



Keltbray Remediation

BERMONDSEY BISCUIT FACTORY - CAMPUS SITE

Verification Report





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CONTENTS

1	INTRODUCTION	1
1.1	AUTHORISATION AND PURPOSE OF THE ASSESSMENT	1
1.2	BACKGROUND	1
1.3	PROPOSED DEVELOPMENT	2
1.4	SCOPE OF WORKS	2
1.5	SOURCES OF INFORMATION	3
1.6	ROLES AND RESPONSIBILITIES	3
1.7	CONFIDENTIALITY AND LIMITATIONS	4
2	SITE SETTING INFORMATION	5
2.1	SITE LOCATION & SITE DESCRIPTION	5
2.2	PUBLISHED GEOLOGY	6
2.3	HYDROGEOLOGY	7
2.4	HYDROLOGY	7
3	SUMMARY OF HISTORICAL REPORTS / GROUND INVESTIGATIONS	8
3.1.1	ARUP 2017	8
3.1.2	HYDROCK 2018	8
3.1.3	ARUP 2018	8
3.1.4	RAMBOLL 2018	8
3.1.5	RAMBOLL / SOCOTEC 2018	9
3.1.6	ADDITIONAL GROUND INVESTIGATIONS	9
3.2	GEOLOGY	9
3.3	HYDROGEOLOGICAL MODEL	10
3.4	HYDROLOGY	11
3.5	RISK ASSESSMENTS	11



3.5.1	HUMAN HEALTH RISK ASSESSMENT FROM SOILS	11
3.5.2	CONTROLLED WATERS RISK ASSESSMENT	14
3.6	GROUND GAS RISK ASSESSMENT	14
4	CONCEPTUAL SITE MODEL (CSM)	17
4.1	RISK ASSESSMENT SUMMARY	17
4.2	POTENTIAL CONTAMINATIVE SOURCES	17
4.3	POTENTIAL RECEPTORS	17
4.4	PLAUSIBLE CONTAMINANT LINKAGES	17
4.5	GAPS WITHIN THE EXISTING DATA	19
5	REMEDIATION STRATEGY	20
5.1	REMEDIATION STRATEGY OUTLINE	20
5.2	PREFERRED REMEDIATION OPTIONS	21
5.2.1	HUMAN HEALTH	21
5.2.2	CONTROLLED WATERS	22
5.2.3	BUILDINGS	22
6	REMEDIATION WORKS AND VALIDATION	24
6.1	WSP SITE VISITS	24
6.2	RELEVANT POLLUTANT LINKAGES	24
6.3	GROUNDWORKS	25
6.4	MATERIAL DISPOSAL	29
6.5	AIR AND NOISE MONITORING	30
7	CONCLUSIONS	32

APPENDICES

APPENDIX A

FIGURES & DRAWINGS



APPENDIX B
LIMITATIONS
APPENDIX C
WSP VISIT SUMMARY
APPENDIX D
ASBESTOS MANAGEMENT PLAN
APPENDIX E
ASBESTOS AIR MONITORING CERTIFICATES
APPENDIX F
TRACKER SHEETS
APPENDIX G
MATERIALS MANAGEMENT PLAN
APPENDIX H
CHEMICAL SCREENING SHEETS
APPENDIX I
CHEMICAL TESTING REPORTS
APPENDIX J
WASTE DISPOSAL INFORMATION
APPENDIX K
AIR AND NOISE MONITORING SUMMARIES
APPENDIX L
ENVIRONMENTAL REPORT



1 INTRODUCTION

1.1 AUTHORISATION AND PURPOSE OF THE ASSESSMENT

WSP has been commissioned by Keltbray Remediation (the Client) to provide a first phase Verification Report of completed remediation works including the enabling works and the basement excavation works at the Bermondsey Biscuit Factory Campus Site, 100 Drummond Road, Bermondsey, London, SE16 4DG (the Site). The Campus part of the Site is located at Compass School Southwark, Drummond Road, Bermondsey, London, SE16 2BT. A site location plan is included within **Appendix A**.

The works verified within this report are in accordance with the WSP Remediation Strategy dated October 2020 (Ref: 70075582-002, Revision 4) and approved by Southwark Council in accordance with the Local Plan and the Core Strategy and Policy SD1 of the London Plan 2021.

The Remediation Strategy (RS) was compiled based on the findings of various phases of Ground Investigations undertaken by WSP and various other consultants in the past and the Generic Quantitative Risk Assessment (GQRA), which was submitted to Southwark Council (Ref: 70075582-001 Revision 4). Reference to this report should be made for further detailed information, although the findings are summarised below.

Additionally, this work has been conducted in line with the current good practice, including that detailed in the Environment Agency (EA) document Land Contamination Risk Management (LCRM).

The RS was written prior to the EA document CLR11, Model Procedures for the Management of Land Contamination being withdrawn.

It should be noted that the works verified within this report only include the enabling works and the basement excavation works for the Site. Any ground gas protection measures, topsoil verification works or piling risk assessment will be undertaken by follow on contractors, therefore, will be verified separately at a later stage.

It should be noted that this verification report has been prepared based on observations made during WSP's part time attendance on Site, generally during excavation works, discussions with the Contractor and information provided by the Contractor.

1.2 BACKGROUND

Multiple phases of ground investigation were carried out by various consultants between the years 2017 and 2019. However, the majority of the most recent reports are focused around the risks posed by asbestos fibres. As such in order to develop an outline remediation strategy, WSP re-screened the historical chemical data available and outlined proposed mitigation measures associated with risks to future land users and the environment following the redevelopment.

The investigations identified elevated concentrations of lead and the presence of asbestos fibres. Therefore, a Remediation Strategy was produced recommending the validation works. A summary of the validation works is provided herein.

1.3 PROPOSED DEVELOPMENT

The proposed development on the Site comprises residential end use and a school. A copy of the Masterplan is presented in **Appendix A** as **The Bermondsey Project – Design & Access Statement – Part C Masterplan**.

The proposed development will be phased as shown on Drawing No's. **2607-KPF-MPLN-XX-DR-PLN A-0015**, **2607-KPF-MPLN-XX-DR-PLN A-0016**, **2607-KPF-MPLN-XX-DR-PLN A-0017** and **2607-KPF-MPLN-XX-DR-PLN A-0018** (**Appendix A**).

The remediation works have been undertaken down to formation level by Keltbray Remediation, details of which are shown within the as built drawing (**BFX-KRE-X-000-XX-DR-CE-0104**) included in **Appendix A**. Campus Dig as Built Photos are also included within **Appendix A** in **BFX-KRE-X-000-XX-DR-CE-0105 - BFX-KRE-X-000-XX-DR-CE-0119**.

This assessment has been undertaken to discharge Contaminated Land Planning Condition 9(c) & 9(d) outlined in the Bermondsey Biscuit Factory Planning Application (No. 17/AP/4088). The Planning Conditions state the following:

(c) Following the completion of the works and measures identified in the approved remediation strategy, a verification report providing evidence that all works required by the remediation strategy have been completed shall be submitted to and approved in writing by the Local Planning Authority.

(d) In the event that potential contamination is found at any time when carrying out the approved development that was not previously identified, it shall be reported in writing immediately to the Local Planning Authority, and a scheme of investigation and risk assessment, a remediation strategy and verification report (if required) shall be submitted to the Local Planning Authority for approval in writing, in accordance with a-c above.

It is understood that planning conditions 9(a) and 9(b) have already been discharged.

1.4 SCOPE OF WORKS

Based on the findings of the previous Ground Investigations, and the Remediation Strategy, the following objectives have been identified:

Prepare a Remediation Verification Report for the first phase of works in accordance with LCRM to address the pollutant linkages identified across the development area.

- A summary of the information contained in the risk assessment reports along with the agreed redevelopment strategy and objectives;
- Details of all parties involved in the works;
- Laboratory validation test certificates if unexpected contamination encountered;
- Details and quantities of excavated soils and soils re-used on Site or disposed of off-Site;
- Records of all earthworks, excavations and sorting including as built drawings, photographs, quantities of materials exported and imported;
- An annotated photographic record showing sides and base of the excavation during the drainage infrastructure works. Photographs should include details of the location, date and as built survey showing the base of the excavation;



- Inclusion of information from an asbestos specialist providing a summary of the asbestos removal works completed which as a minimum should include Consignment Notes, Air Monitoring Records and an account of the works completed;
- Verification of backfill materials on completion of the enabling works in order to confirm suitability of re-use;
- Verification records for the gas protection measures installed;
- As built drawings; and,
- Waste classification and management documentation (including consignment note, waste carrier licenses and waste management licenses).

Any ground gas protection measures, topsoil verification works or piling risk assessment will be undertaken by follow on contractors, therefore, will be verified separately at a later stage.

1.5 SOURCES OF INFORMATION

The following sources of information were used for compiling this report:

- Arup (2017) Project Bermondsey Desk Based Asbestos in Soils Appraisal. 237092-RP-CP-001.
- Hydrock (2018) *The Bermondsey Project – Phase 1 Stage 1 Asbestos in Soil Ground Investigation, Southwark Nominee 1 Limited and Southwark Nominee 2 Limited*. TBP-HYD-S1-GI-RP-GE-1001 July 2018;
- Arup (2018) *The Bermondsey Project – Phase 1 Stage 1 Asbestos in soil investigation Interim Investigation Report, Grosvenor Britain & Ireland*. 237092-CL-RP-001, August 2018;
- Socotec (2018) *The Bermondsey Project, London – Factual Report on Site Investigation, Southwark GP Nominee 1 Limited and Southwark GP Nominee 2 Limited*. D8004-18, September 2018;
- Ramboll (2018) Technical Note - *Assessment of Results Obtained to Date from the First Stage of the Phase II Environmental Site Investigation at Bermondsey Biscuit Factory - Gardiner & Theobald LLP on behalf of Southwark GP Nominee 1 Ltd. and Southwark GP Nominee 2 Ltd*. TNUK11-24348_Stage 1; and,
- Ramboll (2019) *Bermondsey Biscuit Factory – Phase II Environmental Site Assessment: Investigation Stage 1*. UK11-24348, February 2019

1.6 ROLES AND RESPONSIBILITIES

The principal parties involved with regards to remedial activities are provided in **Table 1-1** below.

Table 1-1 – Roles and Responsibilities

ROLE	COMPANY
Employer (Principal Contractor)	Keltbray Demolition & Civils
Subcontractor (Construction)	Keltbray Remediation
Subcontractor (Asbestos Air Monitoring)	Airtech Analysis Ltd



ROLE	COMPANY
Subcontractor (Consultant - Testing)	CET Ltd DETS Ltd
Principal Designer	ARUP
Waste Removal Haulier	Keltbray Group Ltd

1.7 CONFIDENTIALITY AND LIMITATIONS

This report is addressed to and may be relied upon by Keltbray Remediation Ltd.

This assessment has been prepared for the sole use and reliance of the above-named parties. This report has been prepared in line with the WSP proposal and associated notes. This report shall not be relied upon or transferred to any other parties without the express written authorisation of WSP. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party.

This report needs to be read and used in full. General limitations of the assessment are included in **Appendix B**.

2 SITE SETTING INFORMATION

2.1 SITE LOCATION & SITE DESCRIPTION

The Site Location Plan and Site Layout Plans are provided as **Appendix A**.

Table 2-1 provides details of the Site obtained from a review of Ordnance Survey (OS) mapping, online aerial photography and key observations made during historical ground investigation works.

Table 2-1 – Summary of Site Details

Details	Description
Name and Address of Site	Compass School Southwark, Drummond Road, Bermondsey, London, SE16 2BT.
Location and Grid Reference	The Site is located in the northern part of the London Borough of Bermondsey at approximately NGR 534604, 179270
Site Description and Current Use	<p>The Site is irregular in shape and approximately 1.7 hectares (Ha) in size located to the west of Drummond Road and to the north of Clements Road.</p> <p>The Site currently comprises the Compass School Southwark.</p> <p>The Site resides in the northern part of the London Borough of Bermondsey and is located approximately 500 metres (m) south of the River Thames. The Site is currently predominantly occupied by school buildings with limited hardstanding for outdoor activities, parking and soft landscaped areas. Some of the buildings also appear to be available to be used by the general public such as the youth centre in the southern part of the Site.</p>
Surrounding Site Area and Topography	<p>The Site is surrounded by a mix of residential properties and commercial properties.</p> <p>The Site is bound to the north by residential flat with Tranton Road beyond.</p> <p>The Site is bound to the east by Drummond Road with a mix of residential properties and light commercial units beyond.</p> <p>The Site is bound to the south by Clements Road and by the existing Bermondsey Biscuit Factory which forms a part of the wider development area.</p> <p>The Site is bound to the west by several residential properties.</p> <p>The Site is generally flat with site levels ranging from approximately 2.7 metres Ordnance Datum (m OD) in the west and +3.0 m OD in the east of the Site.</p>
Site History	<p>The historical use of the 'Campus' part of the Site included terraced residential housing and a timber yard in the north in the late part of the 19th century. A school was present in the east of the Site by the end of the 19th century. A coffee factory was constructed in the centre of the Site after 1950. Historical Mapping indicates the Site was cleared of all existing buildings by 1960. By 1970, Scott Lidgett School, an open-air theatre and a youth centre were built and the Site has remained relatively unchanged until the present day however is now called the Compass School Southwark.</p>

2.2 PUBLISHED GEOLOGY

The information in the table below has been compiled from the British Geological Survey (BGS) and exploratory hole logs from the ground investigation works undertaken across the Site. A summary of the encountered ground conditions is presented in **Table 2-2**.

Table 2-2 – Geological Ground Model

Strata	General Description	Min Depth to Top (m)	Maximum Depth to Top (m)	Maximum Thickness (m)
Made Ground – Tarmacadam / Asphalt / Paving Slab	Black tarmacadam / asphalt	0.00	0.00	0.10
Made Ground – Cohesive / Granular	Sandy gravelly silt / sandy gravelly clay / clayey sandy gravel, locally with low cobble content. Gravel fractions are comprised of brick, concrete, clay tiles, clinker, flint and sandstone. Locally with thin layers of concrete.	0.05	0.10	2.05
*Alluvium	Soft and firm brown and greyish brown slightly sandy slightly gravelly clay / sandy clay. Gravel is comprised of flint.	0.60	1.50	0.85
Kempton Park Gravels	Medium dense brown and yellow very gravelly sand / Gravel. Gravel is comprised of flint.	0.70	2.35	5.10
Lambeth Group	Stiff and very stiff / very dense dark grey mottled brown, greyish brown and bluish brown, greenish grey, multicoloured silty clay / very sandy clay / sandy gravel / gravelly clayey sand. Locally with frequent shell fragments.	7.20	7.20	17.30
Thanet Formation	Very dense dark grey silty sand.	24.50	24.50	NP
**Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated)	White chalk (not encountered in exploratory holes on Site)	NP	NP	NP

NP = Not proven

* BGS Maps indicate Alluvium is present locally but not present on Site. Alluvium not encountered in all exploratory hole locations.

** Not encountered in any exploratory hole locations on Site.



2.3 HYDROGEOLOGY

The Superficial deposits of the Kempton Park Gravels and the bedrock of the Lambeth Group and the Thanet Sands are all listed as Secondary A Aquifers respectively. The Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated) are classified as a Principal Aquifer.

The site is not located within an Environment Agency (EA) designated Source Protection Zone (SPZ).

Groundwater strikes were encountered at an average depth of 4.00 metres below ground level (m BGL) in the Kempton Park Gravels and at depths between 8.60 and 17.80 m bgl in the Lambeth Group.

Monitored standing ground water levels were measured between 4.09 to 4.16 m bgl in monitoring wells installed in the Kempton Park Gravels and between 11.27 to 11.94 m bgl in monitoring wells installed in the Lambeth Group.

2.4 HYDROLOGY

The closest named surface water feature to the Site is the River Thames located at approximately 500 m north of the Site. The nearest surface water feature is an unnamed lake located 470 m south east of the Site in Southwark Park. It is possible this is a manmade surface water feature. The Site is located within Flood Zone 3.

3 SUMMARY OF HISTORICAL REPORTS / GROUND INVESTIGATIONS

A historical exploratory hole location plan of the ground investigations completed on the Campus Site completed to date is included within **Appendix A** of this report.

An outline of the historical reports provided is summarised below and discussed in detail within **Section 2.3** onwards.

3.1.1 ARUP 2017

A desk based asbestos in soil appraisal was undertaken by Arup in 2017. A review of archive sources identified areas of the Site where there is a potential for buried asbestos and asbestos containing soils present associated the historical development.

Asbestos insulation board and lagging were noted on Plot 5.

The report recommended an asbestos focussed ground investigation the scope for which was included within the Hydrock 2018 works below.

3.1.2 HYDROCK 2018

Intrusive ground investigations were undertaken between 10 April and 22 June 2018. The investigation (inside the Campus area) comprised six mechanically excavated trial pits (TP701-TP704, TP801 and TP802).

The Hydrock report contained did not provide an assessment of the data and provided factual reporting only.

The findings of the ground investigation works were reported within the Hydrock report and are summarised in the sections below.

3.1.3 ARUP 2018

The 2018 Arup report provided an assessment of the results provided in the Hydrock 2018 report. The main purpose of the report was to assess the asbestos fibres present on the Campus Site and the wider area of the Biscuit Factory.

No visual evidence of Asbestos Containing Materials (ACMs) were identified during the GI in any of the six trial pits in the Campus area.

Asbestos was detected within four of the 17 samples taken from the Campus part of the Site at quantities of 0.0005 % w/w to 0.0158 % w/w.

The Arup report only assessed the geochemical testing for waste classification purposes. As such none of the samples from the Campus area were classified above non-hazardous. The human health assessment was completed by Ramboll and is summarised in the section below.

3.1.4 RAMBOLL 2018

The 2018 Ramboll Technical Note assessed the results as presented by the factual Socotec 2018 report. The main purpose of the report was to assess the environmental findings present on the Campus Site and the wider area of the Biscuit Factory.

The Ramboll Technical Note assess the soil results against the Ramboll GACs for residential land use criteria (without plant uptake).

The Ramboll report highlighted elevated soil lead levels in 14 samples with concentrations ranging from 350 to 1362 mg/kg with respect to the GAC of 310 mg/kg.

No other concentrations were found to exceed the GAC from the Campus part of the Site.

3.1.5 RAMBOLL / SOCOTEC 2018

In 2018 Socotec was commissioned by Ramboll to undertake an intrusive ground investigation between 30 April and 13 July 2018. The investigation (inside the Campus area) comprised one cable percussion borehole (BH1B), two window(less) sample boreholes (WS2 & WS4) and one Super Heavy B Dynamic Probe (DP18).

Ramboll completed a Phase II Environmental Site Assessment following the ground investigation. The soil results were assessed against Ramboll GACs for residential land use criteria (without plant uptake). Lead exceedances were recorded in BH1B at 0.8 m bgl, WS2 at 0.9 m bgl and WS4 at 0.4 m bgl against GAC of 310 mg/kg.

A single groundwater sample was taken from BH1B. There were no exceedances of criteria for surface waters or groundwater.

3.1.6 ADDITIONAL GROUND INVESTIGATIONS

The following reports have been completed for the Campus Site and the wider Biscuit factory and are listed within the historical reports but have not been made available to WSP at the time of writing this report:

- Arup (December 2001) The Bermondsey Project, Phase 1 Asbestos in soils ground investigation specification, reference 23709232-SPEC-001 Issue 1;
- Albury SI (2000) Report of geotechnical investigation;
- Concept (2015) Biscuit Factory Plot 5 Ground Investigation, Site investigation report; and,
- Soiltechnics (2017) Biscuit Factory, Building F, Foundation investigation and assessment report.

3.2 GEOLOGY

The information in the table below has been compiled from the British Geological Survey (BGS) and exploratory hole logs from the ground investigation works undertaken across the Site. A summary of the encountered ground conditions is presented in **Table 2-1**.

Table 3-1 – Geological Ground Model

Strata	General Description	Min Depth to Top (m)	Maximum Depth to Top (m)	Maximum Thickness (m)
Made Ground – Tarmacadam / Asphalt / Paving Slab	Black tarmacadam / asphalt	0.00	0.00	0.10

Strata	General Description	Min Depth to Top (m)	Maximum Depth to Top (m)	Maximum Thickness (m)
Made Ground – Cohesive / Granular	Sandy gravelly silt / sandy gravelly clay / clayey sandy gravel, locally with low cobble content. Gravel fractions are comprised of brick, concrete, clay tiles, clinker, flint and sandstone. Locally with thin layers of concrete.	0.05	0.10	2.05
*Alluvium	Soft and firm brown and greyish brown slightly sandy slightly gravelly clay / sandy clay. Gravel is comprised of flint.	0.60	1.50	0.85
Kempton Park Gravels	Medium dense brown and yellow very gravelly sand / Gravel. Gravel is comprised of flint.	0.70	2.35	5.10
Lambeth Group	Stiff and very stiff / very dense dark grey mottled brown, greyish brown and bluish brown, greenish grey, multicoloured silty clay / very sandy clay / sandy gravel / gravelly clayey sand. Locally with frequent shell fragments.	7.20	7.20	17.30
Thanet Formation	Very dense dark grey silty sand.	24.50	24.50	NP
**Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated)	White chalk (not encountered in exploratory holes on Site)	NP	NP	NP

NP = Not proven

* BGS Maps indicate Alluvium is present locally but not present on Site. Alluvium not encountered in all exploratory hole locations.

** Not encountered in any exploratory hole locations on Site.

3.3 HYDROGEOLOGICAL MODEL

The Superficial deposits of the Kempton Park Gravels and the bedrock of the Lambeth Group and the Thanet Sands are all listed as Secondary A Aquifers respectively. The Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated) are classified as a Principal Aquifer.

The Site is not located within an Environment Agency (EA) designated Source Protection Zone (SPZ).

Groundwater strikes were encountered at an average depth of 4.00 metres below ground level (m BGL) in the Kempton Park Gravels and at depths between 8.60 and 17.80 m bgl in the Lambeth Group.

Monitored standing ground water levels were measured between 4.09 to 4.16 m bgl in monitoring wells installed in the Kempton Park Gravels and between 11.27 to 11.94 m bgl in monitoring wells installed in the Lambeth Group.

3.4 HYDROLOGY

The closest named surface water feature to the Site is the River Thames located at approximately 500 m north of the Site. The nearest surface water feature is an unnamed lake located 470 m south east of the Site in Southwark Park. It is possible this is a manmade surface water feature. The Site is located within Flood Zone 3.

3.5 RISK ASSESSMENTS

WSP has not been provided with a compiled generic quantitative risk assessment (GQRA) for the Site. The majority of the recent reports are focused around the risks posed by asbestos fibres.

As such in order to develop an outline remediation strategy, WSP has re-screened the historical chemical data available within this section and outlined proposed mitigation measures associated with the risks identified within subsequent sections of this report.

3.5.1 HUMAN HEALTH RISK ASSESSMENT FROM SOILS

In the United Kingdom, the presence of contamination on a Site is generally only of concern if an actual or potentially unacceptable risk exists. Legislation and guidance on the assessment of contaminated Sites, consistent with the European Union best practice, acknowledges the need for a tiered risk based approach. This report represents a Generic Quantitative Risk Assessment (GQRA) being a comparison of Site contaminant levels against highly conservative standards and compliance criteria including an assessment of risk using the source-pathway-receptor model.

WSP has derived a set of Generic Assessment Criteria (GAC) for the CLEA generic land use scenarios using the CLEA Workbook v1.071 Excel modelling tool. The CLEA workbook does not currently have the capacity to derive criteria to assess risks from the inhalation of vapours resulting from contaminants dissolved in groundwater. Therefore, a set of groundwater GACs has also been derived using the Johnson & Ettinger (J&E) approach.

Where appropriate, exceedances of GACs are compared against published Category 4 Screening Levels (C4SLs) (Ref. 29). These are only applicable for six compounds, namely arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead. C4SL represent a level of acceptable risk in the context of Part IIA of the 1990 Environmental Protection Act i.e. soil concentration below C4SL limit are considered to be 'definitely not contaminated' and pose at most a 'low level of toxicological concern'.

Five samples from the Socotec GI, six samples from the Hydrock GI and five samples from the Ramboll GI were assessed based on a residential end use with no plant uptake (1.0 % SOM) for the Site.

Tables 3-2 and 3-3 overleaf summarise the findings of this assessment.

Table 3-2 - Summary of Soil Contamination Exceedances (GACs)

Analyte	GAC (mg/kg)	No. of Exceedances	Maximum Concentration (mg/kg)	Location and Depth of Elevated Concentrations (Report)
Lead	188	12	569.8	BH1B at 0.8 m bgl (Socotec)
			217.3	WS4 at 0.4 m bgl (Socotec)
			803	WS2 at 0.9 m bgl (Socotec)
			262.8	WS2 at 0.8 m bgl (Socotec)
			420	TP703 at 0.7 – 1 m bgl (Hydrock)
			400	TP801 at 0.5 – 1 m bgl (Hydrock)
			360	TP801 at 2.0 m bgl (Hydrock)
			400	TP801 at 0.2 m bgl (Arup)
			360	TP801 at 0.7 m bgl (Arup)
			569.8	BH1B at 0.8 m bgl (Ramboll)
			540.5	WS2 at 0.9 m bgl (Ramboll)
			617.3	WS4 at 0.4 m bgl (Ramboll)
Benzo(a)pyrene	1.7	3	3.22	WS2 at 0.9 m bgl (Socotec)
			3.90	TP703 at 0.1 – 0.3 m bgl (Hydrock)
			2.97	WS2 at 0.9 m bgl (Ramboll)

When assessed against the current GACs, elevated concentrations of lead and benzo(a)pyrene were reported.

The results of both the lead and the benzo(a)pyrene have been compared against C4SL values for a more pragmatic yet precautionary approach of the findings of which are outlined within **Table 2.4** below.

Table 3-3 - Summary of Soil Contamination Exceedances (C4SLs)

Analyte	C4SL (mg/kg)	No. of exceedances	Maximum Concentration (mg/kg)	Location and Depth of Elevated Concentrations (Report)
Lead	310	10	569.8	BH1B at 0.8 m bgl (Socotec)
			803	WS2 at 0.9 m bgl (Socotec)
			420	TP703 at 0.7 – 1 m bgl (Hydrock)
			400	TP801 at 0.5 – 1 m bgl (Hydrock)
			360	TP801 at 2.0 m bgl (Hydrock)
			400	TP801 at 0.2 m bgl (Arup)
			360	TP801 at 0.7 m bgl (Arup)
			569.8	BH1B at 0.8 m bgl (Ramboll)
			540.5	WS2 at 0.9 m bgl (Ramboll)
			617.3	WS4 at 0.4 m bgl (Ramboll)

Lead is still found to exceed in ten samples when compared against the C4SL target value of 310 mg/kg, however no samples exceeded the C4SL concentration for benzo(a)pyrene.

Chrysotile and amosite asbestos were detected in four of the samples screened during the Hydrock ground investigation. Asbestos fibres were not identified in the four samples screened from the Socotec GI. Asbestos quantification was undertaken on each set of samples the findings of which are presented in **Table 3-4** below.

Table 3-4 - Summary of Positive Asbestos Identifications

Location	Sample Depth (m bgl)	Presence	Quantification (%)	Comment
TP702	0.60	Amosite and Chrysotile	0.0158	Sheeting / board debris
TP703	0.70	Amosite and Chrysotile	0.0014	Loose fibres and loose fibrous debris
TP801	0.10	Chrysotile	0.0005	Loose fibres
TP801	0.50	Amosite and Chrysotile	0.0026	Hard / cement type material and loose fibres

Despite the low percentage of asbestos fibres, based on the variable nature of the Made Ground and the non-threshold nature of this contaminant (i.e. there is no identified safe minimum threshold of exposure), the material could pose a potential risk to human health.

With respect to the potential risk of exposure to asbestos containing materials (ACMs) to construction workers, risk should be mitigated through the use of appropriate PPE and RPE. WSP's approach to

this assessment encompasses current industry guidance including CIRIA C733 – “Asbestos in Soil and Made Ground – A guide for understanding and managing Risks” and the Joint Industry Working Group (JIWG) “Industry Guidance on Managing and Working with Asbestos in Soils in Construction and Demolition Materials”. The JIWG Industry Guidance is specifically used in the consideration of consequence and probability in the exposure model as these documents provide practical advice in relation to the issues associated with asbestos within a soil matrix (as opposed to “original form” asbestos containing materials such as asbestos sheets, insulation boards and pipework lagging).

3.5.2 CONTROLLED WATERS RISK ASSESSMENT

The Site is underlain by three Secondary A Aquifers and one Principal Aquifer. To facilitate the assessment of risk posed by the ground to controlled waters groundwater analysis was undertaken on a single sample during the Ramboll ground investigation in September 2018. A single sample is not representative of the groundwater regime beneath the Site. A controlled waters risk assessment against Drinking Water Standards (DWS) or against Environmental Quality Standards (EQS) has been undertaken but is not thought to be representative.

Based on the proposed formation levels comprising a general cut of 1 to 2 m across the Site, it is considered likely that any potentially contaminated Made Ground on the Site will be excavated and removed. As such, the source of any residual groundwater contamination will be reduced by the removal of the Made Ground source. There still remains a potential risk of contamination being present at formation level the risk for which would require mitigation as a part of the proposed development.

3.5.2.1 Controlled Waters Risk Assessment

The Controlled Waters risk assessment was conducted in accordance with the principles of EA ‘Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination’ 2006 (EA 2006) and the ‘prevent and limit’ approach of the Water Framework Directive (2000/60/EC). Generic Controlled Waters risk assessments compare directly measured concentrations with standard assessment criteria.

Appropriate Water Quality Standards (WQS) are selected based on both a hierarchy of relevance to the receptor. In this case, the Controlled Water receptors identified in the CSM were the underlying Secondary A Aquifers and Principal Aquifers.

Therefore, based on this the following WQS is considered to be appropriate:

- Environmental Quality Standards (EQS) from The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2017; and,
- UK Drinking Water Standards.

Further details on the assumptions and methodologies adopted by WSP are provided in Error! Reference source not found..

The single sample obtained from BH1B identified no exceedances against EQS or DWS.

3.6 GROUND GAS RISK ASSESSMENT

The 2018 Socotec ground investigation included a total of six return visits undertaken from 27 August to 5 September 2018.

The maximum recorded positive flow rate was 0.1 l/hr over the six monitoring visits.

BH1B was installed into the Kempton Park Gravels where as WS4 was cross installed into the Made Ground and the Kempton Park Gravels. **Table 3-5** below presents a summary of the ground gas monitoring results.

Table 3-5 - Summary of Ground Gas Monitoring Results

Exploratory Hole	Max Flow Rate (l/hr)	Max Methane (% v/v)	Max Carbon Dioxide (% v/v)	Min Oxygen (% v/v)	Frequency of Flooding
BH1B	0.1	<0.1	6.5	12.40	0 of 6
WS4	0.1	<0.1	7.0	11.20	0 of 6

Based on the maximum methane and carbon dioxide and flow rate of 0.1l/hr the calculated GSV resulted in a Characteristic Situation 1 (Very Low Risk) Site setting. However, a number of exceedances of 5% v/v of carbon dioxide (CO₂) were recorded on several occasions throughout the monitoring period and when wells were not flooded. Due to the higher carbon dioxide concentrations Gas Characterisation Situation 2 (Low Risk) is considered the most suitable to describe the Site's current gas regime.

Characteristic Situation 2 Sites require the following consideration of the following mitigation measures:

- Reinforced concrete cast in situ floor slab (suspended or raft) with a gas resistant membrane* and underfloor venting; or
- Beam and block or precast concrete slab and reinforced gas membrane and underfloor venting;
- Under floor venting or pressurisation in combination with one of the above.
- During the installation of gas proof membrane all joints, penetrations of the gas proof membrane should be sealed, with service entries protected as appropriate. It is recommended that visual assessment of the workmanship is undertaken post laying and installation of the membrane.

** Gas resistant membrane must meet the following requirements in order to achieve a score of 2: sufficiently impervious to the gases with a methane gas transmission rate <40.0 ml/day/m²/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method), sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions, sufficiently strong to withstand in-service stresses (e.g. settlement if placed below a floor slab), sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc), capable, after installation, of providing a complete barrier to the entry of the relevant gas and verified in accordance with CIRIA C735 [N1].*

The recommendation of any mitigation is beyond the scope of this document and risk assessment based on specific building and development design will be required.

Low-level readings of carbon monoxide (CO) and hydrogen sulphide (H₂S) typically in the range of <1 ppm, were recorded during the ground gas monitoring. The proposed development is therefore not considered at risk from the ingress of these gases within existing soils.

Only two readings of 0.5 ppm and <0.1 ppm of volatile organic compounds (VOCs) from each well were recorded across the six monitoring rounds which is not considered to be sufficient to give a representative view of the VOC concentrations.



Both of the monitoring wells are in the northern part of the Site where the proposed school is likely to be built and therefore the above results would not be considered to be representative of the entire Site.

4 CONCEPTUAL SITE MODEL (CSM)

This section summarises the findings of the Remediation Strategy (RS) which provides the plausible linkages identified at the generic assessment level.

4.1 RISK ASSESSMENT SUMMARY

4.2 POTENTIAL CONTAMINATIVE SOURCES

Based on the Site conditions and potential contaminant linkages, potential sources of contamination that may affect the development have been identified as follows:

- Made Ground;
- Former timber yard; and,
- Former coffee factory.

4.3 POTENTIAL RECEPTORS

Relevant potential receptors are considered to include the following in the context of the proposed development:

Human Health

- Construction workers
- Future Site users
- Adjacent Site users / adjacent residents

Controlled Waters

- Secondary A Aquifers – Kempton Park Gravels, Lambeth Group, Thanet Formation
- Principal Aquifer - Chalk Aquifer

Future development

- Buildings and services
- Neighbouring properties

The risk assessment by WSP identified a limited risk to surface waters (River Thames) based on the distance from the Site. However, groundwater will need to be managed during any earthworks if encountered.

4.4 PLAUSIBLE CONTAMINANT LINKAGES

Table 4-1 presents the Relevant Pollutant Linkages (RPL's) that were considered to be plausible following the Site investigation, based on an evaluation of the potential sources and future receptors.

Table 4-1 - Relevant Pollutant Linkages that require Remedial Action

Relevant Pollutant Linkage	Source	Potential Pathways	Potential Receptors	Comments
RPL1	Asbestos	Inhalation of fibres on-Site	Construction workers, Future Site users Adjacent Site users / residents	Asbestos fibres and Asbestos Containing Materials (ACM) were noted at several locations across the Site. Consideration of further risk assessment and appropriate control measures must be undertaken if this material is to be re-used on site or disposed of off-Site to a suitably licenced facility.
RPL2	Metals within the Made Ground soils	Direct contact / soil ingestion in unsealed areas	Construction workers, Future Site users	Made Ground soil was found to pose a potential risk of harm to human health in unsealed areas. The risks posed by lead in Made Ground soil will require further assessment and mitigation through either further characterisation of soils (Discovery Strategy) and/or remedial measures based on the proposed development plans.
RPL3		Direct contact	Buildings and services	Contaminants within the Made Ground may impact proposed buildings and services. An assessment of concrete in aggressive ground may be required. Any pipe design should be subject to the appropriate soil testing in service trenches and agreed with the relevant statutory authority.
RPL4		Vertical migration to underlying Secondary A Aquifers and Principal Aquifer	Controlled Waters - Secondary A and Principal Aquifers	Future redevelopment will include a reduction in Site levels and removal of a majority of the Made Ground on the Site. There is a potential risk of unidentified contamination being present within the soils below the cut level which may impact Controlled Waters underlying the Site. It is considered likely that the proposed development will be piling through the Made Ground on Site. Piled foundations may provide a preferential pathway for shallow contamination to reach the deeper groundwater bodies. A Piling Risk Assessment should be completed to prevent contamination of the Principal aquifer.

Relevant Pollutant Linkage	Source	Potential Pathways	Potential Receptors	Comments
RPL5	Made Ground: Active generation of ground gas (carbon dioxide, methane, low oxygen concentrations)	Vertical migration and accumulation in confined spaces in proposed development	Future users Adjacent users residents	Site / Site / Ground gas measures will be required for new buildings in accordance with C665 for a low risk Characteristic Situation 2 site. Further GI may be considered to reduce the Gas Characterisation Situation.

4.5 GAPS WITHIN THE EXISTING DATA

Based on the limited coverage across the Campus Site, there are considered to be gaps within the existing data, however, based on the proposed development comprising a reduction in Site levels by 1 to 2 m bgl, it is considered likely that most of the Made Ground soils present on the Site will be excavated and taken off Site. It is recommended that further assessment and a watching brief by a suitably qualified person is maintained for the duration of these works in order to ensure that unidentified contamination is suitably identified and managed, if encountered.

It should be noted that an assessment of the available geotechnical data from historical ground investigations has not been included within this report.

5 REMEDIATION STRATEGY

5.1 REMEDIATION STRATEGY OUTLINE

WSP's Remediation Strategy proposed the following remediation objectives set out below in **Table 5-1** in respect to the RPLs outline in **Table 4-1** above.

Table 5-1 – Summary of Remediation Objectives per Relevant Pollutant Linkage

RPL	Source	Aim / Requirements	Action
RPL1	Asbestos Fibres	Protection of construction workers, future Site users and adjacent Site users / residents	<p>Control measures during earthworks and controlled removal of arisings generated.</p> <p>During groundworks appropriate PPE/RPE and mitigation methods as outlined within an Asbestos Management Plan are recommended to mitigate the risk against the release of airborne asbestos fibres (including air monitoring) are recommended.</p> <p>Provision of a pathway break in soft landscaped areas (pathway break to be completed and verified at a later stage by subsequent contractors).</p>
RPL2	Metals within the Made Ground soils	Protection of construction workers and future Site users	<p>Control measures in line with CDM Regulation during earthworks and any other excavation works associated with basements and infrastructure.</p> <p>A watching brief by a suitably qualified person during bulk excavations is recommended to observe potential unidentified contamination.</p> <p>Provision of a pathway break in soft landscaped areas (pathway break to be completed and verified at a later stage by subsequent contractors).</p>
RPL3	Metals within the Made Ground soils	Protection of Buildings and services	Assessment of concrete in aggressive ground and potential requirement for barrier pipes (subject to agreement with relevant statutory authority).
RPL4	Metals within the Made Ground soils	Protection of Controlled Waters - Secondary A and Principal Aquifers	<p>A Watching brief by a suitably qualified person during bulk excavation works to observe potential unidentified contamination during the works.</p> <p>Further assessment of risk to Controlled Waters if potential contaminants of concern are identified at formation level.</p>

RPL	Source	Aim / Requirements	Action
			A Piling Risk Assessment to be completed at a later stage by others when piling design known.
RPL5	Ground Gas	Protection of future Site users	Control measures during excavation works and prevention of gas migration through the use of suitable gas protection measures as a part of the proposed development. Alternatively, further sampling and re-assessment of risk.

5.2 PREFERRED REMEDIATION OPTIONS

Based upon the proposed formation levels, literature review, consultation with a number of specialist contractors, and from direct experience on Sites of similar complexity, it is considered that an appropriate and cost-effective approach can be adopted is a mixture of excavation and dispose / removal to soil treatment facility and materials management and cover systems / barriers.

Based on the available data the preferred remedial option comprises the following:

5.2.1 HUMAN HEALTH

5.2.1.1 Metals – Lead

Residual risks to human health associated with contaminated soils within the upper 600 mm of the final finished formation levels will be mitigated for lead contamination, through the removal of Made Ground to achieve the formation levels and the covering of most of the Site with buildings and hardstanding where Made Ground may still be present following earthworks. In small areas of proposed soft landscaping residual human health risks will be mitigated for lead contaminated soil, through the import or re-use of a 600 mm clean cover system which is chemically compliant with the end-use of the Site. This element of the proposed remediation works that will require verification by subsequent contractors following the completion of the Keltbray works.

5.2.1.2 Asbestos

For asbestos contaminants, this should be managed as a part of the construction works under an Asbestos Management Plan. The Asbestos Management Plan will be produced by Keltbray one month prior to commencing works for their package of works. This document should be updated by subsequent contractors who will be continuing construction. As general Site Management good practice, earthworks operatives should be given a toolbox talk on potential contaminated land risks in particular the possibility of encountering Asbestos Containing Material (ACM) prior to excavation. If suspected ACM is identified, then the following is required:

- I. Stop works in the vicinity of the suspected location;
- II. Inform Site Manager;
- III. Inform the environmental consultant;
- IV. Operatives to be provided with appropriate PPE;
- V. Damp and cover the location to prevent release of asbestos fibres;

- VI. Fence off the area to prevent tracking of fibres across the Site by vehicle / people movements;
- VII. Collection of soil sample for asbestos quantification testing;
- VIII. If the sample is negative for asbestos (i.e. non-detect or <0.001%) no further works are required;
- IX. If the sample records asbestos at >0.001% or is in an area of soft landscaping then the material must be excavated in accordance with the procedure described below (for the remediation of identified contamination RPL1); and,
- X. If the sample records asbestos at <0.1% and is below an area of hardstanding or within the building footprint then the material can remain, provided that a woven geotextile membrane (terram hi viz) and 200 mm of clean validated material is placed over the soil to minimise the spread / release of asbestos fibres during construction phase; or excavated to a temporary covered stockpile for placement below a hardstand area at a later time. If ACMs are identified and the Contractor opts to allow the material to remain in place (after providing cover layer) the extent must be surveyed and recorded on an as built drawing and retained in the Health and Safety File.

Risks to human health will be mitigated across the majority of the Site through the covering of the Site with buildings and hardstanding. Within the small areas of soft landscaping, a 600 mm clean cover will be imported (or Site re-won) and placed as a part of the proposed development. Where development is to be undertaken in stages, sufficient interim cover (minimum 150 mm) should be placed across the Site to protect construction workers and other Site users.

5.2.2 CONTROLLED WATERS

Based on the proposed excavation and removal of the majority of the Made Ground across the Site, any potential sources of contamination are considered likely to be removed. There may be potential areas of unidentified contamination present at formation level following the earthworks which could pose a risk to Controlled Waters.

A watching brief by a suitably qualified person is also recommended during earthworks in order to identify any potential areas of concern at formation level which may require further assessment during the works in order to ensure that there is a low risk to Controlled Waters.

5.2.3 BUILDINGS

5.2.3.1 Ground Gases

The potential presence of elevated ground borne gas (indicating a CS2 classification - Low Risk) should be reconsidered upon completion of the remedial works.

It is understood that the Site levels will be reduced across the Site and the current available data only covers the northern part of the Site. It is recommended that the proposed gas protection measures outlined above are confirmed based on the final formation levels on the Site and the proposed locations of the buildings.

Insufficient data has been provided of volatile organic compounds recorded by the Photo Ionisation Detector for soils. As such the risk from the ingress of volatile organic compounds within existing soils cannot be ruled out at this time. However, based on the proposed removal of the majority of the Made Ground on the Site, the potential source of contamination would be removed.



It should be noted that this element of the proposed remediation works will be completed by subsequent contractors following the completion of the Keltbray works.

5.2.3.2 Foundations

If elevated concentrations of sulphate are noted, the concrete foundations for the buildings will require appropriate design of concrete classification.

5.2.3.3 Services

Based on UK Water Industry Research 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' and the available data, an indicative assessment has been undertaken on the type of water supply pipes that may be suitable for the Site. The assessment suggests that barrier pipes may be required. Once the proposed locations of the potable water supply pipes have been confirmed; appropriate soil testing should be agreed with the relevant statutory authority.

It should be noted that the water supply company's bespoke threshold concentrations take precedence over the UKWIR guidance, therefore, this should be confirmed prior to construction.

6 REMEDIATION WORKS AND VALIDATION

6.1 WSP SITE VISITS

WSP conducted six visits between 23 July and 30 September 2021 during the remediation works within the Bermondsey Biscuit Factory Campus area of the wider development. This verification report has been produced based on observations during those site visits and our conversations with the principal contractor for the duration of the works.

The WSP Site visits are summarised within **Table 6-1**.

Table 6-1 – Summary of WSP Site Visits

Date	Site Visit No.	Site Operative	Details
23/07/2021	1	Alex Reavley	Works commenced on the Campus Site from the 19/07. Excavation of Made Ground (MG) from 20/07. In-Situ soil sampling had occurred across the Campus Site week previous to determine ground works strategy.
03/08/2021	2	Ali Brooke	Groundworks continuing within the previous building area almost excavated to formation levels with laid 6F2 capping of 200mm. SW corner of Site excavated and backfilled using site won MG and finished with Concrete Crush (CC).
24/08/2021	3	Ali Brooke	Excavation and re-levelling of the soils in the former access road entering the site from the east running west. A stockpile of MG was present to be transferred to the Main Site for re-use. The western and southern edges of Site were completed with the edges around the north yet to be finished off.
08/09/2021	4	Ali Brooke	Groundworks largely completely on Site. Northern boundary wall edge left to be excavated, sloped and capped. UXO probing also occurring across the site.
13/09/2021	5	Ali Brooke	Works largely completed with the exception of the small raised areas which run east to west along the northern boundary of the Site along the boundary walls. UXO probing continuing
30/09/2021	6	Ali Brooke	Northern boundary half excavated with the remaining areas being the north west corner. Delays occurred as one of the gardens to the north was collapsing into the campus site due to poor stability and shoring.

A full summary of these visits and associated photographs can be found in **Appendix C**. Note that the summaries contain details about the visits to both the Main Site and the Campus Site.

6.2 RELEVANT POLLUTANT LINKAGES

Table 6-2 below provides a summary of the remediation and validation works in comparison to the required actions and records specified within the Remediation Strategy. An assessment of whether the actions are considered complete is also provided.

Table 6-2 – Summary of Remediation and Validation Works

REQUIRED ACTION (AS PER REMEDIATION STRATEGY)	WSP COMMENT	COMPLETED (YES/NO)
RPL1, RPL2 & RPL4 – Asbestos Fibres and Metals Contamination in the Soils	<p>A watching brief was undertaken by a suitably qualified person from Keltbray Remediation during bulk excavations to observe potential unidentified contamination.</p> <p>Keltbray Remediation carried out appropriate sampling and testing of material in order to demonstrate suitability of use as per the WSP Remediation Strategy. Where asbestos was encountered, further quantification was carried out.</p> <p>Control measures were implemented in line with CDM Regulation during earthworks and any other excavation works associated with basements and infrastructure.</p> <p>The Subcontractor followed procedure within an Asbestos Management Plan (Keltbray Remediation. Ref: DC1220.AMP.010421 Rev 00) and provided a strategy and method statements to ensure safe and robust removal of ACM in accordance with CAR 2012 (Appendix D)</p> <p>Asbestos air monitoring was carried out daily during groundworks, all certificates are included within Appendix E. All asbestos air monitoring values were recorded as below the trigger value.</p> <p>Provision of a pathway break in soft landscaped areas to be completed and verified at a later stage by subsequent contractors).</p>	YES
RPL5 – Ground Gases	<p>The potential presence of elevated ground borne gas (indicating a CS2 classification - Low Risk) was recommended to be reconsidered upon completion of the remedial works.</p> <p>The ground levels have been reduced across the Site therefore gas protection measures should be confirmed based on the final formation levels on the Site and the proposed locations of the buildings.</p> <p>This element of the proposed remediation works will be completed by subsequent contractors following the completion of the Keltbray works.</p>	NO

6.3 GROUNDWORKS

The Keltbray Remediation works included breaking and crushing the concrete slab, removing below ground obstructions, stockpiling of material for subsequent testing, then re-use of Site-won material, off-Site disposal of surplus excavated soil and finally placement of the piling mat.

Keltbray Remediation have provided an as built drawing (**BFX-KRE-X-000-XX-DR-CE-0104**) included in **Appendix A**.

Kelbray Remediation reported that the following Cut & Fill volumes are recorded on Site:

- Actual dig volume Campus Site – 3,385 m³;
- Disposal volume – 324 m³;

- Re-use soil volume (Stockpile SP-F001) – 700 m³;
- Remaining volume was transferred to the Main Biscuit Factory Site for screening, testing, processing for re-use – 2,361 m³.

It should be noted that 314 m³ of the disposed soils is not represented within the Stockpile Tracker as this material was directly loaded into trucks for off-site disposal. 10m³ is shown on the Campus Stockpile Tracker from the metal and asbestos hotspots in the north west corner of the Site (grid square D7).

The following volumes were transferred from the Main Biscuit Factory Site following screening, testing and processing, for capping and building of site levels on the Campus Site:

- Crush material from the Main Biscuit Factory - 1458 m³; and
- Soils from the Main Biscuit Factory (Stockpile SP-F004) – 515 m³.

Copies of the Backfill Tracker and Stockpile Tracker sheets are included within **Appendix F**. The Materials Management Plan (MMP) for the Site is located within **Appendix G**

Chemical testing was undertaken as summarised in **Table 6-3**.

Table 6-3 – Summary of Chemical Testing

Report No	Details	Sample References	Sample Numbers	Date Sampled
21-02149	Initial Trial Pitting Exercise	TP04 @ 0.50 & 1.40 mbgl, TP05 @ 1.50 & 1.90 mbgl & TP06 @ 1.20 mbgl	527470 - 527472	17/02/2021
21-08980	In-situ Soils Sampling	Campus_WS01 - Campus_WS10	555122 - 555131	14/07/2021
21-09370	Re-used Soils Sampling (SP-F001)	Campus_VS01 & Campus_VS02	556761 & 556762	22/07/2021
21-12103	Re-used Concrete Crush Sampling	CC-VS02 - CC-VS05	567964 - 567967	05/10/2021
21-12104	Re-used Soils Sampling (SP-F004)	Campus_VS03 & Campus_VS04	567968 & 567969	04/10/2021

The testing contained exceedances of lead and benzo(a)pyrene above residential without private gardens criteria and of lead above public open space criteria. Asbestos was encountered in five instances. **Table 6-4 & Table 6-5** show the summary of exceedances against GAC.

Table 6-4 – Summary of Exceedances above Residential with no Plant Uptake GAC

Analyte	Location	Grid Square of Origin	Grid Square of Destination	GAC (mg/kg)	Concentration (mg/kg)
Lead	Campus_WS01* – WS03, WS05 – WS10, Campus VS01- VS02 & TP04 – TP06*	D7, F6, E6, D5/6, E6, F5, D5, E5, D4, G5, F4/5 and E7	D5, D6, D7, C2, C3, C4, D2, D3, D4, E3 & E4	188	Range of 232 - 546
	Campus VS03- VS04	BF-OPQ - O11-O12, L10-L13 & M11-M12**	C7-F7, G6-F6 & G4/5		355 - 391
	Campus_WS04	D6	N/A (Disposed)		2800
Benzo(a)pyrene	Campus_WS03	E6	D5, D6, D7, C2, C3, C4, D2, D3, D4, E3 & E4	1.7	1.86
	Campus_WS08	D4	D5, D6, D7, C2, C3, C4, D2, D3, D4, E3 & E4		3.2

*Campus_WS01 and TP06 samples were disposed off site.

** Soils transferred from Main Biscuit Factory Site see (BER-ARP-BFXXX-XX-SK-D-82002_Isopac) presented within Appendix A for origin locations.

Table 6-5 – Summary of Exceedances above Public Open Space GAC

Analyte	Location	Grid Square of Origin	Grid Square of Destination	GAC (mg/kg)	Concentration (mg/kg)
Lead	Campus_WS04	C6/C7	N/A (Disposed)	375	2800
	Campus_WS05, Campus_WS10 & TP04 – TP05	D5/6, D4, G5 & F4/F5	D5, D6, D7, C2, C3, C4, D2, D3, D4, E3 & E4		398 - 613
	Campus VS04	BF-OPQ - O11- O12, L10-L13 & M11-M12**	C7-F7, G6-F6 & G4/5		391

The full screening sheets are presented in **Appendix H**.

Table 6-6 shows details of the encountered asbestos

Table 6-6 – Summary of Encountered Asbestos

Location	Grid Square of Origin	Grid Square of Destination	Identification	Details	Quantification (%)
Campus_WS01	C7	N/A (Disposed)	Amosite	Present in Visible & Microscopic Board debris	0.109
Campus VS02	SPF001	D5, D6, D7, C2, C3, C4, D2, D3, D4, E3 & E4	Amosite	Present as Fibre Bundles	<0.001
TP06	E7	N/A (Disposed)	Chrysotile	Small bundles	<0.001
CC-VS05	BF-OPQ - O11-O12, L10-L13 & M11-M12**	C2-E4	Chrysotile	Present as Fibre Bundles	<0.001
Campus VS03	BF-OPQ - O11-O12, L10-L13 & M11-M12**	C7-F7, G6-F6 & G4/5	Chrysotile	Present as Fibre Bundles	0.001

** Soils transferred from Main Biscuit Factory Site see (BER-ARP-BFXXX-XX-SK-D-82002_Isopac) presented within Appendix A for origin locations.

As outlined below, all the soil material that is to be re-used will be in an area of building footprint or under hardstanding, WSP considers this to provide a sufficient pathway break to future end users.

Samples from Campus_VS01 and VS02 represented soils from the Stockpile SP-F001 (700m³) which comprised of soils from grid squares D7, F6, E6, D5/6, E6, F5, D5, E5, D4, G5, F4/5 and E7. These were reused on the Campus Site and were placed into the following grid squares: D5, D6, D7, C2, C3, C4, D2, D3, D4, E3 and E4.

Samples from Campus_WS01, Campus_WS04 and TP06 (from D7 , D6, E7/ C7) were taken off site for disposal given contamination of Asbestos (0.109% within WS01) and Lead (2,800 mg/kg within WS04). TP06 was also found to contain asbestos and the soils here were removed from site given said contamination and proximity to WS01.

These hotspots (WS01 and WS04) were treated differently to the general Made Ground deposits, to adhere with best practice, the material were segregated into separate stockpiles from the general Made Ground deposits and they were thereafter disposed off-Site separately instead of re-use on Site. Validation samples were taken of the underlying material following excavation and off-Site disposal (Report No. 21-09372 & 21-09373. Samples – 556765, 556766, 556767 & 556768). The full chemical reports are located in **Appendix I**.

The following samples were transferred from the Main Biscuit Factory processing area onto the Campus Site: Campus_VS03-VS04 and CC_VS05. These soils were placed as follows: Campus_VS03-VS04 within C7-F7, G6-F6 and G4/5. The CC_VS05 sample corresponds to concrete crush material which was placed within the south west portion of the Site, grid squares C4-F4, C3-F3 and C2-D2 and is not believed to pose a risk to future site users given it was capped by structures or harstanding.

The origin of the soils and samples (Campus_VS03-VS04) are from BF-OPQ - O11-O12, L10-L13 and M11-M12, **(BER-ARP-BFXXX-XX-SK-D-82002_Isopac)** presented within **Appendix A** show these grid squares. The CC-VS05 sample was from the concrete crush stockpile contained within the RST area of the Biscuit Factory, a grid reference for the specific origin of the CC-VS05 sample is not available.

Chemical testing results of the material transferred from the Main Biscuit Factory can be found within report No. 21-12103.1 (samples 567964, 567965, 567966 & 567967) for CC-VS02 to CC-VS05. As well as report No. 21-12104.1 (samples 567968 & 567969) for Campus_VS03 and VS04 samples. The full chemical reports are located in **Appendix I**.

During construction, visual or olfactory evidence was not recorded by the subcontractor on the Campus Site.

6.4 MATERIAL DISPOSAL

Kelbray Remediation has provided waste transfer notes relating to surplus materials removed off-Site. A summary of the disposal facilities receiving material and the haulage subcontractors that transported it are summarised below.

- Disposal Facility - Mohawk Wharf, Bradfield Road, Silvertown, London, E16 2AX. (Environmental Permitting Number - EPR/FP3092LH):

Kelbray Group Ltd (26 truckloads of material; totalling approximately 234 m³)

- Disposal Facility – Barking Eurohub, Box Lane, Renwick Road, Barking, IG11 0SQ (Environmental Permitting Number - EPR/GB3003GR):

Kelbray Group Ltd (6 truckloads of material; totalling approximately 54 m³)

- Disposal Facility - Orsett Quarry Ecological Park, Buckingham Hill Road, Stanford-le-Hope, Thurrock, Essex, SS17 0PP (Environmental Permitting Number - EPR/DB3102UX):

Kelbray Group Ltd (3 truckloads of material; totalling approximately 27 m³)

- Disposal Facility – Biffa Waste Services Ltd, Redhill Landfill, Cormongers Lane, Nutfield, Redhill, Surrey, RH1 4ER (Permit Number – BU8126):

Kelbray Group Ltd (1 truckload of material; totalling approximately 9 m³)

The material removed from Site, was classified as the following European Waste Codes, summarised in **Table 6-2**.

Table 6-2 – Summary of Material Disposal Classification

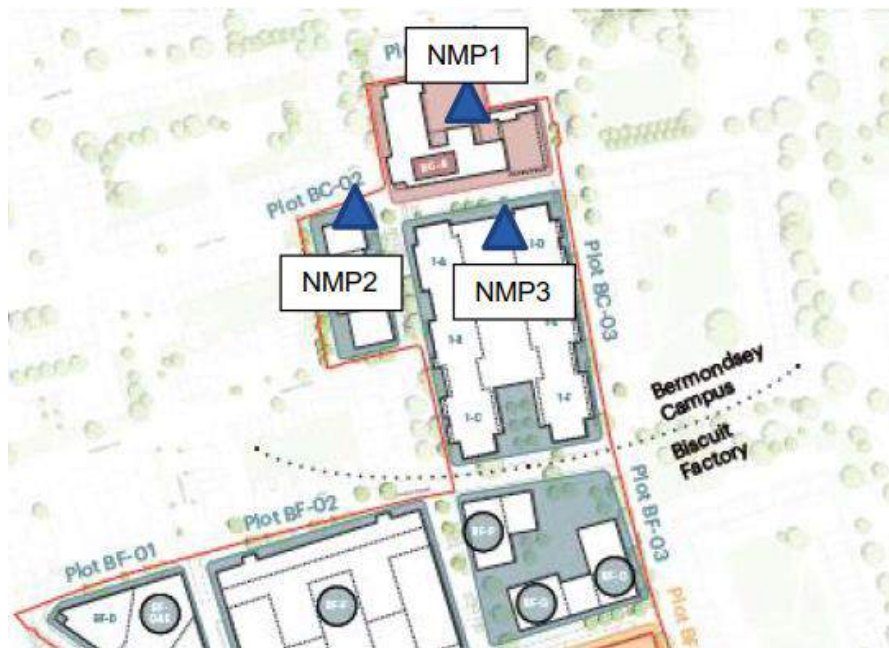
European Waste Classification	European Waste Code	No. of Truck Loads	Approximate Volume (m ³)
Soil and Stones – Hazardous	17.05.03	2	18
Soil and Stones – Non-hazardous	17.05.04	28	252
Soil & Stones – Non-hazardous with >0.001% asbestos	17.05.04	6	54

Appendix J contains details of the waste disposal facilities including disposal facility licenses, haulage licenses and examples of waste transfer tickets.

6.5 AIR AND NOISE MONITORING

The developmental works at the Campus Site are subject to the Best Practice Guidance of London Councils and the Greater London Authority. Keltbray Remediation therefore undertook ambient air and noise quality monitoring at three points, NMP1-NMP3. NMP1 is located on the site hoarding by Flannery Court, NMP2 is located near Sugarhouse Studios and NMP3 is located on the roof of the school as shown in **Figure 1** below.

Figure 1 – Locations of the Air/Noise Monitoring Points



Dust and noise monitoring were undertaken during the bulk earthworks which took place during 26 July and 23 September 2021.

At the three monitoring points air monitoring readings were taken every 1 minute, the trigger value is over a 1-hour average (190ug/m³). The air monitoring is summarised in **Table 6-3**.

Table 6-3 – Summary of Air Monitoring

Monitoring Location	No of Exceedances over Trigger Value	Highest Average Value (ug/m ³) - Date
NMP1 - Roof of the School	0	36.6 - 06/09/2021
NMP2 - Site Hoarding West	0	39.7 - 14/09/2021
NMP3 - Sugarhouse Studios	0	39.5 - 08/09/2021

Real-time noise readings were taken every 1 minute. Cumulative noise readings (LAeq) are recorded over a 10-hour working period (8.00 am to 18:00 pm). The noise trigger value for each monitoring points and highest cumulative noise readings as summarised in **Table 6-4**.

Table 6-4 – Summary of Noise Monitoring

Monitoring Location	Trigger Value (dB)	Highest Cumulative Noise Readings (dB) - Date
NMP1 - Roof of the School	78	66.6 - 19/08/2021
NMP2 - Site Hoarding West	78	76.3 - 19/08/2021
NMP3 - Sugarhouse Studios	80	73.3 - 19/08/2021

Summaries of the air and noise monitoring compiled by Keltbray Remediation are included in **Appendix K**. An example of a weekly environmental monitoring report is included in **Appendix L**.

7 CONCLUSIONS

WSP has prepared this first phase Remediation Validation Report based on the information provided by the Client. A summary of the Relevant Pollutant linkages identified in the Remediation Strategy prepared by WSP is provided below:

- **RPL1, RPL2 & RPL4 – Asbestos Containing Soils and Metals in the Made Ground Soils:** A watching brief was undertaken by a suitably qualified person from Keltbray Remediation during bulk excavations to observe potential unidentified contamination. Keltbray Remediation carried out appropriate sampling and testing of material in order to demonstrate suitability of use as per the WSP Remediation Strategy; and,
- **RPL5 - Ground Gas:** WSP recommended that gas protection measures should be reconsidered as a part of the proposed development following completion of the remedial works. The ground levels have been reduced across the Site therefore gas protection measures should be confirmed based on the final formation levels on the Site and the proposed locations of the buildings.

Provision of a pathway break in soft landscaped areas to be completed and verified at a later stage by subsequent contractors.

Keltbray Remediation reported that 1215 m³ of soil material and 1458 m³ of concrete crush were re-used on-Site. Material was reused in accordance with the MMP included within **Appendix G**. The re-used materials backfill tracking sheet and stockpile tracking sheet are both included within **Appendix F**.

Analysis of the soil material contained exceedances of lead and benzo(a)pyrene above residential without private gardens criteria and of lead above public open space criteria. However, as the material is placed in an area of proposed hardstanding / within the building footprint, WSP considers this to provide a sufficient pathway break to future end users.

Hotspots of the in-situ soil material were segregated into separate stockpiles from the general Made Ground deposits. These hotspots were determined as where asbestos with a quantification of >0.1% was encountered (Campus_WS01 with 0.109%) and an area of exceedingly elevated lead (Campus_WS04 with 2,800 mg/kg). With respect to TP06, these soils were removed along with the hotspot soils given their proximity to WS01. These hotspots were treated differently to the general Made Ground deposits, to adhere with best practice, the materials were segregated into separate stockpiles from the general Made Ground deposits and they were thereafter disposed off-Site separately instead of re-use on Site. Validation samples of the underlying material were taken and tested.

A total of 324 m³ of surplus material was removed off-Site to four disposal facilities by the hauler Keltbray Group Ltd. The material was classified as Soil and Stones and either hazardous or non-hazardous depending on the absence and/or quantification of asbestos.

Ambient air and noise monitoring were undertaken at three monitoring points in close proximity to the Campus Site. There have been no exceedances recorded against the trigger values related to the remedial works.

Based upon the information provided to WSP by Keltbray Remediation and contained within this report, it is considered that the excavation works, and the use of Site won material across the



Bermondsey Biscuit Factory Campus Site have been undertaken in line with the Remediation Strategy. Outstanding works are limited to the pathway break in the soft landscaped areas and further confirmation of gas protection measures.