

Abbey Road, Wrexham Industrial Estate
Proposed Distribution Centre
Geo-environmental Report
McCarthy Haulage Ltd



GroundSolve Ltd
Consulting Geotechnical, Engineering Geology and Environmental Engineers

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1.0 INTRODUCTION

McCarthy Haulage Ltd (MHL) propose to construct a new distribution warehouse on land off Abbey Road in Wrexham Industrial Estate.

The site is part of a land parcel purchased from Wrexham County Borough Council (WCBC) by Clwyd Compounders (CC), who are currently fitting out their new warehouse on site. MHL are purchasing part of the CC site for the construction of their new distribution warehouse.

Prior to the purchase of the site by CC, WCBC commissioned several reports in 2011, which then led onto remediation of the site in 2014. These reports have been made available to MHL, and are listed below:

- Stage 1 Preliminary Environmental Risk Assessment, Smith Grant, February 2011, Report R1570-R01-v2, Reference 1.
- Stage 2 Contamination Investigation, Smith Grant, December 2011, Report R1662-R01-v1, Reference 2,
- Contamination Remediation Strategy, Smith Grant, May 2014, Report R1989-R01-v1, Reference 3,
- Phase I Remediation Completion Report, Smith Grant, August 2014, Report R1989-R02-v2, Reference 4.

In addition, a geo-environmental site assessment was undertaken for the CC development by e3p, which has also been provided, Reference 5.

At this stage, planning has not been obtained for the site, however, it is standard practice for WCBC to place a contaminated land condition on any site on the Wrexham Industrial Estate due to the area being used as a munitions manufacturing facility during World War II.

Therefore, MHL have appointed GroundSolve Ltd to carry out an investigation to address the anticipated planning conditions, and also to provide geotechnical recommendations.

This report summarises the findings of the previous reports, and the remediation works undertaken. It presents conceptual ground models and environmental risk assessments, along with geotechnical recommendations for the development.

2.0 THE SITE

2.1 Site Location and Description

The site is located off Abbey Road in Wrexham Industrial Estate, at National Grid Reference SH 385 504, see Figure 1.

The site is bounded by Abbey Road to the west, Industrial units to the north, with a new industrial building for CC, which is currently being fitted out to the south. A new access road leading to this new warehouse defines the southern site boundary. The eastern site boundary is heavily vegetated, with a drainage ditch visible in the woodland, and a concrete culvert headwall in the northern corner of the site. The Kellogg's factory lies to the immediate east of the woodland, see Figure 2.

Remnants of the past uses of the site can be seen in the eastern and western sides of the site, in areas where ecological concerns are protected, i.e. badgers and butterflies. A newt fence defines the development area. Outside of these protected areas the ground levels have been raised by around 1 to 1.50m, mainly by fill placed during the development of the CC site.

The site is some 150m long in a north to south direction, and 150m wide in an east to west direction. A topographical survey provided by the client is presented in Figure 2. It shows the highest section has been raised to be around 29.20 to 29.40m AOD. The area surrounding the badger sett in the eastern side of the site is still at the previous ground level of around 28.40m AOD, confirming that ground levels have been raised by around 1m in this area. The remnants of previous road surfaces can be seen in this area. The badger sett is in a mound several metres high.

There is a low area on the western side of the site corresponding to a butterfly exclusion area, which is at an elevation of around 28.80m AOD.

Photographs of the site are presented in Appendix A.

2.2 Geology and Hydrogeology

The geology of the site has been studied on the following documents:

- 1:50,000 scale geology plan, Sheet 121,
- Wrexham Applied mapping project by the BGS, Reference 6,
- Geological memoirs, Reference 7.

These show the superficial deposits beneath the site to comprise glacial till (Clay), described as heterogeneous deposits, ranging from structureless silty and sandy pebbly clays, to clay bound gravels. However, laminated clay till lies beneath the glacial till and comprises glacio lacustrine deposits, comprising well laminated, silty clay, with bands of silt and fine sand.

However, Reference 6 records this area to have been extensively remodeled and landscaped and to be underlain by made ground. It also records the superficial deposits to be 65m thick.

The underlying bedrock is the Erbistock Formation, which is Carboniferous in age.

The site is classified as overlying a secondary A aquifer.

The superficial deposits typically comprise interbedded clays and sands, with the sand containing water that is often confined and under sub artesian pressures. Therefore, the depth to groundwater beneath the site is anticipated to be extremely variable.

2.3 Abandoned Mining

A Coal Authority report for the site is summarised below, and presented in full in Appendix B.

- The site is not in a zone of likely influence on the surface from past or present underground coal workings.
- There are no mine entries within, or within 20m of the site boundary.

2.4 History

The history of the site has been studied on old Ordnance Survey (OS) plans contained in Reference 1, dating from 1873, and aerial photographs held in GSL archives.

The 1873 OS plan shows the site to be within open fields crossed by several field boundaries. Two ponds are present close to the southern site boundary, see Figure 3a.

No changes are shown on the 1911 OS plan, although the ponds had been backfilled, see Figure 3b.

During World War II the site was part of the Wrexham Ordnance Factory (ROF), which started in 1939. The site was used for the manufacture of cordite, a composition of nitroglycerine and nitro-cellulose.

Operations ceased at ROF in 1945 and the area became utilized as an industrial estate. The site itself is understood to have formed part of British Celanese's Ltd (BCL), which later became Courtaulds, Reference 1.

BCL undertook the manufacture of textiles, notably viscose rayon using large volumes of wood pulp, sodium hydroxide and carbon disulphide.

An aerial photograph dated 1951 shows the entire area being levelled and landscaped. However, later in 1951 the southernmost buildings on the CC section of the site had been constructed.

By 1954, the OS plan at a scale of 1: 10,560 confirms that the site had been developed, with Abbey Road on the western site boundary, and a road called Elm Road on the approximate line of the southern site boundary. Several buildings had been constructed immediately north of Elm Road.

By 1961, further buildings had been constructed on site, with a Bench Mark on one of the buildings recording an elevation of 95.18'AOD (29mAOD). A mineral railway is present on the eastern site boundary. see Figure 3c.

According to Reference 1, the units on site were used for a variety of light engineering and industrial activities.

No changes are visible on site on the 1974 OS plan, although the mineral railway had been dismantled and the benchmark records an elevation of 28.99mAOD, see Figure 3d.

No changes are shown on the 1982 and 1989 plans, although by 1989 the Kellogg's factory had been constructed to the east of the site, see Figure 3e and 3f. No changes are shown on the 1992 OS plan, apart for the building in the south west corner being demolished, see Figure 3g.

According to Reference 1 the previous buildings on site were numbered 223, 226, 227 and 229, with the following uses listed.

- 223 was demolished, possibly in the late 2,000's, and possibly used for engineering/metal fabrication,
- 226 LM Engineering Services – Steel work fabrication,
- 226 Wrexham General Engineering, with an asbestos roof,
- 227 Wrexham General engineering.

An oblique photograph obtained from Google earth is presented below, taken in 2016 it shows the Clwyd Compounders building had been constructed and there was a large mound of spoil stockpiled on site.

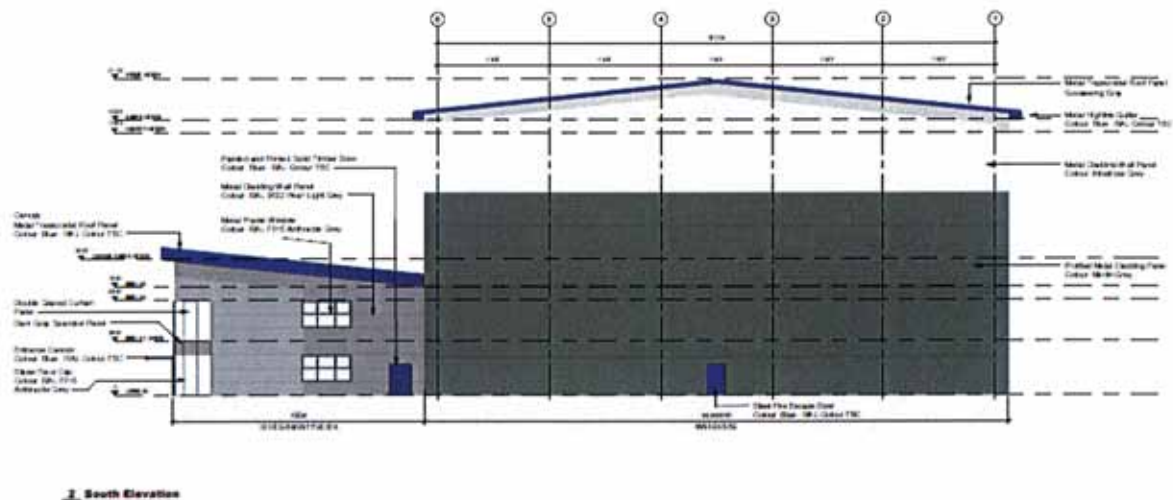


August 2016

3.0 PROPOSED DEVELOPMENT

MHL propose to construct a new distribution warehouse on land off Abbey Road in Wrexham Industrial estate.

It will be a steel framed structure, with conventional cladding, and associated access roads and hardstandings. The proposed development layout is presented in Figure 4, and a cross section through the development below.



The building will be up to 77.292 long, and 38.80m wide, with an attached office block and canopy. It is likely that the office block will be constructed in conventional load bearing masonry, and will be around 16m wide and 18m long

At present development levels have not been set, and loads are not known. However, levels are anticipated to be at grade with the adjacent access road, and based on experience of similar structures, foundation loads are anticipated to be low to moderate, being between 250 and 750kN, with column spacings of 7.60m. In addition, the building is 21m high and will have high racking systems, consequently, floor slab loadings could be high.

There will be 30 car parking spaces and a delivery yard.

The recommendations given in this report are based on these assumptions, and will need to be reviewed and if necessary revised during the detailed design.

4.0 THE INVESTIGATIONS

4.1 Previous Investigation – Smith Grant 2011

Smith Grant undertook a Phase 2 investigation for WCBC in 2011. The investigation on this site was undertaken at a time when the site was still being used by Wrexham General engineering.

It comprised;

- Nineteen machine excavated trial pits to a maximum depth of 2.30m, TP 1 to TP 6 and TP 8 were excavated on this site,
- Seven window sample boreholes to a maximum depth of 4.0m, WS 1 to 3 were drilled on this site.
- All arisings screened with a PID for volatiles,
- Six boreholes were fitted with combined gas/groundwater monitoring standpipes,
- Twenty-three samples were taken for chemical testing,
- Five groundwater samples were taken for chemical analysis,
- One sample taken from the oil tank on site,
- Three rounds of gas monitoring.

As part of this investigation it was observed that an underground storage tank (UST) was noted adjacent to the entrance to unit 226, the location of which is presented on Figure 6.

The following chemical testing was undertaken:

pH, metals, speciated PAH's, SOM, phenols, cyanides, asbestos, EPH, CWG BTEX, VOC's, SVOC's, BRE 2:1 water soluble Sulphate, PCB's, leachate (metals).

In addition, five water samples were subjected to the following testing:

pH, metals, speciated PAH, phenol, total cyanide, PCB's, VOC's, SVOC's.

An additional sample was taken of the oily water from the UST.

Gas monitoring for the following gases was also undertaken.

Methane, Carbon Dioxide, Oxygen, Carbon Monoxide, Hydrogen Sulphide, borehole pressure and gas flow. VOC's were also monitored on one visit.

The location of the boreholes and trial pits on site is shown on Figure 2, with the logs presented in Appendix C.

4.2 Remediation Strategy – Smith Grant 2014

This work was carried out in August 2014 by Smith Grant for WCBC, and the following work was recommended in the remediation strategy.

- Clearance and off-site disposal of all site surface/stored materials, including the black ash to the rear of Unit 226,
- Type 3 asbestos survey of all existing structures prior to demolition,
- Asbestos stripping of existing structures,
- Breaking out of all concrete slabs, foundations, brick structures, voids and drains with inspection of materials and excavation,
- Removal of UST contents and tanks and backfilling void,
- Determine extent of contamination around tanks,
- Retention and stockpiling of suitable engineering materials.

Recommended further measures for future developers of the site included.

- Placement of 300mm of clean soil in areas of landscaping,
- Provision of Sulphate resistant concrete within the development,
- Assessment of requirements for provision of gas protection measures into built development,
- Placement of all services in trenches excavated and backfilled with clean materials, utilisation of appropriate water pipe materials,
- Remediation of ash deposits to be deferred to a second phase of work.

4.3 Remediation Work – Smith Grant 2014

The following work was actually undertaken.

- The buildings were crushed, the spoil being used to backfill the hot spot remediation excavations,
- The UST were emptied by Enviroclear, with solid waste being removed off site by their sub-contractor ASH,
- A total of four tanks were remediated, all tanks contained a combination of weathered fuel or lubricating oil and polluted water,
- All tanks were estimated to have a 5,000-gallon capacity, the tanks were surrounded by reworked clay, or general rubble/hardcore fill,
- The tanks were cleaned and scrapped,
- Hydrocarbon contaminated spoil was removed from site,
- Two manhole chambers were revealed during the works, which were of brick construction and contaminated with oil/water, which was pumped out by Enviroclear,
- There was only limited oil contamination observed following removal of the tanks, with the clay surround containing minor contamination,

- The void was unfilled with crushed aggregate.

A second hot spot was remediated, which was limited to staining of surface gravel. The gravel was then removed to approximately 200mm bgl over an area of 15m².

Validation testing was undertaken at all locations to the previously agreed limits in the remediation strategy. The location of the UST is presented in Figure 6.

4.4 Geo-environmental Site Assessment – e3p 2015

This investigation was undertaken for the entire site by e3P in 2015 for Russell Construction (RC) who were the main contractors for CC.

At the time of the investigation stockpiles of spoil derived from crushing the buildings were recorded on site.

It comprised;

- Two shell and auger boreholes to depths up to 35m,
- Twelve window sample boreholes, to a maximum depth of 5.45m, seven having monitoring installations, WS 101, 107, and WS 109, to 112 were drilled on this site,
- Twelve machine excavated trial pits to a maximum depth of 3.70m, TP 109 to 112 were excavated on this section of the site,
- In situ geotechnical testing,
- Laboratory testing,
- Ground gas monitoring,
- Contamination risk assessment.

The following chemical testing was undertaken on soil and groundwater samples.

- Metals, cyanides, pH, total Sulphate, water soluble Sulphate (2;1 extract) sulphide,
- Asbestos,
- Phenols,
- Speciated PAH,
- Speciated petroleum hydrocarbons,
- TPH,
- Total Organic Carbon,
- Volatile organic compounds, and semi volatile organic compounds.

Physical testing of soils included;

- Atterberg limit,
- Moisture content.

The location of the boreholes and trial pits is presented on Figure 2, with the logs presented in Appendix D.

The investigation proved made ground to a maximum depth of 1.50m, although it was generally between 0.20 and 0.80m thick, and comprised a surface covering of crushed brick and concrete, which was underlain by a clayey gravel of concrete slate and brick.

Beneath the made ground, glacial deposits were encountered comprising firm, low strength, becoming very stiff, very high strength with depth, grey brown silty clay.

A layer of very soft, highly organic silt was encountered at around 2m depth, predominantly beneath the southern area of the site., which was observed to be between 0.30 and 1.0m thick.

Deep boreholes to 35m depth confirmed a sequence of stiff clay, with interbedded sand horizons.

5.0 THIS INVESTIGATION

5.1 Fieldwork

This investigation was undertaken on the 30th October 2017 and comprised.

- Nine machine excavated trial pits to a maximum depth of 3.60m,
- Four window sample boreholes to a maximum depth of 5.45m, with SPT's carried out at 1m intervals,
- Four dynamic probes to depths of 10m,
- CBR testing using a TRL probe.

The boreholes/dynamic probes and trial pits were supervised and logged by a chartered engineering geologist from GSL in general accordance with BS 5930, Reference 8. The borehole and trial pit logs are presented in Appendix D, and the locations shown on figure 2.

The investigation was limited to areas within the newt fencing, with the exception of the TRL probing. In addition, there was a 30m exclusion zone set around the Badger Sett, where no boreholes could be drilled, and trial pits were not allowed within 20m.

5.2 Laboratory Work

Samples were taken from the boreholes and trial pits and taken immediately to the laboratories of ALS and Geotechnics in Chester for the following testing.

Chemical Testing (ALS)

Samples for chemical testing were taken from the made ground encountered in the trial pits, placed in the appropriate containers and a cool box, and taken immediately to the laboratories of ALS in Chester for the following testing:

Metals & Non-metals - Arsenic (As), Boron (B), Cadmium (Cd), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), Phenol, Selenium (Se), and Zinc (Zn).

Petroleum Hydrocarbons - Benzene, Toluene, Ethylbenzene, o-xylene, m-xylene, p-xylene, Aliphatics >C5 – C44, Aromatics >EC5 – EC44.

Polyaromatic Hydrocarbons (PAH) – Acenaphthene, Acenaphthylene, Anthracene, Benz(a)anthracene, Benzo(b)fluoranthene, Benzo (g, h, i) perylene, Benzo (k) fluoranthene, Chrysene, Dibenzo (a, h) anthracene, Fluorene, Indeno (1,2,3-cd) pyrene, Naphthalene, Phenanthrene, Pyrene.

Other Contaminants – Sulphide (easily liberated), Water soluble Sulphate (2:1 extract), Cyanide, pH, Soil Organic Matter (SOM).

In addition, asbestos screening was carried out on all samples.

The results are summarised in Section 7.0, and the results presented in full in Appendix F.

Physical Testing (Geotechnics)

The following physical testing was undertaken;

- Atterberg limit,
- Moisture Content,
- pH & Sulphate (2;1 water extract).

The testing was carried out in accordance with BS 1377, Reference 9.

The test results are discussed in Section 6.0, and presented in full in Appendix G.

6.0 GROUND CONDITIONS

6.1 General Stratigraphy

The following general ground conditions were identified by the three investigations.

BH/TP No	Topsoil (m)	Made ground (m)	Glacial Till (m)	Peat (m)	Soft Clay/Sand (m)	Sand & Gravel (m)
TP 1		0.0-0.75	0.75-1.50			
TP 2	0.0-0.30	0.30-0.60	0.6-1.20		1.20	
TP 3		0.0-1.10	1.10-1.30			
TP 4		0.0-0.10	0.10-1.80			
TP 5		0.0-0.30	0.30-1.0			
TP 6		0.0-0.30	0.30-2.30		2.30	
TP 8		0.0-0.50	0.50-2.0			
WS 1		0.0-0.80	0.80-4.0			
WS 2		0.0-0.58	0.58-3.0			
WS 3		0.0-0.80	0.80-3.0			
TP 109		0.0-1.50	1.50-2.80			
TP 110		0.0-0.45	0.45-2.50	2.50-2.80	2.80-3.30	
TP 111		0.0-0.80	0.80-1.30 2.30-3.0			1.30-2.30
TP 112		0.0-0.50	0.50-3.0			
WS107		0.0-1.45				
WS108		0.0-1.0	1.0-2.80 5.0-5.45	2.80-3.40		3.40-5.0
WS109		0.0-1.80			3.60-4.0	1.80-3.60 4.0-5.45
WS110		0.0-0.40	0.40-2.45			
WS111		0.0-0.40	0.40-3.30 4.10-5.45		3.30-4.1	
WS112		0.0-0.60	0.60-3.45			
TP 1		0.0->0.90				
TP 2		0.0-2.30	2.30-2.80			
TP 3		0.0-1.50	1.50-2.20	3.0-3.50	2.20-3.0	
TP 4		0.0-1.50	1.50-1.80			
TP 5		0.0-1.60	1.60-3.0		3.0-3.60	
TP 6		0.0-0.15	0.15-1.70 2.80-3.20		1.70-2.80	
TP 7		0.0-0.85				
TP 8		0.0-1.30	1.30-2.60			
TP 9		0.0-1.70	1.70-2.50			
BH 1	1.15-1.60	0.0-1.15	1.60-3.0		3.0-5.45	
BH 2		0.0-1.90	1.90-3.40	3.4-4.50	4.50-5.45	
BH 3	1.0-1.35	0.0-1.0	1.35-5.45			
BH 4		0.0-1.80				1.80-5.45

TP 1 This Investigation

TP 1 Smith Grant Investigation

TP 1 e3p Investigation

6.2 Topsoil

Where encountered in previous investigations, it was described as a sandy loam, with several brick fragments.

However, it should be noted that there is no topsoil within the proposed development area.

6.3 Made Ground

The made ground can be divided into two types, as follows:

Type 1 - made ground placed during the earthworks following the post war landscaping.

This predominately comprised the old hardcore surfacing, with the following general descriptions:

- Fine sandy silt, with limestone gravel, i.e. hardcore,
- Black, clayey, sandy gravel, with frequent brick and gravel,
- Medium sand,
- Dark brown, clayey sand, with fine gravel, hardcore.

Type 2 - made ground placed recently following the adjacent construction works.

The following general descriptions were recorded in the investigation.

- Soft to firm, dark brown, gravelly silty clay, with varying proportions of demolition debris,
- Soft to firm, red brown clay, with traces of bricks,
- Medium dense, light grey, sub angular, fine to coarse gravel, hardcore,
- Loose brick and cobble.

The made ground is considered to be largely derived from excavations within the glacial till.

The hardcore was encountered on the lower areas, (previous development surface), and buried beneath the recently placed made ground.

SPT "N" values in the recently placed made ground recorded values between 6 and 12, confirming a soft to firm consistency, see Figure 5.

pH values in the recently placed made ground recorded values between 7.97 and 8.64, with sulphate values, when measured as 2:1 water extract between 0.0374 and 0.211g/l.

6.4 Glacial Till

The clay was typically soft to firm near surface, quickly becoming a stiff to very, red mottled grey, clay, with grey fissures noted in the clay.

SPT “N” values in the glacial till ranged between 8 and greater than 50, see Figure 5. However, there was a clear distinction between the values found in boreholes where only glacial till was encountered, and these areas where it was encountered above soft clay and peat. The reason for this is explained in Section 6.8.

In those boreholes with soft clay and peat, the “N” values were between 8 and 20, although they were generally between 8 and 14, confirming a soft to firm consistency.

In those boreholes with just glacial till, the values ranged between 10 and greater than 50, although they were generally between 10 and 20, confirming a firm to stiff consistency, see Figure 5.

The dynamic probes proved the glacial till to become very stiff to hard with depth.

In TP 6 a layer of loose to medium dense, brown, silty fine sand, was encountered within the glacial till. Whilst in WS 4, and TP 6 of the Smith Grant investigation, a similar layer of sand was encountered beneath the made ground, with no glacial till encountered in the borehole.

SPT “N” Values in the sand ranged between 8 and 23, proving a loose to medium dense consistency.

Reference 8 recorded the glacial till to have liquid limits between 53 and 64%, plastic limits between 24 and 26%, with plasticity indices between 29 and 38%, indicating clays of intermediate plasticity. Natural moisture contents were between 15 and 24%, and were generally just below the plastic limit.

In this investigation, liquid limits between 48 and 65% were recorded, with plastic limits between 24 and 28%, and plasticity indices between 24% to 37% indicating clay of intermediate to high plasticity. The natural moisture content was 26.4 to 28.7%

pH values between 7.06 and 7.84 were recorded for the glacial till, with sulphate values when measures as 2:1 water extract of 0.049 to 0.051 g/l.

6.5 Soft Clay and Peat

On the eastern section of the site soft organic clay and peat was encountered beneath the stiff glacial till.

The soft clay was blue grey in colour and very moist, and the peat was described as a dark brown fibrous clay. In TP 5 a thin layer of grey sand was encountered at the top of the soft blue grey clay

SPT “N” values in the soft clay and peat ranged between 4 and 11, confirming a very soft to firm consistency, see Figure 5.

The dynamic probes in these areas proved the material to be soft to depths of around 5 to 6m, increasing to firm, and then approaching stiff consistency at depths of around 7 to 10m.

The peat was tested and recorded an organic content of 22.37%, and a moisture content of 175%.

The soft clay had a liquid limit of 45%, plastic limit of 21% with a plasticity index of 24%, indicating a clay of intermediate plasticity. The natural moisture content was 31.1%.

6.6 Groundwater

In this investigation groundwater was not recorded in any of the boreholes and only minor seepages were recorded in the trial pits, generally associated with granular horizons within the made ground, or on top of the low permeability glacial till.

The groundwater depths recorded during the Smith Grant investigation are presented below.

BH No	Water	Depth (m)	Strata
	Min	Max	
WS 1b	1.53	1.65	Glacial till
WS2	0.60	1.20	Glacial till
WS3	2.10	2.18	Glacial till

However, it should be noted that the ground levels have been raised by around 1 to 1.50m since these readings were undertaken.

6.7 Services

Whilst on site GSL were informed by the site agent for CC that the main electricity supply for the adjacent Kellogg's site passed through the south east corner of the site.

This was not recorded on the services plans supplied, however, a CAT scan during the site investigation confirmed the presence of an electricity cable in this location. It would appear from reexamination of the service plans that this service may have been miss plotted.

6.8 Ground Model

The ground conditions encountered on site are considered to be unusual in that soft clay and peat was encountered beneath the glacial till on the eastern section of the site. Whilst soft clay and peat was not encountered on the western half of the site, see Figure 6.

This sequence of ground conditions has never been witnessed by GSL on Wrexham Industrial Estate before, and the geological history of this material needs consideration.

The ground conditions on Wrexham Industrial Estate normally comprise the following strata.

Glacial Till, deposited beneath advancing ice sheets, which in this area are known to have been in excess of 400m high. These materials are typically firm to stiff near surface, becoming stiff to very stiff with depth.

Glacial Sands and Gravels, deposited as the ice retreated, with the glacial meltwaters depositing the sand and gravel. It is common for these deposits to form layers within the glacial till, during retreat of the ice sheet.

Laminated clays, deposited in glacial dammed lakes, these deposits are typically weaker than the glacial till deposits, with annual deposition in the lakes forming the laminated deposits. These are anticipated to be at depth beneath the site from the geological memoirs.

Kettle Holes, which are large depressions formed in the surface of the clay by large blocks of ice left behind as the ice retreats. These form large depressions in the ground surface, which are generally infilled with soft clay and peat, and there are numerous examples recorded nearby in the industrial estate.

However, these deposits are generally at surface and easy to detect. Therefore, the only explanation for the soft clay and peat on the eastern section of the site, is that a kettle hole formed during an interglacial period, which was subsequently, buried when the ice sheet re advanced, therefore covering the clay and peat with a thin mantle of stiff glacial till.

Figure 5 shows the SPT “N” values in the glacial till, which have been separated into those where only glacial till was encountered, and those where soft clay and peat was encountered in the same borehole as glacial till.

Those where only glacial till is encountered were generally higher than those where soft clay and peat was encountered. This is considered to be due to the glacial till not being compressed, as much due to compression of the underlying softer deposits.

7.0 RESULTS OF CHEMICAL TESTING

The soil samples were taken from the made ground, which was recently placed by RC during construction of the CC development. The sample depths are presented in the table below.

TP No	Depth (m)
1	0.0-0.9
4	0.0-0.30
7	0.0-0.50
9	0.0-0.50

The results of the soil analyses are presented below, where they have been compared to suitable generic assessment criteria (GACs), in order to allow a generic quantitative risk assessment (GQRA) to be carried out for the site and the proposed development.

The Category 4 Screening Levels (C4SLs) published by DEFRA (2014) have been adopted in the first instance, which have been published for six substances to date. Where a C4SL is unavailable, the “Suitable 4 Use Levels” (S4ULs) published by LQM/CIEH (2015) have been adopted.

These criteria have been derived using the CLEA model for a range of standard end-use scenarios and a range of soil organic matter (SOM) contents. It should be noted that the C4SL values are derived on the basis of a “low level of toxicological concern”, while the S4UL values are based on a “tolerable” or “minimal” level of risk. As such, the S4ULs describe a lower level of risk than the C4SLs, and are equivalent to the former Soil Guideline Values (SGVs, published by the Environment Agency) and the previous editions of the LQM/CIEH GAC values.

A “commercial/Industrial” end-use has been adopted for this analysis, based on the most-conservative SOM content of 1%.

Note: the S4UL values presented below are Copyright Land Quality Management Limited, reproduced with permission; Publication Number S4UL3668. All rights reserved.

Metals & Non-Metals	Min (mg/kg)	Max (mg/kg)	Average (mg/kg)	Count	Adopted Guideline (mg/kg)	Source	Exceedances
Arsenic	4.91	9.77	7.4	4	640	C4SL	0
Boron	5.3	10.1	7.6	4	240000	S4UL	0
Cadmium	0.143	1.17	0.7	4	410	C4SL	0
Chromium, Trivalent	9.79	15.7	11.5	4	8600	S4UL	0
Chromium, Hexavalent	<0.6	<0.6	0.6	4	49	C4SL	0
Copper	10.9	53.1	32.0	4	68000	S4UL	0
Lead	82.6	594	245.9	4	2300	C4SL	0
Mercury	0.342	0.891	0.7	4	58	S4UL	0
Nickel	11	28.2	19.7	4	980	S4UL	0
Phenol	<0.01	<0.01	0.01	4	440	S4UL	0
Selenium	<1	<1	1.0	4	12000	S4UL	0
Zinc	199	565	332.5	4	730000	S4UL	0

Petroleum Hydrocarbons	Min (mg/kg)	Max (mg/kg)	Average (mg/kg)	Count	Adopted Guideline (mg/kg)	Source	Exceedances
Benzene	<0.01	<0.01	0.01	4	98	C4SL	0
Toluene	<0.002	<0.002	0.002	4	56000	S4UL	0
Ethylbenzene	<0.003	<0.003	0.003	4	5700	S4UL	0
o-xylene	<0.003	<0.003	0.003	4	6600	S4UL	0
Aliphatics >C5-C6	<0.01	<0.01	0.01	4	3200	S4UL	0
Aliphatics >C6-C8	<0.01	<0.01	0.01	4	7800	S4UL	0
Aliphatics >C8-C10	<0.01	<0.01	0.01	4	2000	S4UL	0
Aliphatics >C10-C12	<0.01	<0.01	0.01	4	9700	S4UL	0
Aliphatics >C12-C16	0.168	3.16	1.4	4	59000	S4UL	0
Aliphatics >C16-C35	9.29	96.5	50.7	4	1600000	S4UL	0
Aliphatics >C35-C44	2.45	36.2	17.8	4	1600000	S4UL	0
Aromatics >EC5-EC7	<0.01	<0.01	0.01	4	26000	S4UL	0
Aromatics >EC7-EC8	<0.01	<0.01	0.01	4	56000	S4UL	0
Aromatics >EC8-EC10	<0.01	<0.01	0.01	4	3500	S4UL	0
Aromatics >EC10-EC12	<0.01	<0.01	0.01	4	16000	S4UL	0
Aromatics >EC12-EC16	0.956	2.9	1.7	4	36000	S4UL	0
Aromatics >EC16-EC21	4.47	19.3	13.0	4	28000	S4UL	0
Aromatics >EC21-EC35	21.5	167	98.8	4	28000	S4UL	0
Aromatics >EC35-EC44	8.78	78.2	48.5	4	28000	S4UL	0

Polyaromatic Hydrocarbons (PAH)	Min (mg/kg)	Max (mg/kg)	Average (mg/kg)	Count	Adopted Guideline (mg/kg)	Source	Exceedances
Acenaphthene	<0.008	0.0741	0.03	4	84000	S4UL	0
Acenaphthylene	<0.012	0.0591	0.03	4	83000	S4UL	0
Anthracene	0.0344	0.233	0.1	4	520000	S4UL	0
Benz(a)anthracene	0.175	1.22	0.8	4	170	S4UL	0
Benzo(a)pyrene	0.274	2.63	1.4	4	77	C4SL	0
Benzo(b)fluoranthene	0.333	2.94	1.6	4	44	S4UL	0
Benzo(g,h,i)perylene	0.238	2.18	1.1	4	3900	S4UL	0
Benzo(k)fluoranthene	0.124	1	0.6	4	1200	S4UL	0
Chrysene	0.166	1.11	0.7	4	350	S4UL	0
Dibenzo(a,h)anthracene	0.0551	0.476	0.2	4	3.5	S4UL	0
Fluoranthene	0.196	1.44	0.9	4	23000	S4UL	0
Fluorene	<0.01	0.0678	0.03	4	63000	S4UL	0
Indeno(1,2,3-cd)pyrene	0.171	1.74	0.9	4	500	S4UL	0
Naphthalene	0.0439	0.251	0.1	4	190	S4UL	0
Phenanthrene	0.218	0.471	0.3	4	22000	S4UL	0
Pyrene	0.19	1.48	0.9	4	54000	S4UL	0

None of the above values exceed the relevant guidelines for commercial/industrial land use.

Asbestos screening revealed the presence of Amosite in the sample from TP 7, consequently a quantification test was instructed, unfortunately there was insufficient sample for the test.

8.0 CONCEPTUAL GROUND MODEL AND RISK ASSESSMENT

8.1 General

According to the Contaminated Land Regulations, to determine whether there is a significant possibility of significant harm, the following should be taken into account:

“The nature and degree of harm, the susceptibility of the receptors and the timescale within which the harm might occur”.

Current good practice therefore requires that the findings from the desk study or site investigation be evaluated for contamination on a site-specific basis using a risk based approach. Risk assessment involves identification of the hazards and evaluation of the risks associated with these hazards. Risk assessment requires an evaluation of a conceptual “source – pathway – receptor” linkage model and can be qualitative or quantitative.

The basis of an environmental risk assessment involves identifying a ‘source’ of contamination, a ‘pathway’ along which the contamination may migrate and a ‘receptor’ at risk from the contamination.

Current legislation defines the various elements of the pollution linkage as:

- A contaminant ‘source’ is a substance, which is in or under the ground and which has the potential to cause harm or to cause pollution of controlled waters.
- A ‘pathway’ is one or more routes through which a receptor is being exposed to, or affected by, a contaminant, or could be so affected.
- A ‘receptor’ is either a living organism, an ecological system, a piece of land or property, or controlled water.

A pollutant linkage indicates that all three elements have been identified. The site can only be defined as ‘Contaminated Land’ if a pollutant linkage exists and the contamination meets the criteria above.

8.2 Hazard Identification

On Site

The site is to be developed for commercial use, which is the least sensitive end use.

The previous reports identified that the site was originally farmland, and then used during World War II for the manufacture of explosives, and subsequently by engineering works. It revealed several hotspots of contamination, and these were remediated in 2014, with the following work being undertaken.

- The buildings were crushed, with the spoil being used to backfill the hot spot remediation excavations, see Figure 6,

- The UST were emptied by Enviroclear, with solid waste being removed off site by their sub-contractor ASH,
- A total of four tanks were remediated, all tanks contained a combination of weathered fuel, or lubricating oil and polluted water,
- All tanks were estimated to have a 5,000-gallon capacity, the tanks were surrounded by reworked clay, or general rubble/hardcore fill,
- The tanks were cleaned and scrapped,
- Hydrocarbon contaminated spoil was removed from site,
- Two manhole chambers were revealed during the works, which were of brick construction and contaminated with oil/water, which was pumped out by Enviroclear,
- There was only limited oil contamination observed following removal of the tanks, with the clay surround containing minor contamination,
- The void was unfilled with crushed aggregate,
- A second hot spot was remediated, which was limited to staining of surface gravel. The gravel was then removed to approximately 200mm bgl over an area of 15m².

Validation testing was undertaken at all locations to the previously agreed limits in the remediation strategy, Reference 3.

In addition, since the remediation the black flue dust has been taken off site.

The subsequent e3P report, Reference 5, concluded that there were no contaminant exceedances, and the site is chemically suitable for an intended commercial development.

However, since the remediation works were undertaken, the site levels have been raised by around 1.0 to 1.50m in places, as a result of RC spreading their construction arisings across the proposed development area, with the exception of the ecologically sensitive areas.

Trial pits through this material revealed it to be generally derived from clay and demolition debris. No visual or olfactory evidence of contamination was encountered in the recent boreholes and trial pits, and the chemical testing failed to reveal any contamination that presents any risks to site end users.

Off Site

No off-site sources have been identified, although as mentioned above material from the site to the south has been tipped on the site.

The desk study failed to reveal any sources of landfill gas close to the site.

8.3 Pathways

In relation to any on site contamination reaching potential site users for a commercial/industrial end use, the following pathways are generally considered:

- Ingestion and skin contact with soils on site,

- Inhalation from wind-blown dust,
- Leaching of contaminated materials that may affect controlled waters,
- Direct contact with contaminated material during construction.

8.4 Receptors

The potential impact of a hazard must be assessed regarding the following target groups:

- Future site users,
- Construction workers,
- Surface and groundwater, both on and off the site,
- Nearby vegetation,
- Building materials and buried services.

8.5 Summary of Conceptual Ground Model

Potential Contamination Sources	Potential Contaminants of Concern	Potential Pathways	Receptor Group
Made ground Hydrocarbons Flue Dust ROF facility British Celanese	Heavy metals & non-metals PAH Hydrocarbons Explosive residues	Dermal contact Inhalation of contaminated dust and vapour's	Construction Workers End Users
	Carbon disulphide Solvents Degreasers Acids/alkalis Asbestos	Lateral Migration and Infiltration	End Users Groundwater

8.6 Future Site Users Risk Assessment

Reference 5 concluded that, “the chemical analysis and risk assessment, along with the developed conceptual model does not identify any potential contaminant sources for human health, controlled water or the wider environ and therefore no potential pathways or

receptors". It was therefore concluded that the proposed development site is suitable for its intended end use as a commercial development.

This is especially so, following the remediation of the identified hot spots on site.

The development of the site is such that, it will be largely covered with buildings and hardstandings, consequently, any potential pathways for contaminants to reach receptors will have largely been eliminated. As such, the risks to future site users is considered to be very low.

In addition, no evidence of contamination was encountered in the made ground recently deposited on site.

While a trace of asbestos was identified at one location, asbestos only presents a hazard to site users if it is allowed to become airborne. Since the made ground is to be covered it will not present a risk.

However, in accordance with current good practice a watching brief should be undertaken on all excavations, any contamination encountered should be excavated, stored safely on site, tested and disposed of at a suitable licensed landfill facility.

8.7 Controlled Waters Risk Assessment

When considering the risk to controlled waters both surface waters and aquifers must be considered.

Reference 2 identified:

- Groundwater on site is associated with a perched water table in the near surface fill above the glacial clay, and in thin sand layers within the glacial till. Flow rates will be low given the low permeability of the clay.
- Any oil contamination associated with the past UST on site have been remediated.
- The VOC 1, 1 -DCE was detected in the groundwater in WS 1b., which is used as a solvent degreaser and is also a degradation product of the solvent trichloroethane. It was considered to be a source contaminate. However, this contaminate has not been identified as a Priority Pollutant under the Water Framework Directive and no assessment criteria are available.
- Slightly elevated Cr III was detected in shallow groundwater in WS 2, although concentrations are substantially below the 95th percentile EQS. It was considered to be derived from leaching of chromium present in the shallow fill material.

It concluded, that the shallow groundwater is not abstracted locally and the groundwater is considered primarily as a contamination migration route rather than as a receptor in its own right.

The risk of contaminant migration through existing watercourses was considered to be low, although construction works may mobilise hydrocarbons into the shallow groundwater or drainage system.

Reference 5 concluded that a Tier 1 risk assessment indicates that there are no contaminant exceedances within the groundwater samples analysed. It therefore concluded that there is no unacceptable risk to identified controlled water receptors, and no further work with respect to controlled waters was required.

Therefore, the risk to controlled waters is considered to be very low and will reduce as more buildings and hardstandings are constructed on site, which will eliminate any potential leaching through the made ground.

8.8 Construction Workers Risk Assessment

The risks to construction workers is considered to be very low and can be catered for by appropriate PPE and washing facilities in accordance with current good practice.

8.9 Ground Gases Risk Assessment

Reference 2 did not identify any nearby historic or recent landfilling activity.

Reference 5 identified the following potential sources of ground gases;

- Made ground,
- UST's in northern section of the site,
- Substantial ash deposits across the site.

However, the monitoring failed to reveal any elevated concentrations of methane and carbon dioxide.

In accordance with CIRIA C665 the calculated gas screening values (GSV's) resulted in a Characteristic Situation 1. Consequently, no gas protection measures are required.

Examination of Reference 10 confirms that Radon protection measures are not required for the development.

8.10 Building Materials Risk Assessment

The desk study has not revealed any contamination that could adversely affect building materials or services.

Reference 5 concluded that polyethylene pipes would be suitable for the proposed development. However, it will be necessary to complete an assessment form for the Water Authority and the chemical results provided.

8.11 Vegetation Risk Assessment

There is no existing topsoil on site, therefore any material for landscaping will need to be imported. This material should be tested/validated prior to import to site to ensure contaminated material is not imported.

9.0 GEOTECHNICAL RECOMMENDATIONS

9.1 Excavations and Site Preparation

At present the development levels have not been set. However, there is currently a level difference of up to 1.50m, with areas to the east and west sides of the proposed building being at a lower elevation, see Figure 6.

Consequently, some cut/fill will be required to achieve a level development platform. It is recommended that a cut/fill balance be calculated, as taking material off site, which although suitable to remain, may be classified as hazardous if taken off site. If this is the case, then samples will need to be taken for Waste Acceptance Criteria (WAC) analysis. The suitability of the made ground for use as a structural fill will also need to be evaluated.

Excavations will be in made ground and glacial till and will be possible using conventional earthmoving equipment. However, there were numerous previous buildings on site, which may provide obstructions in the form of old foundations, as witnessed in several of the trial pits. The approximate position of the previous building is shown on Figure 6, which records geotechnical constraints to the development.

Groundwater seepages are not anticipated, if encountered they are anticipated to be slight and easily catered for by pumping from sumps cut within the excavation.

9.2 Foundations and Floor Slabs

As mentioned in Section 6.8, the ground conditions were not as anticipated beneath the site, with soft clay and peat encountered beneath the glacial till in the eastern section of the site.

It is understood that the CC building is founded on pad foundations, however, it is also understood that during construction the floor slab was observed to be cracking and subsequent investigations proved the slab to be underlain at around 1.0m depth by a thin peat layer. It is also understood from discussion with the CC site manager that the entire site has been prepared using a reinforced granular blanket, with imported granular material reinforced with geotextiles. Despite this cracking was still observed in the external concrete hardstandings.

Therefore, if conventional spread foundations are considered, the pads would be sitting above the soft clay and peat in the eastern section of the building, and the possibility of large total and differential settlements need to be considered. Therefore, it is recommended that the building foundations either be piled, or a solution such as Vibrated Concrete Columns (VCC's) used.

As the soft clay and peat has recently been surcharged by up to 1.5m of made ground this would have already induced settlement of the ground, which with peat underlying the site could take many years to complete. In addition, slab loadings are anticipated to be quite high

due to the high racking loads. Consequently, to prevent differential settlement of the slab it is recommended that the floor slab is suspended.

This would involve either piles or VCC as described above. The problem with the building is that on the western side of the building the piles could be quite short, whilst on the eastern side they could be much longer.

It will therefore be necessary to undertake several boreholes to enable the most appropriate foundation solution to be determined. This should only be undertaken when the badger sett has been moved, as this covers a large section of the proposed building. The main reason being that there is a limit on the depth that can be obtained with VCC's. This is typically around 12m depth.

VCC's are formed by vibrating a large poker into the ground and then installing concrete through the annulus as the poker is withdrawn. The concrete can then be reinforced and loads of around 400 to 600kN are feasible. Beneath floor slabs it is envisaged that a grid of around 2m would be required. VCC's have the advantage in that they are quick to install and no spoil is generated that would require disposal off site.

When considering piling types, all types of pile would be suitable at this site, i.e.

- Bored,
- Driven pre-cast,
- Driven cast in situ.

The most cost-effective solution ahead of the additional site investigation is considered to be the driven pre-cast, or cast in situ piles, as no spoil is generated that would require disposal off site. In addition, no groundwater is generated at surface that would require disposal.

Whichever option is pursued it will be necessary to provide a granular piling platform, which typically comprises a 300 to 600mm thick granular platform, which can then be left in situ to form part of the hardstanding construction. Finally, it should be anticipated that piling or VCC's may encounter obstructions in the ground as proved by the site investigation, which will need to be addressed, as follows:

Option 1 would be to remove the obstructions in advance of a piling contract, although the depth of the additional made ground placed, could lead to significantly sized, and deep excavations.

Option 2 would be to locally excavate and remove the obstructions as and when they are encountered. Inspection of Figure 6 suggests that this would be the most cost-effective solution, with an allowance placed in the contract.

9.3 Drainage

The site is not considered suitable for the use of soakaways, and storm drainage will probably have to be attenuated prior to discharge into the local drainage system

9.4 Reuse of Materials

It is anticipated some cut and fill will be required to provide a level building platform and also to reduce ground levels ahead of construction.

Filling on the western side of the building can be undertaken using the existing made ground on site, as the building slabs will be suspended. However, they will still have to be compacted to support the piling platform discussed above. The more suitable this material is for compaction, the less piling platform that will be required.

The lower area on the western side of the site is beneath the hardstandings, which will be trafficked by large lorries. Consequently, the made ground will have to be compacted in accordance with an approved earthworks specification.

9.5 Access Road and Hard Standings

California Bearing Ratio (CBR Tests) have been carried out at the site and are presented below.

DCP No	Depth (m)	CBR Range %	Material
1	0.0-0.656	8-15	Recent fill
2	0.0-0.872	4-9	Recent fill
3	0.0-0.636	4-29	Recent fill
4	0.0-0.677	4-13	Recent fill
5	0.0-0.609	6-8	Recent fill
6	0.0-0.66	7-25	Recent fill
7	0.0-0.774	6-14	Recent fill
8	0.0-0.557	4-14	Recent fill
9	0.0-0.892	5-20	Recent fill
10	0.0-0.902	8-29	Recent fill
11	0.0-0.464	4-26	Recent fill
12	0.0-0.547	6-14	Recent fill
13	0.0-0.648	8-13	Lower Area
14	0.0-0.394	10-48	Lower Area
15	0.0-0.904	5-21	Lower Area
16	0.0-0.875	8-41	Lower Area
17	0.0-0.873	5-43	Lower Area
18	0.0-0.881	4-40	Lower Area

The location of the CBR tests are shown on Figure 2, with the tests presented in full in Appendix H. Whilst most tests were undertaken on top of the recently placed fill, some were carried out on the lower areas.

From the above table a wide variability in results is evident, largely due to the amount of coarse material in the made ground. However, for initial design purposes a lower bound CBR value of 4% can be assumed for the design, which based on the material description is considered reasonable. It should be noted that if this material is used as fill to form level building platforms, it is extremely sensitive to deterioration in wet weather and on trafficking, which should be avoided.

In the lower area, a provisional CBR value of 5% can be assumed for design purposes.

If hardstandings are proposed to the east of the building, which is underlain by peat and soft clay, it is recommended that a reinforced granular blanket be constructed to reduce differential settlements.

9.6 Protection of Buried Concrete

Chemical testing failed to record any risks to buried concrete. Therefore, in accordance with Reference 11, and assuming mobile groundwater, the buried concrete can be classified as:

- DS-1,
- AC-1.

However, it is known that peat can be highly acidic, with very low pH values. Therefore, when the additional boreholes are undertaken tests should be carried out on the organic material, and also on shallow groundwater in contact with the peat.

It should be noted that Reference 2 contained the following classification for groundwater

- DS-2,
- AC-2.

9.7 Landfill and Radon Gas

The results from the gas monitoring from the previous investigation are presented below:

BH No	CH ₄ % max	CH ₄ GSV (l/hr)	CO ₂ % Max	CO ₂ GSV (l/hr)	O ₂ % Min	VOC (ppm)
WS 1b	<0.1	<0.07	9.2	<0.07	5.6	<0.1
WS 2	<0.1	<0.07	0.4	<0.07	12.7	<0.1
WS 3	<0.1	<0.07	1.4	<0.07	18.2	<0.1

Based on the maximum flow and gas concentration measured at each location, the results place the site into Characteristic Situation CS 1 for methane, and CS 2 for Carbon dioxide, Reference 2. However, no special precautions were recommended.

No radon protection measures have been identified by the previous reports, and Reference 10 indicates that no radon protection measures are required.

10.0 ADDITIONAL SITE INVESTIGATION

The site investigations have identified unusual ground conditions at the site and it is recommended that additional boreholes be drilled at the site to enable pile/VCC design to be undertaken.

However, to enable this work to be carried out it will be necessary to get access to the area around the badger sett, which influences the eastern side of the proposed development.

At this stage, five boreholes to provisional depths of 25m are recommended, with SPT testing carried out at 1m intervals.

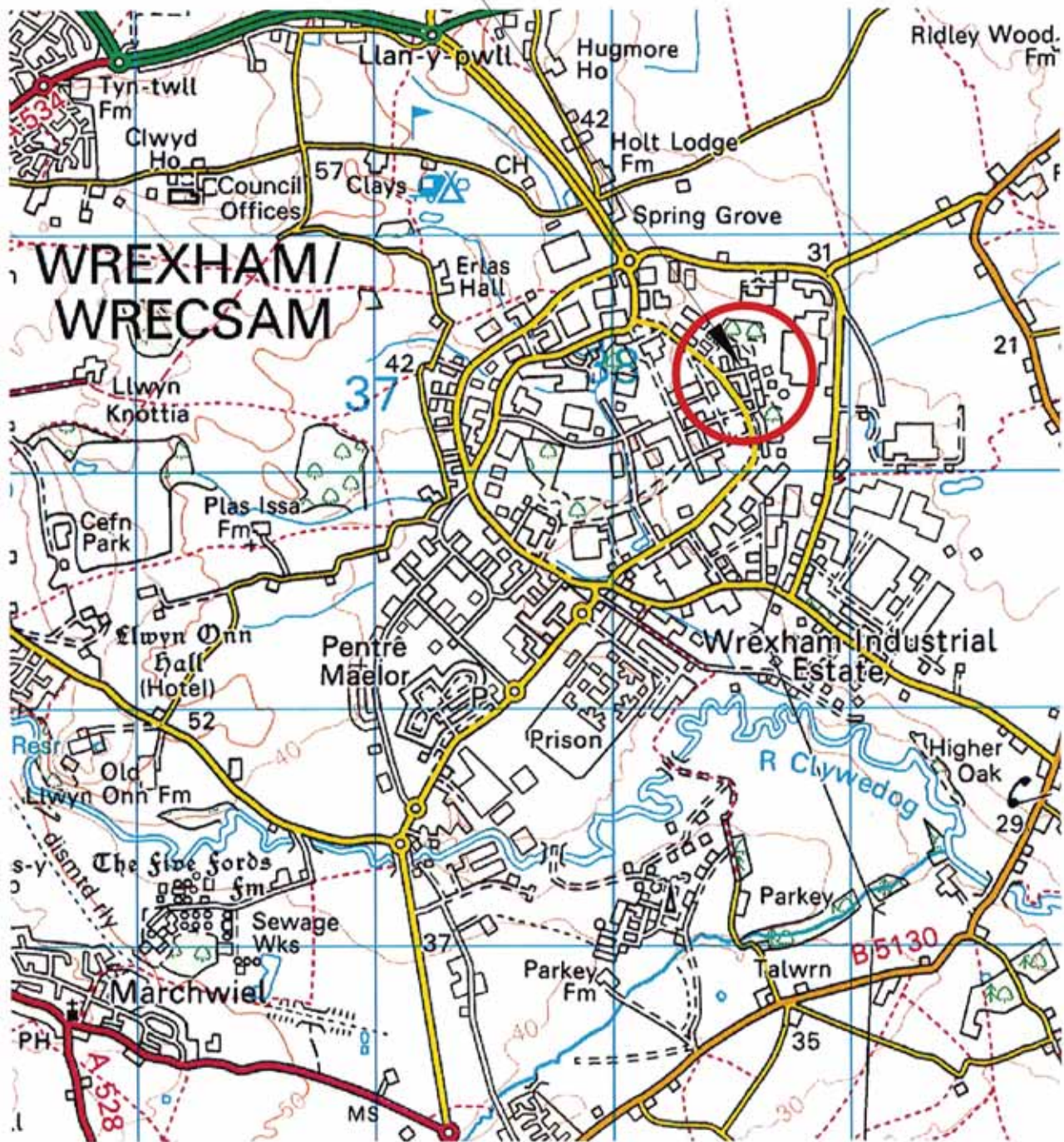
Samples should be taken of the peat and groundwater for pH and Sulphate testing.

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2. Stage 2 Contamination Investigation, Smith Grant, December 2011, Report R 1662-R01-v1, Reference 2,
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FIGURES

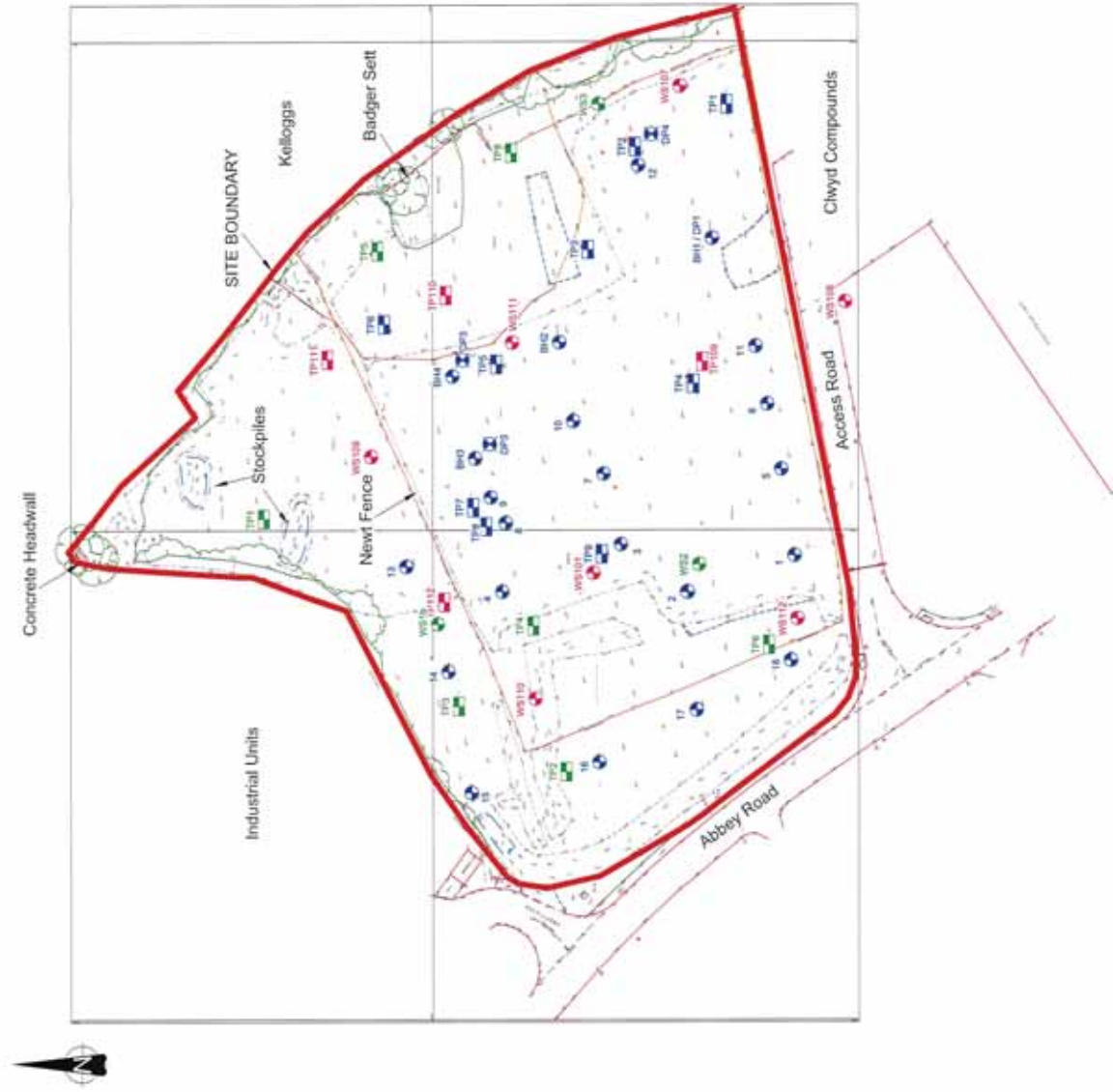
Site Location



SCALE 1:25,000 @ A4

Figure Title
SITE LOCATION

FIGURE 1

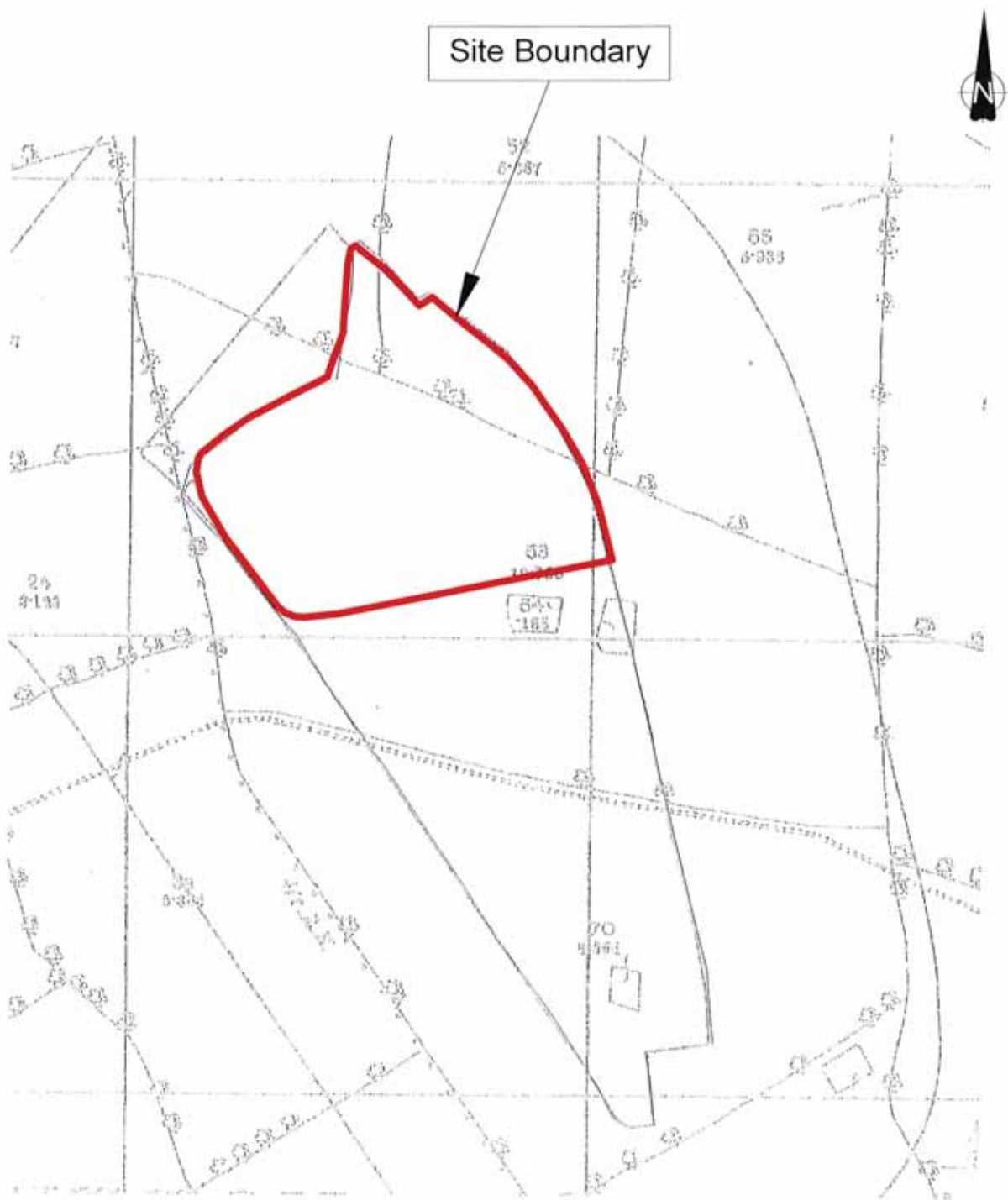


Legend

- Trial Pit Location (This investigation)
- Borehole Location (This investigation)
- TRRL Probe Location (This investigation)
- Dynamic Probe Location (This investigation)
- e3p Trial Pit Location
- e3p Borehole Location
- Smith Grant Trial Pit Location
- Smith Grant Borehole Location

SCALE 1:1000 @ A3

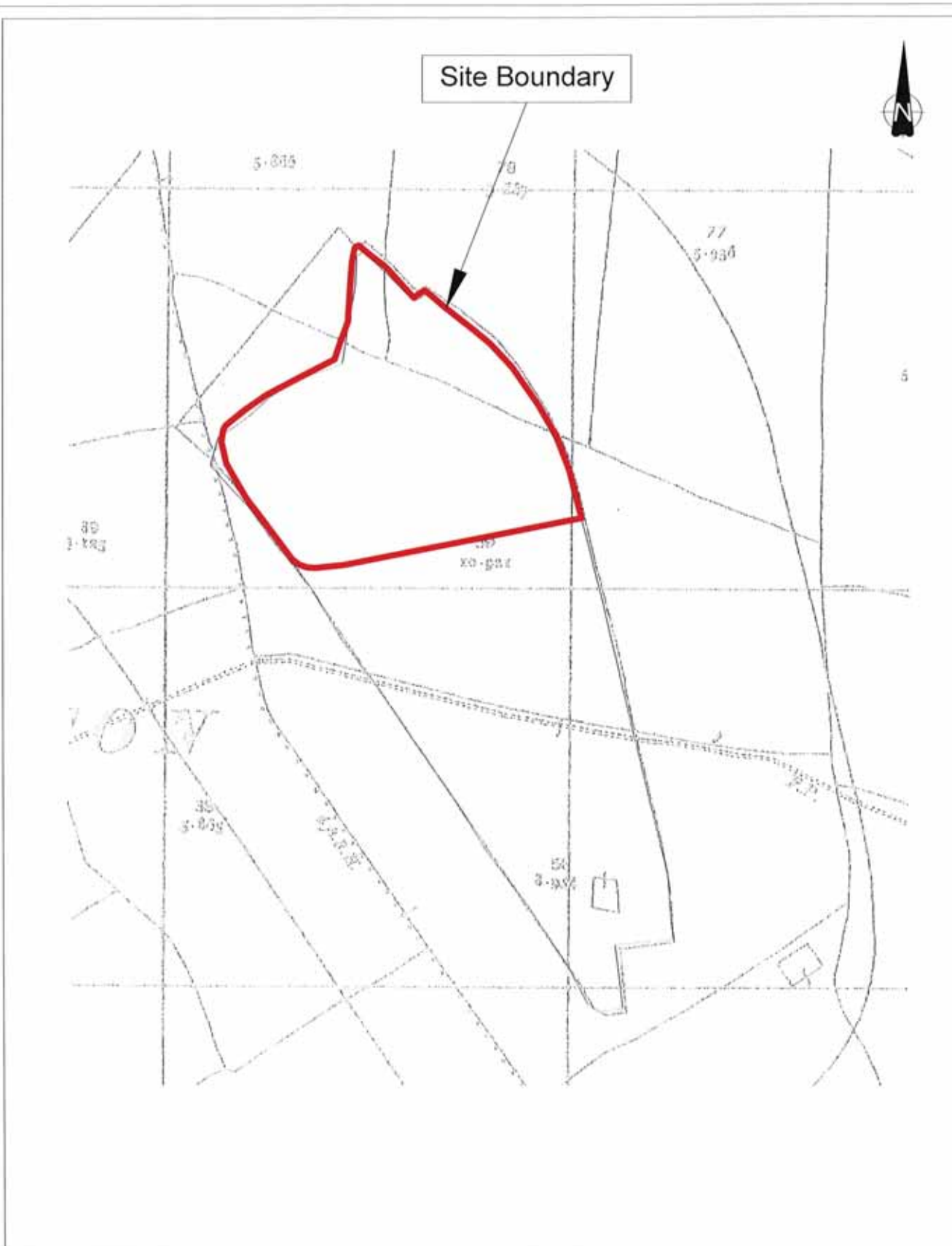
Figure 2-10
SITE LAYOUT & LOCATION OF
TRIAL PITS & BOREHOLES



SCALE 1:2,500 @ A4

Figure Title
SITE HISTORY - 1873

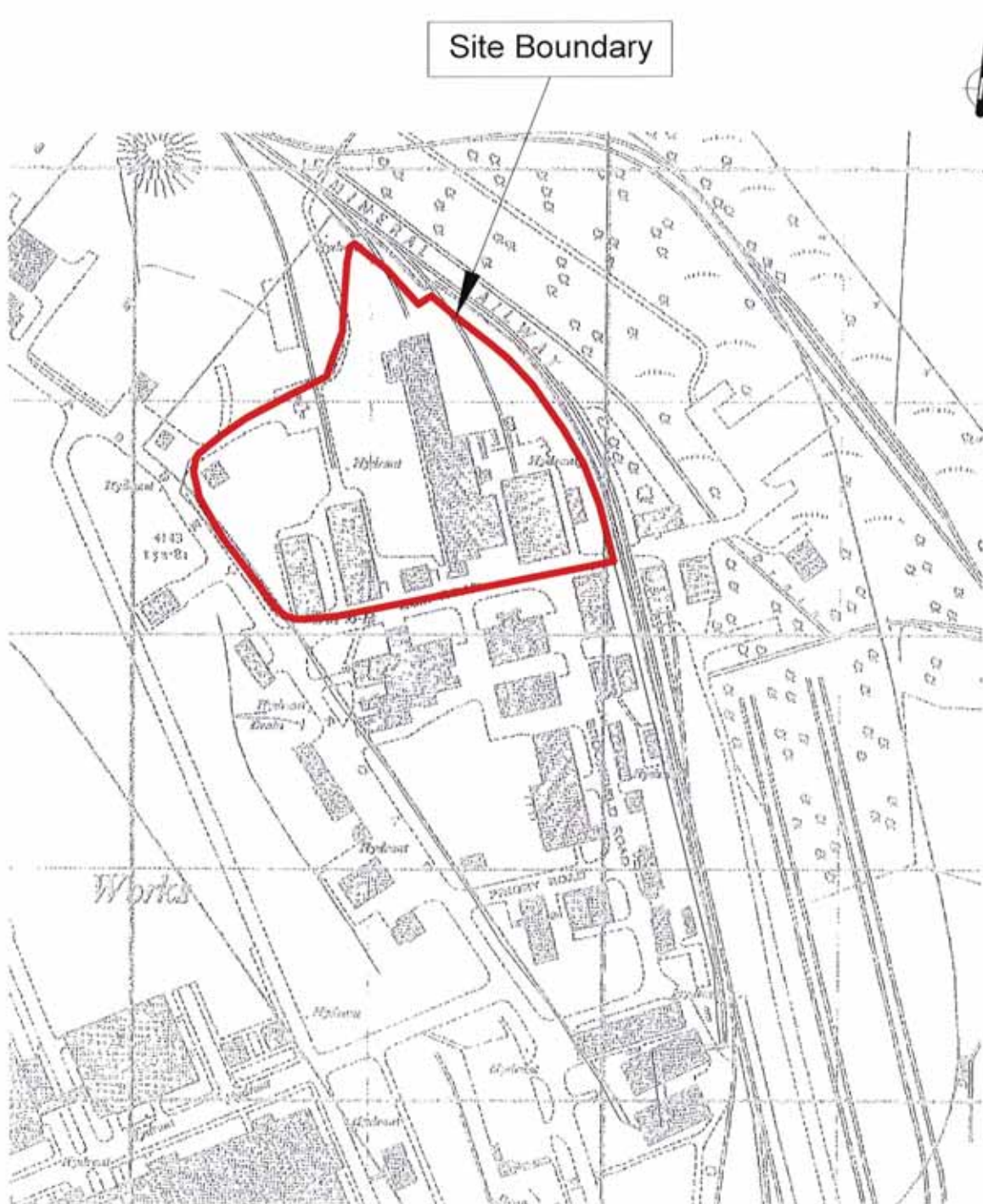
FIGURE 3a



SCALE 1:2,500 @ A4

Figure Title
SITE HISTORY - 1911

FIGURE 3b

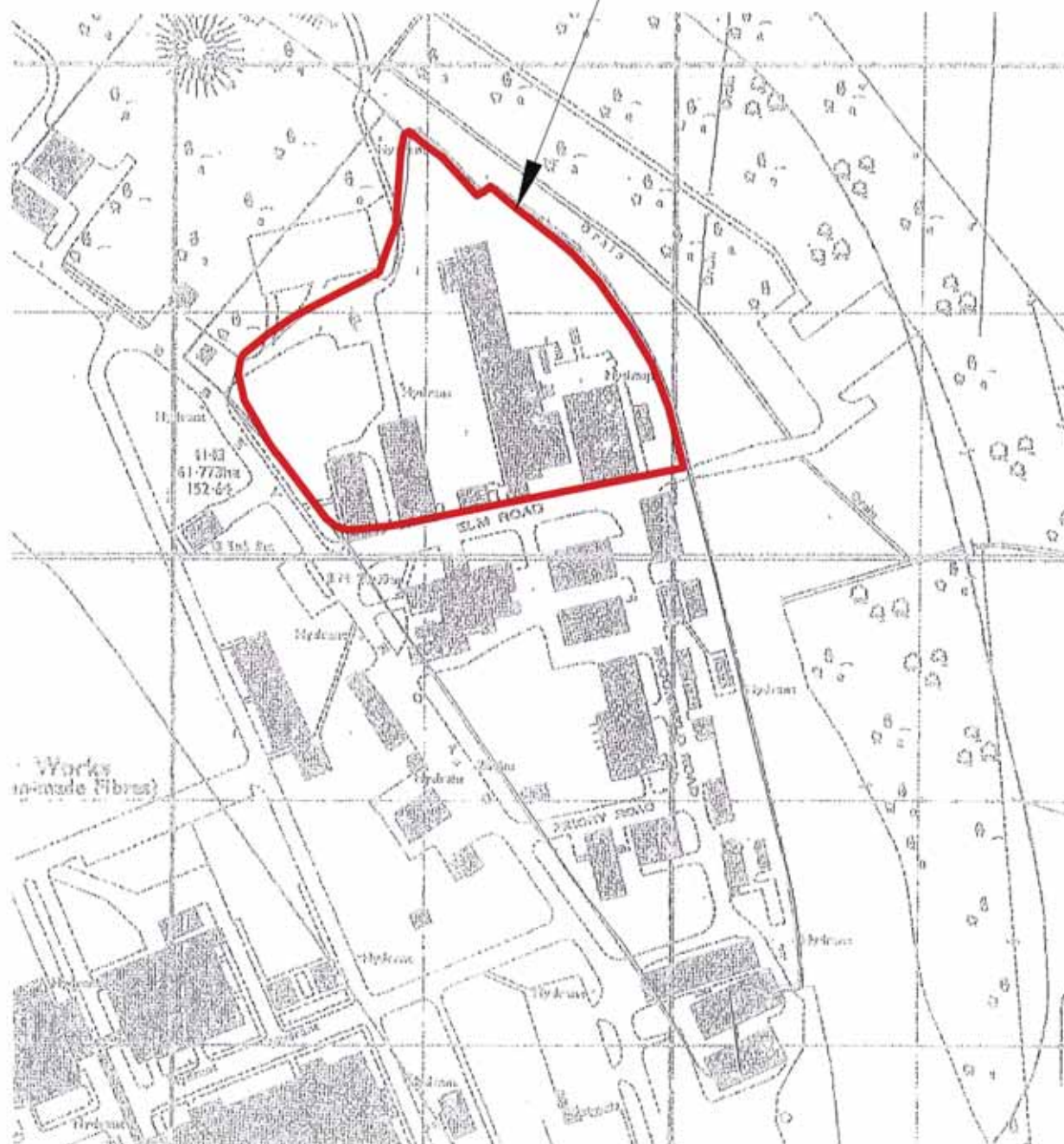


SCALE 1:2,500 @ A4

Figure Title
SITE HISTORY - 1961

FIGURE 3C

Site Boundary

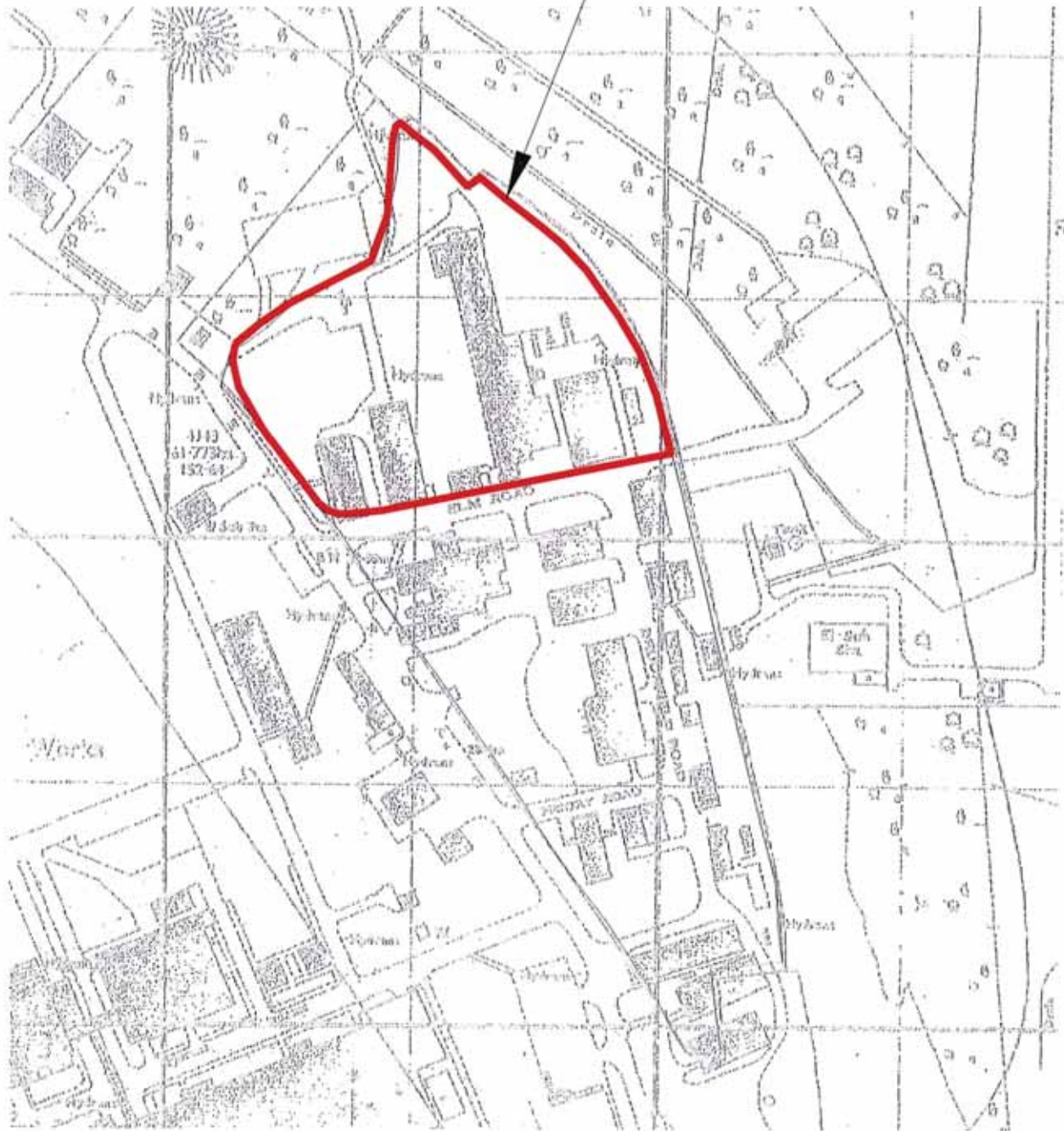


SCALE 1:2,500 @ A4

Figure Title
SITE HISTORY - 1974

FIGURE 3d

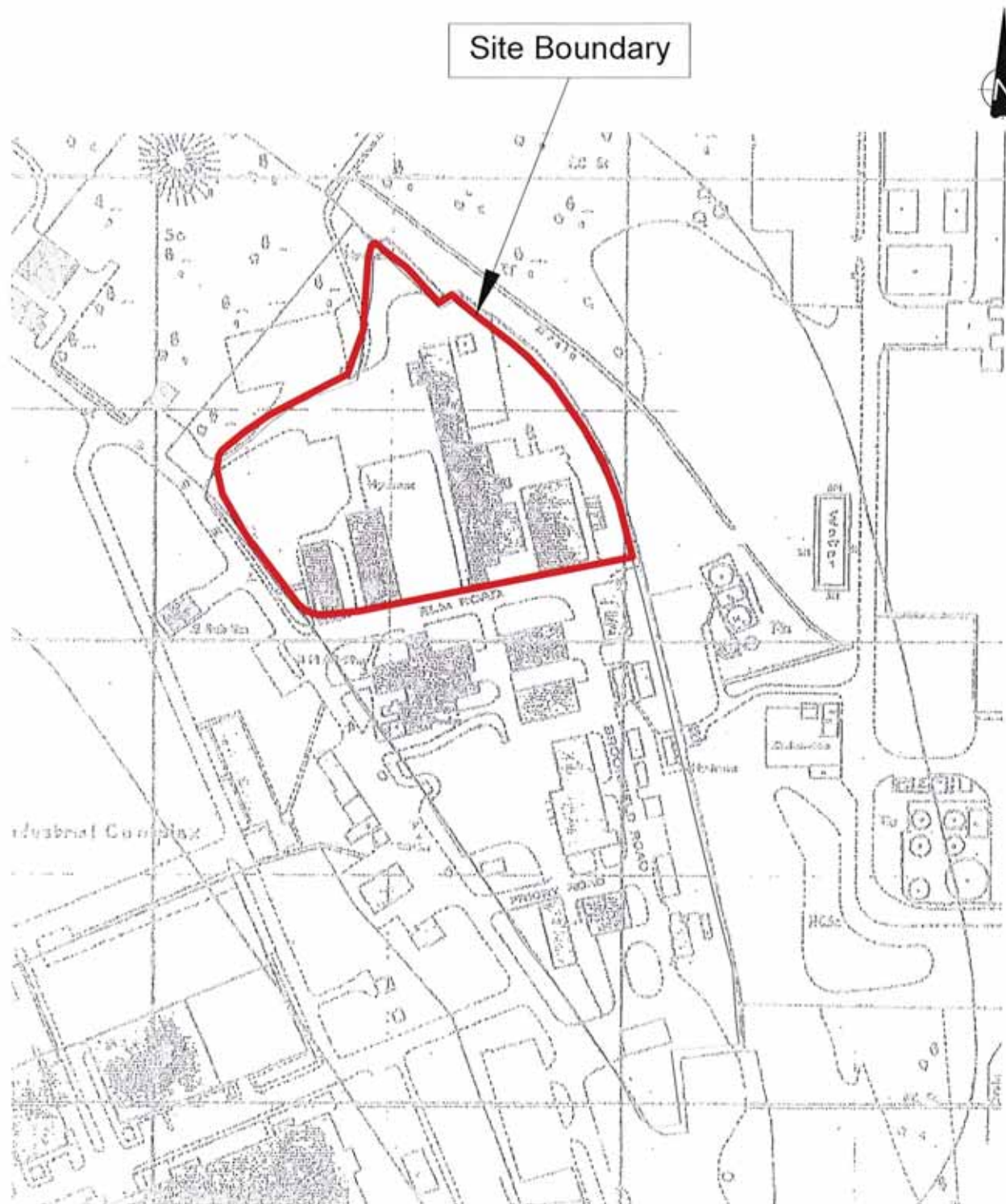
Site Boundary



SCALE 1:2,500 @ A4

Figure Title
SITE HISTORY - 1982

FIGURE 3e

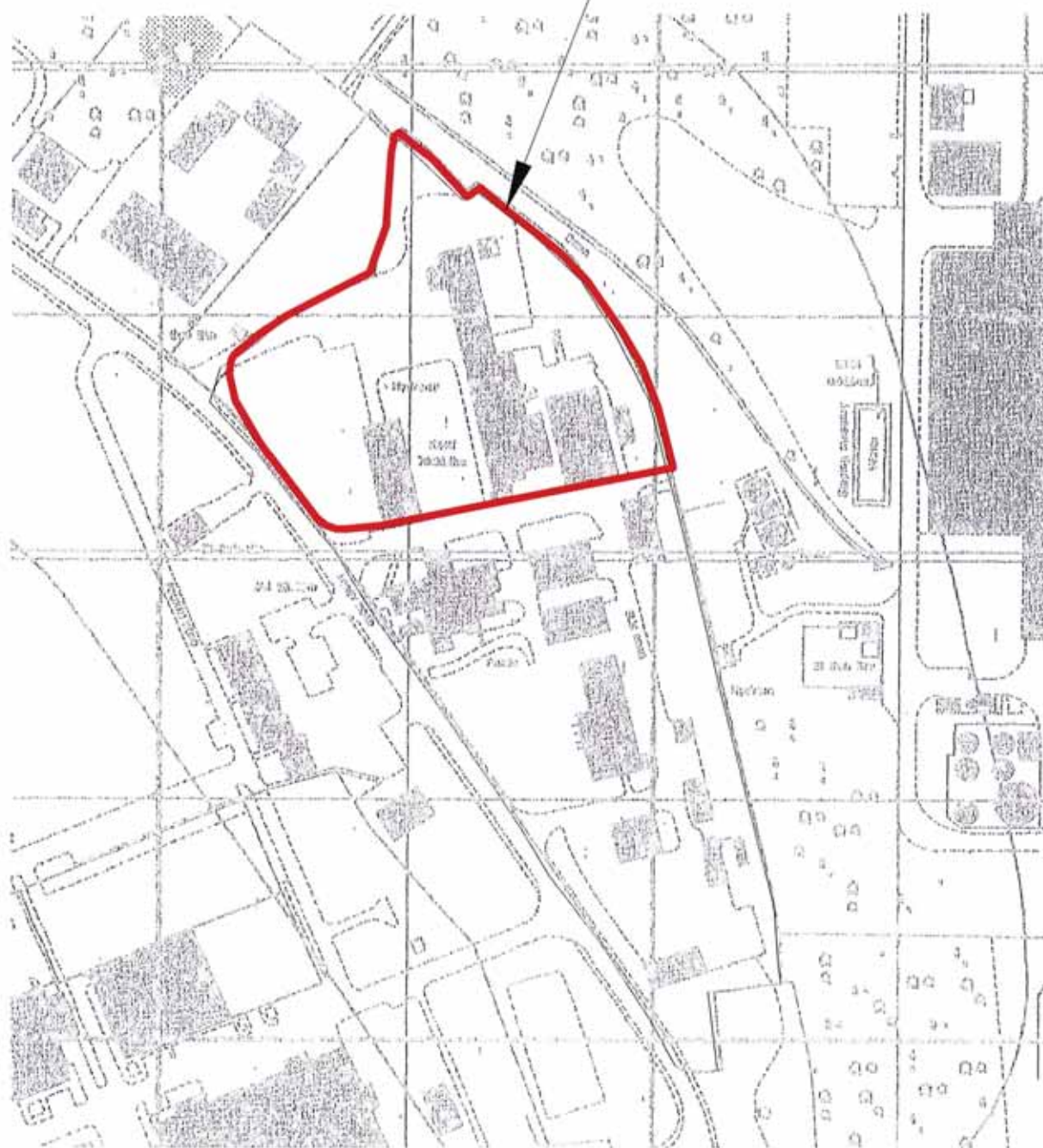


SCALE 1:2,500 @ A4

Figure Title
SITE HISTORY - 1989

FIGURE 3f

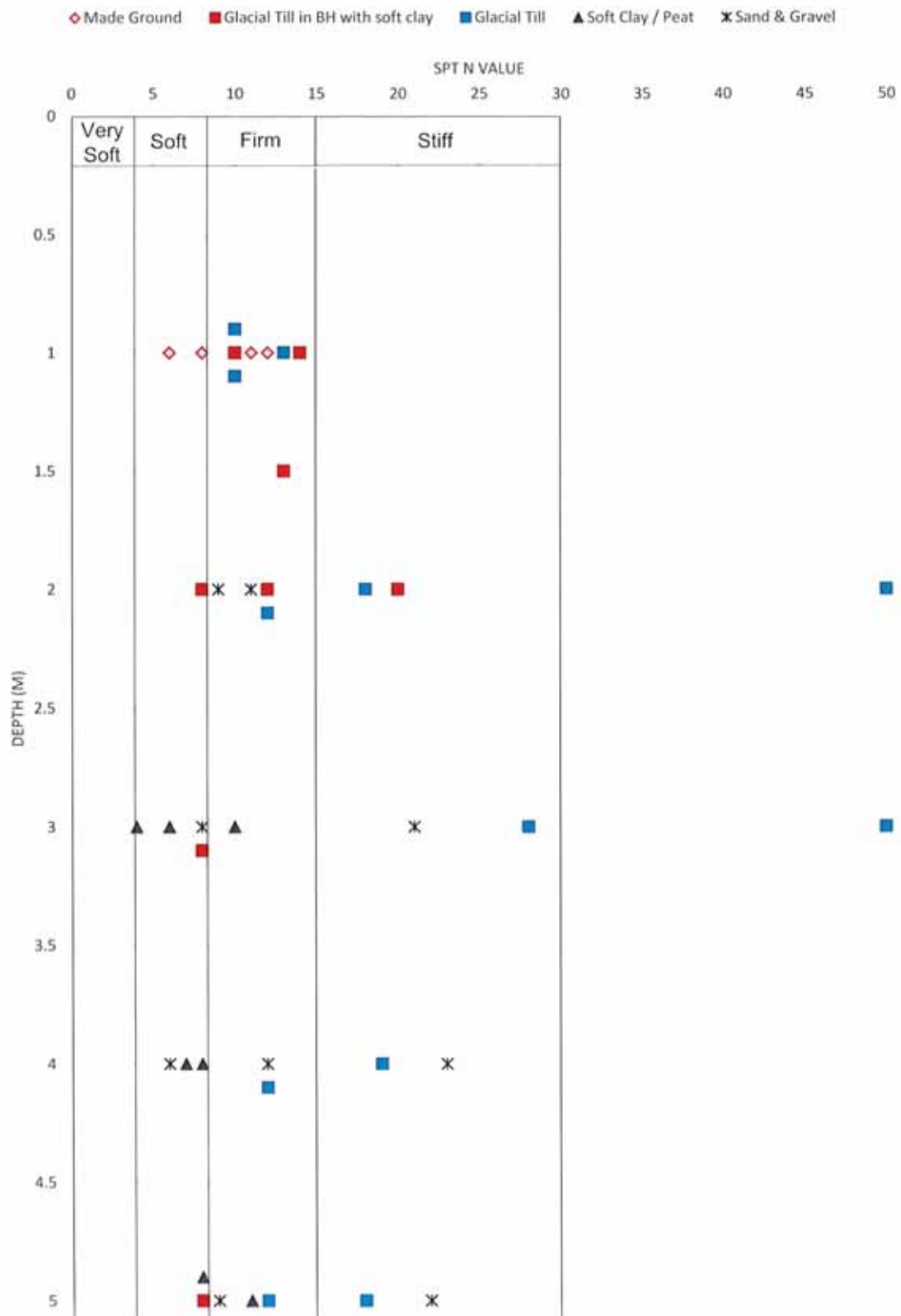
Site Boundary



SCALE 1:2,500 @ A4

Figure Title
SITE HISTORY - 1992

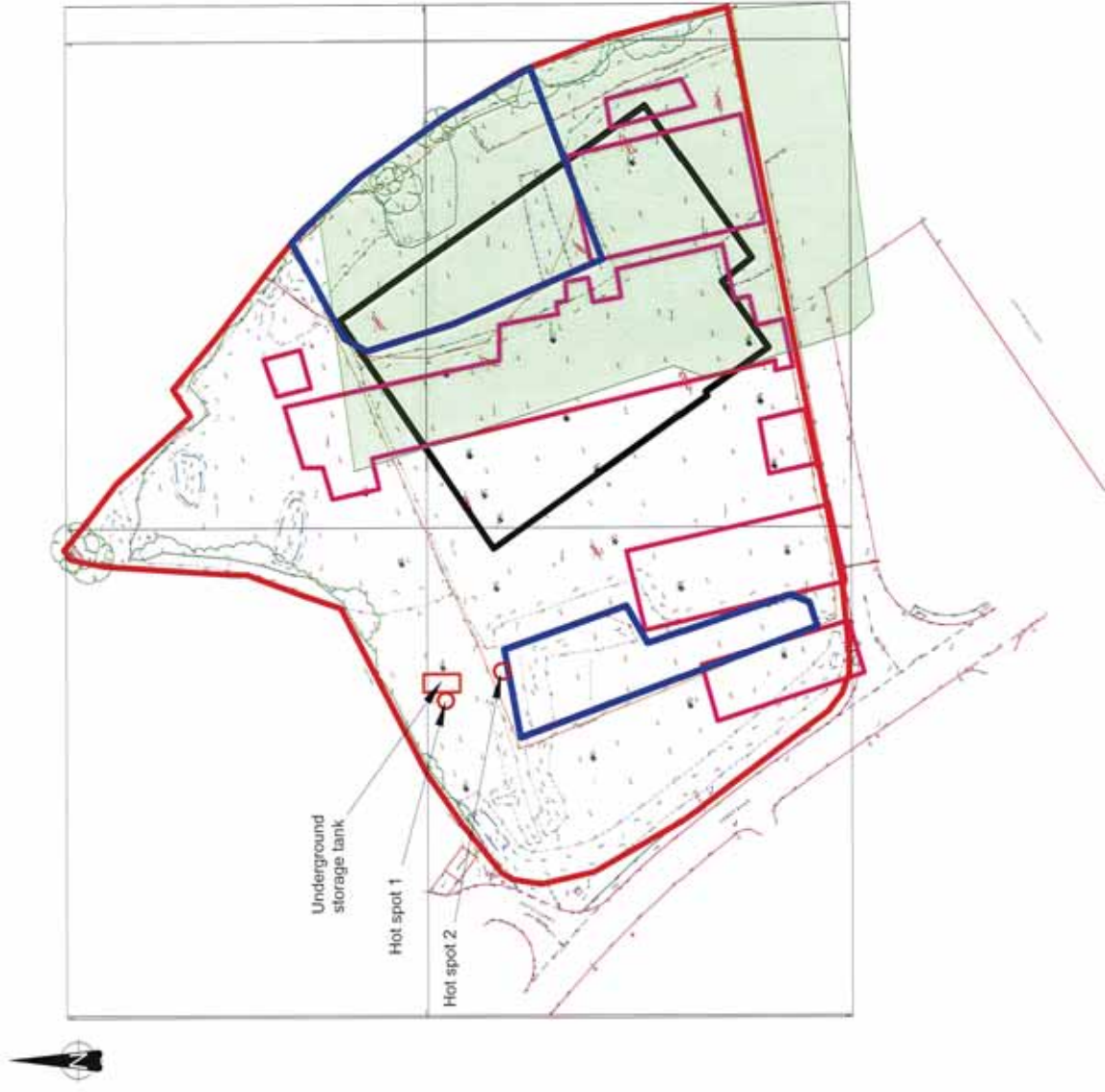
FIGURE 3g



SCALE NTS @ A4

Figure Title
SPT 'N' VALUE VS DEPTH

FIGURE 5



SCALE 1:1000 @ A3

Figure 6
GEOTECHNICAL
CONSTRAINTS

FIGURE 6

APPENDIX A

Site Photographs



Photograph 1 Looking east towards Kellogg's



Photograph 2 Looking south towards Clwyd Compounders



Photograph 3 looking west towards Abbey Road



Photographs 4



Photograph 5 Badger Sett



Photograph 6 remnants of Flue dust



Photograph 7 Lower area surrounding Badger Sett



Photograph 8 Lower area surrounding Badger Sett



Photograph 9 Butterfly exclusion Zone



Photograph 10 looking towards north corner of site



Photograph 11 Looking east towards Kellogg's



Photograph 12 Access road on southern site boundary



Photograph 13 Abbey Road



Photograph 14 Concrete headwall in northern corner of site

APPENDIX B

Coal Authority Report



The Coal
Authority

Resolving the **impacts** of mining

CON29M Non-Residential Mining Report

LAND AT ELM POINT
ABBAY ROAD
WREXHAM INDUSTRIAL ESTATE
WREXHAM
WREXHAM
LL13 9UE

Date of enquiry:	22 March 2017
Date enquiry received:	22 March 2017
Issue date:	22 March 2017
Our reference:	51001399203001
Your reference:	16434736



CON29M Non-Residential Mining Report

This report is based on, and limited to, the records held by the Coal Authority and the Cheshire Brine Subsidence Compensation Board's records, at the time we answer the search.

Client name

TM PROPERTY SEARCHES LIMITED

Enquiry address

LAND AT ELM POINT , ABBEY ROAD , WREXHAM
INDUSTRIAL ESTATE , WREXHAM, WREXHAM, LL13
9UE

How to contact us

0345 762 6848 (UK)
+44 (0)1623 637 000 (International)

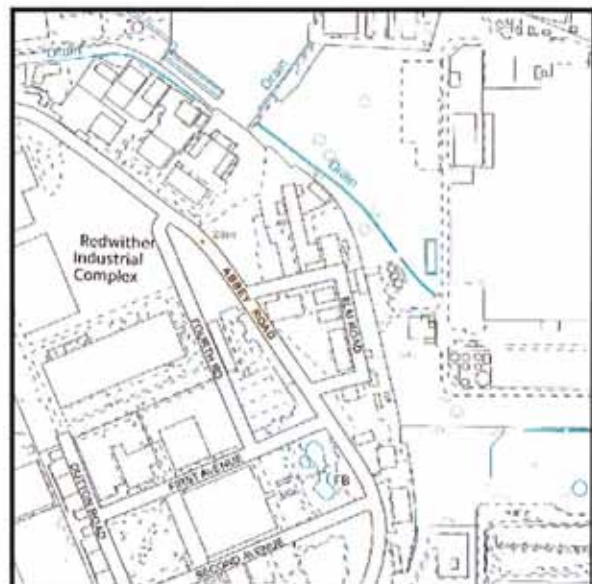
200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

www.groundstability.com

 /company/the-coal-authority

 /thecoalauthority

 /coalauthority



Approximate position of property



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Summary

Has the search report highlighted evidence or potential of		
1	Past underground coal mining	No
2	Present underground coal mining	No
3	Future underground coal mining	Yes
4	Mine entries	No
5	Coal mining geology	No
6	Past opencast coal mining	No
7	Present opencast coal mining	No
8	Future opencast coal mining	No
9	Coal mining subsidence	No
10	Mine gas	No
11	Hazards related to coal mining	No
12	Withdrawal of support	No
13	Working facilities order	No
14	Payments to owners of former copyhold land	No
15	Information from the Cheshire Brine Subsidence Compensation Board	No

For detailed findings, please go to page 4.

Detailed findings

1. Past underground coal mining

The property is not within a surface area that could be affected by past underground mining.

2. Present underground coal mining

The property is not within a surface area that could be affected by present underground mining.

3. Future underground coal mining

The property is not in an area where the Coal Authority has plans to grant a licence to remove coal using underground methods.

The property is not in an area where a licence has been granted to remove or otherwise work coal using underground methods.

The property is not in an area likely to be affected from any planned future underground coal mining.

However, reserves of coal exist in the local area which could be worked at some time in the future.

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

4. Mine entries

There are no known coal mine entries within, or within 20 metres of, the boundary of the property.

5. Coal mining geology

The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining.

6. Past opencast coal mining

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

7. Present opencast coal mining

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

8. Future opencast coal mining

There are no licence requests outstanding to remove coal by opencast methods within 800 metres of the boundary.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

9. Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

10. Mine gas

The Coal Authority has no record of a mine gas emission requiring action.

11. Hazards related to coal mining

The property has not been subject to remedial works, by or on behalf of the Authority, under its Emergency Surface Hazard Call Out procedures.

12. Withdrawal of support

The property is not in an area where a notice to withdraw support has been given.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

13. Working facilities order

The property is not in an area where an order has been made, under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

14. Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

15. Information from the Cheshire Brine Subsidence Compensation Board

The property lies outside the Cheshire Brine Compensation District.

Additional remarks

Information provided by the Coal Authority in this report is compiled in response to the Law Society's Con29M Coal Mining and Brine Subsidence Claim enquiries. The said enquiries are protected by copyright owned by the Law Society of 113 Chancery Lane, London WC2A 1PL. Please note that Brine Subsidence Claim enquiries are only relevant for England and Wales. This report is prepared in accordance with the Law Society's Guidance Notes 2006, the User Guide 2006 and the Coal Authority and Cheshire Brine Board's Terms and Conditions applicable at the time the report was produced.

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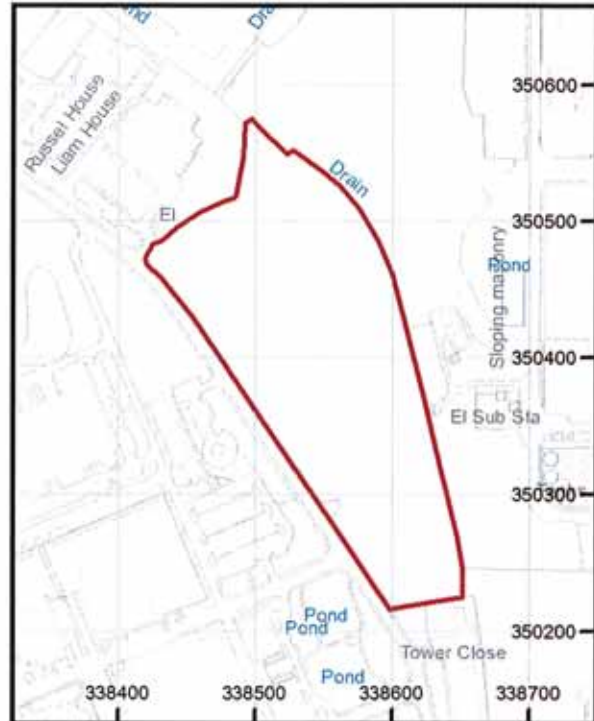
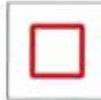
Alternative formats

If you would like this report in an alternative format, please contact our communications team.

Enquiry boundary

Key

Approximate position of enquiry boundary shown



How to contact us

0345 762 6848 (UK)
+44 (0)1623 637 000 (International)

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

www.groundstability.com

 /company/the-coal-authority

 /thecoalauthority

 /coalauthority



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APPENDIX C

Smith Grant boreholes and Trial Pits

TRIAL PIT RECORD
Trial Pit No: 1

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.00	Fine sandy silt with limestone gravel, frequent pieces of metal wire, plastic, wood and red brick fragments	TP1.S1 (0-0.5m)			Made Ground
0.75	Soft to firm grey clay with frequent organic matter (rootlets)				Natural glacial deposits
1.2	Stiff red clay with grey mottles	TP1.S2 (1.3-1.5m)			Natural glacial deposits
1.5	Base of excavation				
					
Comments: No odour, no hydrocarbons PID <0.1ppm					
Land Quality Assessors, Environmental Auditors Contaminated Land Specialists Station House, Station Road, Ruabon, Wrexham, LL14 6DL tel: 01978 822367 fax: 01978 824718 e-mail: consult@smithgrant.co.uk 					
Project: Redwither Central Area, Wrexham Industrial Estate			Drawn: DW	Date: 02.11.2011	Job No: R1662
Drawing: TP1			Checked:	Scale: NTS	Drg No: TP1

TRIAL PIT RECORD
Trial Pit No: 2

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Fine sandy loam with some pieces of red brick	TP2.S1 (0-0.3m)			Topsoil
0.3	Light red fine sandy silty loam with small fragments of brick, angular gravel and occasional cobbles	TP2.S2 (0.3-0.6m)			Made Ground
0.6	Very stiff dark grey clay . Possible relict cast iron pipe intercepted at ~1m bgl				Natural glacial deposits
1.2	Soft grey silty clay				Natural glacial deposits


Comments:

No odour, no hydrocarbons

PID <0.1ppm

**Land Quality Assessors, Environmental Auditors
Contaminated Land Specialists**

Station House, Station Road, Ruabon, Wrexham, LL14 6DL
tel: 01978 822367 fax: 01978 824718
e-mail: consult@smithgrant.co.uk



Project:	Redwither Central Area, Wrexham Industrial Estate	Drawn:	DW	Date:	02.11.2011	Job No:	R1662
Drawing:	TP2	Checked:		Scale:	NTS	Drg No:	TP2

TRIAL PIT RECORD
Trial Pit No: 3

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Fine clayey limestone gravel				Made Ground
0.1	Black clayey gravel with strong hydrocarbon odour. Frequent pieces of red brick and angular gravel	TP3.S1 (0-0.4m)			Made Ground
0.4	Concrete sidewall – possibly of underground storage tank			Oily water	Made Ground
0.8	Medium sand	TP3.S2 (0.8-1.0m)		Viscous Green liquid	Made Ground
1.0	Red clayey sandy gravel with pieces of red brick, strong hydrocarbon odour. Pockets of gravel stuck together with black tarry substance				Made Ground
1.1	Very stiff light brown clay	TP3.S3 (1.1-1.3m)			Natural glacial deposits
1.3	Base of Excavation				
					
Comments: Strong hydrocarbon odour through Made Ground until Natural. Oily water entering trial-pit alongside concrete slab and green viscous secretion through horizon of sand PID <0.1ppm					
Land Quality Assessors, Environmental Auditors Contaminated Land Specialists Station House, Station Road, Ruabon, Wrexham, LL14 6DL tel: 01978 822367 fax: 01978 824718 e-mail: consult@smithgrant.co.uk 					
Project: Redwither Central Area, Wrexham Industrial Estate			Drawn: DW	Date: 02.11.2011	Job No: R1662
Drawing: TP3			Checked:	Scale: NTS	Drg No: TP3

TRIAL PIT RECORD
Trial Pit No: 4

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Sandy clay soil with limestone angular gravel and cobbles	TP4.S1 (0-0.6m)			Made Ground
0.1	Dark brown to black clayey sand with fine gravel				Natural glacial deposits
0.3	Stiff light brown clay	TP4.S2 (1.5-1.8m)			Natural glacial deposits
1.8	Base of excavation – sidewalls collapsing				Natural glacial deposits
 					
Comments: No odour, no hydrocarbons PID <0.1ppm					
Land Quality Assessors, Environmental Auditors Contaminated Land Specialists Station House, Station Road, Ruabon, Wrexham, LL14 6DL tel: 01978 822367 fax: 01978 824718 e-mail: consult@smithgrant.co.uk 					
Project: Redwither Central Area, Wrexham Industrial Estate			Drawn: DW	Date: 02.11.2011	Job No: R1662
Drawing: TP4			Checked:	Scale: NTS	Drg No: TP4

TRIAL PIT RECORD

Trial Pit No: 5

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Fine gravelly sand with limestone cobbles. Mild hydrocarbon odour	TP5.S1 (0-0.5m)			Made Ground
0.3	Fine red clayey gravel				Natural glacial deposits
0.5	Stiff light brown clay	TP5.S2 (0.8-1.0m)			Natural glacial deposits
1.0	Base of excavation				




Comments:
Mild hydrocarbon odour
PID <0.1ppm

**Land Quality Assessors, Environmental Auditors
Contaminated Land Specialists**

Station House, Station Road, Ruabon, Wrexham, LL14 6DL
tel: 01978 822367 fax: 01978 824718
e-mail: consult@smithgrant.co.uk



Project: Redwith Central Area, Wrexham Industrial Estate	Drawn: DW	Date: 02.11.2011	Job No: R1662
Drawing: TP5	Checked:	Scale: NTS	Drg No: TP5

TRIAL PIT RECORD

Trial Pit No: 6

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	White to grey clayey fine gravel with occasional cobbles of limestone	TP6.S1 (0-0.3m)			Made Ground
0.3	Medium to fine light brown sand				Natural glacial deposits
2.3	Soft light brown clay				Natural glacial deposits
2.3	Base of Excavation				




Comments:
 No odour, no hydrocarbons
 PID <0.1ppm

**Land Quality Assessors, Environmental Auditors
Contaminated Land Specialists**

Station House, Station Road, Ruabon, Wrexham, LL14 6DL
 tel: 01978 822367 fax: 01978 824718
 e-mail: consult@smithgrant.co.uk



Project: Redwither Central Area, Wrexham Industrial Estate	Drawn: DW	Date: 02.11.2011	Job No: R1662
Drawing: TP6	Checked:	Scale: NTS	Drg No: TP6

TRIAL PIT RECORD

Trial Pit No: 8

Depth (m)	Description of strata	Sample	Type	Water	Remarks
0.0	Grey clayey gravel with angular limestone	TP8.S1 (0-0.5m)			Made Ground
0.5	Dark brown stiff clay	TP8.S2 (1.0-1.3m)			Natural glacial deposits
2.0	Base of excavation				




Comments:
 No odour, no hydrocarbons
 PID <0.1ppm

**Land Quality Assessors, Environmental Auditors
Contaminated Land Specialists**

Station House, Station Road, Ruabon, Wrexham, LL14 6DL
 tel: 01978 822367 fax: 01978 824718
 e-mail: consult@smithgrant.co.uk



Project: Redwither Central Area, Wrexham Industrial Estate	Drawn: DW	Date: 02.11.2011	Job No: R1662
Drawing: TP8	Checked:	Scale: NTS	Drg No: TP8

GEO-VENTURES (UK) LIMITED <i>Geotechnical and Environmental Services</i>					Site Redwither Central, Wrexham Industrial Estate, Wrexham		Number WS 1	
Excavation Method Drive-In Window Sampler		Dimensions		Ground Level (mOD)		Client		Job Number 12-362
		Location		Dates 26/10/2011		Engineer Smith Grant LLP		Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend
0.50	D		Seepage(1) at 0.75m.		(0.50)	MADE GROUND : stone (drillers description)		  
					0.50 (0.30)	MADE GROUND : red ash / burnt shale		
					0.80	Complete at 0.80m		
Remarks Service pit excavated by hand to 1.00m						Scale (approx) 1:50		Logged By J. Crook
						Figure No. 12-362.WS 1		

GEO-VENTURES (UK) LIMITED <i>Geotechnical and Environmental Services</i>						Site Redwither Central, Wrexham Industrial Estate, Wrexham		Number WS 1A	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD)		Client		Job Number 12-362	
		Location		Dates 26/10/2011		Engineer Smith Grant LLP		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.50	D				(0.35)	MADE GROUND : stone (drillers description)			
					0.35	MADE GROUND : black ash and cinder with fragments of broken brick			
1.00	D				(0.45)				
					0.80	Firm / stiff to stiff grey / brown CLAY			
2.00	D				(1.20)				
					2.00	Firm brown boulder CLAY with bands of sand (drillers description)			
3.00	D				(0.50)				
					2.50	Firm / stiff brown CLAY with occasional fine sub-rounded gravel			
4.00	D				(1.50)				
					4.00	Complete at 4.00m			

Remarks Service pit excavated by hand to 1.00m		Scale (approx) 1:50	Logged By J. Crook
		Figure No. 12-362.WS 1	

GEO-VENTURES (UK) LIMITED

Geotechnical and Environmental Services

Site
Redwith Central, Wrexham Industrial Estate, Wrexham

Borehole
Number
WS 2

Installation Type
Single Installation

Dimensions
Internal Diameter of Tube [A] = 35 mm
Diameter of Filter Zone = 80 mm

Client

Job
Number
12-362

Location

Ground Level (mOD)

Engineer

Smith Grant LLP

Sheet
1/1

Legend	Value	Instr (A)	Level (mOD)	Depth (m)	Description	Groundwater Strikes During Drilling																					
						Date		Time		Depth Struck (m)		Casing Depth (m)		Inflow Rate		Readings				Depth Sealed (m)							
																5 min 10 min 15 min 20 min											
[Pattern]				0.10	Concrete																						
[Pattern]					Bentonite Seal																						
Groundwater Observations During Drilling																											
						Date		Start of Shift						End of Shift													
								Time		Depth Hole (m)		Casing Depth (m)		Water Depth (m)		Water Level (mOD)		Time		Depth Hole (m)		Casing Depth (m)		Water Depth (m)		Water Level (mOD)	
				1.00																							
Instrument Groundwater Observations																											
Inst. [A] Type : Slotted Standpipe																											
						Date		Instrument [A]				Remarks															
								Time		Depth (m)											Level (mOD)						
				3.00	Well Screen																						

Remarks

GEO-VENTURES (UK) LIMITED <i>Geotechnical and Environmental Services</i>						Site Redwither Central, Wrexham Industrial Estate, Wrexham		Number WS 3	
Excavation Method Drive-in Window Sampler		Dimensions		Ground Level (mOD)		Client		Job Number 12-362	
		Location		Dates 26/10/2011		Engineer Smith Grant LLP		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.50	D				(0.40)	MADE GROUND : stone (drillers description)			
					0.40 (0.40)	MADE GROUND : stiff / very stiff grey / brown clay			
1.00	D				0.80	Firm / stiff brown CLAY with occasional fine sub-rounded gravel			
2.00	D				(2.20)				
3.00	D				3.00				
4.00	D					Complete at 4.00m			
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									
									

Remarks Service pit excavated by hand to 1.00m		Scale (approx) 1:50	Logged By J. Crook
		Figure No. 12-362.WS 1	

APPENDIX D

Borehole and Trial Pit Logs -e3p

			Trial Pit Log			Trialpit No TP109 Sheet 1 of 1		
Project Name: Elm Point			Project No. 10610		Co-ords: - Level:		Date 05/06/2015	
Location: Wrexham			Dimensions (m):		2.30		Scale 1:25	
Client: Russells Construction			Depth 2.80		0.45		Logged R. Walker/F. Newman	
Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
Depth	Type	Results						
2.30	ES	HVP=67	0.30		 MADE GROUND: Red brown sandy gravel. Gravel is fine to coarse sub-angular to sub-rounded of brick, coal, granite, limestone and concrete.	 MADE GROUND: Red brown gravelly clay. Gravel is fine to coarse sub-angular to sub-rounded of brick.		
			1.50					 Firm grey very silty CLAY.
			2.10					
			2.80					End of pit at 2.80 m
Remarks: Complete at 2.80m bgl.								
Stability: Stable.								



Trial Pit Log

Trialpit No

TP110

Sheet 1 of 1

Project Name: Elm Point

Project No.
10610Co-ords: -
Level:Date
05/06/2015

Location: Wrexham

Dimensions
(m):

2.30

Client: Russells Construction

Depth
3.30

0.45

Scale
1:25

Logged

R. Walker/F. Newman

Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
Depth	Type	Results					
0.20	ES	HP=147	0.10			MADE GROUND: Grey white gravel. Gravel is fine to medium sub-angular to sub-rounded of limestone.	
			0.25			MADE GROUND: Black red gravel. Gravel is fine sub-angular to sub-rounded of brick and ash.	
			0.45			MADE GROUND: Red gravel. Gravel is fine to medium sub-angular to sub-rounded of brick.	
						Stiff grey brown silty CLAY.	
							1
			2.50			Dark brown very silty CLAY with organic odour.	
			2.80			Soft grey brown very silty CLAY.	
							3
			3.30			End of pit at 3.30 m	
							4
							5

Remarks: Complete at 3.30m bgl.

Stability: Stable.





Trial Pit Log

Trialpit No

TP111

Sheet 1 of 1

Project Name: Elm Point

Project No.
10610

Co-ords: -

Level:

Date
05/06/2015

Location: Wrexham

Dimensions
(m):

2.30

Depth
3.00

0.45

Scale
1:25

Client: Russells Construction

Logged
R. Walker/F. Newman

Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
Depth	Type	Results					
0.40	ES	HP=74	0.30			MADE GROUND: White gravel. Gravel is fine to coarse sub-angular to sub-rounded of limestone.	
						MADE GROUND: Red brown gravel. Gravel is fine to coarse sub-angular to sub-rounded of brick.	
			0.80			Firm grey brown slightly silty CLAY.	1
			1.30			Brown clayey fine SAND.	2
			2.30			Stiff grey brown slightly silty CLAY.	
		HP=147	3.00			End of pit at 3.00 m	3
							4
							5

Remarks: Complete at 3.00m bgl.

Stability: Stable.





Trial Pit Log

Trialpit No

TP112

Sheet 1 of 1

Project Name: Elm Point

Project No.
10610Co-ords: -
Level:Date
05/06/2015

Location: Wrexham

Dimensions
(m):

2.30

Depth
3.00

0.45

Scale
1:25

Logged

R. Walker/F. Newman

Samples and In Situ Testing

Depth Type Results

Depth
(m)Level
(m)

Legend

Stratum Description

0.30

ES

HVP=109

0.50

3.00

MADE GROUND: Cream gravel with cobbles and boulders. Gravel is fine to coarse angular to sub-rounded of concrete, limestone, sandstone brick and glass. Cobbles are of concrete and brick. Boulders are of concrete and re-bar.

Stiff brown grey CLAY.

End of pit at 3.00 m

Remarks: Complete at 3.00m bgl.

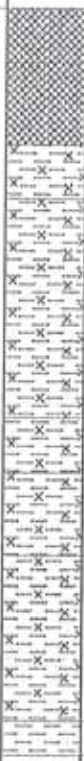
Stability: Stable.



				Borehole Log			Borehole No. WS101	
Project Name Elm Point				Project No. 10610		Co-ords: -		Sheet 1 of 1
Location: Wrexham				Level:		Hole Type WS		
Client: Russells Construction				Dates: 05/06/2015 - 06/06/2015		Scale 1:50		
Logged By R. Walker/F. Newman								

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.20		MADE GROUND: Slightly grey slightly sandy gravel. Gravel is fine to medium sub-angular to sub-rounded of brick, limestone and sandstone.	1	
		0.30	PP	199					
		0.60	ES						
				N=12 (1,2/3,3,3,3)					
		1.30	ES						
		1.50	PP	128					
				N=27 (2,4/5,6,8,8)	2.00		Very stiff high to very high strength brown slightly silty CLAY.	2	
				N=50 (8,8/10,12,14,14)	3.05				
							End of borehole at 3.05 m	3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	

Remarks Refused at 3.05m bgl due to stiff clay.								
--	--	--	--	--	--	--	--	---

e3p			Borehole Log			Borehole No. WS102		
Project Name Elm Point			Project No. 10610		Co-ords: -		Sheet 1 of 1	
Location: Wrexham			Level:		Hole Type WS		Scale 1:50	
Client: Russells Construction			Dates: 05/06/2015 - 06/06/2015		Logged By R. Walker/F. Newnan			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.40			MADE GROUND: Light grey gravel. Gravel is fine to coarse sub-angular to sub-rounded of slate and sandstone.
		0.80	ES					MADE GROUND: Reddish brown gravel with frequent cobbles. Gravel is fine to medium sub-angular to sub-rounded of brick, sandstone and slate. Cobbles are sub-rounded of sandstone.
		1.10	ES	N=10 (1,1/2,2,3,3)	1.00			Stiff medium strength blueish grey silty CLAY with rootlets and organic odour.
		1.50	PP	169	1.40			Stiff medium strength brown slightly silty CLAY.
				N=9 (2,2/2,2,2,3)				
		2.50	PP	128				
				N=8 (0,1/2,2,2,2)	3.00			Firm low strength grey silty CLAY.
		3.20	PP	42	3.40			Dark brown very silty CLAY with organic odour.
		3.70	ES		4.00			Firm low strength grey silty CLAY.
				N=9 (2,2/2,2,2,3)				
			N=18 (2,2/3,3,6,6)	5.20				
				5.45			Stiff medium strength brown CLAY.	
							End of borehole at 5.45 m	

Remarks

Complete at 5.45m bgl.



e3p			Borehole Log				Borehole No. WS103	
Project Name Elm Point			Project No. 10610		Co-ords: -		Sheet 1 of 1	
Location: Wrexham			Level:		Hole Type WS		Scale 1:50	
Client: Russells Construction			Dates: 05/06/2015 - 06/06/2015		Logged By R. Walker/F. Newman			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.50		MADE GROUND: White gravel. Gravel is fine to medium sub-angular to sub-rounded of limestone.	1
		0.70	PP	162 N=15 (2,2/3,4,4,4)			Stiff to very stiff medium to high strength brown grey slightly silty CLAY.	
		1.80	PP	221 N=13 (2,2/2,3,4,4)				2
					2.60 2.70		Dark brown very silty CLAY with organic odour.	3
		3.20	ES	N=4 (2,2/1,1,1,1)	3.00	Soft brown very sandy slightly gravelly CLAY. Gravel is fine sub-angular to sub-rounded of mudstone.		
		3.40	PP	113 N=27 (4,4/5,5,8,9)	3.25 3.50	Very loose brown fine SAND. Soft brown very sandy slightly gravelly CLAY. Gravel is fine sub-angular to sub-rounded of mudstone.	4	
				N=10 (2,1/1,2,3,4)		Stiff to very stiff medium to high strength firm brown slightly silty CLAY.	5	
					5.45		End of borehole at 5.45 m	6
								7
								8
							9	
							10	

Remarks
Complete at 5.45m bgl.

e3p

e3p			Borehole Log				Borehole No. WS104	
Project Name Elm Point			Project No. 10610		Co-ords: -		Sheet 1 of 1	
Location: Wrexham			Level:		Scale 1:50		Hole Type WS	
Client: Russells Construction			Dates: 05/06/2015 - 06/06/2015		Logged By R. Walker/F. Newman			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.40	ES		0.60		MADE GROUND: Grey black gravel. Gravel is fine to coarse sub-angular to sub-rounded of ash, sandstone, slate, coal and brick.	
		0.90	PP	221 N=11 (1,2/2,3,3,3)			Stiff medium strength brown grey slightly silty CLAY.	1
				N=11 (2,2/2,2,3,4)				2
		2.30	ES	74	2.20		Stiff medium strength slightly silty sandy gravelly CLAY. Gravel is fine to medium sub-angular of mudstone.	
		2.30	PP		2.50		Stiff to very stiff medium to high strength brown slightly silty CLAY.	3
				N=23 (3,3/5,5,6,7)				4
				N=12 (2,2/3,3,3,3)				5
				N=10 (2,2/2,2,3,3)				6
					5.45		End of borehole at 5.45 m	7
								8
								9
								10

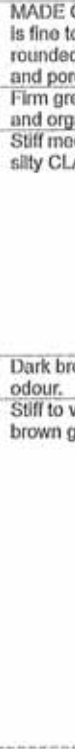
Remarks
Complete at 5.45m bgl.



				Borehole Log			Borehole No. WS105		
Project Name Elm Point				Project No. 10610		Co-ords: -		Sheet 1 of 1	
Location: Wrexham				Level:		Hole Type WS		Scale 1:50	
Client: Russells Construction				Dates: 05/06/2015 - 06/06/2015		Logged By R. Walker/F. Newman			
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.60			MADE GROUND: Reddish brown gravel. Gravel is fine to medium sub-angular to sub-rounded of limestone, brick and mudstone.	
	0.80	ES	221					Firm to stiff low to medium strength brown grey slightly silty slightly gravelly CLAY. Gravel is fine to medium sub-angular to sub-rounded of coal, mudstone and sandstone.	1
	0.80	PP	N=11 (2,2/2,3,3,3)						2
			N=11 (2,2/2,3,3,3)						
	2.70	PP	123						3
			N=7 (0,0/1,1,2,3)						
	3.50	ES			3.30			Firm low strength brown grey very silty CLAY.	
			N=16 (3,3/3,4,4,5)		3.60			Dark brown very silty CLAY with organic odour.	
					3.70			Soft brown grey very silty CLAY.	4
			N=12 (3,2/3,3,3,3)		4.00			Stiff medium strength brown grey slightly silty CLAY.	5
				5.45			End of borehole at 5.45 m	6	
								7	
								8	
								9	
								10	

Remarks
 Complete at 5.45m bgl.



e3p		Borehole Log				Borehole No. WS106		
Project Name Elm Point		Project No. 10610		Co-ords: -		Sheet 1 of 1		
Location: Wrexham				Level:		Hole Type WS		
Client: Russells Construction				Dates: 05/06/2015 - 06/06/2015		Scale 1:50		
						Logged By R. Walker/F. Newman		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.50	PP	157	0.30			MADE GROUND: Dark grey gravel. Gravel is fine to coarse sub-angular to sub-rounded of brick, concrete, limestone, slate and porcelain.
				N=12 (2,2/3,3,3,3)	0.90			Firm grey slightly silty CLAY with rootlets and organic odour.
				N=10 (2,2/2,2,3,3)				Stiff medium strength brown grey slightly silty CLAY.
					2.60			
					2.65			
		2.90	PP	88				Dark brown very silty CLAY with organic odour.
				N=14 (3,3/3,3,4,4)				Stiff to very stiff medium to high strength brown grey slightly silty CLAY.
		3.40	PP	123				
				N=24 (3,4/4,6,7,7)				
				N=18 (3,3/3,5,5,5)				
					5.45			End of borehole at 5.45 m
Remarks Complete at 5.45m bgl. 								

Project Name
Elm Point

Project No.
10610

Co-ords: -

Hole Type
WS

Location: Wrexham

Level:

Scale
1:50

Client: Russells Construction

Dates: 05/06/2015 - 06/06/2015

Logged By
R. Walker/F.
Newman

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.70	ES	27 (11,12/27 for 150mm)	0.30 0.50 1.45		MADE GROUND: Grey gravel. Gravel is fine to medium sub-angular to sub-rounded of concrete and limestone. MADE GROUND: White red gravel. Gravel is fine to medium sub-rounded of concrete, limestone and brick. MADE GROUND: Red orange gravel with occasional cobbles. Gravel is fine to coarse sub-angular to sub-rounded of brick. Cobbles are sub-angular of brick. End of borehole at 1.45 m	1 2 3 4 5 6 7 8 9 10	
Remarks Refused at 1.45m bgl in Made Ground.									
e3p									

e3p				Borehole Log			Borehole No. WS109	
Project Name Elm Point				Project No. 10610		Co-ords: -		Sheet 1 of 1
Location: Wrexham				Level:		Hole Type WS		
Client: Russells Construction				Dates: 05/06/2015 - 06/06/2015		Scale 1:50		
						Logged By R. Walker/F. Newman		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.50		MADE GROUND: Dark brown red clayey gravel. Gravel is fine to coarse of brick, concrete and limestone.	
					0.90		MADE GROUND: Firm grey clay.	
	0.90	PP	88 N=11 (2,2/3,2,3,3)	0.90		MADE GROUND: Stiff medium strength brown clay with frequent gravel. Gravel is fine to coarse sub-angular to sub-rounded of slate and brick.	1	
	1.70	PP	221	1.80		Orange brown red slightly clayey fine SAND.	2	
	1.90	ES	N=9 (2,2/2,2,3,2)	2.00		Loose brown orange clayey fine SAND.	2	
				2.50		Loose brown orange slightly clayey fine SAND.	3	
			N=8 (2,3/2,2,2,2)	3.60		Soft brown orange slightly sandy CLAY.	4	
			N=14 (2,2/3,3,4,4)	4.00		Medium dense brown slightly clayey fine SAND.	4	
			N=22 (3,4/4,5,6,7)	5.45		End of borehole at 5.45 m	5	
								6
Remarks Complete at 5.45m bgl.								7
								8
								9
								10

Project Name				Project No.		Co-ords:		Borehole No.	
Location:				Level:		Hole Type		Scale	
Client:				Dates:		Logged By		Newman	
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.40			MADE GROUND: Red brown slightly sandy gravel. Gravel is fine to medium sub-angular to sub-rounded of concrete, limestone, ash and brick.	
		0.60	PP	221 N=10 (2,2/2,2,3,3)				Stiff to very stiff medium to very high strength brown grey CLAY.	
				N=50 (8,8/10,12,14,14)	2.45			End of borehole at 2.45 m	
Remarks									
Complete at 2.45m bgl.									

				Borehole Log				Borehole No. WS111	
Project Name Elm Point				Project No. 10610		Co-ords: -		Sheet 1 of 1	
Location: Wrexham				Level:		Hole Type WS			
Client: Russells Construction				Dates: 05/06/2015 - 06/06/2015		Scale 1:50			
Logged By R. Walker/F. Newman									

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.40		 MADE GROUND: Brown slightly clayey gravel with occasional rootlets. Gravel is fine to medium sub-angular to sub-rounded of brick, sandstone and limestone.	1	
				N=10 (2,2/2,2,3,3)			 Firm to stiff low to medium strength brown slightly silty CLAY with rootlets.	2	
				N=8 (1,1/2,2,2,2)	2.40		 Firm low strength dark brown very silty CLAY with organic odour.	3	
				N=6 (0,0/0,2,2,2)	3.30		 Soft grey slightly sandy CLAY.	4	
				N=14 (2,2/3,3,4,4)	4.10		 Stiff to very stiff medium to very high strength grey very sandy CLAY.	5	
				N=12 (2,2/2,3,3,4)	5.45		 End of borehole at 5.45 m	6	
								7	
								8	
								9	
								10	

Remarks Complete at 5.45m bgl.	
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				Borehole Log				Borehole No. WS112	
Project Name Elm Point				Project No. 10610		Co-ords: -		Sheet 1 of 1 Hole Type WS	
Location: Wrexham						Level:		Scale 1:50	
Client: Russells Construction						Dates: 05/06/2015 - 06/06/2015		Logged By R. Walker/F. Newman	
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.40	ES		0.60		 MADE GROUND: Grey gravel. Gravel is fine to coarse sub-angular to sub-rounded of sandstone, limestone and cement.		
		1.30	ES	N=10 (2,2/2,2,3,3)			 Firm grey brown slightly silty CLAY.	1	
				N=12 (3,3/3,3,3,3)				2	
				N=50 (5,7/10,11,13,16)	3.45		 End of borehole at 3.45 m	3	
4 5 6 7 8 9 10									
Remarks Complete at 3.45m bgl.									

APPENDIX E

Borehole and Trial Pit Logs

(This Investigation)

BOREHOLE LOG

Project Abbey Road				BOREHOLE No WS1	
Job No 2023	Date 30-10-17	Ground Level (m)	Co-Ordinates ()		
Contractor Earth Engineering				Sheet 1 of 1	

SAMPLES & TESTS			STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)		
1.00		N7				(1.15) 1.15		
						(0.45) 1.60		
2.00		N13				(1.40) 3.00		
3.00		N8				(0.80) 3.80		
4.00		N8				(1.65) 5.45		
5.00		N8						

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											Recovery 0 - 1 95% 1 - 2 94% 2 - 3 86% 3 - 4 86% 4 - 5 64% No groundwater encountered.

All dimensions in metres Scale 1:50	Client McCarthy Haulage Ltd	Method/ Plant Used	Logged By MJS
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BOREHOLE LOG

Project Abbey Road				BOREHOLE No WS2	
Job No 2023	Date 30-10-17	Ground Level (m)	Co-Ordinates ()		
Contractor Earth Engineering				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
1.00		N12				(1.60)	Brown silty very gravelly CLAY (MADE GROUND)		
						1.60			
						1.90	Bricks overlying ash and clinker (MADE GROUND)		
2.00		N20				(1.50)	Stiff, orange brown silty CLAY quickly becoming very stiff (GLACIAL TILL) HV >120kPa		
3.00		N4				3.40			
						3.60	Soft grey CLAY		
							Soft dark brown fibrous CLAY (PEAT)		
4.00		N7				(0.90)			
						4.50			
							Soft grey sandy CLAY		
5.00		N11				(0.95)			
						5.45			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											Recovery 0 - 1 90% 1 - 2 75% 2 - 3 95% 3 - 4 70% 4 - 5 60% No groundwater encountered.
All dimensions in metres Scale 1:50			Client	McCarthy Haulage Ltd			Method/ Plant Used			Logged By MJS	

BOREHOLE LOG

Project Abbey Road				BOREHOLE No WS3	
Job No 2023	Date 30-10-17	Ground Level (m)	Co-Ordinates ()		
Contractor Earth Engineering				Sheet 1 of 1	

SAMPLES & TESTS			STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result	Water	Reduced Level	Legend	Depth (Thickness)		
1.00		N13				(1.00)	Firm brown very gravelly CLAY gravel fine to coarse (MADE GROUND)	
						1.00 1.35	Firm grey brown slightly organic silty CLAY (OLD TOPSOIL)	
2.00		N18				(0.95) 2.30	Firm to stiff becoming firm at 1.80m brown mottled grey CLAY	
3.00		N28				(3.15)	Very stiff red brown/brown mottled grey CLAY (GLACIAL TILL) HV > 120kPa	
4.00		N19						
5.00		N18				5.45		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											Recovery 0 - 1 100% 1 - 2 100% 2 - 3 90% 3 - 4 93% 4 - 5 85% No groundwater encountered.
All dimensions in metres Scale 1:50			Client McCarthy Haulage Ltd			Method/ Plant Used			Logged By MJS		

BOREHOLE LOG

Project Abbey Road				BOREHOLE No WS4	
Job No 2023	Date 30-10-17	Ground Level (m)	Co-Ordinates ()	Sheet 1 of 1	
Contractor Earth Engineering					

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick- ness)	DESCRIPTION		
1.00		N8				(1.60) 1.60	Firm brown CLAY with some to much gravel of brick, masonry and aggregate (MADE GROUND)		
						1.80	BRICK		
2.00		N11				(0.40) 2.20	Medium dense dark grey/black sub angular fine to coarse GRAVEL (MADE GROUND) very wet		
3.00		N21					Medium dense grey brown silty fine SAND occasional bands of stiff brown clay (GLACIAL DEPOSITS)		
4.00		N23				(3.25)			
5.00		N9				5.45			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
											Recovery 0 - 1 100% 1 - 2 75% 2 - 3 75% 3 - 4 100% 4 - 5 40% No Groundwater encountered.
All dimensions in metres Scale 1:50			Client McCarthy Haulage Ltd			Method/ Plant Used			Logged By MJS		

Depth(m)	BLOWS (100mm)	DIAGRAM DPSH N100 VALUES
	0	
	1	
	2	
	2	
	2	
	3	
	15	
	19	
	4	
1.00	9	
	10	
	36	
	30	
	12	
	7	
	4	
	4	
	4	
	3	
	3	
2.00	4	
	4	
	5	
	6	
	6	
	4	
	4	
	4	
	4	
3.00	4	
	3	
	5	
	6	
	6	
	7	
	7	
	7	
	7	
	7	
4.00	7	
	8	
	8	
	10	
	11	
	11	
	10	
	10	
	10	
	12	
5.00	10	
	11	
	11	
	12	
	13	
	12	
	12	
	11	
	11	
6.00	15	
	12	
	14	
	14	
	14	
	12	
	14	
	14	
	15	
	19	
7.00	19	
	15	
	22	
	18	
	18	
	15	
	16	
	13	
	14	
	14	
8.00	14	
	12	
	13	
	13	
	15	
	22	
	21	
	17	
	14	
9.00	15	
	17	
	18	
	14	
	15	
	15	
	17	
	18	
	15	
	16	
	17	
10.00	18	
REMARKS: 1		PROBE NUMBER: 1
CONTRACT: Abbey Road, WIE		DATE: 30.10.17
		PAGE 1 of 1

Depth(m)	BLOW COUNTS (100mm)	DIAGRAM DPSH N100 VALUES
	0	
	2	
	2	
	2	
	2	
	3	
	3	
	1	
	1	
1.00	34	
	18	
	4	
	2	
	2	
	2	
	3	
	2	
	3	
	3	
2.00	3	
	2	
	2	
	3	
	3	
	4	
	4	
	6	
	5	
	7	
	7	
3.00	5	
	6	
	6	
	6	
	7	
	6	
	6	
	7	
	5	
4.00	6	
	5	
	5	
	4	
	4	
	5	
	4	
	3	
	3	
	3	
5.00	3	
	2	
	2	
	2	
	3	
	3	
	4	
	3	
	4	
	4	
6.00	5	
	5	
	6	
	7	
	7	
	7	
	7	
	8	
	8	
	9	
7.00	9	
	9	
	10	
	10	
	11	
	11	
	12	
	11	
	12	
	12	
8.00	13	
	10	
	10	
	12	
	12	
	13	
	14	
	14	
	14	
	17	
9.00	17	
	13	
	17	
	16	
	17	
	19	
	20	
	23	
	23	
	23	
10.00	23	
REMARKS: 1		PROBE NUMBER: 2
CONTRACT: Abbey Road, WBE		DATE: 30.10.17
		PAGE 1 of 1

Depth(m)	BLOWS (100mm)	DIAGRAM DPSH N100 VALUES
	0	
	0	
	1	
	2	
	4	
	3	
	2	
	1	
	1	
1.00	1	
	1	
	1	
	1	
	2	
	2	
	1	
	1	
	1	
2.00	1	
	1	
	2	
	2	
	2	
	4	
	3	
	2	
	5	
	4	
3.00	1	
	4	
	3	
	3	
	6	
	3	
	7	
	5	
	4	
	2	
4.00	3	
	2	
	2	
	3	
	3	
	1	
	1	
	2	
	1	
5.00	2	
	3	
	4	
	4	
	1	
	1	
	3	
	2	
	4	
	3	
	3	
6.00	3	
	2	
	4	
	3	
	2	
	3	
	3	
	5	
	8	
	13	
	12	
7.00	12	
	8	
	11	
	10	
	11	
	11	
	12	
	15	
	12	
	11	
8.00	10	
	4	
	4	
	8	
	9	
	9	
	6	
	5	
	3	
	4	
9.00	3	
	5	
	7	
	7	
	7	
	9	
	8	
	7	
	7	
	7	
10.00	7	

REMARKS: 1

CONTRACT Abbey Road, WBE

PROBE NUMBER: 3

DATE: 30.10.17

PAGE 1 of 1

Depth(m)	BLOWS (100mm)	DIAGRAM DPSH N100 VALUES
	0	
	2	
	1	
	3	
	2	
	2	
	2	
	2	
	1	
1.00	2	
	2	
	1	
	1	
	1	
	5	
	3	
	4	
	1	
2.00	1	
	4	
	2	
	14	
	6	
	3	
	2	
	2	
	3	
	4	
3.00	4	
	4	
	4	
	3	
	2	
	1	
	1	
	1	
4.00	2	
	3	
	3	
	4	
	3	
	3	
	2	
	2	
	4	
	2	
5.00	3	
	2	
	3	
	5	
	3	
	4	
	4	
	4	
	4	
	6	
	5	
6.00	5	
	7	
	6	
	6	
	3	
	9	
	6	
	4	
	4	
7.00	3	
	3	
	4	
	4	
	10	
	9	
	5	
	4	
	4	
8.00	5	
	7	
	5	
	6	
	5	
	5	
	5	
	6	
	4	
	4	
9.00	5	
	4	
	6	
	5	
	6	
	6	
	7	
	5	
	6	
	7	
10.00	8	
	10	
REMARKS: 1		PROBE NUMBER: 4
CONTRACT: Abbey Road, WIE		DATE: 30.10.17
		PAGE 1 of 1

TRIAL PIT 1

Depth (m)	Strata
0.00 – 0.90	Loose brown concrete slabs, masonry bricks plastic in a gravelly silty CLAY matrix with small fragments of timber and organic material (MADE GROUND)
0.90	Brick wall/Foundation

Notes

1. Unable to progress past 0.90m.
2. No groundwater seepage.





Trial Pit 1

TRIAL PIT 2

Depth (m)	Strata
0.00 – 1.40	Firm dark brown gravelly silty CLAY with old foundations (Brick) concrete cobble and boulder plastic and slightly organic (MADE GROUND)
1.40 – 2.30	Soft to firm red brown CLAY with traces of bricks (MADE GROUND)
2.30 – 2.80	Firm to stiff quickly becoming very stiff with grey fissures grey brown silty CLAY (GLACIAL TILL) HV 80kPa

Notes

1. Slight water seepage at 2.30m
2. Sides of pit stable.





Trial Pit 2

TRIAL PIT 3

Depth (m)	Strata
0.0 – 1.50	Soft to firm grey and brown CLAY with pockets of gravel, bricks, concrete and tarmac (MADE GROUND)
1.50 – 2.20	Stiff becoming very stiff brown with grey streaks silty CLAY (GLACIAL TILL) HV 105kPa
2.20 – 3.0	Soft grey moist CLAY (GLACIAL DEPOSITS)
3.0 – 3.50	Dark brown fibrous CLAY (PEAT)

Notes

1. Sides of pit stable.
2. Steady water seepage at 1.0m.
3. Water seepage from Peat as well.





Trial Pit 3

TRIAL PIT 4

Depth (m)	Strata
0.0 – 1.50	Soft to firm brown very gravelly CLAY, clay largely derived from glacial till, with bricks, concrete cobble and boulder, traces of wire and a layer of sub base at 0.70-0.80 (MADE GROUND)
1.50 – 1.80	Firm to stiff orange brown silty CLAY (Weathered GLACIAL TILL)

Notes

1. Sides of pit stable.
2. Old clay drain encountered at 1.20m
3. Large drain encountered at one end of pit at 1.80m, pit abandoned.





Trial Pit 4

TRIAL PIT 5

Depth (m)	Strata
0.00 – 1.60	Firm brown and red brown sandy very gravelly CLAY, mainly derived from glacial till, with bricks, concrete cobble and boulder, old concrete slab, tiles (MADE GROUND)
1.60 – 3.00	Stiff becoming firm to stiff with depth and then stiff again orange brown with grey streaks CLAY and one large boulder (GLACIAL TILL) HV >120kPa
3.00 – 3.20	Grey SAND (GLACIAL DEPOSITS)
3.20 – 3.60	Soft blue grey sandy CLAY with layers and pockets of brown peat (GLACIAL DEPOSITS)

Notes

1. Sand lens saturated.
2. Slight water seepage below 3.0m.
3. Sides of pit stable.





Trial Pit 5

TRIAL PIT 6

Depth (m)	Strata
0.00 – 0.15	Medium dense light grey sub angular fine to coarse GRAVEL (HARDCORE)
0.15 - 0.65	Stiff orange brown CLAY (Weathered GLACIAL TILL) HV 95kPa
0.65 – 1.70	Very stiff to hard red brown with grey streaks silty CLAY (GLACIAL TILL) HV 110kPa
1.70 – 2.80	Loose to medium dense brown silty fine to medium SAND with occasional layers of fine to medium gravel and clay (GLACIAL DEPOSITS)
2.80 – 3.20	Stiff brown with grey streaks silty CLAY (GLACIAL TILL) HV 105kPa

Notes

1. Slight seepage at base of sand
2. Sides of pit stable.





Trial Pit 6

TRIAL PIT 7

Depth (m)	Strata
0.00 – 0.70	Firm brown sandy very gravelly CLAY mainly derived from glacial till with a little cobble of brick and concrete (MADE GROUND)
0.70 – 0.85	Loose to medium dense light grey sub angular fine to coarse GRAVEL (HARDCORE)
0.85	Concrete

Notes

1. Pit abandoned on concrete.

TRIAL PIT 8

Depth (m)	Strata
0.00 – 0.70	Firm brown sandy very gravelly CLAY mainly derived from glacial till with a little cobble of brick and concrete (MADE ground)
0.70 – 0.85	Loose to medium dense light grey sub angular fine to coarse GRAVEL (HARDCORE)
0.85- 1.30	Loose Brick and cobble overlying Terram
1.30 - 2.60	Very Stiff to hard brown CLAY (GLACIAL TILL)

Notes

1. Unable to progress any deeper as clay too stiff.
2. High water flow from bricks below sub base, quickly ceased.





Trial Pit 8

TRIAL PIT 9

Depth (m)	Strata
0.00 – 1.30	Loose/loose to medium dense dark grey brown sandy fine to coarse GRAVEL with a little cobble and large pockets of firm brown clay (MADE GROUND)
1.30 - 1.70	Firm orange brown CLAY (Weathered GLACIAL TILL)
1.70 – 2.50	Stiff to very stiff brown mottled grey CLAY (GLACIAL TILL) HV > 120kPa

Notes

1. No groundwater seepage encountered, very slight seepage at base of made ground.
2. Sides of pit stable
3. Unable to penetrate any deeper





Trial Pit 9

APPENDIX F

Chemical Test Results



Ground Solve
Unit 1
Well House Barns
Chester Road
Bretton
Cheshire
CH4 0DH

Attention: Mike Scott

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

CERTIFICATE OF ANALYSIS

Date: 21 November 2017
Customer: H_GRSOLVE_BRE
Sample Delivery Group (SDG): 171104-40
Your Reference:
Location: ABBEY ROAD, WREXHAM
Report No: 433501

We received 4 samples on Wednesday November 01, 2017 and 4 of these samples were scheduled for analysis which was completed on Tuesday November 14, 2017. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).

Approved By:

Sonia McWhan
Operations Manager





CERTIFICATE OF ANALYSIS

Validated

SDG: 171104-40

Client Reference:

Report Number: 433501

Location:

ABBEY ROAD, WREXHAM

Order Number:

2023/mjs

Superseded Report:

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
16490508	TP1		0.00 - 0.90	30/10/2017
16490509	TP4		0.00 - 0.30	30/10/2017
16490510	TP7		0.00 - 0.50	30/10/2017
16490511	TP9		0.00 - 0.50	30/10/2017

Maximum Sample/Coolbox Temperature (°C) :

13.2

ISO5667-3 Water quality - Sampling - Part3 -

During Transportation samples shall be stored in a cooling device capable of maintaining a temperature of (5±3)°C

ALS have data which show that a cool box with 4 frozen icepacks is capable of maintaining pre-chilled samples at a temperature of (5±3)°C for a period of up to 24hrs.

Only received samples which have had analysis scheduled will be shown on the following pages.



CERTIFICATE OF ANALYSIS

Validated

SDG: 171104-40
Location: ABBEY ROAD, WREXHAM

Client Reference:
Order Number: 2023/mjs

Report Number: 433501
Superseded Report:

Results Legend			Lab Sample No(s)			
X Test N No Determination Possible			16490508	16490509	16490510	16490511
			TP1	TP4	TP7	TP9
			0.00 - 0.90	0.00 - 0.30	0.00 - 0.50	0.00 - 0.50
			250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)
			S	S	S	S
Arions by Kone (soil)	All	NDPs: 0 Tests: 4	X	X	X	X
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 4	X	X	X	X
Asbestos Quantification - Full	All	NDPs: 1 Tests: 0			N	
Chromium III	All	NDPs: 0 Tests: 4	X	X	X	X
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 4	X	X	X	X
Easily Liberated Sulphide	All	NDPs: 0 Tests: 4	X	X	X	X
Elemental Sulphur	All	NDPs: 0 Tests: 4	X	X	X	X
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 4	X	X	X	X
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 4	X	X	X	X
GRO by GC-FID (S)	All	NDPs: 0 Tests: 4	X	X	X	X
Hexavalent Chromium (v)	All	NDPs: 0 Tests: 4	X	X	X	X
Metals in solid samples by OES	All	NDPs: 0 Tests: 4	X	X	X	X
PAH by GC/MS	All	NDPs: 0 Tests: 4	X	X	X	X
pH	All	NDPs: 0 Tests: 4	X	X	X	X
Phenols by HPLC (S)	All	NDPs: 0 Tests: 4	X	X	X	X



CERTIFICATE OF ANALYSIS

Validated

SDG: 171104-40 Client Reference: Report Number: 433501
 Location: ABBEY ROAD, WREXHAM Order Number: 2023/mjs Superseded Report:

Results Legend			Lab Sample No(s)			
X Test N No Determination Possible			16490508	16490509	16490510	16490511
Customer Sample Reference			TP1	TP4	TP7	TP9
AGS Reference						
Depth (m)			0.00 - 0.90	0.00 - 0.30	0.00 - 0.50	0.00 - 0.50
Container			250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)	250g Amber Jar (ALE210)
Sample Type			S	S	S	S
Sample description			All	NDPs: 0 Tests: 4		
				X	X	X
Total Organic Carbon			All	NDPs: 0 Tests: 4		
				X	X	X
TPH CWG GC (S)			All	NDPs: 0 Tests: 4		
				X	X	X



CERTIFICATE OF ANALYSIS

Validated

SDG: 171104-40

Client Reference:

Report Number: 433501

Location: ABBEY ROAD, WREXHAM

Order Number: 2023/mjs

Superseded Report:

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm
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Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Inclusions	Inclusions 2
16490508	TP1	0.00 - 0.90	Dark Brown	Sandy Clay	Crushed Brick	N/A
16490509	TP4	0.00 - 0.30	Dark Brown	Sandy Clay	Crushed Brick	Stones
16490510	TP7	0.00 - 0.50	Dark Brown	Sandy Clay	Crushed Brick	Stones
16490511	TP9	0.00 - 0.50	Dark Brown	Sand	Crushed Brick	N/A

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.



CERTIFICATE OF ANALYSIS

Validated

SDG: 171104-40
Location: ABBEY ROAD, WREXHAMClient Reference:
Order Number: 2023/mjsReport Number: 433501
Superseded Report:

TPH CWG (S)

Results Legend			Customer Sample Ref		TP1	TP4	TP7	TP9		
#	ISO17025 accredited.		Depth (m)		0.00 - 0.30	0.00 - 0.30	0.00 - 0.50	0.00 - 0.50		
M	mCERTS accredited.		Sample Type		Soilsolid (S)	Soilsolid (S)	Soilsolid (S)	Soilsolid (S)		
aq	Aqueous / settled sample.		Date Sampled		30/10/2017	30/10/2017	30/10/2017	30/10/2017		
dis.filt	Dissolved / filtered sample.		Sample Time							
incun.filt	Total / unfiltered sample.		Date Received		01/11/2017	01/11/2017	01/11/2017	01/11/2017		
+	Subcontracted test.		SDG Ref		171104-40	171104-40	171104-40	171104-40		
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery		Lab Sample No. (N)		16400508	16400508	16400510	16400511		
(F)	Trigger breach confirmed.		AGS Reference							
1.54x50	Sample deviation (see appendix)									
Component	LOD/Units	Method								
GRO Surrogate % recovery**	%	TM089	61	75	80	73				
			2	2	2	2				
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089	<44	<44	<44	<44				
			2 M	2 M	2 M	2 M				
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089	<5	<5	<5	<5				
			2 #	2 #	2 #	2 #				
Benzene	<10 µg/kg	TM089	<10	<10	<10	<10				
			2 M	2 M	2 M	2 M				
Toluene	<2 µg/kg	TM089	<2	<2	<2	<2				
			2 M	2 M	2 M	2 M				
Ethylbenzene	<3 µg/kg	TM089	<3	<3	<3	<3				
			2 M	2 M	2 M	2 M				
m,p-Xylene	<6 µg/kg	TM089	<6	<6	<6	<6				
			2 M	2 M	2 M	2 M				
o-Xylene	<3 µg/kg	TM089	<3	<3	<3	<3				
			2 M	2 M	2 M	2 M				
sum of detected mpo xylene by GC	<9 µg/kg	TM089	<9	<9	<9	<9				
			2	2	2	2				
sum of detected BTEX by GC	<24 µg/kg	TM089	<24	<24	<24	<24				
			2	2	2	2				
Aliphatics >C5-C6	<10 µg/kg	TM089	<10	<10	<10	<10				
			2	2	2	2				
Aliphatics >C6-C8	<10 µg/kg	TM089	<10	<10	<10	<10				
			2	2	2	2				
Aliphatics >C8-C10	<10 µg/kg	TM089	<10	<10	<10	<10				
			2	2	2	2				
Aliphatics >C10-C12	<10 µg/kg	TM089	<10	<10	<10	<10				
			2	2	2	2				
Aliphatics >C12-C16	<100 µg/kg	TM173	948	168	3160	1250				
Aliphatics >C16-C21	<100 µg/kg	TM173	4790	1200	12400	2160				
Aliphatics >C21-C35	<100 µg/kg	TM173	67900	23300	84100	7130				
Aliphatics >C35-C44	<100 µg/kg	TM173	17800	14600	36200	2450				
Total Aliphatics >C12-C44	<100 µg/kg	TM173	91500	39200	136000	13000				
Aromatics >EC5-EC7	<10 µg/kg	TM089	<10	<10	<10	<10				
			2	2	2	2				
Aromatics >EC7-EC8	<10 µg/kg	TM089	<10	<10	<10	<10				
			2	2	2	2				
Aromatics >EC8-EC10	<10 µg/kg	TM089	<10	<10	<10	<10				
			2	2	2	2				
Aromatics >EC10-EC12	<10 µg/kg	TM089	<10	<10	<10	<10				
			2	2	2	2				
Aromatics >EC12-EC16	<100 µg/kg	TM173	1960	2900	1110	956				
Aromatics >EC16-EC21	<100 µg/kg	TM173	15600	12700	19300	4470				
Aromatics >EC21-EC35	<100 µg/kg	TM173	111000	95600	167000	21500				
Aromatics >EC35-EC44	<100 µg/kg	TM173	52400	54600	78200	8780				
Aromatics >EC40-EC44	<100 µg/kg	TM173	21000	22500	29500	3340				
Total Aromatics >EC12-EC44	<100 µg/kg	TM173	181000	166000	265000	35700				
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173	273000	205000	401000	48700				



CERTIFICATE OF ANALYSIS

Validated

SDG: 171104-40
Location: ABBEY ROAD, WREXHAM

Client Reference:
Order Number: 2023/mjs

Report Number: 433501
Superseded Report:

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP1 0.00 - 0.90 SOLID 30/10/2017 00:00:00 05/11/2017 08:03:50 171104-40 16490508 TM048	08/11/2017	Neville Mann	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP4 0.00 - 0.30 SOLID 30/10/2017 00:00:00 04/11/2017 16:24:54 171104-40 16490509 TM048	08/11/2017	Neville Mann	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP7 0.00 - 0.50 SOLID 30/10/2017 00:00:00 05/11/2017 08:15:10 171104-40 16490510 TM048	08/11/17	Neville Mann	Loose fibres in soil	Detected (#)	Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP9 0.00 - 0.50 SOLID 30/10/2017 00:00:00 04/11/2017 16:08:23 171104-40 16490511 TM048	08/11/2017	Neville Mann	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected



CERTIFICATE OF ANALYSIS

Validated

SDG: 171104-40 Client Reference: Report Number: 433501
Location: ABBEY ROAD, WREXHAM Order Number: 2023/mjs Superseded Report:

Notification of NDPs (No determination possible)

Date Received : 04/11/2017 08:35:48

Sample No	Customer Sample Ref.	Depth (m)	Test	Comment
16490510	TP7	0.00 - 0.50	Asbestos Quantification - Full	Insufficient Sample



CERTIFICATE OF ANALYSIS

Validated

SDG: 171104-40

Client Reference:

Report Number: 433501

Location:

ABBEY ROAD, WREXHAM

Order Number:

2023/mjs

Superseded Report:

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample *	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM062 (S)	National Grid Property Holdings: Methods for the Collection & Analysis of Samples from National Grid Sites version 1 Sec 3.9	Determination of Phenols in Soils by HPLC		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990, BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM136	Method 17.10, Second Site property, March 2003	Determination of Sulphur by HPLC		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media - Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM180	Sulphide in waters and waste waters 1991 ISBN 01 175 7186 SCA rec. 2007 (unpublished)	The Determination Of Easily Liberated Sulphide In Soil Samples by Ion Selective Electrode Technique		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM218	Determination of PAH by GCMS Microwave extraction	The determination of PAH in soil samples by microwave extraction and GC-MS		
TM243		Mixed Anions In Soils By Kone		

* Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).



CERTIFICATE OF ANALYSIS

Validated

SDG: 171104-40
Location: ABBEY ROAD, WREXHAM

Client Reference:
Order Number: 2023/mjs

Report Number: 433501
Superseded Report:

Test Completion Dates

Lab Sample No(s)	16490508	16490509	16490510	16490511
Customer Sample Ref.	171	174	177	179
AGS Ref.				
Depth	0.00 - 0.90	0.00 - 0.30	0.00 - 0.50	0.00 - 0.50
Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Anions by Kone (soil)	08-Nov-2017	08-Nov-2017	08-Nov-2017	08-Nov-2017
Asbestos ID in Solid Samples	08-Nov-2017	08-Nov-2017	08-Nov-2017	08-Nov-2017
Chromium III	09-Nov-2017	09-Nov-2017	09-Nov-2017	09-Nov-2017
Cyanide Comp/Free/Total/Thiocyanate	08-Nov-2017	08-Nov-2017	08-Nov-2017	08-Nov-2017
Easily Liberated Sulphide	10-Nov-2017	10-Nov-2017	09-Nov-2017	10-Nov-2017
Elemental Sulphur	09-Nov-2017	09-Nov-2017	09-Nov-2017	09-Nov-2017
EPH CWG (Aliphatic) GC (S)	09-Nov-2017	09-Nov-2017	09-Nov-2017	09-Nov-2017
EPH CWG (Aromatic) GC (S)	09-Nov-2017	09-Nov-2017	09-Nov-2017	09-Nov-2017
GRO by GC-FID (S)	09-Nov-2017	09-Nov-2017	09-Nov-2017	09-Nov-2017
Hexavalent Chromium (x)	08-Nov-2017	08-Nov-2017	08-Nov-2017	08-Nov-2017
Metals in solid samples by OES	09-Nov-2017	09-Nov-2017	09-Nov-2017	14-Nov-2017
PAH by GCMS	08-Nov-2017	08-Nov-2017	08-Nov-2017	08-Nov-2017
pH	08-Nov-2017	08-Nov-2017	08-Nov-2017	08-Nov-2017
Phenols by HPLC (S)	09-Nov-2017	09-Nov-2017	09-Nov-2017	08-Nov-2017
Sample description	05-Nov-2017	05-Nov-2017	05-Nov-2017	04-Nov-2017
Total Organic Carbon	14-Nov-2017	14-Nov-2017	14-Nov-2017	14-Nov-2017
TPH CWG GC (S)	09-Nov-2017	09-Nov-2017	09-Nov-2017	09-Nov-2017



CERTIFICATE OF ANALYSIS

SDG: 171104-40
Location: ABBEY ROAD, WREXHAM

Client Reference:
Order Number: 2023/mjs

Report Number: 433501
Superseded Report:

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH₄ by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unusable sample

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix effect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

21. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GC/FID/GCMS and all subcontracted analysis.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GC/FID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

Sample Deviations

If a sample is classed as deviated then the associated results may be compromised

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
S	Sampled on date not provided
h	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

APPENDIX G

Physical Test Results

Form REP008 Rev 1



Schiano

#REF!

Project No: PC176945

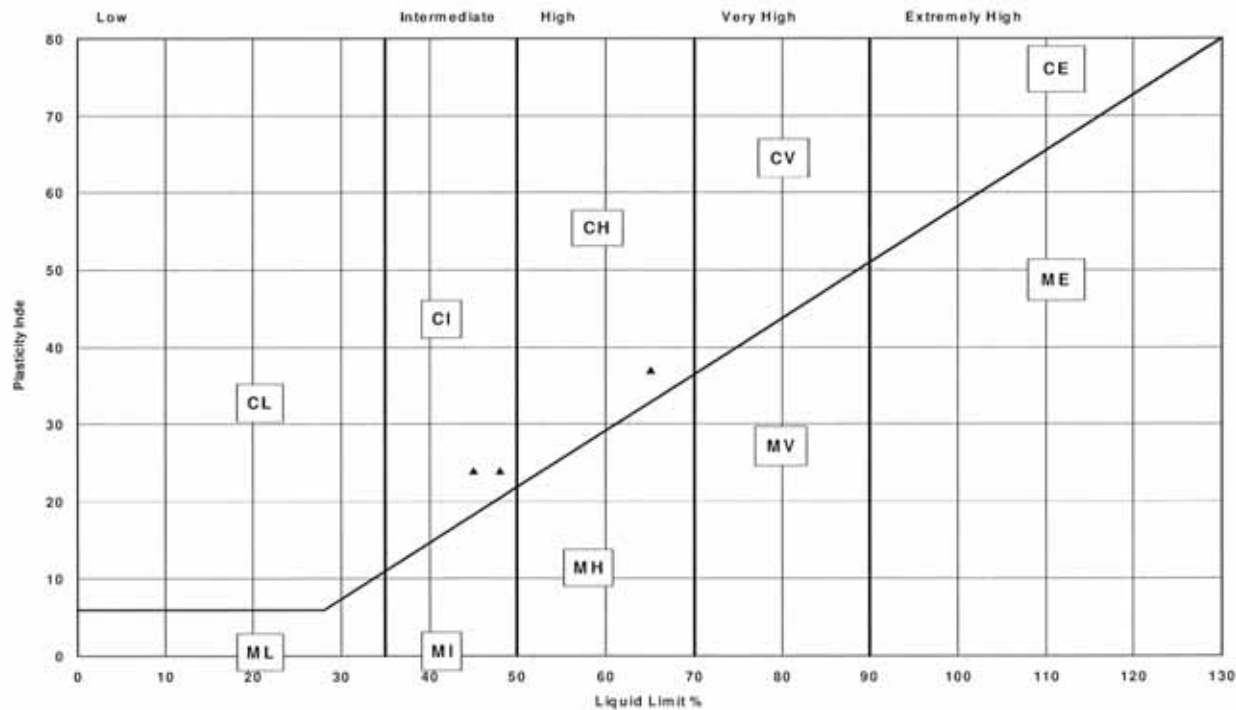
Remarks  Tests performed in accordance with BS 1377: Part 3: 1990
Sulphate reported as SO₃, results in brackets reported as SO₄

LABORATORY RESULTS - Classification Chart

Project: ABBEY ROAD, WREXHAM

Project No: PC176945

PLOT OF PLASTICITY INDEX AGAINST LIQUID LIMIT
for all items tested



Soil Type	Plasticity Characteristics
C Clay	L Low
	I Intermediate
M Silt	H High
	V Very High
	E Extremely High

Table of Soil Types and Plasticity Characteristics from BS 5930 : 1999

Remarks

14/11/2017

Project No: PC176945

GEOTECHNICS
geotechnical and geoenvironmental specialists

APPENDIX H

CBR Results



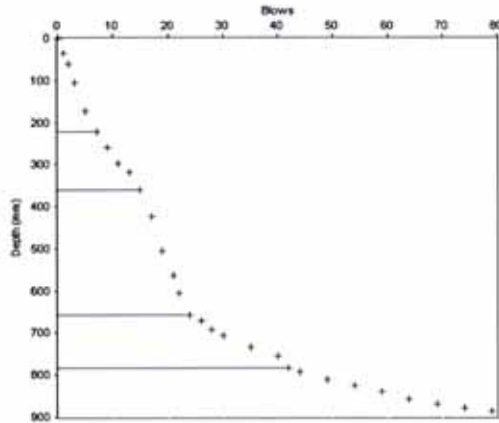
Dynamic Cone Penetrometer Strength Analysis Report

Site: ABBEY ROAD NORTH
 Location: DCP1
 Cone Angle: 60 degrees
 Zero Error: 55
 Test Date: 30/10/2017

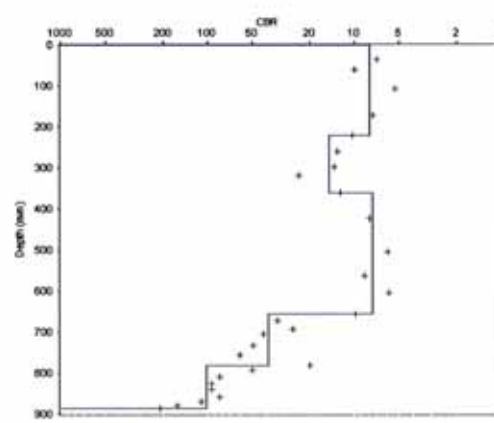
Job Number: CCG-C-17-9966
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	55	0	21	2	42	837	13.0
2	1	1	90	35.0	22	2	44	848	5.5
3	1	2	115	25.0	23	5	49	865	3.4
4	1	3	161	46.0	24	5	54	880	3.0
5	2	5	227	33.0	25	5	59	895	3.0
6	2	7	276	24.5	26	5	64	912	3.4
7	2	9	315	19.5	27	5	69	925	2.6
8	2	11	352	18.5	28	5	74	934	1.8
9	2	13	374	11.0	29	5	79	941	1.4
10	2	15	415	20.5					
11	2	17	478	31.5					
12	2	19	560	41.0					
13	2	21	618	29.0					
14	1	22	660	42.0					
15	2	24	711	25.5					
16	2	26	727	8.0					
17	2	28	747	10.0					
18	2	30	760	6.5					
19	5	35	788	5.6					
20	5	40	811	4.6					

Layer Boundaries: Chiraga 1.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	8	221	221		
2	15	139	360		
3	8	296	656		
4	39	126	782		
5	101	104	886		

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL. (MADE GROUND)

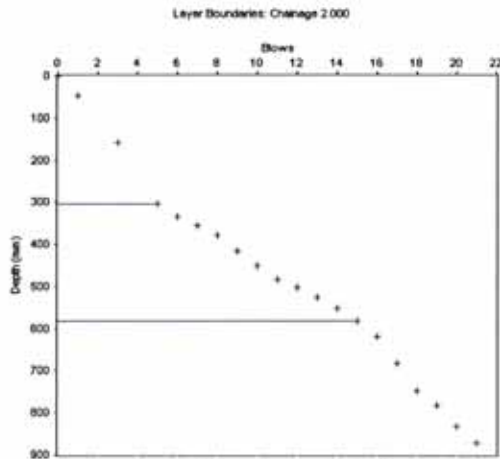


Dynamic Cone Penetrometer Strength Analysis Report

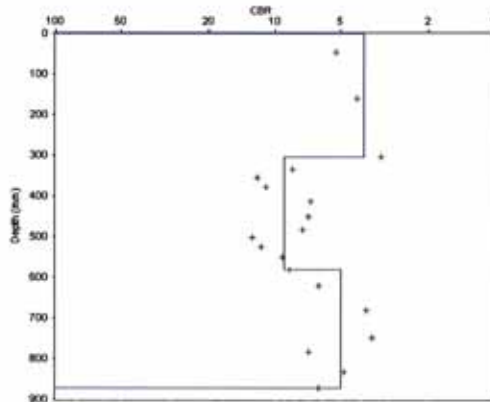
Site: ABBEY ROAD NORTH
 Location: DCP2
 Cone Angle: 60 degrees
 Zero Error: 75
 Test Date: 30/10/2017

Job Number: CCG-C-17-9966
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	75	0					
2	1	1	121	46.0					
3	2	3	235	57.0					
4	2	5	380	72.5					
5	1	6	410	30.0					
6	1	7	431	21.0					
7	1	8	454	23.0					
8	1	9	490	36.0					
9	1	10	525	35.0					
10	1	11	558	33.0					
11	1	12	578	20.0					
12	1	13	600	22.0					
13	1	14	627	27.0					
14	1	15	656	29.0					
15	1	16	695	39.0					
16	1	17	757	62.0					
17	1	18	823	66.0					
18	1	19	858	35.0					
19	1	20	908	50.0					
20	1	21	947	39.0					



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	4	305	305		
2	9	276	581		
3	5	291	872		

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL. (MADE GROUND)



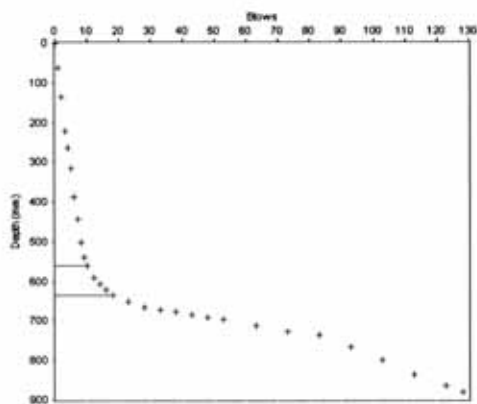
Dynamic Cone Penetrometer Strength Analysis Report

Site: ABBEY ROAD NORTH
 Location: DCP3
 Cone Angle: 60 degrees
 Zero Error: 60
 Test Date: 30/10/2017

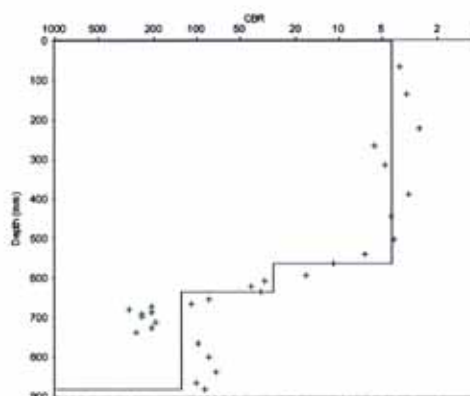
Job Number: CCG-C-17-9966
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	60	0	21	5	48	751	1.2
2	1	1	124	64.0	22	5	53	757	1.2
3	1	2	195	71.0	23	10	63	772	1.5
4	1	3	281	86.0	24	10	73	786	1.4
5	1	4	324	43.0	25	10	83	797	1.1
6	1	5	375	51.0	26	10	93	826	2.9
7	1	6	448	73.0	27	10	103	860	3.4
8	1	7	504	56.0	28	10	113	898	3.8
9	1	8	562	58.0	29	10	123	926	2.8
10	1	9	599	37.0	30	5	128	942	3.2
11	1	10	622	23.0					
12	2	12	652	15.0					
13	2	14	668	8.0					
14	2	16	681	6.5					
15	2	18	696	7.5					
16	5	23	713	3.4					
17	5	28	726	2.6					
18	5	33	733	1.4					
19	5	38	738	1.0					
20	5	43	745	1.4					

Layer Boundaries: Change 3.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	4	562	562		
2	29	74	636		
3	129	246	882		

CBR Derived by TDR equation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL, (MADE GROUND)

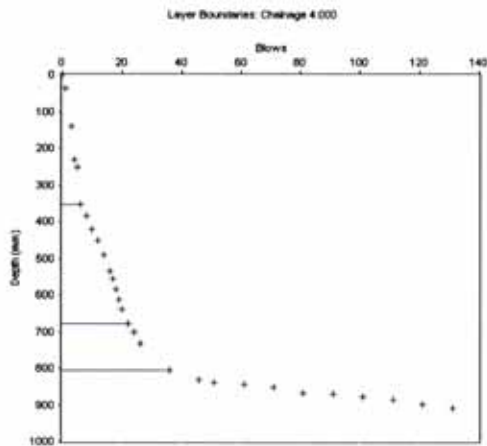


Dynamic Cone Penetrometer Strength Analysis Report

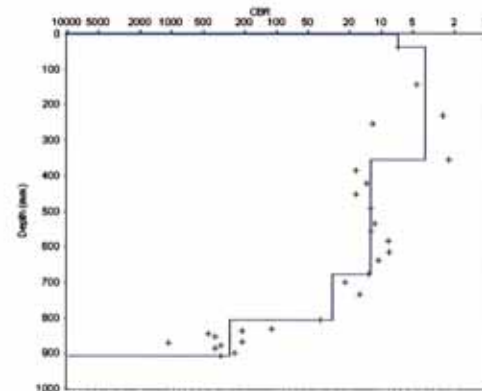
Site: ABBEY ROAD NORTH
Location: DCP4
Cone Angle: 60 degrees
Zero Error: 57
Test Date: 30/10/2017

Job Number: CCG-C-17-9966
Surface Type: -
Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	57	0	21	5	51	895	1.4
2	1	1	93	36.0	22	10	61	902	0.7
3	2	3	198	52.5	23	10	71	910	0.8
4	1	4	288	90.0	24	10	81	924	1.4
5	1	5	309	21.0	25	10	91	927	0.3
6	1	6	411	102.0	26	10	101	936	0.9
7	2	8	441	15.0	27	10	111	944	0.8
8	2	10	478	18.5	28	10	121	956	1.2
9	2	12	508	15.0	29	10	131	965	0.9
10	2	14	548	20.0					
11	2	16	592	22.0					
12	1	17	612	20.0					
13	1	18	641	29.0					
14	1	19	671	30.0					
15	1	20	695	24.0					
16	2	22	734	19.5					
17	2	24	758	12.0					
18	2	26	790	16.0					
19	10	36	862	7.2					
20	10	46	888	2.6					



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	7	36	36		
2	4	318	354		
3	13	323	677		
4	29	128	805		
5	277	103	908		

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL, (MADE GROUND)



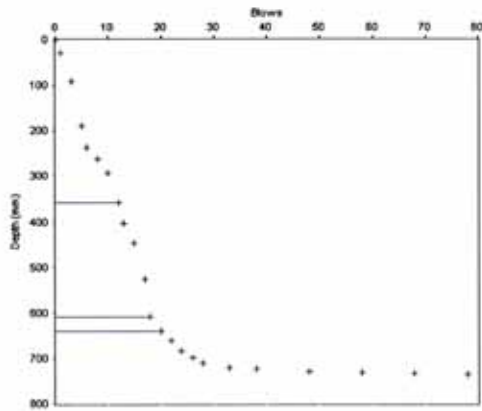
Dynamic Cone Penetrometer Strength Analysis Report

Site: ABBEY ROAD NORTH
Location: DCP5
Cone Angle: 60 degrees
Zero Error: 62
Test Date: 30/10/2017

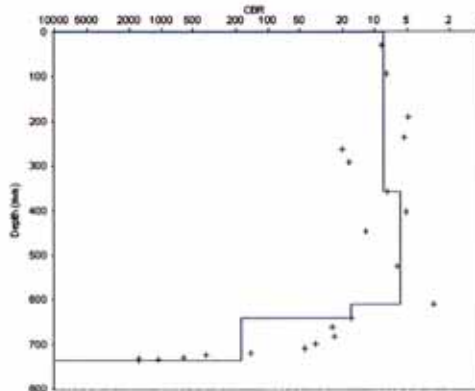
Job Number: CCG-C-17-9966
Surface Type: -
Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	62	0	21	10	58	793	0.2
2	1	1	91	29.0	22	10	68	796	0.3
3	2	3	154	31.5	23	10	78	798	0.2
4	2	5	252	49.0					
5	1	6	298	46.0					
6	2	8	324	13.0					
7	2	10	354	15.0					
8	2	12	419	32.5					
9	1	13	466	47.0					
10	2	15	508	21.0					
11	2	17	587	39.5					
12	1	18	671	84.0					
13	2	20	702	15.5					
14	2	22	723	10.5					
15	2	24	745	11.0					
16	2	26	760	7.5					
17	2	28	772	6.0					
18	5	33	782	2.0					
19	5	38	786	0.8					
20	10	48	791	0.5					

Layer Boundaries: Change 5.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	8	357	357		
2	6	252	609		
3	17	31	640		
4	177	96	730		

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL. (MADE GROUND)



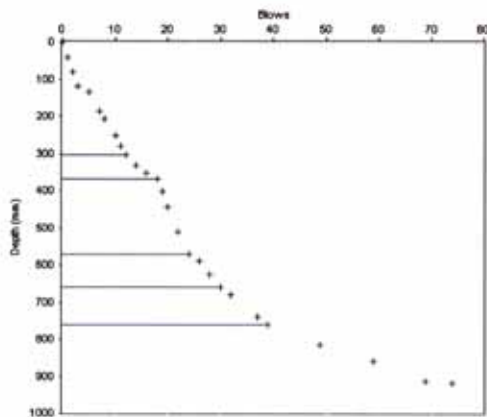
Dynamic Cone Penetrometer Strength Analysis Report

Site: ABBEY ROAD NORTH
Location: DCP6
Cone Angle: 60 degrees
Zero Error: 55
Test Date: 30/10/2017

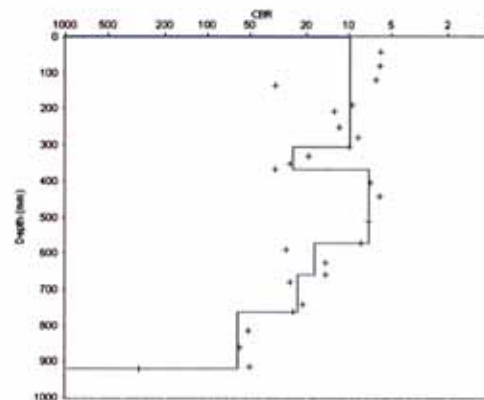
Job Number: CCG-C-17-9966
Surface Type: -
Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	55	0	21	2	32	735	10.0
2	1	1	96	41.0	22	5	37	796	12.2
3	1	2	136	40.0	23	2	39	817	10.5
4	1	3	174	38.0	24	10	49	870	5.3
5	2	5	190	8.0	25	10	59	916	4.6
6	2	7	243	26.5	26	10	69	970	5.4
7	1	8	263	20.0	27	5	74	975	1.0
8	2	10	306	21.5					
9	1	11	335	29.0					
10	1	12	360	25.0					
11	2	14	387	13.5					
12	2	16	407	10.0					
13	2	18	423	8.0					
14	1	19	458	35.0					
15	1	20	498	40.0					
16	2	22	566	34.0					
17	2	24	626	30.0					
18	2	26	645	9.5					
19	2	28	680	17.5					
20	2	30	715	17.5					

Layer Boundaries: Change 0.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	10	305	305		
2	25	63	368		
3	7	203	571		
4	17	89	660		
5	23	102	762		
6	61	158	920		

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL. (MADE GROUND)



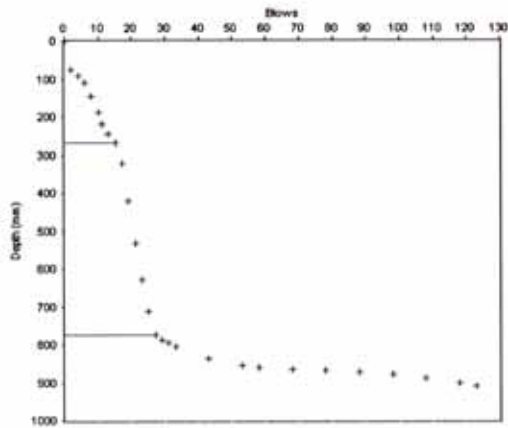
Dynamic Cone Penetrometer Strength Analysis Report

Site: ABBEY ROAD NORTH
 Location: DCP7
 Cone Angle: 60 degrees
 Zero Error: 60
 Test Date: 30/10/2017

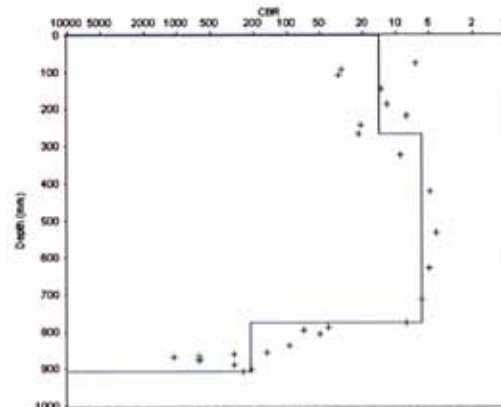
Job Number: CCG-C-17-9966
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	60	0	21	5	58	920	1.0
2	2	2	135	37.5	22	10	68	925	0.5
3	2	4	152	8.5	23	10	78	928	0.3
4	2	6	168	8.0	24	10	88	933	0.5
5	2	8	205	18.5	25	10	98	938	0.5
6	2	10	247	21.0	26	10	108	948	1.0
7	1	11	278	31.0	27	10	118	962	1.4
8	2	13	303	12.5	28	5	123	968	1.2
9	2	15	327	12.0					
10	2	17	382	27.5					
11	2	19	480	49.0					
12	2	21	592	56.0					
13	2	23	688	48.0					
14	2	25	772	42.0					
15	2	27	834	31.0					
16	2	29	847	6.5					
17	2	31	855	4.0					
18	2	33	866	5.5					
19	10	43	896	3.0					
20	10	53	915	1.9					

Layer Boundaries: Change 7.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	14	267	267		
2	6	507	774		
3	212	134	908		

CBR Derived by TDR equation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL. (MADE GROUND)



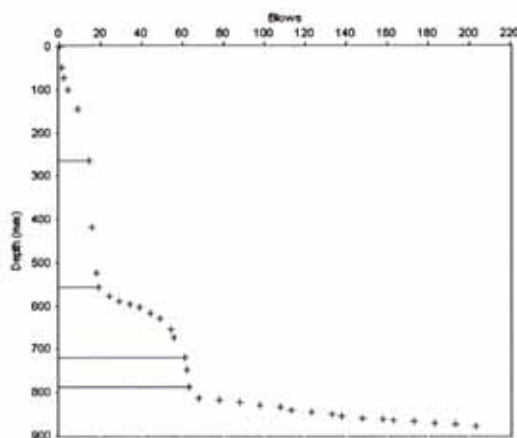
Dynamic Cone Penetrometer Strength Analysis Report

Site: ABBEY ROAD NORTH
Location: DCP8
Cone Angle: 60 degrees
Zero Error: 61
Test Date: 30/10/2017

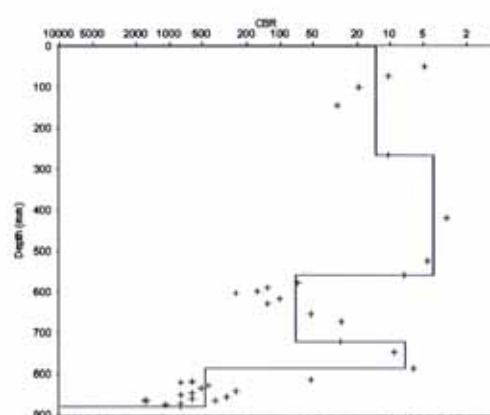
Job Number: CCG-C-17-9966
Surface Type: -
Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	61	0	21	5	68	874	5.2
2	1	1	110	49.0	22	10	78	879	0.5
3	1	2	134	24.0	23	10	88	883	0.4
4	2	4	161	13.5	24	10	98	890	0.7
5	5	9	205	8.8	25	10	108	896	0.6
6	5	14	325	24.0	26	5	113	902	1.2
7	2	16	480	77.5	27	10	123	907	0.5
8	2	18	585	52.5	28	10	133	911	0.4
9	1	19	618	33.0	29	5	138	916	1.0
10	5	24	638	4.0	30	10	148	921	0.5
11	5	29	649	2.2	31	10	158	923	0.2
12	5	34	658	1.8	32	5	163	927	0.8
13	5	39	664	1.2	33	10	173	929	0.2
14	5	44	678	2.8	34	10	183	933	0.4
15	5	49	689	2.2	35	10	193	936	0.3
16	5	54	715	5.2	36	10	203	940	0.4
17	2	56	734	9.5					
18	5	61	781	9.4					
19	1	62	808	27.0					
20	1	63	848	40.0					

Layer Boundaries: Chnage 8.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	14	264	264		
2	4	293	557		
3	72	163	720		
4	7	67	787		
5	471	92	879		

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL. (MADE GROUND)



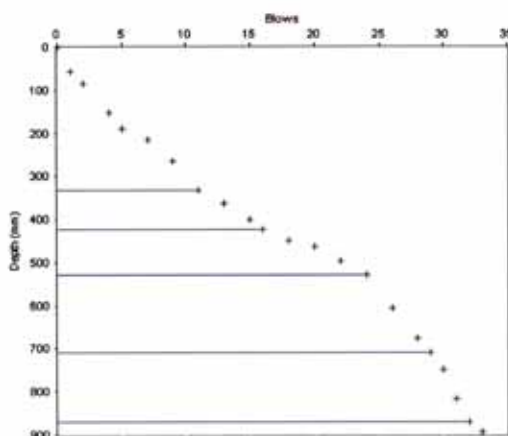
Dynamic Cone Penetrometer Strength Analysis Report

Site: ABBEY ROAD NORTH
 Location: DCP9
 Cone Angle: 60 degrees
 Zero Error: 63
 Test Date: 30/10/2017

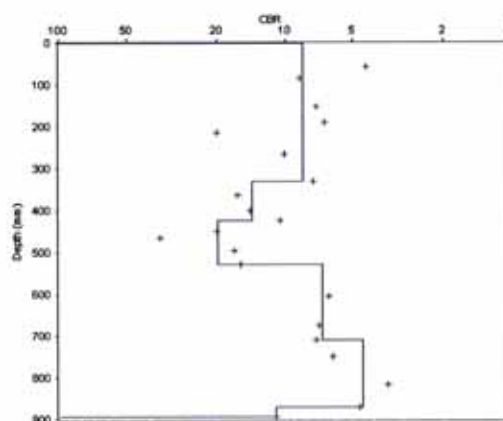
Job Number: CCG-C-17-9966
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	63	0	21	1	32	932	52.0
2	1	1	118	55.0	22	1	33	955	23.0
3	1	2	147	29.0					
4	2	4	215	34.0					
5	1	5	252	37.0					
6	2	7	278	13.0					
7	2	9	328	25.0					
8	2	11	394	33.0					
9	2	13	426	16.0					
10	2	15	462	18.0					
11	1	16	486	24.0					
12	2	18	512	13.0					
13	2	20	527	7.5					
14	2	22	558	15.5					
15	2	24	591	16.5					
16	2	26	668	38.5					
17	2	28	738	35.0					
18	1	29	772	34.0					
19	1	30	812	40.0					
20	1	31	880	68.0					

Layer Boundaries: Chirnage 9.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	8	331	331		
2	14	92	423		
3	20	105	528		
4	7	181	709		
5	5	160	869		
6	11	23	892		

CBR Derived by TDR equation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL. (MADE GROUND)



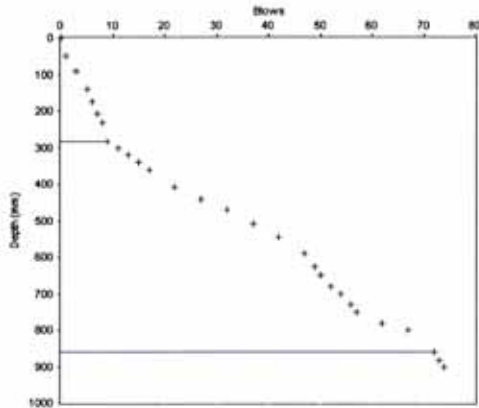
Dynamic Cone Penetrometer Strength Analysis Report

Site: ABBEY ROAD NORTH
 Location: DCP10
 Cone Angle: 60 degrees
 Zero Error: 55
 Test Date: 30/10/2017

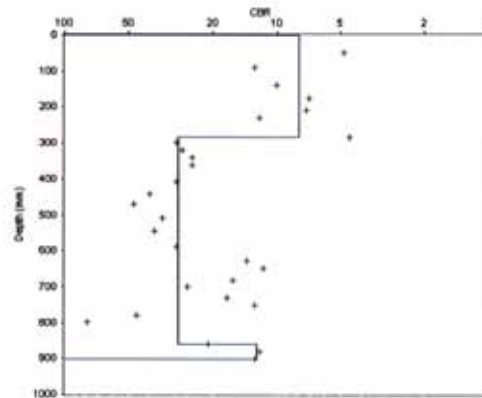
Job Number: CCG-C-17-9966
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	55	0	21	2	52	736	16.0
2	1	1	105	50.0	22	2	54	756	10.0
3	2	3	145	20.0	23	2	56	786	15.0
4	2	5	195	25.0	24	1	57	806	20.0
5	1	6	230	35.0	25	5	62	836	6.0
6	1	7	264	34.0	26	5	67	854	3.6
7	1	8	285	21.0	27	5	72	916	12.4
8	1	9	338	53.0	28	1	73	937	21.0
9	2	11	356	9.0	29	1	74	957	20.0
10	2	13	375	9.5					
11	2	15	396	10.5					
12	2	17	417	10.5					
13	5	22	462	9.0					
14	5	27	496	6.8					
15	5	32	525	5.8					
16	5	37	564	7.8					
17	5	42	600	7.2					
18	5	47	645	9.0					
19	2	49	682	18.5					
20	1	50	704	22.0					

Layer Boundaries: Chisage 10.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	8	283	283		
2	29	578	861		
3	12	41	902		

CBR Derived by TDR equation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL. (MADE GROUND)



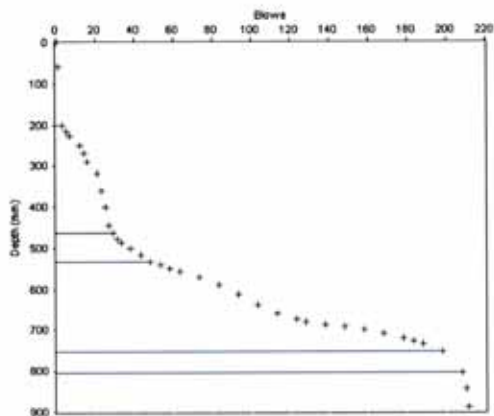
Dynamic Cone Penetrometer Strength Analysis Report

Site: ABBEY ROAD NORTH
Location: DCP11
Cone Angle: 60 degrees
Zero Error: 64
Test Date: 30/10/2017

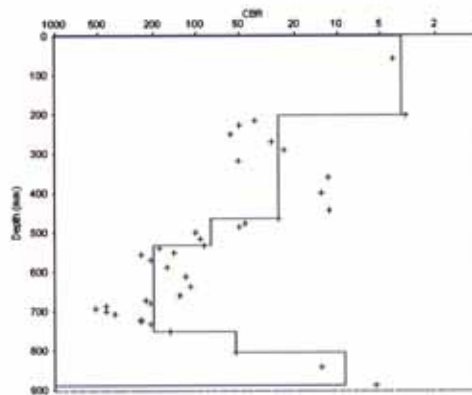
Job Number: CCG-C-17-9966
Surface Type: -
Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	64	0	21	5	63	620	1.2
2	1	1	123	59.0	22	10	73	634	1.4
3	2	3	266	71.5	23	10	83	652	1.8
4	2	5	280	7.0	24	10	93	676	2.4
5	2	7	291	5.5	25	10	103	702	2.6
6	5	12	315	4.8	26	10	113	724	2.2
7	2	14	333	9.0	27	10	123	737	1.3
8	2	16	355	11.0	28	5	128	744	1.4
9	5	21	382	5.4	29	10	138	751	0.7
10	2	23	425	21.5	30	10	148	757	0.6
11	2	25	464	19.5	31	10	158	764	0.7
12	2	27	508	22.0	32	10	168	772	0.8
13	2	29	528	10.0	33	10	178	784	1.2
14	2	31	540	6.0	34	5	183	790	1.2
15	2	33	551	5.5	35	5	188	797	1.4
16	5	38	565	2.8	36	10	198	816	1.9
17	5	43	580	3.0	37	10	208	868	5.2
18	5	48	596	3.2	38	2	210	907	19.5
19	5	53	604	1.6	39	1	211	952	45
20	5	58	614	2.0					

Layer Boundaries: Change 11.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	4	202	202		
2	26	262	464		
3	78	68	532		
4	201	220	752		
5	53	52	804		
6	9	84	888		

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL. (MADE GROUND)



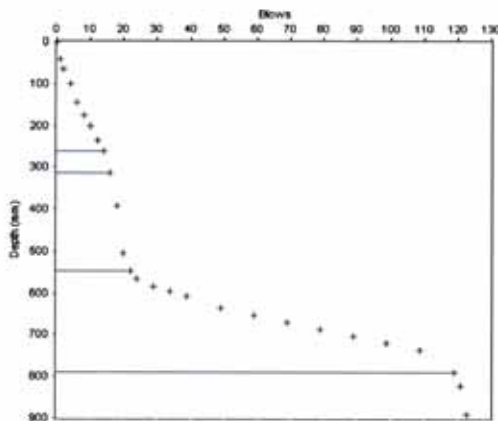
Dynamic Cone Penetrometer Strength Analysis Report

Site: ABBEY ROAD NORTH
 Location: DCP12
 Cone Angle: 60 degrees
 Zero Error: 60
 Test Date: 30/10/2017

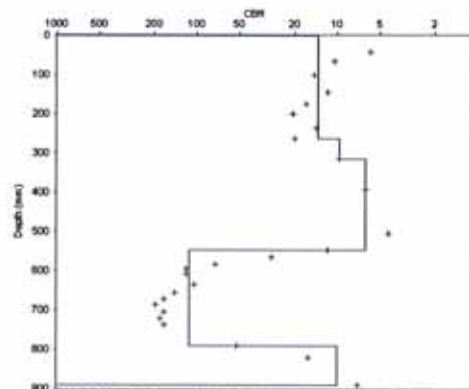
Job Number: CCG-C-17-9966
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	60	0	21	10	79	747	1.5
2	1	1	102	42.0	22	10	89	764	1.7
3	1	2	126	24.0	23	10	99	780	1.6
4	2	4	161	17.5	24	10	109	797	1.7
5	2	6	204	21.5	25	10	119	850	5.3
6	2	8	235	15.5	26	2	121	882	16.0
7	2	10	260	12.5	27	2	123	951	34.5
8	2	12	296	18.0					
9	2	14	322	13.0					
10	2	16	374	26.0					
11	2	18	452	39.0					
12	2	20	564	56.0					
13	2	22	607	21.5					
14	2	24	625	9.0					
15	5	29	644	3.8					
16	5	34	656	2.4					
17	5	39	668	2.4					
18	10	49	695	2.7					
19	10	59	715	2.0					
20	10	69	732	1.7					

Layer Boundaries: Change 60.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	14	262	262		
2	10	52	314		
3	6	233	547		
4	114	243	790		
5	10	101	891		

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL. (MADE GROUND)



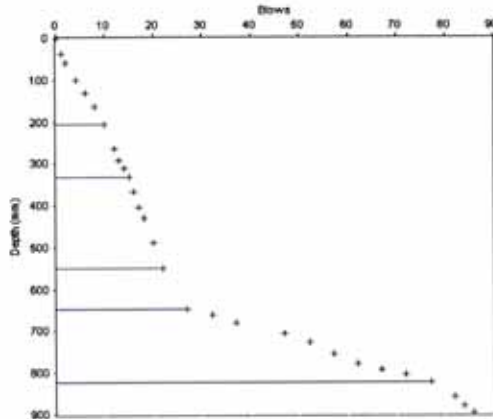
Dynamic Cone Penetrometer Strength Analysis Report

Site: ABBEY ROAD NORTH
Location: DCP13
Cone Angle: 60 degrees
Zero Error: 52
Test Date: 30/10/2017

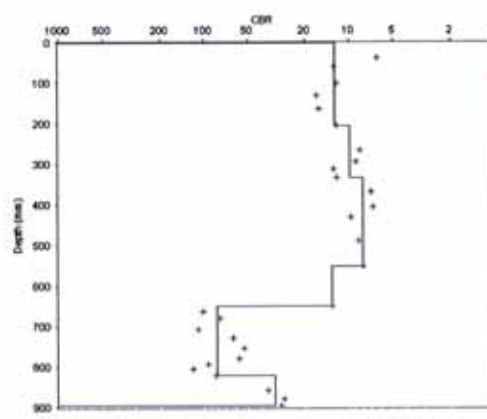
Job Number: CCG-C-17-9966
Surface Type: -
Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	52	0	21	5	52	780	4.4
2	1	1	90	38.0	22	5	57	806	5.2
3	1	2	110	20.0	23	5	62	830	4.8
4	2	4	152	21.0	24	5	67	845	3.0
5	2	6	183	15.5	25	5	72	857	2.4
6	2	8	215	16.0	26	5	77	874	3.4
7	2	10	257	21.0	27	5	82	911	7.4
8	2	12	316	29.5	28	2	84	930	9.5
9	1	13	344	28.0	29	2	86	948	9.0
10	1	14	364	20.0					
11	1	15	385	21.0					
12	1	16	420	35.0					
13	1	17	456	36.0					
14	1	18	482	26.0					
15	2	20	540	29.0					
16	2	22	602	31.0					
17	5	27	700	19.6					
18	5	32	714	2.8					
19	5	37	732	3.6					
20	10	47	758	2.6					

Layer Boundaries: Chaining 13.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	12	205	205		
2	10	128	333		
3	8	217	550		
4	13	98	648		
5	81	174	822		
6	33	74	896		

CBR Derived by TDR equation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL. (MADE GROUND)



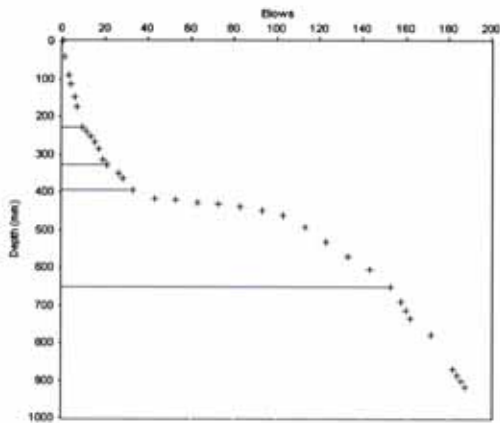
Dynamic Cone Penetrometer Strength Analysis Report

Site: ABBEY ROAD NORTH
 Location: DCP14
 Cone Angle: 60 degrees
 Zero Error: 42
 Test Date: 30/10/2017

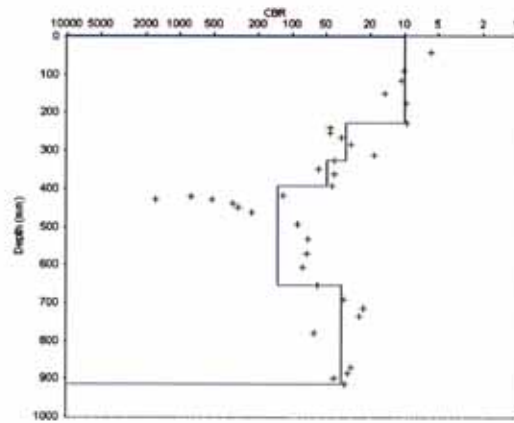
Job Number: CCG-C-17-9966
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	42	0	21	10	83	481	0.9
2	1	1	84	42.0	22	10	93	491	1.0
3	2	3	133	24.5	23	10	103	504	1.3
4	1	4	157	24.0	24	10	113	536	3.2
5	2	6	191	17.0	25	10	123	575	3.9
6	1	7	217	26.0	26	10	133	613	3.8
7	2	9	270	26.5	27	10	143	648	3.5
8	2	11	282	6.0	28	10	153	695	4.7
9	2	13	294	6.0	29	5	158	734	7.8
10	2	15	309	7.5	30	2	160	757	11.5
11	2	17	327	9.0	31	2	162	778	10.5
12	2	19	355	14.0	32	10	172	822	4.4
13	2	21	368	6.5	33	10	182	912	9
14	5	26	392	4.8	34	2	184	929	8.5
15	2	28	405	6.5	35	2	186	942	6.5
16	5	33	436	6.2	36	2	188	958	8
17	10	43	460	2.4					
18	10	53	464	0.4					
19	10	63	470	0.6					
20	10	73	472	0.2					

Layer Boundaries: Change 14.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	10	228	228		
2	33	98	326		
3	48	68	394		
4	134	259	653		
5	36	263	916		

CBR Derived by TDR equation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL. (MADE GROUND)



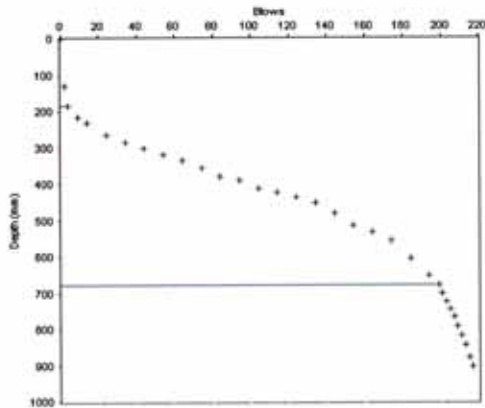
Dynamic Cone Penetrometer Strength Analysis Report

Site: ABBEY ROAD NORTH
 Location: DCP15
 Cone Angle: 60 degrees
 Zero Error: 51
 Test Date: 30/10/2017

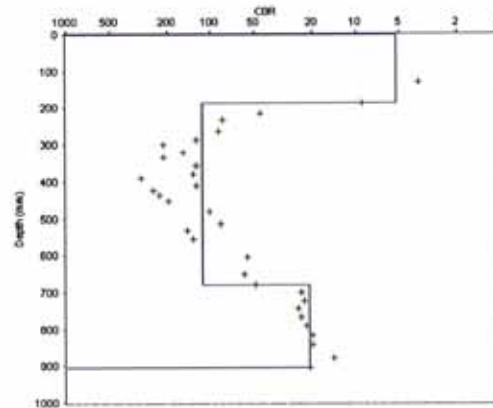
Job Number: CCG-C-17-9966
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	51	0	21	10	174	606	2.2
2	2	2	181	65.0	22	10	184	655	4.9
3	2	4	236	27.5	23	10	194	702	4.7
4	5	9	266	6.0	24	5	199	730	5.6
5	5	14	283	3.4	25	2	201	752	11.0
6	10	24	315	3.2	26	2	203	775	11.5
7	10	34	338	2.3	27	2	205	796	10.5
8	10	44	352	1.4	28	2	207	818	11.0
9	10	54	371	1.9	29	2	209	842	12.0
10	10	64	385	1.4	30	2	211	868	13
11	10	74	408	2.3	31	2	213	894	13
12	10	84	430	2.2	32	2	215	930	18
13	10	94	440	1.0	33	2	217	955	12.5
14	10	104	463	2.3					
15	10	114	475	1.2					
16	10	124	488	1.3					
17	10	134	503	1.5					
18	10	144	531	2.8					
19	10	154	564	3.3					
20	10	164	584	2.0					

Layer Boundaries: Coverage 15.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	5	185	185		
2	113	494	679		
3	21	225	904		

CBR Derived by TDR equation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL. (MADE GROUND)



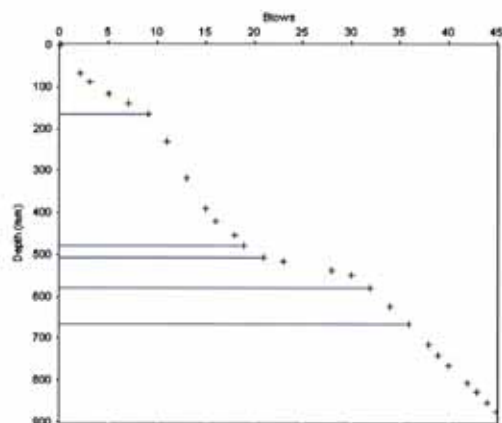
Dynamic Cone Penetrometer Strength Analysis Report

Site: ABBEY ROAD NORTH
 Location: DCP16
 Cone Angle: 60 degrees
 Zero Error: 77
 Test Date: 30/10/2017

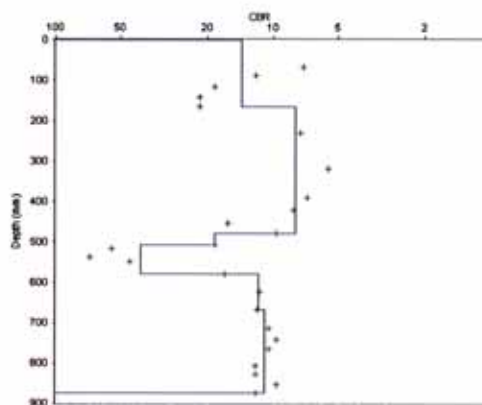
Job Number: CCG-C-17-9966
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	77	0	21	1	39	818	26.0
2	2	2	145	34.0	22	1	40	842	24.0
3	1	3	166	21.0	23	2	42	884	21.0
4	2	5	194	14.0	24	1	43	905	21.0
5	2	7	218	12.0	25	1	44	931	26.0
6	2	9	242	12.0	26	1	45	952	21.0
7	2	11	308	33.0					
8	2	13	396	44.0					
9	2	15	467	35.5					
10	1	16	498	31.0					
11	2	18	530	16.0					
12	1	19	556	26.0					
13	2	21	584	14.0					
14	2	23	594	5.0					
15	5	28	614	4.0					
16	2	30	626	6.0					
17	2	32	657	15.5					
18	2	34	701	22.0					
19	2	36	744	21.5					
20	2	38	792	24.0					

Layer Boundaries: Change 16 000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	14	165	165		
2	8	314	479		
3	19	28	507		
4	41	73	580		
5	12	87	667		
6	11	208	875		

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL. (MADE GROUND)



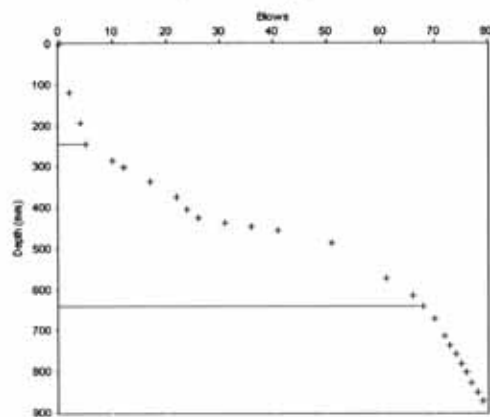
Dynamic Cone Penetrometer Strength Analysis Report

Site: ABBEY ROAD NORTH
 Location: DCP17
 Cone Angle: 60 degrees
 Zero Error: 85
 Test Date: 30/10/2017

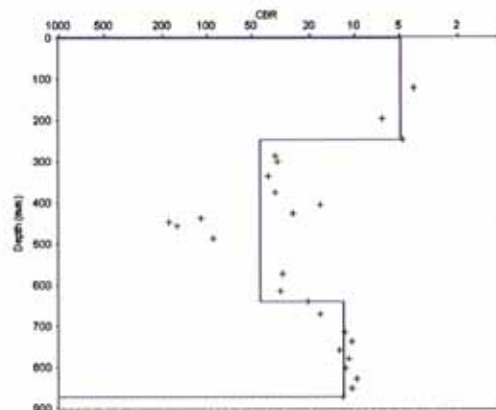
Job Number: CCG-C-17-9966
 Surface Type: -
 Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	85	0	21	1	74	842	20.0
2	2	2	205	60.0	22	1	75	865	23.0
3	2	4	280	37.5	23	1	76	887	22.0
4	1	5	331	51.0	24	1	77	913	26.0
5	5	10	370	7.8	25	1	78	937	24.0
6	2	12	386	8.0	26	1	79	958	21.0
7	5	17	421	7.0					
8	5	22	460	7.8					
9	2	24	490	15.0					
10	2	26	510	10.0					
11	5	31	523	2.6					
12	5	36	531	1.6					
13	5	41	540	1.8					
14	10	51	571	3.1					
15	10	61	658	8.7					
16	5	66	700	8.4					
17	2	68	725	12.5					
18	2	70	755	15.0					
19	2	72	798	21.5					
20	1	73	822	24.0					

Layer Boundaries: Change 17.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	5	246	246		
2	43	394	640		
3	12	233	873		

CBR Derived by TDR equation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL. (MADE GROUND)



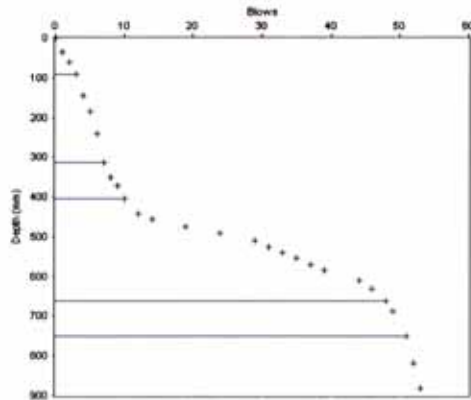
Dynamic Cone Penetrometer Strength Analysis Report

Site: ABBEY ROAD NORTH
Location: DCP18
Cone Angle: 60 degrees
Zero Error: 67
Test Date: 30/10/2017

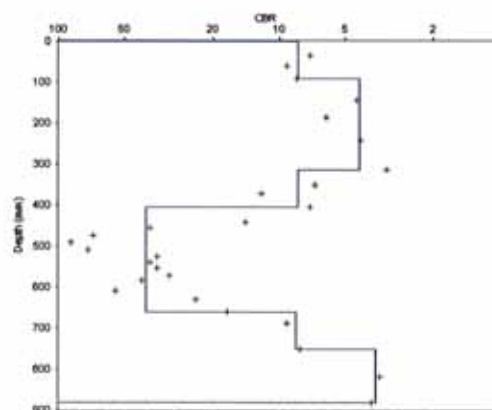
Job Number: CCG-C-17-9966
Surface Type: -
Thickness (mm): -

No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)	No.	Blows	Cumulative Blows	Penetration Depth (mm)	Penetration Rate (mm/b)
1	0	0	67	0	21	2	39	651	6.5
2	1	1	101	34.0	22	5	44	676	5.0
3	1	2	128	27.0	23	2	46	698	11.0
4	1	3	158	30.0	24	2	48	728	15.0
5	1	4	212	54.0	25	1	49	755	27.0
6	1	5	252	40.0	26	2	51	817	31.0
7	1	6	308	56.0	27	1	52	885	68.0
8	1	7	381	73.0	28	1	53	948	63.0
9	1	8	417	36.0					
10	1	9	438	21.0					
11	1	10	472	34.0					
12	2	12	508	18.0					
13	2	14	522	7.0					
14	5	19	542	4.0					
15	5	24	558	3.2					
16	5	29	577	3.8					
17	2	31	592	7.5					
18	2	33	606	7.0					
19	2	35	621	7.5					
20	2	37	638	8.5					

Layer Boundaries: Change 18.000



Layer Boundaries Chart



CBR Chart

Layer Properties

No.	CBR value	Thickness	Depth	Position	Strength Coefficient
1	8	91	91		
2	4	223	314		
3	8	91	405		
4	40	256	661		
5	8	89	750		
6	4	131	881		

CBR Derived by TDR equation

$$\log_{10}(\text{CBR}) = 2.48 - 1.057 \times \log_{10}(\text{penetration rate})$$

Remarks Surface material description: Brown sandy GRAVEL. (MADE GROUND)