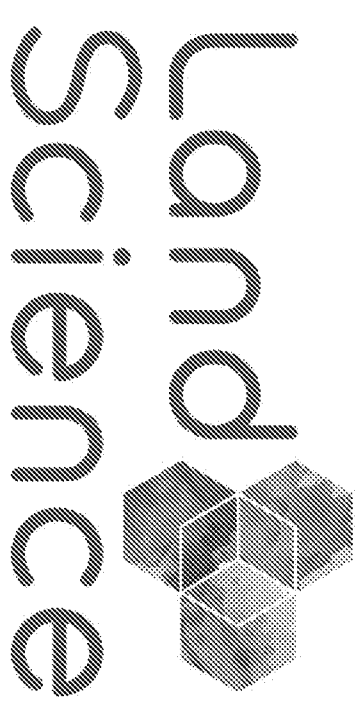




46A TO 47 PIER ROAD,
LITTLEHAMPTON, BN17 5LW
REMEDIATION METHOD
STATEMENT
TL HOMES LIMITED
19TH NOVEMBER 2020

Site:	46A TO 47 PIER ROAD, LITTLEHAMPTON, BN17 5LW
Title:	REMEDIATION METHOD STATEMENT
Development:	RESIDENTIAL DEVELOPMENT
Client:	TL HOMES LIMITED
Date:	19 TH NOVEMBER 2020
Reference:	LS 5391
Version:	V3.0
Prepared by:	SAMUEL WHEWELL M.Sc., B.Sc. (Hons.) <u>Engineering Geologist</u>
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DESK STUDIES GROUND INVESTIGATION CONSULTANCY

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appreciate the role ground issues
play within a wider context. That's
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a reliable service and first class
expertise tailored to specific
requirements.





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1 INTRODUCTION

1.1 General

Land Science was instructed by TL Homes Limited (the Client) to prepare a Remediation Method Statement in relation to the proposed redevelopment of Land at 46A to 47 Pier Road, Littlehampton, BN17 5LW. The location of the site is shown on Figure 1, which is centred at grid reference TQ 0276 0175.

1.2 The Site

The area under investigation comprised several recently vacated industrial buildings with areas of hardstanding. The layout of the existing site is indicated on Figure 2.

1.3 Form of Development

The proposed development was understood to comprise the demolition of the existing buildings and the construction of a three-storey building (commercial units at ground level and residential units on the first and second floors). The proposed development was covered under planning application number LU/287/17/PL.

Figure 3 illustrates the layout of the proposed redevelopment. The findings of this report may be not valid if the proposed development is altered.

1.4 Previous Investigations

Land Science had previously undertaken the report relevant to the site:

- o Phase I Site Investigation, Reports4Planning, November 2019
- o Phase II Geotechnical and Geo-Environmental Ground Investigation LS4823 dated 24th March 2020.

This Remediation Method Statement is based on the findings and recommendations within the above reports.

1.5 Scope of Works

Land Science were instructed to carry out a Remediation Method Statement, in relation to removing/reducing any potential risks to any sensitive receptors.

It is understood that this report will be used to inform planning conditions with regards to managing contaminated land risks as part of the development.

1.6 Standards

Where practicable, the investigation was undertaken in accordance with the following standards and guidance:

- o Model Procedures for the Management of Contaminated Land, DEFRA and Environment Agency, September 2004 ("CLR11").
- o Guiding Principles for Land Contamination, Environment Agency, March 2010, ("GPLC").
- o National Planning Policy Framework, July 2018.
- o Building Regulations Approved Document C: Site preparation and resistance to contaminants and moisture, HM Government, July 2013.
- o NHBC Standards Chapter 4.1: Land Quality - Managing Ground Conditions, 2018 edition.

Other technical sources have been cited in respect of specific aspects of the investigation, as referenced throughout the text.

1.7 Confidentiality and Limitations

Reference should be made to the Report Conditions section at the end of this report.

2 REMEDIATION OBJECTIVES AND OPTIONS

2.1 Objectives

The distribution, nature and concentrations of contaminants of concern are a critical consideration for the selection of the correct remedial technology for the attainment of the remediation objectives.

The prevalence of some recalcitrant contaminants may make a specific technology expensive or unviable in terms of treatability and/or cost. The selection of the right remedial technology is further complicated by other considerations such as the geological and hydrogeological setting, extent of previous investigation/remediation works, the time available for implementation and treatment, site access and restrictions posed by ongoing development, and cost.

The primary objective of the remediation activities will be for the safe redevelopment of the site that is suitable for the proposed end-use. Considering the previous sections, the following remedial options available to manage unacceptable risks will either:

- Manage (remove, destroy, modify or immobilise) the source;
- Interrupt the pathway; or
- Modify the receptor or the behaviour of the receptor.

The preferred options will be designed to manage the source of contamination or interrupt the pathway.

Source management may involve the removal, destruction, or transformation of the source. Pathway interruption may involve either the blocking of the pathway or the destruction or removal of contaminants moving along a pathway.

This can be achieved either via the permanent reduction of contaminant concentrations to acceptable limits; source removal; pathway interruption.

2.2 Constraints

There are a number of specific site constraints that affect the choice of the remediation technology, namely:

- Site levels will not be altered.
- No option to re-use material on site.
- Limited space to treat materials on site.

2.3 Preferred Remediation Options

On the basis of the above the preferred remediation options are as follows:

- Post demolition inspection of the exposed soils following removal of the exiting buildings (including ground floor slab) to assess the presence or absence of any potential contamination e.g. interceptors / tanks etc.
- Removal of possible historic buried tanks at the front of the site, associated pipework and any impacted surrounding soils from around these features.
- Localised remediation around BH2 and DS5 where elevated concentrations of hydrocarbons were previously detected,
- The production of a Piling Method Statement with possible monitoring of groundwater prior to, during and after piling activities,
- Removal of Made Ground and provision of a 'clean' capping system within soft landscaping areas. The 'clean' capping should be imported chemically validated topsoil and subsoil.
- Considerations regarding potential disturbance of asbestos during the groundworks phase.
- Use of barrier pipes for all new potable water supply pipes.
- Installation of Volatile Vapour protection measures.
- Class DS-2 and ACEC Class AC-2s.
- Any soil arisings must not be re-used on site and should be disposed of off site.
- Testing of any imported granular material used to raise site levels,
- A Discovery Strategy should be followed during the development.

Details of how this should be implemented are provided in section 3.0.

3 IMPLEMENTATION PLAN

The following strategy has been prepared to render the site safe for residential occupation.

3.1 End Users

3.1.1 Post Demolition Inspection

Following the demolition and removal of the existing vacant buildings including ground floor slabs the exposed soils should be inspected by a suitably competent Environmental Consultant to confirm the presence or absence of any potential contamination in the underlying Made Ground. This could include hydrocarbon impacted soils around features like buried tanks, interceptors, drains etc.

Any potential contaminative features encountered should be removed with any visually impacted soils identified around them. Samples should be collected from the formation level. The results must meet the chemical specification in Appendix A; any evidence of further contamination either removed, or further sampling and risk assessment carried out.

3.1.2 Below Ground Tanks

It is recommended that the underground fuel tanks and associated pipework that may be present at the southern end of the site should be removed and any contaminated soils around the tanks removed. The removal of the tanks should be undertaken as part of the site clearance and preparation.

Any liquids present within the tanks (and any further unknown tanks that might be encountered) should be sampled and tested, pumped out and disposed of to a licensed treatment facility. Limits should be calculated in order to prevent risks to end users, adjacent land users, and controlled waters, and those limits should be agreed with the Local Authority in good time prior to commencing the works.

Care should be taken so as not to undermine existing structures or adjacent properties whilst undertaking the remediation excavations.

Removal of the below ground tank to standards prescribed by the Local Planning Authority (LPA) and with reference to 'installation, decommissioning and removal of underground

storage tanks: PPG27' is advisable. Inspection and record keeping of the tank removal / disposal must be kept on record, as these may be required by the LPA.

3.1.3 Localised Hydrocarbon Contamination

The previous Phase II Geotechnical and Geo-Environmental Ground Investigation identified elevated Total Petroleum Hydrocarbons within the Made Ground at DSS and BH2. It is recommended that the Made Ground at these positions be removed to an initial depth of 0.60m with the soils inspected with samples taken and tested and any further impacted soils removed. Limits should be calculated in order to prevent risks to end users, adjacent land users, and controlled waters, and those limits should be agreed with the Local Authority in good time prior to commencing the works.

3.1.4 Soft Landscaping

Made Ground has been encountered within the proposed soft landscaping areas, this material is considered unsuitable for soft landscaping purposes. The previous reports recommended the removal of Made Ground in these areas and replacement with chemically compliant material.

The Made Ground should be removed to the required depth (600mm) or to the top of the natural soils, whichever is shallower. The levels should then be raised by 'clean' imported subsoil and topsoil. Where excavations encounter natural soils within 600mm the soils should be inspected and sampled as part of remedial inspections. Where Made Ground is still present below a depth of 0.60m a geotextile membrane (terram hi-viz or similar) should be placed between the Made Ground and imported soils.

The removal of Made Ground and the provision of fill material should be monitored and validated by a suitably qualified environmental consultant. This is to include confirmation that the areas have been excavated and filled to the appropriate depth with a chemically suitable class of material.

Material used to backfill the proposed garden and soft landscaped areas must be compliant with test criteria, as detailed in **Appendix A** and in accordance with BS3882:2015 Specification for Topsoil and BS8601:2013 Specification for Subsoil and Requirements for Use.

The soil testing requirements for backfill material is a minimum of three soil tests per source (anti-dig layer, sub-soil, topsoil) and once placed *in-situ* verification testing to confirm

depth of fill meets the specified fill depths and chemical suitability at a rate of approximately one sample per 50 sq.m. If the verification tests fail screening criteria then the material is deemed not acceptable and should be removed from site.

3.1.5 Vapour Resistant Membrane

Elevated hydrocarbons have been recorded within the Made Ground at the site that may pose a potential risk to end users from Volatile Vapours. Therefore, an organic vapour barrier (a specialist double layer damp proof membrane with foil core) has been recommended in the proposed ground floor construction.

The membrane should be installed in accordance with BS8485:2015 "Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings", CIRA C735 "Good practice on the testing and verification of protection systems for buildings against hazardous ground gases" and CIRA C748 "Guidance and use of plastic membranes as VOC vapour barriers". The following should be considered:

- The membrane should be robust enough to withstand the installation and following construction process, including following trades.
- If installed beneath a ground slab (i.e. unsupported), the membrane should be strong enough to withstand in-service stresses, including settlement (if anticipated).
- If installed beneath a ground slab, the membrane should be protected on top and bottom with a thick geo-fabric (or other appropriate protection) immediately following a satisfactory inspection and testing regime. Architects insulation may be laid over the membrane as an alternative to using a protective geo-fabric.
- If installed above a solid slab, protection should be installed at least on top of the membrane.
- The selected membrane should be compatible with the proposed foundations and structures requiring protection, that is, consideration should be given to the level of detailing and joining complexity.
- The membrane should be sealed to all service or other penetrations through it. Once sealed any internal annulus should also be sealed (e.g. if water pipes are in ducts).
- The membrane should be sealed across all wall cavities.

The installation of the gas protection measures should be inspected and validated in accordance with CIRA C735. A verification report should be provided to the Local Planning Authority for their approval.

3.1.6 Imported Materials

Material used to raise site levels (e.g. piling mat or granular sub-base materials) must be suitable for the proposed end use and chemical testing is recommended to confirm that they do not contain elevated concentrations of potential contaminants of concern that could pose a risk to end users (e.g. asbestos).

Testing should meet the screening criteria appended to this document. If *in-situ* verification tests fail screening criteria then the material is deemed not acceptable and should be removed from site.

3.2 Building materials

3.2.1 Below Ground Concrete

Based on BS8005-1:2006, the results of the Sulphate and pH analyses fell into Class DS-2 and an ACEC class AC-2s is deemed appropriate.

3.2.2 Potable water supply pipework and new service utility routes

The recorded concentrations of TPHs exceeded the respective standard for Polyethylene (PE). In accordance with these guidelines, metal or Protectaline may be suitable. No pipework should be laid where there is evidence of hydrocarbons.

Confirmation should be sought from the utility supply company as to the suitability of potable water supply pipes prior to install.

New service utility trenches should be backfilled with chemically inert material for example naturally sourced sand or pea shingle or material that has been chemically tested and meets the chemical validation specification in Appendix A.

All service utility trenches should be surveyed and an as built drawing of the locations included within the Health and Safety Plan.

3.3 Groundworks Phase

During the construction phase of this project adequate protection measures for site workers and adjacent properties should be provided within a Construction Method Statement, completed by the Principal Contractor (CDM regulations 2015) for the project, including the site controls provided in Section 5.0

We note that the Made Ground may contain asbestos in soil or asbestos containing materials and suitable precautions must be in place for any works that disturb existing soils for example (but not limited to), new soft landscaped areas and/or new utility service trenches.

The Control of Asbestos Regulations 2012 (CAR2012) should be referenced prior to undertaking excavations into Made Ground and the required actions implemented on-site. Suitable control measures could involve (but are not limited to) toolbox talks to make people aware of potential risks, use of appropriate PPE/RPE and dampening down of the excavations during any exposure, digging and removal of this material to prevent the release of respirable asbestos fibres into the air.

Appropriate controls should be produced by the Contractor to mitigate risks to construction workers.

We also note that deep excavations should only be entered where a detailed risk assessment is prepared and any safety measures employed where appropriate, in accordance with confined space regulations and guidance. The risks to site workers is a safety matter for site management, and these recommendations should only be used as a guide.

Asbestos containing material poses a potential risk to site workers and adjacent land users if significant quantities are identified and disturbed during the construction phase.

3.4 Piling Monitoring

Piles have been recommended for the proposed foundation design for the development, these will go through the Made Ground and Alluvium and into the underlying Chalk.

It was recommended that a Piling Method Statement is undertaken and submitted to the relevant regulatory bodies. This document should detail the type of piling, methodology,

measures to prevent / minimise potential impact to controlled waters (groundwater aquifers and surface waters), and a programme of works. This may include a piling monitoring exercise and collection of groundwater samples for laboratory analysis prior to, during and after piling to assess impacts to groundwater due to penetrative works.

3.5 Stockpiles and Waste Management

If material is excavated from the ground (e.g. site strip, landscaped area and service trenches) it is unlikely to be stockpiled on site, due to the size constraints of the site. If stockpiles are to be created, they should be on impermeable ground, over a geotextile membrane and managed suitably to minimise dust generation i.e. dust suppression and suitable covers. Stockpiles must be banded to prevent possibility of contaminated surface water run-off impacting surrounding land.

Stockpiles of 'waste arising' for offsite disposal and stockpiles of imported 'clean' material granular subbase need to be clearly marked and appropriately segregated to avoid the potential for cross contamination.

Stockpiles should be regularly surveyed, and records maintained to be included in the verification report.

The Contractor undertaking the remediation works is responsible for compliance with waste management legislation where issues relating to waste arise as a result of the works. As a minimum, the following is required:

- Management of material that arises during the works and is classified as waste.
- Waste streams are appropriately classified prior to offsite disposal.
- Audit process for the selection of waste management contractors to include the collection and assessment of licences, permits and registrations.

3.5.1 Soil Disposal

The contractor should allow for a suitable regime of testing soil arisings to ensure they are being disposed of to the appropriate facility with the appropriate level of duty of care. Numerous phases of soil investigation have been undertaken at the site. The following table summarises the proposed positions for each survey.

The Made Ground and underlying natural soils (Alluvium and White Chalk) were previously given the following preliminary classifications for waste disposal: -

Soil	Hazardous		Non Hazardous		Details
	Hazardous	Stable Non-Reactive	Non-Hazardous	Inert	
Made Ground BH1 0.50m DS2 0.30m DS4 0.30m DS6 0.30m DS8 0.30m			✓		Non Hazardous – No WAC test carried out
Made Ground DS3 0.50m				✓	The soil analysis was not identified as Non hazardous and the WAC test met the requirements for Inert Waste
Made Ground BH2 0.50m	✓				The soil analysis was identified as Hazardous waste due to elevated TPH. No WAC test carried out.
Made Ground DS1 0.30m DS5 0.30m DS7 0.30m		✓			The soil analysis was identified as Hazardous waste due to elevated TPH. The WAC test met the criteria for Stable Non reactive Hazardous Waste .
Alluvium DS6 1.00m			✓		The soil analysis was identified as Non-Hazardous . The WAC test did not meet the requirements for Inert waste. The tests failed the criteria for: Total Dissolved Solids
Alluvium BH1 4.00m BH1 6.00m BH2 3.00m BH2 4.00m BH2 5.00m BH2 6.50m			✓		Non Hazardous – No WAC test carried out

Soil	Hazardous		Non Hazardous		Details
	Hazardous	Stable Non-Reactive	Non-Hazardous	Inert	
DS1 1.00m DS1 3.50m DS2 4.00m DS4 1.50m DS4 4.00m DS4 5.00m DS5 5.00m DS6 3.50m DS7 4.50m DS7 5.00m					

It is anticipated that the underlying White Chalk would meet the Inert Waste Criteria.

Waste Acceptance Criteria (WAC) analyses should be carried out once soils destined for removal off site as waste have been clearly identified. Liaison with the proposed receiving facility is recommended to be undertaken at an early stage in the scheme to confirm the requirements.

Further WAC testing may be considered for soils identified as Non-Hazardous, as the tests may enable those materials to be re-classified as Inert and therefore represent a potential saving on disposal costs

Records of the removal and disposal of soils must be kept and included within the final validation report. The records should include details of volumes, waste codes, facility that the material is sent to and dates etc.

3.6 Discovery Strategy

During groundworks, a watching brief is required by a competent environmental consultant or engineer. Should visual signs or olfactory signs of unexpected contamination be identified then the following is required:

- Stop works in the location of identified gross contamination;
- Inform the Site Manager and Environmental Consultant;
- Environmental consultant to inform Local Planning Authority;
- Excavate the impacted area until impacted material is visually removed;
- The excavated material can be temporarily stockpiled on site, for pre-treatment

and waste classification, prior to being disposed of offsite at a suitably licensed facility in accordance with the above (as detailed in Section 4.4).

Unexpected contamination may include:

- Visible fragments of asbestos board / tile or fibre (lagging);
- Soil headspace readings >100 ppm (using photo-ionisation detector [PID]);
- Significant discolouration of the soil;
- Visible hydrocarbon seeps; and,
- Strong hydrocarbon odour.

4 SITE CONTROLS

4.1 General Controls

Site works should be undertaken in accordance with the CDM:2015 Regulations and guidelines prepared by the Health and Safety Executive [HSE, 1991 Protection of Works and the General Public during the Development of Contaminated Land and Guidance Note HS(G)66, Health and Safety Executive, HMSO, 1991].

Detailed control measures with respect to contaminated land will be required during works on the site, to include (but not limited to):

- Monitoring of actual changes to ensure mitigation of potential adverse effects;
- Education of workers to risks associated with contamination (site inductions and appropriate tool box talks);
- Posting of appropriate warning signs;
- Provision of suitable welfare facilities; and
- Provision of suitable PPE (and RPE if required).

4.2 Odours, Noise and Vibration

Care will need to be taken during activities to minimise the impact of any odours, dusts, noise and vibration on the surrounding buildings and receptors. In all instances, best practicable means (BPM) should be employed to control noise and vibration. BPM should also be employed to control dust emissions, such as (but not limited to) damping down dusty operations throughout the earthworks

5 Validation report requirements

There is a requirement that the remediation of the site is validated and documented in line with Environment Agency document: verification of remediation of land contamination report (SC030114/R1).

The Contractor will hold as a minimum:

- Records of all excavations including:
 - Ordnance survey extents and depths
 - Photographic record of each excavation; and
 - Records of inspection records including accurate survey depths and final extents of validation.
- Records of any previously unidentified contamination as detailed in the Discovery Strategy (if encountered).
- Validation of vapour protection measures.
- Records and photographic evidence of reduced levels following Made Ground removal from proposed soft landscaping areas,
- Records of laboratory analytical and *in-situ* field test results, including:
 - Laboratory test certificate for each verification test of imported material;
 - Particulars of monitoring (date / location / personnel);
 - Confirmation of depths of sub-soil and topsoil layers; and,
 - Chain of custody forms.
- Records of material movement, including:
 - Volumes, origin and placement location of soils references to field results;
 - Details and quantities of excavated and imported materials;
 - Records of earthworks excavations including, as constructed, photographs, quantities of materials and records of progress; and,
 - Waste transfer notes for any material disposed of as waste.
- Waste classification and management documentation, including:
 - Details of all parties involved in the works;
 - Records of approval and method statements;
 - Records of discussions with regulatory authorities and written approval for actions;
 - Records of license applications (including mobile treatment license or declaration under the Definition of Waste Industry Code of Practice); and,
 - Records demonstrating environmental monitoring.

All relevant information as detailed in above shall be collected during the remediation works and an independent verification report compiled on completion. The validation report shall take account of the recommendations in CLR11 and comprise as a minimum:

- A summary of the information contained in the risk assessment reports along with the agreed redevelopment strategy and objectives;
- Decision records covering agreement with regulators;
- Records of works undertaken and associated validation and monitoring records e.g. laboratory validation test certificates);
- Details of all parties involved in the works;
- Details and quantities of excavated soils and volumes disposed of off-site;
- Records of inspections of the gas protection measures,
- Specialist contractor's validation reports for particular elements of work (if used);
- Details of the validation data for imported soils used on-site (at least three sets of analyses per source) plus *in-situ* validation test results confirming depth and chemical quality;
- Records of all earthworks, excavations and sorting including as constructed, photographs, quantities of materials;
- Waste classification and management documentation;
- Additional risks assessments / non-scheduled reactive works relating to previously unidentified contamination and all related remedial works that were undertaken; and,
- Final status of remediation and achievement remedial objectives to satisfy planning conditions.

It should be noted that consideration has not been given to the protection of groundworkers, during the construction phase of this project, as that is outside the scope of this report. Adequate protection measures should be provided within a Construction Method Statement, completed by the Principal Contractor (CDM regulations 2015) for the project.

6 REPORT CONDITIONS

6.1 General

Interpretation of ground conditions inherently depends on the conditions revealed by a limited data set. Land Science takes all reasonable professional care in preparation of this report, using current standards and industry best practice. However, we accept no liability whatsoever expressed or implied in respect of:

- The scope, extent or design of an investigation.
- Any conditions not directly revealed by the investigation.
- Published standards or methodologies used or adopted in this report.
- The opinion of any other party including any regulator, authority or stakeholder.
- Any dispute, claim or consequential loss arising from this report.
- Any matter other than ground conditions.

Land Science does not accept any risk or any direct or consequential liability relating to ground conditions. The client should understand their risks and liabilities and seek further professional advice.

No aspect of this report constitutes a design. Where this information is used in design, the designer should verify that the information has been used appropriately.

No aspect of this report constitutes the supply of Goods.

Our appointment is covered under our Terms and Conditions, agreed and accepted by the Client.

6.2 Confidentiality

This report may only be relied upon by the Client and their design team, and should only be read and used in full. No responsibility will be accepted where this report is used, by any other party, who do so at their peril. The report may not be relied upon or transferred to any other parties without the express written agreement of Land Science.

6.3 Third Party Information

Third party information used in the production of this report has been relied upon as being accurate. Land Science cannot warrant or accept any liability for errors and/or omissions in third party information.

6.4 Regulators and Approvals

It is recommended that this report is submitted to any relevant authorities for their own assessments and to provide their approval or comments accordingly. This should be in good time before commencing on site in case additional work is to be carried out.

Standards, technical guidance and regulatory positions change over time and which may therefore affect the findings and recommendations made in this report. This should be verified by the client prior to any critical contractual points or commencing on site.

6.5 Variations with time

The report relates to conditions revealed at the time of the investigation and any monitoring visits. A number of parameters may vary over time or seasonally. Groundwater levels, ground gas compositions, or concentrations of contaminants are particularly variable in this respect. Further monitoring or verification should be considered as appropriate.

6.6 Other Matters

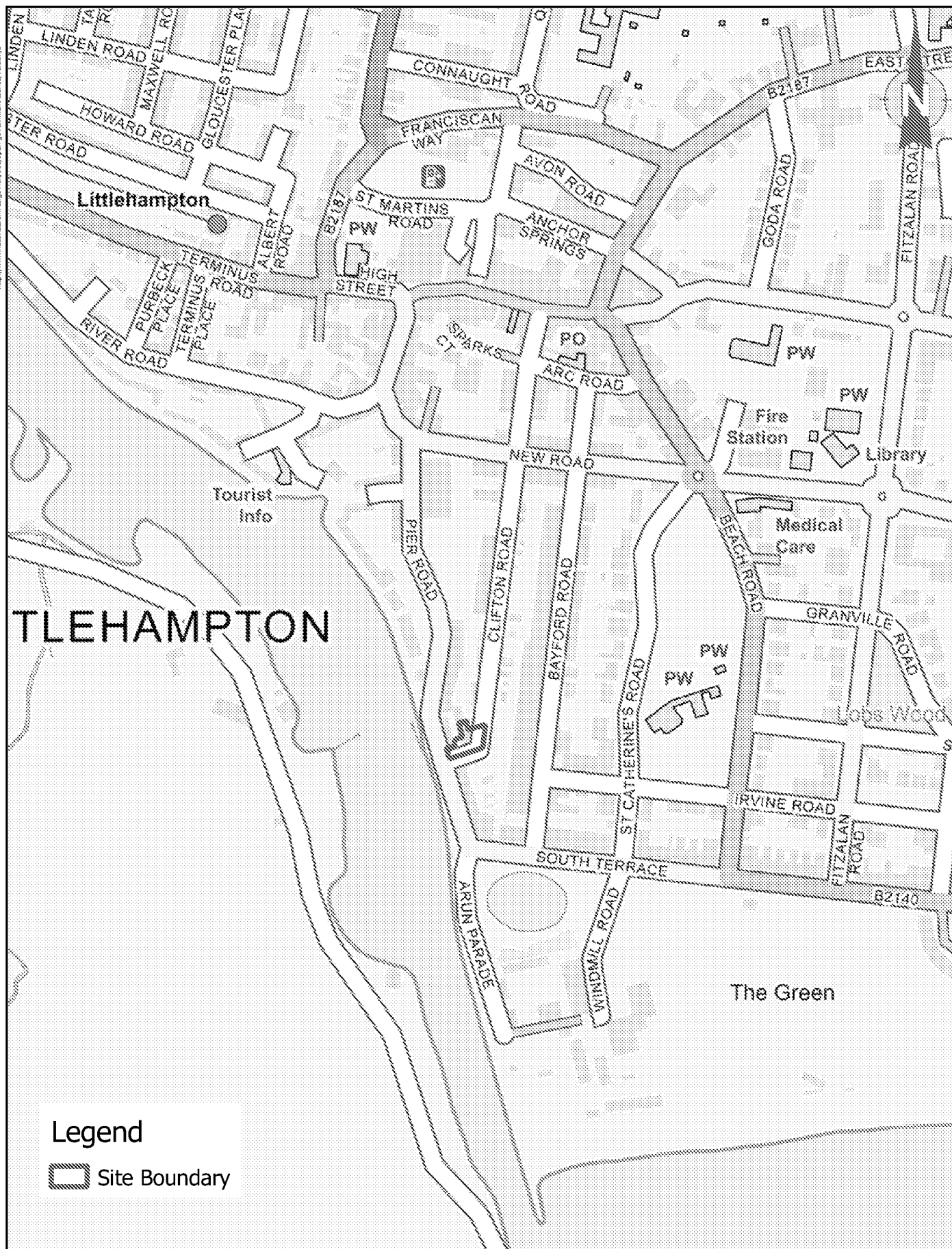
This report makes no representation on other matters such as ecology, agronomy, arboriculture, structural condition, building materials, boundaries and planning etc.

This report and findings may not be valid if the proposals for the site e.g. design of the development (if relevant) are changed. This must be checked.

No aspect of this report should be taken as a guarantee whatsoever that a site is free of pollution, contamination or hazardous materials.

GLOSSARY OF TERMS

ACM	Asbestos Containing Material	PQRA	Preliminary Quantitative Risk Assessment
BGS	British Geological Survey	PSD	Particle Size Distribution Test
BRE	Building Research Establishment	RMS	Remediation Method Statement
BS	British Standard	SGV	Soil Guideline Value
CBR	California Bearing Ratio	SOM	Soil Organic Matter
CDM	Construction Design and Management regulations	SPZ	Source Protection Zone
CIRIA	Construction Industry Research and Information Association	SPT	Standard Penetration Test
CL:AIRE	Contaminated Land: Applications in Real Environments	SSI	Sites of Special Scientific Interest
CLEA	Contaminated Land Exposure Assessment model	ST-WEL	Short Term Workplace Exposure Limit
Coc	Chemical of Concern	SVOC's	Semi-Volatile Organic Compounds
CSM	Conceptual Site Model	TPH	Total Petroleum Hydrocarbons
EA	Environment Agency	TRRL	Transport Road Research Laboratory
EQS	Environmental Quality Standards	TWA-WEL	Time Weighted Average Workplace Exposure Limit
FOC	Fraction of Organic Carbon	UK HBF	United Kingdom House Building Federation
GAC	Generic Assessment Criterion	VOC's	Volatile Organic Compounds
mbgl	Meters Below Ground Level	WAC	Waste Acceptance Criteria
NHBC	National House Building Council		
mod	Metres above Ordnance Datum		
PAH's	Polycyclic Aromatic Hydrocarbons		
PCoC	Potential Contaminant of Concern		
PBET	Physiological Based Extraction Testing		
PHE	Public Health England		
PID	Photo-Ionisation Detector		



Legend

 Site Boundary

Land
Science

Title: Site Location

Reference: LS4823

Project: 46A to 47 Pier Road, Littlehampton, BN17 5LW

Figure: 1

Client: Pier Road Limited

Date: 07/02/2020

Prepared by: JT

Checked by: MR

Version: 01

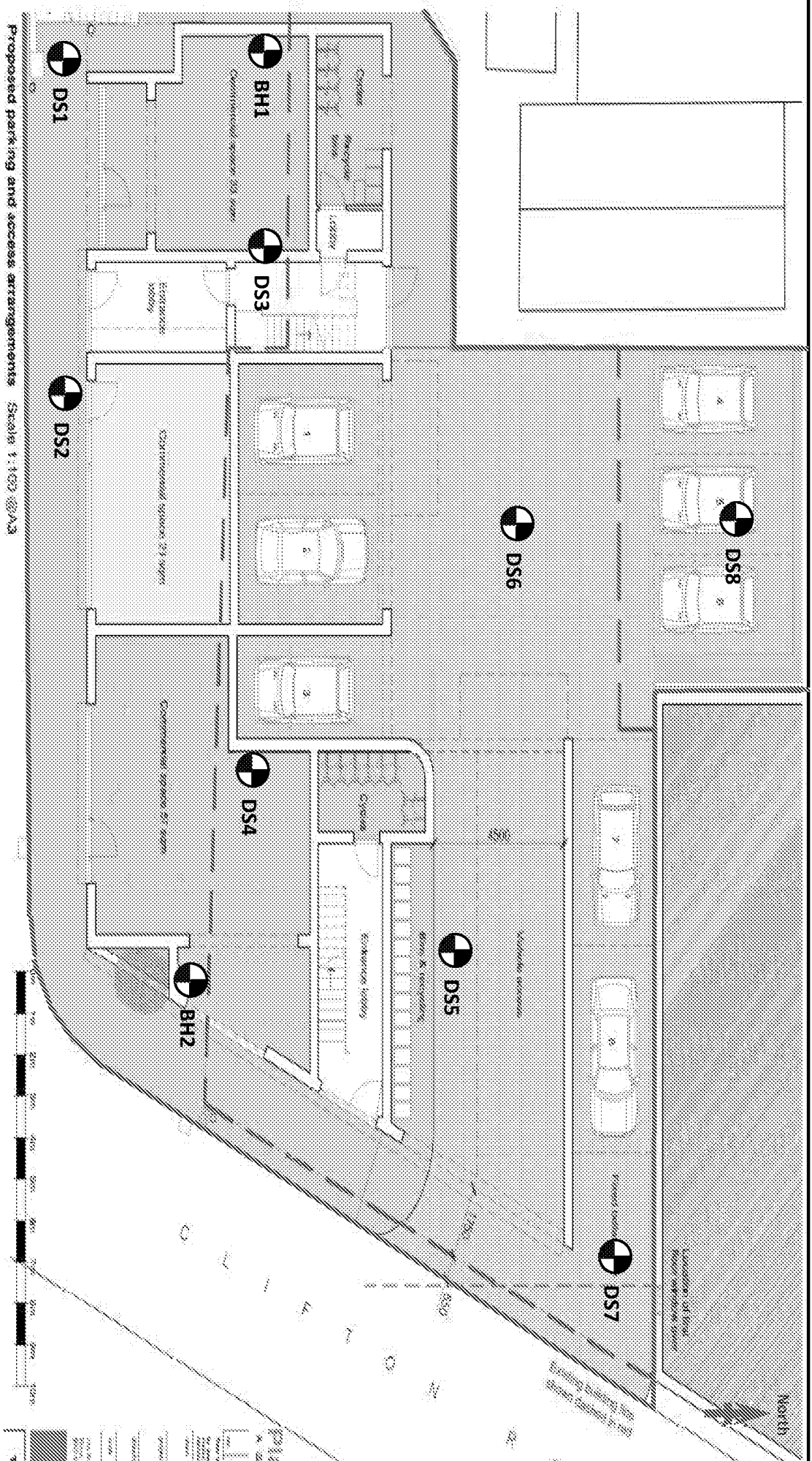
Sheet: 1 of 1



Legend

-  Site Boundary
-  Cable Percussive Investigation
-  Dynamic Sampler Investigation

	Title: Investigation Layout			Reference: LS4823
	Project: 46A to 47 Pier Road, Littlehampton, BN17 5LW			Figure: 2
	Client: Pier Road Limited			Date: 07/02/2020
	Prepared by: JT	Checked by: MR	Version: 01	Sheet: 1 of 1



 Land Science			
TITLE:	Proposed Development	REF:	1.5.42.23
PROJECT:	46 to 47A Pier Road, Littlehampton, BN17 5LW	FIGURE:	Figure 3
CLIENT:	Pier Road Limited	DATE:	25/03/2020
		PREPARED:	AS
		CHECKED:	MR
		VERSION	V1

UNIT 10, 19 ALBERT DRIVE BURGESS HILL, WEST SUSSEX, RH15 9TN
 2ND FLOOR, 25-28 FIELD STREET, LONDON, WC1X 9DA

APPENDIX B

TIER 1 SOIL SCREENING (HUMAN HEALTH)



Project: Pier Road, Soil Organic Matter (calculated): 2.10%
Reference: LS5391 Soil Organic Matter (adopted): 1.00%
Assessor: MR Scenario: Residential (without vegetation)

Determinand	Source	Value	Units
Asbestos (identification)	N/A	Not detected	Type
Herbicide and Pesticide Screening	N/A	Absent	P/A
General Inorganics			
pH	NONE	-	pH Units
Total Cyanide	NONE	-	mg/kg
Water Soluble Sulphate (Soil Equivalent)	No health risk	-	g/l
Water Soluble Sulphate as SO ₄ (2:1)	No health risk	-	mg/kg
Water Soluble Sulphate (2:1 Leachate Equivalent)	No health risk	-	g/l
Sulphide	NONE	-	mg/kg
Fraction Organic Carbon (FOC)	No health risk	-	N/A
Total Organic Carbon (TOC)	No health risk	-	%
Loss on ignition @ 450oC	NONE	-	%
Acid Neutralisation Capacity	No health risk	-	+/ - mol/kg
Total Phenol			
Total Phenol (monohydric)	S4UL	440	mg/kg
Speciated PAHs			
Naphthalene	S4UL	2.3	mg/kg
Acenaphthylene	S4UL	2900	mg/kg
Acenaphthene	S4UL	3000	mg/kg
Fluorene	S4UL	2800	mg/kg
Phenanthrene	S4UL	1300	mg/kg
Anthracene	S4UL	31000	mg/kg
Fluoranthene	S4UL	1500	mg/kg
Pyrene	S4UL	3700	mg/kg
Benzo(a)anthracene	S4UL	11	mg/kg
Chrysene	S4UL	30	mg/kg
Benzo(b)fluoranthene	S4UL	3.9	mg/kg
Benzo(k)fluoranthene	S4UL	110	mg/kg
Benzo(a)pyrene	S4UL	3.2	mg/kg
Indeno(1,2,3-cd)pyrene	S4UL	45	mg/kg
Di-benzo(a,h)anthracene	S4UL	0.31	mg/kg
Benzo(ghi)perylene	S4UL	360	mg/kg
Coronene	NONE	-	mg/kg
Total PAHs			
Total WAC-17 PAHs	NONE	-	mg/kg
Heavy Metals / Metalloids			
Arsenic	S4UL	40	mg/kg
Barium	NONE	-	mg/kg
Beryllium	S4UL	1.7	mg/kg
Boron	S4UL	11000	mg/kg
Cadmium	S4UL	85	mg/kg
Chromium (VI)	S4UL	6	mg/kg
Chromium (III)	S4UL	910	mg/kg
Copper	S4UL	7100	mg/kg
Lead	C4SL	310	mg/kg
Mercury (elemental)	S4UL	1.2	mg/kg
Nickel	S4UL	180	mg/kg
Selenium	S4UL	430	mg/kg
Vanadium	S4UL	1200	mg/kg
Zinc	S4UL	40000	mg/kg
Monoaromatics			
Benzene	S4UL	380	µg/kg
Toluene	S4UL	880000	µg/kg
Ethylbenzene	S4UL	83000	µg/kg
Xylene (p & m) (note - values for p used)	S4UL	79000	µg/kg
Xylene (o)	S4UL	88000	µg/kg
MtBE (Methyl Tertiary Butyl Ether)	NONE*	1	µg/kg
Total BTEX	NONE	-	µg/kg
Petroleum Hydrocarbons			
Mineral Oil (C10 - C40)	NONE	-	mg/kg
TPH (C10 - C40)	NONE	-	mg/kg
Hazard Index (Combined)			
Aliphatic EC 5-6	S4UL	42	mg/kg
Aliphatic EC >6-8	S4UL	100	mg/kg
Aliphatic EC >8-10	S4UL	27	mg/kg
Aliphatic EC >10-12	S4UL	130	mg/kg
Aliphatic EC >12-16	S4UL	1100	mg/kg
Aliphatic EC >16-35	S4UL	65000	mg/kg
Aliphatic EC >35-44	S4UL	65000	mg/kg
Aromatic EC 5-7	S4UL	370	mg/kg
Aromatic EC >7-8	S4UL	860	mg/kg
Aromatic EC >8-10	S4UL	47	mg/kg
Aromatic EC >10-12	S4UL	250	mg/kg
Aromatic EC >12-16	S4UL	1800	mg/kg
Aromatic EC >16-21	S4UL	1900	mg/kg
Aromatic EC >21-35	S4UL	1900	mg/kg
Aromatic EC >35-44	S4UL	1900	mg/kg

APPENDIX A

Gas Protection Verification Requirements

Gas protection measures should be verified in accordance with directions supplied in BS8485:2015 '*Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*'; CIRIA C748:2014 '*Guidance on the use of plastic membranes as VOC vapour barriers*'; and CIRIA C735:2014 '*Good practice on the testing and verification of protection systems for buildings against hazardous ground gases.*'

In accordance with the recommendations made in Annex 1, Table A1, A2 and A3 of CIRIA Report C735, the membrane may be installed either by the Ground Worker for the scheme or by a Specialist Contractor under a Low or Intermediate risk site.

Regardless, the membrane installation should be subject to independent inspection by an independent verifier who should be able to demonstrate their competence, training and relevant experience.

The inspection process should include a thorough visual inspection of the membrane, including photographic records. The recommended membrane verification approach is provided below.

Inspection and Testing Regime – Floor Slab, non-reinforced

If the membrane is installed by the Ground Worker the independent inspection should cover 100% of the membrane surface area.

If the membrane is installed by a Specialist Contractor (at least one operative being qualified with an NVQ Level 2 in Gas Protection Installation), it is recommended that 100% of the first plot/building is independently inspected. The regime of inspection may be reduced to 1 in 5 plots/buildings provided that the Specialist Contractor continues to provide sufficient evidence to demonstrate the compliance, including as a minimum sign off sheets and photographs.

All joints, pipe penetrations etc. of the inspected membrane area should be independently air lanced to ASTM D4437.

Inspection and Testing Regime – Floor Slab, reinforced

If the membrane is installed by the Ground Worker the independent inspection should cover 100% of the membrane surface area.

If the membrane is installed by a Specialist Contractor (at least one operative being qualified with an NVQ Level 2 in Gas Protection Installation) the regime of independent inspection may be reduced to 50% of the membrane surface area. The regime of inspection may be reduced to 1 in 10 plots/buildings provided that the Specialist Contractor continues to provide sufficient evidence to demonstrate the compliance, including as a minimum sign off sheets and photographs.

All joints, pipe penetrations etc. of the inspected membrane area should be independently air lanced to ASTM D4437.

Summary of Verification Recommendations: Residential Low/Intermediate Risk¹

Installer	Verification Recommendation	Non-reinforced concrete slab	Reinforced concrete slab⁴
Groundworker ²	Thorough visual inspection completed by competent and suitably experienced consultant or qualified installer ³ prior to concrete pours.	Yes (100%)	Yes (100%)
	Membrane joints, pipe penetrations etc. independently air lanced to ASTM D4437.	Yes (100%)	Yes (100%)
	Evidence of installation and verification provided to the independent verifier by the Ground Worker, including photographs demonstrating conformance.	Yes	Yes
Specialist Contractor ³	Thorough visual inspection completed by competent and suitably experienced consultant or qualified installer ³ prior to concrete pours.	Yes (100%)	Yes (100%)
	Membrane joints, pipe penetrations etc. independently air lanced to ASTM D4437.	Yes (100%)	Yes (100%)
	Evidence of installation and verification provided to the independent verifier by the Ground Worker, including photographs demonstrating conformance.	Yes	Yes

(100%) – recommended percentage of the membrane surface independently inspected.

1 Assumes a site-specific gas risk assessment has determined that basic mitigation is required (i.e. passive ventilation and a proprietary gas membrane).

2 Installer holds no relevant qualification.

3 Operative (at least one) being qualified with an NVQ Level 2 in Gas Protection Installation.

4 Assumes well reinforced slab of minimum 150mm thickness.

It is noted that:

- The installer must be appropriately experienced and qualified to install the proposed mitigation system.
- Conflicts of interest should be avoided, for example a membrane supplier certifying their own work. If verification works are completed by the same company that completed the installation, then this work should be audited by an independent consultant.
- Reporting should be as per Section 5 of C735. As a minimum this should include the completion of sign off/inspection records detailing the site and plot/building inspected, quality of workmanship, membrane type, membrane detailing, integrity testing method, non-conformances and repairs, as well as good resolution photographs and any matters requiring further investigation and/or rectification.