



Site Investigation

YEX1928 – 3 Maltings Lane

February 22

	Name	Position	Signature	Date
Responsible	James von Mehren	Geo- Environmental Engineer		9 February 2022
Authorised	Colin Hiscock	Technical Director		9 February 2022

Issue	Date	Description	Contributors	Responsible	Authorised
01	9 February 2022	Final Report	AH	AH	CH

Contents

Contents	- 2 -
Executive Summary	- 3 -
Introduction.....	- 4 -
Site Investigation	- 8 -
Site Investigation Findings	- 14 -
Updated Conceptual Site Model and Risk Assessment.....	- 15 -
Recommendations.....	- 17 -
Notes and Limitations.....	- 19 -

Appendix A	Site Investigation Plan
Appendix B	Laboratory testing results

Executive Summary

The below table shows a snapshot of the recommendations concerning contamination. It is advised that the report is read in its entirety to gain a better understanding of our findings.

No Further Works Required

There is no evidence presented within this report of potential contamination that would require any further works.

Contaminant Found	
Soil – Metals	X
Soil – Hydrocarbons	X
Soil – Asbestos	X
Soil – Others insert here	X

Introduction

This Site Investigation (SI) is undertaken as a result of recommendations made by a previously issued Phase 1 Report (YEX1803). This report seeks to address the potential pollutant linkages identified within this report and update the Conceptual Site Model (CSM).

We are content that as a result of the SI works, we have characterised the ground conditions and the potential for contamination to exist on site.

Preliminary Conceptual Site Model (CSM)

The assessment is undertaken based on the current proposals for the site and is taken from the existing Phase 1 report.

Proposed Land use Assessment Criteria

Residential without consumption of homegrown produce

Any change in the development proposals for the site involving a change in end use class will result in a requirement for this assessment to be revised.

On Site						
Source	Pathways	Receptor	Severity	Probability	Risk	Justification
Made Ground possibly containing metals, TPH, PAH, VOC's and sVOC's	Ingestion, dermal contact, inhalation of dusts and vapours	Future end users and site visitors	Mild	Low Likelihood	Low ●	A low risk has been assessed due to the absence of any contaminative past land uses identified on site. However, a pathway is present through garden areas.
		Construction Workers	Mild	Likely	Moderate/ Low ●●	Construction workers are likely to come into direct contact with soils during groundworks. Safe working practices should be implemented and appropriate personal protective equipment (PPE) should be used to mitigate any potential risk from contact with soils and shallow/perched groundwater.
	Leaching through soils and migration via groundwater or soil pore moisture	Controlled Waters	Mild	Unlikely	Very Low ●●	A very low risk rating has been assessed due to the absence of potentially contaminative sources on site and the presence of Unproductive aquifers in the underlying geology. There are no abstraction licenses within 1000m of the site.
	Permeation of water pipes	Construction materials, future end users and site visitors	Medium	Low Likelihood	Moderate/ Low ●●	Hydrocarbons, especially aromatics are known to permeate plastic pipes. Provision of water supply pipes and connectors formed from proprietary "barrier pipe" materials (eg polyethylene-aluminium-polyethylene) may be required by the water supply company.

	Uptake	Plant and Wildlife	Minor	Low Likelihood	Very Low ●●	A low risk has been assessed due to the absence of any contaminative past land uses identified on site. However, a pathway is present through garden areas.
Asbestos at/near ground surface in Made Ground	Inhalation of fibres in airborne dust	Future end users and site visitors	Medium	Low Likelihood	Moderate/ Low ●●	A moderate/low risk rating has been assessed due to the commercial history of the site creates potential for asbestos.
		Construction Workers	Medium	Low Likelihood	Moderate/ Low ●●	Construction workers are likely to come into direct contact with soils during groundworks. Safe working practices should be implemented and appropriate personal protective equipment (PPE) should be used to mitigate any potential risk from contact with soils and shallow/perched groundwater.
Ground Gases: from Made Ground: H, CH ₄ , CO, CO ₂ and H ₂ S	Gas migration and build up within buildings (explosion/asphyxiation risk)	Future end users and building structures	Mild	Unlikely	Very Low ●●	A very low risk rating has been assessed due to the limited thickness and lack of organic and/or degradable content assumed to be present in the made ground. Such made ground is generally classified as very low risk in terms of potential for gas generation.

Off Site						
Source	Pathways	Receptor	Severity	Probability	Risk	Justification
Land uses in the vicinity possibly containing metals, TPH, PAH, VOC's and sVOC's	Leaching through soils and migration via groundwater or soil pore moisture	Future end users and site visitors	Medium	Low likelihood	Moderate/ Low ●●	Given the low permeability of underlying deposits, it is considered a low likelihood of contaminant migration to site. However, given the presence of sources within a close proximity of the site, there is some potential of migration.
	Ingestion, dermal contact, inhalation of dusts/vapours	Future end users and site visitors	Medium	Low likelihood	Moderate/ Low ●●	Given the low permeability of underlying deposits, it is considered a low likelihood of contaminant migration to site. However, given the presence of sources within a close proximity of the site, there is some potential of migration and the proposed garden areas are a potential pathway.
Ground Gases: from Made Ground: H, CH ₄ , CO, CO ₂ and H ₂ S	Gas migration and build up within buildings (explosion/asphyxiation risk)	Future end users and building structures	Mild	Unlikely	Very Low ●●	No significant landfilling activities have been identified. Therefore, the chance of ground gas generation and migration from offsite sources is considered unlikely.

Site Investigation

The following SI works were completed on June 23rd 2021 under the supervision of a Geo-Environmental Engineer from YE. In summary, the investigation included:

A two-man team ascertained the routes of any below ground services in close proximity to the proposed exploratory hole positions, using a CAT scan and lifting up of any man hole covers. Following the CAT scan, hand dug starter pits were completed to a depth of 1.20 metres below ground level (mbgl).

Excavation of six (6no.) machine dug trial pits (TP01 to TP06) were completed to a maximum depth of 2.00mbgl. The locations of exploratory positions were selected relative to the historic land use and current proposed redevelopment plans for the site whilst providing a broad coverage of the site as feasibly as possible.

The trial pit locations were logged with any groundwater conditions noted and representative soil samples removed in accordance with current guidelines.

Soil samples were removed from shallow sub surface locations, with further samples taken at depth every 1.00mbgl or when the underlying stratum changed. Samples were subsequently placed in suitable containers including 1kg tubs and 250ml glass jars and placed in cool boxes with cool packs prior to storage within our *in-house* laboratory fridges and then subsequent forwarding to our designated laboratory for analysis.

Upon completion, all exploratory locations were back filled, compacted and made good to existing levels and finishes, with any surplus spoil bagged up and removed from site.

The positions of exploratory holes in relation to the existing site layout can be reviewed within Appendix A.

Geology & Ground Conditions

The following ground conditions were encountered during the works:

Made Ground – Encountered in TP02 to a depth of 0.20mbgl and is described as Brown gravelly SAND. Gravel is fine, subangular to subrounded of flint, rare brick and macadam.

Topsoil – Encountered in both locations to 1.30mbgl and is described as Brown slightly clayey SAND with rootlets.

Visual and Olfactory Observations

With the exception of general anthropogenic material identified, no visual and/or olfactory evidence of potential contamination was noted within any soils encountered as part of the investigative works undertaken.

Soil Testing

A total of six (6no.) samples have been analysed by Chemtech Environmental Ltd in their UKAS and MCERTS accredited laboratory. This testing comprise of:

- Speciated Total Petroleum Hydrocarbons (TPH CWG Aromatic/aliphatic split)
- Heavy metals and other metalloids
- Speciated Polycyclic Aromatic Hydrocarbons (PAH)
- Asbestos
- Soil organic matter (SOM)
- MTBE & BTEX
- Sulphates

The results of this laboratory testing have been compared to the Soil Guideline Values (SGVs) as well as the CIEH 'LQM' guideline values for inorganic and organic contaminants in soils.

The proposed development of the site is intended to comprise of residential and therefore screening has been made against a land use of 'residential with homegrown produce'.

Selection of Screening Criteria

The on site receptors for the study site are considered to be:

- Construction workers (during redevelopment of the site only);
- Future maintenance workers (following redevelopment);
- Future end users and site visitors (following redevelopment); and

Risks to construction workers during the redevelopment process will be mitigated by adhering to appropriate health and safety legislation, and the wearing of appropriate personal protective equipment (PPE). During redevelopment, the site will be securely fenced to prevent trespassers from accessing the site, and good site management practices will be implemented to mitigate exposure to off-site receptors.

The potential pathways for contaminants within the soil to human health receptors following redevelopment are considered to be:

- Direct ingestion of soil and soil derived dust
- Dermal contact with soil outside and soil derived dust inside
- Inhalation of soil derived dust inside and outside
- Inhalation of soil derived vapours inside and outside

The potential pathways for contaminants within the soil to off-site human health receptors following redevelopment are considered to be:

- Direct ingestion of soil and soil derived dust
- Dermal contact with soil outside and soil derived dust inside
- Inhalation of soil derived dust inside and outside
- Inhalation of soil derived vapours inside and outside if contamination within soil is able to migrate across the site boundary within

In the first instance, the results of this laboratory testing have been compared to generic assessment criteria (GAC) for the residential with homegrown produce land use scenario. These incorporate the following pathways:

- Direct ingestion of soil and soil derived dust
- Dermal contact with soil outside and soil derived dust inside
- Inhalation of soil derived dust inside and outside
- Inhalation of soil derived vapours inside and outside

Contaminants have been screened against revised LQM/CIEH S4UL criteria¹ where available. These GAC have been designed for use under planning, using Health Criteria Values based on minimal risk, and updated exposure parameters. The S4UL are intended to replace the previous LQM/CIEH GAC. The S4UL are based on the assumption of a sandy loam soil the 1.0% soil organic matter (SOM) criteria have been used, where available and appropriate, in the first instance. All soil samples were analysed for %SOM, the range was from 3.5–6.4%, and so this conservative approach is considered appropriate for initial screening.

Where no S4UL are available, the EIC/ AGS/ CL:AIRE/ GAC² have been used. The toxicological criteria within these are also based on minimal risk. It is recognised that these criteria have not recently been updated, and in particular, do not incorporate the slightly higher inhalation rates that have been used within the S4UL. However, given that they incorporate additional pathways, they are considered suitable for an initial screen. The EIC/ AGS/ CL:AIRE/ GAC are also based on a sandy loam soil and the 1% SOM criteria have been used in the first instance.

There is neither an S4UL nor a EIC/ AGS/ CL:AIRE/ GAC available for lead. In the absence of a GAC based on minimal risk, the C4SL for lead has been used. It is recognised that this is based on a “low level of toxicological concern” rather than on a minimal risk level. However, it is considered appropriate for use under planning, especially for a site where there will effectively be no pathways for inorganic metals following redevelopment.

All the GAC are based on a sandy loam soil. This is considered appropriate for use for initial screening. Although it is apparent from the laboratory soil descriptions, that the Made Ground, by its very nature is heterogeneous, and often has a significant sand/gravel component, especially at shallow depths, it is noted that many of the soil descriptions have a significant clay component at increasing depth.

All the GAC assume unsaturated soils. However, the use of the GAC are considered to be conservative, because they assume a certain air-filled porosity and water-filled porosity.

¹ Nathanail et al. (2015) The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, 2015. Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3495

² CL:AIRE (2010) The EIC/AGS/CL:AIRE Generic Assessment Criteria for Human Health Risk Assessment

The GAC also assume that no free phase product is present and are not intended for use in this instance. No free product was observed within soils during the site investigation.

Soil Testing Results & Screening

All of the soil contamination laboratory analytical results are presented within Appendix B and presented below:

Metals³

Determinant	Min	Max	GAC	Number of exceedances
Arsenic	13	17	37*	0
Cadmium	<0.2	1.5	11*	0
Chromium (III)	60	69	910*	0
Chromium (VI)	<1	<1	6*	0
Copper	20	29	2400*	0
Lead	37	88	200*	0
Mercury	<0.5	<0.5	40* ^a	0
Nickel	20	30	180* ^b	0
Selenium	1.1	1.6	250*	0
Zinc	76	105	3700*	0
Total Phenols	<0.5	< 0.5	420*	0
Total Cyanide	<1	< 1	140*	0

There are no exceedances in metals or metalloids identified in any of the tested samples.

³ LQM/CIEH GAC for Residential with homegrown produce land use scenario based on a sandy loam soil and 1% SOM. Based on the inorganic mercury GAC as the conceptual site model does not suggest that other forms of mercury are likely to be present on site. LQM issued an update to the nickel S4ULs in August 2015 and this has been taken into account.

Organics

Determinant	Min	Max	GAC	Number of exceedances
Naphthalene	<0.02	< 0.02	2.3*	0
Acenaphthylene	<0.02	0.05	170*	0
Acenaphthene	<0.02	0.19	210*	0
Fluorene	<0.02	0.08	170*	0
Phenanthrene	0.06	1.01	95*	0
Anthracene	<0.02	0.33	2400*	0
Fluoranthene	0.09	3.56	280*	0
Pyrene	0.09	3.38	620*	0
Benzo(a)anthracene	0.06	2.16	7.2*	0
Chrysene	0.08	1.62	15*	0
Benzo(b)fluoranthene	0.09	2.46	2.6*	0
Benzo(k)fluoranthene	0.04	0.88	77*	0
Benzo(a)pyrene	0.05	1.97	2.2*	0
Indeno(1,2,3-cd)pyrene	0.06	1.68	27*	0
Dibenz(a,h)anthracene	<0.02	0.24	0.24*	0
Benzo(ghi)perylene	0.09	1.30	320*	0

There were no exceedances for PAH congeners, within any of the tested samples.

Determinant	Min	Max	GAC ⁴	Number of exceedances
Aliphatic >C5 – C6	< 0.01	< 0.01	42*	0
Aliphatic >C6 – C8	< 0.01	< 0.01	100*	0
Aliphatic >C8 – C10	< 0.01	< 0.01	27*	0
Aliphatic >C10 – C12	< 4	< 4	130*	0
Aliphatic >C12 – C16	< 4	< 4	1100*	0
Aliphatic >C16 – C35	< 4	51	65000*	0
Aromatic >C5 – C7	< 0.01	< 0.01	70*	0
Aromatic >C7 – C8	< 0.01	< 0.01	130*	0
Aromatic >C8 – C10	< 0.01	< 0.01	34*	0
Aromatic >C10 – C12	< 1	< 1	74*	0
Aromatic >C12 – C16	< 1	< 1	140*	0
Aromatic >C16 – C21	< 1	9	260*	0
Aromatic >C21 – C35	< 1	35	1100*	0

There are no exceedances noted from the screening undertaken on the respective TPH CWG bands.

Determinant	Min	Max	GAC	Number of exceedances
Benzene	<0.01	< 0.01	0.087	0
Toluene	<0.01	< 0.01	130	0
Ethylbenzene	<0.01	< 0.01	47	0
p & m-xylene	<0.02	< 0.02	56	0
o-xylene	<0.01	< 0.01	60	0
MTBE	<0.02	< 0.02	49	0

There were no exceedances for BTEX/MTBE congeners, all of which were below the level of detection (LoD).

Others

The asbestos screening returned a negative result for the presence of fibrous material from all samples analysed.

The soil contamination laboratory certificates can be reviewed in Appendix B

⁴ LQM/CIEH GAC Residential with Homegrown Produce land use scenario based on a sandy loam soil and 1.0% SOM. It is noted that the LQM/CIEH S4UL guidance recommends an additive approach for the TPH fraction, so that a hazard index approach is used. Based on a preliminary conservative comparison of maximum concentrations to S4ULs, no forward modelling is necessary to prove that this would still result in no exceedances at the site.

Site Investigation Findings

Risks to Human Health

With the exception of the limited depth of Made Ground identified, no visual and/or olfactory evidence of potential contamination was noted within any soils encountered during the SI works undertaken.

Overall, there were no exceedances identified tested material. Therefore, it would be reasonable to conclude that there is no risk to human health receptors.

Risks to Plants and Wildlife

A negligible risk has been attributed given the concentrations of phytotoxic contaminants below elevated concentrations often below the limit of detection returned.

Risks to Site Workers

Despite the absence of returned elevated concentrations of determinants precautions should be taken to minimise exposure of site workers during ground works through the implementation of site safety procedures and the use of suitable personal protective equipment (PPE). Such precautions should include, but not be limited to:

- Personal hygiene, washing and changing procedures;
- Availability of site welfare;
- Provision of PPE appropriate to the task; and
- Daily safety briefings and tool box talks.
- All site works will be undertaken in accordance with the guidelines prepared by the Health and Safety Executive (1991) and all work will be carried out in accordance with the Principal Contractor's Health and Safety Plan.

Updated Conceptual Site Model and Risk Assessment

The Conceptual Site Model has been re-formulated based upon the results from the SI in accordance with BS10175:2015.

On Site						
Source	Pathways	Receptor	Severity	Probability	Risk	Justification
Made Ground possibly containing metals, TPH, PAH, VOC's and sVOC's	Ingestion, dermal contact, inhalation of dusts and vapours	Future end users and site visitors	Mild	Unlikely	Very Low ●●	A very low risk has been assessed due to the absence of any exceedances within tested soil.
		Construction Workers	Mild	Low likelihood	Low ●	A low risk has been assessed due to the absence of any exceedances within tested soil. Construction workers are likely to come into direct contact with soils during groundworks. Safe working practices should be implemented and appropriate personal protective equipment (PPE) should be used to mitigate any potential risk from contact with soils and shallow/perched groundwater.
	Leaching through soils and migration via groundwater or soil pore moisture	Controlled Waters	Mild	Unlikely	Very Low ●●	A very low risk has been assessed due to the absence of any exceedances within tested soil.

	Permeation of water pipes	Construction materials, future end users and site visitors	Medium	Unlikely	Low ●	Hydrocarbons, especially aromatics are known to permeate plastic pipes. Provision of water supply pipes and connectors formed from proprietary “barrier pipe” materials (eg polyethylene-aluminium-polyethylene) may be required by the water supply company.
	Uptake	Plant and Wildlife	Minor	Low Likelihood	Very Low ●●	A low risk has been assessed due to the absence of any contaminative past land uses identified on site. However, a pathway is present through garden areas.
Asbestos at/near ground surface in Made Ground	Inhalation of fibres in airborne dust	Future end users and site visitors	Medium	Unlikely	Low ●	A low risk has been assessed due to the absence of any exceedances within tested soil.
		Construction Workers	Medium	Unlikely	Low ●	A low risk has been assessed due to the absence of any exceedances within tested soil. Construction workers are likely to come into direct contact with soils during groundworks. Safe working practices should be implemented and appropriate personal protective equipment (PPE) should be used to mitigate any potential risk from contact with soils and shallow/perched groundwater.

Recommendations

There were no detected exceedances in any of the tested soils when compared to the screening value for a residential end use with homegrown produce. As such there is considered to be no risk from soils and Your Environment do not make any recommendations for remedial works.

Watching Brief and Discovery Strategy

A watching brief should be maintained by the Main Contractor at all times during the groundworks stage. Should any unforeseen contamination, such as oils or soils/groundwater with an unusual colour or odour, be encountered during groundworks then the following procedure should be implemented:

Work to cease in that area to prevent exposure to ground workers and potential contaminants being spread around;

Notify a Geo-Environmental Consultant, to attend site and sample material;

Notify the Environmental Health Department / Contaminated Land Officer(s) of the Local Planning Authority.

If the nature and extent of the contamination is unmanageable under the procedure set out above, then a suitable management, mitigation or remediation procedure will be agreed with the CLO. However, this is considered unlikely at this particular site.

Asbestos

Although screening has revealed no asbestos to be present within the samples analysed from exploratory holes undertaken, it cannot be guaranteed that asbestos is not present within the soils across the remainder of the site. Consequently, we would recommend that a watching brief be adopted with regards to the site for the potential of finding any Asbestos Containing Materials (ACMs). If any ACMs are identified these need to be dealt with accordingly in relation to the Hazardous Waste Regulations 2005.

Services

If new services will be installed as part of the redevelopment of the site, we would recommend the local water board be contacted to determine their specification for the type of pipework which should be used on this site.

All services and in particular potable water supply pipework should comprise of material that is resistant to attack and degradation to chemical attack.

Report Submission

This report should be submitted to the Local Planning Authority at the earliest opportunity to seek their acceptance of the findings of this report.

Notes and Limitations

YE have prepared this report with all reasonable skill, care and diligence. The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources.

The opinions given in this report have been dictated by the finite data on which are they based and are relevant only to the purpose for which the report was commissioned.

Information reviewed should not be considered exhaustive and has accepted in good faith as providing true and representative data with respect to site conditions. Should additional information become available which may influence the opinion expressed in this report, YE reserves the right to review such information and, if warranted, to alter the opinions accordingly.

It should be noted that any risks identified in this report are perceived risks based on the information reviewed.

The recommendations contained in this report represent our professional opinions. These opinions were arrived at in accordance with currently accepted industry practices at this time and as such is not a guarantee that the study site is free of hazardous conditions.

This report has been prepared solely for the use of the named client, and may not be relied upon by other parties without written consent from YE. YE disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

The information contained in this report is intended for the use of our client. Should any part of this report be relied on by a third party, that party does so wholly at its own risk and YE disclaims any liability to such parties. Should the purposes for which the report is used, or the proposed use of the site change, this report may no longer be valid and further use of, or reliance upon the report in those circumstances shall be at the client's sole and own risk. Your Environment should be contacted to amend the report should the proposed development change in any way.