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VERIFICATION REPORT

FOR

30 Radford Way,
Billericay,
CM12 0DA



Report Title: Verification Report for 30 Radford Way, Billericay, CM12 0DA

Report Status: Final

Job No: P2647J1906/SEJ

Date: 18 December 2023

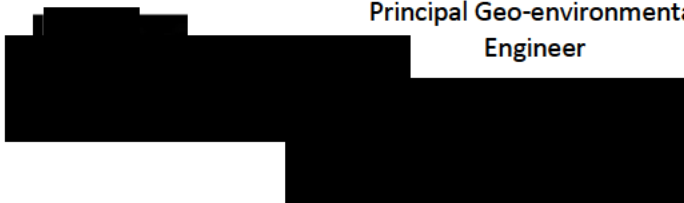
Quality Control: Revisions

Version	Date	Issued By	Comment

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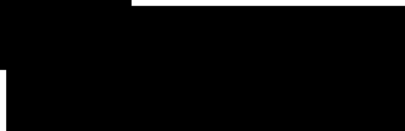
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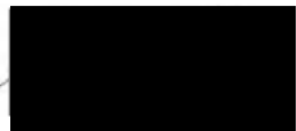
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1 INTRODUCTION

1.1 Background

1.1.1 Clontara Developments Ltd (“The Client”) has commissioned Jomas Associates Ltd (‘Jomas’), to produce a verification report for the site at 30 Radford Way, Billericay, CM12 0DA following redevelopment of the site.

1.1.2 The site location plan is provided as Figure 1, Appendix 1.

1.1.3 The site has undergone redevelopment comprising the part demolition, retention and refurbishment of an existing building and construction of a part two, part four-storey mixed use building with partial single storey basement comprising the retention of the existing Class D2 (gym/children’s activity centre), Class A3 (café) and Class D2 (yoga studio) at basement and ground floor level, Class B1 (offices) at first floor, and 20 Class C3 (residential) units at second and third floors with associated car parking and development.

1.1.4 The following previously issued reports pertain to the site, and should be read in conjunction with this document:

- Phase I Geo-environmental Desk Study Report for 30 Radford Way, Billericay, CM12 0DA, AGB Environmental, ref:3235.1.3/Final. 27th February 2019.
- Geo-environmental & Geotechnical Assessment (Ground Investigation) Report 30 Radford Way, Billericay, CM12 0DA, Jomas Associates, ref: P2647J1906, 31st March 2020.
- Remedial Strategy & Verification Plan for 30 Radford Way, Billericay, CM12 0DA, P2647J1906, June 2020, updated to V2.0 July 2022, Jomas Associates Ltd.

1.1.5 Development permission has been granted by Basildon Borough Council with a number of conditions relating to various requirements.

1.1.6 Planning Conditions 13 to 16 of application ref 19/00401/FULL, relate to land contamination matters, as reproduced below:

Condition 13

A detailed site investigation (Phase II contaminated land assessment) shall be carried out prior to commencement of development to fully and effectively characterise the nature and extent of any land contamination and/or pollution of controlled waters. It shall specifically include a risk assessment that adopts the Source-Pathway-Receptor principle, in order that any potential risks are adequately assessed, taking into account the sites existing status and proposed new use. Two copies of the site investigation and findings shall be submitted to and approved in writing by the Local Planning Authority without delay upon completion.

Condition 14

A written method statement detailing the remediation requirements for land contamination and/or pollution of controlled waters affecting the site, shall be submitted to and approved in writing by the Local Planning Authority prior to commencement of development and all requirements shall be implemented and completed to the satisfaction of the Local Planning Authority. No deviation shall be made from this scheme without the express written agreement of the Local Planning Authority. If during redevelopment contamination not previously considered is identified, then the Local Planning Authority shall be notified immediately and no further work shall be carried out until a method statement detailing a scheme for dealing with the suspected contamination has been submitted to and approved in writing with the Local Planning Authority.

Condition 15

Following completion of measures identified in the remediation scheme, two copies of a full closure report shall be submitted to and approved in writing by the Local Planning Authority. The report shall provide verification that the required works regarding contamination have been carried out in accordance with the approved Method Statement(s). Post remediation sampling and monitoring results shall be included in the closure report to demonstrate that the required remediation has been fully met. The closure report shall include a completed certificate, signed by the developer, confirming that the required works regarding contamination have been carried out in accordance with the approved written method statement. A sample of the certificate to be completed is available in Appendix 2 of Land Affected by Contamination: Technical Guidance for Applicants and Developers.

Condition 16

If during redevelopment ground contamination is identified, then the Local Planning Authority shall be notified immediately and no further work shall be carried out until a method statement detailing a scheme for dealing with the suspected contamination has been submitted to and agreed in writing with the Local Planning Authority.

- 1.1.7 Condition 13 has been addressed by the Ground Investigation Report issued previously by Jomas.
- 1.1.8 Condition 14 has been addressed by the Remedial Strategy Report issued previously by Jomas.
- 1.1.9 The report herein aims to address Conditions 15 and 16 following completion of the required remedial measures.
- 1.2 Ground Investigation Summary**
 - 1.2.1 The ground investigation reported concentrations of benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(ah)anthracene and TPH band

>C₂₁-C₃₅ in soils in excess of generic assessment criteria for the protection of human health within a 'residential with plant uptake' end-use scenario.

1.2.2 Statistical assessments showed that the 95% upper confidence limits for benzo(a)pyrene, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(ah)anthracene and TPH banded > C₂₁- C₃₅ were in excess of their respective generic assessment criteria. For each determinand, a statistical outlier was identified as the sample WS2 - 0.25mbgl (the only sample to exceed GAC).

1.2.3 At this location, and at adjacent WS2A, asphalt fragments were identified within the Made Ground, considered likely to be responsible for the elevated PAHs and TPH concentrations detected.

1.2.4 On the basis of the statistical evaluation and the recorded ground conditions, it was considered that a "hotspot" of contamination localised in the area of WS2 and WS2A was present, associated with the presence of asphalt within the Made Ground. The Made Ground elsewhere on site was considered suitable for use with respect to human health receptors.

1.2.5 The land contamination assessments within the reports referenced above concluded that remedial works were required to bring the site into a condition that could be considered suitable for the proposed use.

1.2.6 The Remediation Strategy report was prepared following the findings of the Ground Investigation Report (also prepared by Jomas, dated March 2020).

1.3 Remediation Strategy

1.3.1 The remediation strategy was compiled by Jomas and published as referenced in Section 1.1.4. A summary of the strategy is provided below, although reference should be made to the full document for details.

1.3.2 The remediation strategy determined that the following remedial activities were required:

- The excavation and validation of a hotspot of contamination associated with asphalt fragments within the Made Ground.
- A watching brief following demolition and during enabling works.
- CS₂ soil gas mitigation measures were recommended within the proposed structures based on ground investigation results.
- Installation of appropriate utility pipework in accordance with supplier's guidelines.
- Validation testing upon soils imported to site to confirm their suitability for use.

1.3.3 This report summarises the above-mentioned works, providing the results of the chemical analysis of validation samples to determine whether the imported soils are suitable for use as well as documents supporting the implementation of the correct gas protection measures.

1.4 Limitations

1.4.1 Jomas Associates Ltd ('Jomas') has prepared this report for the sole use of Clontara Developments Ltd in accordance with the generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon by any other party without the explicit written agreement of Jomas. No other third-party warranty, expressed or implied, is made as to the professional advice included in this report. This report must be used in its entirety.

1.4.2 The records search was limited to information available from public sources; this information is changing continually and frequently incomplete. Unless Jomas has actual knowledge to the contrary, information obtained from public sources or provided to Jomas by site personnel and other information sources, have been assumed to be correct. Jomas does not assume any liability for the misinterpretation of information or for items not visible, accessible or present on the subject property at the time of this study.

1.4.3 Whilst every effort has been made to ensure the accuracy of the data supplied, and any analysis derived from it, there may be conditions at the site that have not been disclosed by the investigation and could not therefore be taken into account. As with any site, there may be differences in soil conditions between exploratory hole positions. Furthermore, it should be noted that groundwater conditions may vary due to seasonal and other effects and may at times be significantly different from those measured by the investigation. No liability can be accepted for any such variations in these conditions.

2 IMPORTED SOIL COVER LAYER VERIFICATION

- 2.1.1 On 23rd November 2023, a Jomas engineer attended the site to inspect and validate the areas of completed soft landscaping on site.
- 2.1.2 Four hand pits were completed within the areas of soft landscaping to examine the imported soils and obtain samples for testing.
- 2.1.3 As per the remedial strategy, although not a formal remedial measure, any topsoil imported to site must be suitable for the proposed use. As the topsoil is not a remedial requirement, there is no minimum soil thickness necessary beyond that required for landscaping purposes.
- 2.1.4 Pit locations are as identified on Figure 2. Photographs of the validation visit are provided as Figure 3.
- 2.1.5 Table 2.1 below summarises the observations made.

Table 2.1: Imported Topsoil Observations

Pit ID	Observations
TP1	GL – 0.35mbgl: Dark brown becoming brown clayey slightly gravelly sand. Sand is fine to coarse. Gravel consists of fine to medium sub-angular to sub-rounded flint and brick. (TOPSOIL/MADE GROUND) 0.36mbgl: Solid ground/gravel encountered.
TP5	GL – 0.10mbgl: Grass over dark brown clayey slightly gravelly sand. Sand is fine to coarse. Gravel consists of fine to medium sub-angular to sub-rounded flint and brick. (TOPSOIL/MADE GROUND) 0.10mbgl: Solid ground/gravel encountered.
TP6	GL – 0.17mbgl: Grass over dark brown clayey slightly gravelly sand. Sand is fine to coarse. Gravel consists of fine to medium sub-angular to sub-rounded flint and brick. (TOPSOIL/MADE GROUND) 0.17mbgl: Solid ground/gravel encountered.
TP7	GL – 0.15mbgl: Grass over dark brown clayey slightly gravelly sand. Sand is fine to coarse. Gravel consists of fine to medium sub-angular to sub-rounded flint and brick. (TOPSOIL/MADE GROUND) 0.15mbgl: Solid ground/gravel encountered.

- 2.1.6 4No. samples were submitted to a UKAS and MCERTS accredited laboratory for testing against a standard suite of common contaminants and asbestos. Details of the basic suite testing are provided below in Table 2.2.
- 2.1.7
- 2.1.8
- 2.1.9

SECTION 2
IMPORTED TOPSOIL COVER LAYER
VERIFICATION

2.1.10 Table 2.2: Basic Suite of Determinands

2.1.11	DETERMINAND	LIMIT OF DETECTION (mg/kg)	UKAS ACCREDITATION	TECHNIQUE
	Arsenic	<2	Y (MCERTS/ISO 17025)	ICP-OES
	Cadmium	<0.2	Y (MCERTS/ISO 17025)	ICP-OES
	Chromium	<2	Y (MCERTS/ISO 17025)	ICP-OES
	Chromium (Hexavalent)	<2	N	ICP-OES
	Lead	<3	Y (MCERTS/ISO 17025)	ICP-OES
	Mercury	<1	N	ICP-OES
	Nickel	<3	Y (MCERTS/ISO 17025)	ICP-OES
	Selenium	<3	N	ICP-OES
	Copper	<4	Y (MCERTS/ISO 17025)	ICP-OES
	Zinc	<3	Y (MCERTS/ISO 17025)	ICP-OES
	Boron (Water Soluble)	<1	N	ICP-OES
	pH Value	+/- 0.1	Y (MCERTS/ISO 17025)	pH Probe
	Sulphate (Water Soluble)	<0.01	Y (MCERTS/ISO 17025)	Ion Chromatography
	Total Cyanide	<2	N	Distillation
	Speciated/Total PAH	<0.1	Y (MCERTS/ISO 17025)	GC/MS
	Phenols	<2	N	CFA
	Total Petroleum Hydrocarbons (banded)	< 1 – < 6 (depending on carbon band)	Y (MCERTS/ISO 17025)	GC/FID

2.1.12

Table 2.2: Basic Suite of Determinands

DETERMINAND	LIMIT OF DETECTION (mg/kg)	UKAS ACCREDITATION	TECHNIQUE
Arsenic	<2	Y (MCERTS/ISO 17025)	ICP-OES
Cadmium	<0.2	Y (MCERTS/ISO 17025)	ICP-OES
Chromium	<2	Y (MCERTS/ISO 17025)	ICP-OES
Chromium (Hexavalent)	<2	N	ICP-OES
Lead	<3	Y (MCERTS/ISO 17025)	ICP-OES
Mercury	<1	N	ICP-OES
Nickel	<3	Y (MCERTS/ISO 17025)	ICP-OES
Selenium	<3	N	ICP-OES
Copper	<4	Y (MCERTS/ISO 17025)	ICP-OES
Zinc	<3	Y (MCERTS/ISO 17025)	ICP-OES
Boron (Water Soluble)	<1	N	ICP-OES
pH Value	+/- 0.1	Y (MCERTS/ISO 17025)	pH Probe
Sulphate (Water Soluble)	<0.01	Y (MCERTS/ISO 17025)	Ion Chromatography
Total Cyanide	<2	N	Distillation
Speciated/Total PAH	<0.1	Y (MCERTS/ISO 17025)	GC/MS
Phenols	<2	N	CFA
Total Petroleum Hydrocarbons (banded)	< 1 – < 6 (depending on carbon band)	Y (MCERTS/ISO 17025)	GC/FID

2.2 Verification Test Results

2.2.1 The results of the chemical testing are outlined below in Table 2.4 to Table 2.6. The site specific criteria used to derive the relevant screening criteria are provided in Table 2.3.

2.2.2 Full laboratory test certificates are provided in Appendix 2.

Table 2.3: Site Specific Data

Input Details	Value
Land Use	Residential without plant uptake
Soil Organic Matter	1%

SECTION 2
IMPORTED TOPSOIL COVER LAYER
VERIFICATION

Table 2.4: Soil Laboratory Analysis Results – Metals, Metalloids, Phenol, Cyanide – Imported Topsoil

Determinand	Unit	No. samples tested	Screening Criteria	Min	Max	No. Exceeding
Arsenic	mg/kg	4	40 S4UL	6	6	0
Cadmium	mg/kg	4	85 S4UL	0.3	0.7	0
Chromium	mg/kg	4	910 S4UL	16	22	0
Lead	mg/kg	4	310 C4SL	92	137	0
Mercury	mg/kg	4	56 S4UL	<1	<1	0
Nickel	mg/kg	4	180 S4UL	10	16	0
Copper	mg/kg	4	7100 S4UL	30	86	0
Zinc	mg/kg	4	40000 S4UL	103	291	0
Total Cyanide ^B	mg/kg	4	33 CLEA v 1.06	<1	<1	0
Selenium	mg/kg	4	430 S4UL	<2	<2	0
Boron Water Soluble	mg/kg	4	11000 S4UL	<1	1.4	0
Phenols	mg/kg	4	440 S4UL	<2	<2	0

Notes:

^B Generic assessment criteria derived for free inorganic cyanide.

Table 2.5: Soil Laboratory Analysis Results – Polycyclic Aromatic Hydrocarbons (PAHs) – Imported Topsoil

Determinand	Unit	No. Samples Tested	Screening Criteria	Min	Max	No. Exceeding
Naphthalene	mg/kg	4	S4UL 2.3	<0.1	<0.1	0
Acenaphthylene	mg/kg	4	S4UL 2900	<0.1	<0.1	0
Acenaphthene	mg/kg	4	S4UL 3000	<0.1	<0.1	0
Fluorene	mg/kg	4	S4UL 2800	<0.1	<0.1	0
Phenanthrene	mg/kg	4	S4UL 1300	0.14	0.41	0
Anthracene	mg/kg	4	S4UL 2300	<0.1	<0.1	0
Fluoranthene	mg/kg	4	S4UL 1500	0.42	1.04	0
Pyrene	mg/kg	4	S4UL 3700	0.38	0.87	0
Benzo(a)anthracene	mg/kg	4	S4UL 11	0.18	0.44	0
Chrysene	mg/kg	4	S4UL 30	0.23	0.47	0
Benzo(b)fluoranthene	mg/kg	4	S4UL 3.9	0.28	0.58	0
Benzo(k)fluoranthene	mg/kg	4	S4UL 110	<1	0.16	0
Benzo(a)pyrene	mg/kg	4	S4UL 3.2	0.27	0.53	0

**SECTION 2
IMPORTED TOPSOIL COVER LAYER
VERIFICATION**

Determinand	Unit	No. Samples Tested	Screening Criteria	Min	Max	No. Exceeding
Indeno(123-cd)pyrene	mg/kg	4	S4UL 45	0.15	0.28	0
Dibenzo(ah)anthracene	mg/kg	4	S4UL 0.31	<0.1	<0.1	0
Benzo(ghi)perylene	mg/kg	4	S4UL 360	0.14	0.27	0
Total PAH	mg/kg	4	- -	2.2	5	-

Table 2.6: Soil Laboratory Analysis Results – Total Petroleum Hydrocarbons (TPH) – Imported Topsoil

TPH Band	Unit	No. Samples Tested	Screening Criteria	Min	Max	No. Exceeding
C ₈ -C ₁₀	mg/kg	4	S4UL 27	<1	<1	0
>C ₁₀ -C ₁₂	mg/kg	4	S4UL 130	<1	<1	0
>C ₁₂ -C ₁₆	mg/kg	4	S4UL 1100	<1	<1	0
>C ₁₆ -C ₂₁	mg/kg	4	S4UL 1900	2	5	0
>C ₂₁ -C ₃₅	mg/kg	4	S4UL 1900	13	46	0
Total TPH	mg/kg	4	- -	15	51	-

Note: *The lower value of guidelines for Aromatic/Aliphatics has been selected

2.3 Asbestos

2.3.1 In addition to the suites above, all 4No samples were screened for the presence of asbestos.

2.3.2 No asbestos was detected in any of the samples tested.

2.4 Conclusions

2.4.1 As shown in the tables above, no contaminants included within the scheduled testing suites returned results above the relevant screening criteria.

2.4.2 On this basis the topsoil is considered suitable and safe for use on site with a commercial end use.

3 GAS PROTECTION MEASURES

3.1 Background

3.1.1 As defined within the Remediation Strategy, gas protection measures are required in accordance with a CS2 classification. A minimum of 3.5 protection points are required in accordance with BS8485.

3.2 Gas Membrane Verification

3.2.1 The client has provided Jomas with a gas membrane verification report produced by Membrane Testing Solutions Limited, relating to the membrane installed at the site.

3.2.2 The report concludes that the membrane installation works have been completed, passed and verified in accordance with CIRIA 735 and are therefore considered to be providing 2 gas protection points in accordance with BS8485.

3.2.3 The membrane verification reports are provided in Appendix 3.

3.3 Structural Gas Protection

3.3.1 The remaining points are being provided by the cast in-situ reinforced ground bearing slab to provide 1.5 points as confirmed within section 4 of the provided gas membrane verification report shown in Appendix 3.

3.3.2 The cast in-situ reinforced ground bearing slab is considered suitable to provide at least 1.5 protection points and therefore the required 3.5 gas protection points have been achieved in accordance with BS8485.

4 HOTSPOT REMOVAL

4.1 Background

4.1.1 As described in the remediation strategy, following removal of hardstanding, the Made Ground soils in the vicinity of WS2/WS2a that were reported to contain fragments of asphalt required removal.

4.2 Removal

4.2.1 Jomas understands the affected area was excavated as part of surface water drainage activities and that soils were disposed of off-site. The client has provided photographs of the area during excavation, provided as Figure 4.

4.2.2 Following removal of the soils, the area in question has been encapsulated with hardstanding asphalt as part of an onsite car park. The hardstanding present will effectively provide a barrier between remaining affected soils, if present, and end users of the site.

5 SITE OBSERVATIONS - OTHERS

5.1 Utilities Pipework

5.1.1 The client has confirmed that utility pipework has been installed in accordance with the supplier's requirements, and provided associated documentation (included in Appendix 5).

5.2 Evidence of Previously Uncharacterised Contamination

5.2.1 The client has confirmed that no further evidence of contamination was observed during the construction phase of works on site.

5.2.2 Correspondence to this effect is provided in Appendix 4.

5.3 Waste Disposal

5.3.1 Documentation for the disposal of waste soils removed from site are provided in Appendix 6.

6 CONCLUSIONS

6.1 Conclusions

6.1.1 The results of the validation work undertaken to date indicate that the asphalt impacted soils have been removed from the site and encapsulated, gas protection measures have been successfully installed, and soft landscaping soils have met the required standards for use as such.

6.1.2 No further remedial measures are considered necessary and the site is considered suitable for the proposed use.

7 REFERENCES

British Standards Institution (2015) BS 3882 Specification for topsoil and requirements for use. BSI, London

British Standards Institution (2011) BS 10175 Code of practice for the investigation of potentially contaminated sites. BSI, London

British Standards Institution (2013) BS 8576 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOC's), BSI, London

British Standards Institution BS 5930:2015+A1:2020 Code of practice for ground investigations. BSI, London

British Standards Institution (2015) BS 8485:2015 Incorporating corrigendum No.1 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. BSI, London

CIRIA C665 (2007) Assessing risks posed by hazardous ground gases to buildings. CIRIA, London

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Environment Agency (2020) Land contamination risk management (LCRM)

Environment Agency, NHBC & CIEH (2008) Guidance for the safe development of housing on land affected by contamination. R & D Publication 66. London: Environment Agency

LQM/CIEH S4ULs. LQM, 2014

Ministry of Housing, Communities & Local Government: National Planning Policy Framework. February 2019.

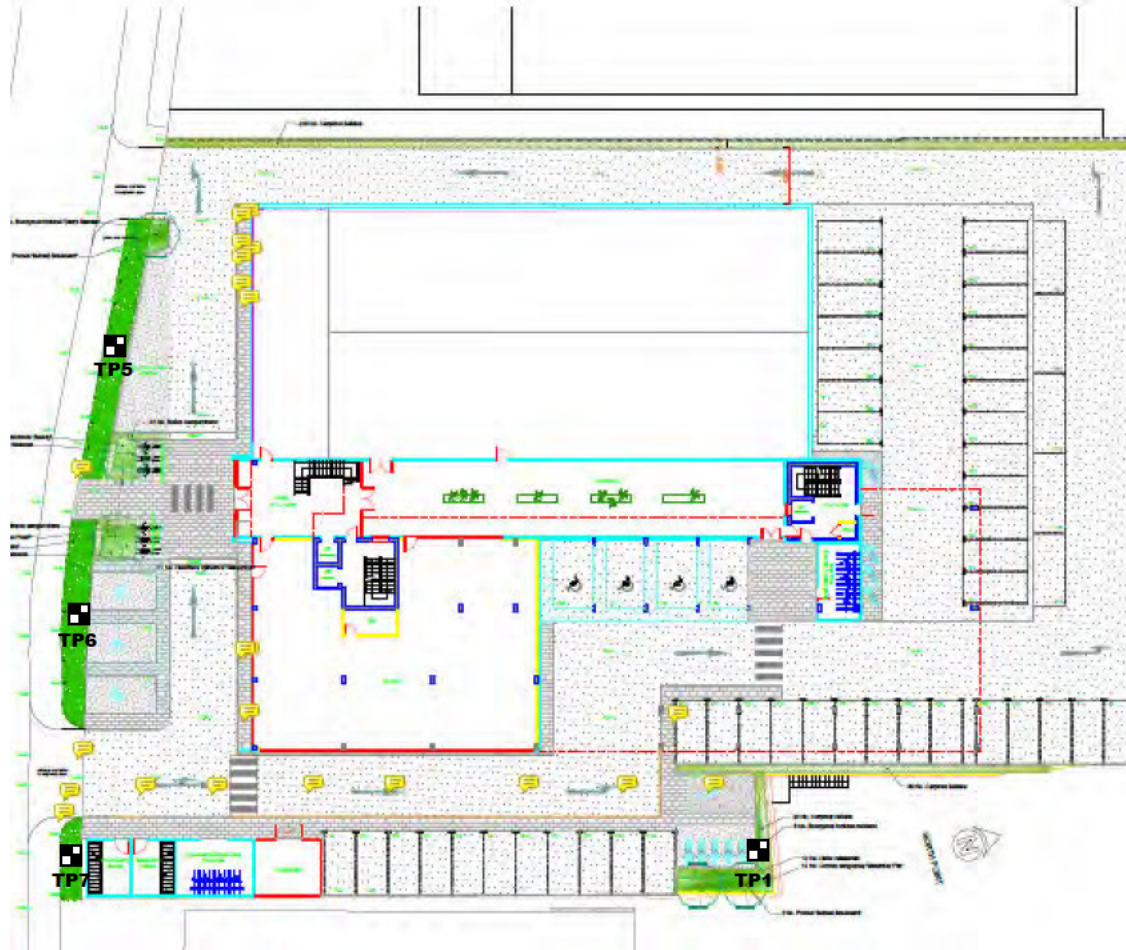
APPENDICES

APPENDIX 1 – FIGURES

PROJECT NAME:	30 Radford Way, CM12 0DA	CLIENT:	Clontara Developments Ltd
TITLE:	Site Location Plan	PROJECT NO.:	P2647J1906
DATE:	February 2020	FIGURE:	1



PROJECT NAME	Radford Way, Billericay	CLIENT	Clontara Developments Ltd
TITLE	Completed Verification Plan	PROJECT NO.	P2647J1906
DATE	November 2023	FIGURE NO.	2



PROJECT NAME	30 Radford Way	CLIENT	Clontara Developments Ltd
TITLE	Topsoil validation Photoplan – November 2023	FIGURE	3
Photo 1: TP5 shown to a depth of 0.1mbgl.		Photo 2: Arisings from TP5.	
			

PROJECT NAME	30 Radford Way	CLIENT	Clontara Developments Ltd
TITLE	Topsoil validation Photoplan – November 2023	FIGURE	3
Photo 3: TP6 shown to a depth of 0.17mbgl.		Photo 4: Arisings from TP6.	



PROJECT NAME	30 Radford Way	CLIENT	Clontara Developments Ltd
TITLE	Topsoil validation Photoplan – November 2023	FIGURE	3
Photo 5: TP7 shown to a depth of 0.15mbgl.		Photo 6: Arisings from TP7.	




PROJECT NAME	30 Radford Way	CLIENT	Clontara Developments Ltd
TITLE	Topsoil validation Photoplan – November 2023	FIGURE	3
Photo 7: TP1 shown to a depth of 0.35mbgl.		Photo 8: Arisings from TP7.	



PROJECT NAME	30 Radford Way	CLIENT	Clontara Developments Ltd
TITLE	Topsoil validation Photoplan – November 2023	FIGURE	3
Photo 9: Wide angle view of the front of site.		Photo 10: Area where TP7 was positioned.	
			

PROJECT NAME	30 Radford Way	CLIENT	Clontara Developments Ltd
TITLE	Topsoil validation Photoplan – November 2023	FIGURE	3
Photo 11: TP5 and TP6 positioned in landscaped area parallel to the road.		Photo 12: View of the front of the building on site.	



PROJECT NAME	30 Radford Way	CLIENT	Clontara Developments Ltd
TITLE	Topsoil validation Photoplan – November 2023	FIGURE	3
Photo 13: View of the south facing side of site.			
			

PROJECT NAME	30 Radford Way	CLIENT	Clontara Developments Ltd
TITLE	Hotspot Removal Photographs	FIGURE	4
Photo 1: Removal of soil and installation of drainage infrastructure.		Photo 2: Backfilled excavation.	



PROJECT NAME	30 Radford Way	CLIENT	Clontara Developments Ltd
TITLE	Hotspot Removal Photographs	FIGURE	4
Photo 3: Hard cover across the finished area.		Photo 4: Hard cover across the finished area.	



APPENDIX 2 – LABORATORY CHEMICAL TEST DATA (TOPSOIL VALIDATION TESTING)



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24 Sarum Complex
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Uxbridge
UB8 2RZ

Derwentside Environmental Testing Services Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 23-14615

Site Reference: 30 Radford Way, Billericay, CM12 0DA

Project / Job Ref: JJ1906

Order No: P2647JJ1906.17

Sample Receipt Date: 28/11/2023

Sample Scheduled Date: 28/11/2023

Report Issue Number: 1

Reporting Date: 06/12/2023

Authorised by:



Steve Knight
Customer Support Manager

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.



DETS Ltd
 Unit 1, Rose Lane Industrial Estate
 Rose Lane
 Lenham Heath
 Maidstone
 Kent ME17 2JN
 Tel : 01622 850410



Soil Analysis Certificate					
DETS Report No: 23-14615	Date Sampled	28/11/23	28/11/23	28/11/23	28/11/23
Jomas Associates Limited	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: 30 Radford Way, Billericay, CM12 ODA	TP / BH No	TP1	TP5	TP6	TP7
Project / Job Ref: JJ1906	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: P2647JJ1906.17	Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied
Reporting Date: 06/12/2023	DETS Sample No	687681	687682	687683	687684

Determinand	Unit	RL	Accreditation	28/11/23	28/11/23	28/11/23	28/11/23
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	8.1	8.1	8.1	8.2
Total Cyanide	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	1017	668	476	740
Total Sulphate as SO ₄	%	< 0.02	MCERTS	0.10	0.07	0.05	0.07
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	135	20	35	21
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.14	0.02	0.04	0.02
Arsenic (As)	mg/kg	< 2	MCERTS	6	6	6	6
W/S Boron	mg/kg	< 1	NONE	1.3	1.3	< 1	1.4
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.7	0.5	0.3	0.6
Chromium (Cr)	mg/kg	< 2	MCERTS	17	19	22	16
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	86	39	30	62
Lead (Pb)	mg/kg	< 3	MCERTS	137	117	92	113
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	16	12	10	12
Selenium (Se)	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2
Zinc (Zn)	mg/kg	< 3	MCERTS	291	159	103	195
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
 Subcontracted analysis (S)



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 23-14615	Date Sampled	28/11/23	28/11/23	28/11/23	28/11/23	
Jomas Associates Limited	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: 30 Radford Way, Billericay, CM12 0DA	TP / BH No	TP1	TP5	TP6	TP7	
Project / Job Ref: JJ1906	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: P2647JJ1906.17	Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	
Reporting Date: 06/12/2023	DETS Sample No	687681	687682	687683	687684	

Determinand	Unit	RL	Accreditation				
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	0.41	0.17	0.14	0.18
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	1.04	0.51	0.42	0.63
Pyrene	mg/kg	< 0.1	MCERTS	0.87	0.50	0.38	0.57
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.44	0.23	0.18	0.33
Chrysene	mg/kg	< 0.1	MCERTS	0.47	0.27	0.23	0.33
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.58	0.33	0.28	0.45
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.16	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.53	0.33	0.27	0.41
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.28	0.17	0.15	0.21
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.27	0.18	0.14	0.21
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	5	2.7	2.2	3.3



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Soil Analysis Certificate - EPH Banded (Type D)						
DETS Report No: 23-14615	Date Sampled	28/11/23	28/11/23	28/11/23	28/11/23	
Jomas Associates Limited	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: 30 Radford Way, Billericay, CM12 0DA	TP / BH No	TP1	TP5	TP6	TP7	
Project / Job Ref: JJ1906	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: P2647JJ1906.17	Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	
Reporting Date: 06/12/2023	DETS Sample No	687681	687682	687683	687684	

Determinand	Unit	RL	Accreditation				
EPH (>C8 - C10) : EH 1D Total	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1
EPH (>C10 - C12) : EH 1D Total	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1
EPH (>C12 - C16) : EH 1D Total	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1
EPH (>C16 - C21) : EH 1D Total	mg/kg	< 1	MCERTS	5	3	2	3
EPH (>C21 - C35) : EH 1D Total	mg/kg	< 6	NONE	46	27	13	25
EPH (C8 - C35) : EH 1D Total	mg/kg	< 6	NONE	51	30	15	28



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Soil Analysis Certificate - Sample Descriptions

DETS Report No: 23-14615	
Jomas Associates Limited	
Site Reference: 30 Radford Way, Billericay, CM12 0DA	
Project / Job Ref: JJ1906	
Order No: P2647JJ1906.17	
Reporting Date: 06/12/2023	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
687681	TP1	None Supplied	None Supplied	17.3	Brown sandy clay with stones
687682	TP5	None Supplied	None Supplied	22	Brown sandy clay with stones and vegetation
687683	TP6	None Supplied	None Supplied	14.8	Brown sandy clay with stones
687684	TP7	None Supplied	None Supplied	17.6	Brown sandy clay with stones

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{IS}

Unsuitable Sample ^{US}

Soil Analysis Certificate - Methodology & Miscellaneous Information	
DETS Report No: 23-14615	
Jomas Associates Limited	
Site Reference: 30 Radford Way, Billericay, CM12 ODA	
Project / Job Ref: JJ1906	
Order No: P2647JJ1906.17	
Reporting Date: 06/12/2023	

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content: determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCS	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received



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List of HWOL Acronyms and Operators
DETS Report No: 23-14615
Jomas Associates Limited
Site Reference: 30 Radford Way, Billericay, CM12 ODA
Project / Job Ref: JJ1906
Order No: P2647JJ1906.17
Reporting Date: 06/12/2023

Acronym	Description
HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eq. EH+HS_Total or EH_CU+HS_Total

Det - Acronym
EPH Spill Response Banded (C10 - C12) - EH_1D_Total
EPH Spill Response Banded (C12 - C16) - EH_1D_Total
EPH Spill Response Banded (C16 - C21) - EH_1D_Total
EPH Spill Response Banded (C21 - C35) - EH_1D_Total
EPH Spill Response Banded (C8 - C10) - EH_1D_Total
EPH Spill Response Banded (C8 - C35) - EH_1D_Total

APPENDIX 3 – GAS MEMBRANE VERIFICATION

RETROSPECTIVE GROUND GAS MITIGATION AND 3rd PARTY INDEPENDENT INSPECTION, TESTING & VALIDATION REPORT:

FOR MATERIALS TO BE INSTALLED AT:

**30, RADFORD WAY,
BILLERICAY, CM12 0DA**

Document Reference No: MTS.VR.747-MS

Client: MB Membranes Limited

Dated: July 2023



Client Name: MB Membranes Limited
Reference: MTS.VR.747-MS
Issue: **FINAL**
Date: 4th July 2023

Approval Status: **PASS IN FULL**

Prepared by: Michael A Smith
Position: Senior Validation Surveyor



Revisions:

This 3rd party ground gas mitigation and validation report has been prepared by MembraneTestingSolutions Ltd with all reasonable skill, care, and diligence within the terms of the contract with the client, incorporation of our General Terms and Conditions of Business and considering the resources devoted to us by agreement with the client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

This 3rd party ground gas mitigation and validation report is confidential to our client, and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on this report at its own risk.



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Appendix A – Validation Surveyors/Installer Certificates of Competence

Mr Barrie Ackroyd (MTS Ltd)
 Mr Michael Smith (MTS Ltd)
 Mr Robert Boosey (MTS Ltd)
 Mr Carl Orr (MTS Ltd)

Appendix B – Design Drawings

Barden Chapman Civil & Structural Design Consultants

- 19738-S-2201 - Sections and Details - Sheet 2
- 19738-S-2202 – Sections and Details – Sheet 3
- 19738-S-2203 – Sections and Details – Sheet 4
- 19738-S-2204 – Sections and Details – Sheet 5
- 19738-S-2205 – Sections and Details – Sheet 6

Devise Architecture & Design LTD

- DA20–024–060 - Rev D – Proposed Site Plan
- DA20–024–105 - Rev M – Proposed Ground Floor Plan – Sheet 1
- DA20–024–106 - Rev D – Proposed Ground Floor Plan – Sheet 2
- Sheet 1 MTS Progression Mark-up
- Sheet 2 MTS Progression Mark-up

Appendix C – JUTA Material Specifications

- Juta GP5 Membrane
- JUTA GR Self-Adhesive Membrane
- JUTA GP Bitumen Primer

Appendix D – Project Survey Sheets

Gas Protection Inspection & Validation Record (Example)
 Independent Inspection & Validation - Certificate of Conformance (Example)
 CL:Aire Residential Declaration of Conformance (Example)



EXECUTIVE SUMMARY

1. LIMITATIONS

Membrane Testing Solutions Ltd (MTS Ltd) have prepared this 3rd party ground gas mitigation and validation report in accordance with the instructions of MB Membranes (The Client) under the terms of the appointment for the 3rd party ground gas mitigation system, inspection, testing, validation & reporting.

This retrospective 3rd party ground gas mitigation and validation report is limited to the proposed ground gas protection measures installed to the existing building meeting industry and current best practices. MTS Ltd have not provided ground gas mitigation design proposals for this site, therefore professional Indemnity liability is limited to £2M for our gas mitigation design and validation works and to ensure the specified gas mitigation measures meet site specific contaminants.

This retrospective 3rd party ground gas mitigation and validation report has been prepared in accordance with the information currently received, along with industry best practices and in conjunction with the relevant best practice and guidance documents listed below, of which our MD was a contributor and member of the steering committee for the Ciria C735 publication “Good practice on the testing and verification of protection systems for buildings against hazardous ground gases” (2014). MTS Ltd were also contributors and part funders on the steering committees for the CIRIA 773 project ‘A guide to small brownfield sites and land contamination’ C795 project ‘Retrospective Fitting of Gas Protective Measures to Existing Buildings’ released in December 2020 and CIRIA 801 – ‘Ground Gas - a site managers guide released in December 2021’.

We are pleased to advise that our Managing Director Mr Barrie Ackroyd has successfully completed the Validation & Integrity Testing Course provided by the British Geomembrane Association for validation, which is also backed by the CITB. Membrane Testing Solutions Ltd are a member of the British Geomembrane Association and are pleased to advise we are registered with CQMS/SSIP, The Radon Council, The Property Care Association, CL:Aire and we are proud to be a founding member of the British Verification Council (BVC) of which Mr Ackroyd is Chairperson.

Mr Ackroyd has achieved the Level 3 Assessors Award for the NVQ Level 4 qualification in Validation of Ground Gas Protection Systems, we are also pleased to advise he has successfully achieved CL:Aire accreditation as a Specialist in Gas Protection Validation (SGPV). Our Senior Validation Surveyor Mr Michael Anthony Smith has qualified in the NVQ Level 4 for Verification of Ground Gas Protection Systems (assessed by others) and has achieved CL:Aire TGPV accreditation.



Guidance Reference Documents:

- Ground Gas Handbook “NHBC Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present” (2007)
- Ciria C665 “Assessing risks posed by hazardous ground gases to buildings” (2007)
- Ciria C716 “Remediating and mitigating risks from volatile organic compound (VOC) vapours from land affected by contamination” (2012)
- Ciria C735 “Good practice on the testing and verification of protection systems for buildings against hazardous ground gases (2014)
- Ciria C748 “Guidance on the use of plastic membranes as VOC vapour barriers” (2014)
- BS 8485:2015+A1:2019 “Code of practice for the design of protective measures for methane and carbon dioxide ground gasses for new buildings” (2019)
- Ciria C795 “Retrofitting hazardous ground gas protection measures in existing or refurbished buildings” (2020)
- Ciria C801 “Ground Gas – a site managers guide” (2021)



2. BACKGROUND INFORMATION

MembraneTestingSolutions Ltd (MTS Ltd) were approached by Mr Neil McNamara of MB Membranes Ltd on the 5th June 2023 having worked with MTS on previous projects with excellent installations observed and validated. Mr McNamara made us aware that MB Membranes were installing gas membranes on this project which included a change of building use and new build extensions.

The site is located at:

30, Radford Way, Billericay, CM12 0DA

In accordance with the above we offered a quotation for the retrospective ground gas mitigation and validation services with our proposed verification measures and reporting processes. MTS Ltd were subsequently commissioned by the client for the testing, validation and reporting processes required on the retrospectively installed gas protection measures installed on this project. As the installations were being carried out on two occasions, MTS had quoted for two validation visits and one CL:Aire report.

Upon acceptance of our costs and commencement of the project our validation of the retrospectively installed membranes commenced on the 16th June 2023 and Our validation surveyor commented on the good standard of workmanship observed. The scope of validation consisted of the retrospectively installed GP5 membrane and sealing to the previously installed DPC to the ground level slab only. The DPC was not validated by MTS however the visible sections on the inside of the building were.

The following is our validation and reporting processes for the gas protection measures installed to this project.

3. GROUND GAS MONITORING

MTS Ltd received a remedial strategy and verification plan document from the client performed by Jomas Engineering Environmental. Report no. P2647J1906/TE. The report classified the site as a 'CS2 Risk' as noted below;

Gas Protection Measures

Following 4No return visits to monitor gas concentrations at the site, it was concluded that the site should be Considered Situation 2, meaning basic gas protection measures are considered necessary.

In accordance with BS8485, Type B buildings on a CS2 site require 3.5 protection points. This can be achieved in a number of ways, within BS8485 it is recommended that a range of protection measures are utilised with a minimum of two separate methods chosen from the three groupings (structural, ventilation and barrier).



4. BS 8485:2015+A1:2019 COMPLIANCE

Using the tabled contents of the BS 8485:2015+A1:2019 document, along with the CS2 site classification, we are able to calculate the above points score for the ground gas mitigation measures, which is achieved by the following:

Table 3, Building Type	Table 4, Gas Protection Score by CS and Type of Building	Table 5, Gas Protection Scores for the Structural Barrier	Table 6, Gas Protection Scores for Ventilation Protection Measures	Table 7, Gas Protection Score for the Gas Resistant Membrane
Type 'A' Private	CS2 + Type A = 3.5 Points Required	Cast in Situ Re- enforced Ground Bearing Slab = 1.5 Points	Passive ventilation of the underfloor void to 'Good Performance' = 0 Points	Gas membrane installed and validated in accordance with CIRIA C735 = 2.0 Points

Total 'MINIMUM' Points Score from the above = (T5 = 1.5 + T7 = 2.0) = **3.5 Points Achieved**, which meets the requirements of the BS 8485:2015+A1:2019 document.

However, the BS 8485:2015+A1:2019 should not be used to calculate a points score for hydrocarbon vapour mitigation design measures as this document is only for Carbon Dioxide and Methane.

5. DESIGN DRAWINGS

MTS Ltd received drawings inclusive of proposed ground floor plans and section details for the project produced by Barden Chapman and Devise Architecture & Design.

Barden Chapman Civil & Structural Design Consultants

- 19738-S-2201 - Sections and Details - Sheet 2
- 19738-S-2202 – Sections and Details – Sheet 3
- 19738-S-2203 – Sections and Details – Sheet 4
- 19738-S-2204 – Sections and Details – Sheet 5
- 19738-S-2205 – Sections and Details – Sheet 6

Devise Architecture & Design LTD

- DA20-024-060 - Rev D – Proposed Site Plan
- DA20-024-105 - Rev M – Proposed Ground Floor Plan – Sheet 1
- DA20-024-106 - Rev D – Proposed Ground Floor Plan – Sheet 2
- Sheet 1 MTS Progression Mark-up
- Sheet 2 MTS Progression Mark-up

Copies of all drawings noted below are appended in Appendix. B of this report.

6. MATERIAL SPECIFICATIONS

MB Membranes installed a premium membrane on this project. The materials are supplied by the following manufacturer:

JUTA UK Limited
Melton Grove Works
Blackpool Road



Lytham
FY8 5PL

Tel: 01772 754 177
Contact: Mr Patrick Flood
Email: info@juta.co.uk
Web: www.juta.co.uk

The gas resistant materials installed on this project are as follows;

- JUTA GP5 Gas Membrane
- JUTA GR Self-Adhesive Membrane
- JUTA GP Primer

The above Material Specifications may be found appended in Appendix. C of this report.

7. MEMBRANE INSTALLATION CONTRACTOR

MTS Ltd confirm that MB Membranes Ltd installed the gas mitigation system to this project and are specialist NVQ Level 2 qualified gas membrane installation operatives, or at least overseen by someone who holds his qualification, which is in accordance with the CIRIA C716, C735, C748 & BS 8485:2015+A1:2019 best practice documents.

The relevant qualification for gas membrane installations is as follows;

Cskills Awards L2 NVQ Diploma in sub-structure work occupations (construction) – Installation of gas membranes:
<http://tinyurl.com/lj8w7ay>

MTS Ltd have worked with MB Membranes on many occasions with excellent results observed. Please find below their contact details;

MB Membranes Ltd
7 Cecil Court
Harlow
Essex
CM18 7QR

Contact: Mr Neil McNamara
Tel: 01279 444 300
Email: neil@mbmembranes.co.uk

MTS Ltd have validated this companies' workmanship on numerous occasions and consider them all to be premier specialist installers within the UK. They all also employ fully welded seaming techniques where ever able whereby reducing the potential failure of butyl taped joints.

8. PROPOSED INSPECTION, TESTING AND VALIDATION REGIME

It was proposed the visible DPC and installed gas protective materials were 3rd party independently inspected, tested and validated in accordance with the Ciria C735 best practice document by a competent and qualified validation surveying company, namely Membrane Testing Solutions Ltd.



Due to the perceived CS2 risk associated with the site and with the installation of gas mitigation measures by NVQ Level 2 specialist installation operatives, installed above the beam and block floor slabs it is proposed to apply a 'Reduced Level' of validation processes on this project.

All aspects of the gas mitigation measures were checked and validated in some manner, inclusive of specialist membrane installation and 3rd party inspection, testing and validating the gas membrane inclusive of checking service pipe sealings and the like.

We had allowed for up to 2no site validation visits to validate the gas membranes in the following manner:

- The surveyor will mark up a drawing with the position and numbers of existing periscopic air bricks on a layout drawing.
- We will also ensure compliance with the 3m maximum centres design criteria for additional cavity vents below the cavity tray/DPC and mark them on a layout plan.
- We have allowed 1no site visit as we have assumed all plots will be remediated at the same time. However should the membranes be installed in phases, then additional validation visits will be necessary.
- It is proposed MTS Ltd employ a detailed visual inspection and seam pick probe testing to 100% of site seams, in line with ASTM D4437-2018 test method.
- QA certification and record of gas/vapour mitigation measure forms will be completed and submitted to the client for confirmation of validation pass of which these documents will be included within our final sign off validation report.
- Produce a final sign off validation report for each block along with inclusion of installers QA documentation and photographic evidence taken by MTS Ltd on site, to further include 1no CL:Aire Residential Declaration of Conformity certificate for each block.

MTS Ltd consider the above proposed site visit will provide what is considered sufficient inspection, testing and validation practices to ensure that the gas mitigation measures are installed in accordance with the design, material specifications and industry best practices.

No membranes will be validated and signed off by MTS Ltd until a minimum acceptable standard has been achieved, whereby ensuring the membrane installation is suitably managed to achieve maximum confidence to the suitability of the installed materials.

Should any site inspections prove to be unacceptable and prove such on a continual basis, MTS Ltd reserve the right to increase our site inspection validation visit numbers, to ensure that the installed materials are sufficiently managed ensuring the materials are fit for purpose and future occupant's health and safety is maintained.

8.1 INSPECTION, VALIDATION & TESTING METHOD STATEMENT

1. The Validation Surveyor will be suitably experienced and qualified to carry out a detailed visual inspection and seam integrity testing of the installed gas membrane system.
2. All membrane areas will be subject to independent, inspection validation and seam integrity testing.
3. The Validation Surveyor will visually inspect 100% of the installed gas/vapour protection measures to the areas submitted for inspection.
4. Seam pick testing will be performed to 100% of all site seams provided for inspection, inclusive of service pipe seals and welded/taped joints etc. ensuring all seams are suitably bonded/adhered. Seam pick testing comprises of a hand-held implement with a wooden handle and 6mm diameter x 250mm long shaft terminating in a point at 90° to the main shaft. The point of the seam pick test is drawn down the length of the seam seeking intrusion of the implement into the seam whereby indicating a defect. This testing method is also used for difficult detailing or intricate works such as around pipe sealing details etc. This test method also complies to the ASTM D4437 2018 test criteria.
5. Any faults/rips/tears/punctures or un-bonded seams will be "number marked" and recorded for repair on a defect position plan. Repair methods will be agreed with the installation contractor.



6. All repairs will be re-inspected for suitability, with photographic evidence given in the final report provided at the end of the contract.
7. Upon completion of the test and re-test of any subsequent repairs found, the gas/vapour membrane area will be signed off and certified as integral.
8. The Validation Surveyor will complete a “Independent Inspection & Validation Certificate of Conformance” for each plot and photographic evidence will be taken. The project survey sheets and photographic logs will be incorporated in the final report submission.
9. Upon completion of the validation/integrity test inspection, a validation certificate stating the outcome of the inspection whether being a pass or fail will be issued. When the inspection test shows a pass, the membrane should be immediately protected using the manufacturers recommended system, otherwise follow-on construction works are suitably risk assessed to ensure the geomembrane remains intact and undamaged during the construction phase. Should the inspection outcome prove a failure, the failure points are to be remediated in the agreed manner and re-inspected by the Validation Surveyor at a future agreed date/time.

The Validation Surveyor Did:

- Perform all visual detailed and intimate Inspections:
- Perform seam testing to 75% of site seams:
- Mark and identify any repairs required:
- Re-inspect and re-test the repairs:
- Complete the project survey sheets:
- Take photographs for inclusion in the final validation report:
- Produce a final validation report at the end of the installation process, to include 1no CL:Aire Residential Declaration of Conformance for the building.

9. MTS LTD VALIDATION PROCESS

MTS LTD performed two validation visits on this retro fit project. Our validation surveyor inspected all membrane in full consisting of the visible internal DPC, GP5 membrane, associated welded seams and the gas resistant self-adhesive membrane used to seal service entries, perimeter walls, DPC and the like. Our surveyor was happy with the quality of the installation and the management of the main contractor, ensuring other trades didn't walk or work on the installed membrane until the insulation was laid.

Please see below excerpts of the inspection and validation sign off certs produced at the end of each visit;

DATE: 12.6.2023

PROJECT NAME: 30, Radford Way, Billericay.

CONTRACT NO: C897 - Retro-Fit Installation for the Gas Mitigation Measures
See Attached Mark-ups for Areas Completed



INSPECTION, VALIDATION & INTEGRITY TESTING DETAILS:

MTS Ltd were requested to attend site to inspect/validate the membrane installed to the above mentioned area. On initial inspection our validation surveyor noted that the membrane had been laid and formed well. Our surveyor then using a seam pick tool, inspected all welded seams, checking for integrity and membrane for any damage or defects, then checking overlaps and for correct specification. Our surveyor then inspected all gas resistant self-adhesive membrane to seal the perimeter formation, service entries, pillars and the like. Checking for the correct adhesion and specified overlaps etc. Lastly our surveyor inspected all bitumen based sealer was applied to all C channels and fixing screws. All was installed well however, 18 defects were found and repaired immediately. The defects were marked up and immediately repaired. The repairs were validated proving a pass. Photo evidence of all the above has been taken for inclusion into the final report. All membrane was installed to design specification. Areas in red on the mark-ups are discounted from this cert.

MembraneTestingSolutions Ltd hereby confirm that the elements of the project detailed above have been inspected and validated by a suitably qualified independent consultant in accordance with industry requirements, with the test result noted below:

CONCLUSION (PASS/FAIL)

PASS IN FULL

DATE: 19.6.2023

PROJECT NAME: 30, Radford Way, Billericay.

CONTRACT NO: C897 - Retro-Fit Installation for the Gas Mitigation Measures For Toilets and Incomplete Service entry Area. See Attached Mark-ups for Areas

INSPECTION, VALIDATION & INTEGRITY TESTING DETAILS:

MTS Ltd were requested to attend site to inspect/validate the membrane installed to the above mentioned area. On initial inspection our validation surveyor noted that the membrane had been laid and formed well. Our surveyor then using a seam pick tool, inspected all welded seams, checking for integrity and membrane for any damage or defects, then checking overlaps and for correct specification. Our surveyor then inspected all gas resistant self-adhesive membrane to seal the perimeter formation, service entries, pillars and the like. Checking for the correct adhesion and specified overlaps etc. Lastly our surveyor inspected all bitumen based sealer was applied to all C channels and fixing screws. All was installed well however, 1 defect was found at the toilet area and repaired immediately. The defect was marked up and immediately repaired. The repair was validated proving a pass. Photo evidence of all the above has been taken for inclusion into the final report. All membrane was installed to design specification. Areas in red on the mark-ups are discounted from this cert.

MembraneTestingSolutions Ltd hereby confirm that the elements of the project detailed above have been inspected and validated by a suitably qualified independent consultant in accordance with industry requirements, with the test result noted below:

CONCLUSION (PASS/FAIL)

PASS IN FULL

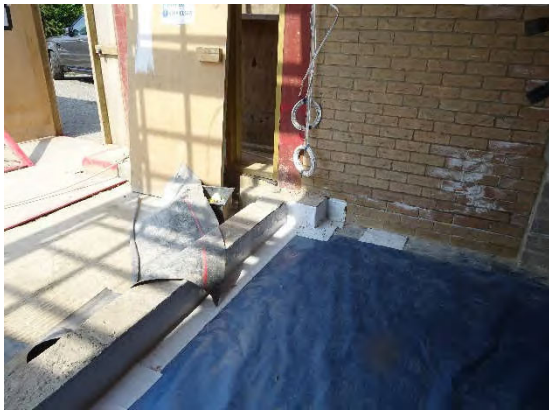
Full copies of the project survey sheets can be found in Appendix D at the end of this report.



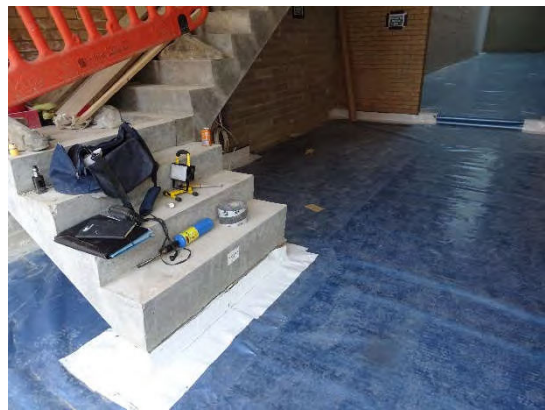
10. INDICATIVE INSTALLATION & VALIDATION TESTING PHOTOGRAPHS

MTS Ltd took a number of photographs throughout the duration of our validation process, the photos shown below are an excerpt of the photographs taken on site and are indicative of the installed membrane and validation processes performed by MTS Ltd on this project.

All photographs taken on site are contained on a USB Storage Device appended to Appendix. E of this report.



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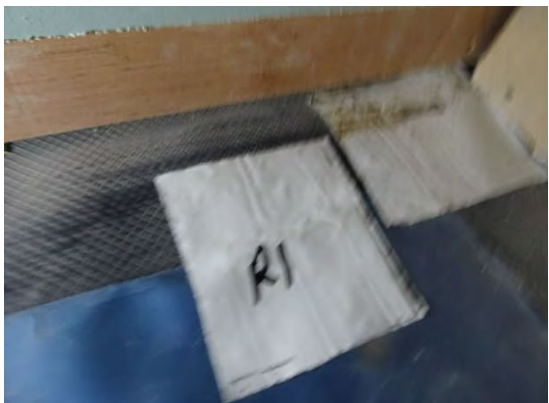
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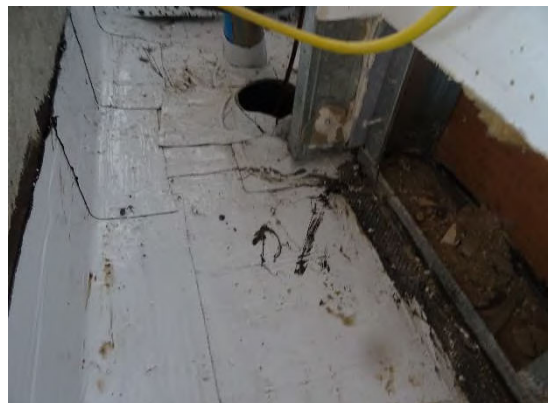
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18

RETROSPECTIVE TRACER GAS TESTING SEQUENCE PHOTOGRAPHS INDEX

No.	Description	No.	Description
1	Showing the main entrance with the cavity sealing and connection to previously installed DPC	2	A good example of the GR SAM sealing detail used to seal to the pre-formed stairs
3	Showing the retro fit sealing to internal walls	4	Again, showing the retro fit sealing to internal walls with the added detail at the cavity
5	Overview of the retrofit sealing in the stair/lift foyer. Note the plaster has been removed to allow sealing to structure	6	Again, an overview of the retrofit sealing in the stair/lift foyer. Note the plaster has been removed to allow sealing to structure
7	1 st angle of the pillar sealing detail	8	2 nd angle of the pillar sealing detail
9	Showing a marked-up patch repair	10	Showing the sealing detail to a step, pillar and wall the wall cavity
11	An awkward sealing detail to service entries in a tight space	12	Showing a seam defect found using the seam pick tool
13	Showing the patch repair adopted to seal the previously shown seam defect	14	Again, showing an awkward sealing detail to service entries in a tight space
15	Again, more retro fit sealing to internal walls and again showing the removed plaster	16	The sealing detail adopted for a wall end
17	Overview of the the membrane installation in the communal area	18	Showing the GR SAM and additional marked up puncture repairs to previously installed DPC



11. CONCLUSIONS AND RECOMMENDATIONS

As a result of our 3rd party independent inspection, testing & validation process, MTS Ltd conclude the gas mitigation measures prescribed for this site were inspected, tested and validated in accordance with the industry best practice installation requirements.

Therefore, MTS Ltd believe the gas mitigation measures installed on this project were sufficiently managed to maintain maximum confidence to the proficiency of the installed mitigation system, therefore we conclude that the materials installed on this project are ultimately appropriate to the 'CS2 Risk' and were "validated in accordance with the CIRIA C735" best practice document.

As such, it is Membrane Testing Solutions Ltd recommendation to the Local Authority/Project Stakeholders to sign off the gas mitigation measures and validation report as;

"PASS IN FULL"

END OF REPORT