

CONTAMINATED LAND RISK ASSESSMENT

PHASE 1 DESK TOP STUDY – PRELIMINARY RISK ASSESSMENT

Tyne & Wear Building Preservation Trust

**St Hilda's Colliery Head Stock
South Shields**



Our Ref: SES/TWBPT/SH/1#1

Date: 28th July 2016

Client:

Tyne & Wear Building Preservation Trust
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Newcastle
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**St Hilda's Colliery Head Stock
South Shields**

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EXECUTIVE SUMMARY

Current site conditions	Former engine house and rail lines
Proposal	The proposal is for the refurbishment of St Hilda's Colliery Head Stocks to provide start up units for community use and exhibition space for the history of the head stocks to be displayed and accessible to all. Installation of a staircase, lift and toilet, replacement windows, external viewing deck extension to roof, six on site car parking spaces, refuse storage, cycle parking
Adjacent site conditions	The site is situated within an industrial estate.
Site history	Part of St Hilda's colliery.
Geology	Glaciolacustrine Deposits, Devensian - Clay and Silt over Pennine Middle Coal Measures Formation - Mudstone, Siltstone and Sandstone.
Hydrogeology	The site is on a variably permeable Unproductive Superficial and Secondary A Bedrock aquifer.
Hydrology	The closest surface water is South Shields harbour 445 south-west the site.
Potential sources and contaminants	Potential sources are considered to have been generated on-site from the former colliery activities and adjacent industrial activities.
Conclusions	Based on the information available, plausible pollutant linkages or significant uncertainties are considered to exist therefore further investigation is considered to be 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:

St Hilda's
Station Road
South Shields
Tyne & Wear
NE33 1RA

OS Grid Ref: 436179, 566828

The proposal is for the refurbishment of St Hilda's Colliery Head Stocks to provide start up units for community use and exhibition space for the history of the head stocks to be displayed and accessible to all. Installation of a staircase, lift and toilet, replacement windows, external viewing deck extension to roof, six on site car parking spaces, refuse storage, cycle parking (Planning Application ST/0529/16/FUL). See Drawing 2 for the illustrative proposal.

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 0.17 ha of land located off Station Road, South Shields. The site is situated within an industrial estate (Photo 1). A Grade II listed building and grass occupy the site (Photos 1 & 2). The general topography of the site and surrounding land slopes down to the south and west.

PHOTO 1 Aerial view



PHOTO 2 Google Streetview May 2016



2.2 Former investigations and consultations

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

2.3 Planning history – see Appendix D for full planning history

No former planning applications are evident for the site.

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 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			
Engine House (pre 1857)	On-site	0	<i>part of a colliery</i>
Coal Screens (pre 1857-pre 1896)	On-site	0	<i>west of site</i>
Rail lines (pre 1857-c.1955)	On-site	0	
Shaft marked (1956-c.2006)	On-site	0	
Off site			
Engine House (1857-c.1940)	W	1	
Rail lines (pre 1857-c.1955)	S	1	
Industrial activities (pre 1857-current)	N,E,S,W	1	
Fuel works (1896-c.1915)	NE	5	
Engineering works/battery factory to c.1975	NW	70	

A Heritage Statement for the site (Mawson Kerr may 2015) informs:

'St Hilda Colliery in South Shields began in the 1820's and was an active mine for over a century. After mining stopped it became a ventilation shaft for Westoe Colliery which closed in 1993. The mine itself went to a depth of 859ft 4inches and at its peak it employed over 2000 people.

The colliery is an important monument in the history of mining due to a significant disaster in 1839 which killed 51 miners, the youngest being 9 years of

age. The tragedy is a prominent event in mining history as the disaster affected every family in the town. From this disaster came a series of reforms which changed mining safety forever. One major reform was the introduction of a government inspection act, which sought to enforce mining safety laws across the country. The disaster also led to the establishment of the North of England Institute of Mining and Mechanical Engineering which developed knowledge and research to facilitate safer practice.

Another notable aspect from the mines history is the remarkable career of St Hilda Colliery Band who became national champions five times between 1912-26, they also played at Buckingham Palace. The colliery currently sits vacant. It is without heating, water and utilities. The old mine shaft has been capped with a concrete slab that protrudes nearly 2m above ground level, the first and second floor can only be accessed by ladder. The original winding gear still remains and sits on the roof of the building.

The building is both historically and architecturally significant and this has led to it being Grade II listed. Work has been carried out to preserve the building, it was partially renovated in 1989 and 2000, but the colliery requires further work to bring it back into viable use and secure its future for the generations to come'.

2.5 Soils, geology and hydrology

BGS maps indicate that the site is located on:

Superficial geology

1:50 000 scale superficial deposits description: Glaciolacustrine Deposits, Devensian - Clay and Silt. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by ice age conditions.

Bedrock geology

1:50 000 scale bedrock geology description: Pennine Middle Coal Measures Formation - Mudstone, Siltstone and Sandstone. Sedimentary Bedrock formed approximately 309 to 312 million years ago in the Carboniferous Period. Local environment previously dominated by swamps, estuaries and deltas.

A BGS borehole log (BGS ID 17315656, BGS Reference NZ36NE872) mapped on the site indicates:

NATURE OF STRATA		THICKNESS		DEPTH	
Geologist's Notes	Borer's Journal	Feet	In.	Feet	In.
Nunnery Floor 1940. A.O.D. 43.66 A.O.D. 35.16					
	Soil	1	-	1	-
	Red Clay	4	-	5	-
	Brown Clay and Sand	14	-	19	-
	Sand, water.	2	-	21	-
	Blue Stony Clay	13	6	34	6
	Blue Metal	1	-	35	6
	Brown Metal	2	8	38	2
	Blue Metal	2	2	40	4
	Post		3	40	7
	Blue Metal	1	11	42	6
	Black Stone	2		42	8
	Blue Metal	1	5	44	1
	- 9.51 Coal		7	44	8
	Thill	1	-	45	8
	Brown Post	13	1	118	11
	Soft Brown Metal	10		119	9
	Black stone and coal	7		126	4
	Blue Metal soft	5	6	125	10

Hydrology

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

Surface water flow could find a possible route to surface water drains and channels to the south and west leading to South Shields harbour 445 south-west the site.

The site is on a variably permeable Unproductive Superficial and Secondary A 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 on a variably permeable Unproductive Superficial and Secondary A Bedrock aquifer
- The site is not in a groundwater source protection zone.
- No pollution incidents within 390 m.
- No substantiated pollution incidents within 1000 m.
- No contaminated land register entries and notices within 1000 m.
- No current or historic landfill sites within 600 m.
- The Urban Soil Chemistry maps (Appendix B) indicate no significant elevated soil metal concentrations.
- The site is in an area that might be affected by coal mining (a separate Coal Mining Risk Assessment has been prepared for the site).
- Less than 1 % of homes are above the action level for radon. No protective measures are considered necessary in the construction of new properties.
- No contemporary trade directory entries are listed for the site.
- No potentially infilled land (water) is mapped within 250 m.
- Potentially infilled water (1993) is mapped adjacent to the site.
- One fuel station (obsolete) is mapped 199 m north-east of the site.
- One waste management site 169 m north-west (1995-2002)

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 located on soils of a high leaching potential. Potential sources of contamination are considered to have been generated on the site given the colliery activities that have occurred on and adjacent to the site. The future workers and visitors in the building and workshop units are the main receptors on site. Plausible pollutant pathways to proposed future workers and visitors are considered to be evident.

3.1 Potential sources

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

TABLE 2 Possible source locations and potential contaminants

Source location	Direction	Distance (m)	Potential Contaminants
On-site			
Engine House (pre 1857)	On-site	0	Metals, hydrocarbons
Coal Screens (pre 1857-pre 1896)	On-site	0	Metals
Rail lines (pre 1857-c.1955)	On-site	0	Metals, hydrocarbons
Shaft marked (1956-c.2006)	On-site	0	Methane, carbon dioxide
Off site			
Engine House (1857-c.1940)	W	1	Metals, hydrocarbons
Rail lines (pre 1857-c.1955)	S	1	Metals, hydrocarbons
Industrial activities (pre 1857-current)	N,E,S,W	1	Metals, hydrocarbons
Fuel works (1896-c.1915)	NE	5	Metals, hydrocarbons
Engineering works/battery factory to c.1975	NW	70	Metals, hydrocarbons, acids, organic compounds
Registered waste treatment site (1995)	N	103	Metals, hydrocarbons, solvents
Waste management site (1995-2002)	NW	169	Metals. Hydrocarbons
Garage/fuel station (obsolete)	NE	199	Metals, hydrocarbons, paints, solvents

3.2 Receptors

Humans

- Visitors and workers in the proposed building and workshop units.
- Workers in nearby properties.
- Development workers.

Controlled waters

- The site is on a variably permeable Unproductive Superficial and Secondary A 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. Dermal contact with soil
4. Dermal contact with dust
5. Inhalation of fugitive soil dust
6. Inhalation of fugitive dust
7. Inhalation of vapours outside
8. Inhalation of vapours inside
9. Ingress to water supplies is also considered
10. Accumulation and explosion of methane

Controlled waters

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

Surface water flow could find a possible route to surface water drains and channels to the south and west leading to South Shields harbour 445 south-west the site.

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

TABLE 3. Initial source/receptor matrix Y = yes, N = no, Blank = not possible											CSM	Ref	No.	1	Version	a										
SOURCE	Chemicals		RECEPTORS																							
	Type	Possible present on site	On site								Off site															
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																										
Engine House	Metals	Y	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N								
	Hydrocarbons	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N								
Coal mines	Metals	Y	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N								
	Hydrocarbons	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N								
Rail lines	Metals	Y	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N								
	Hydrocarbons	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N								
Shaft marked	Methane	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N								
	Carbon dioxide	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N								
OFF SITE																										
Engine House	Metals	Y	N	Y	N	N	N	N	N	N	N/A															
	Hydrocarbons	N	N	N	N	N	N	N	N	N																
Rail lines	Metals	Y	N	Y	N	N	N	N	N	N																
	Hydrocarbons	N	N	N	N	N	N	N	N	N																
Industrial activities	Metals	Y	N	Y	N	N	N	N	N	N																
	Hydrocarbons	Y	N	Y	N	N	N	Y	Y	N																
Fuel works	Metals	Y	N	Y	N	N	N	N	N	N																
	Hydrocarbons	N	N	N	N	N	N	N	N	N																
Engineering/battery works	Metals	N	N	N	N	N	N	N	N	N																
	Hydrocarbons	N	N	N	N	N	N	N	N	N																
	Acids	N	N	N	N	N	N	N	N	N																
Waste sites	Inorganic compounds	N	N	N	N	N	N	N	N	N																
	Metals	N	N	N	N	N	N	N	N	N																
Former petrol station	Hydrocarbons	N	N	N	N	N	N	N	N	N																
	Solvents	N	N	N	N	N	N	N	N	N																
	Metals	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								
Engine house	Metals, hydrocarbons	Indoor inhalation, direct ingestion and/or dermal contact with contaminants	Humans (site users)	Likely	Medium	Moderate	Natural attenuation of hydrocarbons however residual contamination from metals may be present	Moderate
Coal seams	Metals	Direct ingestion and/or dermal contact with contaminants	Humans (site users)	Likely	Medium	Moderate	Residual contamination from metals may be present	Moderate
Rail lines	Metals, hydrocarbons	Indoor inhalation, direct ingestion and/or dermal contact with contaminants	Humans (site users)	Likely	Medium	Moderate	Natural attenuation of hydrocarbons however residual contamination from metals may be present	Moderate
Shaft	Methane, carbon dioxide	Indoor inhalation	Humans (site users)	Unlikely	Medium	Low	A Coal Authority report indicates that the shaft was filled with clean hardcore and concrete	Low
OFF-SITE								
Engine house/rail lines/fuel works	Metals, hydrocarbons	Indoor inhalation, direct soil and dust ingestion and/or inhalation following any movement through the strata	Humans (site users)	Likely	Medium	Moderate	Migration of potential contaminants through the permeable strata	Moderate
Industrial activities	Metals, hydrocarbons	Direct soil and dust ingestion and/or inhalation following any movement through the strata	Humans (site users)	Likely	Medium	Moderate	Migration of potential contaminants through the permeable strata	Moderate
Former engineering works/battery works	Metals, hydrocarbons, inorganic compounds, acids	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
Waste treatment facilities	Metals, hydrocarbons	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
Former petrol station	Metals, hydrocarbons, paints, solvents	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
<p>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</p>								

4. RISK ASSESSMENT SUMMARY

4.1 Human health

A *moderate* potential risk exists from on and off-site sources (Table 4). Residual contamination may be present from on-site sources. The migration of potential contaminants may also have occurred through the strata from the adjacent sources. The major risk could be from ingestion and dermal contact with metals and hydrocarbons and risks from hydrocarbon vapour inhalation within indoor air-space.

4.2 Controlled waters

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

4.3 Ecology

A potential risk is considered to exist as significant sources are considered to exist on the site and receptors on the site.

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 service pipes may exist on the site.

5. UNCERTAINTIES AND RECOMMENDATIONS

Some uncertainties are considered to exist with regards to the concentration of potential contaminants from on and off-site activities. Metals, hydrocarbons and other potential contaminants could be present in the soil at concentrations above guideline values. These could pose a risk to human health and controlled waters.

It is recommended that a Phase 2 investigation is undertaken with sampling of the site in order to substantiate the possible risks from contamination. The investigation may consist of soil samples from targeted boreholes with soils samples analysed in a UKAS and MCERTS accredited laboratory for metals, hydrocarbons 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 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 scope of works for the Phase 2 intrusive investigation will need to be agreed with the council prior to intrusive or development works.

DRAWING 1 & DRAWING 2

Current site location & proposed site plan

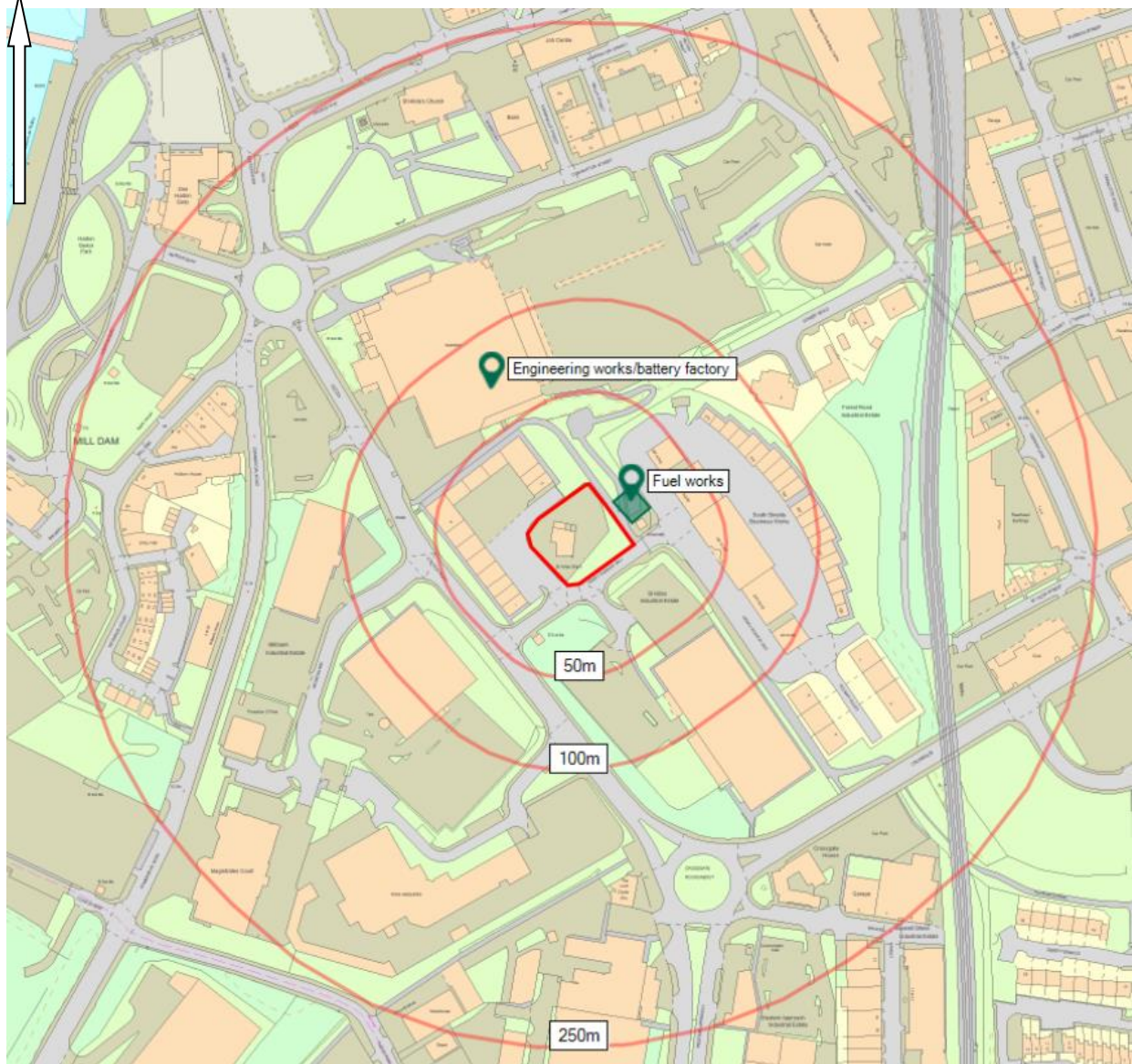
NOTES:

 Site boundary

Soil Environment Services

Drawing number	1
Drawing title	Current site location
Scale	1:2680
Date	28/07/2016

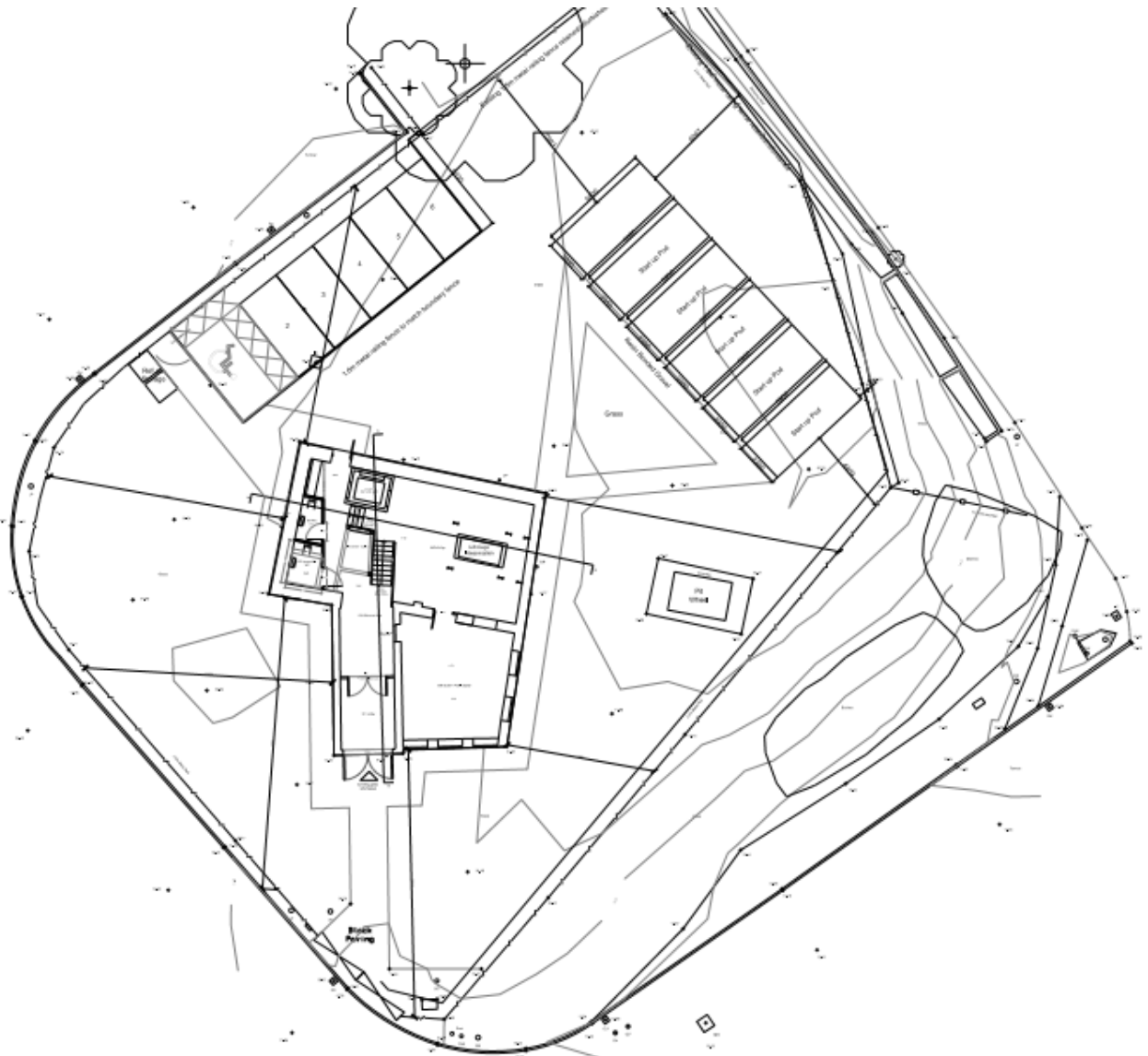
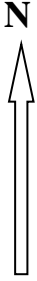
N



NOTES:

Soil Environment Services

Drawing number	2
Drawing title	Proposed site plan
Scale	1:500
Date	28/07/2016



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)

(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.