

CONTAMINATED LAND RISK ASSESSMENT

***PHASE 1 DESK TOP STUDY AND SITE WALKOVER SURVEY
– PRELIMINARY RISK ASSESSMENT***

AL3D

**125 Highgrove Street
Reading**



**Soil Environment Services Ltd
May 2017**

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**125 Highgrove Street
Reading**

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EXECUTIVE SUMMARY

Current site conditions	A number of small buildings used for various vehicle workshop activities and storage occupy the site.
Proposal	The proposal is for residential development (Drawing 2). No current planning application was available for viewing at the time of report completion.
Adjacent site conditions	Residential dwellings and garden bound the site in all directions.
Site history	Buildings have been on the site c.1958. These have been used for a Builder's Yard (1972-1990) and for vehicle repair activities.
Geology	Boyn Hill Gravel Member - Sand and Gravel over London Clay Formation - Clay, Silt and Sand.
Hydrogeology	The site is on a variably permeable Secondary A Superficial and Unproductive Bedrock aquifer and is not in a groundwater source protection zone.
Hydrology	No surface water is mapped downgradient within a 500 m radius of the site.
Potential sources and contaminants	Potential sources are considered to exist from on-site activities.
Conclusions	Plausible pollutant linkages and significant uncertainties are considered to exist from on-site sources. A moderate risk is evident and therefore an intrusive investigation is needed.

1. INTRODUCTION AND OBJECTIVES

1.1 Introduction

The purpose of this assessment is to examine specifically the current and potential risks to human, ecological and ground and surface water receptors associated with possible contamination of the ground at the site located at:

125 Highgrove Street
Reading
RG1 5EJ

OS Grid Ref: 472110, 172282

The proposal is for residential development (Drawing 2). No current planning application was available for viewing at the time of report completion.

The site was visited on the 16th May 2017 to undertake a site walkover survey in order to assess current site conditions, particularly with respect to potential sources, pathways and receptors.

1.2 Objectives

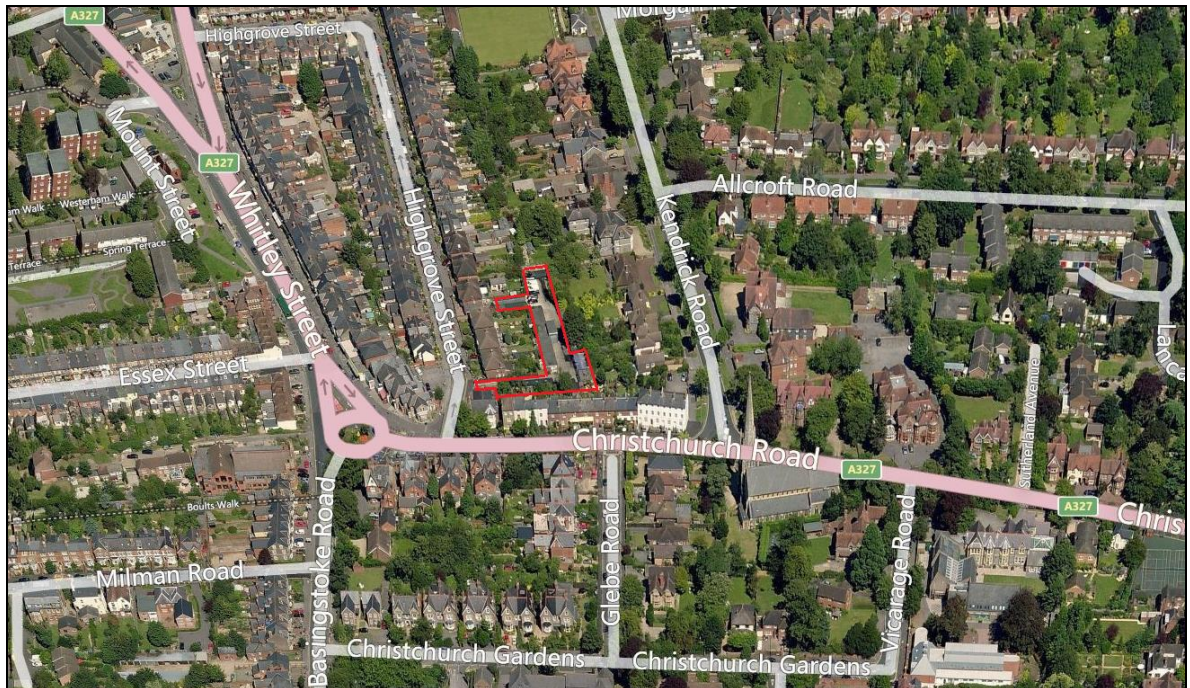
The primary objective of this risk assessment is to assess potential contamination sources, the pathways which these could possibly take through the environment and then the effects on likely receptors. A preliminary Conceptual Site Model (CSM) has been developed and evaluation of the risks is given. Subsequently, if needed, recommendations are made with regard to further (Phase 2) investigation and/or remediation.

2. SITE CHARACTERISATION

2.1 Current setting and condition (Drawing 1)

The site assessed for this investigation comprises 0.14 ha of land located off Highgrove Road, Reading. Residential dwellings and garden bound the site in all directions (Photo 1). A number of small outbuildings used for various vehicle workshop activities and storage occupy the site (Photos 1-9). The site and surround land slopes down to the west.

PHOTO 1 Aerial view



Site walkover findings

PHOTO 2 View S to N



PHOTO 3 View to SE corner



PHOTO 4



PHOTO 5



Some storage of oils was evident within a car repair workshop building on the site (Photo 6).

PHOTO 6



PHOTO 7 View N



PHOTO 8

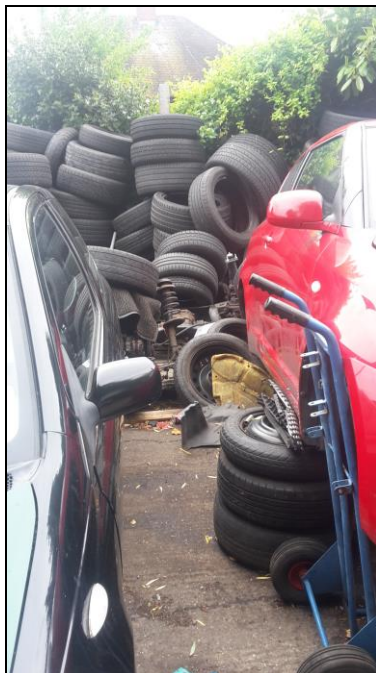
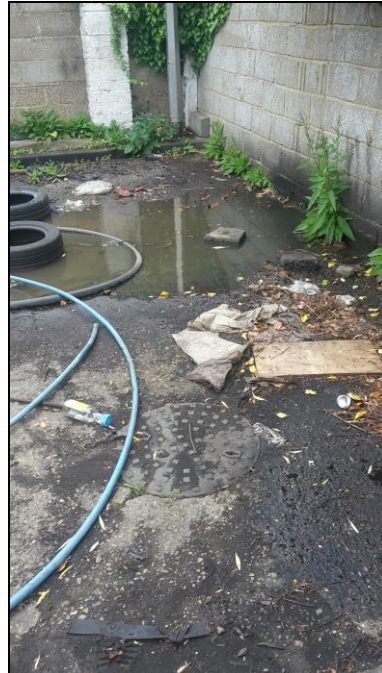


PHOTO 9 Northern corner



The walkover survey revealed:

- The site is currently being used for vehicle repair activities.
- The site and surrounding lands slopes very gently down to the north and west.
- No visual or olfactory evidence of ground contamination was noted during the site walkover. No significant leaks, spillages or staining of the ground were noted.
- The trees surrounding the site had good foliage and no chlorosis. There was no evidence of vegetation dieback.
- Asbestos was not evident on the buildings on-site.
- An oily sheen or 'rainbow colours' indicative of hydrocarbon contamination was evident within the rainwater which has collected on the site (Photo 9).
- The site is approximately 2 m higher than surrounding land at the northern boundary.

2.2 Former investigations and consultations

No known former investigations with regards to contamination appear to have been undertaken for the site.

2.3 Planning history

App. No.:	050756	Site Address:	125 Highgrove Street Reading RG1 5EJ
Description:	Use of part of the site at 125 Highgrove Street for A1 (retail) use		
Received Date:	04/07/2005	Decision Sent Date:	18/08/2005
		Decision Date:	18/08/2005

App. No.:	041385	Site Address:	125 Highgrove Street Reading RG1 5EJ
Description:	Demolition of existing building and erection of four one-bedroom and two two-bedroom flats		
Received Date:	27/09/2004	Decision Sent Date:	22/11/2004
		Decision Date:	22/11/2004

2.4 Site history (see Historical maps – Appendix A)

A chronological list of potential sources of contamination and significant features on and surrounding the site, noted on historical maps, considered relevant to the proposed development are outlined below (Table 1).

TABLE 1 Significant features on the historical maps

Land use	Direction	Distance (m)	Notes
On-site			
Undeveloped land (pre 1880)	On-site	0	
Glass house mapped (1931-1958)	On-site	0	
Buildings developed c.1958	On-site	0	<i>additional buildings developed c.1972</i>
Builder's Yard mapped (1972-1990)	On-site	0	
Off site			
Residential dwellings (pre 1879-current)	N,S	1	
Water (spring/reservoir) (pre 1879-1958)	W	15	
Reservoir (pre 1879 - 1912)	W	143	
Electricity substation (1962-current)	SW	132	
Electricity substation (1962-current)	E	192	

2.5 Soils, geology and hydrology

BGS maps indicate that the site is located on:

Superficial geology

1:50 000 scale superficial deposits description: Boyn Hill Gravel Member - Sand and Gravel. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by rivers.

Bedrock geology

1:50 000 scale bedrock geology description: London Clay Formation - Clay, Silt and Sand. Sedimentary Bedrock formed approximately 34 to 56 million years ago in the Palaeogene Period. Local environment previously dominated by deep seas.

No BGS listed borehole logs are mapped within a 250 m radius of the site.

Hydrology

Flow to groundwater may occur through the soils to the aquifer at depth.

Surface water flow could possibly find a route via surface water drains and channels to the north and west. No surface water is mapped downgradient within a 500 m radius of the site.

The site is on a variably permeable Secondary A Superficial and Unproductive Bedrock aquifer and is not in a groundwater source protection zone.

2.6 Environmental data search

Environmental data (Appendix B) indicates the following:

- The site is located on a variably permeable Secondary A Superficial and Unproductive Bedrock aquifer.
- The site is not in a groundwater source protection zone.
- No Contaminated Land Register Entries and Notices within 1000 m.
- No pollution incidents within 250 m.
- No substantiated pollution incidents within 1000 m.
- No current or historical landfill sites within 600 m.
- No waste treatment, management or disposal sites within 800 m.
- No contemporary trade directory entries are listed for the site or within a 450 m radius.
- 1-3 % of homes are above the action level for radon. No radon protective measures are considered necessary in the construction of new properties.
- No fuel station entries within 1000 m.
- The Urban Soil Chemistry maps (Appendix B) indicate no significant elevated soil metal concentrations.
- One area of potentially infilled land (water) 140 m west (1900).
- One area of potentially infilled land (non-water) 244 m north-west of the site (1995).

3. INITIAL CONCEPTUAL SITE MODEL

The initial conceptual site model detailed here is by a written and tabular description of the sources, pathways and receptors. A cross section or diagram is only added if this will aid in understanding the conceptual site model.

Model summary

The site is situated on soils of a high leaching potential. The residents will be the main receptors on site. Potential sources of contamination from hydrocarbons and metals are considered to have possibly been generated from on-site activities. No significant pollutant pathways from off-site have been identified. A potential risk to human health and controlled waters is considered to be evident.

3.1 Potential sources

A review of the historical maps (Appendix A) and the site walkover survey has identified that potential significant sources of contamination are considered to have been generated from on-site sources (Table 2).

TABLE 2 Possible source locations and potential contaminants

Source location	Direction	Distance (m)	Potential Contaminants
On-site			
Builder's Yard mapped (1972-1990)	On-site	0	Metals, hydrocarbons, paints, solvents
Current vehicle repair activities	On-site	0	Metals, hydrocarbons, paints, solvents, asbestos
Off site			
Water (spring/reservoir) (pre 1879-1958)	W	15	Methane, carbon dioxide
Reservoir/infilled land (pre 1879 - 1912)	W	143	Methane, carbon dioxide
Electricity substation (1962-current)	SW	132	PCB's, mineral oils
Electricity substation (1962-current)	E	192	PCB's, mineral oils
Infilled land (1995)	NW	244	Methane, carbon dioxide

3.2 Receptors

Humans

- Residents in the proposed dwellings.
- Residents in the adjacent dwellings.
- Development workers.

Controlled Waters

- The site is on a variably permeable Secondary A Superficial and Unproductive Bedrock aquifer.
- The site is not in a groundwater source protection zone.
- Underlying aquifer.

Ecology

- Animals and plants are considered to be possible receptors.

Buildings and services

- Underground pipes and foundations.

3.3 Pathways and plausible pollutant linkages (See Table 3)

Pathways to and from the site could exist via service channels.

Human health

The main pathways considered possible are:

1. Ingestion of soil
2. Ingestion of dust
3. Ingestion of contaminated vegetables
4. Ingestion of soil attached to vegetables
5. Dermal contact with soil
6. Dermal contact with dust
7. Inhalation of fugitive soil dust
8. Inhalation of fugitive dust
9. Inhalation of vapours outside
10. Inhalation of vapours inside
11. Ingress to water supplies is also considered
12. Ingress and accumulation of methane

Controlled Waters

Flow to groundwater may occur through the soils to the aquifer at depth.

Surface water flow could possibly find a route via surface water drains and channels to the north and west. No surface water is mapped downgradient within a 500 m radius of the site.

The site is on a variably permeable Secondary A Superficial and Unproductive Bedrock aquifer and is not in a groundwater source protection zone.

TABLE 3. Initial source/receptor matrix											Y= yes, N= no, N/A= not applicabale											CSM	Ref	No.	1	Version	a
SOURCE	Chemicals		RECEPTORS																								
		Possible present on site	On site								Off site																
	Type		Current workers	Future workers	Dev,ment workers	Current residents	Future residents	Ground water	Surface water	Ecology	Current workers	Future workers	Dev,ment workers	Current residents	Future residents	Ground water	Surface water	Ecology									
ON SITE																											
Former builder's yard and current vehicle reapiir activities	Metals	Y	Y	N	N	N	Y	Y	N	N	N	N	N	Y	N	Y	N	N									
	Hydrocarbons	Y	Y	N	Y	N	Y	Y	N	N	N	N	N	Y	N	Y	N	N									
	Paints	Y	Y	N	Y	N	Y	Y	N	N	N	N	N	Y	N	Y	N	N									
	Solvents	Y	Y	N	N	N	Y	Y	N	N	N	N	N	Y	N	Y	N	N									
	Asbestos	Y	Y	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	N									
OFF SITE																											
Former reservoirs	Methane	N	N	N	N	N	N	N	N	N	N/A																
	Carbon dioxide	N	N	N	N	N	N	N	N	N																	
Electricity sub-stations	PCB's	N	N	N	N	N	N	N	N	N																	
	Mineral oils	N	N	N	N	N	N	N	N	N																	
Infilled land	Methane	N	N	N	N	N	N	N	N	N																	
	Carbon dioxide	N	N	N	N	N	N	N	N	N																	
Notes	For sources and contaminants see Section 3.1 of the report.																										
	For receptors and plausible linkages see Sections 3.2 and 3.3 of the report.																										
	For risks from sources on-site and sources off-site see Section 4 of the report.																										

The identified potential contaminants (sources) and receptors have been considered in relation to pathways that may link them (Table 4 and Appendix C):

TABLE 4 – Initial Conceptual Site Model (see Appendix C)

Potential source	Potential contaminants of concern	Plausible pathway	Potential receptor	Probability	Severity	Risk	Justification	Risk classification
ON-SITE								
Former builder's yard and current vehicle repair activities	Metals, hydrocarbons, paints, solvents, asbestos	Indoor inhalation, direct ingestion and/or dermal contact with contaminants	Humans (site users), development workers	Likely	Medium	Moderate	Residual contamination may be present. Leaks and spillages into the ground may have occurred	Moderate
		Leaching via vertical or lateral migration following any movement through the strata	Perched water, groundwater	Low likelihood	Medium	Moderate/low	Residual contamination from hydrocarbons. Given that metals are not risk drivers for controlled waters due to their minimal solubility, no significant risk from metals is considered to exist	Moderate/low
		Direct contact following any movement through the strata	Buildings and service pipes	Likely	Mild	Moderate/low	Aggressive substances (PAH's, TPHs) which may affect the foundations or plastic/metal pipes may exist on site	Moderate/low
OFF-SITE								
Former reservoirs (1912 and 19580)	Methane, carbon dioxide	Indoor inhalation following any movement through the strata	Humans (site users)	Unlikely	Medium	Low	Natural attenuation of ground gases given the time since infill*	Low
Electricity substations	PCB's, mineral oils	Indoor inhalation, direct soil and dust ingestion and/or inhalation following any movement through the strata	Humans (site users)	Unlikely	Medium	Low	Distance restricting pathways	Low
Infilled land (1995)	Methane, carbon dioxide	Indoor inhalation following any movement through the strata	Humans (site users)	Unlikely	Medium	Low	Distance restricting pathways. Some natural attenuation given the time since infill	Low
Notes to table: * Given the length of time since in-fill, any potential gas generated during decomposition is likely to have peaked and be in decline. This information is based on the document prepared by CIRIA titled 'CIRIA C665 -Assessing risks posed by hazardous gases to buildings'. Section 7.2.5 (Figure 7.1), details that the landfill gas generation rate significantly reduces with the age of the waste. By 30 years, the rate of gas generation is insignificant, and by 50 years, the rate is minimal.								
Pathway: Classification of human exposure pathways (routes) from The CLEA model, Research and Development Publication CLR10. Probability and severity: Classification of Probability and Consequence from CIRIA C552 Contaminated land risk assessment, a guide to good practice 2001. Risk Classification from DETR Guidelines for Environmental Risk Assessment and Management, 2000								

4. RISK ASSESSMENT SUMMARY

4.1 Human health

A ***moderate*** potential risk exists from on-site sources (Table 4). The major risk could be from hydrocarbon vapour inhalation within indoor air-space and also ingestion and dermal contact with metals and hydrocarbons in any proposed landscaped or garden areas. A risk from asbestos is also evident.

4.2 Controlled Waters

A ***moderate/low*** risk to groundwater is considered to exist due to potential on-site sources.

4.3 Ecology

A ***low risk*** is considered to exist as no significant receptors are considered to exist on or within a significant distance of the site. Hence no plausible pollutant linkages are present.

4.4 Buildings and services

A ***moderate/low*** risk is considered to exist as aggressive substances (PAH's) which may affect the foundations or plastic/metal pipes of any buildings may be present on the site from on-site sources.

5. UNCERTAINTIES AND RECOMMENDATIONS

Some risks are considered to be evident in relation to the possible presence of contaminants from on-site activities.

It is recommended that a Phase 2 investigation be undertaken with sampling of the soil in order to substantiate the possible risks from contamination. The investigation should consist of soil samples from targeted boreholes with samples analysed in a UKAS and MCERTS accredited laboratory for metals, hydrocarbons, asbestos and other associated contaminants, such that a site specific quantitative risk assessment can be undertaken and appropriate risk reduction measures recommended.

Any site investigation should be targeted with regard to sampling locations and all works be undertaken in accordance with BS 10175 - Investigation of Potentially Contaminated Sites: Code of Practice and CLR11 - Model Procedures for the Management of Land Contamination, using LQM/CIEH S4ULs guideline values.

A proposed scope of works would be as follows:

- 6 x targeted boreholes to 4 m bgl/ natural ground. One sample of the made ground/upper strata from each of the locations. A sample of the lower strata will be taken and tested if required, otherwise they will be stored in the laboratory.
- Test the six samples (one from each location in the upper strata) in a UKAS/MCERTS accredited laboratory for hydrocarbons (speciated PAH, aliphatic and aromatic fractions), metals, asbestos, pH and organic carbon.
- Risk assessment reporting.

Timing of the Phase 2 investigation is recommended to occur following clearance of all the site buildings and hard-standing.

The above proposed scope of works for the Phase 2 intrusive will need to be agreed with the council prior to intrusive or development works.

DRAWING 1 & DRAWING 2

Current site location & proposed site plan

NOTES:



Site boundary

Soil Environment Services

Drawing number

1

Drawing title

Current site location

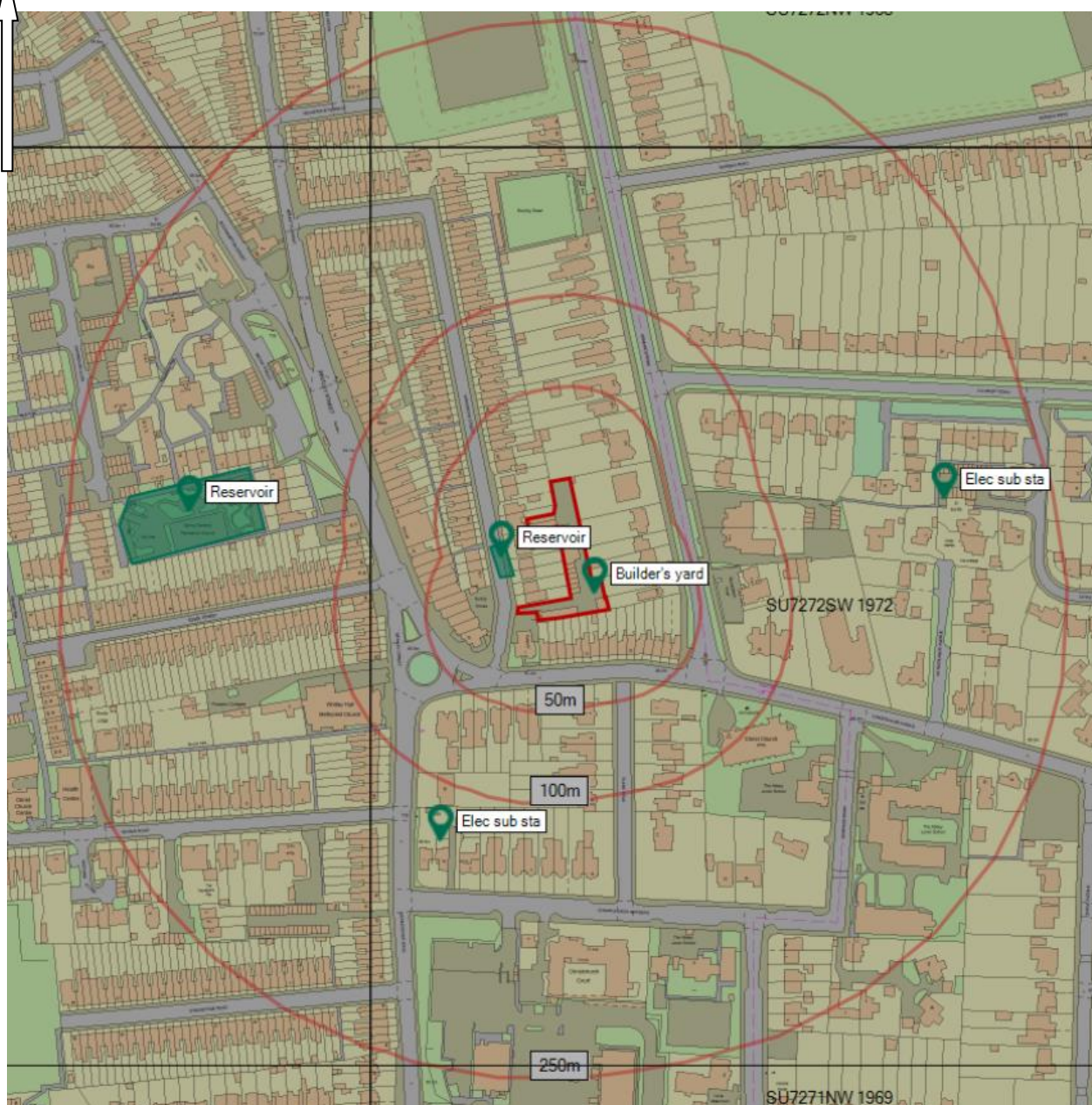
Scale

1:2680

Date

19/05/2017

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NOTES:

Soil Environment Services

Drawing number	2
Drawing title	Proposed site plan
Scale	1:560
Date	19/05/2017



APPENDIX A

Historical maps

APPENDIX B

Environmental data

APPENDIX C

Risk consequence

Risk is regarded as being a combination of the likelihood of an ‘event’ occurring and its severity. Both elements must be considered when assessing risk. As defined in CIRIA C552:2001, the magnitude of the potential severity of risk occurring may be assessed against:

Consequence of Risk Being Realised (based on C552 CIRIA, 2001)

Consequence of risk being realised			
Classification	Category	Definition	Examples
Severe short-term (acute) risks only	Humans	Short-term (acute) risk to human health likely to result in “significant harm” as defined by the Environment Protection Act 1990, Part 2A.	High concentrations of cyanide on the surface of an informal recreation area.
	Controlled Waters	Short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource.	Major spillage of contaminants from site into controlled water.
	Property	Catastrophic damage to buildings/property.	Explosion causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
	Ecological System	A short-term risk to a particular ecosystem, or organism forming part of such ecosystem.	
Medium chronic (long-term) risks; “significant harm”	Humans	Chronic damage to Human Health (“significant harm” as defined in Defra 2006).	Concentrations of a contaminant from site exceed the generic, or site-specific assessment criteria
	Controlled Waters	Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution).	Leaching of contaminants from a site into a major or minor aquifer.
	Ecological System	A significant change in a particular ecosystem	Death of a species within a designated nature reserve.
Mild chronic (long-term) risks; less sensitive receptors	Controlled Waters	Pollution of non-sensitive water resources.	Pollution of non-classified groundwater.
	Property	Significant damage to buildings, structures and services (“significant harm” as defined in Circular on Contaminated Land, Defra, 2006). Damage to sensitive buildings/structures/services	Damage to building rendering it unsafe to occupy (e.g., foundation damage resulting in instability)
	Ecological System	Significant damage to crops. Damage to the environment.	
Minor chronic (long-term) risks; mild	Financial / project	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve.	
	Humans	Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc).	The presence of contaminants at such concentrations that protective equipment is required during site works.
	Property	Easily repairable effects of damage to buildings, structures and services	The loss of plants in a landscaping scheme. Discolouration of concrete.

Similarly, the classification of the magnitude of the probability of the risk occurring may be assessed against:

Probability of Risk Being Realised (C552 CIRIA, 2001)

Probability of risk being realised	
Classification	Definition
High Likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

The risk categories are summarised in the following table:

Risk Classification Matrix (C552 CIRIA, 2001)

Risk classification matrix					
(CIRIA C552, 2001, page 82)		Consequence			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very High	High	Moderate	Moderate/Low
	Likely	High	Moderate	Moderate/Low	Low
	Low Likelihood	Moderate	Moderate/Low	Low	Very Low
	Unlikely	Moderate/Low	Low	Very Low	Very Low

Risk Classification Definitions (C552 CIRIA, 2001)

Risk classification definitions	
Very High	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Moderate / Low	
Low	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very Low	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

REFERENCES

General guidance used:

BS 10175:2011 Investigation of potentially contaminated sites. British Standards Institution, London.

CLR 11: Model procedures for the management of land contamination. Environment Agency.

CIRIA C665 Assessing the risks posed by hazardous ground gases 2013.

CIRIA C682 The VOCs Handbook 2009 Investigation, assessing and managing risks from inhalation of Volatile Organic Compounds at land affected by contamination.

Chartered Institute for Environment and Health Indoor air quality in the home.

Environment Agency Guiding Principles for Land Contamination (GPLC).
(2010) Environment Agency.