



ENVIRONMENTAL
CONSULTING

Validation Report

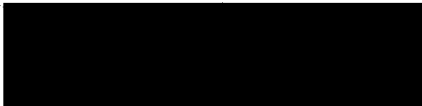
**131-135 Arundel Road
Littlehampton
West Sussex
BN17 7HD**

Prepared for

**PMC Construction
22-24 Railway House
119 High Street
Cosham
Portsmouth
Hampshire
PO6 3DR**

**Omnia ref: A10706/Val1.0
November 2017**

Quality Assurance

Remarks	Draft	
Date	November 2017	
Prepared by	Kate Duggan	
Signature		
Checked by	Tim Mitchell	
Signature		
Authorised by	Lee McDonald	
Signature		
Project number	A10706/Val1.0	

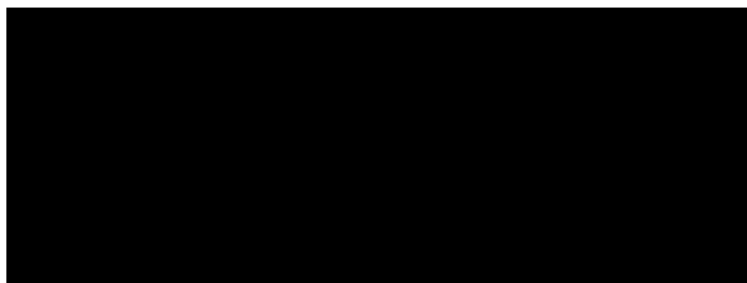


Table of Contents

Quality Assurance	i
Table of Contents	ii
1.0 INTRODUCTION	1
1.1 Background	1
1.2 Report Objectives	1
1.3 Scope of Work	2
1.4 Proposed Development	2
1.5 Confidentiality	2
2.0 Site Characteristics	3
2.1 Site Details	3
2.2 Current Site Use	3
3.0 OEC Remediation Method Statement	4
3.1 Summary of OEC RMS (A10683/RMS/1.0)	4
4.0 Validation	5
4.1 Membrane Validation Plots 1-2 and Plots 6-12	5
4.1.1 Hydrocarbon Membrane Validation	5
4.1.2 Hydrocarbon Membrane Validation Procedure	5
4.2 Plots 1-2 Membrane Validation	6
4.2.1 Plots 1-2 General Condition of Flexible Hydrocarbon Gas Barrier	6
4.2.2 Plots 1-2 Internal Installation and Corner Detailing	10
4.2.3 Plots 1-2 Verification of Service Entry Points	15
4.2.5 Plots 1-2 Validation Condition of Membrane	17
4.3 Plots 6 -12 Membrane Validation	20
4.3.1 Plot 6-12 General Condition of Flexible Hydrocarbon Gas Barrier	20
4.3.2 Plot 6-12 General Condition of Flexible Hydrocarbon Gas Barrier – Initial Visit 12 th June 2017	20
4.3.3 Plot 6-12 General Condition of Flexible Hydrocarbon Gas Barrier – Second Visit 15 th June 2017	26
4.3.4 Plots 6-12 Internal Installation and Corner Detailing– Second Visit 15 th June 2017	32
4.3.5 Plots 6-12 Verification of Service Entry Points – Second Visit 15 th June 2017	37
4.3.6 Plots 6-12 Validation Condition of Membrane	41
4.4 Clean Cover System	41
4.5 Site Works and Observations	41
4.5.1 Site Visit – 17 th October 2017	41
4.5.2 Ground Condition Encountered	41
4.6 Laboratory Analysis	41
4.7 Risk Assessment	42
5.0 CONCLUSION	45
5.1 Validation Conclusion	45

APPENDICES

Appendix I	Limitations
Appendix II	Glossary
Appendix III	Drawings
	Figure 1.0 – Site Location Plan
	Figure 2.0 – Proposed Development
	Figure 3.0 – Remediation Scheme
	Figure 4.0 – Technical drawings undertaken by Kenn Scaddan Associates, Drawing No: 1112 WD32, Rev: P3
	Figure 5.0 – Hand Pit Location Plan

Appendix IV	Membrane Specification Sheets
Appendix V	Exploratory Holes Logs
Appendix VI	Hand Pit Inspection Photographs
Appendix VII	Laboratory Results
Appendix VIII	Tier 1 Screening Values

1.0 INTRODUCTION

1.1 Background

Omnia Environmental Consulting (OEC) were commissioned by PMC Construction to validate the installation of hydrocarbon vapour resistant membranes and topsoil placement at the site, comprising 131-135 Arundel Road, Littlehampton, West Sussex, BN17 7DH.

Remedial works were set out in the Remediation Method Statement (RMS) entitled: Remediation Method Statement, 131-135 Arundel Road, Littlehampton West Sussex BN17 7DH Ref; A10706/RMS/1.0 dated February 2017, which required the installation of hydrocarbon vapour resistant membranes within Plots 1-2 and Plots 6-12 and the placement of topsoil within Plots 3-5 to mitigate the risk posed by metals elevated concentrations. Remedial works were required to mitigate the risks posed by residual hydrocarbon vapours associated with the former hydrocarbon infrastructure originating from the past site use as a petrol filling station.

Installation of the vapour resistant membranes were undertaken by the client's subcontractor, Broadsword Group.

A site location map is presented as Figure 1.0 and the proposed site layout is presented as Figure 2.0 within Appendix III.

1.2 Report Objectives

The objective of this report is to detail implementation of the required remedial works outlined in the RMS.

As set out within the RMS, the required mitigation measures should include:

- The removal of Underground Storage Tanks and Interceptor Systems;
- Excavation of associated impacted soils within the area of the Underground Storage Tanks;
- Treatment onsite or offsite disposal of excavated materials;
- Backing of excavation with inert materials;
- **Implementation of a vapour resistant membrane across Plot 1-2 and Plots 6-12; and,**
- **Implementation of a clean cover system within areas of proposed soft landscaping within Plots 3-5.**
-

This validation report focuses on the implementation of a vapour resistant membrane across Plots 1-2 and Plots 6-12 and the implementation of a clean cover system within areas of proposed soft landscaping within Plots 3-5. All other mitigation measures have been successfully validated within OEC report Ref; A10706/170209/L1 dated May 2017.

The Client adopted a risk averse approach with the installation of a Flexible Hydrocarbon Gas Barrier that mitigates against Radon, Methane, Carbon Dioxide and Hydrocarbons, within both Plots 1-2 and Plots 6-12, with proposed installation in-line with technical drawings, produced by Kenn Scaddan Associates, Drawing No: 1112 WD32, Rev: P3

1.3 Scope of Work

The scope of works undertaken for the membrane validation processes undertaken by OEC are;

- Checking that the specification of membranes utilised meet requirements as stated within the RMS for Plots 1-2 and Plots 6-12;
- Visual verification, by OEC, that membrane installation works undertaken by Broadsword Group, is in line with technical drawings undertaken by Kenn Scaddan Associates, Drawing No: 1112 WD32, Rev: P3, and includes the following:
 - Joints between sheets are acceptable and heat-bonded with no gaps present between the sheets;
 - Identification of any damage (i.e. tears or breaks) within the installed membrane; and,
 - Confirmation that “Top Hats” have been satisfactorily installed at all service penetration points.
- Record instances of membrane non-compliance and details of rectification (i.e. tears and patches); and;
- Photographic evidence recording each stage of the process.

The scope of works undertaken for the validation processes to the implementation of the clean cover system comprise:

- Visual verification of the depth of the installed capping system with hand excavated inspection pits;
- Soil sampling of the installed capping materials and analysis for key contaminants of concern;
- Tier I assessment of the soil analysis to determine compliance with pre-determined Remedial Target Values; and,
- Photographic evidence recording each stage of the process.

1.4 Proposed Development

The proposed development comprises nine (9no.) residential, three (3no.) bedroom terraced houses, one (1no.) two bedroom house with associated parking and private gardens and two (2no.) flats with associated parking and shared gardens. A proposed development plan is presented as Figure 2.0 in Appendix 2.0

1.5 Confidentiality

OEC has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from OEC; a charge may be levied against such approval.

2.0 Site Characteristics

2.1 Site Details

Site Address	131- 135 Arundel Road, Littlehampton, West Sussex, BN17 7DH
Grid Reference	502600, 102870

2.2 Current Site Use

The site at 131-135 Arundel Road, is situated immediately west of Arundel Road (A284), and at the time of validation works the site was accessed off Arundel Road through wooden hoarding.

Due to the nature of the validation site visits undertaken throughout the different stages of the site development, the site progressed through the construction phases during vapour membrane validations, to the final site visits for the clean cover system validation post completion of garden areas within the final phases of development.

3.0 OEC Remediation Method Statement

3.1 Summary of OEC RMS (A10683/RMS/1.0)

The RMS assessed contamination distribution across the site and the potential exposure pathways resulting from the exceedances identified within near surface soils by the Tier I Qualitative Risk Assessment.

The main exposure pathways present on site consisted of metals, through dermal contact and ingestion; and shorter chain length hydrocarbons (C₈-C₁₀) through vapour inhalation.

Given the presence of shorter chain length hydrocarbons (C₈-C₁₀), the requirement for remedial measures to mitigate the risks posed through vapour inhalation was necessary.

The RMS required the installation of a vapour resistant membranes within building footprints of Plots 1-2 and Plots 6-12 to mitigate the risk associated with vapour risk from the USTs and interceptor system within the northern and southern section of the site.

Due to the presence of elevated concentrations of Copper and Lead within the south western section of the site, a clean cover system of 600m clean soil capping was necessary to sever the pollution linkage and render the pollution pathway inactive.

A site layout plan detailing the proposed layout and a Remediation Plan are presented as Figure 2.0 and 3.0 respectively, in Appendix III.

4.0 Validation

4.1 Membrane Validation Plots 1-2 and Plots 6-12

4.1.1 Hydrocarbon Membrane Validation

OEC undertook site visits for Plots 1-2 on the 18th May and the 23rd May 2017, whilst Plots 6-12 visits were undertaken on the 12th June and 15th June 2017 to undergo a visual validation of the Flexible Hydrocarbon Gas Barrier as installed by Broadsword Group.

4.1.2 Hydrocarbon Membrane Validation Procedure

OEC undertook a testing procedure to validate the installation of the hydrocarbon vapour resistant membrane, as detailed below:

- A visual check of the installed membrane for damage across the whole building footprint;
- Mechanical point stress tests with pick or other similar instrument testing to identify any unbonded areas of the membrane along the taped seams and joints;
- A visual check of the installed membrane spanning the wall cavity; and,
- A visual check of the installed membrane detailing around service entry points and penetrations.

Any areas where the above testing failed were highlighted as an area of concern and mitigated by the installers. All mitigation installs were then re-tested under the above testing criteria. Once the membrane had been deemed to pass all the above criteria, the property was signed off by OEC.

The following sections are set out to give an overview of each procedure of the validation process within each plot.

4.2 Plots 1-2 Membrane Validation

4.2.1 Plots 1-2 General Condition of Flexible Hydrocarbon Gas Barrier

OEC undertook site visits for Plots 1-2 on the 18th May and 23rd May 2017.

Photograph 1 – Overview of Plots 1-2: General membrane overview – Internal Corridor



Photograph 2 – Overview of Plots 1-2: General membrane overview



Photograph 3 – Overview of Plots 1-2: General membrane overview – Internal Door Way



Photograph 4 – Overview of Plots 1-2: General membrane overview



Photograph 5 – Overview of Plots 1-2: General membrane overview



Photograph 6 – Overview of Plots 1-2: General membrane overview – Internal Stairwell Corridor



Photograph 7 – Overview of Plots 1-2: General membrane overview



Photograph 8 – Overview of Plots 1-2: General membrane overview

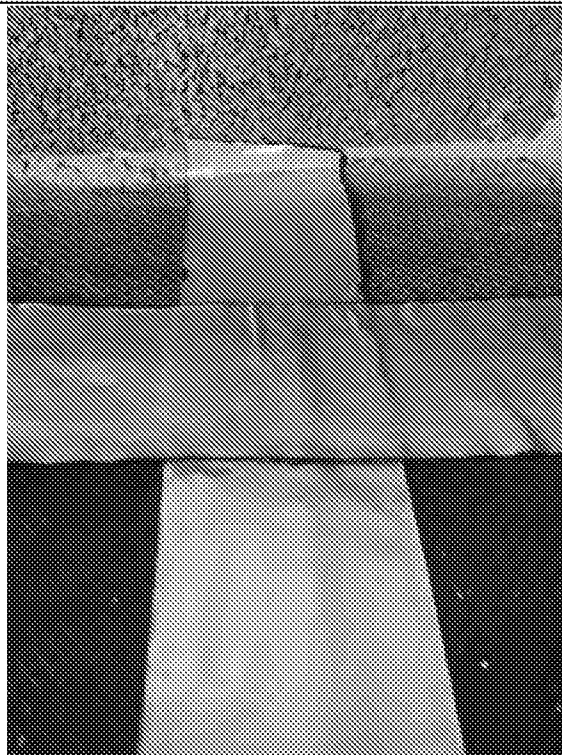


4.2.2 Plots 1-2 Internal Installation and Corner Detailing

Photograph 9 – Plots 1-2: Example of Detailing.



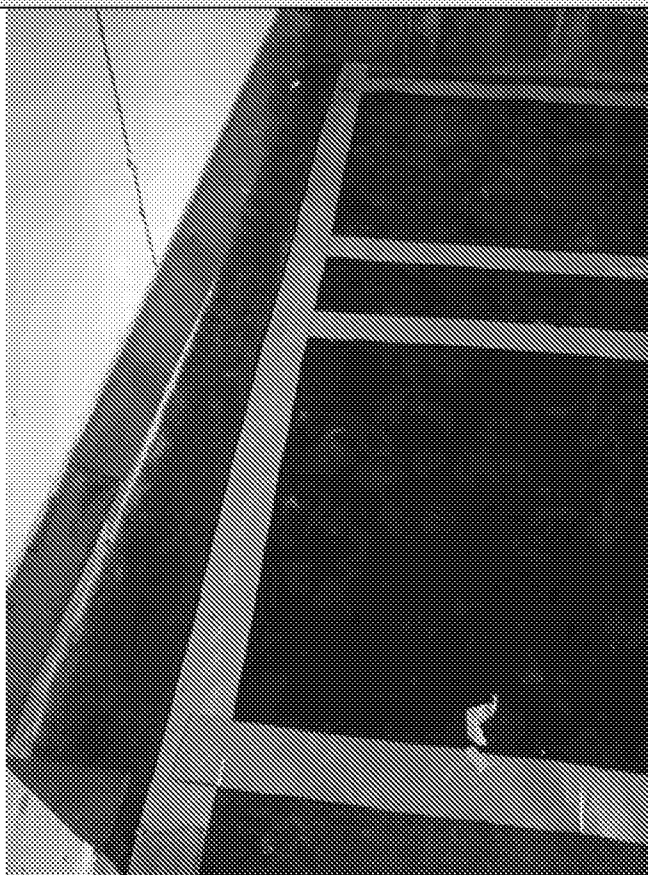
Photograph 10 – Plots 1-2: Example of Detailing.



Photograph 11 – Plots 1-2: Example of Detailing.



Photograph 12 – Plots 1-2: Example of Detailing.



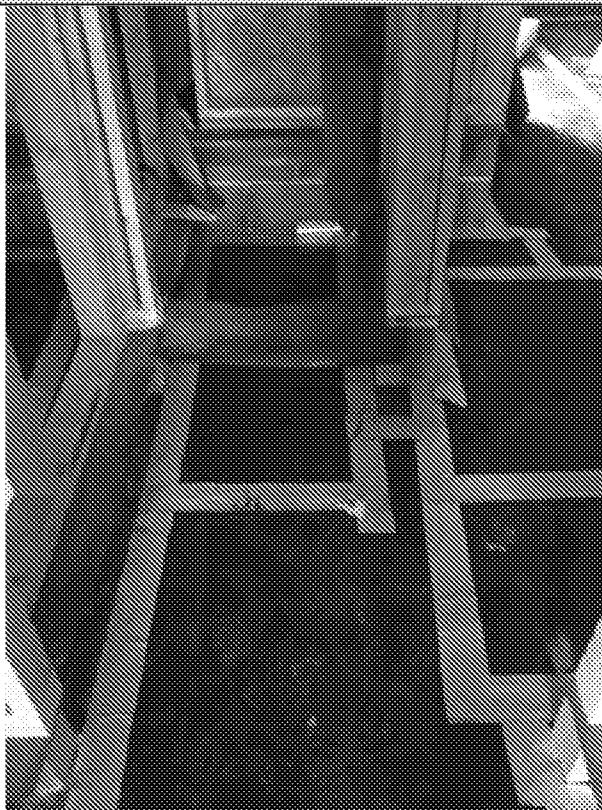
Photograph 13 – Plots 1-2: Example of Detailing Through Doorway with Membrane Under Internal Wall



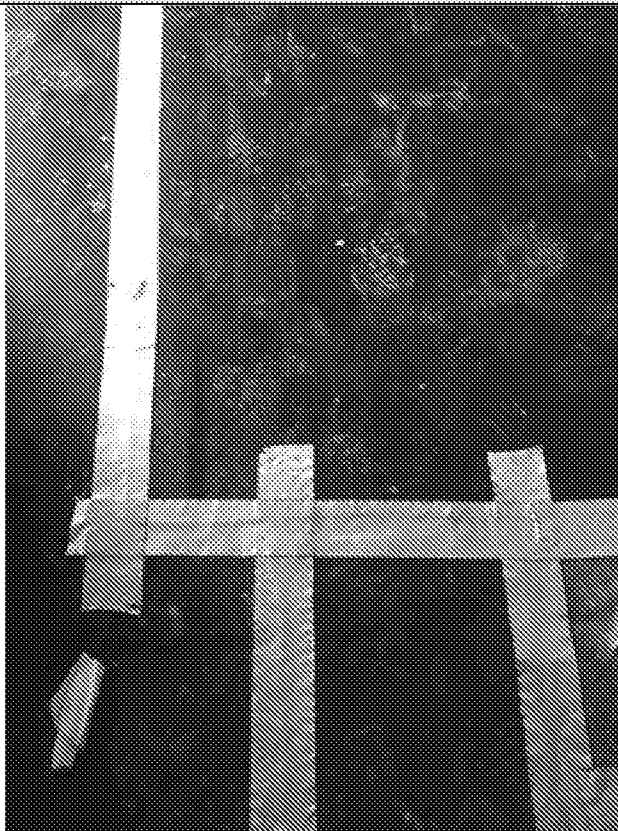
Photograph 14 – Plots 1-2: Example of Detailing.



Photograph 15 – Plots 1-2: Example of Detailing Within a Central Corridor



Photograph 16 – Plots 1-2: Example of Detailing.



Photograph 17 – Plots 1-2: Example of Detailing.



Photograph 18 – Plots 1-2: Example of Detailing.

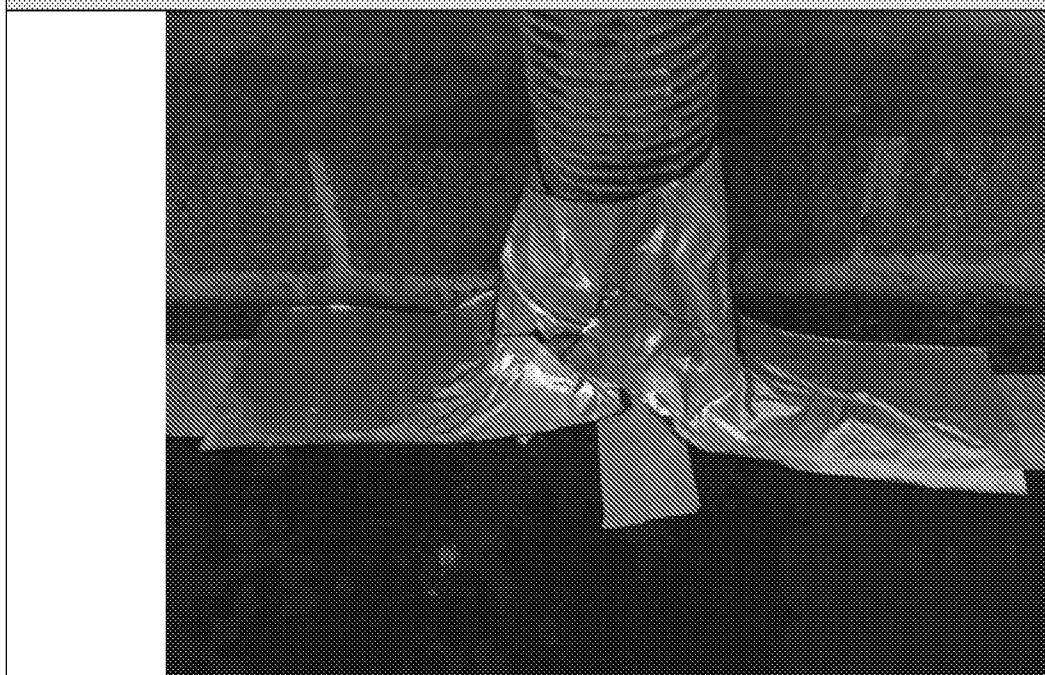


4.2.3 Plots 1-2 Verification of Service Entry Points

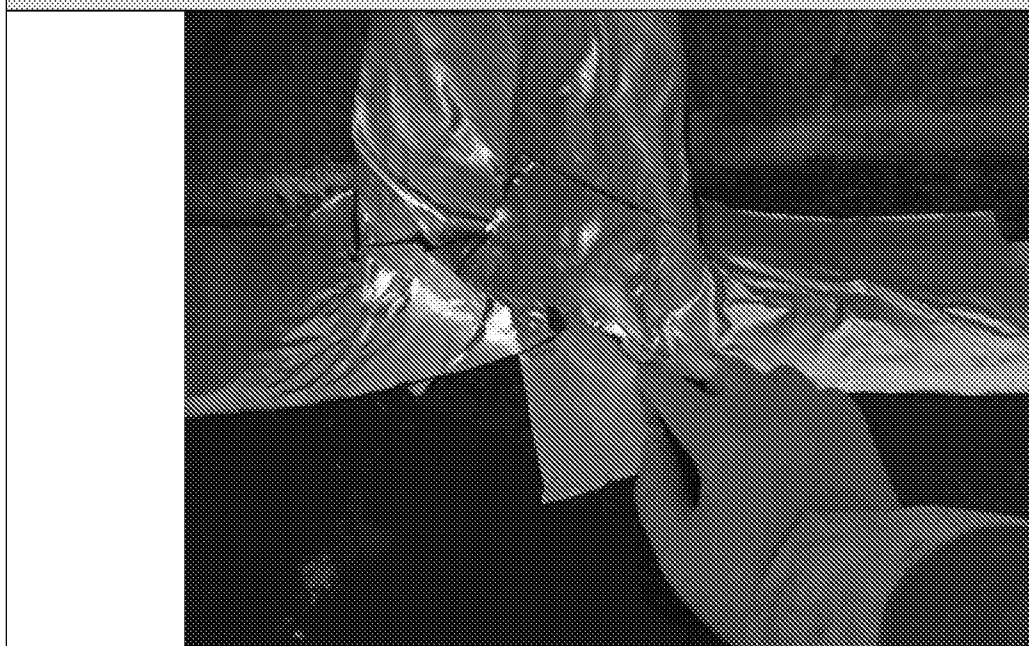
As part of the membrane validation testing, service entry points within Plots 1-2 were also subject to scrutiny, as set out in Section 4.1.2.

It was noted that the top hats had been created utilising the processes of free form sculpting with gas resistant tape in line with CIRIA C735.

Photograph 19 – Plots 1-2: Service Pipe Top Hat



Photograph 20 – Plots 1-2: Service Pipe Top Hat



Photograph 21 – Plots 1-2: Service Pipe Top Hat



Photograph 22 – Plots 1-2: Service Pipe Top Hat



4.2.5 Plots 1-2 Validation Condition of Membrane

During the validation exercise undertaken on the 18th May and 23rd May 2017, one defect was noted across the membranes installed within Plots 1-2 and brought to the attention of the installers. The defect consisted of missing joint taping within the corner of one of the rooms. This was subsequently remediated and photographed.

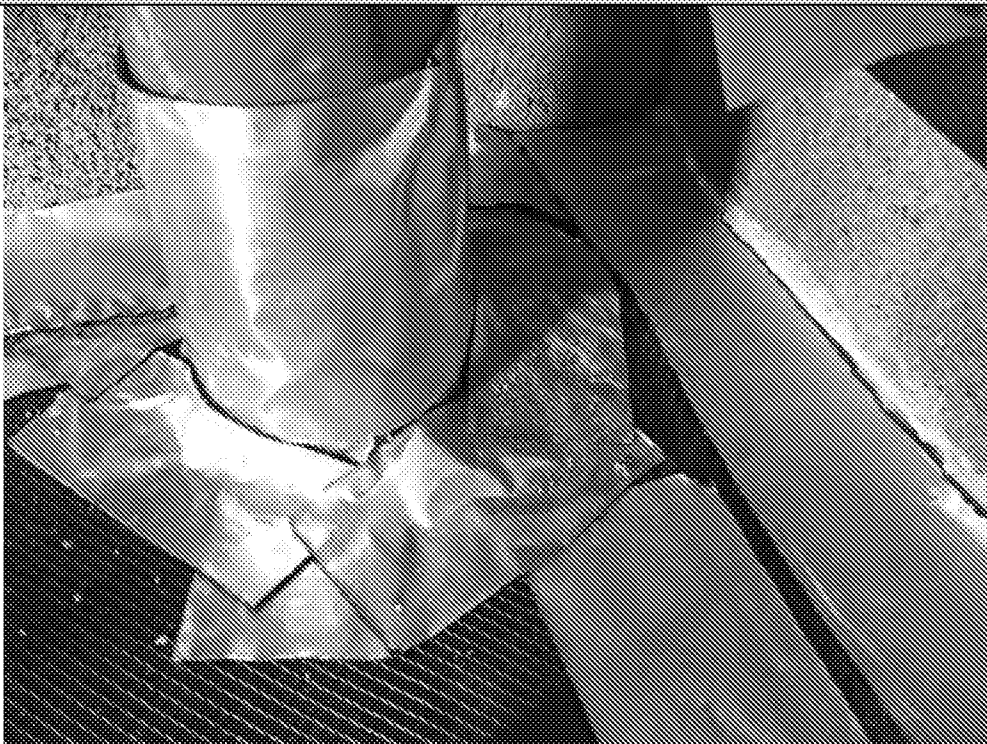
Photograph 23 – Defect in membrane installation



Photograph 24 – Defect in membrane installation



Photograph 25 – Remediated membrane installation



Photograph 26 – Remediated membrane installation



4.3 Plots 6 -12 Membrane Validation

4.3.1 Plot 6-12 General Condition of Flexible Hydrocarbon Gas Barrier

OEC undertook site visits for Plots 6-12 on the 12th June and then a return visit on the 15th June 2017.

During the initial validation exercise undertaken on the 12th June 2017, defects were noted across the membranes installed within Plots 6-12 and brought to the attention of the installers. The defects consisted of missing jointing tape within the corners of the rooms within the plots and poorly installed jointing tape across the membrane seams. Top hats across the plots were also noted as not adequately installed in line with CIRIA C735. These were all subsequently remediated and photographed on the second visit on the 15th June 2017.

4.3.2 Plot 6-12 General Condition of Flexible Hydrocarbon Gas Barrier – Initial Visit 12th June 2017

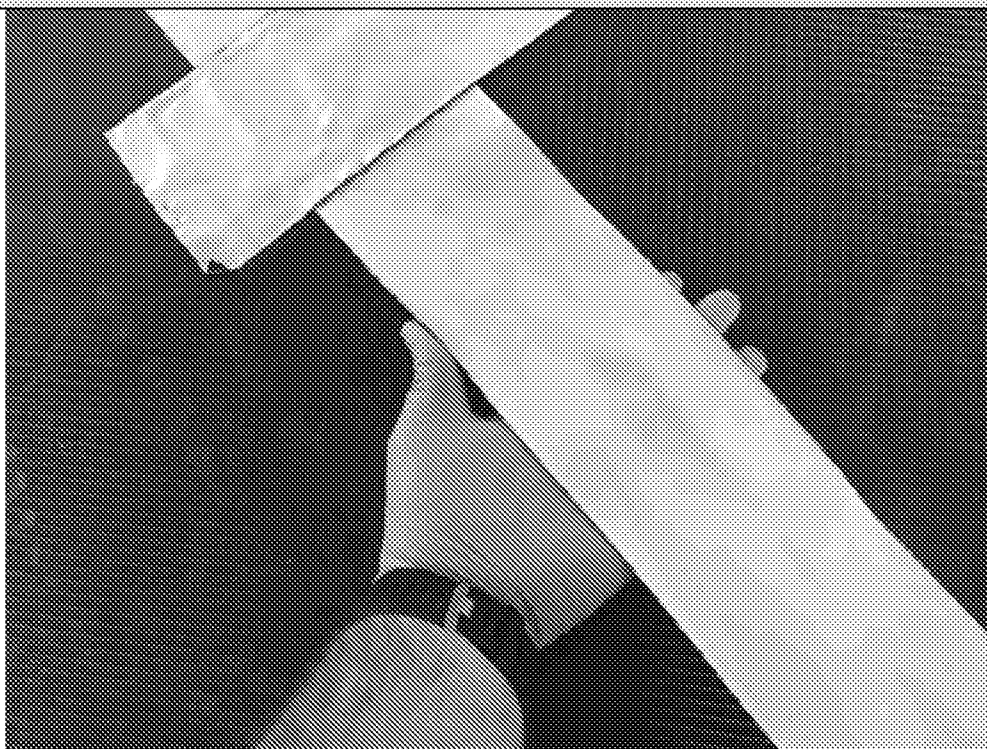
Photograph 27 – Overview of 6-12: General membrane overview



Photograph 28 – Overview of 6-12: Jointing Tape not Installed Properly.



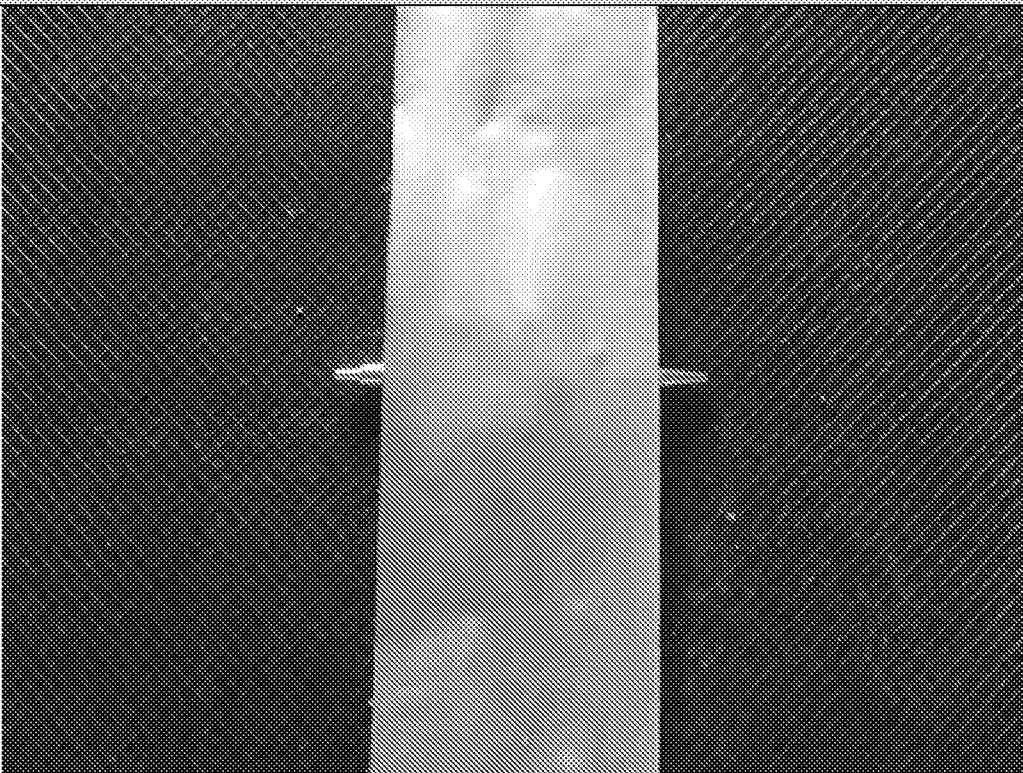
Photograph 29 – Overview of 6-12: Jointing Tape not Installed Properly.



Photograph 30 – Overview of 6-12: Jointing Tape not Installed Properly.



Photograph 31 – Overview of 6-12: Jointing Tape not Installed Properly.



Photograph 32 – Overview of 6-12: Corner Detail not Installed Properly



Photograph 33 – Overview of 6-12: Corner Detail not Installed Properly



Photograph 34 – Overview of 6-12: Top Hat Detail not Installed Properly



Photograph 35 – Overview of 6-12: Top Hat Detail not Installed Properly



Photograph 36 – Overview of 6-12: Top Hat Detail not Installed Properly



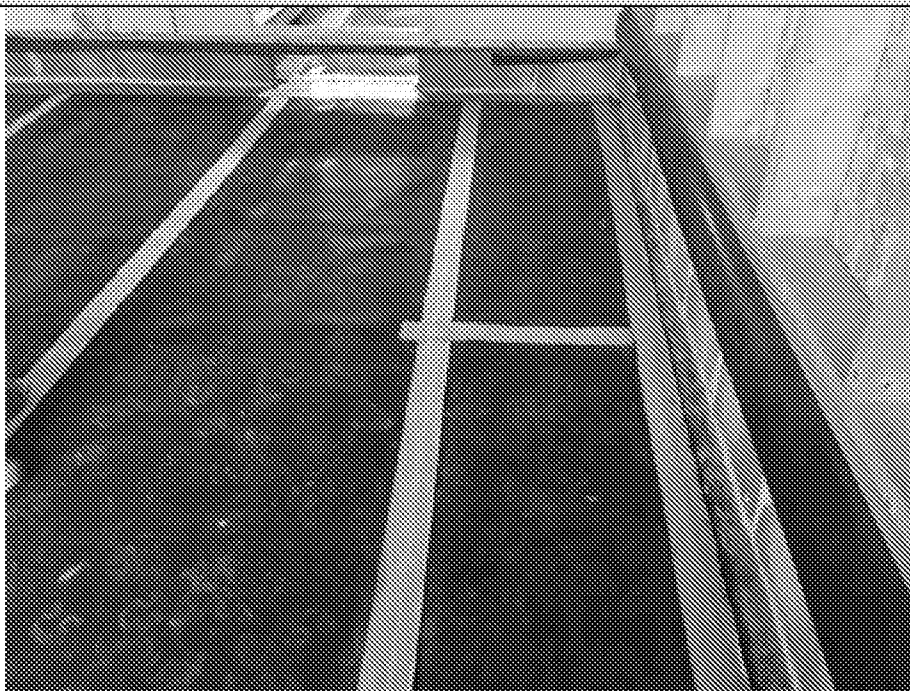
Photograph 37 – Overview of 6-12: Top Hat Detail not Installed Properly



4.3.3 Plot 6-12 General Condition of Flexible Hydrocarbon Gas Barrier – Second Visit 15th June 2017

As stated in section 4.3.1, the second visit on 15th June, inspected the remedial works undertaken on the observation noted in section 4.3.2.

Photograph 38 – Overview of 6-12: General membrane overview



Photograph 39 – Overview of 6-12: General membrane overview



Photograph 40 – Overview of 6-12: General membrane overview



Photograph 41 – Overview of 6-12: General membrane overview



Photograph 42 – Overview of 6-12: General membrane overview



Photograph 43 – Overview of 6-12: General membrane overview



Photograph 44 – Overview of 6-12: General membrane overview



Photograph 45 – Overview of 6-12: General membrane overview



Photograph 46 – Overview of 6-12: General membrane overview



Photograph 47 – Overview of 6-12: General membrane overview

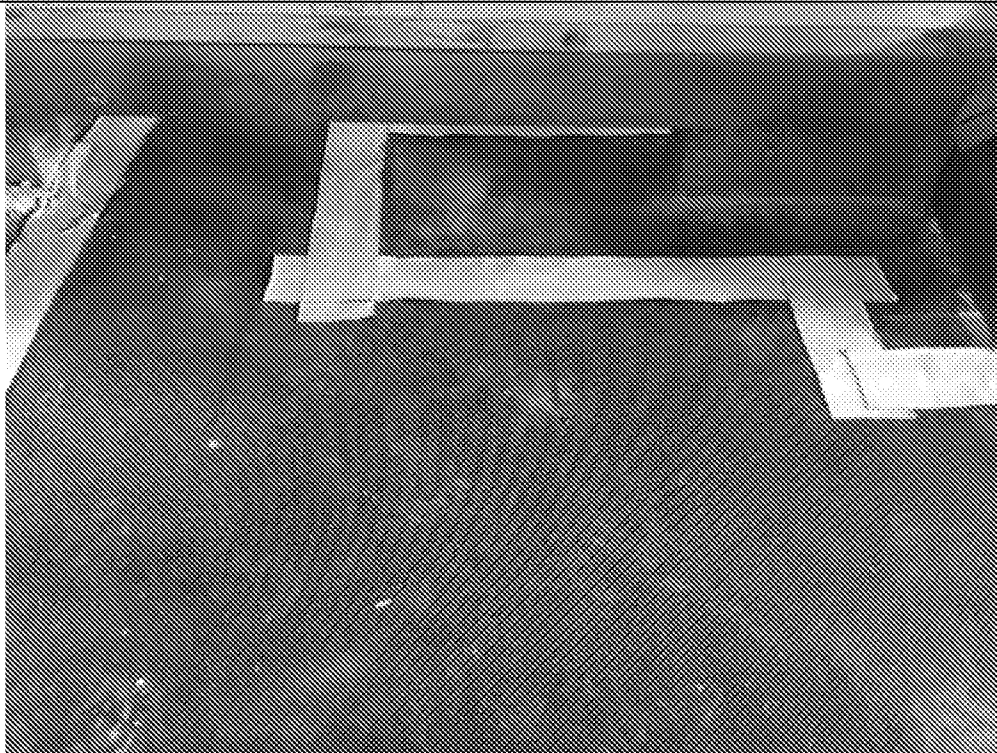


Photograph 48 – Overview of 6-12: General membrane overview



4.3.4 Plots 6-12 Internal Installation and Corner Detailing– Second Visit 15th June 2017

Photograph 49 – Plots 6-12: Example of Detailing.



Photograph 50 – Plots 6-12: Example of Detailing.



Photograph 51 – Plots 6-12: Example of Detailing Error.



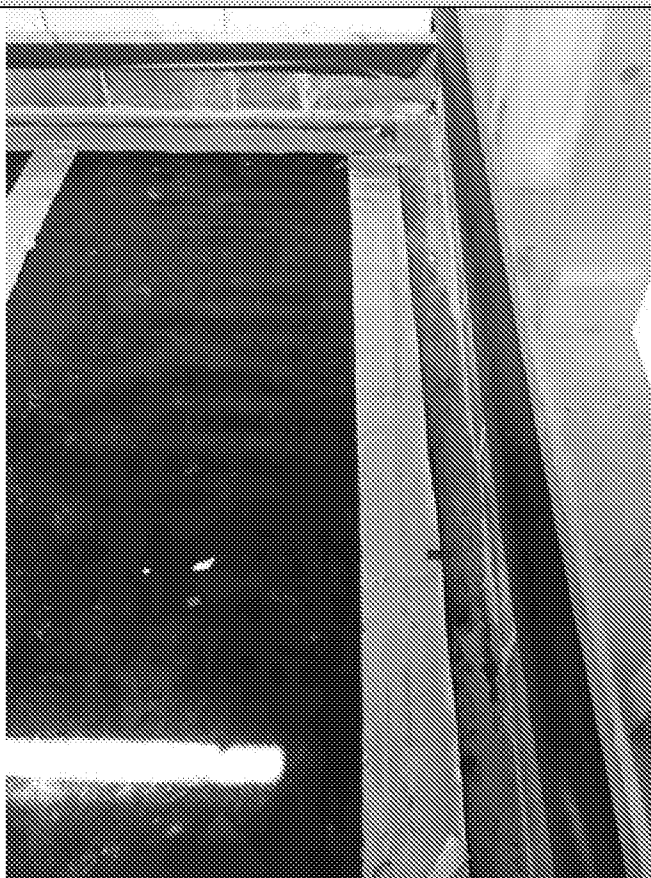
Photograph 52 – Plots 6-12: Example of Detailing Remedial Work.



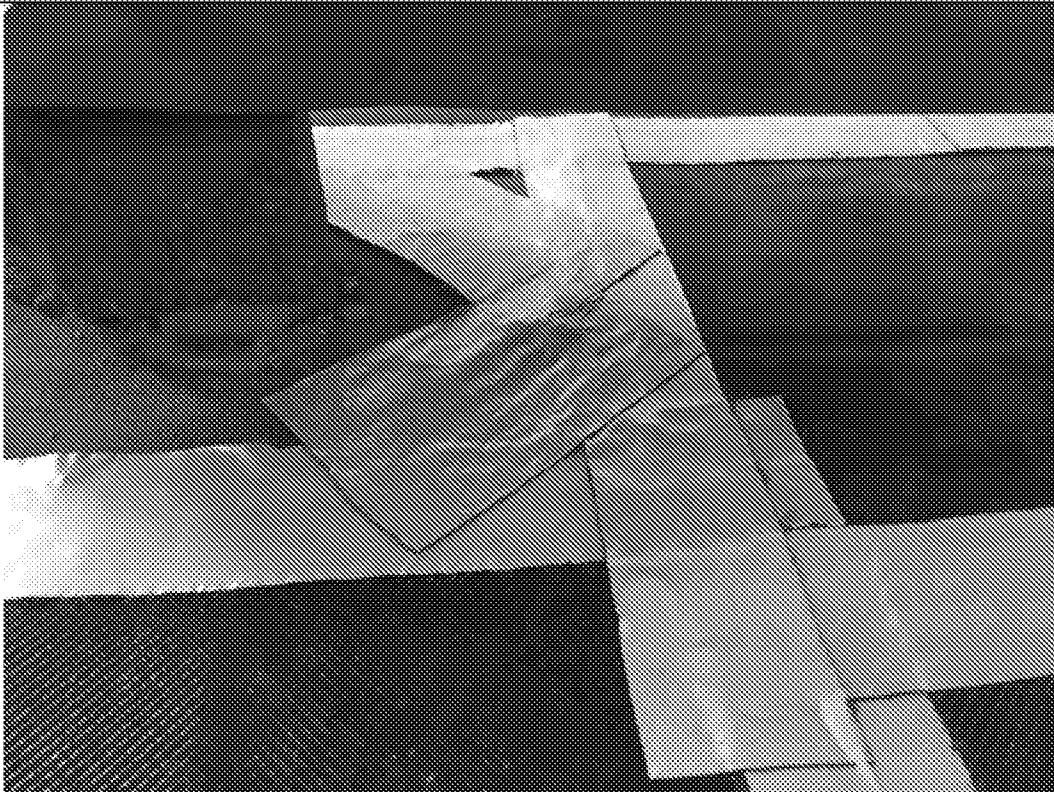
Photograph 53 – Plots 6-12: Example of Detailing.



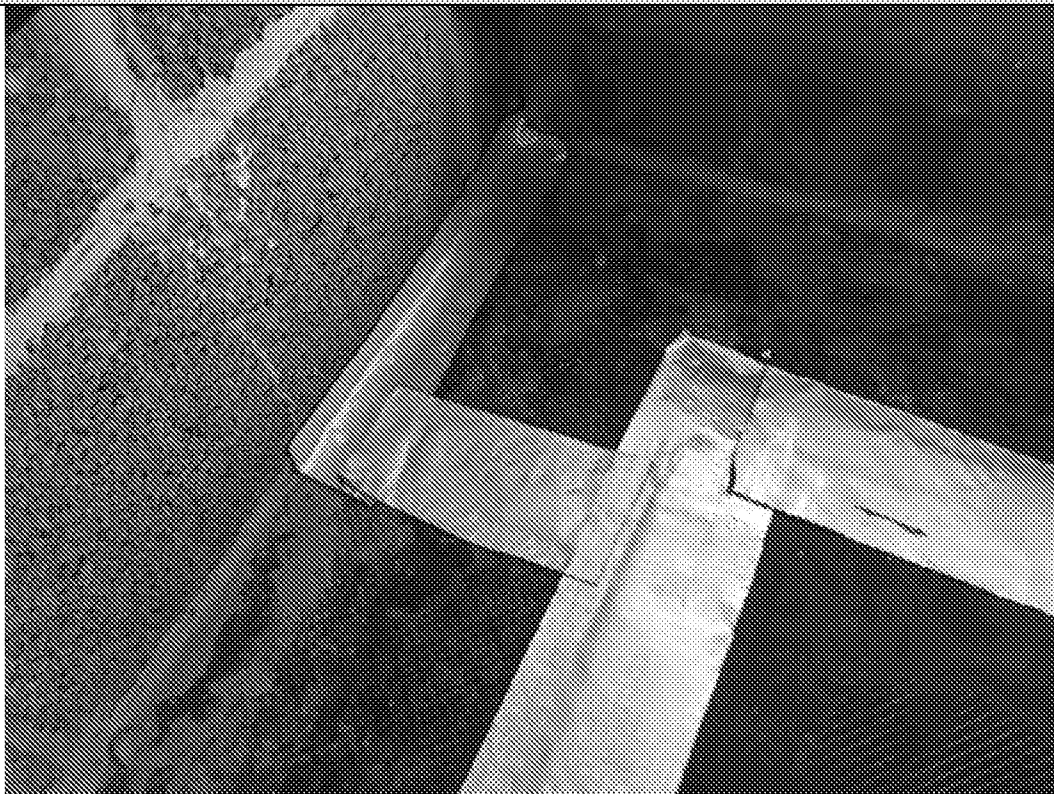
Photograph 54 – Plots 6-12: Example of Detailing.



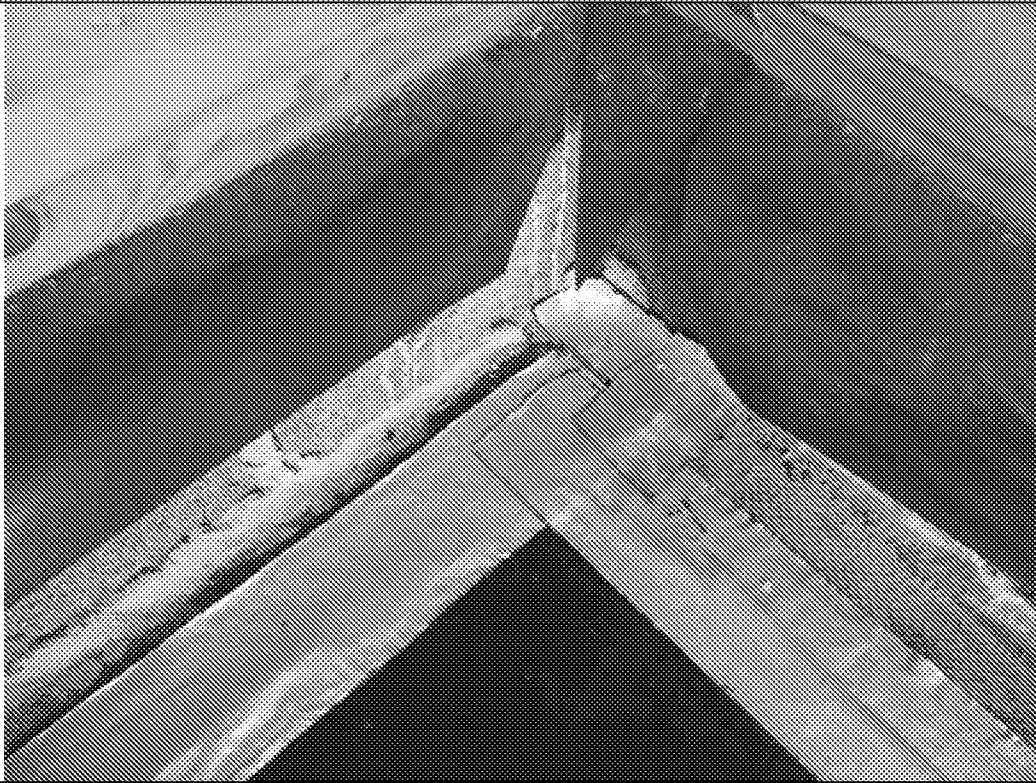
Photograph 55 – Plots 6-12: Example of Detailing.



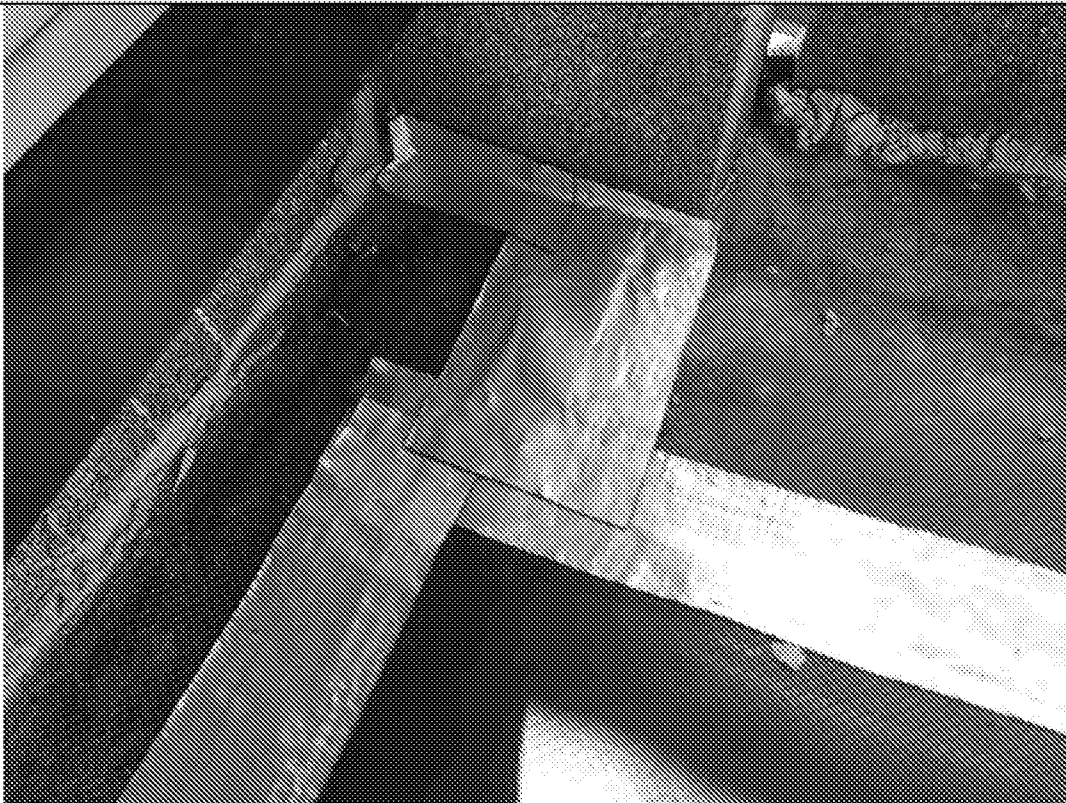
Photograph 56 – Plots 6-12: Example of Detailing.



Photograph 57 – Plots 6-12: Example of Detailing.



Photograph 58 – Plots 6-12: Example of Detailing.



4.3.5 Plots 6-12 Verification of Service Entry Points – Second Visit 15th June 2017

As part of the membrane validation testing, service entry points within Plots 6-12 were also subject to scrutiny, as set out in Section 4.1.2.

As stated in section 4.3.1, It was noted that the top hats had not been installed in line with CIRIA C735. These were then remade and had been created utilising the processes of free form sculpting with gas resistant tape in line with CIRIA C735.

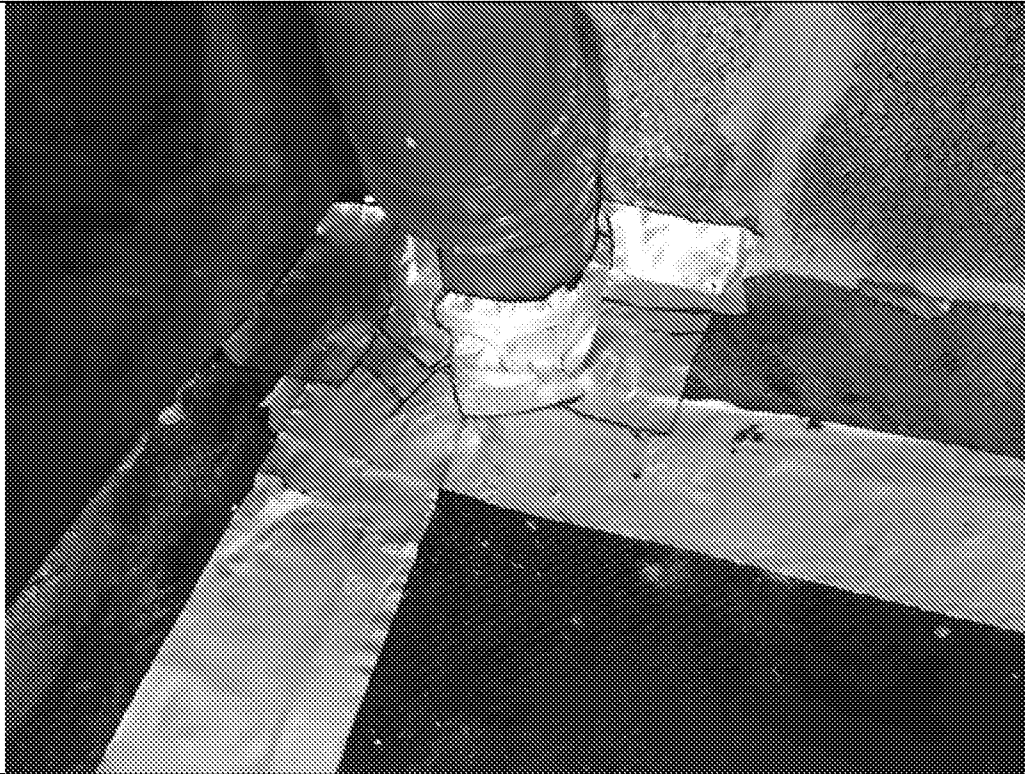
Photograph 59 – Plots 6-12 : Service Pipe Top Hat



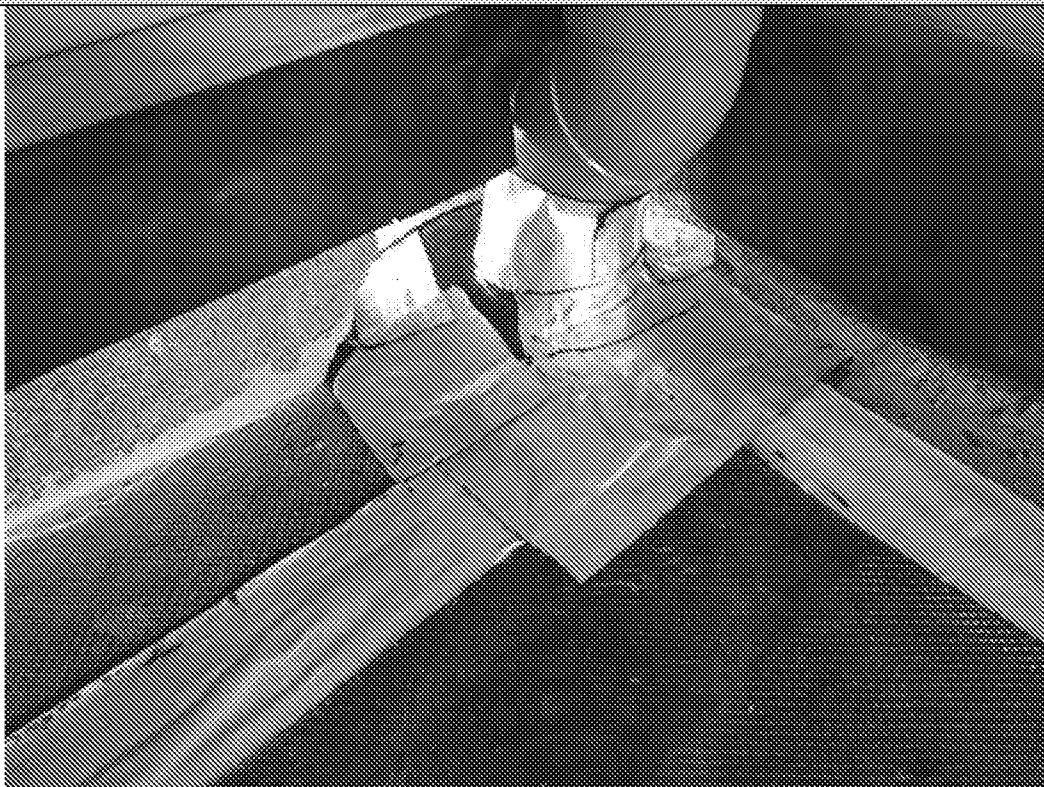
Photograph 60 – Plots 6-12 : Service Pipe Top Hat



Photograph 61 – Plots 6-12 : Service Pipe Top Hat



Photograph 62 – Plots 6-12 : Service Pipe Top Hat



Photograph 63 – Plots 6-12 : Service Pipe Top Hat



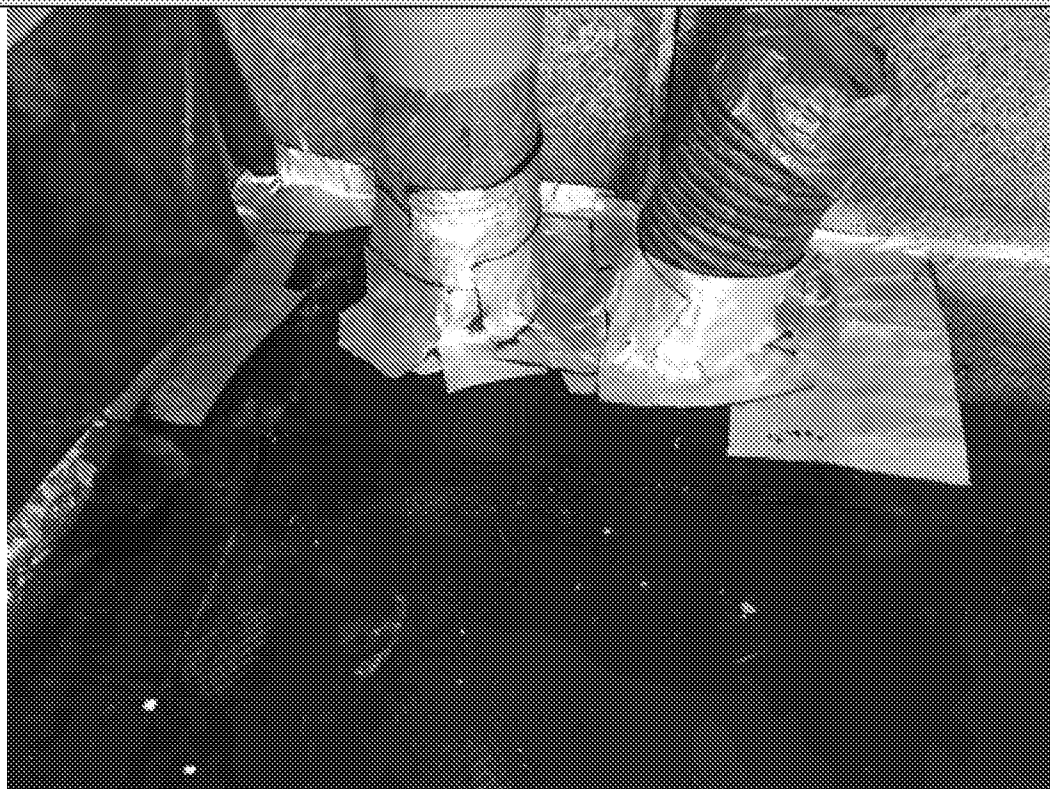
Photograph 64 – Plots 6-12 : Service Pipe Top Hat



Photograph 65 – Plots 6-12 : Service Pipe Top Hat



Photograph 66 – Plots 6-12 : Service Pipe Top Hat



4.3.6 Plots 6-12 Validation Condition of Membrane

During the validation exercise undertaken by OEC during the second site visit on the 15th June 2017 no defects were noted across the membranes installed within Plots 6-12.

As such vapour resistant membranes across all inspected plots were approved by OEC upon completion of corrective works.

4.4 Clean Cover System

OEC undertook a site visit on the 17th October 2017 to collect topsoil samples from Plots 3-5 and to confirm the thickness of the emplaced growing medium. Samples were then submitted for laboratory chemical suitability testing. The location of each hand dug inspection pit is presented as Figure 5.0 in Appendix III

4.5 Site Works and Observations

4.5.1 Site Visit – 17th October 2017

A representative from Omnia Environmental Consulting attended site on the 17th October 2017 to confirm the placement of clean imported soils and retrieve soils samples for laboratory testing for chemical suitability.

At the time of the site visits, the development was near completion with soft landscaping within Plots 3-5 awaiting the placement of turf. Four (4no.) hand dug inspection pits were advanced, three (3no.) within the rear gardens of the plots and a single hand pit within the front garden of Plot 4 in order to retrieve samples, to confirm placement of at least 600mm of clean soil.

4.5.2 Ground Condition Encountered

Topsoil

Topsoil was within all exploratory locations, and comprised a soft light brown slightly gravelly loamy sandy CLAY. Gravel content varied from sub-angular to sub-rounded fine to medium flint, with sand content varying from fine to medium grained in nature. The emplaced topsoil was found to range from 600mm-650mm in thickness. The emplaced cover system thickness encountered at each location is summarised in table below

Location	Cover System Thickness (mm bFGL)
HP101	FGL – 600
HP102	FGL - 600
HP301	FGL - 650

4.6 Laboratory Analysis

Soil samples were submitted to Exova Jones Environmental under UKAS accreditation for analysis comprising:

- CLEA Metals (Inc Cr (VI));
- Speciated PAHs (USEPA 16);
- Banded TPH;
- Asbestos Fibres in Soil;
- pH;
- Phenol; and,
- Cyanide.

Laboratory results for the soils emplaced are presented as Appendix VII

4.7 Risk Assessment

The analytical results have been directly compared to the Tier I Human Health screening criteria for a residential end use with homegrown produce. This comparison is detailed within Table 4.1. The origin of the adopted Tier 1 values are presented as Appendix VIII

Table 4.1 Tier 1 Risk Assessment for a Residential End Use with Homegrown Produce

Determinand	Units	GAC	n	MC	Loc. of Ex	Pathway	Assessment
Inorganics							
Arsenic	mg/kg	37	3	14.6	N/A	1	No Further Action
Beryllium	mg/kg	1.7	3	1.0	N/A	1	No Further Action
Cadmium	mg/kg	11	3	<0.1	N/A	1	No Further Action
Chromium (III)	mg/kg	910	3	68.0	N/A	1	No Further Action
Chromium (VI)	mg/kg	6	3	<0.3	N/A	1	No Further Action
Copper	mg/kg	2400	3	14	N/A	1	No Further Action
Lead	mg/kg	200	3	48	N/A	1	No Further Action
Mercury	mg/kg	40	3	<0.1	N/A	2	No Further Action
Nickel	mg/kg	180	3	24.1	N/A	1	No Further Action
Selenium	mg/kg	250	3	<1	N/A	1	No Further Action
Vanadium	mg/kg	410	3	38	N/A	1	No Further Action
Zinc	mg/kg	3700	3	78	N/A	1	No Further Action
Asbestos	-	None Detect ^(iv)	3	NAD	N/A	2	No Further Action
Organics							
Phenol	mg/kg	280	3	<0.15	N/A	2	No Further Action
Cyanide	mg/kg	791	3	<0.5	N/A	2	No Further Action
Naphthalene	mg/kg	2.3	3	<0.04	N/A	2	No Further Action
Acenaphthylene	mg/kg	170	3	<0.03	N/A	3	No Further Action

Determinand	Units	GAC	n	MC	Loc. of Ex	Pathway	Assessment
Acenaphthene	mg/kg	210	3	<0.05	N/A	1	No Further Action
Fluorene	mg/kg	170	3	<0.04	N/A	1	No Further Action
Phenanthrene	mg/kg	95	3	0.11	N/A	3	No Further Action
Anthracene	mg/kg	2400	3	0.06	N/A	3	No Further Action
Fluoranthene	mg/kg	280	3	0.34	N/A	3	No Further Action
Pyrene	mg/kg	620	3	0.29	N/A	3	No Further Action
Benzo(a)Anthracene	mg/kg	7.2	3	0.24	N/A	3	No Further Action
Chrysene	mg/kg	15	3	0.18	N/A	3	No Further Action
Benzo(b)Fluoranthene ⁽ⁱ⁾	mg/kg	2.6	3	0.27	N/A	3	No Further Action
Benzo(k)Fluoranthene ⁽ⁱ⁾	mg/kg	77	3	0.11			
Benzo(a)Pyrene	mg/kg	2.2	3	0.23	N/A	3	No Further Action
Indeno(123-cd)Pyrene	mg/kg	27	3	0.17	N/A	3	No Further Action
Dibenzo(a,h)Anthracene	mg/kg	0.24	3	<0.04	N/A	3	No Further Action
Benzo(ghi)Perylene	mg/kg	320	3	0.16	N/A	3	No Further Action
TPH (Banded)							
TPH C ₅ -C ₆ (aliphatic)*	mg/kg	100	3	<0.01	N/A	2	No Further Action
TPH C ₆ -C ₈ (aliphatic)*	mg/kg	100	3	<0.01	N/A	2	No Further Action
TPH C ₈ -C ₁₀ (aliphatic)*	mg/kg	27	3	<5	N/A	2	No Further Action
TPH C ₁₀ -C ₁₂ (aromatic)*	mg/kg	74	3	<10	N/A	1	No Further Action
TPH C ₁₂ -C ₁₆ (aromatic)*	mg/kg	140	3	<10	N/A	1	No Further Action
TPH C ₁₆ -C ₂₁ (aromatic)*	mg/kg	260	3	22	N/A	1	No Further Action
TPH C ₂₁ -C ₄₀ (aromatic)*	mg/kg	1100	3	267	N/A	1	No Further Action

Notes

Main Exposure Pathways: 1 = Soil Ingestion, 2 = Vapour Inhalation (indoor), 3 = Dermal Contact & Ingestion, 4 = Dust Inhalation.

Abbreviations: GAC = General Assessment Criteria, n = number of samples, MC = Maximum Concentration; Loc of Ex = Location of Exceedance.

* The Tier 1 GAC for the hydrocarbon fraction is derived from the CIEH/S4UL assessment for petroleum hydrocarbons Criteria Working Group (CWG) for both aliphatic and aromatic compounds. OEC has utilised the lowest of the aliphatic and aromatic chain lengths in order to adopt a conservative approach, which is considered satisfactory for the protection of human health.

(i) Benzo (b) Fluoranthene (2.6mg/kg) Benzo (k) Fluoranthene (77mg/kg)

A review of Table 4.1 indicates that all results fall below the adopted screening level for the protection of Human Health.

Based on the findings of the validation exercise OEC consider that:

- A topsoil growing medium has been emplaced within areas of soft landscaping in Plots 3-5 accordance with recommendations set out within the RMS;
- The imported topsoil meets the chemical suitability criteria set out within the RMS.

It is therefore considered that the tested soils within these areas of soft landscaping do not present a significant risk to human health, and are fit for the intended use.

5.0 CONCLUSION

5.1 Validation Conclusion

Vapour Membrane:

In accordance with the protection measures set out within OEC RMS, Ref; A10706/RMS/1.0 '*Remedial Method Statement*' dated February 2017, and drawings set out by Kenn Scaddan Associates, Drawing No: 1112 WD32, Rev: P3, Plots 1-2 and Plots 6-12 have been visually inspected and validated.

Based on observations made during inspection visits undertaken for Plots 1-2 on the 18th May and the 23rd May 2017, and Plots 6-12 visits undertaken on the 12th June and 15th June 2017, OEC consider that gas protection measures have been installed in accordance with the agreed above remedial measures and the installation of the Flexible Hydrocarbon Gas Barrier protection system within Plots 1-2 and Plots 6-12, has been validated in line with the RMS.

Soil Capping:

Based on the findings of the clean cover system validation exercise OEC consider that a topsoil growing medium has been emplaced within areas of soft landscaping in Plots 3-5, and that the soils meet both the depth and chemical suitability criteria in accordance with recommendations set out within the RMS.

It is therefore considered that the tested soils within these areas of soft landscaping do not present a significant risk to human health, and are fit for the intended use.

Validation works confirm that the site is suitable for the intended use, and does not present a significant risk to identified receptors.

APPENDIX I

LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between OE Ltd and the Client as indicated in Section 1.2.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information, it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination, which are enforced, by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover, reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.
6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials this is for indicative purposes only and do not constitute or replace full and proper surveys.
8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
9. OE cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by OE is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by OE in this connection without their explicit written agreement there to by OE.
10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

APPENDIX II

GLOSSARY

AST	ABOVE GROUND STORAGE TANK
BGS	BRITISH GEOLOGICAL SURVEY
BSI	BRITISH STANDARDS INSTITUTE
BTEX	BENZENE, TOLUENE, ETHYLBENZENE, XYLENES
CIEH	CHARTERED INSTITUTE OF ENVIRONMENTAL HEALTH
CIRIA	CONSTRUCTION INDUSTRY RESEARCH ASSOCIATION
CLEA	CONTAMINATED LAND EXPOSURE ASSESSMENT
CSM	CONCEPTUAL SITE MODEL
DNAPL	DENSE NON-AQUEOUS PHASE LIQUID (CHLORINATED SOLVENTS, PCB)
DWS	DRINKING WATER STANDARD
EA	ENVIRONMENT AGENCY
EQS	ENVIRONMENTAL QUALITY STANDARD
GAC	GENERAL ASSESSMENT CRITERIA
GL	GROUND LEVEL
GSV	GAS SCREENING VALUE
HCV	HEALTH CRITERIA VALUE
ICSM	INITIAL CONCEPTUAL SITE MODEL
LNAPL	LIGHT NON-AQUEOUS PHASE LIQUID (PETROL, DIESEL, KEROSENE)
ND	NOT DETECTED
LMRL	LOWER METHOD REPORTING LIMIT
NR	NOT RECORDED
PAH	POLY AROMATIC HYDROCARBON
PCB	POLY-CHLORINATED BIPHENYL
PID	PHOTOGRAPH IONISATION DETECTOR
QA	QUALITY ASSURANCE
SGV	SOIL GUIDELINE VALUE
SPH	SEPARATE PHASE HYDROCARBON
SP.TPH (CWG)	TOTAL PETROLEUM HYDROCARBON (CRITERIA WORKING GROUP)
SPT	STANDARD PENETRATION TEST
SVOC	SEMI VOLATILE ORGANIC COMPOUND
UST	UNDERGROUND STORAGE TANK
VCCS	VIBRO CONCRETE COLUMNS
VOC	VOLATILE ORGANIC COMPOUND
WTE	WATER TABLE ELEVATION

UNITS

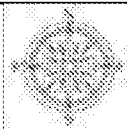
M	METRES
KM	KILOMETRES
%	PERCENT
%V/V	PERCENT VOLUME IN AIR
MB	MILLI BARS (ATMOSPHERIC PRESSURE)
L/HR	LITRES PER HOUR
µG/L	MICROGRAMS PER LITRE (PARTS PER BILLION)
PPB	PARTS PER BILLION
MG/KG	MILLIGRAMS PER KILOGRAM (PARTS PER MILLION)
PPM	PARTS PER MILLION
MG/M ³	MILLIGRAM PER METRE CUBED
M BGL	METRES BELOW GROUND LEVEL
M BCL	METRE BELOW COVER LEVEL
MAOD	METRES ABOVE ORDNANCE DATUM (SEA LEVEL)

KN/M ²	KILO NEWTOWNS PER METRE SQUARED
μM	MICRO METRE

APPENDIX III

DRAWINGS

Key



Site Location

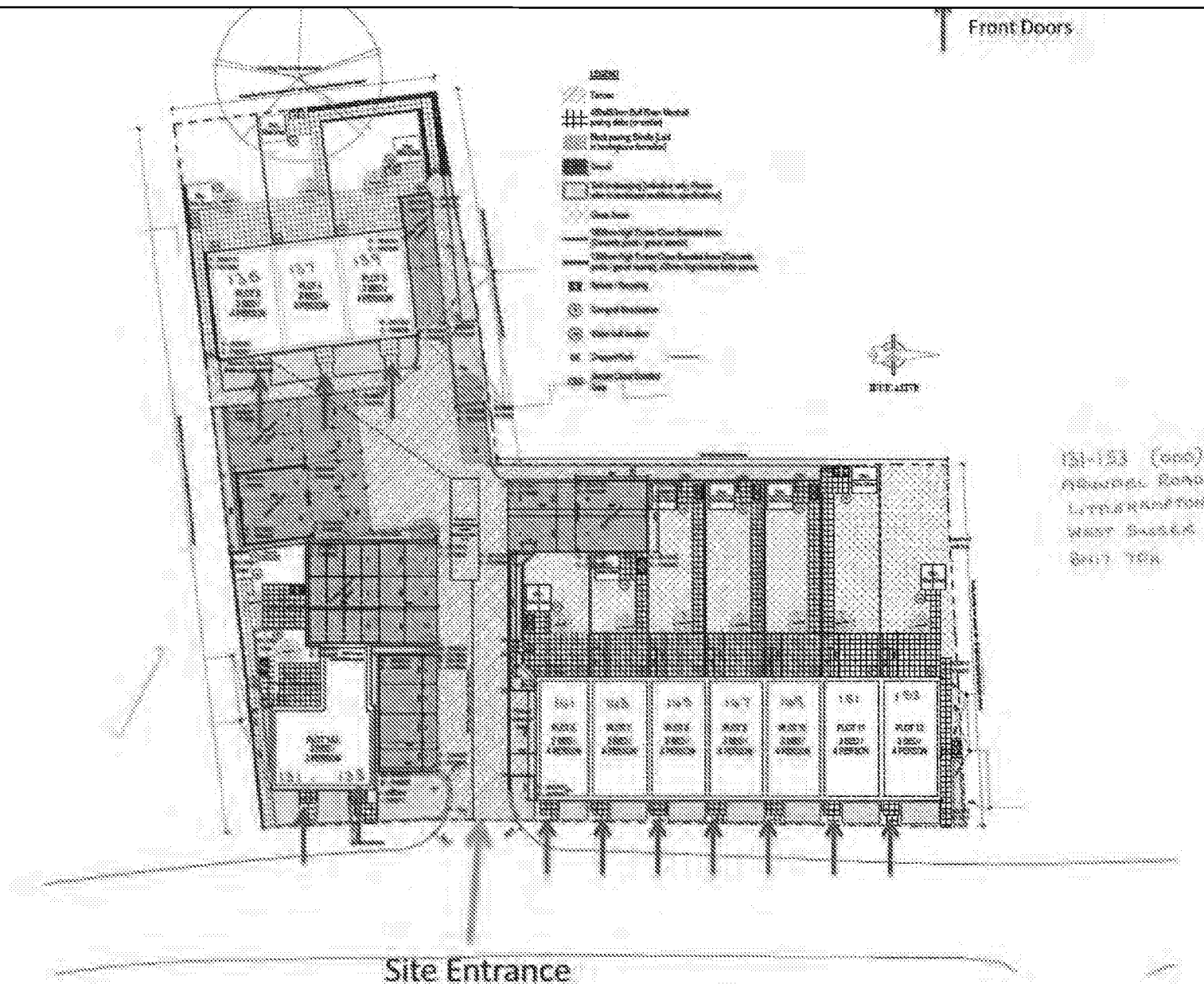
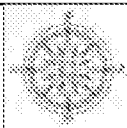


The client must not amend any drawing, design or other intellectual property produced by Omnia Environmental Consulting Ltd. (OEC) without permission in writing from OEC Ltd. in advance of any amendments being made. In the event that such written permission is not obtained, in advance of the amendments being made OEC Ltd. shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.

Omnia Environmental Consulting Ltd
10 Manor Court, Barnes Wallis Road,
Sewerham,
PO15 5TH
T: 01489 808088
E: info@omnia-consulting.co.uk
W: www.omnia-consulting.co.uk

Job Title:	Client:	Project No:	Date:	Drawing Title:
Arundel Road, Littlehampton	PMC	A10706	13/12/2016	
		Drawn By:	Authorised By:	
		K.Duggan	T.Mitchell	Figure 1.0 - Site Location Plan
		Scale:	Notes:	
		1:25,000		

Key

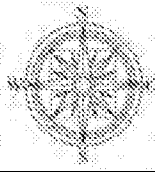


The client must amend any drawing, design or other intellectual property produced by Omnia Environmental Consulting Ltd. (OEC) without permission in writing from OEC Ltd. in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made OEC Ltd. shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.

Omnia Environmental Consulting Ltd
10 Manor Court, Barnes Wallis Road,
Sewage Works,
Fareham,
PO15 5TH
T: 01489 808088
E: info@omnia-consulting.co.uk
W: www.omnia-consulting.co.uk

Job Title: Arundel Road, Littlehampton	Client: PMC	Project No: A10706	Date: 14/02/2017	Drawing Title: Figure 2.0 -Proposed Development
		Drawn By: K.Duggan	Authorised By: T.Mitchell	
		Scale:	Notes:	

Key

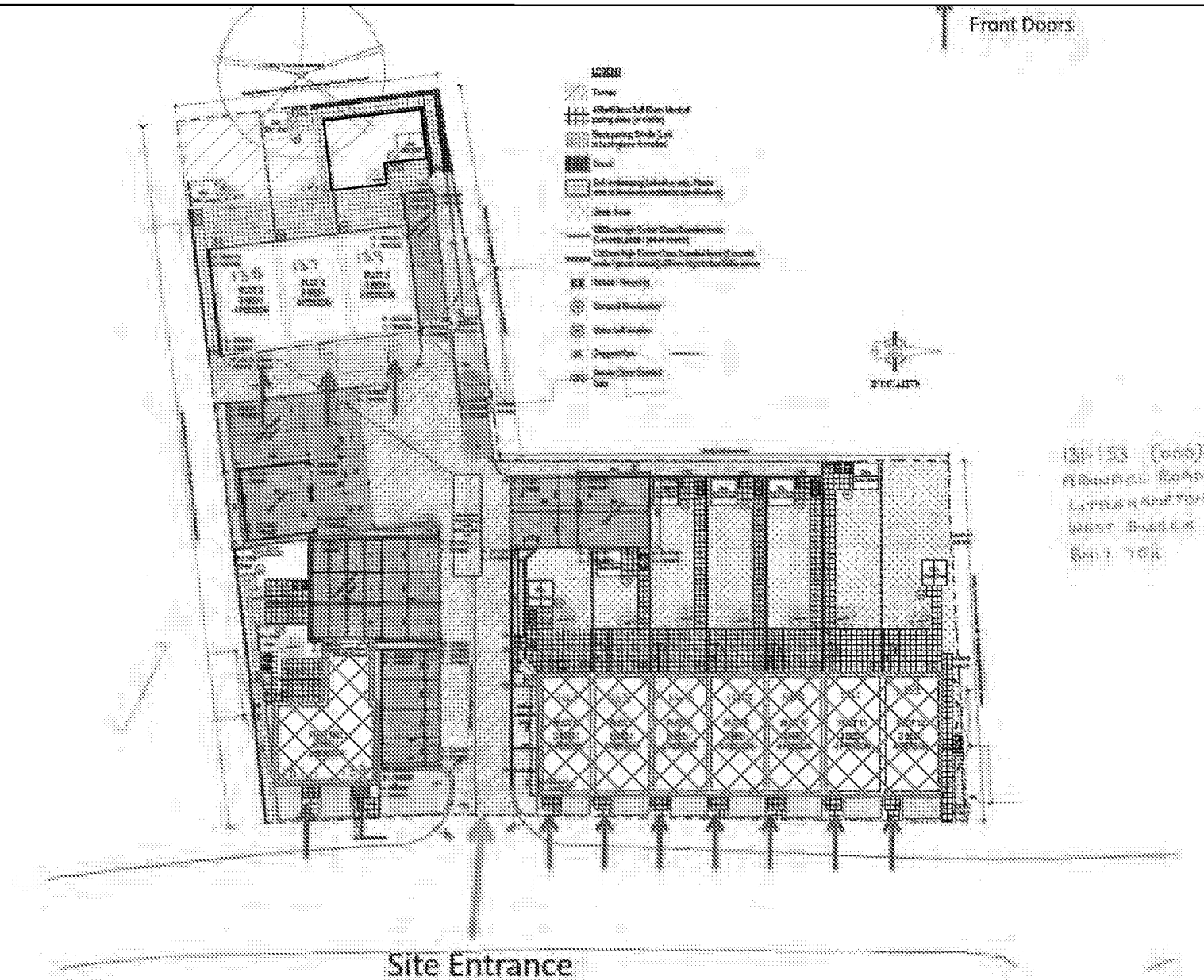


600mm Soil capping thickness

Vapour Membranes

The client must not amend any drawing, design or other intellectual property produced by Omnia Environmental Consulting Ltd. (OEC) without permission in writing from OEC Ltd. in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made OEC Ltd. shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.

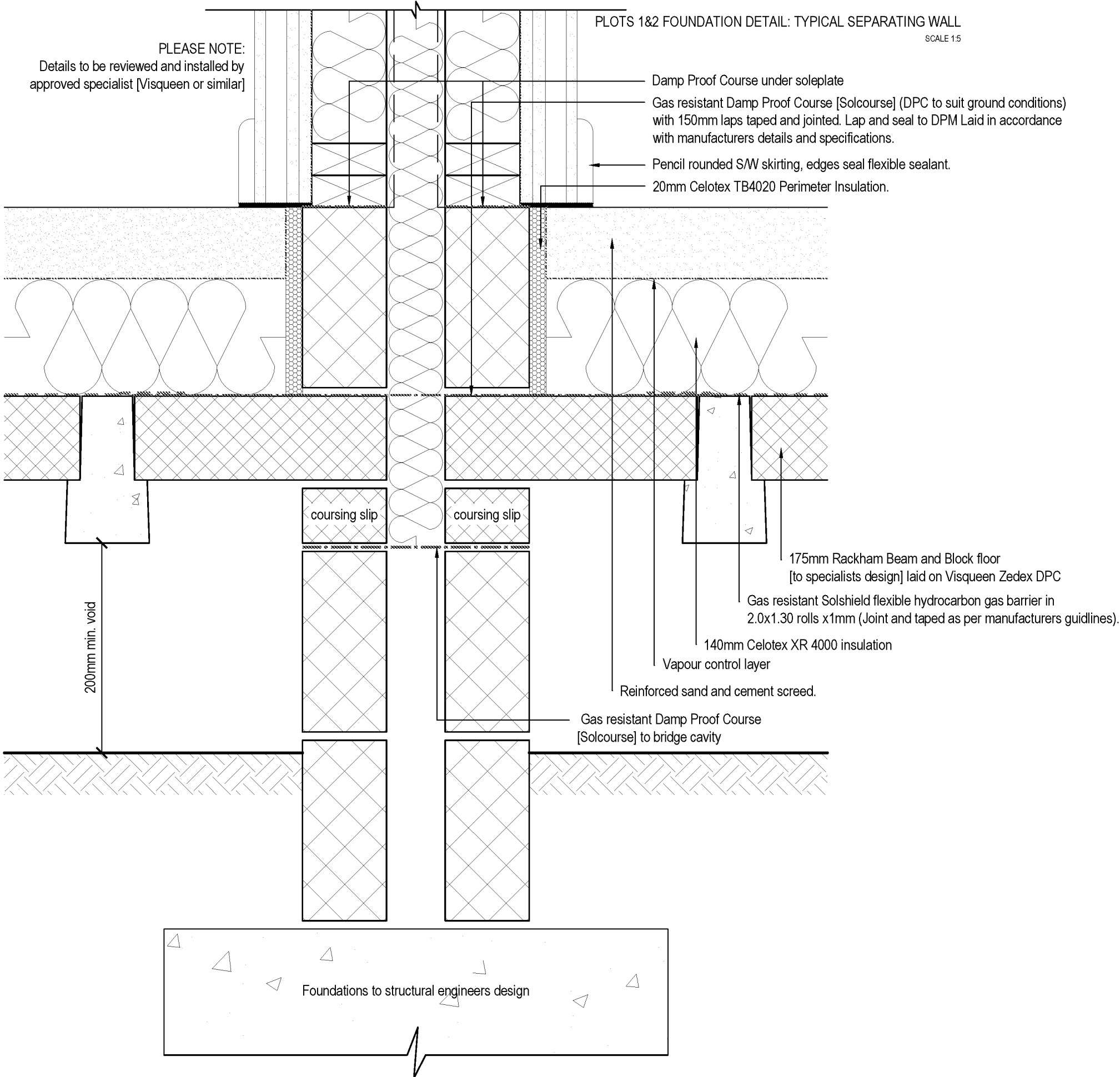
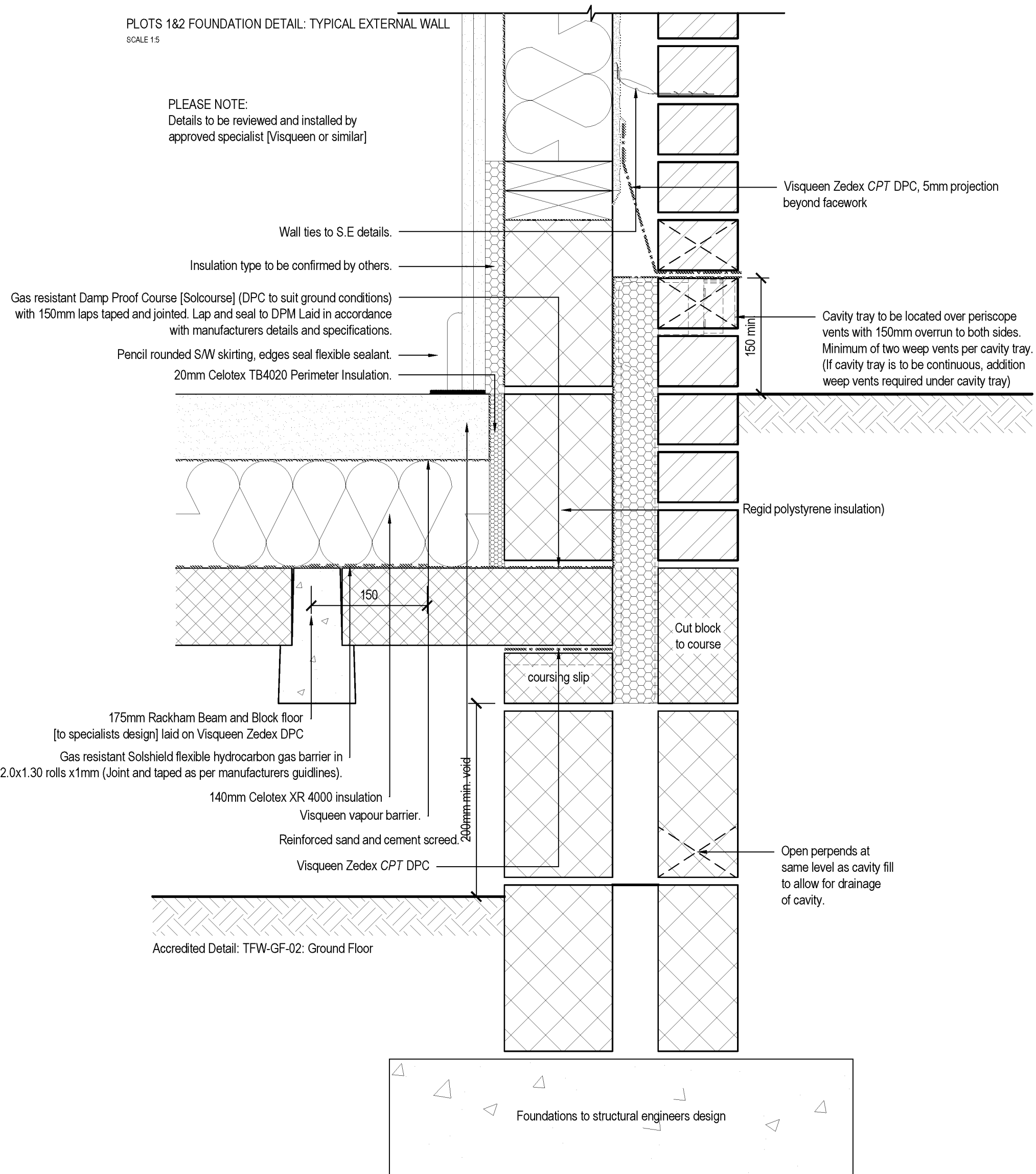
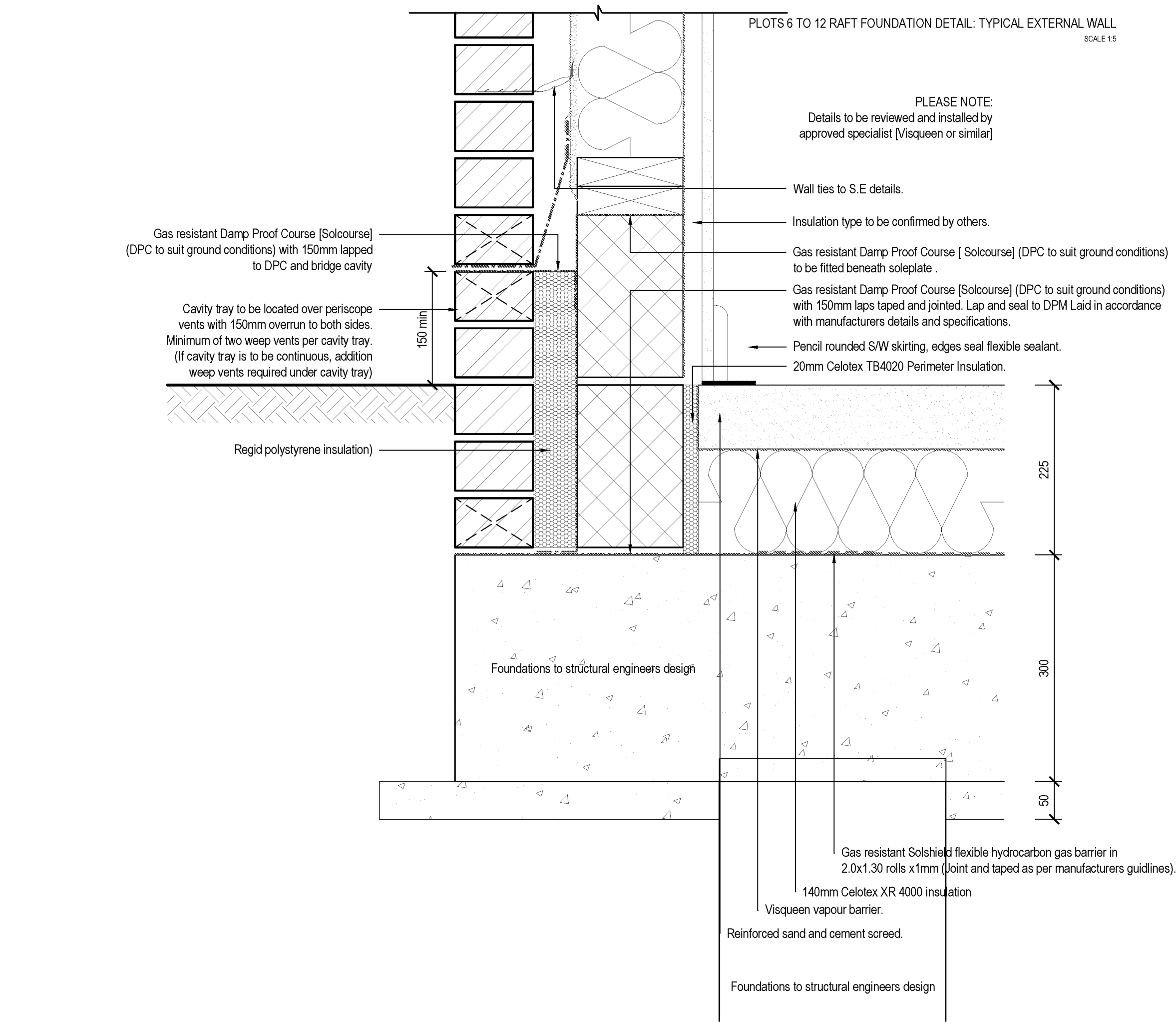
Omnia Environmental Consulting Ltd
10 Manor Court, Barnes Wallis Road,
Segensworth,
Fareham,
PO15 5TH
T: 01489 808088
E: info@omnia-consulting.co.uk
W: www.omnia-consulting.co.uk



Job Title: Arundel Road, Littlehampton	Client: PMC	Project No: A10706	Date: 10/04/2017	Drawing Title: Figure 3.0 Remediation Scheme
		Drawn By: K.Duggan	Authorised By: T.Mitchell	
		Scale:	Notes:	

- GENERAL NOTES:
1. This drawing is to be read in conjunction with all relevant architects, structural engineers, mechanical & electrical engineers and specialists drawings / specifications.
 2. Any discrepancies in dimensions or details between the various drawings should be reported immediately.
 3. All dimensions are in millimetres and all levels are in metres.
 4. Do not scale from this drawing, if in doubt ASK

Rev.	Description	Date	Dn	Ch'd
P1	Preliminary Issue	19.09.16	JK	
P2	Detail added	16.02.17	JK	
P3	Plots 1+2 party wall detail added	20.02.17	JK	



kenn scaddan
associates
architects

CONCEPT HOUSE, 35 KINGSTON CRESCENT, NORTH END, PORTSMOUTH, HAMPSHIRE. PO2 8AA
T - 023 9267 3618 F - 023 9267 9819 www.ksaia.co.uk info@ksaia.co.uk

PROJECT

Arundel Rd, Littlehampton

DRAWING TITLE

General Construction Details

Date	Drawn by	Scale	Drawing No.	Rev.
Feb 2017	JK	1:5	1112 WD32	P3

architecture planning design project management

APPENDIX IV

Membrane Specification Sheets

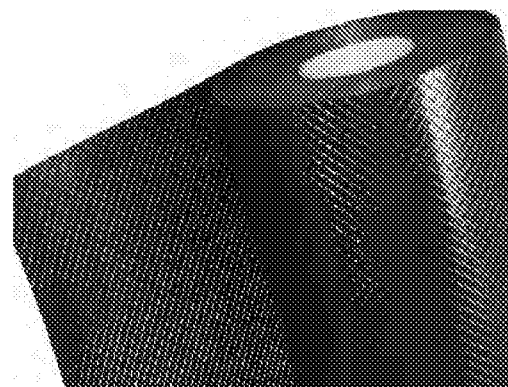
SOLSHIELD

Flexible Hydrocarbon Gas Barrier

SOLSHIELD Flexible Hydrocarbon Gas Barrier is specially engineered tri-polymer construction that provides a highly effective barrier against Radon, Methane, Carbon Dioxide and Hydrocarbon gases



- Complies with relevant codes of practice such as current BRE and CIRIA
- Excellent resistance to chemical and hydrocarbon gases typically found in contaminated industrial sites.
- High quality robust flexible Tri-Polymer Membrane.
- Suitable for hot welding
- Very high puncture & tear resistance.
- Tested to ISO 15105-1 and complies to BS 8485:2015.



Colour	Product Code	Roll Size
Black	SOLSHIELDFLEX	20m x 1.3m x 1mm (other roll sizes available)

SOLSHIELD - Gas Protection System

Last Issue Date 24.11.16

Product Description

SOLSHIELD Flexible Hydrocarbon Gas Barrier is specially engineered tri-polymer construction that provides a highly effective barrier against Radon, Methane, Carbon Dioxide and Hydrocarbon gases. Hydrocarbon gases are formed as a by-product of decomposing organic matter. The Membrane is produced from a uniquely formulated blend of polymers to produce outstanding chemical resistance, mechanical properties, dimensional stability and thermal aging characteristics. The membrane is ideally suited for sites formerly used as coalfield, landfill or industrial sites that previously contained volatile liquids such as petrol stations.

SOLSHIELD Flexible Hydrocarbon Gas Barrier is a very effective gas barrier for the protection of buildings and occupiers from the ingress of gas and moisture. The building regulations require that proper precautions be taken to prevent danger to health and safety when building on gas contaminated land. Solshield Flexible Hydrocarbon Gas Barrier is an advanced high performance flexible membrane suitable for both damp proofing and tanking applications. The membrane has a textured face on one side designed to aid adhesion to cast concrete. This can be used in applications such as: Tanking below ground structures, lift pits, Slab edges and permanent shutter work & Heavy duty reinforced concrete slabs.

SOLSHIELD Flexible Hydrocarbon Gas Barrier is classified as non-hazardous (code of practice CP101 1973). The membrane is chemically inert and will not react with any acidic or alkaline environment it is laid in. SOLSHIELD Flexible Hydrocarbon Barrier has been subjected to accelerated life immersion tests. These tests EN 14414 & EN 14415 require the membrane to be subjected to a range of challenge chemicals at 50 degrees C & then tested to establish the affect they have on the membrane. Full results can be found on the table below.

Installation

SOLSHIELD Flexible Hydrocarbon Gas Barrier must be installed in accordance with the guidelines laid out in Building Research establishment BRE No.414 "Protective measures for housing on gas contaminated land", CIRIA C665 "Assessing risks posed by Hazardous ground gases to buildings", NHBC guidelines and CIRIA C682 the VOC Handbook.

SOLSHIELD Flexible Hydrocarbon Gas Barrier can be used in most common floor constructions and is installed in a similar manor to

damp-proof membrane but with greater attention to joint sealing and under wall sealing. Where there is risk of hydrostatic pressure SOLSHIELD Flexible Hydrocarbon Gas Barrier can be used so long as the jointing is made using the hot weld process and not taped. The membrane should be laid on smooth surface or sand blinding to prevent puncture.

Jointing & Welding

SOLSHIELD Flexible Hydrocarbon Gas Barrier has excellent welding properties, we would recommend that particularly in situations where site investigation demonstrates chemicals or harmful gases are present in significant concentrations all of our gas barriers are heat welded as opposed to being tape jointed, this ensures the integrity of the membrane at the joint location. Seam welding provides maximum performance integrity and enables installers to complete installations quickly and efficiently.

Apply the double sided butyl tape about 50mm from the edge, leaving the backing paper on. Lay the next width of membrane overlapping the first by 150mm. Remove the backing paper from the double sided butyl tape and join the top sheet to the bottom sheet, by applying pressure with a hand roller. Where the membranes overlap apply the Solco XL tape, equidistant on both membranes (see details on page 3).

All service entry points must have airtight seals Top hats and corner pre-forms must be sealed using double sided butyl tape.

Storage & Handling on site

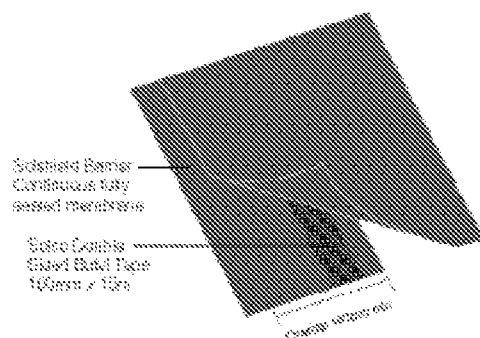
SOLSHIELD Hydrocarbon Gas Barrier is classified as non-hazardous (code of practice CP102 1973). The product is chemically inert and any acids or alkalis present in the subsoil will not affect the membrane. It is not recommended for use when exposed to sunlight and general outdoor weather conditions for long periods of time.

Weathering will not occur when installed with code of practise CP102 1973. Rolls should be stored undercover.

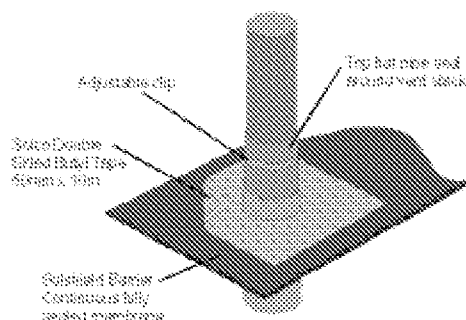
Quality control while laying the membrane is extremely important. The membrane should be protected through the use of temporary boards over the whole area or the immediate laying of the screed. A minimum of 50mm screed is recommended and care should be taken when laying the screed not to stretch, puncture or displace the membrane.

SOLSHIELD Flexible Hydrocarbon Gas Barrier has been tested to ISO 15105-1 and complies to BS 8485:2015.

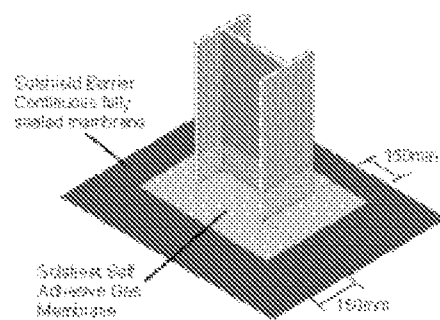
Technical Performance & Test Data				
Length	EN 1848-2	M	-0% / +10%	20
Width	EN 1848-2	M	-cm/ +2.5%	1.3
Thickness	EN 1849-2	mm	+10% / -10%	1.0
Mass	EN 1849-2	g/M ²	+2% / -2%	921
Tensile Strength - MD	EN EN 12311	N/mm ²	≥MLV	24
Tensile Strength - CD	EN EN 12311	N/mm ²	≥MLV	22
Tensile Elongation - MD	EN EN 12311	%	≥MLV	398
Tensile Elongation - CD	EN EN 12311	%	≥MLV	446
Joint Strength	EN12317-2	N	≥MLV	520
Watertightness 2kPa	EN 1928	-	Pass/Fail	Pass
Resistance to impact	EN 12691	mm	≥MLV	660
Resistance to static loading	EN12730	Kg	≥MLV	20
Resistance to nail tear - MD	EN 12310-1	N	≥MLV	700
Resistance to nail tear - CD	EN 12310-1	N	≥MLV	750
Durability - heat ageing	EN 1926		Pass/Fail	Pass
Durability - Chemical resistance	EN 1847		Pass/Fail	Pass
Water vapour permeability	EN 1932	g/ m ² /day	≥MLV	0.08
Reaction to fire	EN 13501-1	Class	Pass/Fail	F
Resistance to low temperature	EN 495-5		MDV	Pass @ -40
Methane permeability	ISO 15105-1	M ³ / (M ² .day.atm)	MDV	28
Diesel permeability	ISO 6179	g/m ² h	MDV	0.096
Petrol permeability	ISO 6179	g/m ² h	MDV	5.172
Xylene permeability	ISO 6179	g/m ² h	MDV	4.845
Toluene permeability	ISO 6179	g/m ² h	MDV	6.695
Chemical Resistance - Acidic	EN 14414-A	% Elongation	≥MLV	MD - 367 CD - 488
Chemical Resistance - Basic	EN 14414-B	% Elongation	≥MLV	MD - 388 CD - 487
Chemical Resistance - Solvents	EN 14414-C	% Elongation	≥MLV	MD - 388 CD - 518
Resistance to Leaching - Hot Water	EN 14415-A	% Elongation	≥MLV	MD - 377 CD - 404
Resistance to Leaching - Aqueous Alkaline	EN 14415-B	% Elongation	≥MLV	MD - 361 CD - 428
Resistance to Leaching - Organic Alcohol	EN 14415-C	% Elongation	≥MLV	MD - 388 CD - 449
Radon Permeability		M ² /S	≥MLV	9.5 x 10 ⁻¹²



Typical Lap Detail



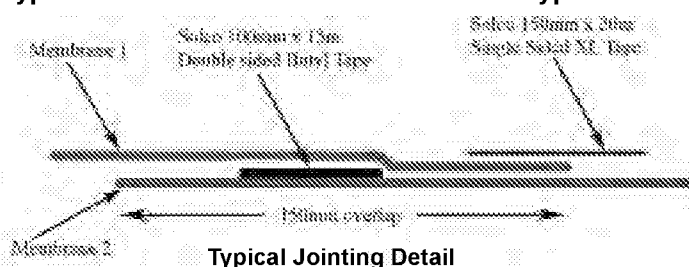
Typical Penetration Detail



Typical Column Detail

Note:

All service entry points must have airtight seals Top hats and corner pre-forms must be sealed using double sided butyl tape.



Typical Jointing Detail

SOLSHIELD - Gas Protection System

Last Issue Date 24.11.16

Gas System Accessories

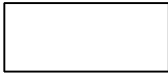


Product	Description	Sizes	Application	Supply
Solco Foil Backed Jointing Tape	Single sided tape for securing laps & joints	75mm x 50m	Securing Laps & Joints	Rolls
Solco Double sided Butyl Jointing Tape	Butyl Adhesive Tape	50mm x 10m 100mm x 15m	Butyl based double sided tape for joints and laps	Rolls
Solco Top Hat Units	Polymeric	Various	For sealing around penetrations through gas membrane	Each
Solcourse Hydrocarbon DPC	A flexible Tri-polymer DPC	300mm - 1000mm	To prevent the transmission of Radon, CO ₂ , Methane Gas & Hydrocarbons	20m Rolls
Solco Gas Sump Units	Part of the Radon Protection System	430 x 430 x 220mm	Radon Sumps are used in full protection areas, where sub floor depressurisation may be required.	Each
Solco XL Jointing Tape	Reinforcing Tape	100, 150 & 300mm wide	Overband tape self-adhesive	20m Rolls
Solseal Bitumen Primer	Primer for SA Membrane	5L & 25L	Surface Primer	Drums
Solco Protection Boards	Bitumen / Polymeric	3mm thick	For heavy duty use	2m x 1m
Solco P30 Protection Fleece	Geotextile Fleece	2 x 50mt	For pedestrian traffic	Rolls

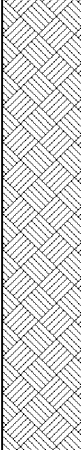
APPENDIX V

Exploratory Hole Logs

 Ominia Environmental Consulting 10 Manor Court Barnes Wallis Road Segensworth Fareham PO15 5TH				Trial Pit Log				Trialpit No Plot 3 HP101 Sheet 1 of 1	
Project Name: Arundel Road, Littlehampton				Project No. A10706		Co-ords: - Level:		Date 17/10/2017	
Location: 131-135 Arundel Road, Littlehampton, West Sussex, BN17 7DH						Dimensions (m):		Scale 1:10	
Client: PMC						Depth 0.65		Logged K.Duggan	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10 - 0.60	ES		0.65			TOPSOIL Soft brown slightly gravelly loamy sandy CLAY. Sand is fine to medium. Gravel is sub-angular to subrounded fine to coarse flint. Rootlets present		
							End of pit at 0.65 m		
Remarks: Cleared by Cable Avoidance Tool. No Groundwater Encountered.									
Stability:									

 Ominia Environmental Consulting 10 Manor Court Barnes Wallis Road Segensworth Fareham PO15 5TH				Trial Pit Log				Trialpit No Plot 4 HP101 Sheet 1 of 1	
Project Name: Arundel Road, Littlehampton				Project No. A10706		Co-ords: - Level:		Date 17/10/2017	
Location: 131-135 Arundel Road, Littlehampton, West Sussex, BN17 7DH						Dimensions (m): Depth 0.60		Scale 1:10	
Client: PMC								Logged K.Duggan	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.10 - 0.60	ES		0.60			TOPSOIL Soft brown slightly gravelly loamy sandy CLAY. Sand is fine to medium. Gravel is sub-angular to subrounded fine to coarse flint.		
							End of pit at 0.60 m		
1									
2									
Remarks: Cleared by Cable Avoidance Tool. No Groundwater Encountered.									
Stability:									



 Ominia Environmental Consulting 10 Manor Court Barnes Wallis Road Segensworth Fareham PO15 5TH				Trial Pit Log				Trialpit No Plot 4 HP102 Sheet 1 of 1	
Project Name: Arundel Road, Littlehampton				Project No. A10706		Co-ords: - Level:		Date 17/10/2017	
Location: 131-135 Arundel Road, Littlehampton, West Sussex, BN17 7DH						Dimensions (m): Depth 0.60		Scale 1:10	
Client: PMC								Logged K.Duggan	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.60			TOPSOIL Soft brown slightly gravelly loamy sandy CLAY. Sand is fine to medium. Gravel is sub-angular to subrounded fine to coarse flint.		
							End of pit at 0.60 m		
Remarks: Cleared by Cable Avoidance Tool. No Groundwater Encountered									
Stability:									



APPENDIX VI

Hand Pit Inspection Photographs

Plot 3 HP101 Depth Check



Plot 4 HP101 Depth Check



Plot 5 HP101 Depth Check



APPENDIX VII

Laboratory Results

Plot 3 HP101 Depth Check



Plot 4 HP101 Depth Check

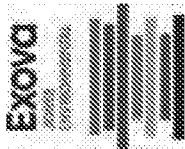


Plot 5 HP101 Depth Check



APPENDIX VII

Laboratory Results

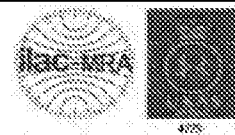


Exova Jones Environmental

Registered Address: Exova Ltd, Unit 10, 11 & 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

Omnia
10 Manor Court
2 Barnes Wallis Road
Segensworth
Fareham
PO15 5TH



Attention : Tim Mitchell
Date : 27th October, 2017
Your reference : A10706
Our reference : Test Report 17/17292 Batch 1
Location : Arundel Road Littlehampton
Date samples received : 19th October, 2017
Status : Final report
Issue : 1

Three samples were received for analysis on 19th October, 2017 of which three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:



Lucas Halliwell
Project Co-ordinator

Please see attached notes for all abbreviations and acronyms

Client Name: Omnia
Reference: A10706
Location: Arundel Road Littlehampton
Contact: Tim Mitchell

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Jones Environmental Laboratory consultant, Jones Environmental Laboratory cannot be responsible for inaccurate or unrepresentative sampling.

Signed on behalf of Jones Environmental Laboratory:



Ryan Butterworth
 Asbestos Team Leader

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
17/17292	1	PLOT 3 HP101	0.10-0.65	2	20/10/2017	General Description (Bulk Analysis)	Soil/Stone
					20/10/2017	Asbestos Fibres	NAD
					20/10/2017	Asbestos Fibres (2)	NAD
					20/10/2017	Asbestos ACM	NAD
					20/10/2017	Asbestos ACM (2)	NAD
					20/10/2017	Asbestos Type	NAD
					20/10/2017	Asbestos Type (2)	NAD
					20/10/2017	Asbestos Level Screen	NAD
17/17292	1	PLOT 4 HP101	0.10-0.60	4	23/10/2017	General Description (Bulk Analysis)	soil/stones
					23/10/2017	Asbestos Fibres	NAD
					23/10/2017	Asbestos Fibres (2)	NAD
					23/10/2017	Asbestos ACM	NAD
					23/10/2017	Asbestos ACM (2)	NAD
					23/10/2017	Asbestos Type	NAD
					23/10/2017	Asbestos Type (2)	NAD
					23/10/2017	Asbestos Level Screen	NAD
17/17292	1	PLOT 5 HP101	0.10-0.60	6	23/10/2017	General Description (Bulk Analysis)	soil/stones
					23/10/2017	Asbestos Fibres	NAD
					23/10/2017	Asbestos Fibres (2)	NAD
					23/10/2017	Asbestos ACM	NAD
					23/10/2017	Asbestos ACM (2)	NAD
					23/10/2017	Asbestos Type	NAD
					23/10/2017	Asbestos Type (2)	NAD
					23/10/2017	Asbestos Level Screen	NAD

Client Name: Omnia
Reference: A10706
Location: Arundel Road Littlehampton
Contact: Tim Mitchell

Matrix : Solid

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 17/17292

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

Please include all sections of this report if it is reproduced

All solid results are expressed on a dry weight basis unless stated otherwise.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS) accredited - UK.
SA	ISO17025 (SANAS) accredited - South Africa.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 17/17292

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.				
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21	As received solid or water samples are extracted in Methanol: Sodium Hydroxide (0.1M NaOH) (60:40) by orbital shaker.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes

JE Job No: 17/17292

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes		AD	Yes
TM89	Modified USEPA method OIA-1667. Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide and Thiocyanate analysis.	Yes		AR	Yes
NONE	No Method Code	NONE	No Method Code			AR	Yes

APPENDIX VIII

Tier 1 Screening Values

Residential with Homegrown Produce – OECv2 Oct 2015

Constituent	Unit	GAC	Origin of Risk Assessment Value
Arsenic	mg/kg	37	LQM CIEH Suitable for Use Levels (S4UL) 2015- Inorganic Arsenic
Beryllium	mg/kg	1.7	LQM CIEH Suitable for Use Levels (S4UL) 2015
Boron	mg/kg	290	
Cadmium	mg/kg	11	
Chromium VI	mg/kg	6	
Chromium III	mg/kg	910	
Lead	mg/kg	200	
Mercury	mg/kg	40	LQM CIEH Suitable for Use Levels (S4UL) 2015- Inorganic Mercury
Nickel	mg/kg	180	LQM CIEH Suitable for Use Levels (S4UL) 2015
Selenium	mg/kg	250	
Copper	mg/kg	2400	
Zinc	mg/kg	3700	
Vanadium	mg/kg	410	
Phenol	mg/kg	280	LQM CIEH Suitable for Use Levels (S4UL) 2015 1%SOM
Cyanide	mg/kg	791	CLEA 1.04 OEC Derived Value
Naphthalene	mg/kg	2.3	LQM CIEH Suitable for Use Levels (S4UL) 2015 based on a sandy loam as defined in SR3 (EA 2009) 1% SOM
Acenaphthylene	mg/kg	170	
Acenaphthene	mg/kg	210	
Fluorene	mg/kg	170	
Phenanthrene	mg/kg	95	
Anthracene	mg/kg	2400	
Fluoranthene	mg/kg	280	
Pyrene	mg/kg	620	
Benzo(a)Anthracene ¹	mg/kg	7.2	
Chrysene	mg/kg	15	
Benzo(b)Fluoranthene	mg/kg	2.6	
Benzo(k)Fluoranthene	mg/kg	77	
Benzo(a)Pyrene	mg/kg	2.2	
Indeno(123-cd)Pyrene	mg/kg	27	
Dibenzo(a,h)Anthracene	mg/kg	0.24	
Benzo(ghi)Perylene	mg/kg	320	
Benzene	mg/kg	0.087	LQM CIEH Suitable for Use Levels (S4UL) 2015 1%SOM
Toluene	mg/kg	130	
Ethylbenzene	mg/kg	47	
Xylenes	mg/kg	56	LQM CIEH Suitable for Use Levels (S4UL) 2015 1% SOM o-Xylene
TPH CWG (Speciated)			
Banded TPH			

Residential with Homegrown Produce – OECv2 Oct 2015

Constituent	Unit	GAC	Origin of Risk Assessment Value
Aliphatic EC 5-6	mg/kg	42	LQM CIEH Suitable for Use Levels (S4UL) 2015 based on a sandy loam as defined in SR3 (EA 2009) 1% SOM, utilising the most conservative of the Ali/Aro chain lengths.
Aliphatic EC >6-8	mg/kg	100	
Aliphatic EC >8-10	mg/kg	27	
Aromatic EC> 10-12	mg/kg	74	
Aromatic EC> 12-16	mg/kg	140	
Aromatic EC> 16-21	mg/kg	260	
Aromatic EC> 21-35	mg/kg	1100	
Aromatic EC> 35-44	mg/kg	1100	