Combined Geo-Environmental Desk Study and Preliminary Site Investigation

At:

50 London Road, Riverhead, Sevenoaks TN13 2DH

For:

Mary Reeves

Private and Confidential

Ref: 4015 21 03 15 Rpt 02 Rev B RD MR

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This report was produced in accordance with the Sevenoaks Environmental Consultancy Ltd Quality Assurance System			
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	Consultant's Name	**Consultant's Signature**	**Date**
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Report reviewed by:	**Brendan Davis** *Technical Director*		25/03/21

SCOPE, SOURCES AND LIMITATIONS

This report has been conducted in line with the source-pathway-receptor (SPR) linkage risk assessment-based methods referred to in Part IIA of the Environmental Protection Act 1990, introduced by Section 57 of the Environment Act 1995.

To establish past site use, possible indications of contamination or ground instability and potential pollutant linkages, this assessment relies on publicly available historic maps, published geological information, information from Local Authority, Building Control and other statutory and non-statutory bodies, data provided by electronic search engines, a walkover survey of the site from ground level only and other information (as reported herein) obtained from non-intrusive sources. All information, comments and opinions given in this report are based on documentary records made available to us at the time of writing.

It should be noted that documentary sources and records may not be totally accurate, precise or complete. It is possible, therefore that there may be potential or actual contaminants or adverse ground conditions that remain undetected.

This report is written in the context of an agreed scope of work between SEC and the Client and should not be used in a different context. In light of additional information becoming available, a change in proposed end-use improved practices and changes in legislation amendment or re-interpretation of the assessment or report in whole or part may be necessary after its original submission.

The scope of this report is restricted to potential ground contamination and its environmental impact; it does not cover above-ground hazards (e.g. asbestos in buildings), ecological sensitivities (e.g. bats), biological or horticultural hazards (e.g. Japanese Knotweed) or structural hazards (e.g. building stability) unless specifically referred to in the text of this report.

This report may make brief reference to the risk of flooding at the subject site but does not constitute a flood risk assessment in accordance with current planning guidance. An ecological survey, an asbestos survey, a geo-technical assessment, a topographical survey, a safety audit a mechanical and electrical survey and a flood risk assessment of the site are beyond the scope of this report.

Advice and recommendations given in this report are provided for information purposes; they are not exhaustive and do not constitute a specification for further investigation / remediation or other works.

Contents

1 Introduction

Sevenoaks Environmental Consultancy Ltd (SEC) were commissioned by Mary Reeves to undertake a Combined Geo-Environmental Desk Study and Preliminary Site Investigation for the site known as 50 London Road, Riverhead, Sevenoaks, TN13 2DH (See Appendix A Figure 1 – Site Location Plan).

The site comprised part of an existing building. Given the site's position cut into a hill the southern end of the site the site formed the first floor of the building and to the northern end of the site the site comprised the ground floor. The building occupied the majority of the site except for a small external area laid to the northern corner laid to paving slabs. (See Appendix A Figure 2 – Existing Site Layout Plan).

This Combined Geo-Environmental Desk Study and Preliminary Site Investigation Report has been prepared to help inform risks associated with potential ground contamination in order to help support a proposed planning application for the proposed redevelopment of the site.

The proposed development is understood to involve the conversion of the existing building into a residential property (at the time of writing no proposed development plans were available however it is assumed that the building will continue to occupy the majority of the site area with a small external courtyard). This report also aims to establish the likely geology and hydrogeology on site, review historical maps and environmental data, produce a conceptual risk model, conduct a qualitative risk assessment and provide recommendations based on the results of preliminary investigation and in accordance with current guidance.

The scope of this assessment was agreed with Mary Reeves and generally comprised:

- A site reconnaissance;
- The collection and review of geological and hydrogeological plans
- The procurement and review of historical maps;
- The review of environmental data relating to the site setting;
- The conduct of 1 no. hand dug trial pit / hand auger;
- Chemical laboratory analysis of soil samples for a range of determinands, including Metals, Speciated PAH's, phenols, TPH, asbestos (presence / absence and quantification) and pH;
- The conduct of 6 no. rounds of environmental monitoring;
- The development of a site conceptual model;
- A preliminary qualitative risk assessment of potential contamination issues; and
- Presentation of recommendations based on the risk assessment.

This Combined Geo-Environmental Desk Study and Geo-Environmental Site Investigation Report has been compiled and conducted in line with the source-pathway-receptor (SPR) linkage risk assessment-based methods referred to in Part IIA of the Environmental Protection Act 1990, introduced by Section 57 of the Environment Act 1995 and brought into force in April 2000.

SEC has not been provided with any other previous reports for the site.

2 Site Details

2.1 Site Location

The site was located in Riverhead, Sevenoaks on London Road. The site was positioned on Ordnance Survey (OS) national grid reference 551330, 156400 (see Appendix A Figure 1 Site Location Plan).

2.2 Site Description

The site covered an area of ~0.02 ha with boundaries forming an approximately rectangular shaped plot (see Appendix A Figure 2 – Existing Site Layout Plan). The site was occupied by an existing building which covered the majority of the site footprint except for a small external area to the northern corner of the site which was laid to paving. The building comprised mixed a commercial office use.

2.3 Current Site Activity

At the time of writing the building on site was unoccupied.

2.4 Site Setting and Topography

The site was situated within an area comprising predominantly commercial and residential land use. The ground level across the site and surrounding area was generally noted to slope downwards from the north east towards the south west.

2.5 Site Walkover

A site walkover inspection was undertaken by SEC in January 2021. The following paragraphs note the observations made during this visit (see Appendix B Site Photos).

The site was noted to have comprised an existing building which had been cut into the side of the south east facing hill. Given the site's position on a hill, the building had been cut into the side of the hill which was quite steeply sloping. As such the ground floor of the building comprised a partial basement to the ground floor beneath the southern end of the site. This part of the building was occupied by a tool hire shop and for the purposes of this assessment was considered to be off site. The site comprised the first floor of the building across the southern end of the site which also formed the ground floor to the northern end of the site given the building's location on a hill. The site was noted to be vacant and had previously been used as office space.

Externally to the northern corner of the site was a small courtyard area laid to paving slabs. It is noted that the backwall (northern elevation) of the existing building and courtyard formed a retaining wall against the ground upslope of the site.

Off site immediately adjacent to the north was a yard area which was used by the tool hire business for storage of their plant and equipment. A side access road passed along the north western site boundary which was called The Patch. This road sloped upwards steeply to the north as it passed the site.

Properties surrounding the site comprised residential houses and commercial properties.

The topography of the surrounding area was noted to generally slope downwards from the north east to south west.

2.6 Services

Service plans were obtained from Statutory Authorities and provided by the client for review by SEC ahead of intrusive site investigation works.

2.7 Site History

The site history has been derived from a review of the available historical maps for the site (See Appendix C Historical Maps) and has been summarised below in Table 1.

Table 1: Historical Map Review

Date	Scale	On Site	Off Site
1871	1:10,560	The site was identified to have been developed with a building on site which appeared to have been generally consistent with the existing building.	The surrounding area comprised predominantly of fields and open space with the area of Riverhead (located ~250m south east) and Sevenoaks (located ~1,000m south east) being the closest towns to site. The River Darent flowed in a north east to south west direction ~250m north of site. A Tannery was located ~125m south of site. A timber yard was located ~250m south east of site.
1879-1895	1:2,500	The site appeared to be generally unchanged from that previously identified.	A graveyard was identified at ~350m south east of site. In addition a clay pit was located ~200m east of site. A surface water ditch or stream was identified ~50m to the south of the site which flowed into a pond at a similar distance from the south of the site. A railway line passed the site ~100m to the north of the site.

1895	1:2,500	The site appeared to be generally unchanged from that previously identified.	The surrounding area was not visible on the map.
1896	1:2,500	The site appeared to be generally unchanged from that previously identified.	A watercress beds are identified 50m west of site. A smithy was located ~250m north of site.
1897-1898	1:10,560	The site appeared to be generally unchanged from that previously identified.	The surrounding area was generally unchanged from that previously identified.
1909	1:2,500	The site appeared to be generally unchanged from that previously identified.	The surrounding area was generally unchanged from that previously identified.
1910	1:10,560	The site appeared to be generally unchanged from that previously identified.	The surrounding area was generally unchanged from that previously identified.
1936-1951	1:10,560	The site appeared to be generally unchanged from that previously identified.	The surrounding area was generally unchanged from that previously identified.
1938	1:10,560	The site appeared to be generally unchanged from that previously identified.	A Works was identified at ~250m east of site.
1941	1:2,500	The site appeared to be generally unchanged from that previously identified.	Marley Tile works had been developed ~200m north west of site with associated earthworks. An allotment gardens was identified at ~100m south. The Watercress beds to the south had reduced in size.
1959	1:1,250	The site appeared to be generally unchanged from that previously identified.	2 No. works were identified at ~200m north and ~200m west (with a pond adjacent to it) of site, associated with the Marley Tile Works identified in 1941. A depot was also located ~275m north east. The pond previously identified ~50m to the south of the site was no longer identified and appeared to have been infilled.
1961	1:10,000	The site appeared to be generally unchanged from that previously identified.	The surrounding area was generally unchanged from that previously identified
1964	1:2,500	The site appeared to be generally unchanged from that previously identified.	The surrounding area was generally unchanged from that previously identified.
1966-1974	1:1,250	The site appeared to be generally unchanged from that previously identified.	3 No. electrical substations were located ~250m north west, ~125m south and ~300m east. 2 No. Depot's were located ~200m west (which was earlier identified as works in 1959). 2 No. Warehouses were located ~125m north and ~150m north. A Pond was located ~100m north west. The watercress beds to the south

			of the site were no longer identified and had been redeveloped with houses.
1968	1:10,000	The site appeared to be generally unchanged from that previously identified.	4 No. Depots were identified the closest of which was ~250m north of the site.
1972-1978	1:1,250	The site appeared to be generally unchanged from that previously identified.	The surrounding area was generally unchanged from that previously identified.
1975	1:10,000	The site appeared to be generally unchanged from that previously identified.	The surrounding area was generally unchanged from that previously identified.
1977-1980	1:1,250	The site was not visible on the map.	The surrounding area was generally unchanged from that previously identified.
1979-1984	1:2,500	The site appeared to be generally unchanged from that previously identified.	The surrounding area was generally unchanged from that previously identified.
1983-1984	1:10,000	The site appeared to be generally unchanged from that previously identified.	The surrounding area was generally unchanged from that previously identified.
1985	1:1,250	The site was not visible on the map.	The Surrounding area was not visible on the map.
1989	1:10,000	The site appeared to be generally unchanged from that previously identified.	The surrounding area was generally unchanged from that previously identified
1992	1:2,500	The site appeared to be generally unchanged from that previously identified.	3 No. Works were located ~200m north, ~200m north east and ~300m north of the site. Some of the previous earthworks associated with Marley Tile Works in 1941 were no longer identified and had been redeveloped with houses, indicating that the former excavations had been infilled. A depot was identified ~75m to the south west.
1992	1:2,500	The site was not visible on the map.	The surrounding area was not visible on the map.
1996	1:10,000	The site appeared to be generally unchanged from that previously identified.	The surrounding area was generally unchanged from that previously identified
1999	1:10,000	The site appeared to be generally unchanged from that previously identified.	The surrounding area was generally unchanged from that previously identified
2021	1:10,000	The site appeared to be generally unchanged from that previously identified.	The surrounding area was generally unchanged from that previously identified

Following a review of the historical maps, potential on site sources of contamination include:

- Made Ground associated with the current development on site since 1871;

Potential off-site sources of contamination identified included:

- Railway located 100m east of site since 1871;
- Former tannery located ~125m to the south of the site between 1879 – 1941;
- A graveyard ~350m to the south of the site since 1879;
- A former claypit ~200m to the east of the site in 1879;
- A former surface water ditch / stream and associated pond ~50m to the south of the site between 1879 – 1959
- Former watercress beds ~50m to the south of the site between 1896 – 1966
- A former smithy located ~250m to the north of the site in 1896;
- A works located ~250m to the east of the site in 1938
- Numerous works, depots and earthworks previously located ~200m to the north and north west of the site associated with the Marley Tile Works between 1941 and 1992.
- An electrical sub-station located ~125m to the south of the site;
- A depot ~75m to the south west of the site.

Potential risks to the site and the proposed development associated with the following sources identified are considered likely to be low given a combination of mitigating factors including the distance of the site from the source and the position of the site down or across groundwater gradient of the source. As such the following sources have not been considered further;

- Railway located 100m east of site since 1871;
- A graveyard ~350m to the south of the site since 1879;
- A former claypit ~200m to the east of the site in 1879;
- A former smithy located ~250m to the north of the site in 1896;
- A works located ~250m to the east of the site in 1938
- Numerous works, depots and earthworks previously located ~200m to the north and north west of the site associated with the Marley Tile Works between 1941 and 1992.
- An electrical sub-station located ~125m to the south of the site;

2.8 Archaeology

From a review of the historical maps there was an Iron Age (Numidian) coin found AD 1931 (seen on the 1961 1:10,000 map) located ~75m south east of the site however, this assessment does not constitute an archaeological assessment.

2.9 Existing Monitoring

SEC is not aware of any 3rd party environmental monitoring being undertaken at (or in close proximity to) the site.

2.10 Asbestos in Buildings

This report does not constitute an asbestos survey and a survey for asbestos containing materials was outside the scope of this report.

2.11 Ecological Considerations

A formal ecological survey is beyond the scope of this study.

3 Geology and Hydrogeology

3.1 Geology

The geological records for the site obtained from the British Geological Survey website indicate that the site is underlain by solid geology comprising the Folkestone Formation (Sandstone) with no overlying superficial deposits.

A nearby BGS Borehole (Ref; TQ55NW67) located ~260m east of the site identified overburden to 1.52m bgl over ballast to 3.04m bgl over sand to 8.22m bgl.

3.2 Hydrogeology and Hydrology

Since April 2010 the Environment Agency (EA) has implemented the use of Aquifer designations that are consistent with the Water Framework Directive. These designations reflect the importance of Aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface flows and wetland ecosystems. The Aquifer designations have been split into two different types; Superficial (Drift) and Bedrock (solid permeable formations).

According to the Groundwater Vulnerability Map the mapping indicates that the Folkestone Formation bedrock geology present beneath the site is classified as a High Vulnerability, Principal Aquifer. These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

There were no surface water features identified on site and the closest surface water feature to the site was located ~35m west of the site associated with a river. The site was found to be located within a Zone 2 Source Protection Zones. Based on the Source Protection Zone mapping it could be inferred that regionally the groundwater gradient appears to be towards the north although locally the gradient may be towards the south east given the local topography.

4 Environmental Data Search

A search of public registers for environmental data was conducted using an automated search engine and is presented in Appendix D. It should be noted that the data search is not exhaustive, and only considers a variable search area up to 2km from the site with data that may be approximated or limited and is periodically updated. The findings of this search are summarised below:

4.1 Local Authority Pollution Prevention Controls

There were no Local Authority Pollution Prevention Controls recorded in relation to the site. 3 No. were however recorded within 1km of the site and the closest was located ~169m south of the site related to a Dry Cleaners which has a status of permitted.

Given the distance of the dry cleaners from the site it is considered likely to pose only a low potential risk and has not been considered further.

4.2 Discharge Consents

There were no Discharge Consents recorded in relation to the site however there were 8 no. identified within 1km of the site. The closest was located ~149m east of the site and related to a Sewage Discharges - Final/Treated Effluent - Water Company to land/ soakaway.

Given the distance of the discharges from the site and that they discharge to the sea potential risks are considered likely to be low and as such discharges have not been considered further.

4.3 Pollution Incidents to Controlled Waters

There were no Pollution Incidents recorded in relation to Controlled Waters on site however 36 No. were recorded within 1km of the site. The closest was located ~22m west of the site and related to category 3 minor incident associated with the release of sewage on the 22nd August 1992.

Potential risks to the site associated with this incident are considered to low given the age of the incident.

4.4 Registered Radioactive Substances

There were no records of Registered Radioactive Substances relating to the site or within 1km of the site.

4.5 Substantiated Pollution Incident Register

There were no Registered Radioactive Substances relating to the site however 3 No. were recorded within 1 km of the site. The closest was located ~684m east of the site and was a category 2 – significant incident to water on the 1st August 2004.

Potential risks to the site associated with this incident are considered to be low given its distance from the site.

4.6 Water Abstractions

There were no water abstractions recorded in relation to the site however 3 No. were located within 1km of the site. The closest is located abstraction to the site was located 572m east of the site and related to an abstraction from the Redlands Lake, Wildfowl Reserve for other Environmental Improvements: Transfer between sources.

The groundwater is considered to be a sensitive receptor.

4.7 Floodplains

The site was in an area with limited potential for groundwater flooding.

Land to the north of the site was identified to be at risk from potential for groundwater flooding to occur at the surface.

4.8 River Quality Monitoring Data

Chemical quality data is based on the general quality assessment headline indicators scheme (GQAHI). In England, each chemical sample is measured for ammonia and dissolved oxygen. The results are graded from A (Very Good) to F (Bad).

A single record of chemical quality was located located ~243m North and indicated that the River Darent is of River Quality B.

4.9 Registered Landfill Sites

The environmental data recorded a single BGS recorded Landfill site, 10 No. Historical Landfill Sites, a single Licensed Waste Management Facilities, 2 No. Local Authority Landfills, and a Registered Landfill Site. The BGS recorded landfill site was associated with Chipstead Sand Pit which is located ~813m south west. The closest historical landfill record was located ~241 south east which is associated with Deposited Waste included Inert and Household Waste. The Licensed Waste Management Facilities (Landfill Boundaries) is located ~774m south west and was associated with Landfills Taking Non-biodegradeable Wastes (Not Construction) however this license is now inactive. The registered landfill site record is located ~379m north west and is owned by Marley Tile Co Ltd.

4.10 Control of Major Accident Hazard Sites (COMAH), Notification of Installations Handling Hazardous Substances (NIHHS) and Planning Hazardous Substances Consent.

The environmental data indicated there were no recorded Control of Major Accident Hazard Sites (COMAH). The data identified no recorded Notification of Installations Handling Hazardous Substances (NIHHS) within 1km of the site.

There were no recorded Planning Hazardous Substance Consents within 1km of the site.

4.11 British Geological Survey

The environmental data indicates the geology beneath the site comprises a Sandstone Subgroup.

The site was described as having:

- Very low hazard potential associated with collapsible rocks;
- Very low hazard potential associated with landslide instability;
- Low hazard potential associated with running sand;
- No hazard associated with shrinking or swelling clay;
- No Hazard associated with ground dissolution of soluble rocks; and
- No hazard associated with compressible ground.

Although the observations made above may have a bearing on foundation design measures, a geotechnical assessment of the site is beyond the scope of this report.

4.12 Natural and Mining Cavities

The environmental data search did not identify any historical coal mining, brine extraction, gypsum extraction, or tin mining within the vicinity of the site.

There was 1no. Non Coal Mining Areas of Britain record on site which indicated that the risk is rare.

There was 1 no. Natural Cavity record which is located ~790m east of the site and the cavity type is unknown.

4.13 Contemporary Trade Directory Entries

The environmental data search identified records of both active and inactive potentially contaminative land uses within the 500m of the site.

There were 32no. Contemporary Trade entries recorded within 1km of the site however none were located on site. The closest is located ~29m north east and is an inactive garage services.

4.14 Environmentally Sensitive Area, Ramsar Site, Site of Special Scientific Interest (SSSI), Special Protection Area (SPA), Special Area of Conservation (SAC), National Nature Reserve (NNR), Local Nature Reserve (LNR), Area of Outstanding Natural Beauty (AONB), National Park (NP), Nitrate Sensitive Areas (NSA) and Green Belt Land

The environmental data identified 1no. Site of Specific Scientific Interest ~356m east of the site relating to Sevenoaks Gravel Pits and 1 no. Area of Adopted Green Belt which is located ~144m east of site and is currently adopted.

4.15 Nitrate Vulnerable Zone (NVZ)

The environmental data search identified the site not to be within a Nitrate Vulnerable Zone relating to groundwater.

4.16 Radon

The Department of Environment, Transport and Regions (DETR) 'Radon: guidance on protective measures for new dwellings' published in 2015 indicates that the site is located within a lower probability radon affected area, with less than 1% of homes estimated to be at or above the Action Level.

The environmental data search also indicates that the site is located within both a lower probability radon area and an intermediate probability radon area. However no radon protective measures are necessary in the construction of new dwellings or extensions.

5 Consultations

See Appendix E Correspondence with the Regulators.

5.1 Environmental Health Officer (EHO)

SEC contacted the Environmental Health Officer (EHO) at Sevenoaks District Council to enquire about the site's Part IIA status and to establish whether there are any private groundwater abstractions locally to the site. Information from the EHO is awaited and this assessment will be updated following receipt of additional information.

5.2 Building Control Officer (BCO)

SEC contacted the Building Control Officer (BCO) at Sevenoaks District Council to enquire as to their understanding of the ground conditions locally to site and the possible depth of the groundwater. The BCO have yet to reply to the enquiry.

Site Work and Ground Conditions

6.1 General

In order to help further the Desk Study findings and to clarify potential impacts to the site associated with the potential sources identified by the Desk Study, a preliminary Geo-Environmental Site Investigation was conducted in January 2021 (See Appendix B for Site Photos).

The preliminary site investigation conducted comprised:

1. Conduct of 1 No. hand auger up to ~2.0m bgl.
2. The Installation of 1no. environmental ground gas monitoring installation;
3. Chemical laboratory analysis of soil samples for a range of determinands, including Metals, Speciated PAH's, phenols, TPH, asbestos (both presence / absence and quantification analysis) and pH;
4. Conduct of 6no. ground gas monitoring visits;
5. Production of a preliminary Interpretative Geo-Environmental Site Investigation Report (Combined with the Desk Study Report)

The exploratory hole undertaken was positioned within the only accessible external area of the site, towards the northern corner. The purpose of the exploratory hole was to facilitate characterisation of the Made Ground within the proposed courtyard area and to facilitate ground gas monitoring given that the existing building is to be retained and converted, therefore access to the ground across site will not be possible / improve for future ground investigation.

Based upon the desk study information the potential sources of contamination include;

On site;

- Made Ground associated with the development on site since 1871.

Off site sources identified included;

- Former tannery located ~125m to the south of the site between 1879 – 1941;
- A former infilled surface water ditch / stream and associated pond ~50m to the south of the site between 1879 – 1959
- Former watercress beds ~50m to the south of the site between 1896 – 1966
- A depot ~75m to the south west of the site.
- Landfill located 241m south east of the site
- A garage 29m north east of the garage

See Appendix A Figure 3 for the Exploratory Hole Location Plan.

6.2 Chemical Laboratory Analysis

Soil samples were collected from the exploratory hole and were sent for analysis at an independent UKAS and MCERTS accredited laboratory.

Soil samples recovered from the Made Ground and underlying natural material were analysed for a range of determinands taking into consideration visual and olfactory observations made on site during the fieldwork and findings of the Desk Study and included Metals, Speciated PAH's, phenols, TPH, asbestos and pH;

6.3 Lithology

Detailed information relating to the strata encountered was recorded on Exploratory Hole Record, which is presented in Appendix F. A summary of the ground conditions encountered however is presented below.

Made Ground was encountered in the exploratory hole up to 0.53m bgl. The Made Ground was observed to have comprised of a concrete paving slab over firm dark brown sandy Clay with occasional fine to medium sub-angular concrete and brick fragments and rare fine to medium sub-angular charcoal fragments. At 0.35m bgl black staining to the material was noted although no odours were observed.

Underlying the Made Ground natural deposits were encountered which generally comprised sandy Clay with flint fragments up to 1.45m bgl over clayey Sand with flint fragments.

6.4 Groundwater

Groundwater was not encountered during the hand auger advanced up to 2.0m bgl.

Subsequent groundwater monitoring visits recorded groundwater at 1.90m bgl.

Please refer to Appendix G for Environmental Monitoring Data.

6.5 Environmental Observations

PID headspace tests conducted on all recovered samples did not indicate any potentially elevated concentrations of VOCs within the samples.

7 Chemical Results

7.1 General

The results of the soil analyses have been compared against the available published guidance for residential without homegrown produce end use given the proposed end use for the site comprises the change of use of the property to a residential property with a courtyard garden. These guidance values have been adopted from the LQM/CIEH (Land Quality Management / Chartered Institution of Environmental Health) Suitable Use Levels (S4ULs) for Human Health Risk Assessment 2015. Where concentrations for contaminants are not provided within the LQM/CIEH S4ULs the Category 4 Screening levels (CL:AIRE) have been used. Results for the soil analysis detailed in Section 7 are presented in Appendix H of this report.

It should be noted that the various available S4UL values that have been used in the current absence of any recognized SGV's must be used with some caution, as they have not been formally reviewed or endorsed by Government or the Environment or Health Protection Agencies.

2 no. samples comprising 1 no sample of Made Ground and 1 no. sample of natural material were scheduled for laboratory analysis for a range of determinands including metals, speciated PAHs, TPH, pH, asbestos (presence / absence and quantification) and pH.

7.2 Soil Analysis Results

Made Ground:

Metals

Toxic metals are those considered to be potentially harmful / toxic to human health at elevated concentrations. Analysis of the Made Ground did not record any unacceptable concentrations of toxic metals.

Phytotoxic metals are those considered to be harmful to the growth of plant life (including copper, nickel, zinc and water-soluble boron) but are not considered to be harmful to human health in concentrations more commonly encountered. Concentrations of zinc were recorded to be slightly elevated in the Made Ground up to 491mg/kg at 0.40m bgl.

Total Petroleum Hydrocarbons (TPH)

Concentrations of Total TPH were recorded up to 168mg/kg but were not considered to be unacceptable elevated.

Total Speciated Polyaromatic Hydrocarbons (PAH's)

Total PAH was recorded up to 11.1mg/kg however concentrations of individual PAH compounds were not typically recorded to be elevated above adopted guidance values within the Made Ground sample analysed.

Asbestos

The Made Ground sample recovered was analysed for asbestos presence / absence and recorded a positive results for the presence of loose chrysotile fibres. Subsequent further more detailed asbestos quantification analysis was undertaken on this sample and the recorded that the concentration of asbestos was <0.0001%.

Other Determinands

Samples were also analysed for other determinands including: phenols, sulphide, thiocyanate, total cyanide and free cyanide however none of the samples recorded elevated concentrations of these particular contaminants.

Natural Material:

Metals

Concentrations of toxic metals within the natural sample analysed were not identified to be elevated.

Total Petroleum Hydrocarbons (TPH)

Concentrations of total TPH were recorded below the laboratories reporting limit and therefore not considered to be elevated.

Total Speciated Polyaromatic Hydrocarbons (PAH)

Concentrations of Speciated PAH's were recorded below the laboratory's detection limit and were therefore not considered to be elevated.

Asbestos

The sample of natural material analysed did not record the presence of asbestos.

Other Determinands

Samples of natural material were also analysed for other determinands including: phenols, sulphide, thiocyanate, total cyanide and free cyanide. The sample did not record any elevated concentrations of these contaminants.

7.3 Ground Gas Monitoring Results

Environmental monitoring has been undertaken by SEC on 6no. occasions between 27th January 2021 and 3rd March 2021 (including 2 No. occasions to coincide with periods of low or falling atmospheric pressure) to help inform a preliminary ground gas risk assessment. The results of the ground gas monitoring visits conducted by SEC are provided in Appendix G and summarised below.

Based on the rounds of monitoring conducted, concentrations of methane were not recorded to be elevated, carbon dioxide was recorded up to 0.5% by volume (HA01 on 10/02/2021). Concentrations of oxygen were recorded to a minimum of 20.4%. Concentrations of VOCs were recorded to be 0.0ppm during every gas monitoring visit and flow rates were recorded up to 0.5l/hr (27/01/2021, 03/03/2021 and 17/02/2021). A ground gas screening value of 0.0025l/hr can be calculated for the site which is consistent with characteristic situation 1 of current CIRIA C665 guidance.

8 Conceptual Model and Qualitative Risk Assessment

8.1 Conceptual Model

In accordance with BS 10175 a conceptual model has been developed for the site, based on the potential sources, pathways and receptors identified from the available data including site observations made by SEC at the time of writing this report and the proposed end-use (see Appendix A Figure 4 for Conceptual Model).

8.2 Sources of Potential Contamination / Hazards

Based upon the available information, the following on site sources or potentially contaminative processes have been identified;

- Made Ground identified up to ~0.53m bgl comprising sandy Clay with brick, concrete and charcoal inclusions with some black staining and exhibiting slightly elevated concentrations of zinc (up to 491mg/kg) and lose Chrysotile asbestos (<0.001%); and

- Ground gases including carbon dioxide recorded up to up to 0.5% by volume and flow rates up to 0.5l/hr

Potential off-site sources of contamination identified included:

- Former tannery located ~125m to the south of the site between 1879 – 1941;
- A former infilled surface water ditch / stream and associated pond ~50m to the south of the site between 1879 – 1959
- Former watercress beds ~50m to the south of the site between 1896 – 1966
- A depot ~75m to the south west of the site.
- Landfill located 241m south east of the site
- A garage 29m north east of the garage

8.3 Potential Receptors for Contamination / Hazards

The following potential receptors have been identified as requiring appraisal in the context of potential pollutant linkages;

- The proposed development (building fabric courtyard garden);
- Future site users;
- Construction / Maintenance workers;

- Neighbouring sites;
- Controlled waters (Principal Aquifer and Surface Water runoff).
- Ecological receptors

8.4 Potential Pathways

The following potential pathways have been considered in relation to the sources and receptors identified above:

- Inhalation;
- Ingestion;
- Direct contact;
- Dust migration;
- Permeable strata;
- Percolation, infiltration and leaching;
- Groundwater and surface water migration; and
- Explosive event.

6.5 Assessment of the Degree of Risk

A Preliminary qualitative risk assessment has been compiled using all available information based upon a source-pathway-receptor model and is presented in the table below.

The terms adopted for severity of impact are – serious, moderate and negligible and for risk to the receptor – high, medium and low. Definitions are presented in Appendix J.

Table 2: Preliminary Qualitative Risk Assessment

Sources of Potential Contamination	Receptor	Pathway	Severity of Impact	Risk	Recommended Action (to clarify level of risk and/or assess suitable mitigation measures or to mitigate the risk)
On Site Sources: Made Ground identified up to ~0.53m bgl comprising sandy Clay with brick, concrete and charcoal inclusions with some black staining and exhibiting slightly elevated concentrations of zinc (up to 491mg/kg) and lose Chrysotile asbestos (<0.001%)	The proposed development (building fabric and courtyard garden) Future site users Construction / Maintenance workers Neighbouring sites Controlled waters (Principal Aquifer and Surface Water runoff)	Inhalation Ingestion Direct contact Dust migration Permeable strata Percolation, infiltration and leaching Groundwater migration	Medium - Severe	Moderate - High	Made Ground appeared to be limited to shallow depth (0.53m bgl) on site and will remain capped across the majority of the site by the existing building which is to be retained as part of the proposed development. Potential risks associated with the asbestos impacted material identified are considered therefore to primarily relate to human health associated with future site residents and construction workers in relation to the proposed small courtyard. Given that the ground on site will remain largely undisturbed and covered by hardstanding associated with the existing building and that the proposed courtyard area where the impacted Made Ground has been identified limited it is recommended that remedial excavation, removal and appropriate disposal of the asbestos impacted Made Ground be conducted to help mitigate human health risks. Reference to Appendix I provides a JIWG Asbestos Risk Assessment to help support the recommended remedial works. Remedial work should be conducted under a Watching Brief by a Geo-

					Environmental Consultant. Health and Safety control measures should include dust suppression using an airless sprayer with surfactant, operatives should wear appropriate PPE / RPE during remedial excavation work and following remedial excavation soil validation samples should be analysed from the base of the remedial excavation. Reassurance background asbestos air monitoring is also recommended during the remedial excavation work to help confirm that asbestos fibres are not released in unacceptable concentrations during remedial excavation work. Waste arisings should be disposed of appropriately to suitably licensed facilities in accordance with EA WM3 guidance. Any material proposed to be disposed of to landfill will require further WAC analysis. All waste disposal documentation should be retained. Any imported material required to backfill the remedial excavation should be certified as “clean” and suitable for use on site. Accordingly, prior to import of any material the supplier chemical batch data should be provided to a Geo-Environmental Consultant for review and following provision to the site validation samples should be analysed to corroborate the initial batch data.

					Subject to Regulatory requirements a Remedial Method Statement may be required for approval prior to the recommended remedial works. All remedial works should also be documented within a Validation Report produced by a Geo-Environmental Consultant for Regulatory approval. To help mitigate potential risks to groundworkers / maintenance workers they should work in well ventilated areas, avoid confined spaces, avoid contact with soil and groundwater, not smoke, adopt high standards of personal hygiene and operate with due care whilst wearing appropriate PPE during all excavation works. To help mitigate potential residual risks chemically resistant barrier water supply pipe is recommended. Additionally a Discovery Strategy should be implemented during the redevelopment of the site which should include for the immediate reporting of any potential indicators of ground or water contamination (e.g. cement bonded asbestos sheeting fragments, ash / clinker or hydrocarbon odours) for additional separate assessment by an Environmental Consultant.

On Site; Ground gases including carbon dioxide recorded up to up to 0.5% by volume and flow rates up to 0.5l/hr	The proposed development (building fabric and courtyard garden) Future site users Construction / Maintenance workers Neighbouring sites	Inhalation Direct contact Permeable strata	Mild - Medium	Low	Based upon the available data ground gas concentrations and flow rates were not recorded to be elevated. In accordance with current CIRIA C665 guidance a gas screening value of 0.0025l/hr can be calculated which corresponds with Characteristic Situation 1 of the guidance which does not require any further ground gas protection measures beyond standard ventilation in accordance with Building Regs.
Off Site: Former tannery located ~125m to the south of the site between 1879 – 1941; A former infilled surface water ditch / stream and associated pond ~50m to the south of the site between 1879 – 1959 Former watercress beds ~50m to the south of the site between 1896 – 1966 A depot ~75m to the south west of the site. Landfill located 241m south east of the site A garage 29m north east of the garage	The proposed development (building fabric and courtyard garden) Future site users Construction / Maintenance workers	Inhalation Ingestion Direct contact Dust migration Permeable strata Percolation, infiltration and leaching Groundwater migration	Mild	Low	Potential impact to the site associated with off site sources would typically be via ground gas and groundwater migration beneath the site. Based on the available data impact to the site associated with the off site sources has not been identified. Ground gas concentrations were not recorded to be elevated and based on the nature of the proposed development it is not anticipated that the groundwater would be encountered and therefore any potential pathways associated with groundwater would not be realised given excavation on site would be minimal. To help mitigate potential risks to groundworkers / maintenance workers they should work in well ventilated areas, avoid confined spaces, avoid contact with soil and groundwater, not smoke,

					adopt high standards of personal hygiene and operate with due care whilst wearing appropriate PPE during all excavation works. Additionally a Discovery Strategy should be implemented during the redevelopment of the site which should include for the immediate reporting of any potential indicators of ground or water contamination (e.g. cement bonded asbestos sheeting fragments, ash / clinker or hydrocarbon odours) for additional separate assessment by an Environmental Consultant.

9 Conclusions and Recommendations

A review of the available information has been undertaken and a qualitative risk assessment has been conducted based on the understanding from the Client that the site's proposed development involves the conversion of the previous commercial offices into a residential house with a small courtyard garden.

The risk assessment, presented as Table 2 above, assesses the potential source-pathway-receptor linkages of concern, and provides recommended actions to either clarify the level of risk or mitigate the risks. For full details reference should be made to Table 3.

Should the existing or proposed usage change (including layout) or additional information be obtained then a re-assessment of the potential risks associated with the site will be required. The recommendations made are subject to regulatory approval.

The following key recommendations have been made in relation to the proposed development of the site;

- That remedial work be conducted to excavate, remove and appropriately disposal of the asbestos impacted Made Ground identified beneath the external court yard area of the site. Remedial work should be conducted under a Watching Brief by a Geo-Environmental Consultant and Health and Safety control measures should include dust suppression using an airless sprayer with surfactant, operatives should wear appropriate PPE / RPE during remedial excavation work and following remedial excavation soil validation samples should be analysed from the base of the remedial excavation to certify source removal. Reassurance background asbestos air monitoring is also recommended during the remedial excavation work to help confirm that asbestos fibres are not released in unacceptable concentrations;

- That waste arisings be disposed of appropriately to suitably licensed facilities in accordance with EA WM3 guidance. Any material proposed to be disposed of to landfill will require further WAC analysis. All waste disposal documentation should be retained;

- That any imported material required to backfill the remedial excavation should be certified as "clean" and suitable for use on site. Accordingly, prior to import of any material the supplier chemical batch data should be provided to a Geo-Environmental Consultant for review and following provision to the site validation samples should be analysed to corroborate the initial batch data;

- That chemically resistant barrier water supply pipe be included within the design of the proposed development;

- That groundworkers / maintenance workers should work in well ventilated areas, avoid confined spaces, avoid contact with soil and groundwater, not smoke, adopt high standards of personal hygiene and operate with due care whilst wearing appropriate PPE during all excavation works:

- That a Discovery Strategy be implemented during the redevelopment of the site which should include for the immediate reporting of any potential indicators of ground or water contamination (e.g. cement bonded asbestos sheeting fragments, ash / clinker or hydrocarbon odours) for additional separate assessment by an Environmental Consultant.

- That subject to Regulatory requirements a Remedial Method Statement may be required for approval prior to the recommended remedial works. All remedial works should also be documented within a Validation Report produced by a Geo-Environmental Consultant for Regulatory approval.

In relation to the recommendations made above, SEC has made the following assumptions;

That any discharges form the site will be appropriately consented by the Environment Agency.

The findings of this assessment are based upon SEC's current understanding of the site. Should circumstances change then the Risk Assessment should be revisited by an Environmental Consultant. The recommendations made above are subject to regulatory approval.

An ecological survey, an asbestos survey, a geotechnical assessment, a topographical survey, and a flood risk assessment of the site were beyond the scope of this report but a factual and interpretative Geotechnical assessment have been done under separate cover.

10 General Limitations and Exceptions

1. The advice given in this report with respect to contaminated land/pollution is based on the guidelines available at the time of writing.

2. The Client is advised that the conditions observed on site by SEC at the time of the investigation or assessments are subject to change. Certain indicators of the presence of hazardous substances may have been latent at the time of the most recent site reconnaissance or investigation and they may subsequently have become observable.

3. Comments made relating to land gas or groundwater conditions are based on observations made at the time of the investigation unless otherwise stated. The normal rate of conduct of an exploratory hole does not usually permit the recording of an equilibrium groundwater level for any one strike. Land gas and / or groundwater conditions may vary as a result of seasonal or other effects.

4. The opinions expressed in this report are based on the ground conditions revealed by the site works, together with an assessment of the site and of laboratory test results. Whilst opinions may be expressed relating to sub-soil conditions in parts of the site not investigated, for example between or beyond borehole positions, these are only for guidance only and no liability can be accepted for their accuracy.

5. Ground contamination often exists as small discrete areas of contamination and there can be no certainty that any or all such areas have been located, sampled and/or identified.

6. This assessment may be subject to amendment in light of additional information becoming available.

7. The findings and opinions conveyed in this report are based on information obtained from a variety of sources, including that from 1) previous site investigations and 2) chemical testing laboratories, and which SEC has assumed are correct. Nevertheless, SEC cannot and does not guarantee the authenticity or reliability of the information it has relied upon. SEC can accept no responsibility for inaccuracies within the data supplied by other parties.

8. This report is written in the context of an agreed scope of work between SEC and the Client and should not be used in a different context. In light of additional information becoming available, improved practices and changes in legislation amendment or re-interpretation of the assessment or report in whole or part may be necessary after its original submission.

9. This report is provided for sole use by the Client and is confidential to them. No responsibility whatsoever for the contents of the report will be accepted to anyone other than the Client.

10. SEC believes that providing information about limitations is essential to help the Client identify and thereby manage risks.

11. The copyright of written materials supplied shall remain the property of SEC but with a royalty free perpetual licence, granted to the Client on payment in full of any outstanding monies.

12. SEC does not provide legal advice and the advice of the Clients legal advisors may also be required.

13. SEC notes that this assessment is subject to regulatory review and approval.

14. This report represents a stage in an iterative process of investigation and assessment and as such it is possible that further work may be recommended.

15. An ecological, topographical or asbestos survey was outside of the scope of this report

16. The use of data generated by this site investigation for the design of foundations or geo-technical assessment was outside the scope of this report.