

CONTAMINATED LAND RISK ASSESSMENT

***PHASE 1 DESK TOP STUDY
& PRELIMINARY SITE INVESTIGATION***

The Fairfield Association

**Aldcliffe Road Triangle
Lancaster**



Our Ref: SES/TFA/ART/1#1

Date: 8th April 2013

Client:

The Fairfield Association
23 Regent Street
Lancaster
LA1 1SQ

CONTAMINATED LAND RISK ASSESSMENT

**Aldcliffe Road Triangle
Lancaster**

A report prepared on behalf of *Soil Environment Services* by:



Louise Tavasso BSc

Checked by:



Dr Robin S Davies BSc PhD MISoilSci PGC *Contaminated Land Management*



INSTITUTE OF PROFESSIONAL SOIL SCIENTISTS

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Soil Environment Services

Agricultural Land Classification, Contaminated Land
Risk Assessment, Mineral Extraction Soil Planning
The Nanotechnology Centre, Herschel Building, Kings Rd, Newcastle upon Tyne NE1 7RU
Tel: 0191 243 0686 Fax: 0191 222 3528 Email: rd@soilenvironmentservices.co.uk
www.soilenvironmentservices.co.uk

CONTENTS

	Page
1. INTRODUCTION AND OBJECTIVES	4
2. SITE CHARACTERISATION AND FORMER INVESTIGATIONS	5
3. CONCEPTUAL SITE MODEL	10
3.1 Sources	10
3.2 Receptors	12
3.3 Pathways and plausible pollutant linkages	12
4. RISK ASSESSMENT	14
4.1 Human health	14
4.2 Controlled waters	15
4.3 Ecology	15
5. CONCLUSIONS AND OPTIONS APPRAISAL	16
DRAWING 1	Current site setting and borehole locations
DRAWING 2	Borehole locations
APPENDIX A	Historical maps
APPENDIX B	Environmental data
APPENDIX C	Laboratory results
APPENDIX D	Borehole logs

1. INTRODUCTION AND OBJECTIVES

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:

Land at Aldcliffe Road
Lancaster
LA1 1ST

Grid Ref: 347470, 461040

The proposal is for the development of a landscaped recreational area.

The site was visited to obtain samples for testing of possible contamination in order to assess current site conditions, particularly with respect to potential sources, pathways and receptors.

Evaluation of the risks is given and subsequently, if needed, recommendations made with regard to further (Phase 2) investigation and/or remediation.

Investigation scope

The site was visited on the 21st March 2013 in order to obtain four soil samples of the made ground and natural strata at depth at the site. Samples were taken from each borehole and laboratory testing undertaken for hydrocarbons (speciated PAH (EPA16) and aliphatic and aromatic fractions), metals, asbestos, pH and organic carbon (Appendix C).

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.

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

2. SITE CHARACTERISATION AND FORMER INVESTIGATIONS

Current setting and condition (Drawing 1)

The site assessed for this investigation currently comprises 759 m² of land located on Aldcliffe Road, Lancaster. Roads bound the site to the north, east and west, with a canal to the south (Photo 1). A grassed area of land with trees and storage buildings are located on the site. The land on and surrounding the site slopes down to the south and west.

Photo 1. (This photo may be several months out of date)



Photo 2. (View)



Photo 3. (View)

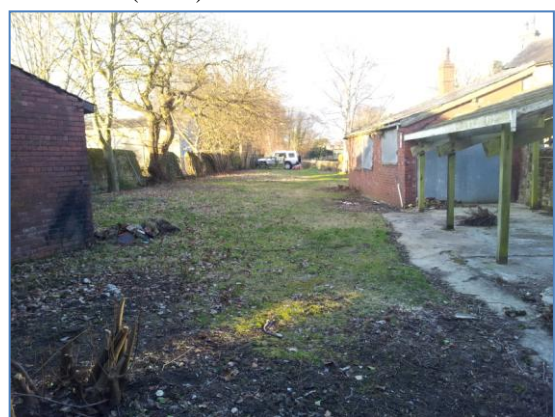


Photo 4. (View at BH1)



Photo 5. (View at BH2)



Photo 6. (View at BH3)



Photo 7. (View at BH4)



Site walkover findings

The recent site investigation revealed no significant visual or olfactory evidence of potential contamination on the site.

No evidence of contamination was evident within the buildings on site. The client has informed that the buildings were formerly used as a cement shed and office space.

Site history (see Historical maps – Appendix A)

Land use	Direction	Distance (m)	Notes
On-site			
Agricultural land (1848)	On-site	0	
Building constructed (1893)	On-site	0	On eastern boundary
Buildings constructed (1913)	On-site	0	On north and south boundary
Buildings extended (1957)	On-site	0	
Builders yard	On-site	0	
Off site			
Railway (pre 1848-current)	SW	112	
Coal yard (pre 1849-1913)	NE	155	
Boat repairing (1893-pre 1957)	S	14	
Coal yards (1849-1913)	NE	11	
Saw mill (1893-pre 1957)	E	32	
Maintenance yard (1957-current)	S	14	
Farm (1893-current)	NW	207	
Chemical/plastic works (1933-1986)	N	131	Marked as a superstore by 1986
Allotment gardens (1933-current)	W	154	
Warehouse (1933-current)	N	175	
Electricity substation (1957-current)	NE	95	
Nursery (1957-1971)	SE	212	
Clothing factory (1957-2006)	NW	167	
Electricity substation (1971-current)	E	170	
Tanks (1990-current)	E	126	
Tanks (1990-current)	S	48	
Car services (Appendix B)	NW	104	
Car repairs (Appendix B)	NW	138	
MOT services (Appendix B)	NW	151	
Radioactive substances (Appendix B)	E	233	
Pollution incident (Appendix B)	NE	246	Oils (Dodecylbenzene)

Current soils, geology and hydrology

BGS maps indicate that the site is located on the Namurian Millstone Grit Series. Sampling of the ground revealed made ground to approximately 0.4 m bgl over sand and gravel to 0.5 m bgl, over stiff clay or sand and gravel at depth. No water was evident in the boreholes (see Appendix D for borehole logs).

Flow to groundwater may occur through the soils finding a possible route 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 the Lancaster Canal 2 m south of the site.

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

Former investigations

No former investigations have taken place.

Investigation decision record

The intrusive investigation involved placing a total of four boreholes to approximately 1.7 m bgl across the site (see Drawing 1 for borehole locations and Appendix D for borehole logs) such that samples could be obtained from within the development site. The samples were taken and stored in new, clean glass jars and in a cold room prior to submission to the laboratory. Four samples were subsequently submitted in glass jars to a UKAS accredited laboratory for testing of metals and hydrocarbons, pH and organic carbon (Appendix C).

The samples were taken within the made ground and natural ground at each location.

Samples of both the made ground and natural ground were examined and tested on site with a PID, measuring VOC's to indicate possible hydrocarbon presence.

All strata were examined for discolouration and odours.

Water was not detected in any of the boreholes up to a depth of 1.7 m bgl.

All sampling protocol was to BS10175 Sections 8.3.1 and Section 8.2.3.3. Samples were taken with window sampling equipment and all equipment had been steam cleaned prior to use. All equipment was cleaned with deionised water between sampling locations. Glass storage jars had been newly purchased prior to the site investigation.

Current environmental data search

Environmental data (Appendix B) indicates the following:

The site is on a variably permeable Secondary A and Unproductive Superficial aquifer and a Secondary A Bedrock aquifer

The site is not in a Groundwater Source Protection Zone

No active landfill sites within 250 m

No historical landfill sites within 250 m

No pollution inventory sites within 250 m

No waste treatment sites within 250 m

One pollution incident within 250 m

Seven registered radioactive substances within 250 m

The site is in a radon affected area as 1-3% of properties are above the action level. However no radon protective measures are considered necessary.

No fuel sites within 250 m

The site is in an area which may be affected by coal mining. It is recommended that a coal authority report is obtained.

3. CONCEPTUAL SITE MODEL

The conceptual site model detailed here is by a written and diagrammatical (Drawing 1) description of the sources, pathways and receptors. A cross section is included if this will aid interpretation.

3.1 Sources

Sources			
Source location	Direction	Distance (m)	Potential Contaminants
On-site			
Hydrocarbons	On-site	0	Laboratory results indicated elevated concentrations of some hydrocarbons.
Off site			
Railway (pre 1848-current)	SW	112	Metals, hydrocarbons
Coal yard (pre 1849-1913)	NE	155	Metals, hydrocarbons
Boat repairing (1893-pre 1957)	S	14	Metals, hydrocarbons
Coal yards (1849-1913)	NE	11	Metals, hydrocarbons
Saw mill (1893-pre 1957)	E	32	Hydrocarbons
Maintenance yard (1957-current)	S	14	Hydrocarbons
Farm (1893-current)	NW	207	Hydrocarbons, pesticides, herbicides
Chemical/plastic works (1933-1986)	N	131	Metals, hydrocarbons, solvents, plasticisers
Allotment gardens (1933-current)	W	154	Hydrocarbons, pesticides, herbicides
Warehouse (1933-current)	N	175	Metals, hydrocarbons
Electricity substation (1957-current)	NE	95	PCB's, mineral oils
Nursery (1957-1971)	SE	212	Hydrocarbons, pesticides, herbicides
Clothing factory (1957-2006)	NW	167	Hydrocarbons, dyes
Electricity substation (1971-current)	E	170	PCB's, mineral oils
Tanks (1990-current)	E	126	Hydrocarbons
Tanks (1990-current)	S	48	Hydrocarbons
Car services (Appendix B)	NW	104	Metals, hydrocarbons, paints, solvents
Car repairs (Appendix B)	NW	138	Metals, hydrocarbons, paints, solvents
MOT services (Appendix B)	NW	151	Metals, hydrocarbons, paints, solvents
Radioactive substances (Appendix B)	E	233	Radioactive materials
Pollution incident (1992) Cat 2 incident	NE	246	Oils (Dodecylbenzene)

Soil sample results

Laboratory results (Appendix B) indicated elevated concentrations of some potential contaminants which exceeded LQM/CIEH GAC and EA guideline values for residential and commercial use.

Elevated concentrations of the following parameters were detected:

Contaminant	Guideline values (residential)	Guideline values (commercial)	BH1	BH2	BH3	BH4
	mg/kg	mg/kg				
Benzo(a)anthracene	3.1	90	15	36		
Benzo(a)pyrene	0.83	14	16	32		2.8
Benzo(b)fluoranthene	5.6	100	15	22		
Benzo(k)fluoranthene	8.5	140		13		
Chrysene	6	140	18	41		
Dibenzo(ah)anthracene	0.76	13	3.9	2.9		1.1
Indeno(123-cd)pyrene	3.2	60	16	15		
Napthalene	1.5	200		5.8		

Potential contaminant concentrations in BH3 were all within guideline values for a residential and commercial property.

All metal concentrations were within LQM/CIEH GAC and EA guideline values for residential and commercial use.

No asbestos was detected in any of the boreholes.

Testing on site in the natural ground revealed all PID VOC readings to be 0 ppm in the natural strata and below 2 ppm in the made ground.

Receptors

Humans

- Visitors in the proposed recreational/landscaped area
- Residents and workers in adjacent properties

Controlled waters

- The site is on a variably permeable Secondary A and Unproductive Superficial aquifer and Secondary A Bedrock aquifer

- The site is not in a source protection zone

Ecology

- Animals and plants are considered to be possible receptors.

3.2 Pathways and plausible pollutant linkages (See Table 1)

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

3.3 Controlled waters

Flow to groundwater may occur through the soils finding a possible route 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 the Lancaster Canal 2 m south of the site.

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

TABLE 1. Plausible pollutant linkage/pathway matrix Y = yes, N = no, N/A = not applicable											CSM	Ref	No.	1	Version	a		
SOURCE	Chemicals		RECEPTORS															
	Type	Possible present 1 yes, 0 no	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																		
	Hydrocarbons	1	N	Y	Y	N	Y	N	N	N	N	N	N	N	N	N	N	N
OFF SITE																		
Former railway	Metals	0	N	N	N	N	N	N	N	N								
	Hydrocarbons	0	N	N	N	N	N	N	N	N								
Former coal yards	Methane	0	N	N	N	N	N	N	N	N								
	Hydrocarbons	0	N	N	N	N	N	N	N	N								
Former boat repairers	Metals	0	N	N	N	N	N	N	N	N								
	Hydrocarbons	0	N	N	N	N	N	N	N	N								
Former saw mill	Hydrocarbons	0	N	N	N	N	N	N	N	N								
Maintenance yard	Hydrocarbons	0	N	N	N	N	N	N	N	N								
Farm	Hydrocarbons	0	N	N	N	N	N	N	N	N								
	Pesticides	0	N	N	N	N	N	N	N	N								
	Herbicides	0	N	N	N	N	N	N	N	N								
Chemical works	Metals	0	N	N	N	N	N	N	N	N								
	Hydrocarbons	0	N	N	N	N	N	N	N	N								
	Solvents	0	N	N	N	N	N	N	N	N								
	Plasticisers	0	N	N	N	N	N	N	N	N								
Allotments	Hydrocarbons	0	N	N	N	N	N	N	N	N								
	Pesticides	0	N	N	N	N	N	N	N	N								
	Herbicides	0	N	N	N	N	N	N	N	N								
Warehouse	Metals	0	N	N	N	N	N	N	N	N								
	Hydrocarbons	0	N	N	N	N	N	N	N	N								
Electricity substations	PCB's	0	N	N	N	N	N	N	N	N								
	Mineral oils	0	N	N	N	N	N	N	N	N								
Former nursery	Hydrocarbons	0	N	N	N	N	N	N	N	N								
	Pesticides	0	N	N	N	N	N	N	N	N								
	Herbicides	0	N	N	N	N	N	N	N	N								
Former clothing factory	Hydrocarbons	0	N	N	N	N	N	N	N	N								
	Dyes	0	N	N	N	N	N	N	N	N								
Former tanks	Hydrocarbons	0	N	N	N	N	N	N	N	N								
	Metals	0	N	N	N	N	N	N	N	N								
Car repairs/MOT services	Hydrocarbons	0	N	N	N	N	N	N	N	N								
	Paints	0	N	N	N	N	N	N	N	N								
	Solvents	0	N	N	N	N	N	N	N	N								
	Radioactive substances	Radioactive materials	0	N	N	N	N	N	N	N	N							
Pollution incident	Oils	0	N	N	N	N	N	N	N	N								
Notes	NA = not applicable																	
	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.																	

4. RISK ASSESSMENT

4.1 Human health

The site is considered to pose a possible risk to human health if developed for recreational use without remediation, due to PAH's within the made ground. The main pathways for risks to human health are via ingestion of soil, dermal contact and inhalation of hydrocarbon vapours.

Table 2. Risks from possible sources

Source location	Direction	Distance (m)	Potential Contaminants	Risk	Reason
On-site					
Hydrocarbons	On-site	0	Hydrocarbons	Yes	Laboratory results indicate elevated concentrations of hydrocarbons around BH1, BH2 and BH4
Off site					
Railway (pre 1848-current)	SW	112	Metals, hydrocarbons	No	Distance restricting pathways
Coal yard (pre 1849-1913)	NE	155	Metals, hydrocarbons	No	Distance restricting pathways
Boat repairing (1893-pre 1957)	S	14	Metals, hydrocarbons	No	Distance and canal restricting pathways
Coal yards (1849-1913)	NE	11	Metals, hydrocarbons	No	Natural attenuation of hydrocarbons, distance
Saw mill (1893-pre 1957)	E	32	Hydrocarbons	No	Natural attenuation, distance restricting pathways
Maintenance yard (current)	S	14	Hydrocarbons	No	Distance and canal restricting pathways
Farm (1893-current)	NW	207	Hydrocarbons, pesticides, herbicides	No	Distance restricting pathways
Chemical/plastic works (1933-1986)	N	131	Metals, hydrocarbons, solvents, plasticisers	No	Distance restricting pathways
Allotment gardens (1933-current)	W	154	Hydrocarbons, pesticides, herbicides	No	Distance restricting pathways
Warehouse (1933-current)	N	175	Metals, hydrocarbons	No	Distance restricting pathways
Electricity substation (1957-current)	NE	95	PCB's, mineral oils	No	Distance restricting pathways
Nursery (1957-1971)	SE	212	Hydrocarbons, pesticides, herbicides	No	Distance restricting pathways
Clothing factory (1957-2006)	NW	167	Hydrocarbons, dyes	No	Distance restricting pathways
Electricity substation (1971-current)	E	170	PCB's, mineral oils	No	Distance restricting pathways
Tanks (1990-current)	E	126	Hydrocarbons	No	Distance restricting pathways
Tanks (1990-current)	S	48	Hydrocarbons	No	Distance restricting pathways
Car services (Appendix B)	NW	104	Metals, hydrocarbons, paints, solvents	No	Distance restricting pathways
Car repairs (Appendix B)	NW	138	Metals, hydrocarbons, paints, solvents	No	Distance restricting pathways
MOT services (Appendix B)	NW	151	Metals, hydrocarbons, paints, solvents	No	Distance restricting pathways
Radioactive substances (AppB)	E	233	Radioactive materials	No	Distance restricting pathways
Pollution incident Cat 2 incident	NE	246	Oils (Dodecylbenzene)	No	Distance restricting pathways
Notes:					

4.2 Controlled waters

The site is considered to pose no risk to controlled waters as no evidence of contamination was evident within the natural ground. The clay soils would help restrict pathways of elevated concentrations of PAH's encountered at BH 4.

4.3 Ecology

The ecology is considered not to be at significant risk as no major pathway exists to significant ecological receptors

5. CONCLUSIONS AND OPTIONS APPRAISAL

Risks to human health are evident at the site and some remedial action is required.

It is recommended that:

Either:

1) Removal of 0.6 m bgl of ground within a 1 m radius in the areas around BH 1, BH 2 and BH4. Imported topsoil should be in accordance with BS3882 and placed over a no dig geotextile barrier in the proposed landscaped areas.

or

2) A no dig barrier is installed into the areas around BH1, BH2 and BH4 and covered with an imported topsoil within raised beds.

3) Development workers wear suitable PPE.

4) A photograph based validation report be submitted following completion of the remediation

DRAWING 1 & DRAWING 2

Current site location and borehole locations

NOTES:

 Site boundary

Soil Environment Services Ltd

Drawing number

1

Drawing title

Site location plan

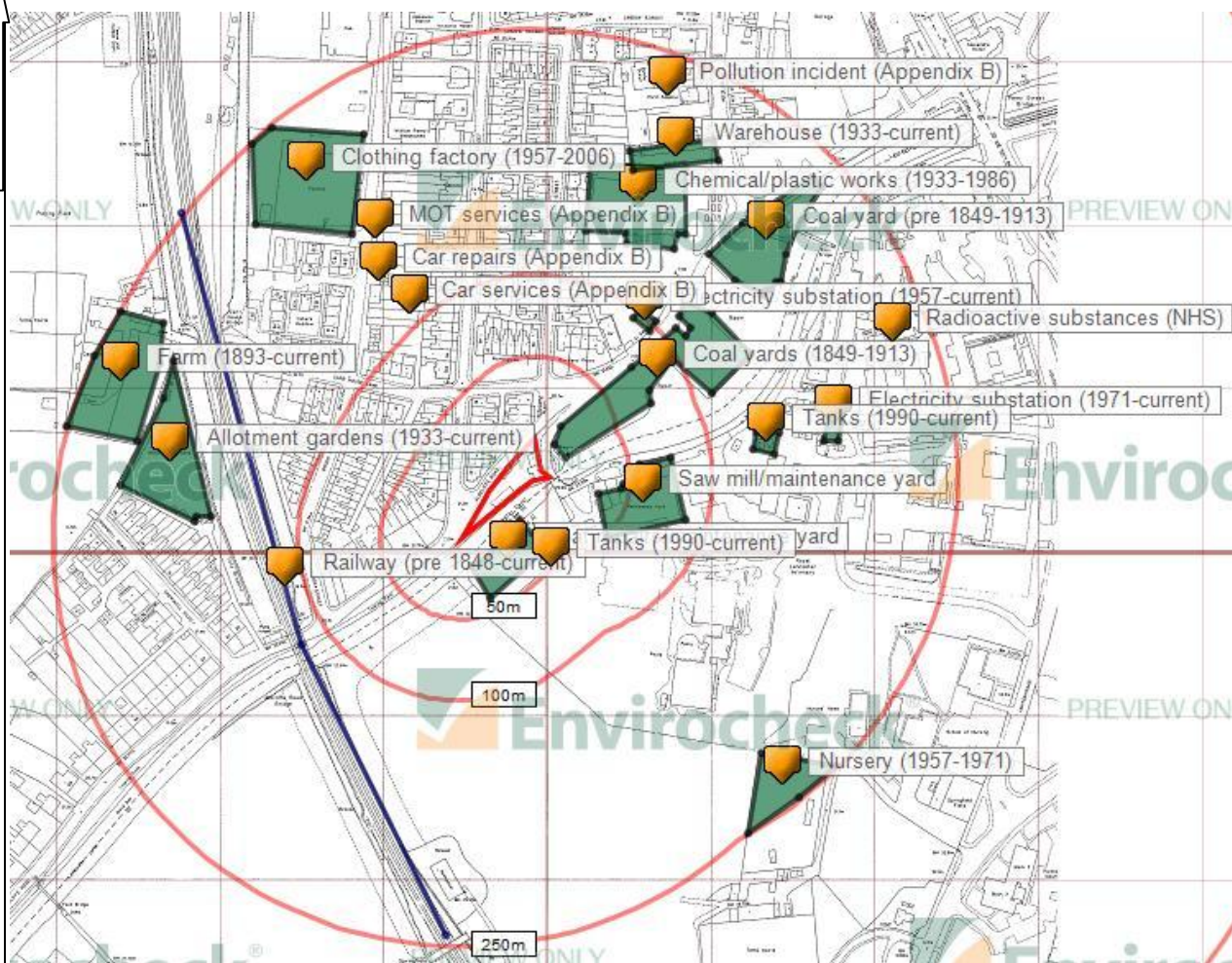
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1:2500


Date

08/04/2013

N



NOTES:

 Site boundary

Soil Environment Services Ltd

Drawing number

2

Drawing title

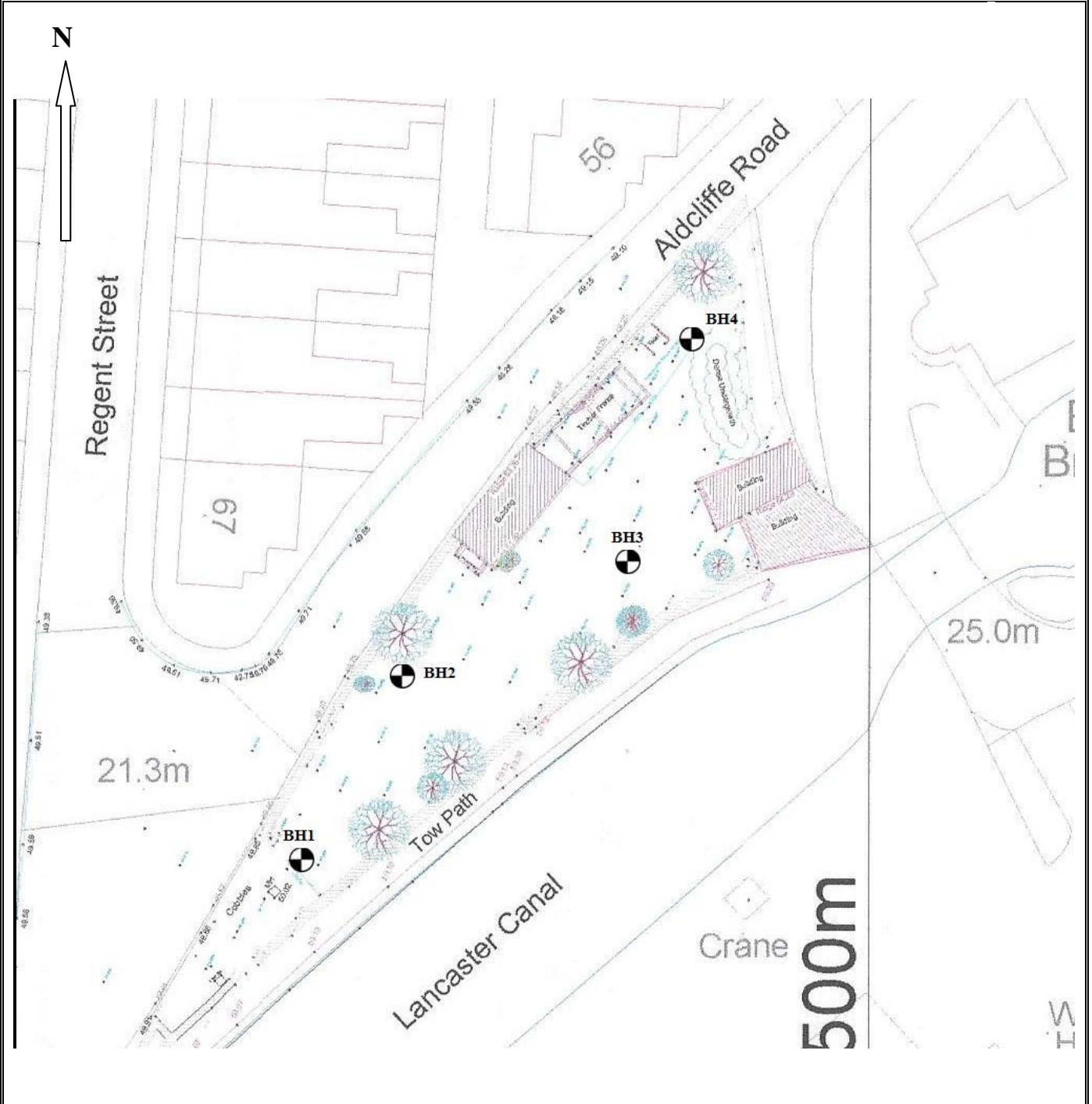
Borehole locations

Scale

1:2500

Date

08/04/2013



APPENDIX A

Historical maps

APPENDIX B

Environmental data

APPENDIX C

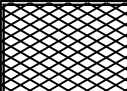



Laboratory results

APPENDIX D

Borehole logs

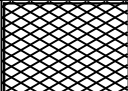



Borehole/ Testpit Log		Excavation type and method:	Date
BH/Pit Ref.	BH 1	WINDOW SAMPLING RIG	21/03/2013

Surface (m OD) NA

Depth (m BGL)	Symbol	Description	Notes	Installations
		MADE GROUND dark brown to black, very sandy GRAVEL		
		MADE GROUND brown sandy CLAY with gravel		
1.0		Orange brown silty SAND		
2.0		Natural pale brown SANDY GRAVEL		
3.0				
4.0				

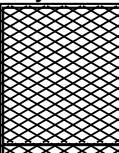
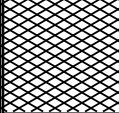
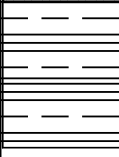
Borehole/ Testpit Log		Excavation type and method:	Date
BH/Pit Ref.	BH 2	WINDOW SAMPLING RIG	21/03/2013

Surface (m OD) NA

Depth (m BGL)	Symbol	Description	Notes	Installations
		MADE GROUND silty sand and gravel		
		MADE GROUND brown sandy gravel		
1.0		Orange brown silty SAND		
2.0		Natural pale brown SANDY GRAVEL		
3.0				
4.0				

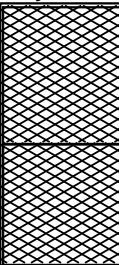
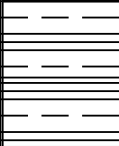
Borehole/ Testpit Log		Excavation type and method:	Date
BH/Pit Ref.	BH 3	WINDOW SAMPLING RIG	21/03/2013

Surface (m OD) NA

Depth (m BGL)	Symbol	Description	Notes	Installations
		MADE GROUND brown loose silty sand and gravel		
		MADE GROUND pale pinkish coarse sand and gravel		
1.0		Natural brown stiff CLAY		
2.0				
3.0				
4.0				

Borehole/ Testpit Log		Excavation type and method:	Date
BH/Pit Ref.	BH 4	WINDOW SAMPLING RIG	21/03/2013

Surface (m OD) NA

Depth (m BGL)	Symbol	Description	Notes	Installations
0.0 - 1.0		MADE GROUND brown loose silty sand and gravel		
		MADE GROUND pale pinkish coarse sand and gravel		
1.0 - 2.0		Natural brown stiff CLAY		
2.0 - 3.0				
3.0 - 4.0				
4.0 - 5.0				