

Geotechnical Engineering and Environmental Services across the UK

# **VERIFICATION REPORT**

FOR

138-140 HIGHGATE ROAD, HIGHGATE, LONDON NW5 1PB



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JUMAS ENGINEERING ENVIRONMENTAL

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Geotechnical Engineering & Environmental Services

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## WE LISTEN, WE PLAN, WE DELIVER



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#### 1 INTRODUCTION

#### 1.1 Background

- 1.1.1Space Free Ltd ("The Client") has commissioned Jomas Associates Ltd ('Jomas'), to<br/>produce a verification report for the site at 138-140 Highgate Road, Highgate, London<br/>NW5 1PB following the completion of remedial measures at the site.
- 1.1.2 A site location plan is provided as Figure 1.
- 1.1.3 The site has undergone redevelopment comprising the demolition of the existing structures associated with former fuel station and workshop use and construction of a new three-storey residential development. The development includes a lower ground floor (north-east is entirely below ground level and south-west is at ground level due to site topography) and a full single-storey basement below. An area of communal soft landscaping is present facing Highgate Road. Private landscaping has been provided above the proposed basement slab. Basement and ground floor plans are presented as Figures 2-5.
- 1.1.4 Development permission has been granted by the London Borough of Camden with a number of conditions relating to various requirements.
- 1.1.5 Planning Condition 15 of application ref 2018/1528/P, relates to land contamination matters.
- 1.1.6 Condition 15 states:
- 1.1.7 "At least 28 days before the development hereby permitted commences a written detailed scheme of assessment consisting of site reconnaissance, conceptual model, risk assessment and proposed schedule of investigation must be submitted to the planning authority. The scheme of assessment must be sufficient to assess the scale and nature of potential contamination risks on the site and shall include details of the number of sample points, the sampling methodology and the type and quantity of analyses proposed. The scheme of assessment must be approved by the LPA and the documentation submitted must comply with the standards of the Environment Agency's Model Procedures for the Management of Contamination (CLR11)."
- 1.1.8 No specific planning condition requiring a remediation strategy or verification report were imposed; however, given the history of the site and findings of the ground investigation, remedial works and the production of such reports became necessary.
- 1.1.9 A number of reports have been undertaken for the site by Jomas Associates, and should be read in conjunction with this document:
  - Phase I Desk Study on 138-140 Highgate Road, Highgate, London NW5 1PB for IDM Land Ltd, 13859/DS Rev 1.02, February 2014, Soils Limited.
  - Desk Study and Basement Impact Assessment Report for 138-140 Highgate Road, Highgate, London NW5 1PB, P1323J1303, February 2018, Jomas Associates Ltd.

- Ground Investigation, Basement Impact Assessment Report & GMA for 138-140 Highgate Road, Highgate, London NW5 1PB, P1323J1303/SL, Final v4.3, December 2018, Jomas Associates Ltd.
- Remedial Strategy & Verification Plan for 138-140 Highgate Road, Highgate, London NW5 1PB, P1323J1303, August 2019, Jomas Associates Ltd.
- Preliminary Verification Report for 138-140 Highgate Road, Highgate, London, NW5 1PB, P1323J1303, October 2019, Jomas Associates Ltd.
- 138-140 Highgate Road, Highgate, London, NW5 1PB, Phase 1 Tank Removal Works, P1323J1303/te/jf, 4th May 2020, Jomas Associates Ltd.
- 138-140 Highgate Road, Highgate, London, NW5 1PB, Phase 2 Tank Removal Works, P1323J1303/te/jf, 16th May 2022, Jomas Associates Ltd.
- 1.1.10 The ground investigation reported concentrations of lead, naphthalene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(ah)anthracene and C21-C35 aromatic hydrocarbons in soils in excess of generic assessment criteria for the protection of human health within a 'residential with plant uptake' end-use scenario. The presence of asbestos was also detected within soils on site.
- 1.1.11 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.
- 1.1.12 The Remediation Strategy report was prepared following the findings of the Ground Investigation Report (also prepared by Jomas, dated December 2018). Remedial works were carried out in accordance with the Remediation Strategy Report between 2019 and 2022.

#### 1.2 Remediation Strategy

- 1.2.1 The remediation strategy was compiled by Jomas and published as referenced above. A summary of the strategy is provided below, although reference should be made to the full document for details.
  - Removal of tanks and associated infrastructure;
  - Removal of impacted and non-impacted soils as part of the basement excavation and beyond.
  - Removal of free phase product and any impacted perched waters discovered using pump and disposal method;
  - A watching brief following demolition and during enabling works for grossly impacted soils or water;
  - CS2 soil gas mitigation measures were recommended based on ground investigation results. Further assessment was recommended following removal of the fuel tanks and impacted soils.

- Proposed gardens will be constructed on the basement slab, and therefore soils within these areas will not be in direct contact with underlying soils and there will be no pathway between potentially contaminated soils and end users. No further remedial measures will be required within private gardens beyond the importation of suitable topsoil for planting and landscaping purposes.
- Within areas of communal soft landscaping which overlie existing Made Ground, a cover layer comprising a minimum 300mm thickness of certified clean topsoil laid over a geotextile membrane will be utilised if soft landscaping is externally managed, to be increased to 450mm if not externally managed;
- Validation testing will be undertaken upon the remedial excavations, basement excavation and on soils imported to site. This will confirm that all impacted soils have been removed and to confirm the suitability of imported soils for use as a clean capping layer.
- 1.2.2 This report focuses on the validation of landscaped areas through verification of the presence of membranes (where necessary) and verifying the chemical suitability of imported topsoil.

#### 1.3 Preliminary Verification Report

- 1.3.1 Jomas produced a preliminary verification report following removal of below ground fuel tanks, infrastructure and surrounding impacted soils.
- 1.3.2 As well as concluding that the tank and soil removal works were completed successfully, the report included an updated ground gas risk assessment.
- 1.3.3 It was concluded that the site can be considered Characteristic Situation 1, meaning no formal ground gas protection measures are considered necessary.
- 1.3.4 The report should be read in its entirety for full context.

#### 1.4 Tank Removal Letter Reports

- 1.4.1 Two additional phases of tank removal works were undertaken following the production of the preliminary verification report due to the discovery of previously unknown tanks. These tanks were removed separately (due to logistical challenges) and reported on separately as referenced in Paragraph 1.1.9.
- 1.4.2 These reports should be read in their entirety for full context.

### 1.5 Outstanding Works

1.5.1 Following the completion of the works outlined in the previously issued verification reports, the only remaining outstanding work requiring validation is the provision of a clean cover layer in accordance with the requirements of the remediation strategy. Reporting these works forms the subject of this report.

#### 1.6 Limitations

- 1.6.1 Jomas Associates Ltd ('Jomas') has prepared this report for the sole use Space Free 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.
- 1.6.2 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.
- 1.6.3 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 31<sup>st</sup> August 2022, a Jomas engineer attended the site to inspect and validate the areas of completed soft landscaping on site.
- 2.1.2 Eleven hand pits were completed within the areas of soft landscaping to examine the imported soils and obtain samples for testing.
- 2.1.3 Pit locations are as identified on Figure 6. Photographs of the validation visit are provided as Figure 7.
- 2.1.4 HTP1-HTP2 were completed within an area to the east of the site, outside the formal development boundary, in an area to be adopted by the local authority as public space.
- 2.1.5 HTP3-HTP5 were located within the area of communal soft landscaping in the south of the site.
- 2.1.6 HTP6-HTP11 were located within the areas of private soft landscaping installed above the basement excavation.
- 2.1.7 Table 2.2.1 below summarises the observations made.

Pit ID	Observations
HTP1	<ul> <li>GL – 0.45mbgl: Grass over dark brown sandy slightly gravelly clay with rootlets and roots. Sand is medium to coarse. Gravel consists of fine to medium sub-angular to sub-rounded brick, occasional plastic and occasional wood fragments.</li> <li>(MADE GROUND)</li> <li>No membrane observed.</li> </ul>
HTP2	<ul> <li>GL – 0.20mbgl: Grass over dark brown sandy slightly gravelly clay with rootlets and roots. Sand is medium to coarse. Gravel consists of fine to medium sub-angular to sub-rounded brick, and occasional wood fragments.</li> <li>(MADE GROUND)</li> <li>0.20 – 0.53mbgl: Brown slightly sandy slightly gravelly clay. Sand is fine to coarse. Gravel is fine to medium angular to sub-rounded brick, flint and occasional plastic.</li> <li>(MADE GROUND)</li> <li>No membrane observed.</li> </ul>
НТРЗ	<ul> <li>GL – 0.60mbgl: Grass over dark brown sandy slightly gravelly clay with rootlets and roots. Sand is medium to coarse. Gravel consists of fine to medium sub-angular to sub-rounded brick, concrete, flint and occasional wood fragments.</li> <li>(MADE GROUND)</li> <li>0.60 – 0.65mbgl: Brown sandy gravel. Sand is fine to coarse. Gravel is fine to coarse angular brick, glass, concrete and flint.</li> <li>(MADE GROUND)</li> <li>No membrane observed.</li> </ul>

#### Table 2.2.1: Imported Topsoil Observations

#### SECTION 2 IMPORTED SOIL COVER LAYER VERIFICATION



Pit ID	Observations
	GL – 0.30mbgl: Grass over dark brown sandy slightly gravelly clay with rootlets and roots. Sand is medium to coarse. Gravel consists of fine to medium sub-angular to sub-rounded brick, and occasional wood fragments.
нтри	(MADE GROUND)
11174	0.30 – 0.45mbgl: Brown sand and gravel. Sand is medium to coarse. Gravel consists of fine to medium angular brick, glass, concrete, flint, occasional ash and occasional slate.
	(MADE GROUND)
	GL – 0.25mbgl: Grass over dark brown sandy slightly gravelly clay with rootlets and roots. Sand is medium to coarse. Gravel consists of fine to medium sub-angular to sub-rounded brick, and occasional wood fragments. (MADE GROUND)
HTP5	0.25 – 0.35mbgl: Greyish brown very sandy gravel. Sand is medium to coarse. Gravel is fine to coarse angular to sub-rounded brick, concrete, flint and occasional glass.
	(MADE GROUND) No membrane observed.
НТР6	GL – 0.30mbgl: Brown sand and gravel. Sand is medium to coarse. Gravel consists of fine to coarse angular to sub-rounded flint, occasional brick, occasional concrete, occasional ceramic and occasional timber.
	Membrane encountered at 0.3mbgl.
	GL – 0.15mbgl: Dark brown slightly gravelly clayey sand. Sand is fine to medium. Gravel consists of medium sub-angular to rounded flint and wood fragments
	(MADE GROUND - topsoil)
HTP7	0.15-0.31mbgl: Brown sand and gravel. Sand is medium to coarse. Gravel consists of fine to coarse angular to sub-rounded flint, occasional brick, occasional concrete and occasional timber.
	(MADE GROUND)
	Membrane encountered at 0.31mbgl.
	GL – 0.30mbgl: Brown sand and gravel. Sand is medium to coarse. Gravel consists of fine to coarse angular to sub-rounded flint, occasional brick, occasional concrete and occasional timber.
	(MADE GROUND)
HTP8	0.30-0.40mbgl: Red and brown mottled slightly sandy gravel. Sand is medium. Gravel consists of medium to coarse angular to rounded aggregate pellets, brick, glass and occasional concrete.
	(MADE GROUND)
	Membrane encountered at 0.40mbgl.
	GL – 0.10mbgl: Dark brown slightly gravelly clayey sand. Sand is fine to medium. Gravel consists of medium sub-angular to rounded flint and wood fragments.
	(MADE GROUND - topsoil)
НТР9	o.10-0.49mbgl: Red and brown mottled slightly sandy gravel. Sand is medium. Gravel consists of medium to coarse angular to rounded abundant concrete, aggregate pellets, glass and brick. (MADE GROUND)
	Membrane encountered at 0.49mbgl.

#### SECTION 2 IMPORTED SOIL COVER LAYER VERIFICATION



Pit ID	Observations
HTP10	GL – 0.35mbgl: Red and brown mottled slightly sandy gravel. Sand is medium. Gravel consists of medium to coarse angular to rounded abundant concrete, aggregate pellets, glass and brick.
	(MADE GROUND)
	Membrane encountered at 0.35mbgl.
HTP11	GL – 0.41mbgl: Red and brown mottled slightly sandy gravel. Sand is medium. Gravel consists of medium to coarse angular to rounded abundant concrete, aggregate pellets, glass and brick. (MADE GROUND)
	No membrane observed due to pit collapsing

2.1.8 8No 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.

DETERMINAND	LIMIT OF DETECTION (mg/kg)	UKAS ACCREDITATION	TECHNIQUE
Arsenic	1	Y (MCERTS)	ICPMS
Cadmium	0.2	Y (MCERTS)	ICPMS
Chromium	1	Y (MCERTS)	ICPMS
Chromium (Hexavalent)	4	Y (MCERTS)	Colorimetry
Lead	1	Y (MCERTS)	ICPMS
Mercury	0.3	Y (MCERTS)	ICPMS
Nickel	1	Y (MCERTS)	ICPMS
Selenium	1	Y (MCERTS)	ICPMS
Copper	1	Y (MCERTS)	ICPMS
Zinc	1	Y (MCERTS)	ICPMS
Boron (Water Soluble)	0.2	Y (MCERTS)	ICPMS
pH Value	0.1 units	Y (MCERTS)	Electrometric
Sulphate (Water Soluble)	0.0125g/l	Y (MCERTS)	Ion Chromatography
Total Cyanide	1	Y (MCERTS)	Colorimetry
Speciated/Total PAH	0.05/0.80	Y (MCERTS)	GCFID
Phenols	1	Y (MCERTS)	HPLC
Total Petroleum Hydrocarbons (banded)	-	N Y (MCERTS)	Gas Chromatography

#### Table 2.2.2: Basic Suite of Determinands

#### 2.2 Verification Test Results

- 2.2.1 The results of the chemical testing are outlined below in Table 2.2.4 to Table 2.2.6. The site specific criteria used to derive the relevant screening criteria are provided in Table 2.2.3.
- 2.2.2 Full laboratory test certificates are provided in Appendix 2.



#### Table 2.2.3: Site Specific Data

Input Details	Value
Land Use	Residential with plant uptake
Soil Organic Matter	1%

# Table 2.2.4: Soil Laboratory Analysis Results – Metals, Metalloids, Phenol, Cyanide – Imported Topsoil

Determinand	Unit	No. samples tested	Screenin	g Criteria	Min	Max	No. Exceeding
Arsenic	mg/kg	8	37	S4UL	9.8	14	0
Cadmium	mg/kg	8	11	S4UL	<0.2	0.5	0
Chromium	mg/kg	8	910	S4UL	14	27	0
Lead	mg/kg	8	200	C4SL	18	540	1No (HTP1@0.40mbgl)
Mercury	mg/kg	8	40	S4UL	<0.3	0.6	0
Nickel	mg/kg	8	180	S4UL	14	29	0
Copper	mg/kg	8	2400	S4UL	16	59	0
Zinc	mg/kg	8	3700	S4UL	62	140	0
Total Cyanide <sup>B</sup>	mg/kg	8	33	CLEA v 1.06	<1.0	<1.0	0
Selenium	mg/kg	8	250	S4UL	<1.0	<1.0	0
Boron Water Soluble	mg/kg	8	290	S4UL	0.6	1.1	0
Phenols	mg/kg	8	120	S4UL	<1.0	<1.0	0

**Notes:** <sup>B</sup> Generic assessment criteria derived for free inorganic cyanide.

# Table 2.2.5: Soil Laboratory Analysis Results – Polycyclic Aromatic Hydrocarbons (PAHs) – Imported Topsoil

Determinand	Unit	No. Samples Tested	Screening	Criteria	Min	Max	No. Exceeding
Naphthalene	mg/kg	8	S4UL	2.3	<0.05	<0.05	0
Acenaphthylene	mg/kg	8	S4UL	170	<0.05	0.26	0
Acenaphthene	mg/kg	8	S4UL	210	<0.05	<0.05	0
Fluorene	mg/kg	8	S4UL	170	<0.05	<0.05	0
Phenanthrene	mg/kg	8	S4UL	95	<0.05	2.3	0
Anthracene	mg/kg	8	S4UL	2400	<0.05	0.47	0

#### SECTION 2 IMPORTED SOIL COVER LAYER VERIFICATION



Determinand	Unit	No. Samples Tested	Screening	Criteria	Min	Max	No. Exceeding
Fluoranthene	mg/kg	8	S4UL	280	<0.05	5	0
Pyrene	mg/kg	8	S4UL	620	<0.05	4.3	0
Benzo(a)anthracene	mg/kg	8	S4UL	7.2	<0.05	3.1	0
Chrysene	mg/kg	8	S4UL	15	<0.05	2.4	0
Benzo(b)fluoranthene	mg/kg	8	S4UL	2.6	<0.05	3.1	1No (HTP1@0.40mbgl)
Benzo(k)fluoranthene	mg/kg	8	S4UL	77	<0.05	1.6	0
Benzo(a)pyrene	mg/kg	8	S4UL	2.2	<0.05	3.3	1No (HTP1@0.40mbgl)
Indeno(123-cd)pyrene	mg/kg	8	S4UL	27	<0.05	1.8	0
Dibenzo(ah)anthracene	mg/kg	8	S4UL	0.24	<0.05	0.37	1No (HTP1@0.40mbgl)
Benzo(ghi)perylene	mg/kg	8	S4UL	320	<0.05	1.8	0
Total PAH	mg/kg	8	-	-	<0.80	29.6	-

# Table 2.2.6: Soil Laboratory Analysis Results – Total Petroleum Hydrocarbons (TPH) – ImportedTopsoil

TPH Band	Unit	No. Samples Tested	Screening	Criteria	Min	Max	No. Exceeding
C <sub>8</sub> -C <sub>10</sub>	mg/kg	6	S4UL	27	<0.1	<0.1	0
>C <sub>10</sub> -C <sub>12</sub>	mg/kg	6	S4UL	74	<2.0	<2.0	0
>C <sub>12</sub> -C <sub>16</sub>	mg/kg	6	S4UL	140	<4.0	<4.0	0
>C <sub>16</sub> -C <sub>21</sub>	mg/kg	6	S4UL	260	<1.0	16	0
>C <sub>21</sub> -C <sub>35</sub>	mg/kg	6	S4UL	1100	<10	47	0
Total TPH	mg/kg	6	-	-	<17.1	54.2	0

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

#### 2.3 Asbestos

- 2.3.1 In addition to the suites above, 8No samples were screened for the presence of asbestos.
- 2.3.2 Asbestos was found within HTP6 at 0.15mbgl and was identified as loose chrysotile fibres.



#### 2.4 Discussion

- 2.4.1 As summarised in the tables above, several contaminants were reported above human health screening criteria for a "residential with plant uptake" end use within the sample from HTP1.
- 2.4.2 The location from where HTP1 was obtained is not within a private residential area, and is located within a plot of land adjacent to the development, outside the formal development boundary that is to be adopted by the Local Authority as public land. On this basis, it is considered appropriate to re-assess these results against generic assessment criteria protective of human health within a "public open space – residential" (POSresi) end use.
- 2.4.3 Only those contaminants previously reported in excess of screening criteria have been included as those suitable for "residential" use are considered suitable for POSresi use.

# Table 2.7: Soil Laboratory Analysis Results – Exceeding Determinants Only – Imported Topsoil – POSresi

Determinand	Unit	No. samples tested	Screenin	g Criteria	Max	No. Exceeding
Lead	mg/kg	1	C4SL	630	540	0
Benzo(b)fluoranthene	mg/kg	1	S4UL	7.1	3.1	0
Benzo(a)pyrene	mg/kg	1	S4UL	5.7	3.3	0
Dibenzo(ah)anthracene	mg/kg	1	S4UL	0.57	0.37	0

- 2.4.4 As shown in the table above, none of the contaminants elevated above residential criteria were reported in excess of POSresi criteria and therefore the soil is considered suitable for use within the public area outside the development boundary.
- 2.4.5 Asbestos was detected within a single sample obtained from HTP6 within the private landscaped area and therefore the soil in this area is not considered suitable for use and will require removal and replacing.
- 2.4.6 Although the soil within the communal area is considered suitable for the proposed end use, no membrane was recorded separating the clean imported topsoil from the underlying Made Ground.

#### 2.5 Conclusions

2.5.1 Soils in the communal landscaping are considered suitable for use; however, no membrane was installed to separate the newly imported soil from existing soil, and in the HTP5 location the newly imported topsoil was insufficiently thick to meet the requirements of the remediation strategy. The client was informed that the soils



should be lifted, membrane placed and soils re-laid above the membrane to appropriate depth.

- 2.5.2 The soil containing asbestos within the private landscaping area is not considered suitable for use and therefore the client was instructed to remove this material from site and replace with new imported topsoil.
- 2.5.3 The remaining material within the private landscaped area is considered chemically suitable for use, although it is noted that significant anthropogenic material is present.

#### 2.6 Verification Re-Visit

- 2.6.1 A subsequent visit was conducted on the 10<sup>th</sup> November 2022 by a Jomas Engineer to confirm the removal of impacted soils, the installation of the membrane and importation of clean soils.
- 2.6.2 At the time of the visit it was confirmed that the asbestos impacted soils within the private landscaped area had been removed up to the location of the sample screening negative for asbestos.
- 2.6.3 Six hand pits were completed within the areas of soft landscaping within the site. Pit locations are shown on Figure 8. Photographs of the validation visit are also provided as Figure 9.
- 2.6.4 Table 2.9 below summarises the observations made.

#### Table 2.8: Imported Topsoil Observations

Pit ID	Observations
TP1	GL – 0.36mbgl: Light brownish black gravely slightly clayey sand, sand is fine to medium. Gravel consists of fine to coarse, sub-angular to sub-rounded flint. (MADE GROUND) Membrane observed.
TP2	GL – 0.38mbgl: Light brownish black gravely slightly clayey sand, sand is fine to medium. Gravel consists of fine to coarse, sub-angular to sub-rounded flint. (MADE GROUND) Membrane observed.
ТРЗ	GL – 0.41mbgl: Light brownish black gravely slightly clayey sand, sand is fine to medium. Gravel consists of fine to coarse, sub-angular to sub-rounded flint. (MADE GROUND) Membrane observed.
TP4	Sampled from stockpile: Brownish black gravely slightly clayey sand, sand is fine to medium. Gravel consists of fine to coarse, sub-angular to sub-rounded flint. (MADE GROUND)
TP5	Sampled from stockpile: Brownish black gravely slightly clayey sand, sand is fine to medium. Gravel consists of fine to coarse, sub-angular to sub-rounded flint. (MADE GROUND)



	Pit ID	Observations
	TP6	Sampled from stockpile: Brownish black gravely slightly clayey sand, sand is fine to medium. Gravel consists of fine to coarse, sub-angular to sub-rounded flint. (MADE GROUND)
2.6.5	i	It should be noted that at the time of the visit, the area beneath the stockpile (TP4- TP6) had not yet had the membrane installed. Following the use of the stockpiled soils this area was excavated and membrane laid. Photographic evidence of the depth and installation of the membrane has been provided by the client. This can be seen in Appendix 1, Figure 10. The stockpiled soils were sampled as they were the intended

#### 2.7 Verification Test Results - Visit 2

2.7.1 The results of the chemical testing are outlined below in to Table 2.9 to Table 2.11. The site specific criteria used to derive the relevant screening criteria are provided in Table 2.2.3.

use soils for the clean cover whilst the membrane was installed to 0.35mbgl.

2.7.2 Full laboratory test certificates are provided in Appendix 2.

# Table 2.9: Soil Laboratory Analysis Results – Metals, Metalloids, Phenol, Cyanide – Imported Topsoil

Determinand	Unit	No. samples tested	Screenir	ng Criteria	Min	Max	No. Exceeding
Arsenic	mg/kg	3	37	S4UL	11	16	0
Cadmium	mg/kg	3	11	S4UL	<0.2	<0.2	0
Chromium	mg/kg	3	910	S4UL	22	28	0
Lead	mg/kg	3	200	C4SL	24	28	0
Mercury	mg/kg	3	40	S4UL	<0.3	<0.3	0
Nickel	mg/kg	3	180	S4UL	16	19	0
Copper	mg/kg	3	2400	S4UL	17	20	0
Zinc	mg/kg	3	3700	S4UL	63	81	0
Total Cyanide <sup>B</sup>	mg/kg	3	33	CLEA v 1.06	<1.0	<1.0	0
Selenium	mg/kg	3	250	S4UL	<1.0	<1.0	0
Boron Water Soluble	mg/kg	3	290	S4UL	1.8	2.1	0
Phenols	mg/kg	3	120	S4UL	<1.0	<1.0	0

Notes: <sup>B</sup> Generic assessment criteria derived for free inorganic cyanide.



# Table 2.10: Soil Laboratory Analysis Results – Polycyclic Aromatic Hydrocarbons (PAHs) – Imported Topsoil

Determinand	Unit	No. Samples Tested	Screening	Criteria	Min	Max	No. Exceeding
Naphthalene	mg/kg	3	S4UL	2.3	0.18	0.25	0
Acenaphthylene	mg/kg	3	S4UL	170	0.12	0.17	0
Acenaphthene	mg/kg	3	S4UL	210	0.07	0.08	0
Fluorene	mg/kg	3	S4UL	170	<0.05	0.07	0
Phenanthrene	mg/kg	3	S4UL	95	0.07	0.14	0
Anthracene	mg/kg	3	S4UL	2400	<0.05	<0.05	0
Fluoranthene	mg/kg	3	S4UL	280	0.13	0.24	0
Pyrene	mg/kg	3	S4UL	620	0.15	0.2	0
Benzo(a)anthracene	mg/kg	3	S4UL	7.2	0.07	0.09	0
Chrysene	mg/kg	3	S4UL	15	0.05	0.09	0
Benzo(b)fluoranthene	mg/kg	3	S4UL	2.6	0.09	0.12	0
Benzo(k)fluoranthene	mg/kg	3	S4UL	77	0.05	0.07	0
Benzo(a)pyrene	mg/kg	3	S4UL	2.2	0.05	0.09	0
Indeno(123-cd)pyrene	mg/kg	3	S4UL	27	<0.05	<0.05	0
Dibenzo(ah)anthracene	mg/kg	3	S4UL	0.24	<0.05	<0.05	0
Benzo(ghi)perylene	mg/kg	3	S4UL	320	<0.05	<0.05	0
Total PAH	mg/kg	3	-	-	1.22	1.54	-

# Table 2.11: Soil Laboratory Analysis Results – Total Petroleum Hydrocarbons (TPH) – ImportedTopsoil

TPH Band	Unit	No. Samples Tested	Screening	Criteria	Min	Max	No. Exceeding
C <sub>6</sub> -C <sub>10</sub>	mg/kg	3	S4UL	27	<0.1	<0.1	0
>C <sub>10</sub> -C <sub>12</sub>	mg/kg	3	S4UL	74	<2.0	<2.0	0
>C <sub>12</sub> -C <sub>16</sub>	mg/kg	3	S4UL	140	<4.0	<4.0	0
>C <sub>16</sub> -C <sub>21</sub>	mg/kg	3	S4UL	260	<1.0	<1.0	0
>C <sub>21</sub> -C <sub>40</sub>	mg/kg	3	S4UL	1100	17	29	0
	ma/ka	2			≥17	≥29	0
	iiig/Kg	Э	-	-	<24.1	<36	U

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



#### 2.8 Asbestos - visit 2

2.8.1 The 3No samples were screened for the presence of asbestos. No asbestos fibres were identified within the samples taken during the topsoil validation.



#### 3 SUMMARY OF LANDSCAPING WORKS COMPLETED

#### 3.1 Public Landscaping

3.1.1 The soils placed within the publicly accessible area outside the development site boundary are considered suitable for use within a "public open space – residential" setting.

#### 3.2 Communal Landscaping

- 3.2.1 The soil within the communal area of landscaping has been shown to be chemically suitable for use, and following the additional works detailed previously has achieved suitable thickness and been placed over a membrane in accordance with the remediation strategy.
- 3.2.2 Photographs of this process are provided in Appendix 1, Figure 10. The additional thickness of topsoil required in the HTP5 area was achieved using newly imported topsoil which has been shown to be chemically suitable for use.

#### 3.3 Private Landscaping

- 3.3.1 The soils in the private landscaping where asbestos was identified in HTP6 were removed from site, with soils removed to beyond the HTP7 location where soils were previously screened free from asbestos.
- 3.3.2 The removed soil was replaced by newly imported topsoil, which has been shown to be chemically suitable for use. As this area is formed above a basement, no minimum depth of cover or membrane is considered necessary in this area.



#### 4 ADDITIONAL ITEMS

#### 4.1 Waste Disposal

4.1.1 Documentation for the disposal of waste soils removed from site are provided in Appendix 3.

#### 4.2 Utilities Pipework

4.2.1 The client has confirmed that utility pipework has been installed in accordance with the supplier's requirements. Confirmation is provided in Appendix 4.

#### 4.3 Evidence of Previously Uncharacterised Contamination

- 4.3.1 The client has confirmed that no further evidence of contamination was observed during the construction phase of works on site beyond that reported to Jomas and addressed in previous reports.
- 4.3.2 Correspondence to this effect is provided in Appendix 4.



#### 5 CONCLUSIONS & OUTSTANDING WORKS

#### 5.1 Conclusions

- 5.1.1 Jomas are satisfied the recommended remedial measure for the soft landscaping have been met. The membrane and required thickness of cover layer in the soft landscaping areas of the development meet the requirements laid out in the remedial strategy.
- 5.1.2 The laboratory test results confirmed that the contaminant concentrations in the imported topsoil were below the relevant assessment criteria and that no asbestos containing materials or fibres were detected.
- 5.1.3 On this basis the requirements of the remediation strategy are considered to have been met, as detailed in this report.

#### 6 **REFERENCES**

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

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#### **APPENDICES**



#### **APPENDIX 1 – FIGURES & SITE VISIT NOTES**



SW

# Figure 2: Basement Plan



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GA_000 Top floor	Unit 1 Ui 33	nit 2 Unit 32.8	3 Uni 32.8	t4 Ur 32.8	nit 5 Ur 32.8	it 6 32.5
GA_B01 Middle Floor	41.9	42. <del>9</del>	43.2	43.4	43.6	39.3
GA_B02 Basement	46.3	47.5	48.6	49.1	49.3	43.4
Total	121.2	123.2	124.6	125.3	125.7	115.2
 Garden Koom —— — Total (with Garden Room)	133.6	12.8	12.8	12.8	138.5	131.3
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The areas are approximate and can only be verified by a detailed dimensional survey of the completed building. Any decisions to be made on the basis of these predictions

AREA MEASUREMENT

# Figure 3: Lower Ground Floor Plan



4	GA_000 Top floor	33	32.8	32.8	32.8	32.8	32.5
¢	GA_B01 Middle Floor	41.9	42.9	43.2	43.4	43.6	39.3
•	GA_B02 Basement	46.3	47.5	48.6	49.1	49.3	43.4
	Total	121.2	<b>1</b> 23.2	124.6	125.3	125.7	<b>1</b> 15.2
	Garden Room	12.4	12.8	12.8	12.8	12.8	16.1
	Total (with Garden Room)	133.6	136	137.4	138.1	138.5	131.3
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of the design and using Gross External Area (GEA), Gross Internal Area (GIA) and Net Internal Area (NIA) method of measurement from the Code of Measuring Practice, 5th edition (RICS code of practice). All areas are subject to Town Planning and Conservation

Unit 1 Unit 2 Unit 3 Unit 4 Unit 5 Unit 6

Area Consent, and detailed Rights to Light analysis.

AREA MEASUREMENT

Figure 4: Proposed Top Floor Plan



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edition (RICS code of practice). All areas are subject to Town Planning and Conservation Area Consent, and detailed Rights to Light analysis.										
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6				
GA_000 Top floor	33	32.8	32.8	32.8	32.8	32.5				
GA_B01 Middle Floor	41.9	42.9	43,2	43.4	43.6	39.3				
GA_B02 Basement	46.3	47.5	48.6	49.1	49.3	43.4				
Total	121.2	123.2	124.6	125.3	1 <b>2</b> 5.7	115.2				
Garden Room	12.4	12.8	12.8	12.8	12.8	16.1				

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AREA MEASUREMENT The areas are approximate and can only be verified by a detailed dimensional survey of the completed building. Any decisions to be made on the basis of these predictions whether as to project viability, pre-letting, lease agreements or the like should include due allowance for the increases and decreases inherent in the design development and building processes. Figures relate to the likely areas of the building at the current state of the design and using Gross External Area (GEA), Gross Internal Area (GIA) and Net Internal Area (NIA) method of measurement from the Code of Measuring Practice, 5th edition (RICS code of practice). All areas are subject to Town Planning and Conservation Area Consent, and detailed Rights to Light analysis.

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Total (with Garden Room)

# Figure 5: Roof Plan



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	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
GA_000 Top floor	33	32.8	32.8	32.8	32.8	32.5
GA_B01 Middle Floor	41.9	42.9	43.2	43.4	43.6	39.3
GA_B02 Basement	46.3	47.5	48.6	49.1	49.3	43.4
Total	121.2	123.2	124.6	125.3	125.7	<b>1</b> 15.2
Garden Room	12.4	12.8	12.8	12.8	12.8	16.1
Total (with Garden Room)	133.6	136	137 4	138.1	138 5	131 3

AREA MEASUREMENT The areas are approximate and can only be verified by a detailed dimensional survey of the completed building. Any decisions to be made on the basis of these predictions whether as to project viability, pre-letting, lease agreements or the like should include due allowance for the increases and decreases inherent in the design development and building processes. Figures relate to the likely areas of the building at the current state of the design and using Gross External Area (GEA), Gross Internal Area (GIA) and Net Internal Area (NIA) method of measurement from the Code of Measuring Practice, 5th edition (RICS code of practice). All areas are subject to Town Planning and Conservation Area Consent, and detailed Rights to Light analysis.

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# WE LISTEN, WE PLAN, WE DELIVER

PROJECT NAME	138-140 Highgate Road, Highgate, London NW5 1PB	CLIENT	Space Free Ltd
TITLE	Topsoil Validation Photo Plan – Visit 1	FIGURE	7
Photo 1: HTP1 – pul	blic open space outside development boundary	Photo 2: HTP1	public open space outside development boundary
	<image/>		

PROJECT NAME	138-140 Highgate Road, Highgate, London NW5 1PB	CLIENT	Space Free Ltd
TITLE	Topsoil Validation Photo Plan – Visit 1	FIGURE	7
Photo 3: HTP1 - publ	ic open space outside development boundary	Photo 4: HTP3 – comn	nunal landscaping



PROJECT NAME	138-140 Highgate Road, Highgate, London NW5 1PB	CLIENT	Space Free Ltd
TITLE	Topsoil Validation Photo Plan – Visit 1	FIGURE	7
Photo 5: HTP3 – com	imunal landscaping	Photo 6: HTP3 – comn	nunal landscaping



PROJECT NAME	138-140 Highgate Road, Highgate, London NW5 1PB	CLIENT	Space Free Ltd
TITLE	Topsoil Validation Photo Plan – Visit 1	FIGURE	7
<b>Photo 7:</b> HTP4 – cor	nmunal landscaping	<b>Photo 8:</b> HTP4 – con	nmunal landscaping

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PROJECT NAME	138-140 Highgate Road, Highgate, London NW5 1PB	CLIENT	Space Free Ltd
TITLE	Topsoil Validation Photo Plan – Visit 1	FIGURE	7
Photo 9: HTP4 – com	nmunal landscaping	<b>Photo 10:</b> HTP5 – 0	communal landscaping



PROJECT NAME	138-140 Highgate Road, Highgate, London NW5 1PB	CLIENT	Space Free Ltd
TITLE	Topsoil Validation Photo Plan – Visit 1	FIGURE	7
<b>Photo 11:</b> HTP5 – c	ommunal landscaping	<b>Photo 12:</b> HTP5 – co	ommunal landscaping



PROJECT NAME	138-140 Highgate Road, Highgate, London NW5 1PB	CLIENT	Space Free Ltd
TITLE	Topsoil Validation Photo Plan – Visit 1	FIGURE	7
<b>Photo 13:</b> HTP6 – pri	vate landscaping	Photo 14: HTP6 – priv	vate landscaping

# WE LISTEN, WE PLAN, WE DELIVER

<b>PROJECT NAME</b>	138-140 Highgate Road, Highgate, London NW5 1PB	CLIENT	Space Free Ltd
TITLE	Topsoil Validation Photo Plan – Visit 1	FIGURE	7
Photo 15: HTP6 – pr	rivate landscaping	Photo 16: HTP7 -	- private landscaping



PROJECT NAME	138-140 Highgate Road, Highgate, London NW5 1PB	CLIENT	Space Free Ltd
TITLE	Topsoil Validation Photo Plan – Visit 1	FIGURE	7
<b>Photo 17:</b> HTP7 – pr	ivate landscaping	<b>Photo 18:</b> HTP7 – pri	ivate landscaping



PROJECT NAME	138-140 Highgate Road, Highgate, London NW5 1PB	CLIENT	Space Free Ltd
TITLE	Topsoil Validation Photo Plan – Visit 1	FIGURE	7
<b>Photo 19:</b> HTP8 – p	rivate landscaping	Photo 20: HTP8	3 – private landscaping

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PROJECT NAME	138-140 Highgate Road, Highgate, London NW5 1PB	CLIENT	Space Free Ltd
TITLE	Topsoil Validation Photo Plan – Visit 1	FIGURE	7
<b>Photo 21:</b> HTP8 – pri	vate landscaping	Photo 22: HTP9 – priva	ate landscaping



PROJECT NAME	138-140 Highgate Road, Highgate, London NW5 1PB	CLIENT	Space Free Ltd
TITLE	Topsoil Validation Photo Plan – Visit 1	FIGURE	7
Photo 23: HTP9 – private landscaping		<b>Photo 24:</b> HTP9 – priv.	ate landscaping



PROJECT NAME	138-140 Highgate Road, Highgate, London NW5 1PB	CLIENT	Space Free Ltd
TITLE	Topsoil Validation Photo Plan – Visit 1	FIGURE	7
Photo 25: HTP10 – private landscaping		<b>Photo 26:</b> HTP10 – pri	ivate landscaping

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PROJECT NAME	138-140 Highgate Road, Highgate, London NW5 1PB	CLIENT	Space Free Ltd
TITLE	Topsoil Validation Photo Plan – Visit 1	FIGURE	7
Photo 27: HTP10 – private landscaping		Photo 28: HTP11 – private landscaping	



PROJECT NAME	138-140 Highgate Road, Highgate, London NW5 1PB	CLIENT	Space Free Ltd
TITLE	Topsoil Validation Photo Plan – Visit 1	FIGURE	7
Photo 29: HTP11 – private landscaping		<b>Photo 30:</b> HTP11 – p	private landscaping

