water Courses:	The closest is Sudden Brook, culverted beneath the local area.
Below Ground Obstructions:	None noted.

5. GEOLOGY

Bedrock Geology:	The Site is underlain by Carboniferous Westphalian Coal Measures – generally undifferentiated sandstone and mudstone. The dip of the local strata is estimated to be 5-10deg south east.
Superficial Geology:	The Site and wider local area are underlain by glaciofluvial sand & gravel deposits.
Coal Seams.	No coal seams subcrop in the local area.

6. BOREHOLES RECORDS

There are relevant borehole records immediately to the south/south west of the Site on the commercial land (now used for car showrooms) between the Site and Edinburgh Way.

In summary, the boreholes indicate made ground immediately to the south of the site comprising inert fill such as brick and ash often gravelly and occasionally bound in a clayey matrix. The fill is up to approximately 7.5m thick and was noted to be above the virgin glaciofluvial sand & gravel.

Description of the fill material ranged for ashy SAND including slag & glass fragments; gravelly CLAY; coarse ash SAND & GRAVEL; clayey, gravelly SAND including brick fragments.

7. PLANNING DATA.

N/A.

8. LANDMARK ENVIRONMENTAL DATA

8.1. AGENCY & HYDROLOGICAL

Discharge consents:	None within a 250m radius of the Site.
Bedrock aquifer:	Secondary A Aquifer.

Superficial aquifer:	Secondary A Aquifer.
Source protection zone:	Not within a Source Protection Zone.

8.2. WASTE

BGS recorded landfill sites:	1 recorded onsite landfill noted as Edinburgh Way, no other information noted. No others within a 250m radius.
Historic landfill sites:	1 recorded onsite landfill noted as Edinburgh Way (EAHLD31939), no other information noted. 1 record within a 250m radius of the Site, noted 48m south east and named Hailwood Street (EAHLD15754), but with no other information noted.
Licensed waste management facilities (landfill boundaries):	1 record within a 250m radius of the Site, noted as Ashfield Valley inert landfill site 159m south.
Registered landfill sites:	No records within a 250m radius of the development.

8.3. HAZARDOUS SUBSTANCES

Planning hazardous substance consents:	No records within a 250m radius of the Site.
Planning hazardous substance enforcements:	No records within a 250m radius of the Site.

8.4. GEOLOGICAL

Mining Instability:	Within a coal mining area.
Potential for Collapsible Ground Stability Hazards:	Very low risk.
Potential for Compressible Ground Stability Hazards:	No hazard.
Potential for Ground Dissolution Stability Hazards:	No hazard.
Potential for Landslide Ground Stability Hazards:	Very low risk.
Potential for Running Sand Ground Stability Hazards:	Very low risk.
Potential for Shrinking or Swelling Clay Ground Stability Hazards:	No hazard.
Radon Potential - Radon Affected Areas:	The property is within a Lower probability radon area (<1% of homes estimated to be at or above the action level).
Radon Potential - Radon Protection Measures:	No radon protection measures are required.

9. COAL AUTHORITY

Mine Shafts, Pits, Adits/Entries:	No coal entries within 20m of the site boundaries or within the local area.
Past Recorded Underground Mining.	No workings noted beneath the Site or local area.

Present/Future Underground Mining.	Not known to be a risk.
Unrecorded Probable/Potential Shallow Underground Workings:	No potential or probable shallow underground risks in the local area.
Past/Present/Future Surface Mining/Opencast:	None noted locally.
Mining Geology and Subsidence:	No issues noted locally.
Hazards and Mine Gas:	No issues noted locally.
Development High Risk Area:	The Site and local area are not within a Development High Risk Area.
Abandonment Plan Data:	Abandonment data not required.

10. INDUSTRY PROFILES

N/A.

11. SITE RECONNAISSANCE

Details of Existing Structures:	The Site was attended on 08.03.2021, accessed off Worcester Street. The Site had been stripped of all structures and vegetation, and levelled with the proposed building footings excavated and filled with some blockwork in place ready for slab construction. The Site surface mainly comprised sand & gravel sized ash fill from the south west to the centre of the Site, and became more loamy ashy topsoil to the north east. There were stockpiles around the Site, most notably to the east side adjacent the railway which comprised gravel sized ash/clinker, and to the north comprising loamy ashy topsoil and general waste (tipping). Some asbestos board (ACM) was noted on and within the ground surface to the north east Site area, presumably from demolition of the former garages where it was used for cladding.
Adjacent Properties:	Residential dwellings with rear gardens on Langton Terrace noted to the north, with further dwellings noted across Worcester Street to the west. Lancashire-Yorkshire Railway noted to the south east boundary of the Site with Sandbrook Park beyond at lower level.
Water Levels, Directions of Flow and Rates in Rivers:	No watercourses noted locally.
Old Mine or Quarry Workings:	No evidence on reconnaissance.
Obvious/Immediate Hazards to Health/Safety:	None noted.
Areas of Discoloured Soil, Polluted Water, Vegetation, and Significant Odours:	Ash noted on site generally comprised contaminants as well as ACMs noted within the ground and on the ground surface.
Relevant Ground Levels, Ground Water Levels, Positions of Wells and Springs:	Gentle fall to the south west, and from the centre to the north east corner.

12. ENVIRONMENTAL SITE SUMMARY

12.1. Summary

Historically the area around the southern part of the Site has been infilled c1930 as well as part of infilling of the Sudden Brook Valley c1970s. Other than this it had remained largely vacant throughout recent history until it was used as a garage site between c1960 & c2013.

The local area has been predominantly residential to the north and west, and commercial to the east and south; with commercial activity such as mills and the cotton/woollen industry within 250m of the Site.

The Lancashire-Yorkshire Railway is adjacent the Site, and has been in existence since earliest mapping data c1850, however is mostly separated by a triangular piece of land between the railway and Site boundary. Potential contaminants from the railway are not thought to impact the Site receptors.

The infilling to the south side of the Site and to the commercial land between the Site and Edinburgh Way is recorded in boreholes which indicate inert fill such as brick clay/gravelly fill and ashy sandy fill. No organic or putrescible fractions were evident throughout the fill zone which is generally shallow close to the Site and deepening toward Edinburgh Way.

Site reconnaissance recorded very ashy ground especially to the south west part of the Site which was almost completely filled with gravel sized ash & clinker.

There is no coal mining risk in the local area, and due to the Coal Measure beneath the Site, radon is not a risk locally.

12.2. Potential Contaminants

CURRENT SOURCE/S	ORIGINAL ASSOCIATED USAGE	CONTAMINANT/S
Onsite upper soil/made ground	Garage site, access road	Metals, PAH, sulphates, inorganics, asbestos, hydrocarbons.
Onsite upper soil/made ground	Adjacent railway	Hydrocarbons.
Onsite upper soil/made ground	Infilled land to the south.	Primarily metals, PAH, sulphates, inorganics.

12.3. Potential Pathways

PATHWAY	MEDIA
Soil and dust ingestion	Soil and indoor dust
Consumption of home-grown fruit and vegetables	Produce
Skin contact (indoors)	Indoor dust
Skin contact (outdoors)	Soil
Inhalation of dust (indoors)	Air
Inhalation of dust (outdoors)	Air
Vapours (indoors)	Air
Vapours (outdoors)	Air

12.4. Potential Receptors

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

13. CONCEPTUAL MODEL

CURRENT SOURCE/S	ORIGINAL ASSOCIATED USAGE	CONTAMINANT TYPE	PATHWAY	RECEPTOR	POLLUTION LINKAGE	CONSEQUENCE	PROBABILITY	RISK
Site surface /sub soil.	Quarry infilling.	Chemical contamination metals, PAH, inorganics, asbestos.	Direct ingestion, aerial ingestion, dermal contact, drinking water. Contact with potential hazards.	Site construction operatives & future occupants. Site buildings.	PRESENT – The local area has been infilled with ash which is a known source of contamination such as metals & PAH. Garages which were noted on Site historically are often clad in asbestos.	Medium.	Likely.	Moderate risk.
Geology - Carboniferous coal measures & ground gas.	Coal seams & radon sources.	CH ₄ , CO ₂ , Rn, other trace gases.	Diffusion through soil, substructures, aerial inhalation.	Future occupants. Explosion, suffocation.	NOT PRESENT – There are no shallow coal seams in the local area, and radon risk is low.	Medium.	Unlikely.	Low risk.
Anthropogenic ground gas from decomposing organic material.	Wastes deposited by Whitworth UDC Sewage Works.	CH ₄ , CO ₂ , other trace gases.	No credible pathway. Deposited over boulder clay soil, and almost at the buffer distance for consideration of risk.	Future occupants. Explosion, suffocation.	NOT PRESENT – Although much of the local area has been infilled, all local boreholes and landfill records where available indicate inert fill with no putrescible material noted.	Medium.	Unlikely.	Low risk.
Contaminated ground /surface water. Controlled Waters.	Brownfield site – past development.	Chemical contamination.	Permeation through soil into ground water, local watercourses, or aquatic habitats.	Water supplies, watercourses, aquatic habitats & associated wildlife.	POTENTIALLY PRESENT – Shallow ground contamination if present is likely to be minor, and immobile. Although there is a watercourse locally, it is culverted beneath the area, and much of the fill is inert. The Site and local area are not within an SPZ or sensitive areas.	Minor.	Unlikely.	Very low risk.
Aerial contaminants.	Local industrial activity.	Chemical contamination.	Dermal contact & aerial inhalation.	All site users / occupants.	POTENTIALLY PRESENT – Although there will have likely been very minor polluting activities historically in the wider area, these will now be recorded in pollutant linkage 1 in the upper ground profile. Current aerial contaminants are regulated and few.	Minor.	Unlikely.	Very low risk.

14. SITE INVESTIGATIONS

14.1. Investigation Design from Conceptual Model

BS10175:2011+A1:2013 & R&D TECHNICAL REPORT P5-066/TR considers the upper 500mm is sufficient to categorise the ground profile for development 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.

There is no definitive guidance on the number of samples required for soil representation in current guidance. However, R&D TECHNICAL REPORT P5-066/TR indicates that sample spacing should be between 10-25m for residential applications.

Considering the proposed area, and without specific parts of the site for targeted sampling; nominally 6 samples across the Site in a grid format representative of the upper 500mm of MADE GROUND would satisfy guidance criteria for sampling.

Soil samples should be tested for the following contaminant suites: metals, speciated PAH, inorganics & sulphates, SOM, and asbestos screening, and analysed against common threshold comparison data, specifically the Defra Category 4 Screening Levels (C4SLs) where available, then to the LQM/CIEH (S4ULs) thereafter..

14.2. Site Investigations

The Site was attended on 08.03.2021, and site investigations were undertaken to assess the geological characteristics of the subsoil for geo-environmental purposes.

The site investigations comprised 6No. hand excavated trial pits, nominally 350-400mm deep to obtain 6No. soil samples (S1-6), refer to SI plan in the Appendix. Samples are described below:

- S1 Red/brown sandy ashy MADE GROUND occasional fragments of brick, plaster, mortar and road planings.
- S2 Dark brown/black sandy ashy MADE GROUND occasional fragments of brick, stone, & plastic.
- S3 Dark brown/black sand & gravel sized ash/clinker MADE GROUND with smaller gravel sized fragments of brick, stone & glass.
- S4 Dark brown/black sand & gravel sized ash/clinker MADE GROUND with smaller gravel sized fragments of brick, stone & glass.
- S5 Dark brown slightly sandy silty rooty topsoil MADE GROUND, occasional gravel sized brick, stone, glass, & rare ash.
- S6 Dark brown slightly sandy silty rooty topsoil MADE GROUND, occasional gravel sized brick, stone, glass, & rare ash. Broken corrugated asbestos roof sheet noted on the ground surface.

The samples were sealed in 1kg white plastic snap top containers & amber jars, and sent to Eurofins Chemtest Ltd to be tested for contaminant suites including metals, speciated PAH, inorganics & sulphates, SOM, and asbestos screening.

No visual or olfactory evidence of hydrocarbon contamination was noted on site.

14.3. Soil Sampling Assessment

Sampling results confirmed the upper made ground is contaminated above threshold levels for a residential use with soil comprising elevated levels of arsenic, lead, sulphates, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(ah)anthracene.

14.4. Gas Monitoring Assessment

No gas monitoring required.

15. REMEDIATION STRATEGY

15.1. Ground/Soil Contamination Risk

The proposed development end use is residential, and the Site has been noted to comprise filled ground in part generally made up of ash fill which has been tested and proven to contain minor contamination above thresholds safe for use in residential development.

The external site finishes are to comprise permanent hardstanding as well as soft landscaping surrounding the site buildings, and therefore a pollutant linkage with regard to soil has been identified.

Due to the above, existing made ground represents a risk to receptors for the associated end use and should be remediated in the form of removal and replacement where necessary to mitigate the risk.

Made ground may remain on site beneath permanent hardstandings such as roads, pavements & pathways etc.

However, it is advised that a cover layer of clean inert soil is imported to replace all areas of made ground in garden and soft landscaping areas ONLY, which must comprise a 600mm cover layer between the existing made ground and proposed ground level, which can be achieved by the following:

- Made ground must be reduced to minimum 600mm from finish levels and be replaced with 600mm of clean inert soil.
- 600mm of topsoil can be placed over the existing made ground if Site levels are to be increased;

Imported soil should be clean/inert, and free from deleterious materials, and should be suitable for use in a residential end use setting. Imported soil should pass testing of the potential contaminant suites to current Defra Category 4 Screening Levels (C4SLs) where available, and then to the LQM/CIEH (S4ULs), for use in a residential end use setting including the following suites:

- Metals, inorganics, PAH USEPA16 speciated, and asbestos screening.

15.2. Ground Gas Risk

Although the landfilling and ground around the development (and partly on Site) is noted to be filled with ash which is generally inert, it would be prudent to include Class 2 gas precautions within the foundations.

CS2 gas protection measures are recommended within the development which should include the following to provide a minimum score of 3.5 (from at least two sources) in accordance with BS8485:2019:

CS2 GAS PROTECTIVE MEASURES		BS8485:2019 score required: 3.5
FOUNDATION TYPE: Piled, suspended slab.		
SLAB	Cast in situ monolithic reinforced ground bearing raft or reinforced cast in situ suspended floor slab with minimal penetrations.	1.5
MEMBRANE	Reinforced gas membrane Alderprufe GRA comprising <40ml/day/m ² CH ₄ transmission rate, >0.4mm thick. All joints and penetrations taped & sealed to manufacturers details & specifications.	2
VOID/SUBSPACE	Not specifically required to achieve CS2.	0
VENTS	Not specifically required to achieve CS2.	

The membrane should be independently verified by the manufacturer/installer for inclusion in any site contamination validation report.

15.3. Additional Notes

Should any suspected unidentified contamination be encountered throughout the groundworks or construction phase of the development: all works should cease, the relevant area isolated, and potential contamination assessed by professional & competent persons detailing further recommendations & remedial measures to be approved by the LPA.

Remedial measures should be validated and comprise the following:

- Soil import for gardens/soft landscaping areas should be sampled at the rate of 1:200m³ from a proven greenfield

source, and 1:50m³ from an unknown/brownfield source; not less than 3 samples to be taken for each.

- Soil import should be tested for the following 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), for use in a residential end use setting.
- Cover levels will need to be confirmed by taped trial pits.
- Manufacturer/installer evidence of slab construction & gas membrane installation.

The above should be analysed by suitably qualified & competent persons and reported upon accordingly in a site completion report detailing validation procedures, analysis, certification as required, and photographic evidence. A validation report should be undertaken following completion of remedial measures indicated above, which should include documentary/photographic evidence of all remediation, and any subsoil/topsoil import sample results & subsequent import depth confirmation.

Before any further work is undertaken, this report should be submitted to and agreed by the Local Planning Authority Contaminated Land Department.

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.

Signed.....

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

T J Booth Associates.

16. REFERENCES

BS5930:2015. Code of practice for site investigations.

BS 10175:2011+A2:2017. 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.

CIRIA. Report C665.

CL:AIRE. 2012. Research Bulletin-RB17-A Pragmatic Approach to Ground Gas Risk Assessment.

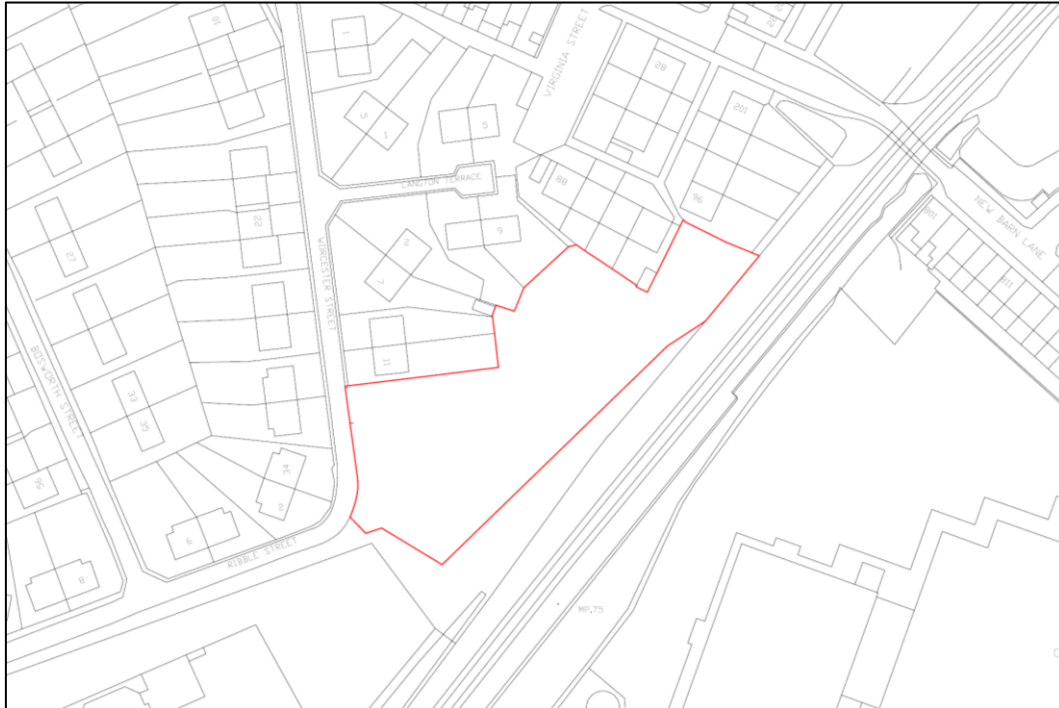
BS 8485:2015+A1:2019. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings.

CIRIA. Report SP32.

ICE Manual of Geotechnical Engineering Volume I. 2012.

17. APPENDIX A: FIGURES

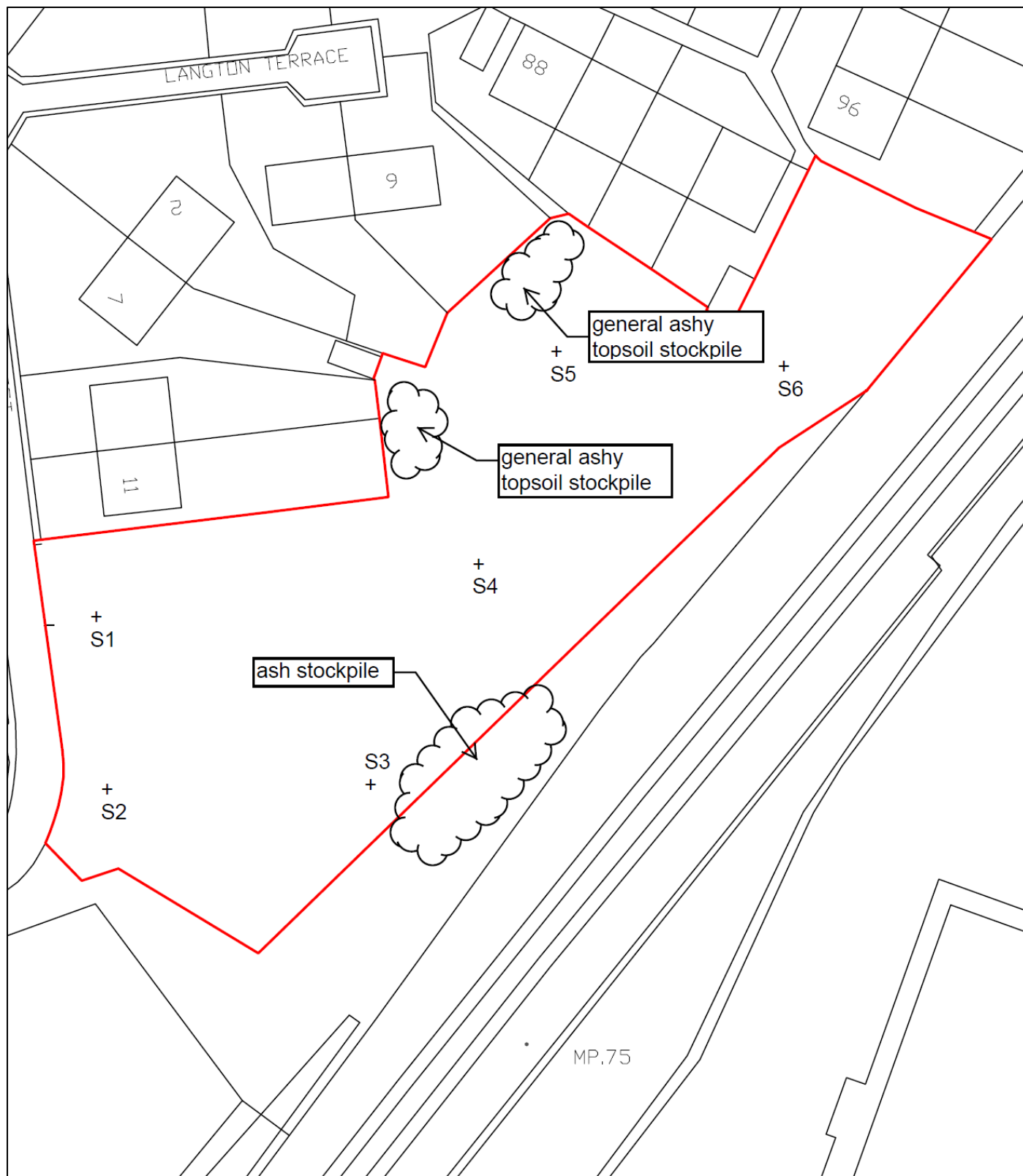
17.1. Location Plan



17.2. Proposed Development



17.3. Existing Site Plan/Site Investigation Plan



17.4. TJBA Soil Analysis

Client / Site		Khan - Langton Terrace, Rochdale					
Sampling Date		08.03.2021					
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	6	190	68.333	156.5	37	FAIL
	Boron as B, hot water sol dw	6	1.1	0.75	1.043	290	PASS
	Cadmium as Cd, dry weight	6	1.6	1.0283	1.525	22	PASS
	chromium as Cr(III) dry weight	6	49	36.50	48.25	910	PASS
	Chromium as Cr(VI), dry weight	6	0.5	0.5	0.5	21	PASS
	Copper, as Dry Weight	6	270	141.67	232.5	2400	PASS
	Lead, as Dry Weight	6	390	228.33	352.5	200	FAIL
	Mercury as Hg, dry weight	6	0.6	0.39	0.57	1.2	PASS
	Nickel as Ni, dry weight	6	120	62.5	106.8	130	PASS
	Selenium as Se, dry weight	6	1.4	1.0933	1.4	250	PASS
	Zinc as Zn, dry weight	6	310	236.67	302.5	3700	PASS
INORGANIC	Cyanide (Total)	6	0.6	0.5167	0.575	2.5	PASS
	Sulphate (Total) as SO4	6	0.36	0.27	0.358	0.24	FAIL
	Sulphide	6	10	8.8667	9.975	250	PASS
	pH	6	8.6	8.4833	8.6	6 to 8	ALKALINE
	Sulphur (Elemental)	6	140	54	117.3	100	comment
	Asbestos Identification	6	0	0	0	0	PASS
ORGANIC	SOM	6	22	13.917	21.25		
	PAH acenaphthene	6	1.6	0.8283	1.55	1100	PASS
	PAH acenaphthylene	6	0.85	0.3683	0.74	920	PASS
	PAH anthracene	6	2.5	1.205	2.375	11000	PASS
	PAH benzo[a]anthracene	6	7.7	3.43	7.275	13	PASS
	PAH benzo[a]pyrene	6	7.5	3.1183	6.95	5	FAIL
	PAH benzo[b]fluoranthene	6	10	4.55	9.475	3.7	FAIL
	PAH benzo[g,h,i]perylene	6	3.8	1.6017	3.55	350	PASS
	PAH benzo[k]fluoranthene	6	4.1	1.8	3.825	100	PASS
	PAH chrysene	6	8.2	3.7	7.7	27	PASS
	PAH dibenz[ah]anthracene	6	1.3	0.3833	1.033	0.3	FAIL
	PAH fluoranthene	6	17	7.1	15.75	890	PASS
	PAH fluorene	6	1.4	0.675	1.3	860	PASS
	PAH indeno[123-cd]pyrene	6	5.3	1.73	4.45	41	PASS
	PAH napthalene	6	2.3	1.1317	2	13	PASS
	PAH phenanthrene	6	11	5.08	10.48	440	PASS
	PAH pyrene	6	17	7.3167	16	2000	PASS
	PAH PAH (Total - SUM EPA16)	6	100	44.167	93.25	1	comment
	SVOC phenol	6	0.3	0.3	0.3	380	PASS

17.5. Chemtest Ltd Soil Testing Certificates



Final Report



eurofins

Chemtest

Eurofins Chemtest Ltd

Depot Road

Newmarket

CB8 0AL

Tel: 01638 606070

Email: info@chemtest.com

Report No.: 21-07716-1

Initial Date of Issue: 24-Mar-2021

Client TJ Booth Associates

Client Address: 20a Eastgate Street
Rochdale
Lancs
OL16 1DH

Contact(s): Daniel Slattery

Project Khan - Longton Terrace

Quotation No.: Q19-18321

Date Received: 11-Mar-2021

Order No.:

Date Instructed: 11-Mar-2021

No. of Samples: 6

Turnaround (Wkdays): 10

Results Due: 24-Mar-2021

Date Approved: 24-Mar-2021

Approved By:

Details: Glynn Harvey, Technical Manager

Results - Soil

Project: Khan - Longton Terrace

Client: TJ Booth Associates	Chemtest Job No.:	21-07716	21-07716	21-07716	21-07716	21-07716	21-07716
Quotation No.: Q19-18321	Chemtest Sample ID.:	1158068	1158069	1158070	1158071	1158072	1158073
	Client Sample ID.:	S1	S2	S3	S4	S5	S6
	Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):	0.00	0.00	0.00	0.00	0.00	0.00
	Bottom Depth (m):	0.35	0.35	0.35	0.35	0.35	0.35
	Date Sampled:	08-Mar-2021	08-Mar-2021	08-Mar-2021	08-Mar-2021	08-Mar-2021	08-Mar-2021
	Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD			
ACM Type	U	2192		N/A	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-
Moisture	N	2030	%	0.020	25	17	18
pH	U	2010		4.0	8.6	8.4	8.6
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	< 0.40	0.79	0.53
Sulphur (Elemental)	U	2180	mg/kg	1.0	20	140	49
Cyanide (Total)	U	2300	mg/kg	0.50	0.50	< 0.50	< 0.50
Thiocyanate	U	2300	mg/kg	5.0	< 5.0	< 5.0	< 5.0
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	9.5	9.6	10
Sulphate (Total)	U	2430	mg/kg	100	2400	1800	3500
Arsenic	U	2450	mg/kg	1.0	190	47	42
Cadmium	U	2450	mg/kg	0.10	1.6	0.84	0.66
Chromium	U	2450	mg/kg	1.0	49	38	26
Copper	U	2450	mg/kg	0.50	270	120	110
Mercury	U	2450	mg/kg	0.10	0.15	0.37	0.60
Nickel	U	2450	mg/kg	0.50	120	49	67
Lead	U	2450	mg/kg	0.50	140	240	130
Selenium	U	2450	mg/kg	0.20	1.4	0.82	1.1
Zinc	U	2450	mg/kg	0.50	220	180	160
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	12	9.7	22
Naphthalene	U	2700	mg/kg	0.10	0.62	0.99	0.94
Acenaphthylene	U	2700	mg/kg	0.10	0.22	0.31	0.21
Acenaphthene	U	2700	mg/kg	0.10	0.13	1.6	0.24
Fluorene	U	2700	mg/kg	0.10	0.20	1.4	0.41
Phenanthrene	U	2700	mg/kg	0.10	0.88	11	1.7
Anthracene	U	2700	mg/kg	0.10	0.30	2.5	0.38
Fluoranthene	U	2700	mg/kg	0.10	1.4	17	1.7
Pyrene	U	2700	mg/kg	0.10	1.4	17	1.7
Benzo[a]anthracene	U	2700	mg/kg	0.10	1.1	7.7	0.98
Chrysene	U	2700	mg/kg	0.10	1.2	8.2	1.1
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	1.1	10	1.3
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	0.48	4.1	0.39
Benzo[a]pyrene	U	2700	mg/kg	0.10	0.75	7.5	0.73
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	0.51	5.3	0.47
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	0.15	1.3	0.23

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Results - Soil

Project: Khan - Longton Terrace

Client: TJ Booth Associates	Chemtest Job No.:	21-07716	21-07716	21-07716	21-07716	21-07716	21-07716
Quotation No.: Q19-18321	Chemtest Sample ID.:	1158068	1158069	1158070	1158071	1158072	1158073
	Client Sample ID.:	S1	S2	S3	S4	S5	S6
	Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):	0.00	0.00	0.00	0.00	0.00	0.00
	Bottom Depth (m):	0.35	0.35	0.35	0.35	0.35	0.35
	Date Sampled:	08-Mar-2021	08-Mar-2021	08-Mar-2021	08-Mar-2021	08-Mar-2021	08-Mar-2021
	Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD			
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	0.29	3.8	0.50
Total Of 16 PAH's	U	2700	mg/kg	2.0	11	100	13
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30

18. APPENDIX B: PHOTOS



Figure 1 – Sample location 1



Figure 2 - Sample location 2



Figure 3 - Sample location 3



Figure 4 - Sample location 4



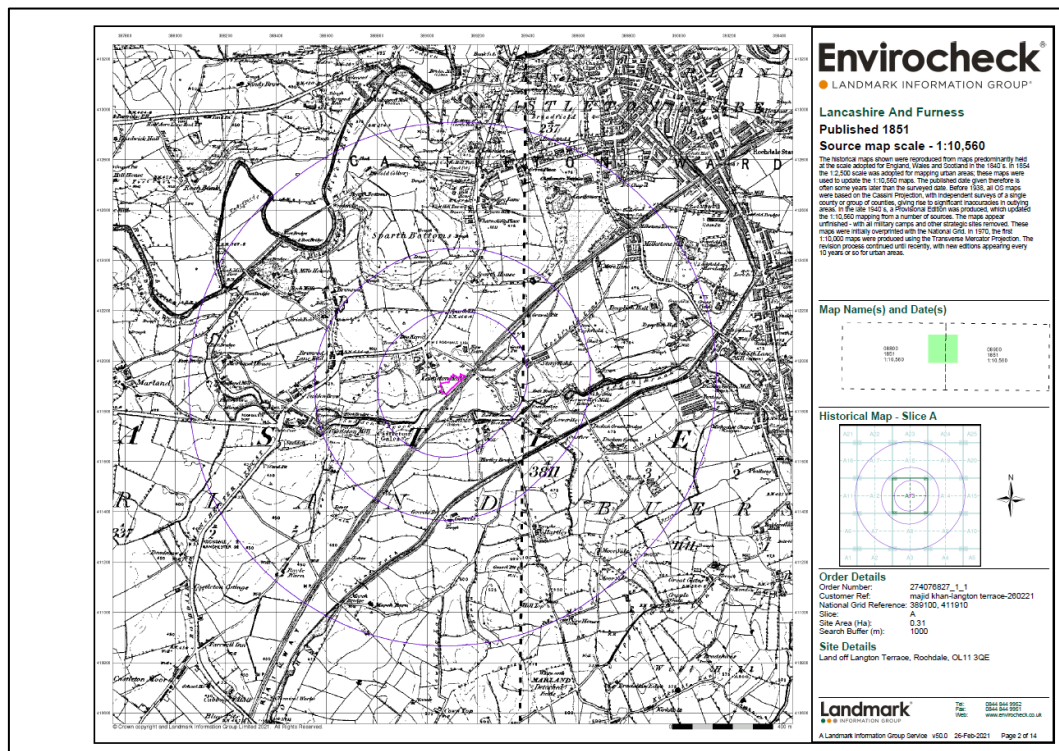
Figure 5 - Sample location 5



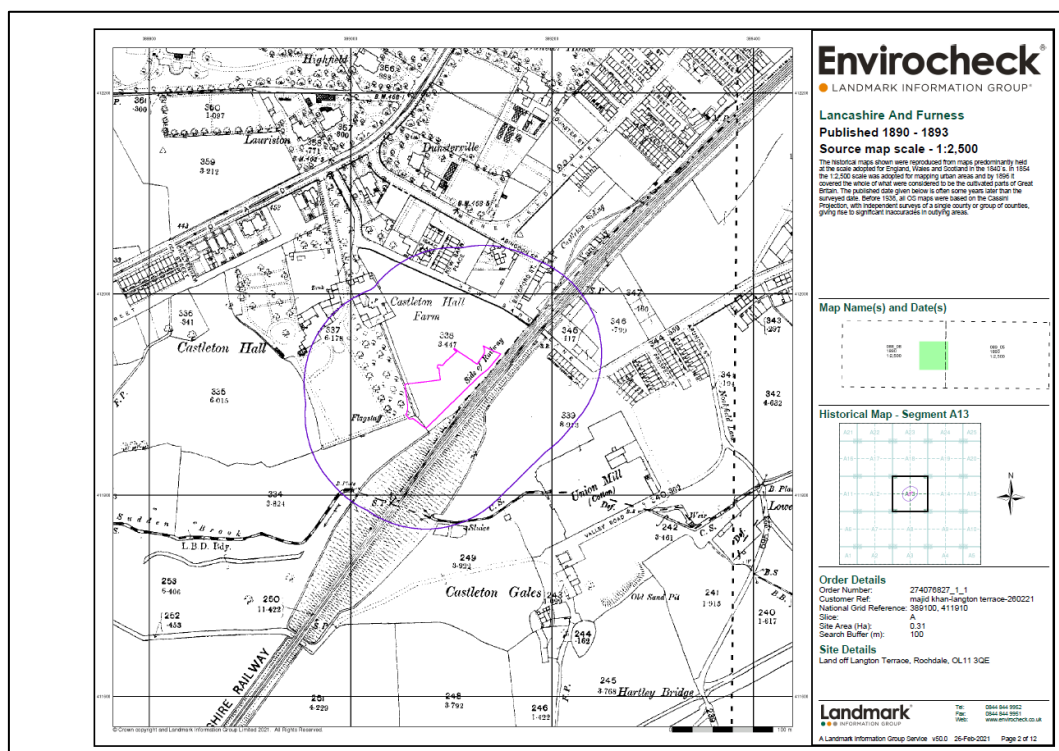
Figure 6 - Sample location 6

19. APPENDIX C: MAPS

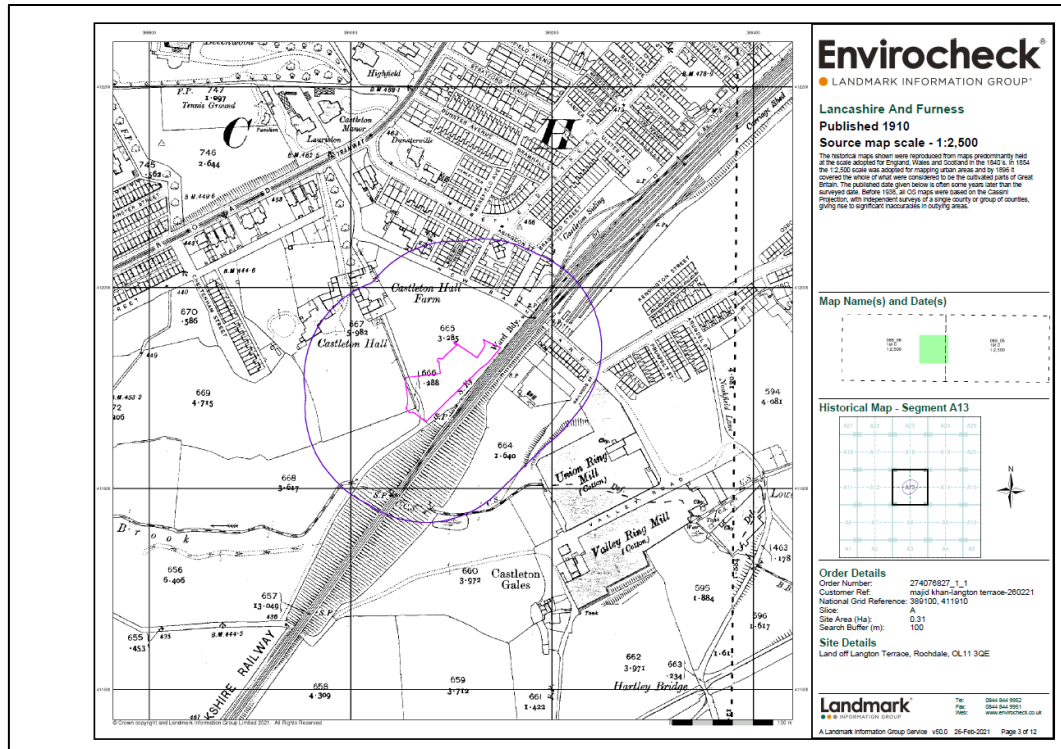
19.1. Ordnance Survey 1851



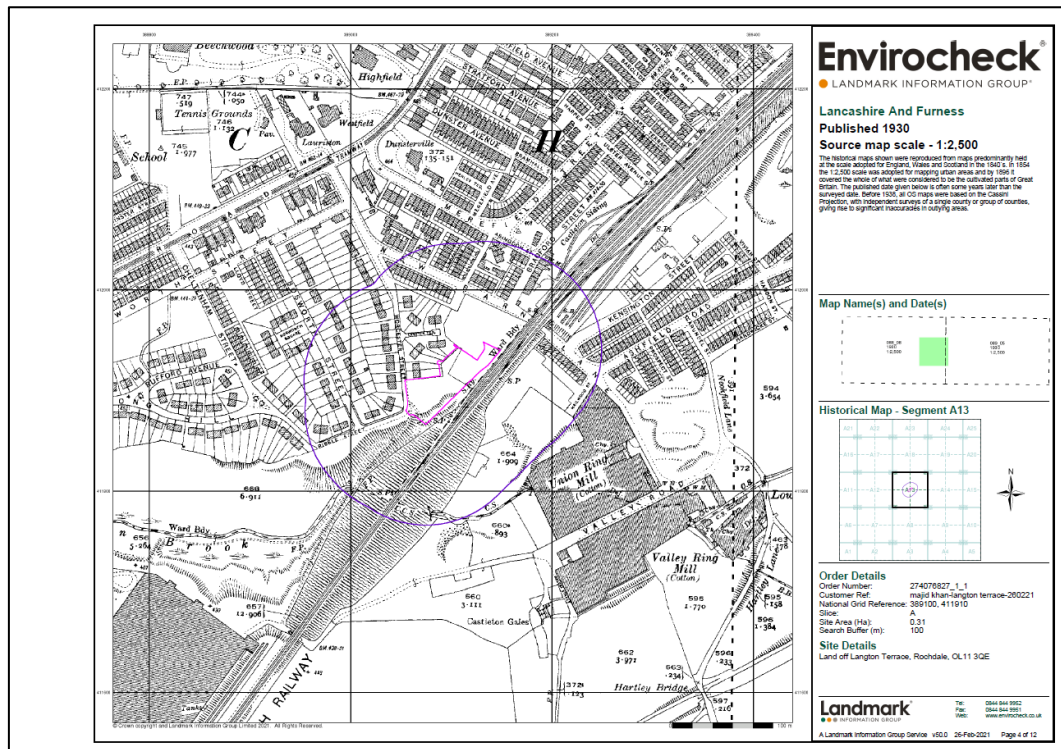
19.2. Ordnance Survey 1890-93



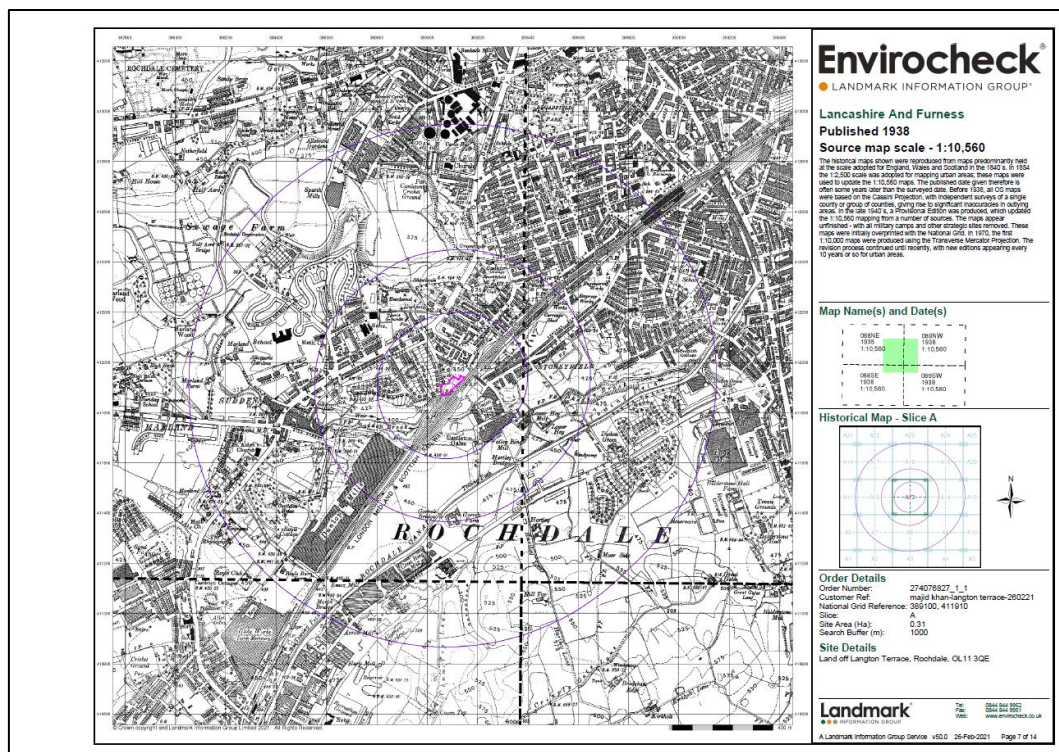
19.3. Ordnance Survey 1910



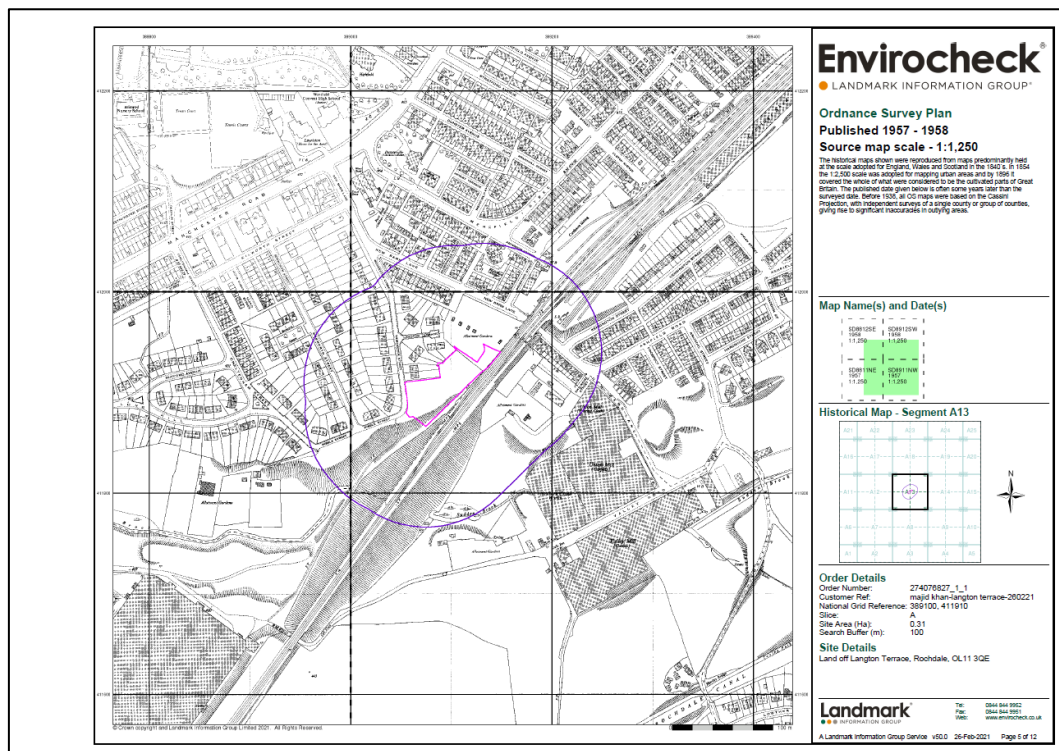
19.4. Ordnance Survey c1930



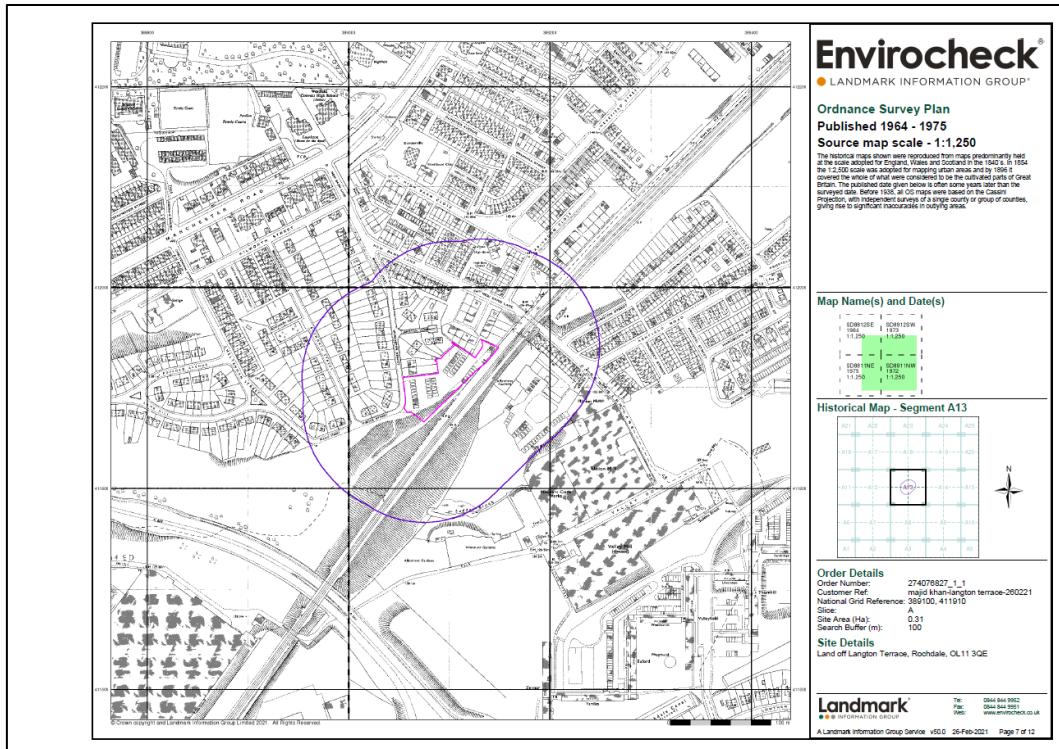
19.5. Ordnance Survey 1938



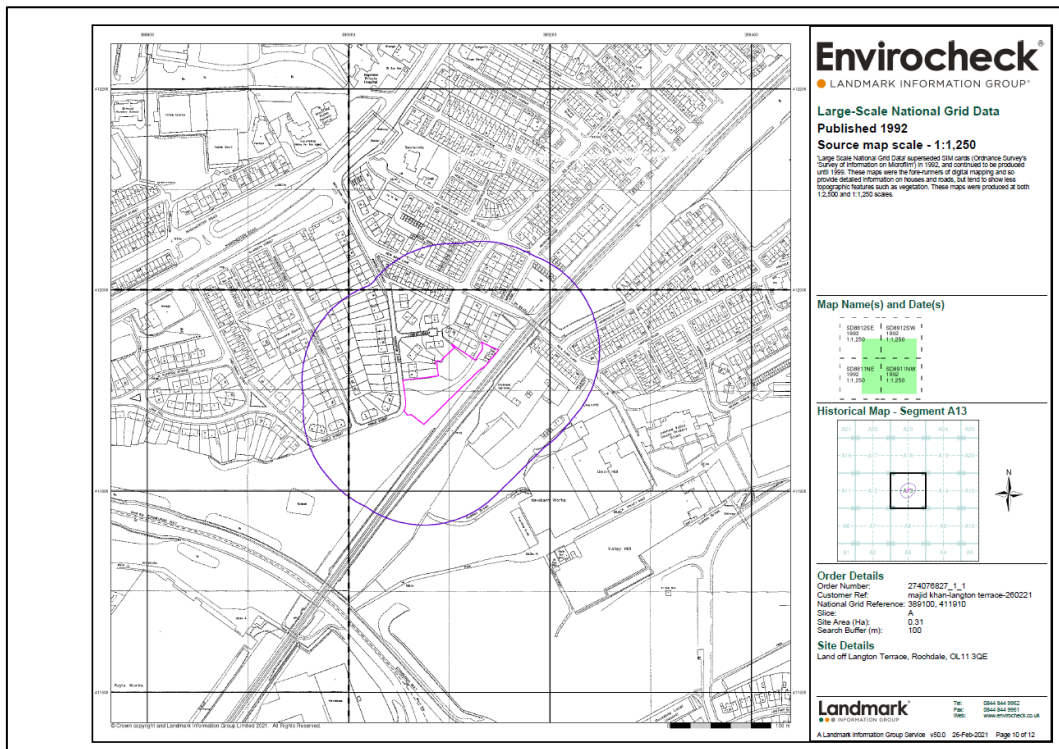
19.6. Ordnance Survey 1957-58



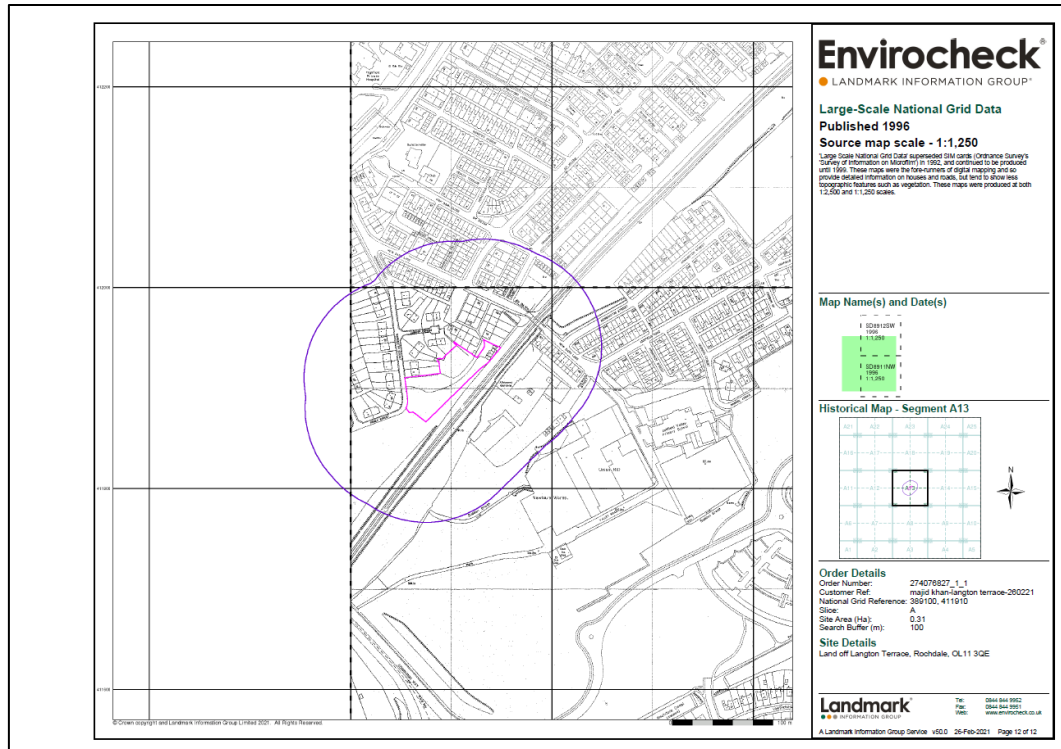
19.7. Ordnance Survey 1964-75



19.8. Ordnance Survey 1992



19.9. Ordnance Survey 1996



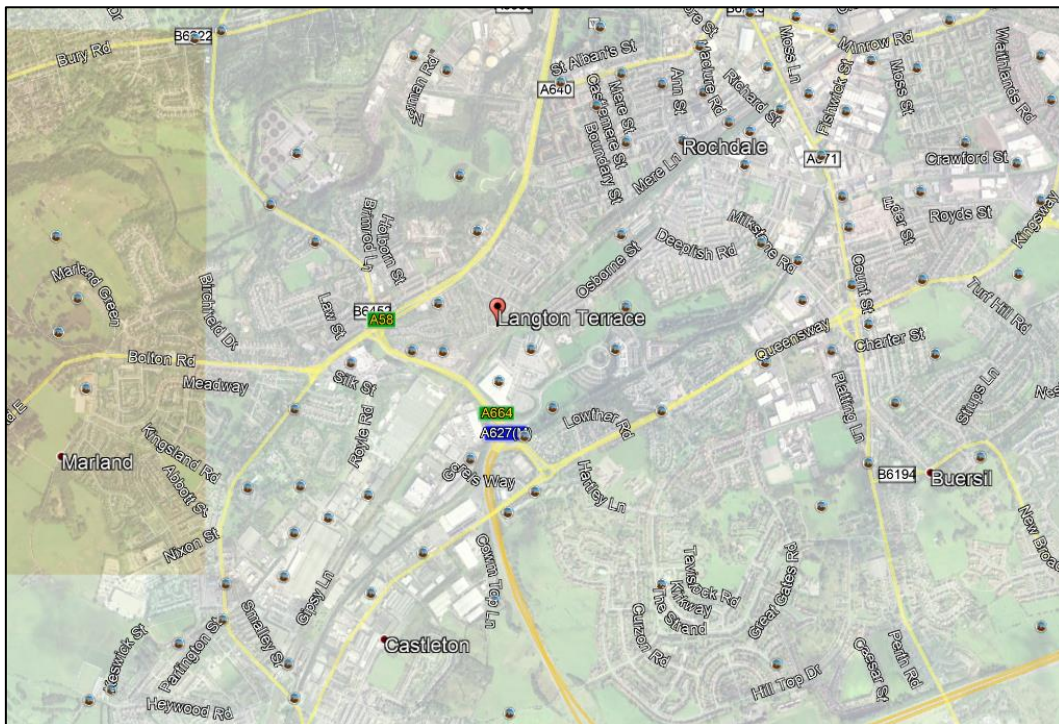
19.10. BGS Geological Map 1:10000 (Solid)

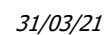
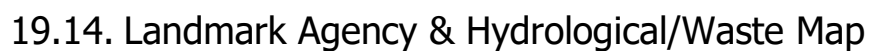


19.11. BGS Geological Map 1:10000 (Superficial)

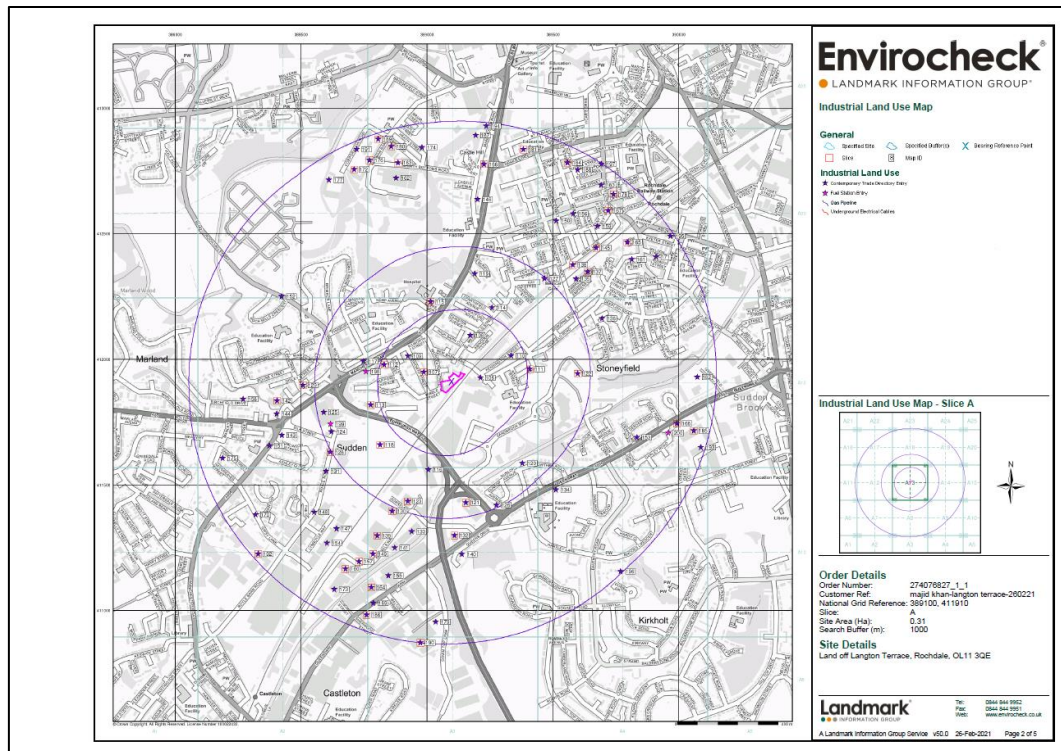


19.12. BGS Radon Maps

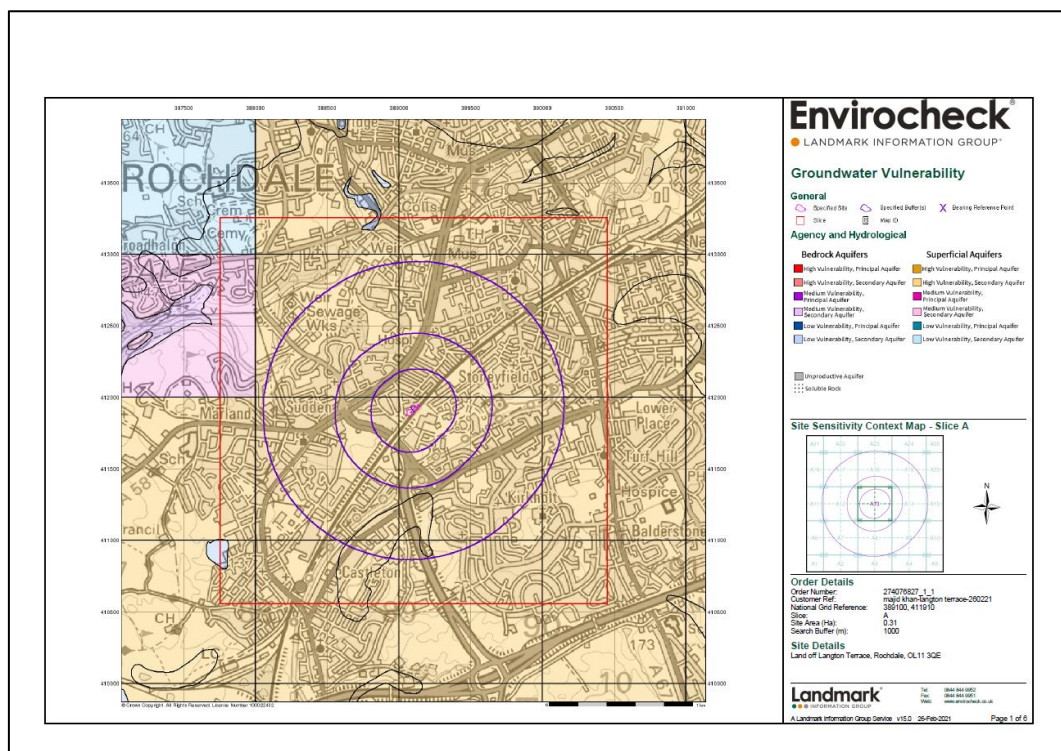




19.15. Landmark Industrial Land Use Map



19.16. Landmark Groundwater Vulnerability Map



20. APPENDIX D: PUBLICATIONS

20.1. 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	●	○			●	○	
Cadmium		○			●	● ¹⁵	
Lead		○		○ ¹¹	●	● ¹⁵	
Cyanide	○	●			● ¹⁴		
PAH ⁶	●		○		●		○
Phenols	●	●		●	●		○
Copper		○		○ ¹¹	○		● ¹⁶
Nickel		○		○ ¹¹			● ¹⁶
Zinc		○		○ ¹¹			● ¹⁶
Sulphate		●		● ¹²	●		○
Sulphide		○		●			
Chloride		○		●			○
Mineral oils	● ⁸	○	○	●	○		
Ammonium ion				●			
Methane	○ ⁹		● ⁹				○
Sulphur			●	○ ¹³			
Combustibles	○		● ⁷				
Oily, tarry substances	●	○	○	●			○
Asbestos	●	○ ¹⁰					
Radioactive materials	●	○			○	○	
Soluble metals		●		○	○		
pH	○	●		●		●	●
Solvents and organics	○	○	○				
Boron		○					○
Expansives				○ ¹⁷			

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

20.2. 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.

20.3. 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 sub-space 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).

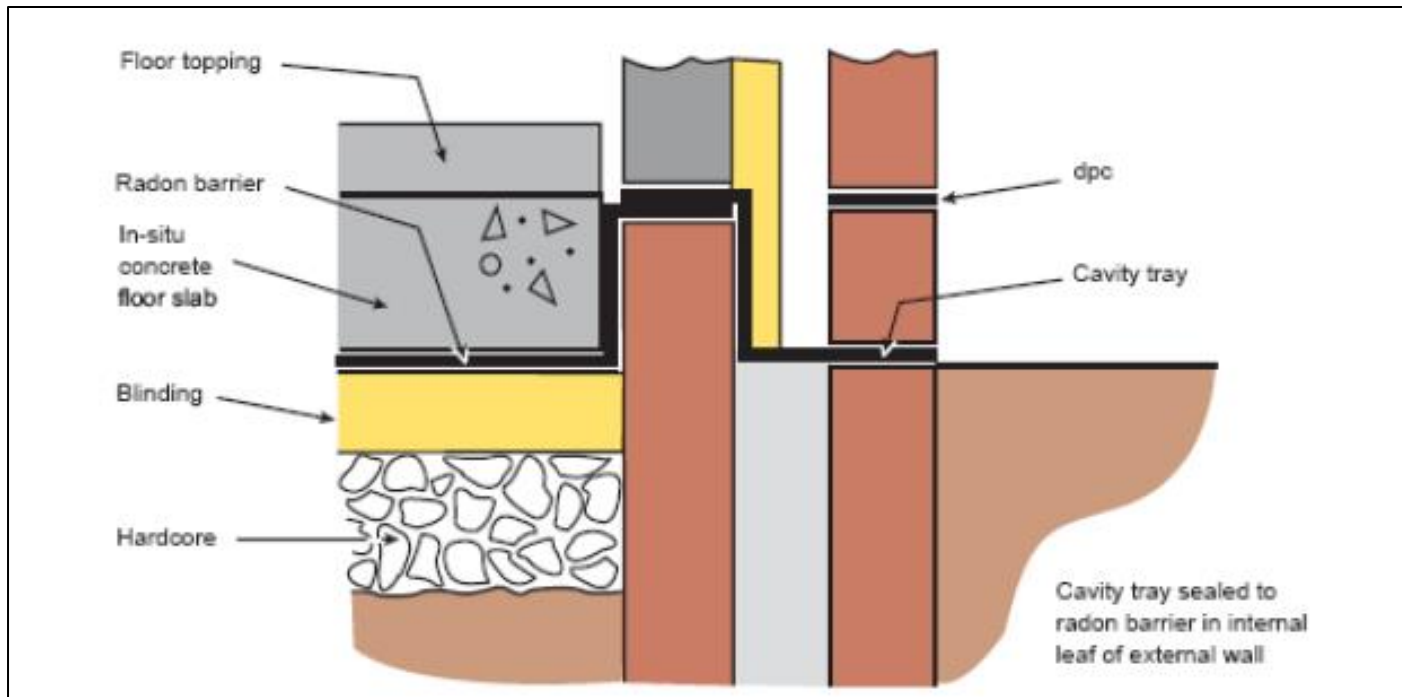
20.4. BGS/HPA report IR/11/044 – Radon Potential Class

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.

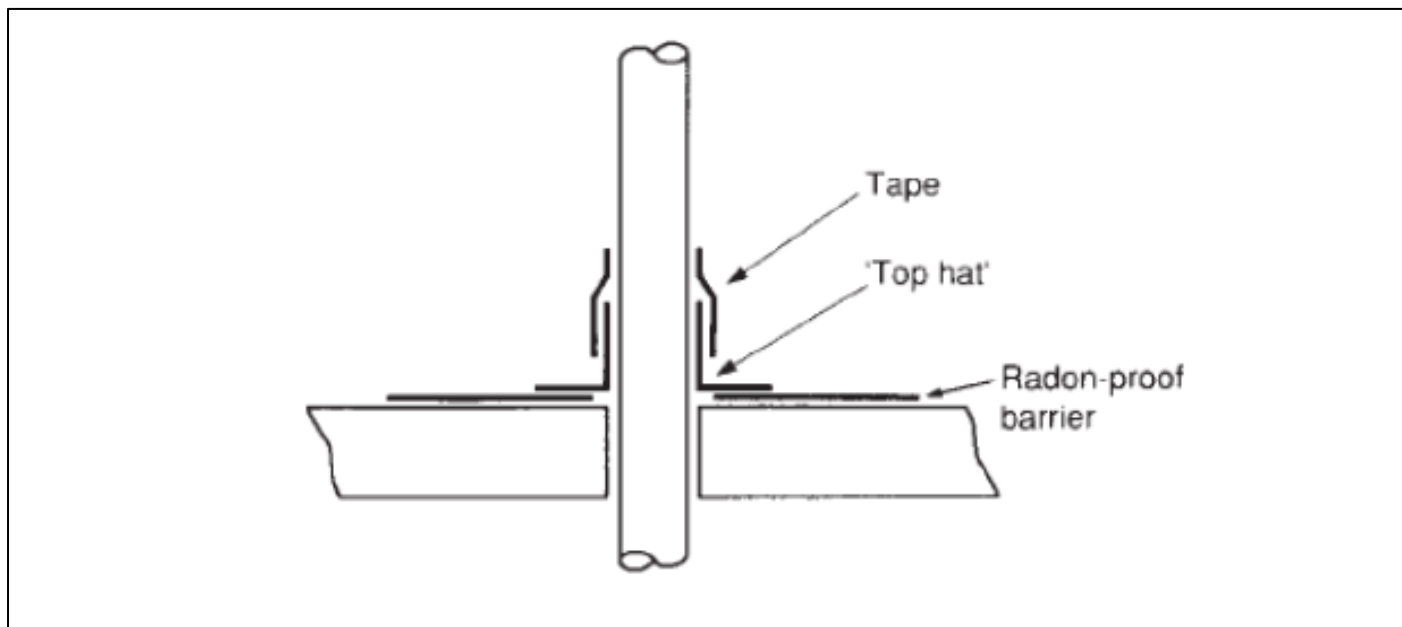
20.5. BGS/HPA report IR/11/044 – Radon Potential Class/Protection Measures

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

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



20.7. BRE 211 – Typical Service Penetration Detail



20.8. 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 <i>Draft Circular on Contaminated Land</i> , 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*

		Consequence			
		Severe	Medium	Mild	Minor
Probability	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.