



**REPORT C7333
SEPTEMBER 2017**

GEOENVIRONMENTAL APPRAISAL REPORT

**of
FORMER MILLFIELD WORKS,
STOCKTON-ON-TEES**

**prepared for
TJ THOMSON & SON LTD**



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C7333/02	Site Features Plan	1:2000
C7333/03	Preliminary Conceptual Site Model	NTS
C7333/04	Exploratory Hole Location Plan	1:1000
C7333/05	Revised Conceptual Site Model	NTS
C7333/06	Indicative Foundation Options Plan	1:1000

NTS: Not to Scale

APPENDIX B RISK ASSESSMENT METHODOLOGY

APPENDIX C EXPLORATORY HOLE LOGS AND FIELD TEST RESULTS

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APPENDIX E GROUND GAS AND GROUNDWATER MONITORING RESULTS

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EXECUTIVE SUMMARY

Introduction	<p>Sirius Geotechnical Ltd was commissioned by Fordy Marshall, acting on behalf of TJ Thomson & Son Ltd, to undertake a geoenvironmental appraisal of the former Millfield Works, Stockton-On-Tees.</p> <p>It is understood that consideration is being given to development of the site primarily for a residential end use, however parts of the site may be retained for, or have continued use as, a commercial/light industrial end use.</p>
Site Details	<p>The site is located north of Grangefield Road and west of the Durham Coast railway line, approximately 0.6km west of Stockton town centre. The site is an irregular shaped relatively level area, which is currently occupied by the former Millfield Works, a scrap metal merchant and processing facility. The western area of the site slopes gently to the west towards Lustrum Beck, which flows northwards through an area of public open space located in the extreme west of the site.</p>
Site History	<p>The site has been developed in several stages throughout its history, including a series of works (iron and steel) with associated infrastructure including tanks, electricity substations and railway tracks. Records of landfilling are held for the site with refuse heaps recorded within the boundary.</p>
Fieldwork	<p>Fieldwork comprised the excavation of 36 No. machine-excavated trial pits to maximum 4.1m depth, the drilling of 20 No. window sampler boreholes to maximum 4.45m depth and the drilling of five cable percussive boreholes to maximum 10m depth. Gas and groundwater monitoring wells were installed within selected window sampler and cable percussive boreholes for subsequent monitoring.</p> <p>Gas and groundwater monitoring is currently ongoing (six visits over a three month period is programmed).</p>
Laboratory Testing	<p>Samples of the made ground, natural soils, groundwater and surface water were submitted for analysis of a range of metal, other inorganic and organic components. Geotechnical testing was scheduled on selected samples of the natural soils. All testing was undertaken at MCERTS accredited laboratories.</p>
Ground Conditions	<p>Made ground was encountered across the majority of the site area, to depths of between 0.35m to 6.5m. The underlying superficial deposits generally comprised stiff and very stiff, medium and high strength glaciolacustrine clays, which locally become laminated with depth. The superficial soils were proven to at least 10m depth. Bedrock was not encountered.</p> <p>Groundwater monitoring of the well installations has revealed the groundwater to be perched above the natural glaciolacustrine clays, with the majority of groundwater movement through overlying granular made ground. Ponded surface water has also been noted in western parts of the site, where the cohesive natural soils prevail from shallow depth.</p>
Ground Stability	<p>Excavations into existing made ground and the underlying natural soils should be assumed to be unstable.</p> <p>Surface instability as a result of underground coal mining is considered to be negligible.</p>
Soakaways	<p>Soakaways are not considered suitable at this site.</p>

Foundations and Floor Slabs	<p>Pile or vibro foundations anticipated across northern and eastern parts of the site (approximating to c.60% of the site area) due to deep made ground and presence of slag. Shallow strip or trench fill foundations may be suitable in western and south-eastern parts of the site.</p> <p>Suspended floor slabs are anticipated across the majority of the site. Ground bearing floor slabs may be suitable in western and south-eastern parts of the site.</p>
Sulphate Class	<p>Generally DS-2 AC-2 for concrete products in made ground.</p> <p>DS-1 AC-1 suitable for concrete products placed in natural soils only.</p>
Contamination	Heavy metal and polycyclic aromatic hydrocarbon contamination identified in site wide made ground.
Asbestos	Chrysotile and amosite asbestos fibres (<0.001% by mass) identified in shallow granular made ground at two locations. Suspected asbestos cement sheet (roof tile) identified in cohesive made ground at a depth of 3m at one location.
Ground Gas	<p>Based on gas monitoring undertaken to date, it is considered that the site is representative of Characteristic Situation 2 (CS2) conditions. Gas monitoring is ongoing and this will be confirmed on completion of the monitoring.</p> <p>Radon protection measures are not required for new buildings at this site.</p>
Invasive Species	None noted.
Other Issues	<p>It would be prudent for any potential developer to consider undertaking specialist identification and analysis on samples of slag, to determine the geotechnical constraints this material may present to the development.</p> <p>A remedial strategy will be required to demonstrate how end users will be protected from the identified contaminants within the made ground on the site.</p>

The executive summary is an overview of the key findings and conclusions of the report. There may be other information contained in the body of the report which puts into context the findings of the executive summary. No reliance should be placed on the executive summary in isolation, particularly when deriving design detail/abnormal costs.

1. INTRODUCTION

Sirius Geotechnical Ltd (Sirius) was commissioned by Fordy Marshall, acting on behalf of TJ Thomson & Son Ltd, to undertake a geoenvironmental appraisal of the former Millfield Works, Stockton-On-Tees (the “site”). It is understood that consideration is being given to redevelopment primarily for a residential end use, however parts of the site may be retained for, or have continued use as, a commercial/light industrial end use.

The objectives of this appraisal were to:

- Investigate soil and groundwater conditions;
- Determine the potential risks posed by any ground contamination and provide recommendations on remedial measures to manage such risks;
- Establish the risks associated with hazardous ground gas;
- Evaluate whether past mining or other extractive industries could have an influence on the site;
- Provide advice relating to geotechnical issues associated with the site;
- Provide foundation recommendations.

The site has been subject to a previous Phase 1 Preliminary Geoenvironmental Appraisal (desk top study) by Sirius, report reference C7333, dated August 2017.

Fieldwork was undertaken from 31st July to 8th August 2017 and comprised the excavation of 36 No. trial pits, the drilling of 20 No. window sampler boreholes and five cable percussive boreholes.

This report, which was designed to meet the requirements of relevant current guidance, presents the factual information available during this appraisal, an interpretation of the data obtained and recommendations relevant to the defined objectives.

It has been assumed in the production of this report that the site is to be redeveloped for a residential end use, this being the most sensitive of proposed end uses. In addition, it is assumed that ground levels will not change significantly from those described in this report. If these are not the case, then amendments to the recommendations made in this report may be required.

Where the report refers to the potential presence of invasive plants (such as Japanese Knotweed) or asbestos-containing materials (ACMs), such observations are for information only and should be verified by a suitably qualified expert.

The comments and opinions presented in this report are based on the findings of ground conditions encountered during intrusive investigation works performed by Sirius and the results of tests carried out within one or more laboratories. There may be other conditions prevailing on the site which have not been revealed by this investigation and which have not been taken into account by this report. Responsibility cannot be accepted for any conditions not revealed by this investigation. Any diagram or opinion on the possible configuration of strata, contamination or other spatially variable features between or beyond investigation positions is conjectural and given for guidance only. Confirmation of ground conditions between exploratory holes should be undertaken if deemed necessary. Evaluation of ground gas and groundwater is based on observations made at the time of the investigation and monitoring visits. It should be noted that ground gas and groundwater levels and quality may vary due to seasonal and other effects.

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2. SITE DETAILS AND DESCRIPTION

Table 2.1 Current Site Overview

Location	<p>Located to the north of Grangefield Road and west of the active Durham Coast railway line, approximately 0.6km west of the centre of the town Stockton-On-Tees.</p> <p>A site location plan is provided as Drawing No. C7333/01 within Appendix A.</p>
National Grid Reference (NGR)	443720, 519150.
Topography and Features	<p>The site comprises an irregular shaped area with major dimensions of approximately 600m by 600m. The site is relatively flat, although the western part of the site slopes gently down to the west towards Lustrum Beck.</p> <p>The central, northern and eastern areas of the site are currently occupied by a former scrap metal merchant and processing facility (the Millfield Works). The site ground surface comprises reinforced concrete hardstand and relict floor slabs in southern and western parts, and gently undulating barren ground/industrial wasteland in northern parts. Made ground was evident at the ground surface in the north. An area of managed soft landscaping, and an asphalt car park accessed via a driveway off Grangefield Road, is present in the south-west. A small brick retaining wall (<1m high) which is lined by mature trees, is present within the landscaping which has been terraced.</p> <p>The majority of sheds, garages and warehouses situated towards the centre south and south-west have recently been demolished to slab level. The main office buildings located at the entrance to the site were still erect at the time of the investigation and in use by site personnel and contractors. An L-shaped two-story building also located in the south was partially demolished at the time of the investigation.</p>

	<p>Demolition arisings (comprising brick, wood, plasterboard, fragments of metal) are currently stockpiled in the south-west. Partially deconstructed former processing plant and machinery are present centrally. Above ground and partially buried concrete structures and plinths are present throughout the central area. It is understood some buried structures may extend two storeys underground, including a former crusher which was being grubbed out and lifted at the time of the site walkover, resulting in a large circa 6m deep excavation. Several small electricity substations/transformers are present on the site, in addition to an above ground (unbunded) fuel tank (AST). A small volume of spilled hydrocarbons was observed on the ground surface below the outlet pipe on the tank, which is situated in the central south. Storage containers, gas canisters, metal drums, old appliances, tyres and other waste materials associated with the former land use are present in small quantities on the site.</p> <p>The western area of the site is largely occupied by undeveloped scrubland, which is currently heavily overgrown with shrubs and trees. The area of scrubland is fenced on all sides and vehicular access cannot be gained. Lustrum Beck flows from south to north in the extreme west, and is flanked by flood alleviation levees and managed public open space (POS). Pedestrian access is granted to the POS from Grangefield Road to the south and Blacksail Close to the north.</p> <p>The southernmost area of the site is separated from the Millfield Works by a public cycle/footpath, and is accessed from Light Pipe Hall Road. This area is relatively level and mostly occupied by overgrown industrial wasteland, although the north-western corner is occupied by an active metal processing works. It is understood that this facility may remain operational in the future.</p>
Approximate Site Area	20 hectares (Ha).
Site Boundaries	<p>The northern boundary is marked by a combination of mature trees and concrete king post walls.</p> <p>The eastern boundary is marked by the active Durham Coast</p>

	<p>railway line.</p> <p>The southern boundary is marked partially by Grangefield Road, Light Pipe Hall Road and Riley Street.</p> <p>The western boundary is marked partially by Grangefield Road and residential gardens along Gray's Road.</p>
Current Land Use	Former scrap metal merchants.
Invasive Plant Species	None noted during the site inspection. An ecological survey should be carried out to confirm the absence of invasive plant species.
Adjacent Land Uses	Principally residential with light industrial units to the north-east and commercial premises to the south. POS and a cemetery are present to the south-west.

The main site features are shown on Drawing No. C7333/02 within Appendix A.

3. ENVIRONMENTAL SETTING

Published environmental, geological and historical data relating to the site has been reviewed previously by Sirius, as detailed within report reference C7333 Preliminary Geoenvironmental Appraisal, dated August 2017. A summary of relevant information is provided below.

Site History

The majority of the site was undeveloped during the mid to late 1800s, with the exception of Light Pipe Hall, which was present in the centre south of the site. Moor Steel and Iron Works and Perseverance Boiler Works were established in the north-east and south of the site respectively by the end of the 19th century. Railway tracks, a reservoir, a chimney, cranes and earthworks/spoil heaps were associated with the Moor Works. Buildings later labelled Oxbridge Foundry (Iron) were also established in the south. The Moor Works expanded during the early 1900s, with further tracks and buildings constructed. A Steel Foundry was established in the south by 1915. Allotment gardens were established in the south-west by 1923. The Moor Steel and Iron Works buildings were demolished during the 1930s. The Millfield Works (scrap metal) is recorded in the on the site from the mid-1950s, with marshland recorded to the east and a refuse heap recorded to the north of the works respectively. Additional allotment gardens were also recorded in the west of the site from the mid-1950s, in addition to several warehouses and a factory in the central south. By the late 1970s, Light Pipe Hall had been demolished and the area redeveloped with unspecified warehouses. Additional railway tracks and small buildings/sheds were also constructed in the north/north-east and the works in the south were expanded and merged to form one complex (labelled as a foundry). During the 1980s, the footprint of the foundry in the south was reduced to one small building, commensurate to a present day steel works.

Published Geology

The central and eastern parts of the site are recorded to be underlain by made ground, considered to be associated with spoil and refuse heaps related to former works on the site.

Made ground is recorded to be underlain by glaciolacustrine deposits, typically noted as laminated clays and silt, although alluvium is recorded to slightly encroach into the centre north. These deposits are in turn underlain by glacial till.

The underlying bedrock is recorded as sandstone of the Triassic Sherwood Sandstone Group.

The site is not located in an area that could be affected by coal mining and there is no evidence of quarrying activities having taken place on the site.

Hydrology and Hydrogeology

Lustrum Beck flows to the north through the north-western part of the site. This watercourse was given a GQA river quality classification C in 2000. An unnamed tributary of Lustrum Beck is located approximately 17m west of the site.

The majority of the site is located in a Flood Zone 1 area, with a low probability of flooding. The north-western most part of the site, in the vicinity of Lustrum Beck, is however indicated to be a risk of flooding (Flood Zone 2 and 3). Flood Zone 2 and 3 areas are also shown to encroach slightly into the central northern part of the site. The north-west and central northern parts of the site are also indicated to have limited potential for groundwater flooding to occur.

No licensed surface water or groundwater abstractions are recorded within 1km of the site.

The site does not lie within a groundwater source protection zone.

Superficial soils recorded below the site are recorded as a Secondary A Aquifer (alluvium) and Unproductive Strata (glaciolacustrine deposits). The Sherwood Sandstone is classified as a Principal Aquifer.

Landfilling and Waste Management

Three historical landfills are recorded on the site, which relate to the Millfield Works. Inert and industrial wastes are reported to have been deposited between 1980 and 1989. Six additional landfills are recorded within 1km of the site, all of which accepted inert construction/industrial wastes only.

Two licensed waste management facilities are recorded within 500m of the site, one being present on the site relating to mixed metal recycling at the Millfield Works. The second entry is located 63m north-east and relates to end of life vehicles.

The site lies within an area in which **no radon protective measures are required**.

3.1. Ecological Receptors

The site is indicated to be located within a nitrate vulnerable zone.

No designated ecological receptors are recorded to be located within 500m of the site.

3.2. Other

Other potentially contaminative activities or environmental constraints are listed below. The entries relate to activities within approximately 250m of the site, with the exception of COMAH facilities where the assessment is extended to a distance of approximately 1km from the site:

- Multiple trade directory entries are provided surrounding the site, principally to the north-east and south. Notable entries include garage services, car body repairs and railway equipment manufacturers. Scrap metal merchants are recorded to be active at the site.
- One pollution incident to controlled waters, recording ‘oils – other oils’ as a Category 3 – minor incident, 212m north of the site. No pollution incidents are directly related to the site, or are likely to have had an adverse impact on the site.
- Three active COMAH sites are recorded between 51m and 440m north-west and north-east of the site relating to Terra Nitrogen, Johnson Matthey PLC and Cf Fertiliser, respectively. Any risks posed to the future development from these entries are considered to be very low.

4. PREVIOUS INVESTIGATION FINDINGS

No previous site investigation report relating to this site have been made available to Sirius.

5. PRELIMINARY CONCEPTUAL SITE MODEL

Based on the desk study information and the results of previous intrusive investigations undertaken at the site, a combined preliminary conceptual site model and conceptual exposure model (CSM) has been developed for the proposed future land use (residential). This summarises the understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors to assess potential contaminant linkages.

A qualitative risk assessment has also been made of each contaminant linkage operating following the methodology described in Appendix B.

The preliminary CSM is presented in schematic form in Drawing No. C7333/03 within Appendix A.

In summary, the following potential contaminant linkages have been assessed as posing a potentially unacceptable level of risk (defined as being greater than “low” risk) in the proposed end-use:

- Direct and indirect ingestion, inhalation of contaminated particles/dusts/vapours and dermal contact with heavy metals, hydrocarbons, polychlorinated biphenyls (PCBs), asbestos and other organic contamination (predominantly from former developments and on-site landfilling, spillages during former site operations and around fuel tanks, etc.) within made ground and/or shallow soils, presenting a potential moderate to high risk to future site users and construction workers;
- Direct contact of construction materials (e.g. concrete) with elevated sulphates within shallow soils and/or made ground; presenting a potential low to moderate risk to the built environment;
- Plant uptake of phytotoxic metals (copper and zinc) and organic contamination within on-site made ground, presenting a potential low to moderate risk to future plant growth in gardens/soft landscaped areas;
- Leaching and migration of metal and/or organic contamination in made ground and/or shallow natural soils, presenting a low to moderate risk to controlled waters (principally the underlying Principal Aquifer and Lustrum Beck);

- Direct flow/migration of free phase hydrocarbons from spillages/leaks surrounding historic/existing fuel tanks; but, also other disparate areas, resulting from local spillages during former on and off-site operations, presenting a potential low to moderate risk to controlled waters (underlying Principal Aquifer and Lustrum Beck); and,
- Migration of hazardous ground gases (carbon dioxide and methane) from on-site made ground and landfill, and off-site made ground to the west, leading to inhalation/accumulation in indoor air; presenting potential moderate to high explosion and asphyxiation risks to the built environment and future site users.

6. FIELDWORK

6.1. Scope of Investigation

The information contained in this report is limited to areas of land accessible during the investigation within the site boundary, as indicated on the site plan presented in Appendix A as Drawing No. C7333/02.

The investigation, which was supervised by a Sirius Geoenvironmental Engineer, took place between 31st July and 8th August 2017 and comprised:

- Excavation of 36 No. of machine-excavated trial pits (TP01 to TP36) to a maximum depth of 4.1m below ground level (bgl);
- Drilling of 20 No. window sampler boreholes (WS01 to WS07, WS09 to WS15, WS04A, WS07A, WS08A, WS08B, WS08C and WS12A) to a maximum depth of 4.45m bgl;
- Drilling of five cable percussive boreholes (CP01 to CP04, CP04A) to a maximum depth of 10.0m bgl.

Permanent monitoring installations for combined groundwater and ground gas monitoring were installed in ten window sampler boreholes to approximately 3.0m bgl and in two cable percussive boreholes to 8.0m bgl.

6.2. Exploratory Hole Locations

The exploratory hole locations were selected using the findings of the preliminary conceptual site model in order to achieve general site coverage, target specific areas of interest and resolve key uncertainties, as detailed in Table 6.1. The principles given in BS 10175:2011+A1:2013 and BS EN 1997:2007 were followed when determining exploratory hole locations.

Table 6.1 Exploratory Hole Rationale

Exploratory Hole	Rationale
TP01 to TP36	General site coverage to determine nature of shallow soils for contamination. Selected trial pits were positioned to target areas previously occupied by buildings (i.e. former steel and iron works, boiler works, sheds/workshops, warehouses, etc.), spoil heaps, tanks and electrical substations.

Exploratory Hole	Rationale
WS01 to WS15	General site coverage to determine nature and geotechnical properties of shallow soils for founding purposes. To install gas and groundwater monitoring wells to determine potential gas risk.
CP01 to CP04	Bottom out potentially deep made ground associated with landfilling in the north and determine nature and geotechnical properties of underlying natural soils for founding purposes. To install gas and groundwater monitoring wells to determine potential gas risk.

Exploratory hole locations are shown on Drawing No. C7333/04 within Appendix A of this report.

Exploratory hole locations were constrained by factors including:

- The presence or suspected presence of buried services and manholes;
- Existing buildings and other above ground and/or buried structures in the central parts of the site, some of which were undergoing demolition at the time of the intrusive investigation;
- An existing active business in the south-east;
- An area of woodland and dense vegetation in the north-west; and
- Lustrum Beck and associated flood alleviation embankments and adjacent area of public open space, all of which lie outwith the enclosed boundary of the Millfield Works site.

Trial pits were excavated to a depth at which further progress was not possible due to the strength of the strata present, the presence of obstructions, the reach of the excavator, or instability within granular material.

Windowless sampler boreholes were generally drilled to 4.45m bgl, a depth considered suitable for the objectives of the investigation bearing in mind the physical limitations of this technique. Windowless sampler boreholes WS04, WS04A, WS07, WS07A, WS08A, WS08C, WS12 and WS12A were terminated at shallow depth due to artificial obstructions.

Cable percussion boreholes were generally drilled to 10.0m bgl, with the exception of CP04 and CP04A which terminated at shallow depths due to obstructions.

6.3. Strata Description

Strata descriptions were logged in accordance with Eurocode 7. Detailed descriptions of strata and groundwater observations made during investigation works, together with samples recovered and the results of all *in situ* field testing, are presented on the Engineer's records within Appendix C. The depths of strata on the record sheets are recorded from current ground levels at each location, unless indicated otherwise.

6.4. Geotechnical Testing

Geotechnical laboratory testing on selected samples was carried out under subcontract by Professional Soils Laboratory (PSL), a UKAS-accredited laboratory.

Geotechnical and geochemical test results are included within Appendix D of this report.

6.5. Chemical Testing

Selected samples of the made ground, natural soils, groundwaters and surface water were tested for a range of potential contaminants under subcontract with Derwentside Environmental Testing Services (DETS), a UKAS and MCERTS-accredited laboratory.

The potential contaminants of concern identified by the preliminary CSM were selected as the analytes for the samples recovered from the site. The results of soil and water analysis, as received from the laboratory, are presented within Appendix D of this report.

7. GROUND CONDITIONS AND MATERIAL PROPERTIES

7.1. Strata Profile

A summary of the strata profile encountered is provided in Table 7.1.

Table 7.1 Strata Profile

Strata	Depth Range (Thickness Range)	Description and Comments
Made Ground	Ground Level (0.35m to 6.5m)	<p>Concrete hardstand, typically reinforced, was identified from the surface across much of the central part of the site to depths of between 0.15m and 0.40m. At one location (WS07) the full thickness was not proven at 0.8m depth. A relict concrete floor slab in the locale of TP02 however, did not appear to be reinforced.</p> <p>Asphalt/tarmacadam hardstand was identified locally from the surface within localised areas towards the centre of the site, within the central west and in the far south-eastern parts of the site, to depths between 0.10m and 0.15m bgl.</p> <p>No hard surfacing is present in the northern part of the site, or across much of the central eastern and south-eastern parts of the site.</p> <p>Concrete/asphalt was typically underlain by granular sub-base comprising gravel of limestone or shale and brick fragments.</p> <p>Granular made ground comprising industrial and demolition wastes (predominantly dark grey to black, but occasionally brown, gravelly [foundry] sand, or sandy gravel with slag, brick, concrete, shale, occasional glass, clinker, metal, wood, sandstone and mudstone) was found within most exploratory holes below hardstand and sub-base materials, or from the surface in northern, central eastern and south-eastern parts</p>

Strata	Depth Range (Thickness Range)	Description and Comments
		<p>of the site.</p> <p>Cohesive made ground was generally limited to the northern parts of the site, but also identified locally in the central south, encountered at depths of between 0.25m and 5.0m bgl. These soils generally comprised firm or stiff medium strength sandy clays, which were locally slightly gravelly. Gravel constituents were typically recorded as brick and concrete fragments, although metal and glass was also recorded in TP34. Where present, the cohesive made ground tends to underlie granular made ground.</p> <p>Made ground depth was not proven within TP09, TP11, TP19, TP22, TP26, TP27, TP29, TP30, TP33, TP34, TP35, WS04, WS04A, WS07, WS07A, WS08A, WS08B, WS11, WS12, WS12A, WS13, CP04 and CP04A.</p>
Glaciolacustrine Deposits	Ground Level to 6.5m (>9.5m)	<p>Identified in all exploratory holes that penetrated through made ground, and in TP24 and WS09 from the ground surface. Natural soils generally comprised stiff and very stiff, medium and high strength, locally very high strength, grey brown becoming reddish brown sandy clay. A band of soft orange brown silty slightly sandy clay was however identified between 2.2m and 2.5m within WS06. The clay soils were observed to become locally laminated at depths of 3.5m to 8.6m.</p>
Sherwood Sandstone	>10.0m (NR)	<p>Bedrock was not encountered within any exploratory hole formed during this investigation.</p>

NR - Not Recorded

7.2. Obstructions / Intact Structures

Obstructions were found in the following exploratory hole locations:

- TP19 – Unknown obstruction (possible fused slag) at 1.0m bgl.
- TP21 – Two perpendicular adjoining intact brick walls present in one end of the excavation, encountered at a depth of 0.2m bgl and extending to a depth in excess of 3.4m bgl.
- TP29 – Partially intact brick wall present in one side of the excavation, encountered at a depth of 1.1m bgl and extending to a depth of 1.7m bgl.
- TP30 – Two perpendicular adjoining intact brick walls and a third partially intact brick wall, present in the excavation, encountered at a depth of 0.3m bgl and extending to a depth of at least 3.8m bgl. Suspected floor slab encountered at 3.8m bgl.
- WS04 and WS04A – Refused at 0.8m and 1.0m bgl respectively on unknown obstruction.
- WS07 and WS07A – Refused at 0.8m bgl on unknown obstruction (suspected concrete slab).
- WS08A and WS08B – Refused at 1.24m and 0.6m bgl respectively on unknown obstructions.
- WS12 and WS12A – Refused at 0.15m and 0.25m bgl respectively on unknown obstructions.
- CP04 – Refused at 3.4m bgl on cobbles/boulders of brick and concrete.

In addition to those structures discussed above, a large substructure, understood to be a car crusher, was present in the central part of the site, which at the time of our investigation was being excavated from the ground. The resultant void was recorded to be in excess of 5m deep.

Intact railway tracks and crane foundations/plinths were also observed throughout central and northern parts of the site.

7.3. Material Properties

Made Ground

Water soluble sulphate (SO_4^{2-}) analyses performed on 37 No. samples of made ground recorded concentrations of between 10mg/l and 2000mg/l, together with recorded pH ranging from 7.7 to 12.2. These results indicate a design sulphate class of DS-3 and an ACEC class of AC-3, in accordance with BRE Special Digest 1 (2005) for the design of buried concrete, based on brownfield site designation and mobile groundwater conditions.

Uncorrected SPT 'N' values in the granular made ground ranged between 2 and 38. Two SPTs refused, recording 50 blow counts for penetrations of 40mm and 295mm. Corrected SPT ' N_{60} ' values, calculated using the hammer energy efficiency of the SPT equipment used, ranged between 2 and 46, indicative of very loose to very dense granular soils.

Hand shear vane results in the cohesive made ground recorded results in the range 55kPa to 90kPa, indicative of medium and high strength.

An Atterberg Limit determination undertaken on one sample of the cohesive made ground indicated the material to be clay of high plasticity, with a liquid limit of 59%, a plastic limit of 28%, and a plasticity index of 31%.

Calculation of the modified Plasticity Index, in accordance with NHBC standards, indicates this soil to have a medium volume change potential. The Consistency Index (I_c) value for the sample tested is 0.84, indicating the material to be of stiff consistency.

Uncorrected SPT 'N' values in the cohesive made ground recorded values of 6 and 17. One SPT refused, recording 50 blow counts for a penetration of 105mm. Corrected SPT ' N_{60} ' values, calculated using the hammer energy efficiency of the SPT equipment used, returned values of 7 and 21. Correlation with laboratory plasticity indices indicates a mass shear strength of approximately 36kPa and 105kPa, indicative of low and high strength cohesive soils.

A remoulded California Bearing Ratio (CBR) test performed on granular made ground reported values ranging from 28.8% to 43.6%, with an average of 36.2%.

Superficial Deposits

Water soluble sulphate (SO_4^{2-}) analyses performed on 15 No. samples of glaciolacustrine deposits recorded concentrations of between 12mg/l and 190mg/l, together with recorded pH ranging from 7.7 to 8.9. These results indicate a design sulphate class of DS-1 and an ACEC class of AC-1, in accordance with BRE Special Digest 1 (2005) for the design of buried concrete, based on brownfield site designation and mobile groundwater conditions.

Hand shear vane results in the glaciolacustrine clays ranged between 60kPa and >120kPa, indicative of medium and high strength.

Atterberg Limit determinations undertaken on 19 No. samples of the glaciolacustrine deposits indicate 18 No. samples to be clay of low to extremely high plasticity, with liquid limits ranging between 33% and 92%, plastic limits ranging between 18% and 38%, and plasticity indices ranging between 15% and 54%. The majority of samples however fall in the intermediate and high plasticity range. One sample, from TP12, was indicated to be non-plastic.

Calculation of the modified Plasticity Index, in accordance with NHBC standards, generally indicates these soils to have a low to medium volume change potential. One sample, from TP32, is however indicated to have a high volume change potential. The Consistency Index (I_c) values for the samples tested ranged from 0.47 to 1.24 indicating the material to be generally of soft to very stiff consistency. The majority of samples however fall in the stiff and very stiff consistency range.

Uncorrected SPT 'N' values in the glaciolacustrine deposits ranged between 7 and 42. Corrected SPT ' N_{60} ' values, calculated using the hammer energy efficiency of the SPT equipment used, ranged between 8 and 52. Correlation with laboratory plasticity indices indicates a mass shear strength of approximately 42kPa to 259kPa, indicative of medium to very high strength cohesive soils.

Single stage triaxial compression tests undertaken on undisturbed samples of the glaciolacustrine clays recorded undrained shear strengths ranging between 65kPa and 154kPa, indicative of medium to very high strength. These values corroborate shear strength results from hand shear vane and in-situ SPT testing within this stratum.

One dimensional consolidation tests on glaciolacustrine clay indicated coefficient of volume compressibility (m_v) values of 0.11m²/MN and 0.18m²/MN, indicating soils of medium compressibility.

A CBR test performed on glaciolacustrine clay reported values ranging from 9.2% to 10.0%, with an average of 9.6%.

7.4. Ground Stability

The coarse granular made ground in some trial pits was observed to be unstable during excavation. Excavation sidewalls were noted to spall in TP05, TP07, TP09, TP11, TP30 and TP32.

7.5. Subsurface Mine Workings

A review of published geological information reveals the site is not at risk of surface instability resulting of underground mine workings. As such, investigation of subsurface mine workings was outside of the scope of this investigation.

7.6. Groundwater

No significant groundwater strikes were recorded during the Sirius ground investigation. Groundwater observations were limited to seepages perched within the made ground strata at three locations, as summarised in Table 7.2.

Table 7.2 Summary of Groundwater Encountered During Intrusive Investigation

Exploratory Hole	Depth Encountered (m bgl)	Description	Stratum
TP04	0.60	Moderate groundwater seepage	Made Ground
TP05	2.70	Moderate groundwater seepage	Made Ground
TP15	1.20	Seepage of groundwater issuing from land drain	Glaciolacustrine Deposits
WS03	3.25	Groundwater encountered	Made Ground

Groundwater level readings taken during post-investigation monitoring are included within the monitoring data presented within Appendix E, and are summarised in Table 7.3.

Table 7.3 Summary of Groundwater Monitoring (2 visits only)

Exploratory Hole	Depth to Groundwater (m bgl)	
	Minimum	Maximum
CP01	2.47	2.73
CP03	4.28	4.49
WS01*	Well submerged beneath ponded surface water	0.18
WS03	>2.50 (Dry)	>2.50 (Dry)
WS05	2.29	2.99
WS08C	2.22	2.23
WS09*	Well submerged beneath ponded surface water	0.00
WS10	1.37	1.76
WS11	3.07	3.07
WS13	2.94	2.94
WS14	1.20	1.37
WS15	1.26	1.48

* Wells monitored on only one occasion to date due to flooding by ponded surface water.

Based on the range of water levels recorded, it would appear that the majority of groundwater movement is through the shallow granular made ground deposits and that groundwater is perched above or within the glaciolacustrine clays.

7.7. Visual / Olfactory Evidence of Contamination

During our works, visual/olfactory evidence of contamination was noted at two site investigation locations, as summarised in Table 7.4.

Table 7.4 Visual / Olfactory Evidence of Contamination Noted During Investigation

Exploratory Hole	Depth Encountered (m bgl)	Stratum	Description
TP11	1.60 – 3.20	Made Ground	Slight hydrocarbon odour
TP27	3.00	Made Ground	Suspected asbestos cement-bound roof tile

The made ground soils present across much of the site were observed to contain a proportion of industrial and demolition waste materials, including foundry sand, slag, whole bricks and brick fragments, concrete and fragments of glass, in addition to clinker, shale, scrap metal and ash locally. Such soils could potentially contain elevated concentrations of metals/metalloids, polycyclic aromatic hydrocarbons (PAHs), asbestos and sulphates.

Due to the presence of historic and existing fuel tanks, workshops/vehicle sheds and railway sidings, in addition to electrical substations and the likely former presence of discarded fridge freezers, boilers, etc. on the site, the shallow soils may also be impacted with petroleum hydrocarbons (TPHs), volatile and semi-volatile organic compounds (VOCs and SVOCs) and PCBs, although no such gross contamination, with the exception of the slight hydrocarbon odour in TP27, was identified during the investigation.

7.8. Soakaway Testing

Based on the ground conditions encountered during the intrusive investigation, soakaway drainage is not considered suitable for the proposed development.

7.9. Ground Gas

Ground gas monitoring has been carried out on two occasions to date, and the results are summarised in Table 7.5. Full details of ground gas monitoring results are included in Appendix E.

Table 7.5 Summary of Gas Monitoring (2 visits only)

Well	Response Zone	Methane (Peak Range) %v/v	Carbon Dioxide (Steady State Range) %v/v	Oxygen (Minimum Range) %v/v	Flow (Peak Range) litres/hr	Flow (Steady State Range) litres/hr
CP01	Glaciolacustrine Clay	ND	4.3 – 7.3	8.1 – 11.7	120.0	4.2 – 5.5
CP03	Granular Made Ground	ND	0.7 – 0.8	19.5 – 19.6	ND	ND
WS01*	Glaciolacustrine Clay	1.0	0.1	9.7	14.9	ND
WS03	Granular Made Ground	ND	4.0 – 4.3	14.5 – 14.8	ND	ND
WS05	Granular Made Ground	ND	0.7 – 7.8	5.9 – 18.7	ND	ND

Well	Response Zone	Methane (Peak Range) %v/v	Carbon Dioxide (Steady State Range) %v/v	Oxygen (Minimum Range) %v/v	Flow (Peak Range) litres/hr	Flow (Steady State Range) litres/hr
WS08C	Granular Made Ground	ND	2.0 – 2.1	18.6	ND	ND
WS09*	Glaciolacustrine Clay	ND	ND	20.3	3.0	ND
WS10	Granular Made Ground & Glaciolacustrine Clay	ND	0.3	0.1 – 2.9	-6.7 – ND	ND
WS11	Granular Made Ground	ND	9.1 – 9.7	4.1 – 4.6	ND	ND
WS13	Granular Made Ground	ND	3.5 – 4.4	11.4 – 13.4	ND	ND
WS14	Granular Made Ground	ND	0.2 – 0.5	12.7 – 20.5	ND	ND
WS15	Granular Made Ground & Glaciolacustrine Clay	ND	7.5 – 9.6	12.1 – 14.2	ND	ND

ND - Not Detected.

* Well monitored on only one occasion to date due to flooding by ponded surface water.

No significant carbon monoxide, hydrogen sulphide concentrations or VOCs, were detected in the ground gas.

The monitoring programme comprises six visits over a three month period. On completion of this monitoring, a full set of results will be issued in an addendum letter.

8. RESULTS OF CHEMICAL TESTING

The results of chemical analysis are provided in full within Appendix F.

8.1. Assessment Methodology

Soil Data

The laboratory test data for the relevant soil strata were reviewed for completeness and consistency. Those determinands that represent potential contaminants of concern were subject to further evaluation.

For each potential contaminant of concern, analytical data for soil samples were evaluated against the relevant Generic Assessment Criterion (GAC), taking account of the Soil Organic Matter (SOM) content. For this site, measured values were compared to GACs derived for a residential end use. Source data for all GACs are provided in Appendix F.

If any samples recorded contaminant concentrations that exceeded that GAC, then consideration was given to the applicability of statistical data evaluation in line with the methods described for the Planning Scenario in CL:AIRE & CIEH “Guidance on Comparing Soil Contamination Data with a Critical Concentration”, May 2008.

Water Data

The Sirius GAC values for controlled waters risk assessment, included within Appendix F are based on two distinct sets of criteria; Environmental Quality Standards (EQS) values for surface water ecosystem receptors, and Drinking Water Standards (DWS) for potable groundwater and surface water sources.

The site is located over a Principal Aquifer but is not within a groundwater Source Protection Zone nor close to any registered potable groundwater or surface water abstraction points. However, the site is in proximity to surface watercourses (Lustrum Beck and its tributaries). Therefore, water analysis results have been evaluated against GAC values based on EQS in the first instance.

8.2. Soil Analysis

Made Ground (All Types)

Table 8.1 presents a summary of the analytical results obtained and their evaluation against the applicable GACs. The average SOM concentration within these materials is 3.3% and, as such, GAC for 2.5% SOM have been used in the first instance. Statistical calculations were undertaken, where applicable, for those analytes where one or more samples exceeded the GAC

Table 8.1 Summary of Total Soil Concentrations – Made Ground

Determinand	No. of Samples Tested	Range of Results (mg/kg unless specified)	US95	GAC (2.5% SOM)	No. of Samples >GAC	Samples Exceeding GAC
Metals and Metalloids						
Inorganic Arsenic	36	1.8 – 73	33.7	37	12	TP14, TP19, TP20(x2), TP22, TP27, TP29, TP32, TP34, TP36, WS03, WS11
Cadmium	36	0.1 – 52	10.9	11	2	TP20, TP29
Chromium (III)	36	4.6 – 1100	251	910	1	TP26
Chromium (VI)	36	<1		6	0	
Copper	36	8.8 – 5200	1027	200	16	TP05, TP07, TP09, TP14, TP16, TP17, TP20, TP22, TP25, TP26, TP27#(x2), TP29, TP34, WS03, WS11
Lead	36	9.2 – 37000	5787	200	13	TP09, TP16, TP19, TP20(x2), TP22, TP25, TP27, TP29, TP34, WS04A, WS11
Inorganic Mercury	36	<0.05 – 11		40	0	
Nickel	36	4.5 – 240	93.9	130	2	TP22 ⁺ , TP26, TP34
Selenium	36	<0.5 – 4.3		250	0	
Zinc	36	29 – 8700	1955	450	8	TP07, TP09, TP22, TP25, TP27#, TP29, TP34#, WS11
Other Inorganics						

Determinand	No. of Samples Tested	Range of Results (mg/kg unless specified)	US95	GAC (2.5% SOM)	No. of Samples >GAC	Samples Exceeding GAC
pH	37	pH7.7 – 12.2		pH<5 – >9	8	TP01, TP03, TP04, TP05, TP07, TP08, TP13, TP33
Total Sulphate	36	400 – 21000		2400	7	TP01, TP09 ⁺ , TP14, TP18, TP27, TP34, WS03, WS15
Water Sol. Sulphate	37	0.01 – 2g/l		0.5g/l	3	TP01, TP18, TP27
Free Cyanide	36	<0.1 – 0.2		34	0	
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	36	<0.1 – 3.5		490	0	
Acenaphthylene	36	<0.1 – 6		400	0	
Anthracene	36	<0.1 – 12		5300	0	
Benzo(a)anthracene	36	<0.1 – 43		<i>b(a)p</i> *	<i>b(a)p</i> *	
Benzo(a)pyrene	36	<0.1 – 52		2.1	9	TP05, TP19, TP25, TP26, TP27, TP29, TP33, TP35, WS11
Benzo(b)fluoranthene	36	<0.1 – 44		<i>b(a)p</i> *	<i>b(a)p</i> *	
Benzo(k)fluoranthene	36	<0.1 – 23		<i>b(a)p</i> *	<i>b(a)p</i> *	
Benzo(g,h,i)perylene	36	<0.1 – 39		<i>b(a)p</i> *	<i>b(a)p</i> *	
Chrysene	36	<0.1 – 47		<i>b(a)p</i> *	<i>b(a)p</i> *	
Dibenzo(a,h)anthracene	36	<0.1 – 8.9		<i>b(a)p</i> *	<i>b(a)p</i> *	
Fluoranthene	36	<0.1 – 78		560	0	
Fluorene	36	<0.1 – 3		390	0	
Indeno(1,2,3-cd)pyrene	36	<0.1 – 42		<i>b(a)p</i> *	<i>b(a)p</i> *	
Naphthalene	36	<0.1 – 10		2.3	1	TP27
Phenanthrene	36	<0.1 – 41		220	0	
Pyrene	36	<0.1 – 63		1200	0	
Speciated Total Petroleum Hydrocarbons						
Aliphatic EC5-6	5	<0.01		41	0	
Aliphatic EC6-8	5	<0.01		110	0	
Aliphatic EC8-10	5	<0.01 – 0.1		31	0	
Aliphatic EC10-12	5	<1.5 – 18		150	0	
Aliphatic EC12-16	5	<1.2 – 110		1200	0	
Aliphatic EC16-21	5	<1.5 – 140		70000	0	
Aliphatic EC21-35	5	<3.4 – 280			0	
Aromatic EC5-7	5	<0.01		110	0	
Aromatic EC7-8	5	<0.01		240	0	
Aromatic EC8-10	5	<0.01 – 0.05		48	0	

Determinand	No. of Samples Tested	Range of Results (mg/kg unless specified)	US95	GAC (2.5% SOM)	No. of Samples >GAC	Samples Exceeding GAC
Aromatic EC10-12	5	<0.9 – 2.9		150	0	
Aromatic EC12-16	5	<0.5 – 28		320	0	
Aromatic EC16-21	5	<0.6 – 37		540	0	
Aromatic EC21-35	5	<1.4 – 130		1500	0	
Banded TPH						
Gasoline Range Organics (EC5-EC10)	8	<0.1		N/A	0	
Diesel Range Organics (EC10-EC24)	8	12 – 80		N/A	0	
Lube Oil Range Organics (EC24-EC40)	8	24 – 210		N/A	0	
BTEX						
Benzene	5	<0.01		0.13	0	
Toluene	5	<0.01		240	0	
Ethylbenzene	5	<0.01		62	0	
Xylene	5	<0.01		67	0	
Speciated Volatile Organic Compounds[^]						
1,1-dichloropropene	6	<0.01 – 0.01		N/A	N/A	
1,3,5-trimethylbenzene	6	<0.01 – 0.02		N/A	N/A	
Speciated Semi-Volatile Organic Compounds[^]						
Acenaphthene	2	<0.1 – 0.1		490	0	
Phenanthrene	2	0.3 – 0.8		220	0	
Anthracene	2	<0.1 – 0.2		5300	0	
Fluoranthene	2	0.1 – 2.1		560	0	
Pyrene	2	0.1 – 1.8		1200	0	
Benzo(a)anthracene	2	<0.1 – 1.2		<i>b(a)p*</i>	<i>b(a)p*</i>	
Chrysene	2	<0.1 – 1.2		<i>b(a)p*</i>	<i>b(a)p*</i>	
Bis(2-ethylhexyl)phthalate	6	<0.1 – 0.1		660	0	
Benzo(b)fluoranthene	2	<0.1 – 2.1		<i>b(a)p*</i>	<i>b(a)p*</i>	
Benzo(k)fluoranthene	2	<0.1 – 0.8		<i>b(a)p*</i>	<i>b(a)p*</i>	
Benzo(a)pyrene	2	<0.1 – 2		2.1	0	
Indeno(1,2,3-cd)pyrene	2	<0.1 – 1.2		<i>b(a)p*</i>	<i>b(a)p*</i>	
Benzo(g,h,i)pyrene	2	0.1 – 0.9		<i>b(a)p*</i>	<i>b(a)p*</i>	
Polychlorinated Biphenyls						
PCB25 + PCB31	6	<0.01 – 0.17		N/A	N/A	
PCB52	6	<0.01 – 0.02		N/A	N/A	
PCB101	6	<0.01 – 0.09		N/A	N/A	
PCB118	6	<0.01 – 0.07		N/A	N/A	
PCB153	6	<0.01 – 0.05		N/A	N/A	
PCB138	6	<0.01 – 0.09		N/A	N/A	
PCB180	6	<0.01		N/A	N/A	
Others						

Determinand	No. of Samples Tested	Range of Results (mg/kg unless specified)	US95	GAC (2.5% SOM)	No. of Samples >GAC	Samples Exceeding GAC
TOC	36	0.1 – 7.4% w/w		3% w/w	7	TP09 ⁺ , TP11, TP14, TP16, TP20, TP27, TP31, WS03
Asbestos	20	NAD – Fibres Present		Fibres Present	2	TP09, TP29
Phenol	36	<0.3 – 2.1		190	0	
MTBE	5	<0.01		55	0	

N/A – Not Applicable.

NAD – No asbestos detected.

Concentrations also exceed LQM/CIEH human health GAC.

+ Concentration recorded at, but not exceeding the GAC.

* Assessed using benzo(a)pyrene as a surrogate marker.

^ Only compounds with concentrations >LoD of laboratory equipment and with a GAC are included in table.

Metals and Metalloids

12 No. samples recorded arsenic concentrations above the applicable GAC. Statistical analysis derived a US₉₅ of 33.7mg/kg, below the GAC of 37mg/kg.

Two samples, from TP20 and TP29, recorded cadmium concentrations above the applicable GAC. Statistical analysis derived a US₉₅ of 10.9mg/kg, marginally below the GAC of 11mg/kg.

One sample, from TP26, recorded a chromium (III) concentration above the applicable GAC. Statistical analysis derived a US₉₅ of 251mg/kg, below the GAC of 910mg/kg.

16 No. samples recorded copper concentrations above the applicable GAC. The GAC applied to copper, derived from the Sludge (Use in Agriculture) regulations (SI 1263/1989), is derived for assessment of sewage sludge amended soils. The equivalent LQM/CIEH derived GAC for human health protection is 2300mg/kg. One sample, from TP27 and TP34, recorded concentrations of 8700mg/kg and 5300mg/kg respectively, which also exceed the human health GAC. Statistical analysis derived a US₉₅ of 1027mg/kg, above the phytotoxic GAC of 200mg/kg, but below the GAC for human health.

13 No. samples recorded lead concentrations above the applicable GAC. Statistical analysis derived a US₉₅ of 5787mg/kg, above the GAC of 200mg/kg.

Two samples, from TP26 and TP34, recorded nickel concentrations above the applicable GAC. One sample, from TP122, also recorded a concentration of nickel at, but not exceeding, the GAC. Statistical analysis derived a US₉₅ of 93.9mg/kg, below the GAC of 130mg/kg.

Eight samples recorded zinc concentrations above the applicable GAC. The GAC applied to zinc, derived from the Sludge (Use in Agriculture) regulations (SI 1263/1989), is derived for assessment of sewage sludge amended soils. The equivalent LQM/CIEH derived GAC for human health protection is 3700mg/kg. Two samples, from TP27, recorded a concentration of 5300mg/kg, which also exceeds the human health GAC. Statistical analysis derived a US₉₅ of 1955mg/kg, above the phytotoxic GAC of 450mg/kg, but below the GAC for human health.

Other Inorganic Analytes

Eight samples recorded pH values greater than the upper GAC value, which is selected to be protective of potential dermal irritation by alkaline materials.

Three samples recorded water-soluble sulphate concentrations above the applicable GAC, which is set at the upper limit of Design Sulphate Class DS-1 and ACEC Class AC-1 within BRE Special Digest 1 (BRE SD-1).

Seven samples also recorded total sulphate concentrations above the applicable GAC, which is also set at the upper limit of DS-1 in BRE SD-1.

PAHs

The relative ratio of PAH compounds within each of the samples of this material analysed falls within the range for which the use of benzo(a)pyrene concentrations as a surrogate marker for genotoxic PAH compounds is applicable. Of the 36 No. samples analysed, nine recorded benzo(a)pyrene concentrations above the GAC. Statistical analysis derived a US₉₅ of 9.0mg/kg, above the GAC of 2.1mg/kg.

One sample, from TP27, also recorded a naphthalene concentration above the applicable GAC. Statistical analysis derived a US₉₅ of 1.6mg/kg, below the GAC of 2.3mg/kg.

TPHs

No concentrations of any TPH fractions were recorded above the applicable GAC.

VOCs and SVOCs

No concentrations of any VOCs (including BTEX compounds) or SVOCs (including PAHs) were recorded above the applicable GAC.

PCBs

Detectable concentrations of PCB compounds were recorded in two samples, from TP22 and TP28, located in the central north of the site. In the absence of specific GAC for the PCB compounds analysed, a Hazard Index (HI) value has been conservatively calculated for each sample in broad accordance with EA report SC050021¹, using the total PCB concentration recorded in each sample, together with the exposure factor and toxic equivalency factor for the most toxic compound of those reported (i.e. PCB 118). The HI for both samples were calculated to be <1.0, which indicates there would be no adverse effects on human health if exposed to the concentrations detected.

Miscellaneous

Seven samples recorded total organic carbon (TOC) concentrations above the applicable GAC. However, TOC is a measure of organic carbon within the material and is therefore not a determinand that directly poses a risk to human health and will therefore not be considered further in that respect. This result is, however, used to determine the classification of material for removal from site to a licensed disposal facility. The TOC is also used to derive the relevant SOM for the soils, necessary to derive an appropriate GAC for some organic determinands.

No concentrations of phenol were recorded above the GAC.

No concentrations of any BTEX compounds or MTBE were recorded above the applicable GAC.

Asbestos

Two out of 20 No. samples screened recorded the presence of asbestos. Amosite was noted to be present in a sample from TP09, obtained at a depth of 0.2m. A small bundle of chrysotile was also noted to be present within a sample from TP29, obtained at a depth of 0.1m.

These two samples were further subject to asbestos quantification, using the Phase Contrast Optical Microscopy method. The results of that testing indicate that the asbestos in both samples is present at <0.001% by mass.

¹ Environment Agency (2009), *Soil Guideline Values for dioxins, furans and dioxin-like PCBs in soil*, Science Report SC050021 / Dioxins SGV.

Natural Ground (Glaciolacustrine Deposits)

Table 8.2 presents a summary of the analytical results obtained and their evaluation against the applicable GACs. One sample of natural clay, obtained from TP04 excavated in the vicinity of the AST in the centre south, was subject to speciated hydrocarbon analysis. The GAC for 1% SOM has been used for a conservative assessment in the first instance.

Table 8.2 Summary of Total Soil Concentrations – Natural Ground

Determinand	No. of Samples Tested	Range of Results (mg/kg unless specified)	US95	GAC (1% SOM)	No. of Samples >GAC	Samples Exceeding GAC
Other Inorganics						
pH	15	pH7.7 – 8.9		pH<5 – >9	0	
Water Sol. Sulphate	15	0.012 – 0.19g/l		0.5g/l	0	
Speciated TPH						
Aliphatic EC5-6	1	<0.01		24	0	
Aliphatic EC6-8	1	<0.01		53	0	
Aliphatic EC8-10	1	<0.01		13	0	
Aliphatic EC10-12	1	<1.5		62	0	
Aliphatic EC12-16	1	<1.2		510	0	
Aliphatic EC16-21	1	<1.5		41000	0	
Aliphatic EC21-35	1	<3.4			0	
Aromatic EC5-7	1	<0.01		53	0	
Aromatic EC7-8	1	<0.01		100	0	
Aromatic EC8-10	1	<0.01		20	0	
Aromatic EC10-12	1	<0.9		63	0	
Aromatic EC12-16	1	0.7		140	0	
Aromatic EC16-21	1	<0.6		260	0	
Aromatic EC21-35	1	9.6		1100	0	
BTEX						
Benzene	1	<0.01		0.063	0	
Toluene	1	<0.01		100	0	
Ethylbenzene	1	<0.01		26	0	
Xylene	1	<0.01		28	0	
Other						
MTBE	1	<0.01		31	0	

NA – Not Applicable.

Other Inorganic Analytes

No concentrations of sulphates or pH values were recorded above the applicable GAC.

TPHs

No concentrations of any TPH fractions were recorded above the applicable GAC.

Miscellaneous

No concentrations of any BTEX compounds or MTBE were recorded above the applicable GAC.

8.3. Groundwater Analysis

Table 8.43 presents a summary of the analytical results obtained and their evaluation against the applicable GACs.

Table 8.3 Summary of Groundwater Analysis

Determinand	No. of Samples Tested	No. Samples Above Limit of Detection	Range of Results (µg/l unless specified)	GAC value (µg/l unless specified)		No. of Samples >GAC
				EQS	DWS	
Metals and Metalloids						
Arsenic	2	2	1.4 – 2.6	50	10	0
Cadmium	2	2	0.16 – 0.33	0.15†	5	1 (EQS)
Chromium (Total)	2	2	6.5 – 12	4.7	50	2 (EQS)
Chromium Hexavalent	2	0	<7.0*	3.4	N/A	0
Copper	2	2	3.7 – 27	1.0	2000	2 (EQS)
Lead	2	2	1.4 – 7.9	1.2	10	2 (EQS)
Mercury	2	2	0.02 – 0.03	0.07	1.0	0
Nickel	2	2	3.1 – 10	4.0	20	1 (EQS)
Zinc	2	2	17 – 37	10.9	5000	2 (EQS)
Other Inorganics						
pH	2	2	pH7.4 – 7.5	N/A	N/A	N/A
Free Cyanide	2	0	<20*	10	50	0
Ammoniacal Nitrogen	2	2	0.23 – 0.62mg/l	0.3mg/l#	N/A	1 (EQS)
Sulphate	2	2	170 – 330mg/l	N/A	250mg/l	1 (DQS)
Speciated PAH						
Anthracene	2	1	<0.01 – 0.01	0.1	N/A	0
Benzo(a)pyrene	2	0	<0.01*	1.7E-04	0.01	0
Fluoranthene	2	1	<0.01* – 0.02	0.0063	N/A	1 (EQS)
Naphthalene	2	0	<0.01	2.0	N/A	0
Speciated TPH						
Aliphatic EC5-6	2	0	<0.2	10	10	0
Aliphatic EC6-8	2	0	<0.2	10	10	0
Aliphatic EC8-10	2	0	<0.2	10	10	0

Determinand	No. of Samples Tested	No. Samples Above	Range of Results (µg/l unless	GAC value (µg/l unless specified)		No. of Samples >GAC
Aliphatic EC10-12	2	0	<1.0	10	10	0
Aliphatic EC12-16	2	0	<1.0	10	10	0
Aliphatic EC16-21	2	0	<1.0	10	10	0
Aliphatic EC21-35	2	0	<1.0	10	10	0
Aromatic EC5-7	2	0	<0.2	10	10	0
Aromatic EC7-8	2	0	<0.2	10	10	0
Aromatic EC8-10	2	0	<0.2	10	10	0
Aromatic EC10-12	2	0	<1.0	10	10	0
Aromatic EC12-16	2	0	<1.0	10	10	0
Aromatic EC16-21	2	0	<1.0	10	10	0
Aromatic EC21-35	2	0	<1.0	10	10	0
BTEX						
Benzene	2	0	<2.0	10	1.0	0
Toluene	2	0	<2.0	74	700	0
Xylene	2	0	<2.0	N/A	500	0
Other						
MTBE	2	0	<2.0	2600	200	0

NA - Not Applicable.

† EQS is dependent on hardness of receiving water body.

EQS is dependent on alkalinity and altitude. In the absence of testing, the most conservative alkalinity value of <10mg/l has been adopted.

* Laboratory detection limit is higher than EQS value.

Metals and Metalloids

Both samples, obtained from CP01 and CP03, returned concentrations of chromium, copper, lead and zinc above the applicable EQS GAC. The sample from CP03 also recorded concentrations of cadmium and nickel above the applicable EQS GAC.

Other Inorganic Analytes

One sample, from CP03, recorded a concentration of ammonia above the EQS GAC. This sample also recorded a concentration of sulphate above the DWS GAC.

PAHs

One sample, from CP03, recorded a concentration of fluoranthene above the EQS GAC.

Petroleum Hydrocarbons

No concentrations of any TPH fractions were recorded above the applicable GAC.

Miscellaneous

No concentrations of any BTEX compounds or MTBE were recorded above the applicable GAC.

8.4. Surface Water Analysis

A sample of surface water was obtained from Lustrum Beck at the sampling location shown on Drawing No. C7333/04. Table 8.4 presents a summary of the analytical results obtained and their evaluation against the applicable GACs.

Table 8.4 Summary of Surface Water Analysis (Lustrum Beck)

Determinand	No. of Samples Tested	No. Samples Above Limit of Detection	Range of Results (µg/l unless specified)	GAC value (µg/l unless specified)		No. of Samples >GAC
				EQS	DWS	
Metals and Metalloids						
Arsenic	1	1	1.6	50	10	0
Cadmium	1	1	0.04	0.15 [†]	5	0
Chromium (Total)	1	1	9.7	4.7	50	1 (EQS)
Chromium Hexavalent	1	0	<7.0*	3.4	N/A	0
Copper	1	1	13	1.0	2000	1 (EQS)
Lead	1	1	1.8	1.2	10	1 (EQS)
Mercury	1	1	0.03	0.07	1.0	0
Nickel	1	1	3.4	4.0	20	0
Zinc	1	1	15	10.9	5000	1 (EQS)
Other Inorganics						
pH	1	1	7.4	N/A	N/A	0
Free Cyanide	1	1	<20*	10	50	0
Ammoniacal Nitrogen	1	1	0.63mg/l	0.3mg/l [#]	N/A	1 (EQS)
Sulphate	1	1	61mg/l	N/A	250mg/l	0
Speciated PAH						
Anthracene	1	1	0.01	0.1	N/A	0
Benzo(a)pyrene	1	1	0.02	1.7E-04	0.01	1 (EQS & DWS)
Fluoranthene	1	1	0.04	0.0063	N/A	1 (EQS)
Naphthalene	1	1	0.03	2.0	N/A	0
Speciated TPH						
Aliphatic EC5-6	1	0	<0.2	10	10	0
Aliphatic EC6-8	1	0	<0.2	10	10	0
Aliphatic EC8-10	1	0	<0.2	10	10	0
Aliphatic EC10-12	1	0	<1.0	10	10	0
Aliphatic EC12-16	1	0	<1.0	10	10	0
Aliphatic EC16-21	1	0	<1.0	10	10	0

Determinand	No. of Samples Tested	No. Samples Above	Range of Results (µg/l unless	GAC value (µg/l unless specified)		No. of Samples >GAC
Aliphatic EC21-35	1	0	<1.0	10	10	0
Aromatic EC5-7	1	0	<0.2	10	10	0
Aromatic EC7-8	1	0	<0.2	10	10	0
Aromatic EC8-10	1	0	<0.2	10	10	0
Aromatic EC10-12	1	0	<1.0	10	10	0
Aromatic EC12-16	1	0	<1.0	10	10	0
Aromatic EC16-21	1	0	<1.0	10	10	0
Aromatic EC21-35	1	0	<1.0	10	10	0
BTEX						
Benzene	1	0	<2.0	10	1.0	0
Toluene	1	0	<2.0	74	700	0
Xylene	1	0	<2.0	N/A	500	0
Other						
MTBE	1	0	<2.0	2600	200	0

NA - Not Applicable.

† EQS is hardness related.

EQS is dependent on alkalinity and altitude. In the absence of testing, the most conservative alkalinity value of <10mg/l has been adopted.

* Laboratory detection limit is higher than EQS value.

Metals and Metalloids

Concentrations of chromium, copper, lead and zinc were recorded above the EQS GAC.

Other Inorganic Analytes

A concentration of ammonia was recorded above the EQS GAC.

PAHs

Concentrations of benzo(a)pyrene and fluoranthene were recorded above the EQS GAC. The benzo(a)pyrene concentration was also above the DWS GAC.

Petroleum Hydrocarbons

No concentrations of any TPH fractions were recorded above the applicable GAC.

Miscellaneous

No concentrations of any BTEX compounds or MTBE were recorded above the applicable GAC.

9. REVISED CONCEPTUAL SITE MODEL

The preliminary combined conceptual site model and conceptual exposure model, developed from the desk study information and presented in Section 5, has been revised in light of the ground investigation and the chemical analysis results presented above.

The revised conceptual model has been developed for the proposed future land use (residential). This summarises the understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors.

The revised conceptual model is presented in schematic form in Appendix A, Drawing No. C7333/05.

9.1. Summary of Residual Contaminant Linkages

The qualitative risk assessment of identified contaminant linkages has also been revised, following the methodology described in Appendix B. In summary, the revised CSM has identified the following residual contaminant linkages (defined as being greater than “low” risk) that could result in an unacceptable risk in the proposed end-use:

- Direct and indirect ingestion, inhalation of contaminated particles/dusts and dermal contact with heavy metal and PAH contamination within made ground soils on a site wide basis, and asbestos contaminated soils on a localised basis, presenting a potential moderate to high risk to future site users and construction workers;
- Direct contact of construction materials (e.g. concrete) with elevated sulphates within made ground soils only; presenting a potential low to moderate risk to the built environment;
- Plant uptake of phytotoxic metals (copper and zinc) and organic contamination within made ground soils, presenting a potential moderate risk to future plant growth in gardens/soft landscaped areas;
- Migration of hazardous ground gases (e.g. methane and carbon dioxide) into buildings and confined spaces (e.g. excavations) from made ground and organic soils on site, followed by explosion, asphyxiation or toxic effects, posing a low to moderate risk to future site users and construction workers at this stage, pending full assessment following completion of the ground gas monitoring programme.

Dissolved metal and PAH contaminants, in addition to ammonia, have been identified in both groundwater and in the surface watercourse present on the site, at concentrations above the most conservative EQS values. The concentrations detected are however generally not indicative of significant impacts and are considered to be background levels associated with general made ground and the urban nature of the surrounding area.

Given that any affected groundwaters on the site are likely to be perched and will not be laterally or vertically pervasive, owing to the presence of cohesive glaciolacustrine deposits adjacent to and below on-site made ground, the source/pathway/receptor linkage to Lustrum Beck and the underlying Principal Aquifer will be significantly reduced. Furthermore, development of the site will likely reduce the infiltration of surface waters into the ground and therefore reduce the potential for leaching of chemicals from the made ground into groundwater.

On the above basis, the slightly elevated dissolved determinands are considered to present a low risk to controlled waters receptors.

10. CONCLUSIONS AND RECOMMENDATIONS

10.1. General

This geoenvironmental appraisal has been performed for the former Millfield Works, Stockton-On-Tees.

It has been assumed in the production of this report that the site is to be developed primarily for a residential end use, however it is understood some parts of the site may be retained for, or have continued use as, a commercial/light industrial end use. In addition, it has been assumed that ground levels will not change significantly from those described in this report. If these are not the case, then amendments to the interpretation and conclusions in this report may be required.

10.2. Flood Risk

The Envirocheck report indicates that the north-western part of the site, adjacent to Lustrum Beck, lies within a Flood Zone 2 and Flood Zone 3. Flood Zones 2 and 3 are also shown to encroach into the central northern part of the site. Elsewhere, the site is not recorded to be at risk of flooding from rivers.

A flood risk assessment will be required as part of the planning application for the proposed development.

10.3. Geotechnical

Mining and Quarrying

Based on published geological information, it is considered that there is no risk of coal mining affecting surface stability at the site. No mine entries are known to exist on site.

Inspection of historical plans has not revealed any evidence of quarrying or opencast workings beneath the site.

Foundations

The investigation has identified made ground across the majority of the site to depths ranging between 0.25m and 6.5m bgl, although the thickness was unproven in some areas. The deeper made ground was generally found in the central north and north-eastern areas of the site. Made ground was underlain by generally stiff and very stiff medium and high strength sandy clay.

The made ground soils are unsuitable as bearing strata for structural loads due to the potential for excessive total and differential settlements. In light of the site's current topography and the variable thickness of made ground, it is considered that a range of foundation solutions will be required for the anticipated low rise residential development. In this respect, an indicative foundation options plan is included within Appendix A, as Drawing No. C7333/06.

Piled Foundations

Significant deposits of made ground, which includes a proportion of slag, have been identified in the central, northern and eastern parts of the site, to depths of up to 6.5m bgl. Conventional spread foundations are not considered feasible in these parts of the site due to the excessive depth required for excavation and the potential volumetric instability of slag. It is therefore recommended that piled foundations are adopted in these areas, terminating within the underlying natural glaciolacustrine clays. Further guidance should be sought from a suitably qualified piling contractor. We would currently estimate that piled foundations will be required for at least 60% of the site.

Alternatively, consideration could be given to stabilisation of the made ground by vibro compaction or vibro replacement techniques. Further guidance should be sought from a suitably qualified ground improvement contractor. Deeper boreholes may be required to assist with pile/vibro design.

It should be ensured that piles/vibro columns do not introduce any preferential pathways for the migration of contaminants (including ground gases) and the guidance given in the Environment Agency document '*Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention*' should be followed and discussed with the EA prior to undertaking any piling/vibro operations.

Relict foundations/substructures would require removal to avoid forming obstructions to piling/vibro columns.

Strip/Trench Fill Foundations

In the western and south-eastern parts of the site, where made ground is absent or sufficiently thin, structural loads associated with the proposed development could be supported on conventional spread foundations (such as strip/trench fill) taken down through any residual made ground into the underlying natural ground of adequate bearing capacity.

Cognisance must be taken, however, to the presence of slag within the shallow made ground. As a precautionary measure, it is recommended that any made ground containing fragments of slag is removed below the footprint of proposed buildings.

The underlying glaciolacustrine clay soils are considered to have a characteristic undrained shear strength (C_u) of at least 75kPa at anticipated founding depth. By way of example, calculations indicate that a 0.6m wide strip bearing on the glaciolacustrine clay soils at a depth of 1.0m bgl, can impose a maximum line load of 90kN/m run. The application of such a pressure would keep settlements to 25mm or less.

The glaciolacustrine clay soils on this site have been found to be generally of low and medium shrinkability as defined in NHBC Standards, Chapter 4.2. Foundations placed into the glaciolacustrine soils should be a minimum of 900mm deep (below finished or original ground levels, whichever is the lower), locally deepened within the zone of influence of existing or proposed trees. A tree survey was beyond the scope of this investigation but should be undertaken to enable production of a detailed foundation schedule. The removal of trees during development of the site may cause heave of cohesive soils and heave protection measures should be adopted in foundation design where appropriate.

The above calculations are based on theoretical foundations. Settlements of foundations upon granular and cohesive materials are dependent on foundation loading and dimensions. It is therefore recommended that foundation settlements are reviewed once final loading arrangements and foundation sizes are known.

Foundations should be taken below a line drawn up at 45° from the base of any existing or proposed services.

The layout of foundations should consider any relict foundations, substructures or other potential obstructions on site. Considering the history of the site, relict foundations are expected in the central south and south-eastern parts of the site and an allowance should be made for their removal and over deepening of foundations. Alternative foundations may be required where the presence of relict structures/foundations could result in significant depths of residual made ground once removed.

If greater structural loads are anticipated alternative foundation solutions may be required.

It should be noted that any groundwater encountered may have an adverse effect on foundation construction and performance (such as softening/loosening of founding materials, instability of excavation walls, etc.), particularly in winter months. Foundations should be blinded immediately after excavation to prevent softening of the foundation base. If softening does occur foundations will have to be over deepened down to clay of adequate bearing capacity. This should be considered when designing foundations.

Floors

Based on proven ground conditions and in accordance with current NHBC Standards, it is considered that ground bearing floor slabs could be utilised in parts of the site, principally in the west and south-east. However, cognisance must be given to the presence of slag within any residual/thin made ground.

For the most part of the site however, due to the recorded thicknesses of made ground being >600mm and the presence of potentially volumetrically unstable slag within the made ground deposits, ground-bearing floor slabs are not considered to be suitable and suspended floor slabs will be required.

Notwithstanding the above, the ground gas protection requirements to be incorporated within ground floors will be determined upon completion of the ground gas monitoring programme and reported within a supplementary ground gas risk assessment letter.

Sulphate Attack

Based on the samples tested, a Design Sulphate Class of DS-2 and an ACEC Class of AC-2 could be used for buried concrete structures in contact with the made ground soils present on the site. This assumes that the shale and brick granular sub-base present directly below concrete surfacing in the vicinity of TP01 and TP02 is excavated and removed from site. If this material is to remain on site, a Design Sulphate Class of DS-3 and an ACEC Class of AC-3 should be used locally in these areas, owing to an elevated sulphate concentration of 2000mg/l recorded in that material.

For concrete structures in contact with the natural soils only, a Design Sulphate Class of DS-1 and an ACEC Class of AC-1 may be used.

Groundworks, Excavation Stability and Groundwater Dewatering

Due to the presence of significant substructures in central and north-eastern parts of the site, it is generally recommended that the made ground is excavated and these structures be removed, and the excavation(s) be replaced with suitably compacted selected fill. It is considered likely that other similar substructures are present within the site i.e. arising from former development in the south-east, which will require treatment to facilitate development.

A proportion of the central area of the site is currently covered by intact concrete slabs, which could be crushed on site to form a granular fill material complying with the requirements of Highways Agency *Specification for Highways Works, Series 600: Earthworks*.

Laboratory analysis should be undertaken on samples of the asphalt/tarmac identified in central and south-east parts of the site, to confirm the composition of the macadam and if it would be considered a hazardous material that requires off-site disposal, to a suitably licensed hazardous landfill, or suitably licensed recycling facility.

Based on the investigation data, it is considered feasible for existing hardstand and underlying granular materials, generated as part of any groundworks/earthworks, and any imported fill material be crushed, sorted, classified and compacted in a controlled manner in accordance with an approved earthworks specification (including verification).

Where cohesive glaciolacustrine deposits are excavated, their re-use in earthworks may be feasible. Dependent on the performance requirements for cohesive fill material, improvement of the geotechnical properties may be required, e.g. by modification by the addition of lime.

The finished site levels should then be achieved by placing selected site-won and/or imported fill materials in a controlled manner in accordance with an approved Earthworks Specification.

Based on observations made during the intrusive site investigation, existing made ground was found to include a some deleterious materials, including scrap metal, occasional wood and plastic. Therefore, excavated made ground will require careful excavation, sorting/processing, classification and segregation prior to re-use.

Excavations into existing made ground and the underlying natural soils should be assumed to be unstable. No personnel entry into unsupported excavations shall be allowed without an appropriate risk assessment. Reference to CIRIA report 97 (1983) should be made to establish suitable means of support or battering of excavation sides.

Excavation should generally be possible with standard plant, although the use of hydraulic or pneumatic breakers is likely to be required where existing buried structures/obstructions are encountered.

Based on the results of this investigation, significant groundwater seepages or inflows within shallow excavations (<1.5m) are considered unlikely and any which do occur are likely to be localised. If groundwater is encountered at shallow depth then it should be possible to deal with seepages through normal site pumping practices for any shallow excavations open for short periods of time. For deeper excavations a point dewatering system may be required. Disposal/discharge of water will require appropriate treatment/consent.

Where perched groundwater is found within intact substructures, this should be pumped out for disposal at a suitable liquid waste disposal facility, or for discharge to foul sewer in accordance with an appropriate discharge consent provided by the local statutory body.

It is recommended that an adequate drainage system for surface water be installed by a competent contractor in order to prevent surface water ponding or collecting both during and post construction, as this may lead to deterioration of the founding stratum.

To reduce the possibility of softening or swelling of cohesive soils at the base of foundation trenches, these should be suitably blinded with concrete.

Slope Stability

Consideration should be given to the type of plant utilised and development activities carried out (e.g. piling) in proximity to the slope between the site and existing neighbouring properties to the north in order to limit imposed vibration. If piling in proximity to the slope is required, it is recommended that a slope stability assessment is undertaken.

Pavements and Highways

Highways Agency document HD25 Interim Advice Note 73/06 Revision 1 (2009) states that where a subgrade has a CBR lower than 2.5%, it is considered unsuitable support for a pavement foundation since it would tend to deform under construction traffic, and must be improved.

Consideration could be given to excavation, sorting and classifying the made ground, in accordance with Highways Agency *Specification for Highways Works, Series 600: Earthworks*, to a minimum depth of 1.00m, or to the full depth of the made ground, whichever is shallower, below formation/subgrade level. This should be undertaken prior to placement and re-compaction. Any material which is used for road construction should also be compacted in accordance with Highways Agency *Specification for Highways Works, Series 600: Earthworks*.

Based on the results of the laboratory testing undertaken on the natural glaciolacustrine clays soils, a CBR value of 3% could be assumed for preliminary pavement design within these soils at this stage.

It is recommended that in-situ CBR testing is carried out following completion of the enabling works, when final site levels will be known.

All road design should be discussed with the relevant local authority if highways are to be subject to a Section 38 agreement.

Soakaways

The site is underlain by made ground, including both cohesive and granular materials, which is in turn underlain by cohesive glaciolacustrine deposits of presumed low permeability. It is therefore considered that the use of soakaway drainage is unlikely to be viable at the site.

10.4. Asbestos-Containing Materials

A suspected asbestos cement-bound roof tile was observed at a depth of 3.0m bgl within the cohesive made ground horizon encountered within TP27.

Due to the historical development and landfilling activities on the site, the possibility of asbestos cement sheeting used as shuttering, and/or fragments of asbestos-containing materials within made ground or shallow natural soils cannot be discounted, particular beneath or in the vicinity of buildings undergoing demolition at the time of our intrusive works. If encountered, advice should be sought from an appropriately qualified asbestos specialist and an appropriate strategy developed for the safe removal and disposal of the material.

Two samples of made ground out of 20 No. analysed were found to contain asbestos, in the form of chrysotile and amosite fibres. Quantitative asbestos analysis identified that the concentration of asbestos within these samples was <0.001% in both cases. Reference to CIRIA Report C733² (specifically, Figure 9.1) indicates that even deliberate vigorous disturbance of dry soils containing such a concentration would be expected to result in release of asbestos fibres that would give airborne concentrations less than, or within the range, recorded as background air quality in urban areas (see Table 6.1 of that report). Therefore, the risk to human health posed by the very small amount of asbestos contamination in soil detected at the site to date is not considered to represent a risk that necessitates remedial action over and above that recommended to protect site end-users from the other forms of soil contamination identified.

10.5. Slag

The investigation has identified the presence of granular made ground, with inclusions of slag materials in varying proportions, recorded to depths of up to 6.5m bgl. The recorded thickness of the ground deposits with slag inclusions is generally in the range of 0.15m to 5.8m thick.

A composite sample, consisting solely of slag material, is currently being subjected to a laboratory Emery slag expansion test, in order to determine a worst case scenario assuming the entirety of that made ground were to comprise slag. The results of the testing will be reported under separate cover upon completion.

The ultimate expansion percentage, and rate of expansion will be variable and dependant upon a number of factors, including the type of slag present, true proportion of slag within the made ground material, groundwater infiltration, changes in groundwater regime and any excavations which expose the slag to air. It would be prudent, pending results of preliminary Emery expansion testing, to undertake specialist slag identification and analysis to identify the true volumetrically unstable proportion.

² Nathanail, P., et al., 2014. *Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks*. CIRIA, London.

10.6. Soil and Groundwater Contamination

Risk Evaluation for the Proposed Land Use (Residential)

The revised conceptual site model indicates that potentially unacceptable contaminant linkages exist for site end-users and ecological receptors. Contaminant linkages assessed as a Low or Negligible risk are not considered significant or requiring remedial action, and are not discussed further.

Human Health Receptors

Elevated concentrations of various metal and PAH compounds in made ground soils pose a potentially unacceptable risk to site end-users and require remedial action. Therefore, there is considered to be an unacceptable risk to human health from exposure to these contaminants within made ground *via* dermal exposure, ingestion and dust inhalation pathways following development if appropriate remedial measures are not taken.

Controlled Waters Receptors

Elevated concentrations of chromium, copper, lead and zinc were detected, with respect to EQS values, within two groundwater samples subject to analysis. One sample also recorded concentrations of cadmium, nickel, ammonia and fluoranthene above the EQS values. Concentrations of chromium, copper, lead, zinc, ammonia, fluoranthene and benzo(a)pyrene were also detected above EQS values, within a sample of surface water obtained from Lustrum Beck.

Concentrations were generally not indicative of significant impacts and appear to be associated with the general made ground and the urban nature of the surrounding area. It is also evident that PAH contaminants not identified in groundwaters obtained from the site, are present in the Lustrum Beck watercourse, suggesting a potential source other than on-site made ground and former site activities. In any event, groundwaters are likely to be perched and will not be laterally or vertically pervasive, owing to the presence of cohesive glaciolacustrine deposits adjacent to and below the made ground. This will effectively mitigate the lateral and vertical migration of any contaminated groundwaters into the adjacent Lustrum Beck watercourse and to the underlying Principal Aquifer of the Triassic Sherwood Sandstone. Consequently, it is considered that the majority of the slightly elevated determinands present a low risk to controlled water receptors.

Landscaping and Planting

Several samples of made ground were found to contain concentrations of copper and zinc that exceed GAC set to be protective of phytotoxic effects on new planting and landscaping. It is therefore considered that a suitable imported growing medium should be provided in such areas to prevent discolouration, stunting or die back of plants.

Utilities

It is recommended that the results of the chemical testing and details of the proposed remedial works are provided to the appropriate utility companies to determine the necessity for service protection.

Construction and Maintenance Workers

Contamination may pose a short-term (acute) or long-term (chronic) risk to workers during construction and maintenance. The potential risks must be specifically assessed as part of the health and safety evaluation for the works to be performed in accordance with prevailing legislation. Site practices must conform to the specific legislative requirements and follow appropriate guidance (e.g., HSE, 1991; CIRIA, 1996).

On the basis of the results obtained, the principal potential exposure risks to workers may arise from heavy metal and PAH contamination and asbestos within made ground.

Given that concentrations of carbon dioxide and depleted oxygen were recorded during ground gas monitoring, precautions should also be taken to protect workers entering and/or working in confined spaces.

Outline Remediation Requirements

Made ground present across the site has been found to be contaminated with heavy metals and PAHs. In addition, the presence of dispersed asbestos fibres has also locally been identified within the shallow made ground, although only low concentrations have been detected. There is a need to remove any potential linkages between these contaminants and future site users, or other identified receptors. With respect to the presence of the low concentration of asbestos fibres within the made ground, it is considered that these will not represent a significant risk to future site users as long as end users do not come into contact with the made ground.

Where made ground is present at the surface and is not removed by reprofiling, it is recommended that all gardens and landscaped areas are provided with a clean cover capping system, to provide a physical barrier between the identified contamination and future site users, thus breaking associated contamination linkages.

To this effect, the following remediation measures are proposed:

- Geotextile separator layer placed on the surface of the made ground in all garden and landscaped areas where made ground is present, to act as a marker layer and also a physical separator between made ground and overlying clean soils; and
- 600mm thick capping layer of clean, texturally and chemically suitable purpose, soil to be placed across all garden areas. The clean capping soils should incorporate at least 150mm of good quality, texturally and chemically suitable topsoil at the surface.

Site levels will need to be designed to take account of the proposed capping layer, especially at the boundaries where they will need to be tied into adjoining features. It is critical to model the site at an early stage to optimise levels and materials balance.

Where site-won natural soils are to be re-used within the remediation scheme, then it is recommended this be undertaken under a Materials Management Plan³, which must be reviewed by a Qualified Person and their declaration submitted to CL:AIRE before works commence.

It is envisaged that suitable clean topsoil, and some subsoil, will need to be imported to the site to complete the clean capping system. Any imported soils will require validation.

Some site clearance, including removal of floor slabs, external hardstanding and below ground structures, such as historical foundations/basements, is likely to be required. Such works should be detailed in Specification for Remedial works and it should be ensured that they do not give rise to further ground contamination.

The above recommendations comprise a general outline of possible or likely works. A remediation strategy report shall be produced and agreed with the regulatory authorities prior to commencement of remediation.

³ CL:AIRE” The Definition of Waste: Development Industry Code of Practice”, version 2, March 2011 (or as amended).

It is possible that areas of more significant contamination, not identified to date, may be encountered on site during excavation and construction works. If any areas of noxious, odorous, brightly coloured, fibrous, liquid or other potential contamination are encountered, then further advice should be sought from a suitably qualified consultant.

10.7. Ground Gas

Summaries of the gas results to date within each area of the site are provided below. Calculated Q_{hg} (Quantity of Hazardous Gas) and Gas Screening Values (GSVs) are provisional only and may be subject to change based on future monitoring data.

Significantly elevated peak flow rates observed in some wells may be considered to be attributed to a combination of the confinement of the ground gases within the solid section of pipework i.e. where groundwater levels are above the response zone of the well, or confinement within low permeability cohesive deposits, which can result in the gas becoming pressurised within the sealed space. Consequently, these exceptionally high initial flow rates could be considered unrepresentative of the true conditions, and have tentatively been discounted during this risk assessment.

The results to date have revealed a maximum peak methane concentration of 1.0% v/v, recorded in WS01 on one occasion only. Methane concentrations were below detection limits (<0.1% v/v) in all other wells. A maximum steady state carbon dioxide concentration of 9.7% v/v has been recorded in WS11 to date. Lower concentrations of carbon dioxide have also been detected in all other wells, except for WS09. Excluding the potentially erroneous data, peak flow rates were generally below detection limits (<0.1litres/hour). A negative peak flow of -6.7litres/hour however has been recorded on one occasion in WS10. As a similar positive outflow of gas cannot be credibly ruled out, for the purposes of this preliminary risk assessment, this negative flow rate is conservatively converted to a positive value. Steady state flow rates were also below detection limits in most wells, except for CP01 in which a maximum flow of 5.5litres/hour has been recorded to date.

Based on these data, worst case Q_{hg} values of 0.067litres/hour for methane and 0.53litres/hour for carbon dioxide in any one stratum have been calculated. If these values are applied as provisional GSVs for the site, then the results are indicative of a low hazard potential, characterised as Characteristic Situation 2 (CS2), as defined in Table 2 of BS8485:2015.

Table 4 of BS8485:2015 indicates that CS2 conditions require a minimum gas protection score of 3.5 for a Type A building for a residential end-use. This score may be achieved, for example, by a passive sub-floor void of suitable design and installation of a suitable gas resistant membrane, installed and verified in accordance with the requirements of BS8485:2015.

VOC concentrations have been recorded below detection limits of the monitoring equipment. At this stage, it is not considered that specific additional gas protection measures will be required for VOCs. This will however be confirmed upon completion of the gas monitoring.

Depleted oxygen concentrations (<18%v/v) have been detected on occasion in most wells to date, with a minimum oxygen concentration of 0.1%v/v having been recorded in WS10. Such low concentrations could present a significant risk to construction and maintenance workers in excavations and below ground confined spaces (i.e. drainage chambers), and to workers and end users in confined spaces and basement type areas on completion of development.

The above indicative assessment must be regarded as interim at this stage. Allowance for CS3 protection measures (moderate hazard potential) to all buildings is recommended for pricing purposes, pending completion of a full gas risk assessment. A further four ground gas monitoring visits are planned and the full results, and an interpretation of these, will be issued as an addendum letter on completion of the monitoring programme.

Radon protection measures are not required by current guidance for the proposed development on this site.

10.8. Invasive Plants

Invasive plant species were not observed on this site at the time of investigation.

It is recommended that the presence or absence of invasive plant species is confirmed by qualified consultant ecologist and their advice taken on appropriate treatment. The treatment of any invasive species should take place in advance of the proposed construction works.

10.9. Disposal of Soils

Any materials removed from site should be undertaken in accordance with current Duty of Care requirements and the Environment Agency Technical Guidance Document WM3, dated 2015. The waste may also be subject to Waste Acceptance Criteria (WAC) testing. In light of the regulations it is recommended that discussion with landfill operators takes place at an early stage.

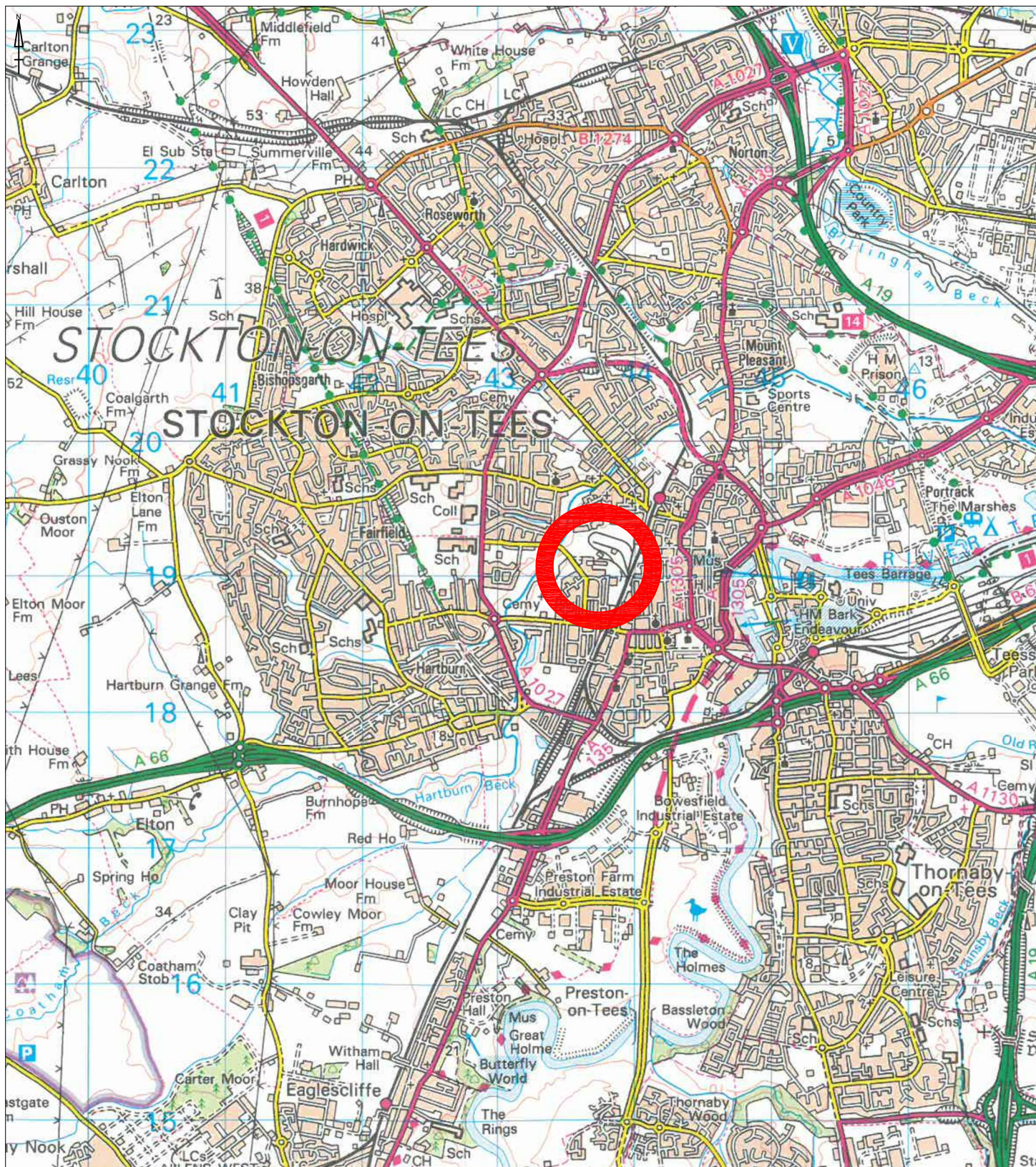
11. REGULATORY APPROVALS

The conclusions and recommendations presented above are considered reasonable based on the findings of the site investigation. However, these cannot be guaranteed to gain regulatory approval and, therefore, the report should be passed to the appropriate regulatory authorities and/or other relevant organisations for their comment and approval prior to undertaking any works on site.



APPENDIX A

FIGURES AND DRAWINGS



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NOTES

 Site Location

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www.thesiriusgroup.com
TEL : 0161 978 0079



CLIENT

TJ Thomson & Son Ltd

SITE

Millfield Works,
Stockton-On-Tees

DRAWING TITLE

Site Location Plan

DRAWING NO.

C7333/01

DRAWN BY

MG

DATE

Sept 2017

REVISION NO.

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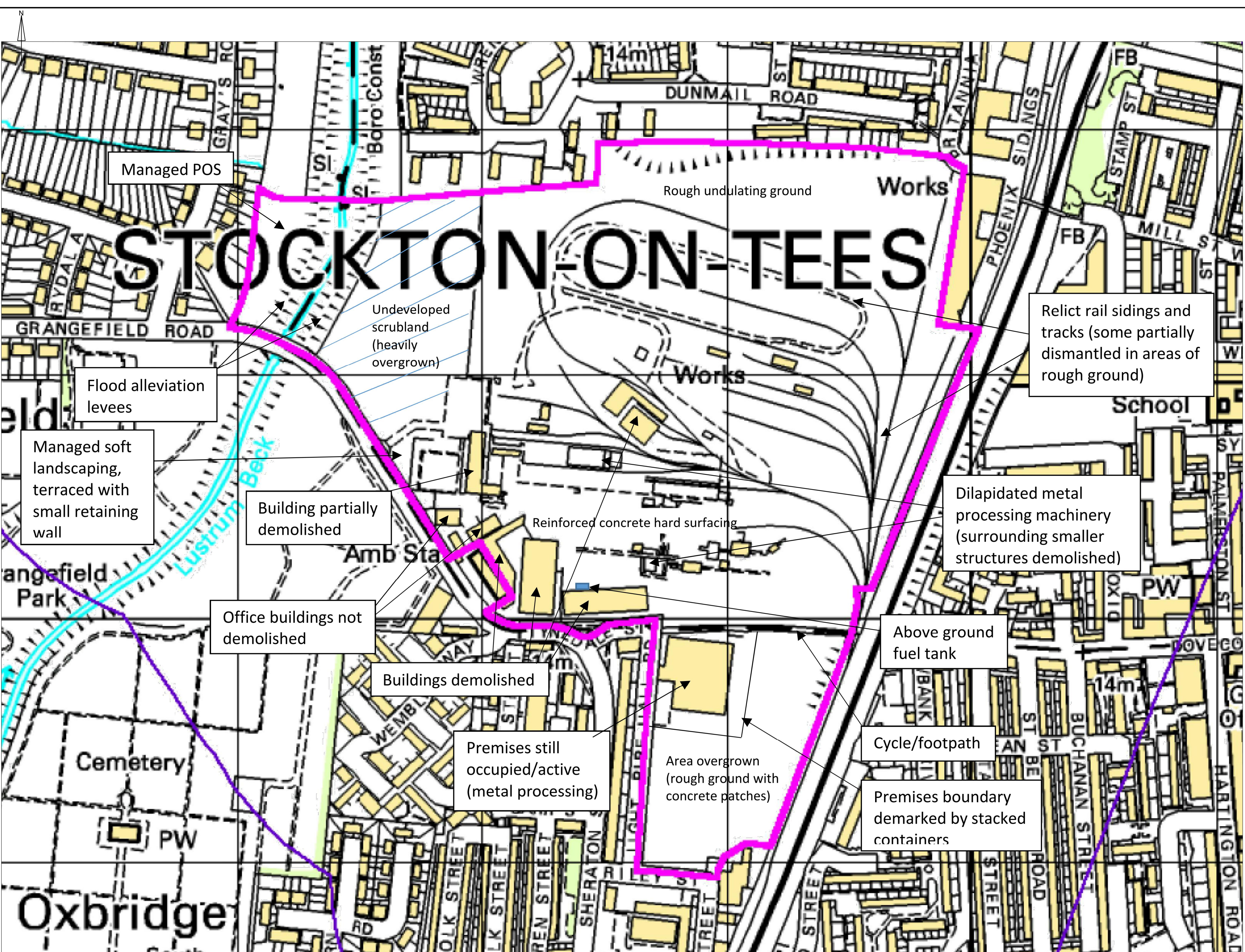
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A4




NOTES

Site boundary

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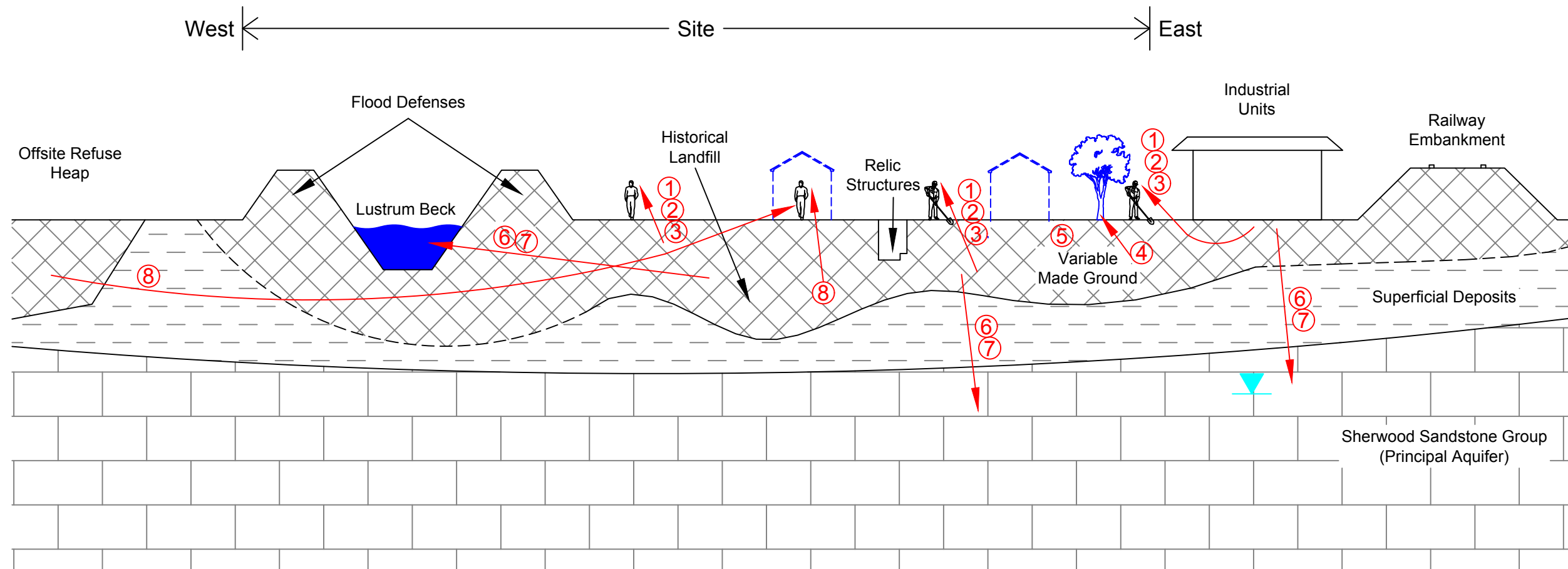
SITE

Millfield Works,
Stockton-On-Tees


DRAWING TITLE

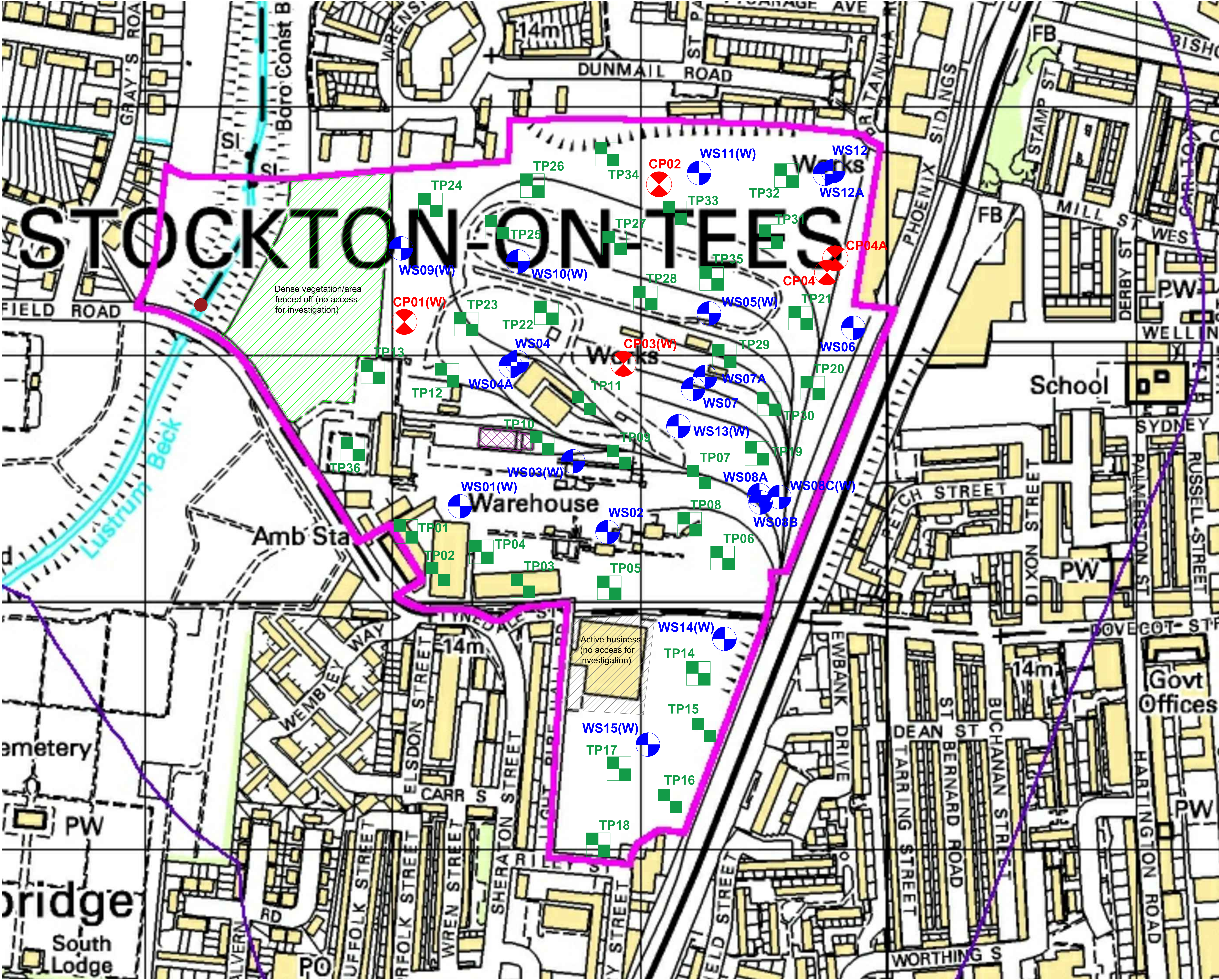
Site Features Plan

DRAWING NO. C7333/02	REVISION NO. 0	
DRAWN BY MG	APPROVED BY NJ	
DATE September 2017	SCALE 1:2000	PAPER SIZE A2



Contamination Sources	Contamination Pathway	Potential Receptors	Risk Classification
Metal/metalloid, organic and inorganic contaminants including asbestos and PCBs in made ground/shallow soils associated with former landfills and past developments within the site.	1. Direct and indirect ingestion 2. Inhalation of contaminants particles/dust/vapours 3. Dermal contact	End users and construction workers	Moderate – High
	4. Plant uptake	Gardens and landscaping	Low – Moderate
	5. Direct contact with construction materials	Construction products including buried concrete and plastics	Low – Moderate
	6. Leaching	Controlled waters (Principal Aquifer, Lustrum Beck watercourse)	Low – Moderate
Incidental localised spillages / discharges of hydrocarbon on site from former site uses e.g. from historical and existing ASTs.	1. Direct and indirect ingestion 2. Inhalation of contaminants particles/dust/vapours 3. Dermal contact	End users and construction workers	Moderate – High
	4. Plant uptake	Gardens and landscaping	Low – Moderate
	5. Direct contact with construction materials	Construction products including buried concrete and plastics	Low – Moderate
	6. Leaching	Controlled waters (Principal Aquifer, Lustrum Beck watercourse)	Low – Moderate
	7. Direct flow of liquids		Low – Moderate
Incidental localised spillages/discharges of hydrocarbons off-site from adjacent industrial uses.	1. Direct and indirect ingestion 2. Inhalation of contaminants particles/dust/vapours 3. Dermal contact	End users and construction workers	Low – Moderate
	4. Plant uptake	Gardens and landscaping	Low
	5. Direct contact with construction materials	Construction products including buried concrete and plastics	Low
	6. Leaching	Controlled waters (Principal Aquifer, Lustrum Beck watercourse)	Low – Moderate
	7. Direct flow of liquids		Low – Moderate
Generation of hazardous ground gases associated with recorded landfill and deep made ground on site and /or off site made ground and former refuse heap.	8. Migration of ground gas into indoor air	Built environment (explosion)	Moderate – High
		End users and construction workers (asphyxiation and explosion)	Moderate – High

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Millfield Works, Stockton-On-Tees			
DRAWING TITLE			
Preliminary Conceptual Site Model			
DRAWING NO. C7333/03		REVISION NO. 0	
DRAWN BY SM		APPROVED BY GB	
DATE September 2017	SCALE NTS	PAPER SIZE A3	



- NOTES
- Site Boundary
 - Wooded Area (Outside Millfield Works Boundary)
 - Deep Substructure (Car Crusher)
 - Trial Pit
 - Window Sample Hole
 - Cable Percussive Borehole
 - (W) Monitoring Well
 - Surface Water Sampling Location

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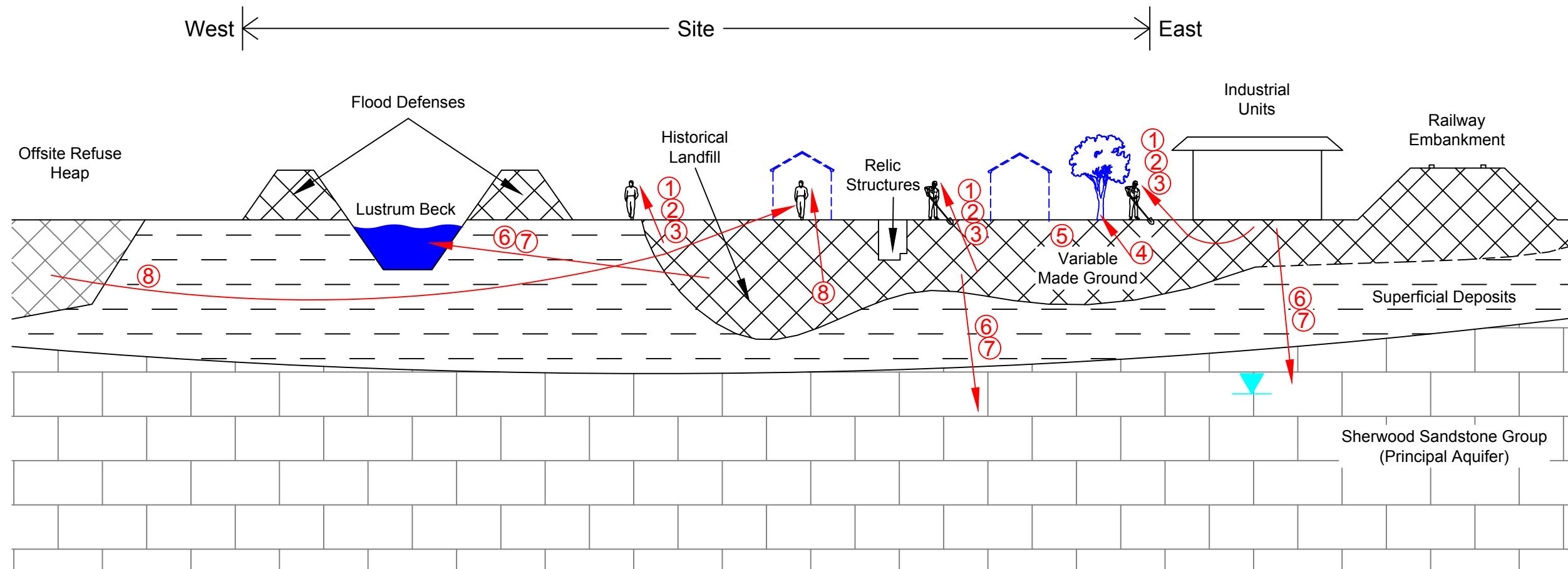
SITE

Millfield Works,
Stockton-On-Tees

DRAWING TITLE

Exploratory Hole
Location Plan

DRAWING NO. C7333/04		REVISION NO. 0	
DRAWN BY MG		APPROVED BY CR	
DATE September 2017	SCALE 1:1000		PAPER SIZE A0



Contamination Sources	Contamination Pathway	Potential Receptors	Risk Classification
Elevated metal/metalloid and PAH contaminants, asbestos and sulphates in made ground associated with former landfills and past developments within the site.	1. Direct and indirect ingestion	End users and construction workers	Moderate – High
	2. Inhalation of contaminants particles/dust/vapours		
	3. Dermal contact		
	4. Plant uptake	Gardens and landscaping	Moderate
	5. Direct contact with construction materials	Construction products including buried concrete and plastics	Low – Moderate
	6. Leaching	Controlled waters (Principal Aquifer, Lustrum Beck watercourse)	Low
Incidental localised spillages / discharges of hydrocarbon on site from former site uses e.g. from historical and existing ASTs.	1. Direct and indirect ingestion	End users and construction workers	Low
	2. Inhalation of contaminants particles/dust/vapours		
	3. Dermal contact		
	4. Plant uptake	Gardens and landscaping	Low
	5. Direct contact with construction materials	Construction products including buried concrete and plastics	Low
	6. Leaching	Controlled waters (Principal Aquifer, Lustrum Beck watercourse)	Low
Incidental localised spillages/discharges of hydrocarbons off-site from adjacent industrial uses.	7. Direct flow of liquids		Low
	1. Direct and indirect ingestion	End users and construction workers	Low
	2. Inhalation of contaminants particles/dust/vapours		
	3. Dermal contact		
	4. Plant uptake	Gardens and landscaping	Low
	5. Direct contact with construction materials	Construction products including buried concrete and plastics	Low
Generation of hazardous ground gases associated with recorded landfill and deep made ground on site and /or off site made ground and former refuse heap.	6. Leaching	Controlled waters (Principal Aquifer, Lustrum Beck watercourse)	Low
	7. Direct flow of liquids		Low
	8. Migration of ground gas into indoor air	Built environment (explosion)	Low
		End users and construction workers (asphyxiation and explosion)	Low – Moderate*

* To be reassessed on completion of gas monitoring

NOTES

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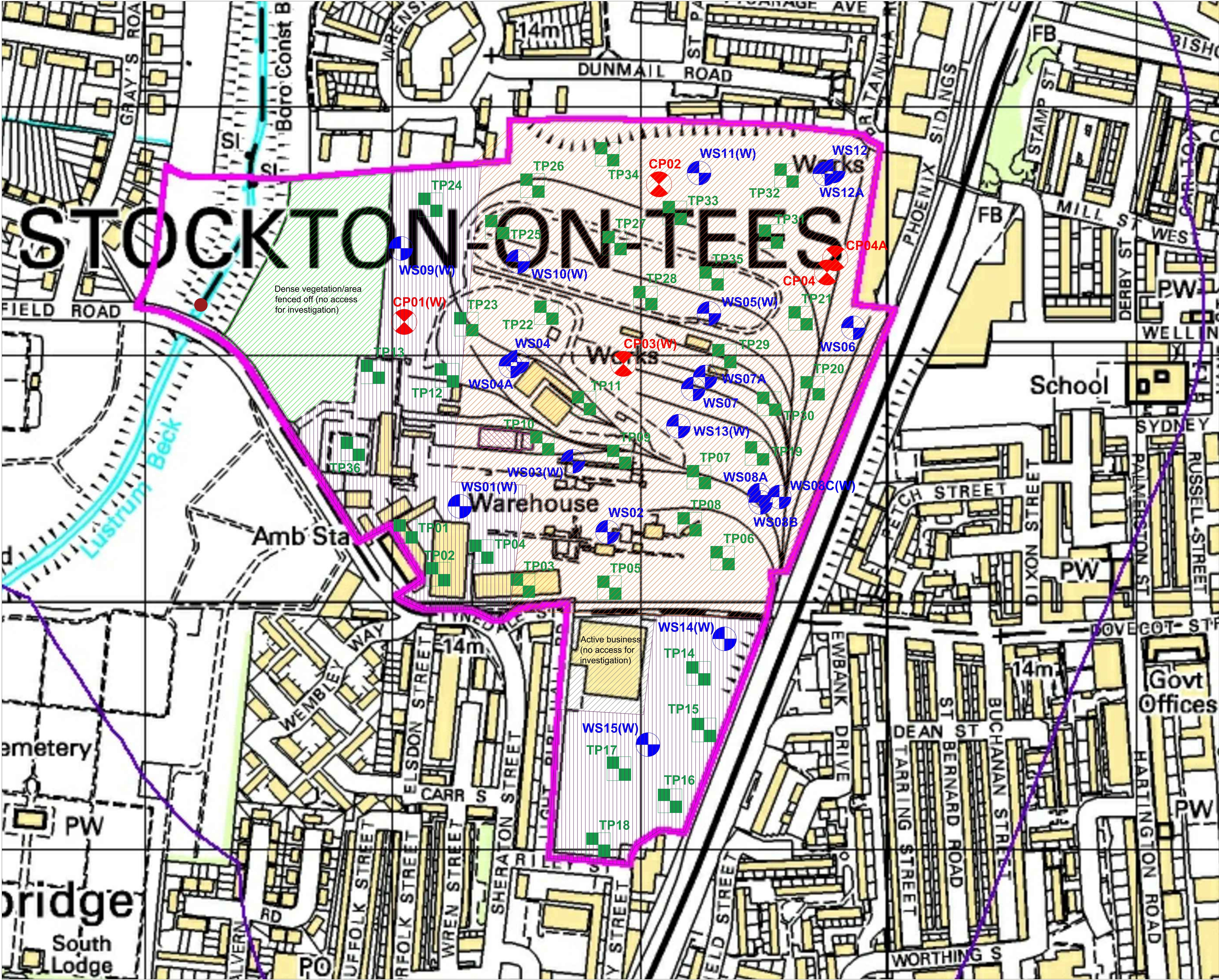
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**Millfield Works,
Stockton-On-Tees**

DRAWING TITLE

**Revised Conceptual
Site Model**

DRAWING NO. C7333/05	REVISION NO. 0
DRAWN BY MG	APPROVED BY CR
DATE September 2017	SCALE NTS
	PAPER SIZE A3



- NOTES
- Site Boundary
 - Wooded Area (Outside Millfield Works Boundary)
 - Deep Substructure (Car Crusher)
 - Trial Pit
 - Window Sample Hole
 - Cable Percussive Borehole
 - (W) Monitoring Well
 - Surface Water Sampling Location
 - Approximate area where pile/vibro foundations are anticipated
 - Approximate areas where strip/trench fill foundations may be suitable
- NB it has been assumed that the north-western most area will remain undeveloped

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DRAWING TITLE		
Indicative Foundation Options Plan		
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DATE September 2017	SCALE 1:1000	PAPER SIZE A0



APPENDIX B

RISK ASSESSMENT METHODOLOGY



Qualitative Risk Assessment Methodology

The approach adopted by Sirius for the qualitative assessment of risk is based upon that given in Annex 4 of NHBC-Environment Agency-CIEH “Guidance for the Safe Development of Housing on Land Affected by Contamination” (2008) and is consistent with other current guidance.

The risk posed by viable contaminant linkages is based upon the consideration of both:

- a) the magnitude of the potential consequence (i.e. its severity); and,
- b) the probability (likelihood) of that consequence being realised.

The classifications used in this report for consequence and probability are given in Tables 1 and 2, respectively. The derived risk classifications are defined in Table 3.

Where there is no viable contaminant linkage there is no potential risk.

Table 1. Classification of Consequence

Classification	Definition
Severe	<p>Contaminant concentrations at the receptor that are likely to result in “significant harm” to human health (as defined in Part 2A of the Environmental Protection Act 1990).</p> <p>Major pollution of controlled waters that could have persistent and/or extensive effects on water quality, for example fish kills, closure of an abstraction, or substantial deterioration in quality of the receiving water body.</p> <p>Major impact on receptor amenity value or major damage to agriculture or commerce.</p> <p>Major damage to an ecosystem that is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long-term maintenance of the population.</p> <p>Catastrophic damage to crops, buildings or property.</p>
Medium	<p>Elevated concentrations at the receptor that might result in “significant harm” to human health (as defined in Part 2A of the Environmental Protection Act 1990).</p> <p>A pollution incident that has significant effect on water quality or abstraction potential.</p> <p>An incident that has a marked effect on receptor amenity value, agriculture or commerce.</p> <p>Damage to an ecosystem that may result in a substantial adverse change in its functioning or harm to a species of special interest that may endanger the long-term maintenance of the population.</p> <p>Significant damage to crops, buildings or property.</p>



Classification	Definition
Mild	<p>Potential human health impact at the receptor point but unlikely to be classified as “significant harm” (as defined in Part 2A of the Environmental Protection Act 1990).</p> <p>Pollution of water that will have a small or short-lived effect on water quality and marginal effects on its amenity or resource value or its use in agriculture or commerce.</p> <p>Minor or short-lived damage to ecosystems, which is unlikely to result in a substantial adverse change</p> <p>Minor damage to crops, buildings or property</p>
Minor	<p>No potential measurable detrimental human health impacts at the receptor point.</p> <p>Impact on water that will have no or minimal effect on water quality or use.</p> <p>No or minor and easily repairable effects on buildings, structures and services.</p>

Table 2. Classification of Probability

Classification	Definition
High	An impact is already occurring or is very likely in the short-term and almost inevitable over the long-term.
Medium	It is probable that an event would occur. This is not inevitable but possible in the short-term and likely over the long-term.
Low	Circumstances are possible under which an event could occur. However, it is by no means certain that an event will take place, even over the long-term.
Unlikely	Circumstances are such that it is improbable that an event would occur even over the very long-term.

Table 3. Risk Classification

Probability	Consequence			
	<i>Severe</i>	<i>Medium</i>	<i>Mild</i>	<i>Minor</i>
High	Very High	High	Moderate	Low
Medium	High	Moderate	Low to Moderate	Low
Low	Moderate	Low to Moderate	Low	Very Low
Unlikely	Low to Moderate	Low	Very Low	Negligible



Table 4 provides a context for interpretation of the risk classification categories. The definitions provided are based on those given in CIRIA (2001) "Contaminated Land Risk Assessment. A Guide to Good Practice", Report C552.




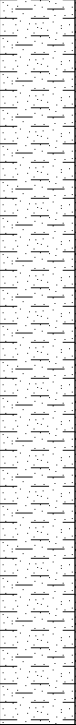

Table 4. Interpretation of Risk Classification Categories






Risk Classification	Definition
Very High	There is a high probability that severe harm to one or more identified receptors could occur or there is evidence that this is already happening. This risk is likely to result in a substantial liability. Urgent investigation and remediation are likely to be required.
High	Harm is likely to be caused to one or more identified receptors. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required and remedial works may be necessary in the short-term and are likely over the longer term.
Moderate	It is possible that harm could be caused to one or more identified receptors. However, it is relatively unlikely that such harm would be severe. Investigation is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low	It is possible that harm could be caused to one or more identified receptors but it is likely that this harm, if realised, would normally be mild. No further investigation is considered necessary to assess risk or environmental liability but investigations could be undertaken if desired to confirm 'baseline' conditions for the purposes of liability management. Remedial works are unlikely to be required.
Very Low	There is a low probability that harm could be caused to one or more identified receptors. In the event of such harm being realised, it is likely to be mild, at worst. No further investigation is considered necessary to assess risk or environmental liability but investigations could be undertaken if desired to confirm 'baseline' conditions for the purposes of liability management. Remedial works are very unlikely to be required.
Negligible	It is unlikely that harm could be caused to one or more identified receptors. In the event of harm being realised, it is likely to be minor. No further investigation is considered necessary to assess risk or environmental liability. Remedial works are not expected.




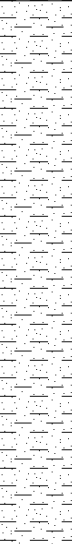
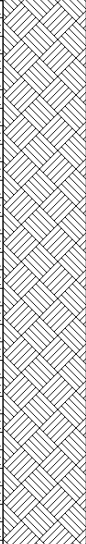


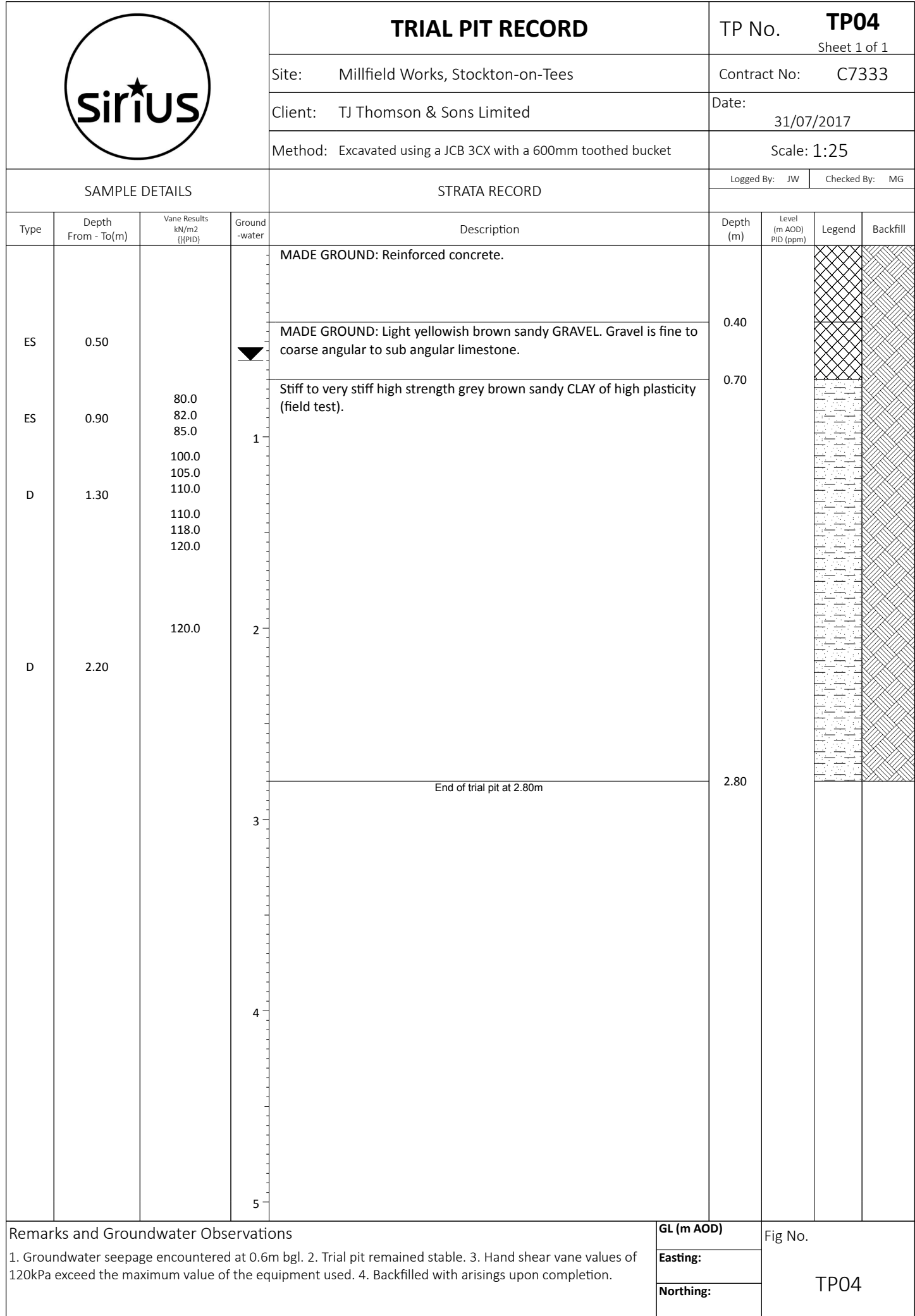
APPENDIX C




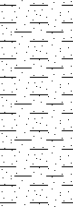

EXPLORATORY HOLE LOGS AND FIELD TEST RESULTS









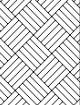




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				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 31/07/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.20			MADE GROUND: Mass concrete.	0.15			
				MADE GROUND: Reddish brown gravelly SAND. Gravel is fine to coarse angular shale and brick fragments.	0.25			
ES	0.50			MADE GROUND: Stiff high strength grey brown slightly sandy gravelly CLAY of high plasticity (field test). Gravel is fine to coarse angular to sub angular concrete fragments and sandstone.	0.50			
		78.0 82.0 90.0		Stiff high strength grey brown slightly sandy CLAY of very high plasticity.				
			1					
D	1.20	85.0 90.0 95.0		After 1.2m bgl: Becomes reddish brown.				
				After 1.5m bgl: Becomes occasionally laminated.				
		120.0 120.0						
D	2.00		2					
			3	End of trial pit at 2.90m	2.90			
			4					
			5					
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					GL (m AOD)		Fig No. TP01	
					Easting:			
					Northing:			

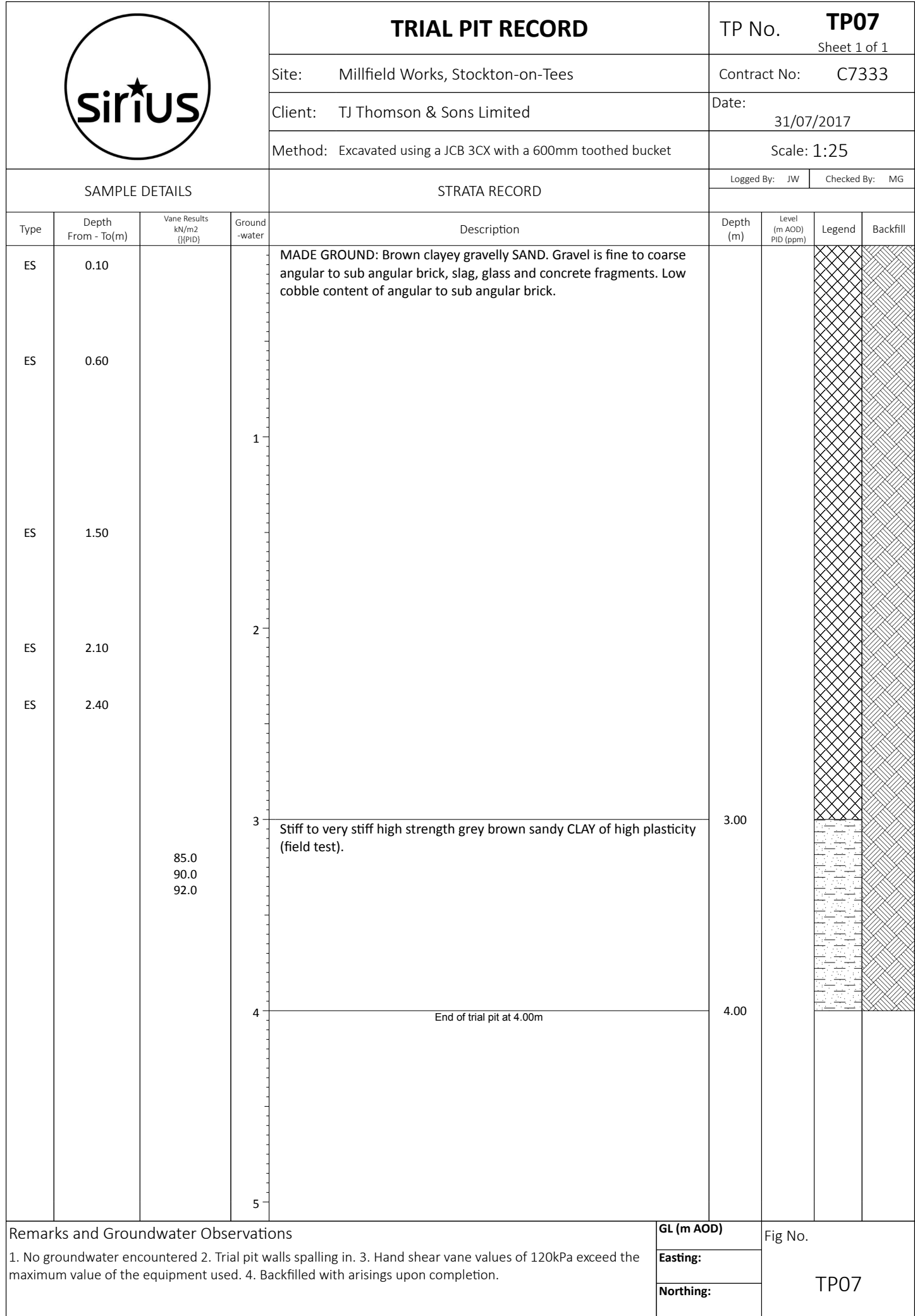
				TRIAL PIT RECORD		TP No. TP02 <small>Sheet 1 of 1</small>		
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				Client: TJ Thomson & Sons Limited		Date: 31/07/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.25			MADE GROUND: Reinforced concrete.	0.20			
				MADE GROUND: Reddish brown gravelly SAND. Gravel is fine to coarse angular shale and brick fragments. Low cobble content of angular brick.				
ES	0.60			Firm to stiff high strength grey brown slightly sandy CLAY of high plasticity (field test).	0.50			
		78.0 87.0 90.0						
D	1.20		1	<i>After 1.1m bgl: Becomes reddish brown and occasionally laminated.</i>				
		102.0 110.0 95.0 120.0 120.0 120.0						
D	1.90		2					
			3					
				End of trial pit at 3.30m	3.30			
			4					
			5					
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					GL (m AOD)		Fig No. TP02	
					Easting:			
					Northing:			

				TRIAL PIT RECORD		TP No. TP03 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 31/07/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.25			MADE GROUND: Reinforced concrete.	0.20			
ES	0.50			MADE GROUND: Light yellowish brown sandy GRAVEL. Gravel is fine to coarse angular to sub angular limestone. MADE GROUND: Brown clayey gravelly SAND. Gravel is fine to coarse angular to sub angular brick and concrete fragments.	0.30			
ES	1.10		1	MADE GROUND: Dark grey to black gravelly SAND. Gravel is fine to coarse slag and concrete fragments.	0.90			
D	1.50	102.0 108.0 98.0		Stiff to very stiff high strength grey brown sandy CLAY of high plasticity (field test).	1.40			
		120.0 120.0		<u>After 1.8m bgl: Becomes reddish brown.</u>				
D	2.10		2					
		120.0 120.0						
			3					
				End of trial pit at 3.20m	3.20			
			4					
			5					
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					GL (m AOD)		Fig No. TP03	
					Easting:			
					Northing:			












				TRIAL PIT RECORD		TP No. TP05 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 31/07/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.40		1	MADE GROUND: Reinforced concrete.	0.30			
				MADE GROUND: Light yellowish brown sandy GRAVEL. Gravel is fine to coarse angular to sub angular limestone.				
				MADE GROUND: Dark grey to black gravelly SAND. Gravel is fine to coarse slag and concrete fragments.				
	ES			0.70				
ES	1.00							
D	2.90	75.0 78.0 82.0 102.0 105.0 110.0 120.0 120.0	3	Stiff to very stiff high strength grey brown sandy CLAY of high plasticity (field test).	2.80			
				End of trial pit at 3.50m				
Remarks and Groundwater Observations						GL (m AOD)		Fig No. TP05
1. Groundwater seepage encountered at 2.7m bgl. 2. Trial pit walls spalling in. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arising upon completion.						Easting:		
						Northing:		




				TRIAL PIT RECORD		TP No. TP06 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 31/07/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.50			MADE GROUND: Reinforced concrete.	0.35 0.40			
				MADE GROUND: Light yellowish brown sandy GRAVEL. Gravel is fine to coarse angular to sub angular limestone. MADE GROUND: Brown gravelly SAND. Gravel is fine to coarse angular to sub angular slag and sandstone.				
ES	1.20				2.00			
		68.0 68.0 70.0 84.0 86.0 90.0 120.0 120.0 120.0	1	Stiff medium to high strength grey brown sandy CLAY of high plasticity (field test).				
			2					
			3	After 2.5m bgl: Becomes very stiff high strength reddish brown.				
		120.0 120.0 120.0	4	End of trial pit at 3.50m	3.50			
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arising upon completion.					GL (m AOD)	Fig No. TP06		
					Eastings:			
					Northings:			









TRIAL PIT RECORD

TRIAL PIT RECORD



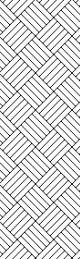
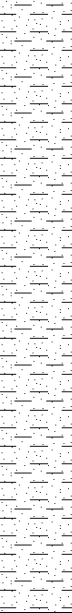
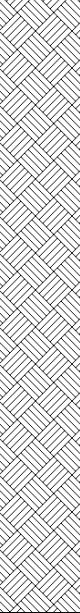
				TRIAL PIT RECORD		TP No. TP10 Sheet 1 of 1		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 01/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 (j PID)	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.60		1	MADE GROUND: Light yellowish brown sandy GRAVEL. Gravel is fine to coarse angular to sub angular limestone.	0.25			
				MADE GROUND: Brown grey gravelly SAND. Gravel is fine to coarse angular to sub angular slag and metal fragments. Low cobble content of slag.				
ES	1.30		2	MADE GROUND: Grey gravelly SAND. Gravel is fine to coarse angular to sub angular slag and occasional metal fragments.	1.20			
ES	2.30		3	After 2.2m bgl: Becomes sandy gravel.	2.90			
				Stiff to very stiff high strength grey brown sandy CLAY of high plasticity (field test).				
				After 3.6m bgl: Becomes very stiff reddish brown.				
			4	End of trial pit at 4.10m	4.10			
Remarks and Groundwater Observations					GL (m AOD)		Fig No.	
1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					Easting:		TP10	
					Northing:			








				TRIAL PIT RECORD		TP No. TP11 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 01/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.50			MADE GROUND: Reinforced concrete.	0.25 0.40			
				MADE GROUND: Light yellowish brown sandy GRAVEL. Gravel is fine to coarse angular to sub angular limestone.				
				MADE GROUND: Grey brown gravelly SAND. Gravel is fine to coarse angular to sub angular slag and concrete fragments. Low cobble content of angular slag and concrete.				
ES	1.20							
ES	1.80			<u>Between 1.6 and 3.2m bgl: Slight hydrocarbon odour.</u>				
ES	2.60							
				End of trial pit at 3.50m	3.50			
Remarks and Groundwater Observations					GL (m AOD)		Fig No.	
1. No groundwater encountered 2. Trial pit walls spalling in. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					Easting:		TP11	
					Northing:			



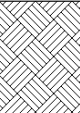
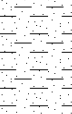

				TRIAL PIT RECORD		TP No. TP12 Sheet 1 of 1		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 01/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.50			MADE GROUND: Reinforced concrete.	0.20 0.40			
				MADE GROUND: Light yellowish brown sandy GRAVEL. Gravel is fine to coarse angular to sub angular limestone.				
				Stiff to very stiff high strength grey brown sandy CLAY.				
ES	1.00	80.0 82.0 85.0	1					
ES	1.40	120.0 120.0						
D	2.10	120.0 120.0	2					
			3					
				End of trial pit at 3.20m	3.20			
			4					
			5					
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					GL (m AOD)		Fig No. TP12	
					Easting:			
					Northing:			




				TRIAL PIT RECORD		TP No. TP13 Sheet 1 of 1		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 01/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.30	105.0 92.0 120.0 120.0	1	MADE GROUND: Tarmacadam.	0.15			
				MADE GROUND: Light yellowish brown sandy GRAVEL. Gravel is fine to coarse angular to sub angular limestone and concrete fragments.				
ES	0.70			120.0	2			
ES	1.50	End of trial pit at 2.50m	2.50					
		120.0	3					
			4					
			5					
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					GL (m AOD)		Fig No. TP13	
					Easting:			
					Northing:			




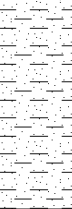

TRIAL PIT RECORD


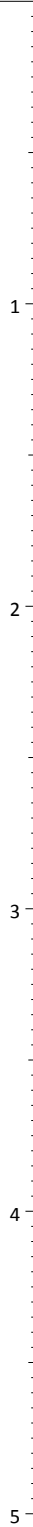


				TRIAL PIT RECORD		TP No. TP16 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 02/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.10	65.0 67.0 72.0	1	MADE GROUND: Dark brown to grey clayey gravelly SAND. Gravel is fine to coarse angular brick, glass and sandstone.	0.20			
ES	0.50			MADE GROUND: Dark brown clayey gravelly SAND. Gravel is angular to sub rounded sandstone, slag, clinker and glass. Low cobble content of whole bricks.				
ES	0.75			MADE GROUND: Grey brown coarse angular GRAVEL and COBBLES of slag.				
D	1.40	120.0 120.0	2	Stiff medium strength grey brown sandy CLAY of high plasticity (field test).	0.85			
				After 1.3m bgl: Becomes very stiff high strength reddish brown.				
				End of trial pit at 2.90m	2.90			
			3					
			4					
			5					
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					GL (m AOD)		Fig No. TP16	
					Easting:			
					Northing:			

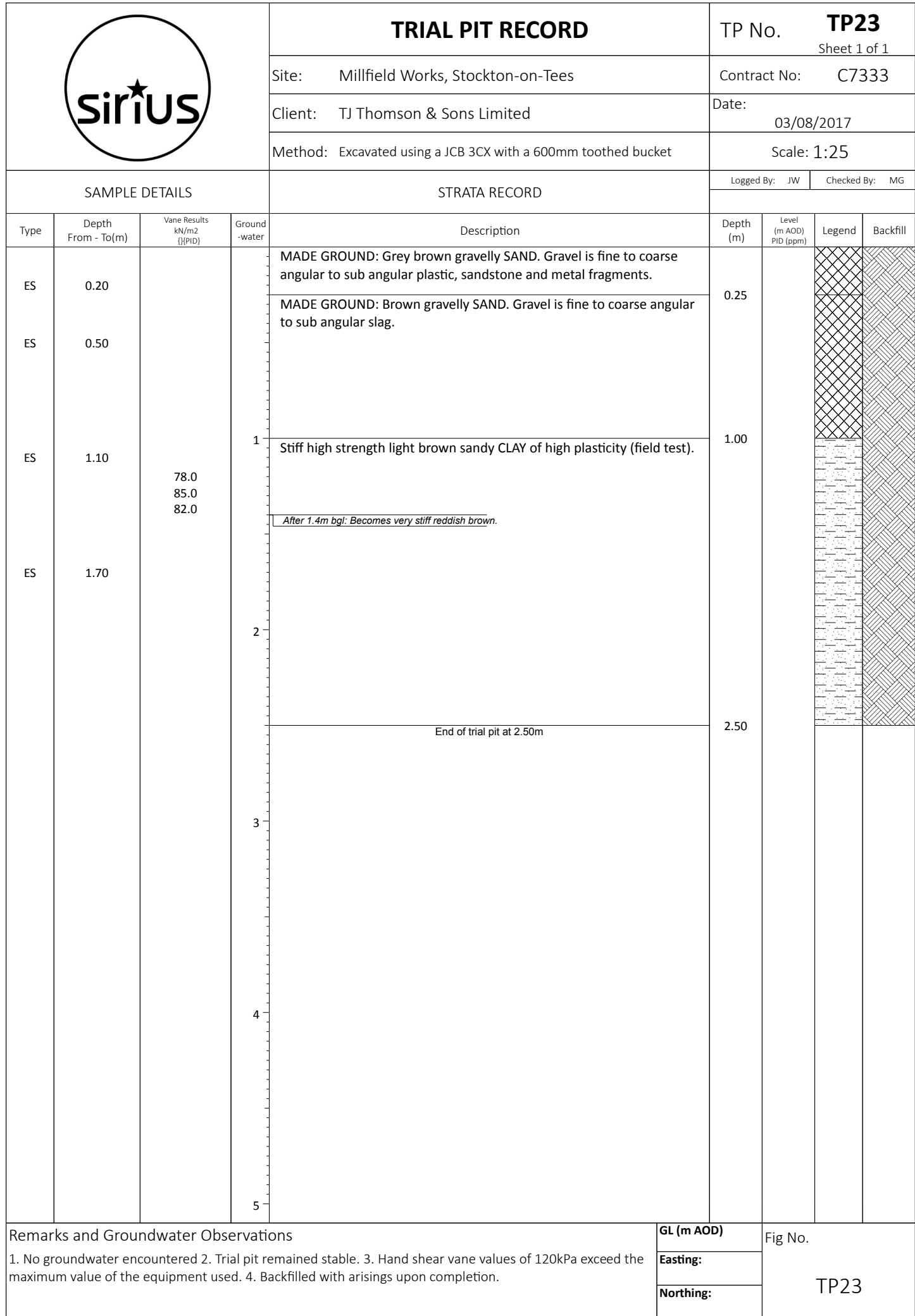
				TRIAL PIT RECORD		TP No. TP17 Sheet 1 of 1		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 02/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.10		1	MADE GROUND: Dark brown to grey clayey gravelly SAND. Gravel is fine to coarse angular brick, glass and sandstone.	0.15			
ES	0.40			MADE GROUND: Dark grey to light grey clayey gravelly SAND. Gravel is fine to coarse angular to sub angular wood, slag and metal.				
ES	1.00							
D	1.50	85.0 90.0	2	Stiff high strength grey brown sandy CLAY of high plasticity (field test).	1.30			
				After 1.8m bgl: Becomes very stiff reddish brown.				
		100.0 105.0 97.0						
D	2.30	120.0 120.0	3		3.20			
			4	End of trial pit at 3.20m				
			5					
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					GL (m AOD)		Fig No. TP17	
					Easting:			
					Northing:			


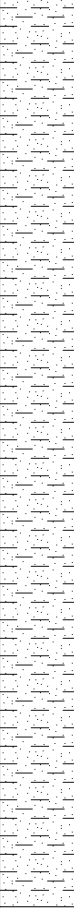

				TRIAL PIT RECORD		TP No. TP18 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 02/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.40			MADE GROUND: Tarmacadam.	0.10			
				MADE GROUND: Dark grey gravelly SAND. Gravel is fine to coarse angular to sub angular sandstone, mudstone, metal fragments and clinker.				
				MADE GROUND: Grey brown coarse angular GRAVEL and COBBLES of slag.				
ES	0.80				0.65			
ES	1.00		1	MADE GROUND: Brown slightly clayey slightly gravelly SAND. Gravel is fine to coarse sub rounded slag.	0.95			
D	1.70	120.0 120.0 120.0	2	Stiff to very stiff high strength grey brown sandy CLAY of high plasticity (field test).	1.10			
				End of trial pit at 2.50m	2.50			
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					GL (m AOD)	Fig No. TP18		
					Easting:			
					Northing:			

				TRIAL PIT RECORD		TP No. TP19 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 02/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.10			MADE GROUND: Dark brown clayey gravelly SAND. Gravel is fine to coarse brick fragments and slag.	0.20			
ES	0.50			MADE GROUND: Black to dark grey gravelly SAND. Gravel is fine to coarse angular to sub angular slate and brick fragments. Medium cobble content of whole bricks.				
ES	0.90				1.00			
			1	End of trial pit at 1.00m				
			2					
			3					
			4					
			5					
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit terminated at 1.0m bgl. due to obstruction. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					GL (m AOD)		Fig No. TP19	
					Easting:			
					Northing:			




				TRIAL PIT RECORD		TP No. TP21 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 02/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 (j PID)	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.20			MADE GROUND: Dark brown clayey gravelly SAND. Gravel is fine to coarse concrete fragments, shale and slag. <i>Between 0.2m and 3.9m bgl; Brick wall encountered, extending beyond 3.9m bgl. With a second perpendicular wall encountered in the east of the trial pit.</i>	0.50			
				MADE GROUND: Reddish brown sandy GRAVEL. Gravel is fine to coarse angular shale.				
ES	1.10		1					
B	2.00		2					
ES	2.90		3					
				Stiff to very stiff grey brown sandy CLAY of high plasticity (field test).	3.20			
				End of trial pit at 3.90m	3.90			
			4					
			5					
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Between 0.2m and 3.9m bgl; Brick wall encountered, extending beyond 3.9m bgl, with a second perpendicular wall encountered in the east of the trial pit. 5. Backfilled with arisings upon completion.					GL (m AOD)		Fig No. TP21	
					Easting:			
					Northing:			





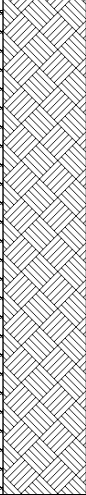
				TRIAL PIT RECORD		TP No. TP22 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 03/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.20			MADE GROUND: Brown gravelly SAND. Gravel is fine to coarse angular to sub angular brick fragments, glass, metal and slag.	0.30			
ES	0.60	MADE GROUND: Dark brown to grey gravelly SAND. Gravel is fine to coarse angular slag and concrete fragments						
ES	1.50	MADE GROUND: Light brown gravelly SAND. Gravel is fine to coarse sub angular sandstone and slag.		1.40				
ES	2.30			4.00				
				End of trial pit at 4.00m				
Remarks and Groundwater Observations					GL (m AOD)		Fig No.	
1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					Easting:		TP22	
					Northing:			









				TRIAL PIT RECORD		TP No. TP24 <small>Sheet 1 of 1</small>			
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333			
				Client: TJ Thomson & Sons Limited		Date: 03/08/2017			
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25			
SAMPLE DETAILS				STRATA RECORD		Logged By: JW		Checked By: MG	
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill	
ES	0.10	100.0 102.0 105.0	1	Very stiff high strength reddish brown sandy CLAY of high plasticity.					
D	0.80	120.0 120.0 120.0							
D	1.20	120.0 120.0 120.0							
			2						
			3	End of trial pit at 3.00m	3.00				
			4						
			5						
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					GL (m AOD)		Fig No. TP24		
					Easting:				
					Northing:				




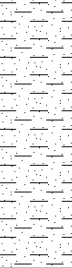

TRIAL PIT RECORD




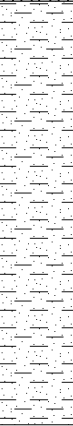

				TRIAL PIT RECORD		TP No. TP26 Sheet 1 of 1		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 03/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.10			MADE GROUND: Dark grey gravelly SAND. Gravel is fine to coarse metal, slag and mudstone.	0.20			
				MADE GROUND: Brown gravelly SAND. Gravel is fine to coarse angular to sub angular brick fragments, clinker, metal and slag.				
ES	0.90		1					
D	1.70		2					
D	2.30		3					
D	3.50		4					
			5	End of trial pit at 4.00m	4.00			
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					GL (m AOD)		Fig No. TP26	
					Easting:			
					Northing:			






				TRIAL PIT RECORD		TP No. TP27 Sheet 1 of 1		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 03/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 (jIPID)	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.20			MADE GROUND: Grey brown gravelly SAND. Gravel is fine to coarse angular to sub angular slag, sandstone and metal fragments. Medium cobble content of slag and brick.	1.10			
ES	0.90		1	MADE GROUND: Brown gravelly SAND. Gravel is fine to coarse angular to sub angular slag, brick fragments, shale and mudstone. Low cobble content of angular brick. <i>Between 1.1 and 1.3m bgl: Light pinkish brown sand band.</i>				
ES	1.70		2					
D	2.60	65.0 70.0 72.0 78.0 85.0 90.0	3	MADE GROUND: Firm to stiff medium strength grey brown slightly gravelly sandy clay of high plasticity (field test). Gravel is fine to coarse angular brick and concrete fragments. Low cobble content of brick. <i>At 3.0m bgl: Suspected asbestos cement roof tile.</i> <i>After 3.0m bgl: Becomes high strength.</i>	2.50			
			4	End of trial pit at 4.10m	4.10			
Remarks and Groundwater Observations					GL (m AOD)		Fig No.	
1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					Easting:		TP27	
					Northing:			




				TRIAL PIT RECORD		TP No. TP29 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 03/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.10			MADE GROUND: Dark grey to brown gravelly SAND. Gravel is fine to coarse sub angular brick and concrete fragments.	1.10			
ES	0.90		1	MADE GROUND: Dark grey to brown gravelly SAND. Gravel is fine to coarse angular to sub angular occasional brick and slag. <i>Between 1.1 and 1.7m bgl; Partial brick wall encountered within the western trial pit wall.</i>				
ES	1.50							
ES	2.10		2					
			3					
			4	End of trial pit at 3.80m	3.80			
			5					
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Between 1.1 and 1.7m bgl; Partial brick wall encountered within the western trial pit wall. 5. Backfilled with arisings upon completion.					GL (m AOD)		Fig No. TP29	
					Easting:			
					Northing:			



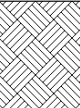
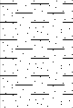
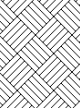
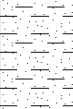

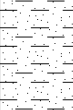

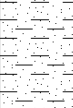
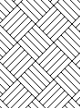
				TRIAL PIT RECORD		TP No. TP30 Sheet 1 of 1		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 03/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 (j PID)	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.20			MADE GROUND: Dark brown gravelly SAND. Gravel is fine to coarse angular to sub angular slag, concrete and brick fragments. <i>Between 0.3m and 3.8m bgl; Three brick walls encountered; two parallel walls c.1.5m apart joining a third perpendicular wall. Suspected floor at 3.8m bgl.</i>	0.50			
ES	0.70			MADE GROUND: Brown gravelly SAND. Gravel is fine to coarse angular to sub angular slag and occasional brick fragments.				
ES	1.60							
ES	2.50							
			1					
			2					
			3					
			4	End of trial pit at 3.80m	3.80			
			5					
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit walls spalling in. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Between 0.3m and 3.8m bgl; Three brick wall encountered; two parallel wall c.1.5m apart joining a third perpendicular wall. 5. Obstruction encountered at 3.8m bgl. 6. Backfilled with arisings upon completion.					GL (m AOD)		Fig No. TP30	
					Easting:			
					Northing:			





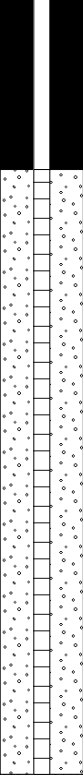




				TRIAL PIT RECORD		TP No. TP31 Sheet 1 of 1		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 04/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.20			MADE GROUND: Grey gravelly SAND. Gravel is fine to coarse angular to sub angular slag and occasional brick fragments.				
ES	0.90		1					
ES	1.70		2					
B	2.40							
ES	2.80		3	Stiff grey brown sandy CLAY of high plasticity.	3.10			
D	3.30	80.0 87.0 95.0 105.0 110.0 97.0 120.0 120.0 120.0						
				<i>After 3.5m bgl: Becomes very stiff reddish brown.</i>				
			4	End of trial pit at 4.00m	4.00			
			5					
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					GL (m AOD)		Fig No. TP31	
					Easting:			
					Northing:			





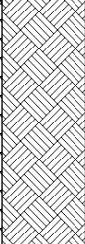
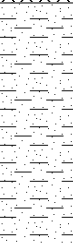
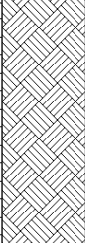
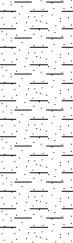
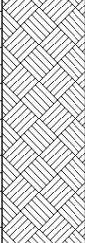
				TRIAL PIT RECORD		TP No. TP32 Sheet 1 of 1		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 04/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.20			MADE GROUND: Dark brown grey gravelly SAND. Gravel is fine to coarse angular brick and slag.	0.50			
ES	0.80			MADE GROUND: Light brown gravelly SAND. Gravel is fine to coarse angular to sub angular slag and occasional brick.				
ES	1.50			MADE GROUND: Reddish brown sandy gravelly COBBLES of brick. Gravel is fine to coarse brick and slag.				
ES	2.60	78.0 82.0 85.0		Very stiff high strength grey brown sandy CLAY of extremely high plasticity.	2.40			
D	3.00	100.0 100.0 98.0 118.0 120.0 120.0		<u>After 2.8m bgl: Becomes reddish brown.</u>				
				End of trial pit at 3.80m	3.80			
Remarks and Groundwater Observations					GL (m AOD)		Fig No.	
1. No groundwater encountered 2. Trial pit walls spalling in. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					Easting:		TP32	
					Northing:			






				TRIAL PIT RECORD		TP No. TP33 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 04/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.15			MADE GROUND: Dark brown gravelly SAND. Gravel is fine to coarse angular glass, metal and occasional brick.				
ES	0.70							
ES	1.50							
ES	2.40	55.0 55.0 60.0 75.0 80.0		MADE GROUND: Stiff medium strength grey brown slightly gravelly sandy CLAY of high plasticity. Gravel is angular brick and concrete fragments.	2.30			
D	2.80							
		65.0 70.0		End of trial pit at 4.10m	4.10			
Remarks and Groundwater Observations					GL (m AOD)		Fig No.	
1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					Easting:		TP33	
					Northing:			

				TRIAL PIT RECORD		TP No. TP35 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 04/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.20			MADE GROUND: Light grey gravelly SAND. Gravel is fine to coarse angular brick and concrete fragments. High cobble content of angular brick including whole bricks.	0.55			
ES	0.70			MADE GROUND: Dark grey gravelly SAND. Gravel is angular to sub angular brick fragments and slag.				
			1					
ES	1.60		2					
ES	2.40		3					
D	3.30							
				End of trial pit at 3.80m	3.80			
			4					
			5					
Remarks and Groundwater Observations 1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.					GL (m AOD)		Fig No. TP35	
					Easting:			
					Northing:			

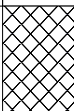
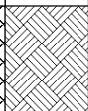
				TRIAL PIT RECORD		TP No. TP36 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 04/08/2017		
				Method: Excavated using a JCB 3CX with a 600mm toothed bucket		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
Type	Depth From - To(m)	Vane Results kN/m2 {j PID}	Ground -water	Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
ES	0.10			MADE GROUND: Dark brown gravelly SAND. Gravel is fine to medium sub angular to sub rounded ceramic, sandstone and mudstone. (Topsoil)	0.35			
				Very stiff high strength reddish brown sandy CLAY of high plasticity.				
ES	0.60	110.0 115.0 120.0						
D	1.30	120.0 120.0						
D	2.10	120.0 120.0						
				End of trial pit at 2.90m	2.90			
Remarks and Groundwater Observations				GL (m AOD)		Fig No.		
1. No groundwater encountered 2. Trial pit remained stable. 3. Hand shear vane values of 120kPa exceed the maximum value of the equipment used. 4. Backfilled with arisings upon completion.				Easting:		TP36		
				Northing:				





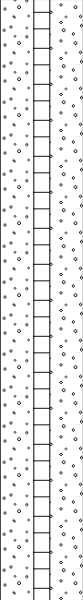
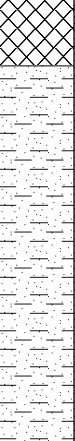





				WINDOW SAMPLING RECORD		BH No. WS01 Sheet 1 of 1		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 07/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
				Driller:				
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground- water	Description	Depth (m)	Level (m AOD)	Legend	Well
ES	0.30			MADE GROUND: Concrete.	0.20			
				MADE GROUND: Reddish brown sandy GRAVEL. Gravel is fine to coarse angular to sub angular sandstone and shale.	0.45			
ES	0.70	60.0 58.0		Firm to stiff medium strength grey brown sandy CLAY of high plasticity (field test).				
		N=7 (1,2/1,2,2,2)	1	After 1.0m bgl: Becomes very stiff reddish brown				
ES	1.50	80.0		Between 1.5 and 3.0m bgl: High strength.				
		115.0 N=14 (2,3/3,3,3,5)	2					
D	2.60	120.0						
		120.0 N=29 (3,2/5,7,9,8)	3	Between 3.0 and 3.45m bgl: Very high strength.				
D	3.40							
		N=12 (3,2/2,3,3,4)	4	Between 4.0 and 4.45m bgl: Medium strength.				
				End of Borehole at 4.45m	4.45			
Remarks and Water Observations: 1. No groundwater encountered. 2. Groundwater and gas monitoring well installed to 3m bgl. 3. Cased to 1m bgl. 4. Hand shear vane values of 120kPa exceed the maximum value of the equipment used.					GL (m AOD)		Fig No. WS01	
					Easting:			
					Northing:			




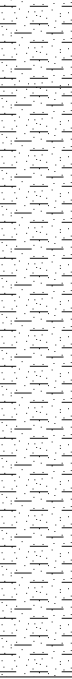
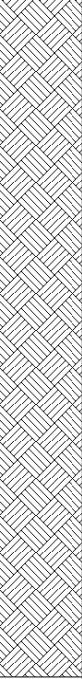
<div></div>				WINDOW SAMPLING RECORD		BH No. WS02 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 07/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
				Driller: RP Drilling Ltd.				
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground- water	Description	Depth (m)	Level (m AOD)	Legend	Well
ES	0.50	N=38 (8,15/14,10,7,7)	1	MADE GROUND: Concrete.	0.35 0.40			
				MADE GROUND: Dark grey sandy GRAVEL. Gravel is fine to coarse angular slag and concrete fragments. MADE GROUND: Very dense brown gravelly SAND. Gravel is fine to coarse angular to sub angular slag, glass and concrete fragments.				
ES	1.30	N=26 (2,4/13,6,3,4)	2	MADE GROUND: Orange brown gravelly SAND. Gravel is fine to coarse sub angular sandstone and slag.	1.20			
ES	1.70							
ES	2.20	N=17 (2,2/3,4,5,5)	3	Stiff very high strength grey brown sandy CLAY of high plasticity.	2.00			
D	2.80			Between 2.4 and 3.0m bgl: Silty sand band.				
		After 3.0m bgl: Becomes very stiff high strength reddish brown						
		120.0	4		4.45			
		120.0						
		N=19 (3,2/3,4,5,7)						
				End of Borehole at 4.45m				
Remarks and Water Observations:					GL (m AOD)		Fig No. WS02	
1. No groundwater encountered. 2. Backfilled with arising upon completion.					Easting:			
					Northing:			



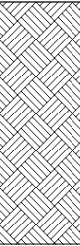
<div></div>				WINDOW SAMPLING RECORD		BH No. WS03 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 07/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
				Driller: RP Drilling Ltd.				
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground-water	Description	Depth (m)	Level (m AOD)	Legend	Well
ES	0.30			MADE GROUND: Concrete.	0.20			
				MADE GROUND: Brown gravelly SAND. Gravel is fine to coarse angular to sub angular slag, glass and concrete fragments.				
				MADE GROUND: Dense grey gravelly SAND. Gravel is angular to sub angular slag and occasional concrete fragments.				
ES	0.80				0.50			
ES	1.50	N=26 (4,3/3,3,10,10)	1					
ES	2.50	N=19 (16,9/7,5,4,3)	2	After 2.0m bgl: Medium dense.				
ES	3.30	N=8 (7,3/2,2,2,2)	3					
ES	3.30	90.0	4	Stiff high strength grey brown sandy CLAY of high plasticity (field test).	3.35			
				After 3.5m bgl: Becomes very stiff reddish brown				
		95.0						
		N=19 (3,3/3,4,6,6)						
				End of Borehole at 4.45m	4.45			
Remarks and Water Observations:					GL (m AOD)		Fig No. WS03	
1. Groundwater encountered at 3.25m bgl. 2. Groundwater and gas monitoring well installed to 2.5m bgl. 3. Cased to 1m bgl.					Easting:			
					Northing:			



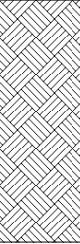


SAMPLE DETAILS				STRATA RECORD				Logged By: JW		Checked By: MG	
								Driller: RP Drilling Ltd.			
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground-water	Description	Depth (m)	Level (m AOD)	Legend	Well			
ES	0.60			MADE GROUND: Concrete.	0.35						
				MADE GROUND: Dark grey sandy GRAVEL. Gravel is fine to coarse angular slag, glass and concrete fragments.							
				1	End of Borehole at 1.00m				1.00		
			2								
			3								
			4								
Remarks and Water Observations:					GL (m AOD)		Fig No. WS04A				
1. No groundwater encountered. 2. Borehole terminated at 1m bgl due to obstruction. 3. Backfilled with arising upon completion.					Easting:						
					Northing:						




<div></div>				WINDOW SAMPLING RECORD		BH No. WS05 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 07/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
				Driller: RP Drilling Ltd.				
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground- water	Description	Depth (m)	Level (m AOD)	Legend	Well
ES	0.60	N=29 (7,6/6,7,9,7)	1	MADE GROUND: Dense brown slightly clayey gravelly SAND. Gravel is fine to coarse angular to sub angular slag and brick.				
ES	1.50	N=9 (3,2/2,3,2,2)	2	After 1.5m bgl: Becomes grey brown.				
ES	2.40	N=13 (1,2/2,3,4,4)	3	After 2.0m bgl: Becomes medium dense.				
		N=16 (2,2/2,3,5,6)	4	Stiff high strength grey brown sandy CLAY of high plasticity (field test).	3.20			
		95.0		End of Borehole at 4.45m	4.45			
Remarks and Water Observations:					GL (m AOD)		Fig No.	
1. No groundwater encountered. 2. Groundwater and gas monitoring well installed to 3m bgl. 3. Cased to 1m bgl.					Easting:		WS05	
					Northing:			




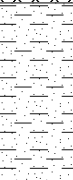
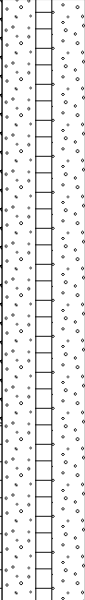
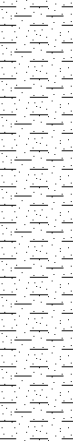
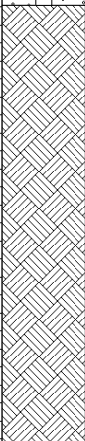
				WINDOW SAMPLING RECORD		BH No. WS06 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 07/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
				Driller: RP Drilling Ltd.				
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground- water	Description	Depth (m)	Level (m AOD)	Legend	Well
ES	0.80	N=4 (1,1/1,0,0,3)	1	MADE GROUND: Loose brown gravelly SAND. Gravel is fine to coarse angular to sub angular slag, glass and concrete fragments.	1.30			
ES	1.50	N=2 (2,1/0,0,1,1)	2	MADE GROUND: Very loose reddish brown sandy GRAVEL. Gravel is fine to coarse angular to sub angular sandstone and slag.				
ES	2.30			Soft orange brown silty slight sandy CLAY of low plasticity.				
				Very stiff high strength reddish brown CLAY of intermediate plasticity.				
D	2.80	110.0 N=22 (3,3/4,5,6,7)	3		2.50			
		N=19 (3,3/4,4,5,6)	4					
				End of Borehole at 4.45m	4.45			
Remarks and Water Observations: 1. No groundwater encountered. 2. Backfilled with arising upon completion.					GL (m AOD)		Fig No. WS06	
					Easting:			
					Northing:			


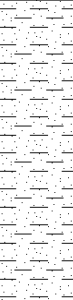

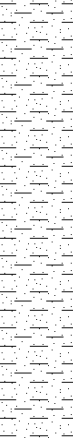
				WINDOW SAMPLING RECORD		BH No. WS07 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 07/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
				Driller: RP Drilling Ltd.				
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground- water	Description	Depth (m)	Level (m AOD)	Legend	Well
				MADE GROUND: Concrete.	0.80			
				End of Borehole at 0.80m				
			1					
			2					
			3					
			4					
Remarks and Water Observations:					GL (m AOD)		Fig No. WS07	
1. No groundwater encountered. 2. Borehole terminated due to obstruction at 0.8m bgl; suspected concrete slab. 3. Backfilled with arising upon completion.					Easting:			
					Northing:			




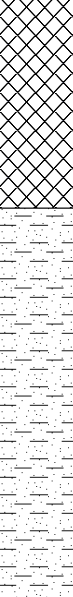
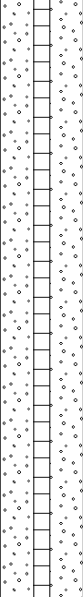
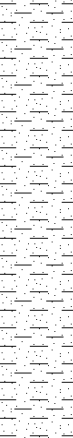

				WINDOW SAMPLING RECORD		BH No. WS07A <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 07/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
				Driller: RP Drilling Ltd.				
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground- water	Description	Depth (m)	Level (m AOD)	Legend	Well
				MADE GROUND: Light grey sandy GRAVEL. Gravel is fine to coarse angular concrete fragments and brick.	0.80			
				End of Borehole at 0.80m				
			1					
			2					
			3					
			4					
Remarks and Water Observations:					GL (m AOD)		Fig No. WS07A	
1. No groundwater encountered. 2. Borehole terminated due to obstruction at 0.8m bgl; suspected concrete slab. 3. Backfilled with arising upon completion.					Easting:			
					Northing:			



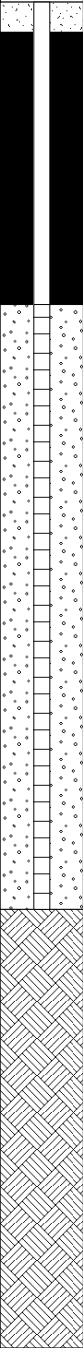





				WINDOW SAMPLING RECORD		BH No. WS08B <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 07/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
				Driller: RP Drilling Ltd				
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground- water	Description	Depth (m)	Level (m AOD)	Legend	Well
				MADE GROUND: Dark grey gravelly SAND. Gravel is fine to coarse angular to sub angular brick, shale and concrete fragments.	0.60			
				End of Borehole at 0.60m				
			1					
			2					
			3					
			4					
Remarks and Water Observations:					GL (m AOD)		Fig No. WS08B	
1. No groundwater encountered. 2. Borehole terminated at 0.6m bgl due to obstruction. 3. Backfilled with arising upon completion.					Easting:			
					Northing:			

				WINDOW SAMPLING RECORD		BH No. WS08C <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 07/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
				Driller: RP Drilling Ltd				
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground-water	Description	Depth (m)	Level (m AOD)	Legend	Well
ES	0.50	N=11 (2,2/2,3,3,3)	1	MADE GROUND: Medium dense dark grey gravelly SAND. Gravel is fine to coarse angular to sub angular brick and concrete fragments.				
ES	1.50	N=5 (2,1/2,2,0,1)	2					
ES	2.60	102.0 N=15 (2,2/2,3,4,6)	3					
D	3.60	120.0 120.0 N=11 (2,2/2,3,3,3)	4					
				Stiff high strength grey brown sandy CLAY of high plasticity.	2.40			
				Between 4.0 and 4.45m bgl: Medium strength.				
				End of Borehole at 4.45m	4.45			
Remarks and Water Observations:					GL (m AOD)		Fig No.	
1. No groundwater encountered. 2. Groundwater and gas monitoring well installed to 3m bgl. 3. Cased to 1m bgl. 4. Hand shear vane values of 120kPa exceed the maximum value of the equipment used.					Easting:		WS08C	
					Northing:			





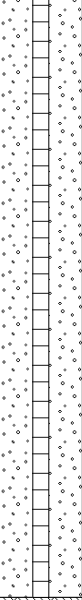

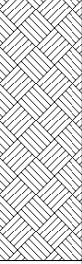
				WINDOW SAMPLING RECORD		BH No. WS09 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 08/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
				Driller: RP Drilling Ltd				
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground- water	Description	Depth (m)	Level (m AOD)	Legend	Well
ES	0.20	55.0		Stiff high strength locally medium strength light yellowish brown sandy CLAY of high plasticity (field test).				
		82.0						
		95.0						
		110.0						
D	0.70	120.0	1					
		N=15 (2,2/4,4,3,4)						
D	1.50	120.0	2					
		120.0 N=16 (2,3/3,3,4,6)						
D	2.60	120.0	3					
		120.0						
		N=19 (3,3/4,4,5,6)						
		120.0						
		N=24 (3,4/5,5,6,8)	4					
				End of Borehole at 4.45m	4.45			
Remarks and Water Observations:					GL (m AOD)		Fig No. WS09	
1. No groundwater encountered. 2. Groundwater and gas monitoring well installed to 3m bgl. 3. Cased to 1m bgl. 4. Hand shear vane values of 120kPa exceed the maximum value of the equipment used.					Easting:			
					Northing:			





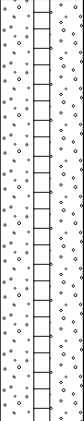
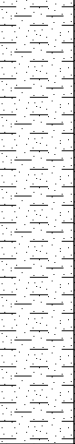

				WINDOW SAMPLING RECORD		BH No. WS10 Sheet 1 of 1		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 08/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
				Driller: RP Drilling Ltd				
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground-water	Description	Depth (m)	Level (m AOD)	Legend	Well
ES	0.40			MADE GROUND: Medium dense brown slightly clayey gravelly SAND. Gravel is fine to coarse angular to sub angular slag and brick.				
ES	1.40	N=9 (3,2/3,2,2,2)	1					
ES	1.90	85.0 N=10 (3,2/2,2,3,3)	2	Stiff medium to high strength grey brown sandy CLAY of high plasticity.	1.70			
		120.0 120.0						
		N=19 (2,2/4,4,5,6)	3					
D	3.50	120.0 N=11 (2,2/2,3,3,3)	4	After 3.5m bgl: Becomes thinly laminated with fine sand laminations.				
				End of Borehole at 4.45m	4.45			
Remarks and Water Observations:					GL (m AOD)		Fig No.	
1. No groundwater encountered. 2. Groundwater and gas monitoring well installed to 3m bgl. 3. Cased to 1m bgl. 4. Hand shear vane values of 120kPa exceed the maximum value of the equipment used.					Easting:		WS10	
					Northing:			





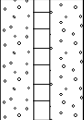
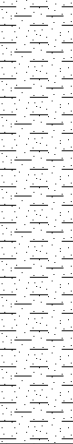

				WINDOW SAMPLING RECORD		BH No. WS11 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 08/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
				Driller: RP Drilling Ltd				
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground- water	Description	Depth (m)	Level (m AOD)	Legend	Well
ES	0.60	N=11 (4,3/3,2,4,2)	1	MADE GROUND: Medium dense brown to grey brown clayey gravelly SAND. Gravel is fine to coarse angular to sub angular brick, concrete fragments, slag and glass. <div>Between 2.0 and 3.0m bgl: Becomes loose.</div>				
ES	1.50	N=4 (2,1/0,1,1,2)	2					
ES	2.40	N=9 (3,2/2,2,3,2)	3					
ES	3.20	N=8 (2,1/1,2,2,3)	4					
				End of Borehole at 4.45m	4.45			
Remarks and Water Observations:					GL (m AOD)		Fig No.	
1. No groundwater encountered. 2. Groundwater and gas monitoring well installed to 3m bgl. 3. Cased to 1m bgl.					Easting:		WS11	
					Northing:			












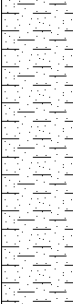
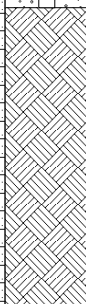
				WINDOW SAMPLING RECORD		BH No. WS12 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 08/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
				Driller: RP Drilling Ltd				
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground- water	Description	Depth (m)	Level (m AOD)	Legend	Well
				MADE GROUND: Brown gravelly SAND. Gravel is fine to coarse angular to sub angular slag, glass and concrete fragments. End of Borehole at 0.15m	0.15			
			1					
			2					
			3					
			4					
Remarks and Water Observations:					GL (m AOD)		Fig No.	
1. No groundwater encountered. 2. Borehole terminated at 0.15m bgl due to obstruction. 3. Backfilled with arising upon completion.					Easting:		WS12	
					Northing:			








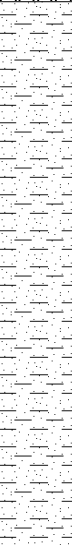
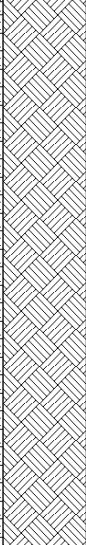
				WINDOW SAMPLING RECORD		BH No. WS12A <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 08/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
				Driller: RP Drilling Ltd				
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground- water	Description	Depth (m)	Level (m AOD)	Legend	Well
				MADE GROUND: Brown gravelly SAND. Gravel is fine to coarse angular to sub angular slag, glass and concrete fragments.	0.25			
				End of Borehole at 0.25m				
			1					
			2					
			3					
			4					
Remarks and Water Observations:					GL (m AOD)		Fig No. WS12A	
1. No groundwater encountered. 2. Borehole terminated at 0.25m bgl due to obstruction. 3. Backfilled with arising upon completion.					Easting:			
					Northing:			


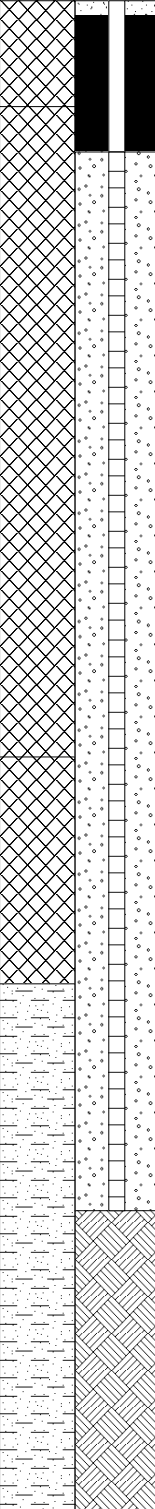
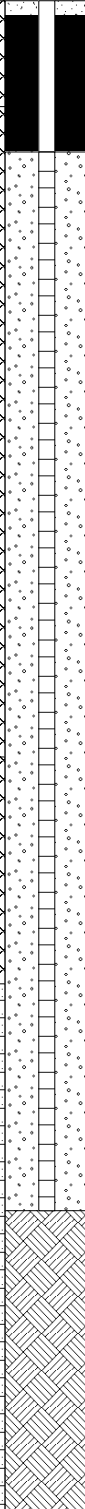
<div></div>				WINDOW SAMPLING RECORD		BH No. WS13 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 08/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
						Driller: RP Drilling Ltd		
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground- water	Description	Depth (m)	Level (m AOD)	Legend	Well
ES	0.20	55.0 60.0 N=6 (2,1/0,2,2,2)	1	MADE GROUND: Brown to reddish brown gravelly SAND. Gravel is fine to coarse sub angular to angular brick and concrete fragments.	0.50			
ES	0.70			MADE GROUND: Firm medium strength brown sandy gravelly CLAY of high plasticity (field test). Gravel is fine to coarse angular to sub angular brick and concrete fragments.				
ES	1.30			MADE GROUND: Loose to medium dense brown gravelly SAND. Gravel is fine to coarse angular to sub angular slag, glass and concrete fragments.				
ES	2.10	N=7 (3,1/3,1,1,2)	2		1.20			
		N=9 (3,2/3,2,2,2)	3	After 3.0m bgl: Becomes medium dense.	3.89			
		50 (25 for 50mm/50 for 40mm)	4	End of Borehole at 3.89m				
Remarks and Water Observations:					GL (m AOD)		Fig No. WS13	
1. No groundwater encountered. 2. Groundwater and gas monitoring well installed to 3m bgl. 3. Borehole terminated at 3.89m bgl due to obstruction. 4. Cased to 1m bgl.					Easting:			
					Northing:			

				WINDOW SAMPLING RECORD		BH No. WS14 Sheet 1 of 1		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 08/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
				Driller: RP Drilling Ltd				
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground-water	Description	Depth (m)	Level (m AOD)	Legend	Well
ES	0.70	N=13 (12,5/3,4,3,3)	1	MADE GROUND: Light grey sandy GRAVEL. Gravel is fine to coarse angular concrete fragments and brick.	0.50			
				MADE GROUND: Medium dense dark grey gravelly SAND. Gravel is fine to coarse angular to sub angular brick and concrete fragments.				
ES	1.50	N=2 (1,0/0,1,0,1)	2	<div>Between 2.0 and 2.4m bgl: Very loose to loose.</div>	2.40			
ES	2.70	N=20 (2,3/3,5,6,6)	3	Very stiff high strength reddish brown sandy CLAY of intermediate plasticity.				
		120.0			4.45			
		120.0	4					
		N=22 (3,3/4,5,7,6)		End of Borehole at 4.45m				
Remarks and Water Observations:					GL (m AOD)		Fig No. WS14	
1. No groundwater encountered. 2. Groundwater and gas monitoring well installed to 3m bgl. 3. Cased to 1m bgl. 4. Hand shear vane values of 120kPa exceed the maximum value of the equipment used.					Easting:			
					Northing:			

<div></div>				WINDOW SAMPLING RECORD		BH No. WS15 <small>Sheet 1 of 1</small>		
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333		
				Client: TJ Thomson & Sons Limited		Date: 08/08/2017		
				Method: Bored using a tracked windowless sampler rig		Scale: 1:25		
SAMPLE DETAILS				STRATA RECORD		Logged By: JW Checked By: MG		
						Driller: RP Drilling Ltd		
Type	Depth From - To(m)	(N) {PID} Shear Vane	Ground- water	Description	Depth (m)	Level (m AOD)	Legend	Well
ES	0.30	N=5 (2,2/1,1,1,2)	1	MADE GROUND: Light grey and reddish brown sandy GRAVEL. Gravel is fine to coarse angular concrete fragments and brick.	0.50			
ES	0.70			MADE GROUND: Loose dark grey gravelly SAND. Gravel is fine to coarse angular to sub angular brick and concrete fragments.				
ES	1.50	120.0 120.0 N=18 (2,3/3,5,5,5)	2	Very stiff high strength reddish brown sandy CLAY of high plasticity. <i>After 2.0m bgl: Becomes occasionally laminated.</i>	1.40			
ES	2.40	N=18 (3,3/3,4,5,6)	3					
		N=12 (3,2/3,3,3,3)	4	<i>Between 4.0m and 4.45m bgl: Medium to high strength.</i>				
				End of Borehole at 4.45m	4.45			
Remarks and Water Observations:					GL (m AOD)		Fig No. WS15	
1. No groundwater encountered. 2. Groundwater and gas monitoring well installed to 3m bgl. 3. Cased to 1m bgl. 4. Hand shear vane values of 120kPa exceed the maximum value of the equipment used.					Easting:			
					Northing:			

<div></div>				BOREHOLE RECORD			BH No. CP01 Sheet 1 of 1			
				Site: Millfield Works, Stockton-on-Tees			Contract No: C7333			
				Client: TJ Thomson & Sons Limited			Dates: 01/08/2017 - 01/08/2017			
				Method: Cable percussive borehole bored using a Dando 2000 rig using 150mm diameter tools			Scale: 1:50			
SAMPLE DETAILS				STRATA RECORD			Logged By: JW		Checked By: MG	
							Driller: RP Drilling Ltd			
Type	Depth From - To(m)	N, {Cu}, [Cu peak]	Ground -water	Description			Depth (m)	Level (m AOD)	Legend	Well
D	0.30	N=16 (1,2/3,4,4,5)	1	MADE GROUND: Greyish brown gravelly SAND. Gravel is fine to coarse angular to sub rounded brick, wood, plastic and metal fragments.			0.50			
D	1.00			Very stiff high strength reddish brown slightly sandy CLAY of intermediate plasticity.						
SPTLS	1.20 - 1.65									
U	2.00 - 2.45	N=22 (3,2/5,5,6,6)	2	At 2.0m bgl: Very high strength.						
D	2.60									
SPTLS	3.00 - 3.45									
U	4.00 - 4.45	N=25 (4,4/4,6,7,8)	4	At 4.0m bgl: Firm medium strength.						
D	4.60									
SPTLS	5.00 - 5.45			After 5.0m bgl: Becomes very high strength locally high strength thinly laminated with occasional thin laminations of fine sand.						
D	6.00	N=28 (2,3/4,4,8,12)	6							
U	6.50 - 6.95			At 6.5m bgl: Stiff high strength.						
D	7.10			Between 7.0 and 8.0m bgl: Firm.						
SPTLS	8.00 - 8.45	N=35 (6,6/7,10,9,9)	8							
				Between 9.0 and 10.0m bgl: Occasional fine sand bands.						
SPTLS	9.50 - 9.95		10	End of Borehole at 10.00m			10.00			
Remarks: 1. No groundwater encountered 2. Groundwater and gas monitoring well installed to 8m bgl.							GL (mAOD)		Fig No. CP01	
							Easting:			
							Northing:			

<div></div>				BOREHOLE RECORD		BH No. CP02 Sheet 1 of 1			
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333			
				Client: TJ Thomson & Sons Limited		Dates: 02/08/2017 - 02/08/2017			
				Method: Cable percussive borehole bored using a Dando 2000 rig using 150mm diameter tools		Scale: 1:50			
SAMPLE DETAILS				STRATA RECORD		Logged By: JW		Checked By: MG	
						Driller: RP Drilling Ltd			
Type	Depth From - To(m)	N, {Cu}, [Cu peak]	Ground -water	Description	Depth (m)	Level (m AOD)	Legend	Well	
D	0.60			MADE GROUND: Loose dark brown gravelly SAND. Gravel is fine to coarse angular to sub angular brick and glass.	2.00				
B	1.20 - 1.70	N=4 (2,1/1,1,1,1)	1						
B	2.00 - 2.50	N=7 (4,2/2,1,1,3)	2	MADE GROUND: Medium dense reddish brown gravelly SAND. Gravel is fine to coarse angular to sub angular slag and brick fragments.					
B	3.00 - 3.50	N=12 (2,4/4,3,2,3)	3						
B	4.00 - 4.50	N=16 (5,4/2,5,6,3)	4		5.00				
B	5.00 - 5.50	N=17 (5,3/3,6,4,4)	5	MADE GROUND: Firm high strength brown sandy gravelly CLAY of high plasticity (field test). Gravel is fine to coarse angular to sub angular brick fragments. Low cobble content of whole bricks.					
D	6.40		6		6.40				
U	6.50 - 6.95			Very stiff very high strength reddish brown slightly sandy CLAY of high plasticity.					
D	7.10		7		10.00				
SPTLS	8.00 - 8.45	N=42 (7,7/9,9,12,12)	8	After 8.0m bgl: Becomes thinly laminated.					
D	9.00		9						
SPTLS	9.50 - 9.95			At 9.5m bgl: High strength. Intermediate plasticity.					
D	10.00		10	End of Borehole at 10.00m					
Remarks: 1. No groundwater encountered 2. Backfilled with arisings upon completion.					GL (mAOD)		Fig No. CP02		
					Easting:				
					Northing:				

<div></div>				BOREHOLE RECORD		BH No. CP03 Sheet 1 of 1												
				Site: Millfield Works, Stockton-on-Tees		Contract No: C7333												
				Client: TJ Thomson & Sons Limited		Dates: 03/08/2017 - 03/08/2017												
				Method: Cable percussive borehole bored using a Dando 2000 rig using 150mm diameter tools		Scale: 1:50												
SAMPLE DETAILS				STRATA RECORD		Logged By: JW		Checked By: MG										
				Driller: RP Drilling Ltd														
Type	Depth From - To(m)	N, {Cu}, [Cu peak]	Ground -water	Description		Depth (m)	Level (m AOD)	Legend	Well									
D	0.30	N=8 (2,3/2,2,2,2)	1	MADE GROUND: Brown gravelly SAND. Gravel is fine to coarse angular to sub angular rubber, plastic, brick and glass.		0.70												
D	0.80			MADE GROUND: Medium dense dark brown gravelly SAND. Gravel is fine to coarse angular to sub angular slag and occasional brick fragments.														
B	1.20 - 1.70																	
B	2.00 - 2.50	N=5 (2,3/1,1,2,1)	2	<i>Between 2.0 and 2.45m bgl: Loose.</i>		5.00												
B	3.00 - 3.50	N=13 (3,3/4,2,3,4)	3															
		N=16 (5,5/7,6,1,2)	4															
B	5.00 - 5.50	N=9 (4,4/3,2,2,2)	5	MADE GROUND: Medium dense brown sandy GRAVEL. Gravel is fine to coarse angular to sub angular slag.		6.50												
B	6.50 - 7.00	N=18 (4,3/3,3,6,6)	6															
D	7.20	7	Stiff high strength reddish brown slightly sandy CLAY of high plasticity. <i>Between 6.5 and 7.0m bgl: Firm with grey brown discolouration/weathering.</i>															
U	8.00 - 8.45		8			10.00												
D	8.60		9	<i>After 8.6m bgl: Becomes thinly laminated.</i>														
SPTLS	9.50 - 9.95	N=25 (4,4/5,6,7,7)	10	<i>After 9.5m bgl: Very high strength.</i>														
				End of Borehole at 10.00m														
Remarks: 1. No groundwater encountered 2. Groundwater and gas monitoring well installed to 8m bgl.						GL (mAOD)		Fig No.										
						Easting:		CP03										
						Northing:												







APPENDIX D

LABORATORY TEST RESULTS



LABORATORY REPORT REPORT



4043

Contract Number: PSL17/3987

Report Date: 06 September 2017
Client's Reference: C7333
Client Name: Sirius Durham
Suite 2, Russel House
Mill Road
Langley Moor
Durham
DH7 8HJ

For the attention of: Michelle Gibson

Contract Title: Millfield Works, Stockton-On-Tees
Date Received: 16/8/2017
Date Commenced: 16/8/2017
Date Completed: 6/9/2017

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson
(Director)

A Watkins
(Director)

R Berriman
(Quality Manager)

L Knight
(Senior Technician)

C Marshall
(Laboratory Manager)

A Fry
(Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
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e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
CP01		D	1.20	1.65	Brown mottled grey slightly gravelly slightly sandy CLAY.
CP01		U	2.00	2.45	Very stiff brown CLAY.
CP01		U	4.00	4.45	Firm brown slightly sandy CLAY.
CP01		U	6.50	4.95	Stiff brown CLAY.
CP02		U	6.50	6.95	Very stiff brown slightly gravelly CLAY.
CP02		U	9.50	9.95	Stiff brown slightly sandy CLAY.
CP03		U	8.00	8.45	Stiff brown CLAY.
TP01		D	0.50		Brown slightly gravelly sandy CLAY.
TP12		D	0.50		Brown SAND and GRAVEL.
TP24		D	0.80		Brown slightly gravelly slightly sandy CLAY.
TP31		D	3.30		Brown sandy CLAY.
TP32		D	2.60		Brown sandy CLAY.
TP33		D	2.80		MADE GROUND brown slightly gravelly slightly sandy clay.
TP36		D	0.60		Brown slightly gravelly sandy CLAY.
WS02		D	2.20		Brown sandy CLAY.
WS06		D	2.30		Orangish brown slightly gravelly sandy CLAY.
WS06		D	2.80		Brown mottled grey slightly gravelly sandy CLAY.
WS08C		D	2.60		Brown CLAY.
WS10		D	1.90		Brown slightly gravelly sandy CLAY.



Millfield Works, Stockton-On-Tees

Contract No:

PSL17/3987

Client Ref:

C7333

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
WS14		D	2.70		Brown slightly gravelly sandy CLAY.
WS15		D	1.50		Brown CLAY.
CP02		B	1.20		MADE GROUND brown gravelly slightly clayey sand.

		Millfield Works, Stockton-On-Tees	Contract No:
			PSL17/3987
			Client Ref:
			C7333

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m ³ Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
CP01		D	1.20	1.65	18			48	23	25	93	Intermediate plasticity CI.
CP01		U	4.00	4.45	26			39	19	20	94	Intermediate plasticity CI.
CP01		U	6.50	4.95	24			46	23	23	100	Intermediate plasticity CI.
CP02		U	6.50	6.95	21			51	24	27	93	High plasticity CH.
CP02		U	9.50	9.95	20			42	21	21	91	Intermediate plasticity CI.
CP03		U	8.00	8.45	24			50	22	28	96	High plasticity CH.
TP01		D	0.50		35			74	33	41	94	Very high plasticity MV.
TP12		D	0.50		16				NP			
TP24		D	0.80		21			50	23	27	92	High plasticity CH.
TP31		D	3.30		25			59	25	34	100	High plasticity CH.
TP32		D	2.60		25			92	38	54	100	Extremely high plasticity CE.
TP33		D	2.80		33			59	28	31	94	High plasticity CH.
TP36		D	0.60		20			52	25	27	94	High plasticity CH.
WS02		D	2.20		31			61	29	32	100	High plasticity CH.
WS06		D	2.30		26			33	18	15	94	Low plasticity CL.
WS06		D	2.80		18			47	21	26	94	Intermediate plasticity CI.
WS08C		D	2.60		26			51	25	26	100	High plasticity CH.
WS10		D	1.90		24			51	23	28	93	High plasticity CH.
WS14		D	2.70		19			49	20	29	93	Intermediate plasticity CI.

SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.



PSL
Professional Soils Laboratory

Millfield Works, Stockton-On-Tees

Contract No:

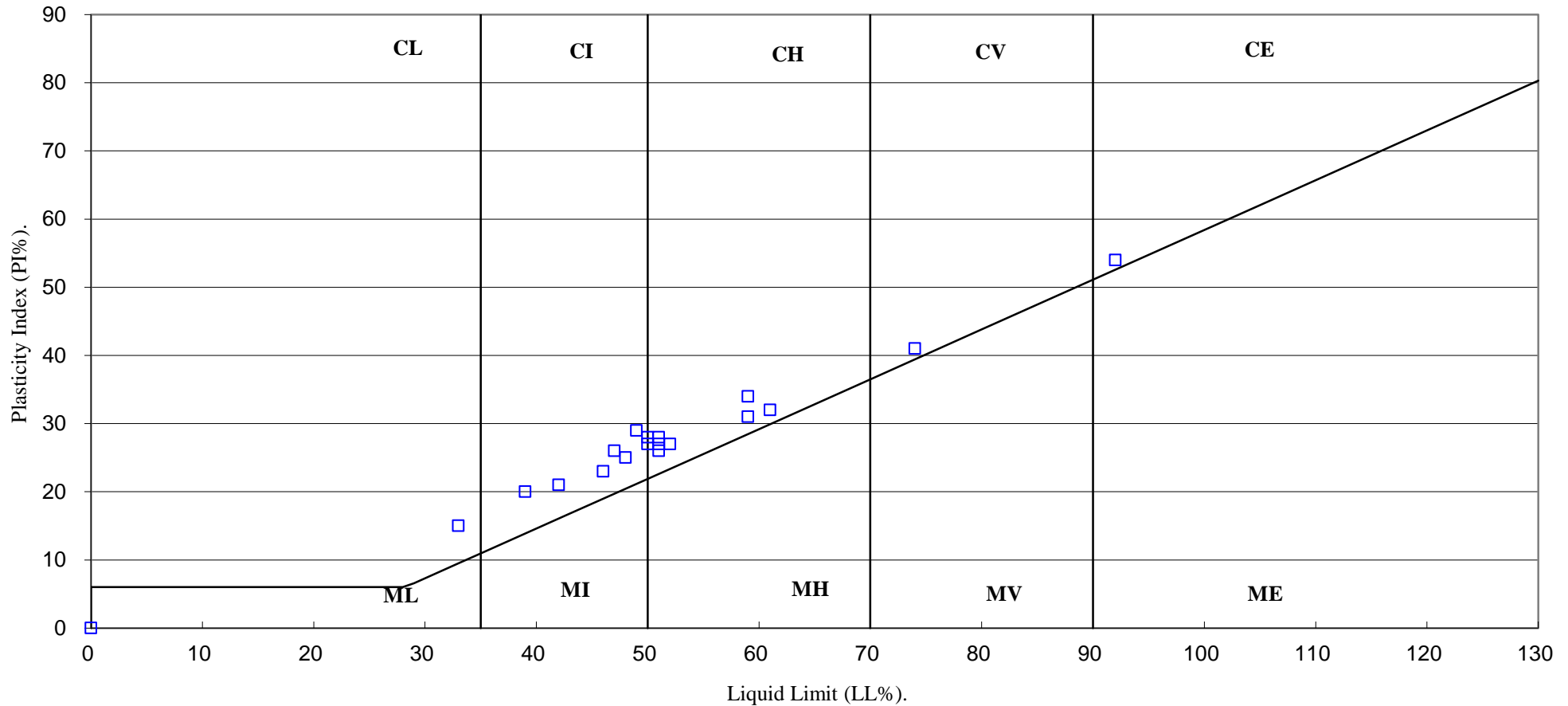
PSL17/3987

Client Ref:

C7333

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(BS5930 :2015)



PSL
Professional Soils Laboratory

Millfield Works, Stockton-On-Tees

Contract No:

PSL17/3987

Client Ref:

C7333

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.



PSL
Professional Soils Laboratory

Millfield Works, Stockton-On-Tees

Contract No:

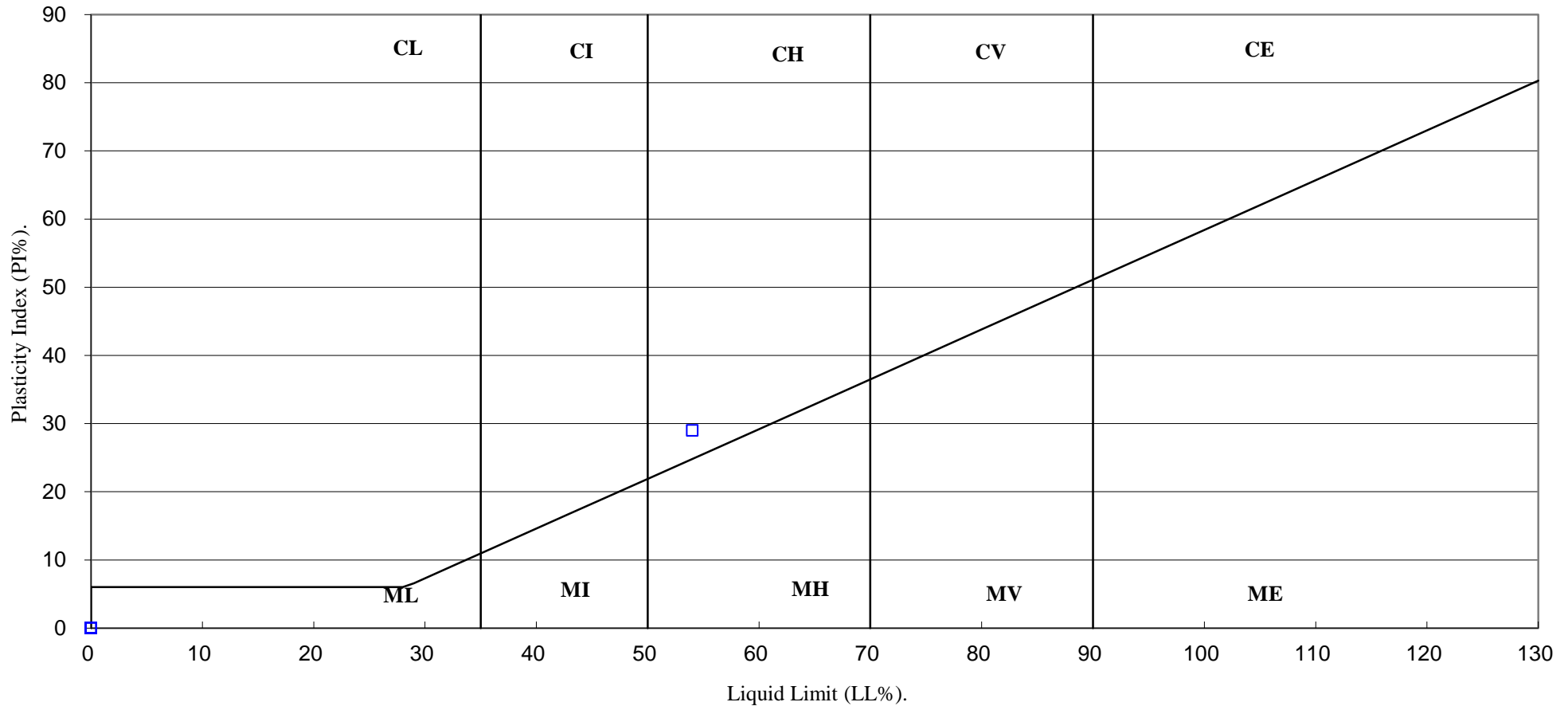
PSL17/3987

Client Ref:

C7333

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(BS5930 :2015)



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Millfield Works, Stockton-On-Tees

Contract No:

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Client Ref:

C7333

CALIFORNIA BEARING RATIO TEST

BS 1377 : Part 4 : 1990

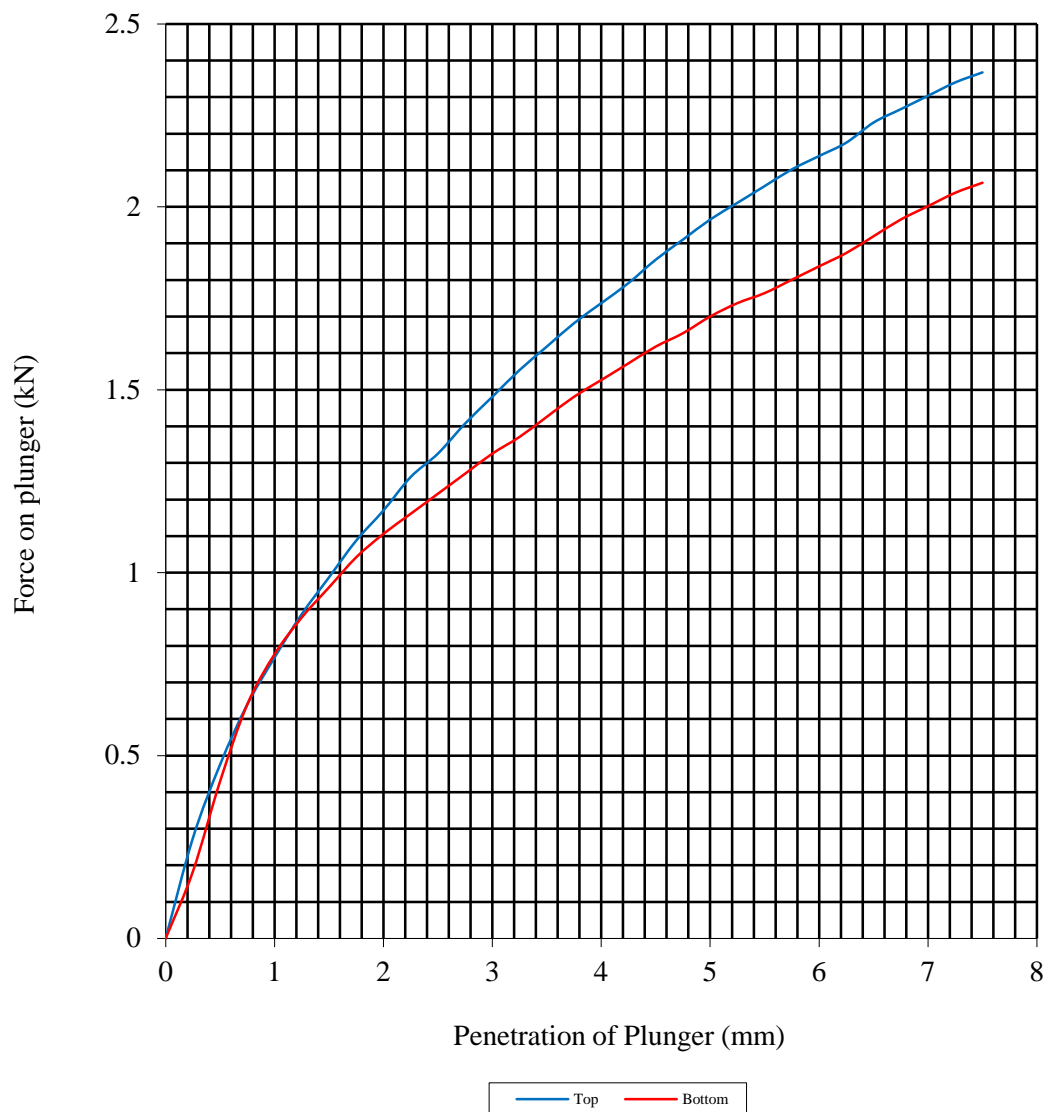
Hole Number: CP01

Top Depth (m): 2.00



Sample Number:

Base Depth (m): 2.45

Sample Type: B



Initial Sample Conditions		Sample Preparation		Final Moisture Content %		C.B.R. Value %	
Moisture Content:	22	Surcharge Kg:	4.20	Sample Top	22	Sample Top	10.0
Bulk Density Mg/m3:	1.95	Soaking Time hrs	0	Sample Bottom	22	Sample Bottom	9.2
Dry Density Mg/m3:	1.59	Swelling mm:	0.00	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:		0					
Compaction Conditions		2.5kg					

 4043		Millfield Works, Stockton-On-Tees	Contract No:
			PSL17/3987
			Client Ref:
			C7333

CALIFORNIA BEARING RATIO TEST

BS 1377 : Part 4 : 1990

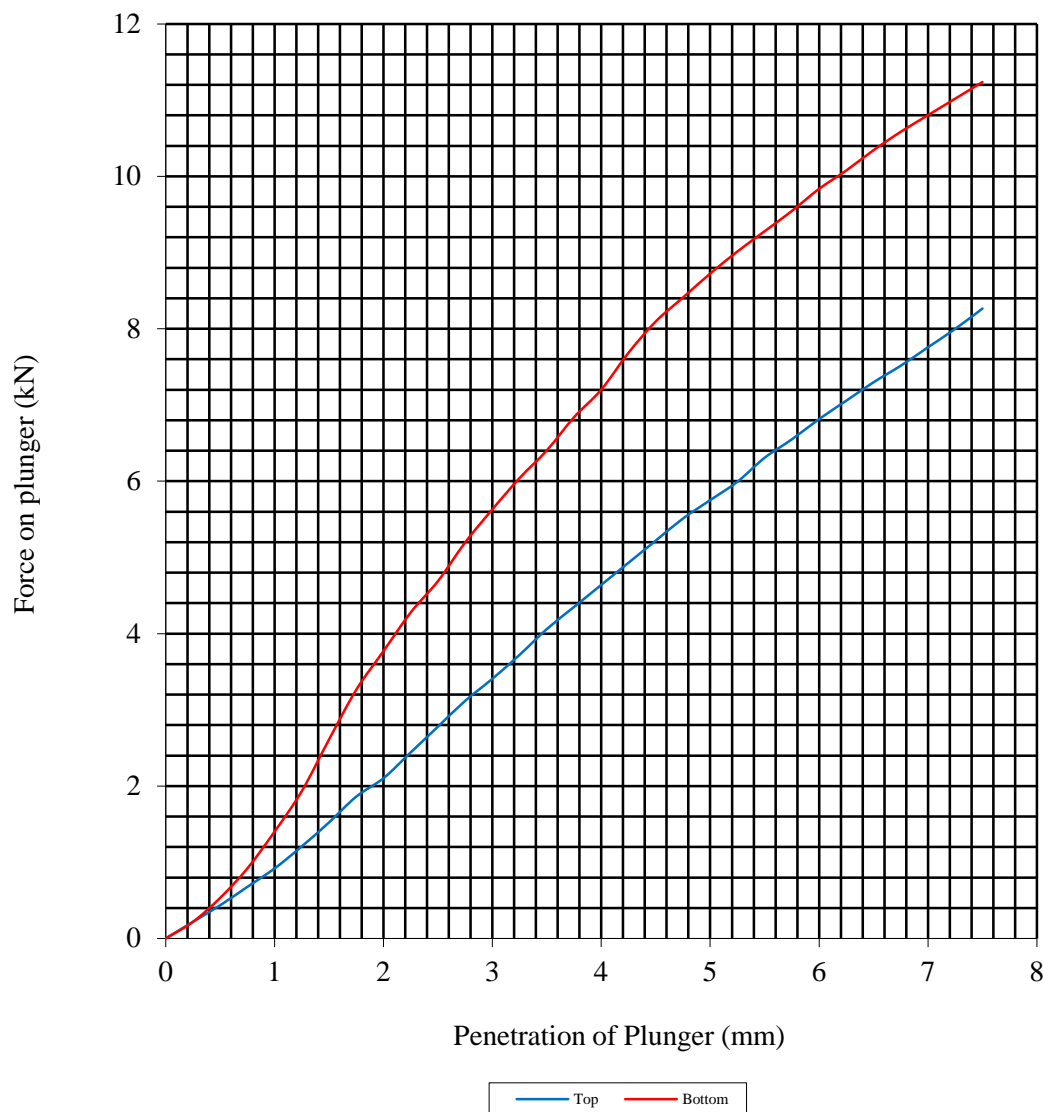
Hole Number: CP02

Top Depth (m): 1.20


Sample Number:

Base Depth (m):

Sample Type: B



Initial Sample Conditions		Sample Preparation		Final Moisture Content %		C.B.R. Value %	
Moisture Content:	15	Surcharge Kg:	4.20	Sample Top	15	Sample Top	28.8
Bulk Density Mg/m3:	2.00	Soaking Time hrs	0	Sample Bottom	15	Sample Bottom	43.6
Dry Density Mg/m3:	1.74	Swelling mm:	0.00	Remarks : See Summary of Soil Descriptions.			
Percentage retained on 20mm BS test sieve:		0					
Compaction Conditions		2.5kg					

 4043		Millfield Works, Stockton-On-Tees	Contract No:
			PSL17/3987
			Client Ref:
			C7333

ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: CP01

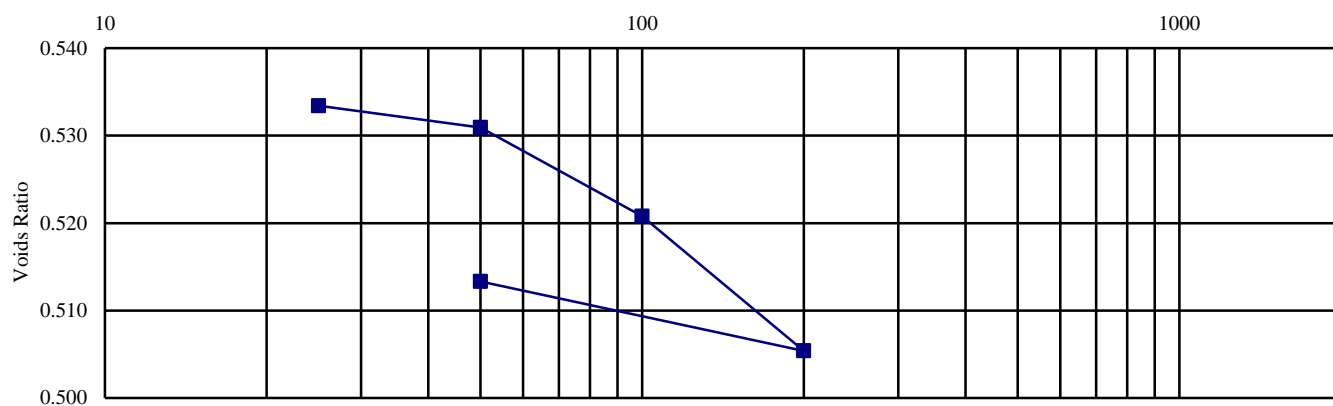
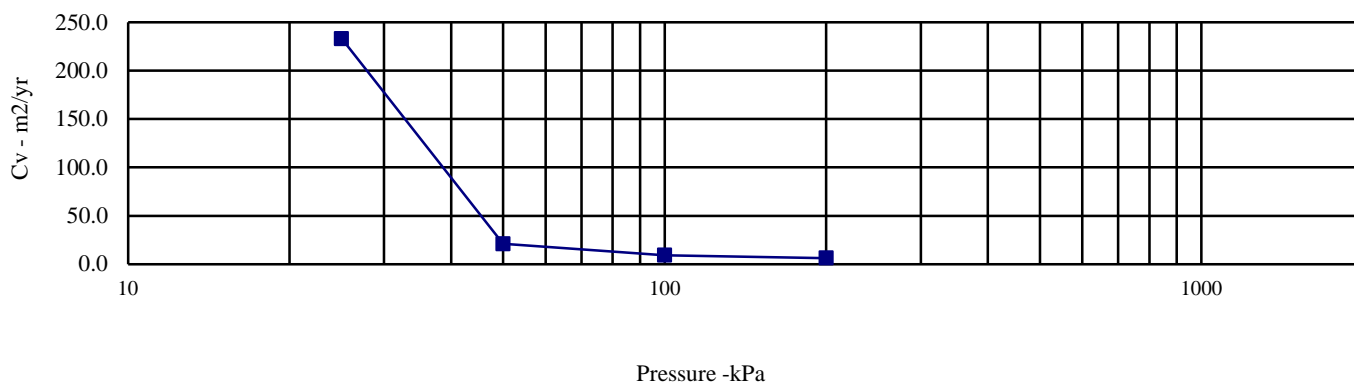
Top Depth (m): 2.00

Sample Number:

Base Depth (m) : 2.45

Sample Type: U

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	20	kPa		m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	2.06	0	25	0.200	232.984	Method used to	
Dry Density (Mg/m3):	1.72	25	50	0.064	20.920	determine CV:	T90
Voids Ratio:	0.541	50	100	0.133	9.289	Nominal temperature	
Degree of saturation:	98.2	100	200	0.101	6.259	during test ' C:	20
Height (mm):	20.02	200	50	0.035	-	Remarks:	
Diameter (mm)	75.06					See summary of descriptions	
Particle Density (Mg/m3):	2.65						
Assumed							



Millfield Works, Stockton-On-Tees

Contract No:

PSL17/3987

Client Ref:

C7333

ONE DIMENSIONAL CONSOLIDATION TEST

BS 1377: Part 5: 1990: Clause 3

Hole Number: CP01

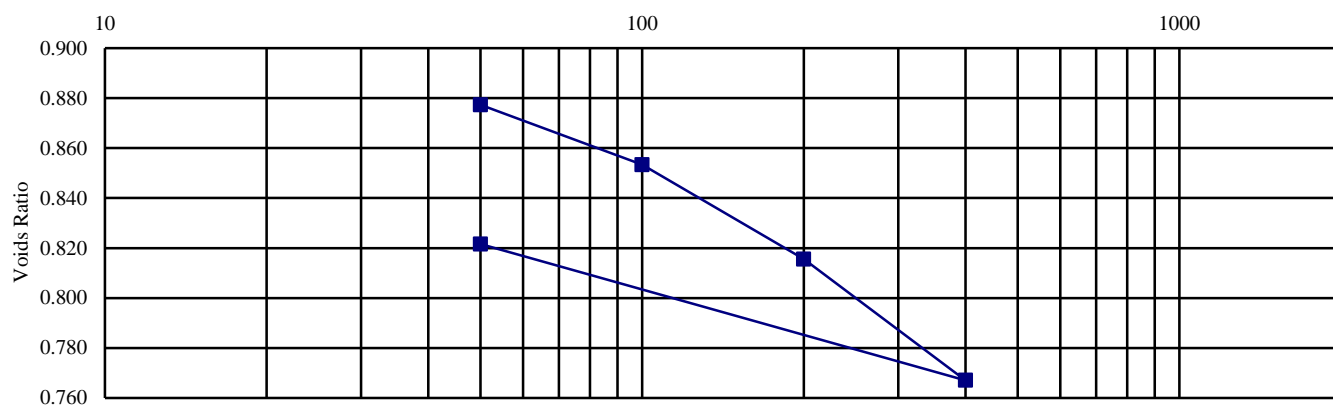
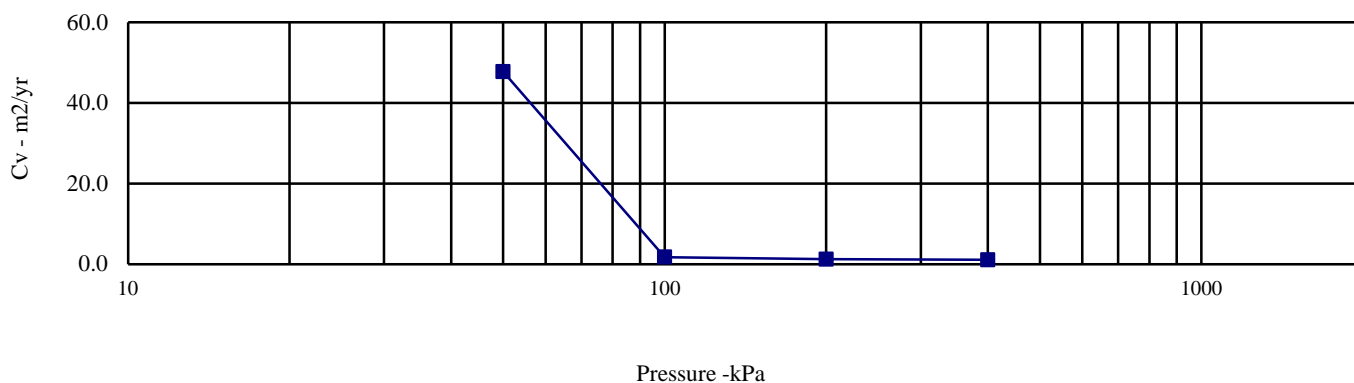
Top Depth (m): 4.00

Sample Number:

Base Depth (m) : 4.45

Sample Type: U

Initial Conditions		Pressure Range		Mv	Cv	Specimen location	
Moisture Content (%):	35	kPa		m2/MN	m2/yr	within tube:	Top
Bulk Density (Mg/m3):	1.88	0	50	0.279	47.742	Method used to	
Dry Density (Mg/m3):	1.39	50	100	0.255	1.755	determine CV:	T90
Voids Ratio:	0.904	100	200	0.204	1.241	Nominal temperature	
Degree of saturation:	103.7	200	400	0.134	1.087	during test 'C':	20
Height (mm):	20.01	400	50	0.088	-	Remarks:	
Diameter (mm)	75.06					See summary of descriptions	
Particle Density (Mg/m3):	2.65						
Assumed							



Millfield Works, Stockton-On-Tees

Contract No:

PSL17/3987

Client Ref:

C7333

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

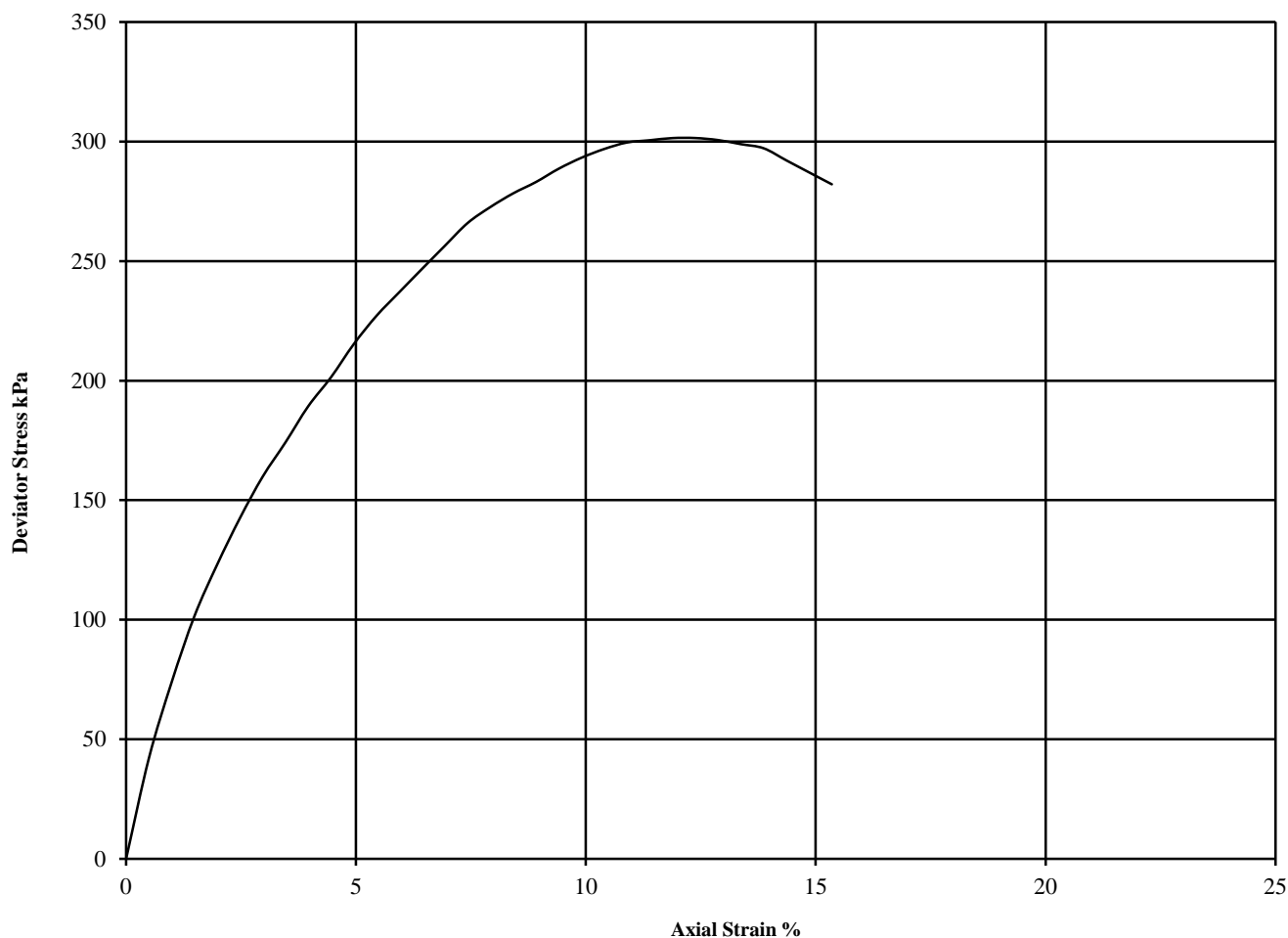
Hole Number: CP01

Top Depth (m): 2.00

Sample Number: D

Base Depth (m): 2.45

Sample Type U



Diameter (mm):		103.0	Height (mm):		208.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.35 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	23	2.01	1.63	40	301	151	12.4	Brittle	



Millfield Works, Stockton-On-Tees

Contract No:

PSL17/3987

Client Ref:

C7333

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

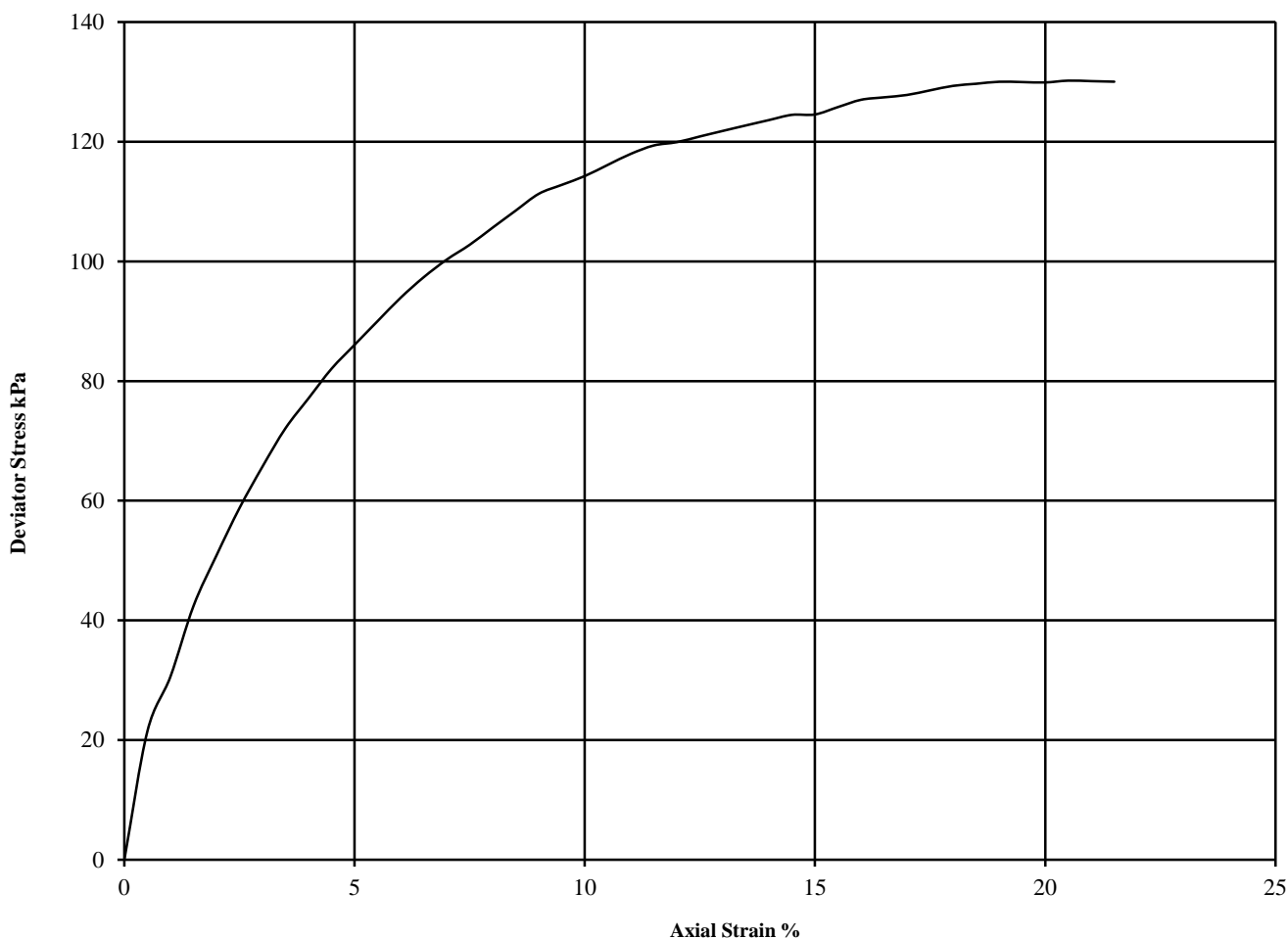
Hole Number: CP01

Top Depth (m): 4.00

Sample Number: D

Base Depth (m): 4.45

Sample Type U



Diameter (mm):		104.0	Height (mm):		208.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	30	1.86	1.43	80	130	65	20.5	Intermediate	



Millfield Works, Stockton-On-Tees

Contract No:

PSL17/3987

Client Ref:

C7333

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

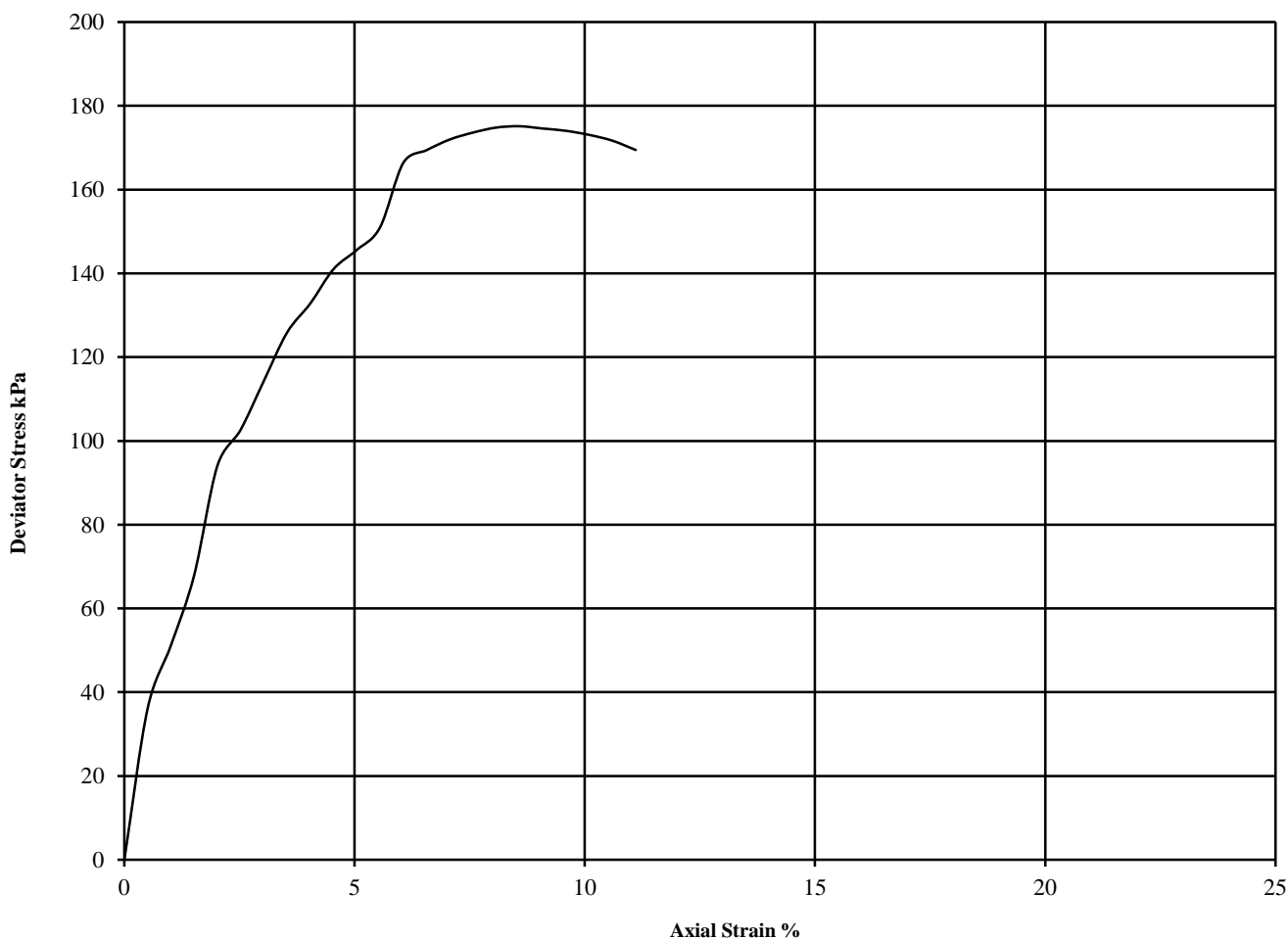
Hole Number: CP01

Top Depth (m): 6.50

Sample Number: D

Base Depth (m): 6.95

Sample Type U



Diameter (mm):		104.0	Height (mm):		206.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.35 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	24	1.97	1.59	130	175	88	8.6	Intermediate	



Millfield Works, Stockton-On-Tees

Contract No:

PSL17/3987

Client Ref:

C7333

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

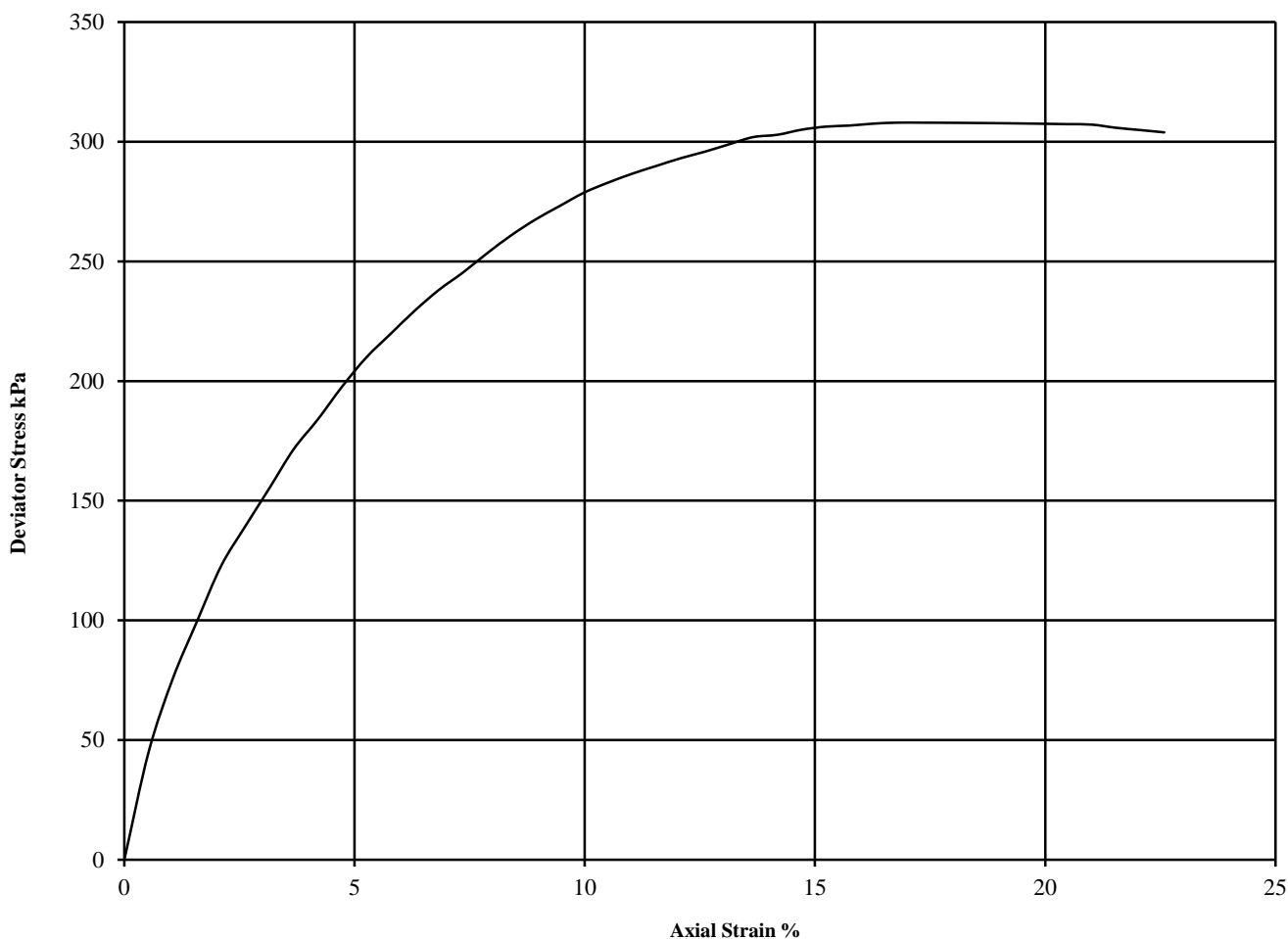
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: CP02 Top Depth (m): 6.50

Sample Number: D Base Depth (m): 6.95

Sample Type U



Diameter (mm):		104.0	Height (mm):		198.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	21	2.00	1.65	130	308	154	16.8	Brittle	



Millfield Works, Stockton-On-Tees

Contract No:

PSL17/3987

Client Ref:

C7333

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

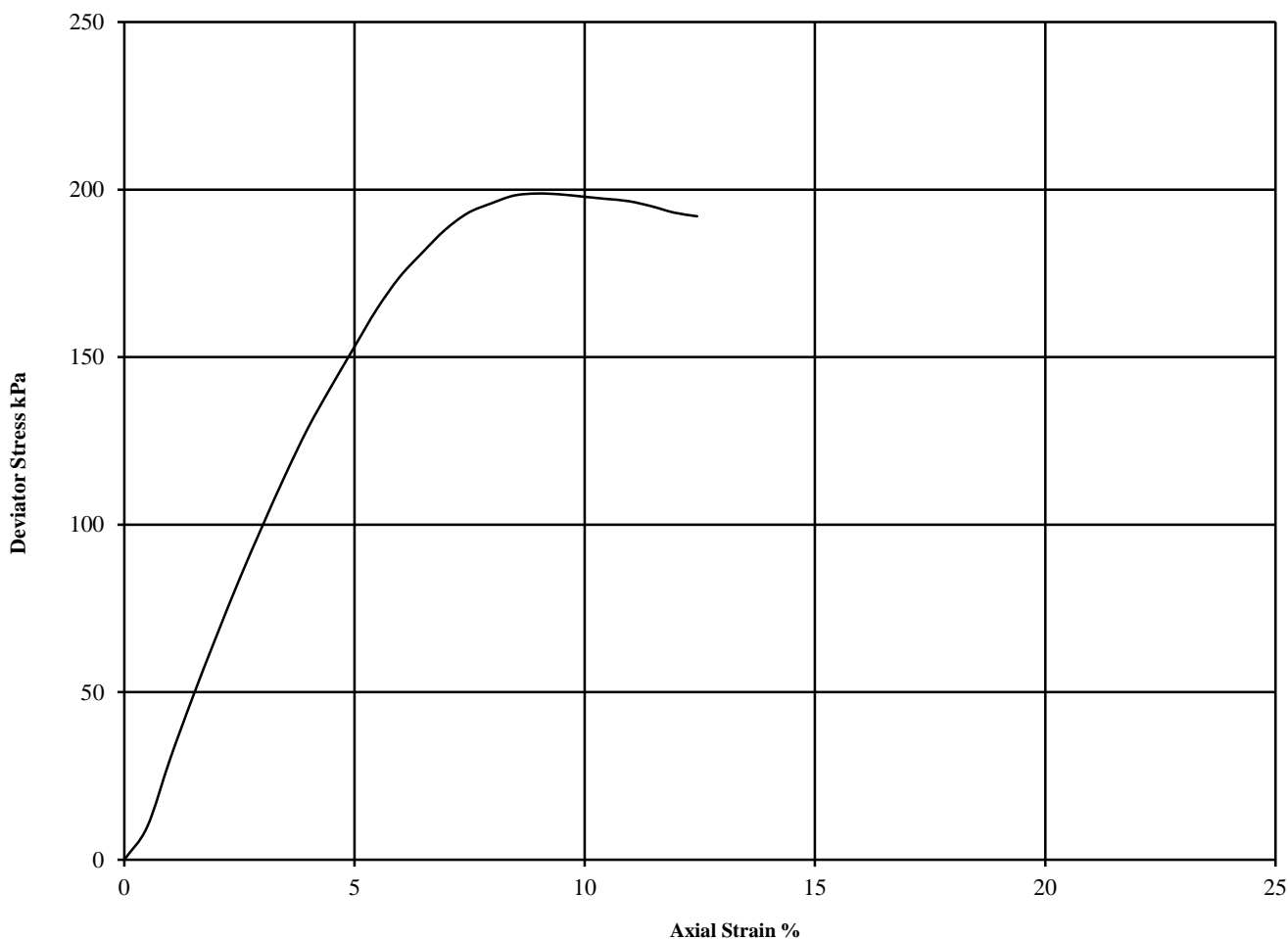
Hole Number: CP02

Top Depth (m): 9.50

Sample Number: D

Base Depth (m): 9.95

Sample Type U



Diameter (mm):		104.0	Height (mm):		209.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max.	Shear	Failure Strain (%)	Mode of Failure	Undisturbed Sample
					Deviator Stress	Cu			Sample taken from top of tube
					(kPa)	(kPa)			Rate of strain = 2 %/min
					θ_3	$\frac{1}{2}(\theta_1-\theta_3)_f$			Latex Membrane used 0.2 mm thick,
					$(\theta_1-\theta_3)_f$	$\frac{1}{2}(\theta_1-\theta_3)_f$			Correction applied 0.35
1	20	1.98	1.65	190	199	99	9.0	Brittle	See summary of soil descriptions



Millfield Works, Stockton-On-Tees

Contract No:

PSL17/3987

Client Ref:

C7333

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

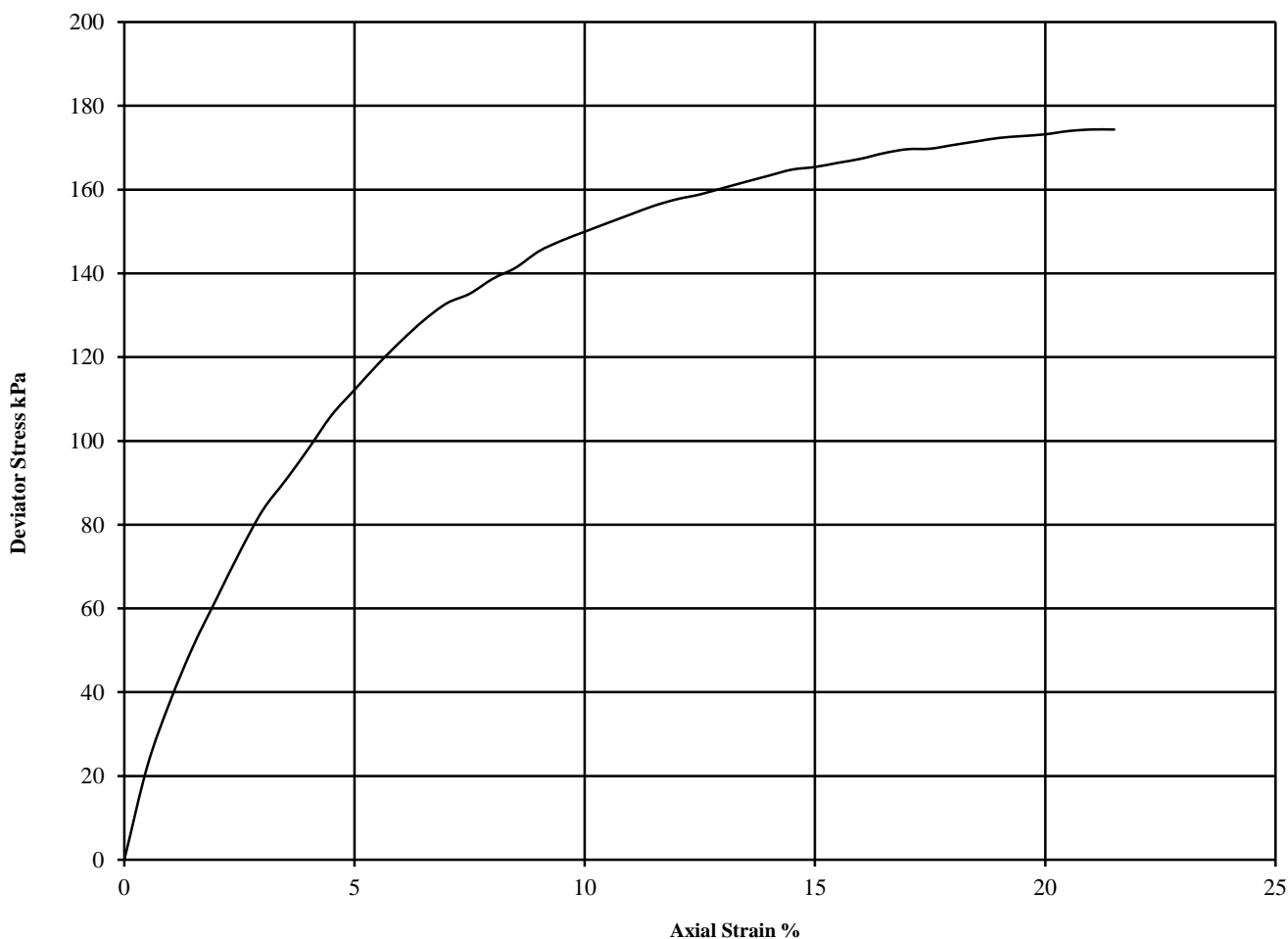
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: CP03 Top Depth (m): 8.00

Sample Number: D Base Depth (m): 8.45

Sample Type U



Diameter (mm):		104.0	Height (mm):		208.0	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m3)	Dry Density (Mg/m3)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	24	1.98	1.60	160	174	87	21.0	Intermediate	



Millfield Works, Stockton-On-Tees

Contract No:

PSL17/3987

Client Ref:

C7333



Certificate of Analysis

Certificate Number 17-08230

22-Aug-17

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference 17-08230

Client Reference PSL17/3987

Order No (not supplied)

Contract Title Millfield Works, Stockton-On-Tees

Description 16 Soil samples.

Date Received 19-Aug-17

Date Started 19-Aug-17

Date Completed 22-Aug-17

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager



Summary of Chemical Analysis Soil Samples

Our Ref 17-08230

Client Ref PSL17/3987

Contract Title Millfield Works, Stockton-On-Tees

Lab No	1219416	1219417	1219418	1219419	1219420	1219421	1219422	1219423	1219424	1219425	1219426
Sample ID	CP01	CP01	CP02	CP03	TP01	TP12	TP24	TP32	TP33	TP36	WS02
Depth	1.20-1.65	6.50-6.95	9.50-9.95	8.00-8.45	0.50	0.50	0.80	2.60	2.80	0.60	2.20
Other ID											
Sample Type	D	U	U	U	D	D	D	D	D	D	D
Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units											
Inorganics														
pH	DETSC 2008#			8.4	8.5	8.5	8.4	7.9	8.1	8.5	8.0	8.5	8.9	7.8
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	43	67	46	69	190	150	79	140	210	12	36

Summary of Chemical Analysis

Soil Samples

Our Ref 17-08230

Client Ref PSL17/3987

Contract Title Millfield Works, Stockton-On-Tees

Lab No	1219427	1219428	1219429	1219430	1219431
Sample ID	WS06	WS08C	WS10	WS14	WS15
Depth	2.30	2.60	1.90	2.70	1.50
Other ID					
Sample Type	D	D	D	D	D
Sampling Date	n/s	n/s	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units					
Inorganics								
pH	DETSC 2008#			8.0	7.7	8.4	7.7	8.2
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	12	21	73	36	48

Information in Support of the Analytical Results

Our Ref 17-08230
 Client Ref PSL17/3987
 Contract Millfield Works, Stockton-On-Tees

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1219416	CP01 1.20-1.65 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1219417	CP01 6.50-6.95 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1219418	CP02 9.50-9.95 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1219419	CP03 8.00-8.45 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1219420	TP01 0.50 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1219421	TP12 0.50 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1219422	TP24 0.80 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1219423	TP32 2.60 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1219424	TP33 2.80 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1219425	TP36 0.60 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1219426	WS02 2.20 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1219427	WS06 2.30 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1219428	WS08C 2.60 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1219429	WS10 1.90 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1219430	WS14 2.70 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1219431	WS15 1.50 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Information in Support of the Analytical Results

Our Ref 17-08230
Client Ref PSL17/3987
Contract Millfield Works, Stockton-On-Tees

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.
Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



Certificate of Analysis

Certificate Number 17-07828-1

25-Aug-17

Client Sirius Geotechnical & Environmental
Russel House
Suite 2
Mill Road
Langley Moor
DH7 8HJ

Our Reference 17-07828-1

Client Reference C7333

Order No 15579/C7333/MG

Contract Title Millfield Works, Stockton-on-Tees

Description 42 Soil samples.

Date Received 15-Aug-17

Date Started 15-Aug-17

Date Completed 25-Aug-17

Test Procedures Identified by prefix DETSn (details on request).

Notes This report supersedes 17-07828. Extra testing.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Matrix Descriptions

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Sample ID	Depth	Lab No	Completed	Matrix Description
TP01	0.2	1217452	21/08/2017	Brown red very gravelly SAND (Possible made ground - brick)
TP03	0.5	1217453	21/08/2017	Brown orange slightly clayey, very gravelly SAND (Possible made ground - brick) (Possible made ground - slag)
TP04	0.5	1217454	21/08/2017	Light brown very gravelly SAND (Possible made ground - slag)
TP05	0.7	1217456	21/08/2017	Brown slightly clayey, very gravelly SAND (Possible made ground - brick)
TP07	0.1	1217457	21/08/2017	Dark brown gravelly, very sandy CLAY including odd rootlets (Possible made ground - brick)
TP08	0.4	1217458	21/08/2017	Brown slightly clayey, very gravelly SAND including odd rootlets (Possible made ground - brick)
TP09	0.2	1217459	21/08/2017	Dark brown gravelly, very sandy CLAY (Possible made ground - brick)
TP11	0.5	1217460	21/08/2017	Dark brown black very gravelly SAND (Made ground - slag)
TP13	0.3	1217463	21/08/2017	Grey light brown sandy, clayey GRAVEL (Made ground -) (sample matrix outside MCERTS scope of accreditation)
TP14	0.15	1217464	21/08/2017	Brown gravelly, slightly clayey SAND including odd rootlets (Possible made ground - brick) and some organic matter
TP15	0.4	1217465	21/08/2017	Dark brown slightly clayey, very gravelly SAND including odd rootlets (Possible made ground - brick)
TP16	0.5	1217466	21/08/2017	Brown very gravelly, clayey SAND (Possible made ground - brick) (Possible made ground - slag)
TP17	0.4	1217467	21/08/2017	Brown slightly clayey, very gravelly SAND including odd rootlets (Possible made ground - slag) (Possible made ground - brick)
TP18	0.8	1217468	21/08/2017	Brown sandy GRAVEL (Possible made ground - slag) (sample matrix outside MCERTS scope of accreditation)
TP19	0.5	1217469	21/08/2017	Dark brown gravelly, very sandy CLAY including odd rootlets (Possible made ground - brick)
TP20	0.1	1217470	21/08/2017	Gravelly, very sandy CLAY including odd rootlets (Possible made ground - brick)
TP20	1.2	1217471	21/08/2017	Brown sandy GRAVEL (Possible made ground - slag) (Possible made ground - brick) (sample matrix outside MCERTS scope of accreditation)
TP21	1.1	1217472	21/08/2017	Light brown red sandy GRAVEL (Possible made ground - brick) (sample matrix outside MCERTS scope of accreditation)
TP22	0.2	1217473	21/08/2017	Dark brown gravelly,, clayey SAND (Possible made ground - brick) (Possible made ground - glass)
TP23	0.5	1217474	21/08/2017	Brown gravelly, clayey SAND including some organic matter (Possible made ground - brick)
TP25	0.2	1217475	21/08/2017	Brown very gravelly, clayey SAND including odd rootlets and some organic matter (Possible made ground - brick)
TP26	0.9	1217476	21/08/2017	Brown slightly clayey, gravelly SAND (Possible made ground - brick)
TP27	1.7	1217477	21/08/2017	Dark brown very gravelly SAND (Possible made ground - brick) (Possible made ground - slag)
TP27	2.6	1217478	21/08/2017	Dark brown slightly sandy, gravelly CLAY (Possible made ground - brick)
TP29	0.1	1217479	21/08/2017	Dark brown gravelly SAND including odd rootlets
TP31	0.2	1217480	21/08/2017	Dark brown very gravelly, clayey SAND (Possible made ground - brick)
TP32	0.8	1217481	21/08/2017	Dark brown very gravelly SAND (Possible made ground - brick) (Possible made ground - slag)
TP33	0.15	1217483	21/08/2017	Brown sandy GRAVEL including odd rootlets (Possible made ground - brick) (sample matrix outside MCERTS scope of accreditation)
TP34	1	1217484	21/08/2017	Brown slightly gravelly CLAY including odd rootlets
TP35	0.2	1217485	21/08/2017	Brown very gravelly SAND (Possible made ground - brick)
TP36	0.1	1217486	21/08/2017	Brown slightly gravelly, sandy CLAY including numerous rootlets (Possible made ground - brick)
WS02	0.5	1217487	21/08/2017	Dark brown gravelly, very sandy CLAY (Possible made ground - brick) (Possible made ground - slag)
WS03	0.8	1217488	21/08/2017	Dark brown very gravelly SAND
WS04A	0.6	1217489	21/08/2017	Dark brown very gravelly SAND (Possible made ground - brick)

Summary of Chemical Analysis

Matrix Descriptions

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Sample ID	Depth	Lab No	Completed	Matrix Description
WS11	0.6	1217491	21/08/2017	Brown clayey, very gravelly SAND (Possible made ground - brick) (Possible made ground - slag) including odd rootlets
WS15	0.2	1217492	21/08/2017	Dark brown very gravelly SAND (Made ground - slag)

Summary of Chemical Analysis

Soil Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217452	1217453	1217454	1217455	1217456	1217457
Sample ID	TP01	TP03	TP04	TP04	TP05	TP07
Depth	0.20	0.50	0.50	0.90	0.70	0.10
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	31/07/17	31/07/17	31/07/17	31/07/17	31/07/17	31/07/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Asbestos Quantification	DETSC 1102	0							
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	8.7	9.6	1.8		11	26
Cadmium	DETSC 2301#	0.1	mg/kg	< 0.1	< 0.1	0.1		0.4	3.7
Chromium	DETSC 2301#	0.15	mg/kg	36	87	4.6		20	190
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0		< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	18	65	8.8		330	230
Lead	DETSC 2301#	0.3	mg/kg	11	18	17		180	340
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05		< 0.05	1.7
Nickel	DETSC 2301#	1	mg/kg	8.4	46	4.5		20	110
Selenium	DETSC 2301#	0.5	mg/kg	1.7	1.4	0.6		0.7	1.1
Zinc	DETSC 2301#	1	mg/kg	29	35	29		110	560
Inorganics									
pH	DETSC 2008#			10.8	10.1	12.2		10	9.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1		< 0.1	< 0.1
Total Organic Carbon	DETSC 2002	0.1	%	0.1	0.3	0.1		1.1	2
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	2000	160	42		110	89
Sulphate as SO4, Total	DETSC 2321#	0.01	%	2.1	0.09	0.19		0.12	0.18
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg			< 0.01	< 0.01		
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg			< 0.01	< 0.01		
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg			< 0.01	< 0.01		
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg			< 1.5	< 1.5		
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg			< 1.2	< 1.2		
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg			1.7	< 1.5		
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg			30	< 3.4		
Aliphatic C5-C35	DETSC 3072*	10	mg/kg			32	< 10		
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg			< 0.01	< 0.01		
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg			< 0.01	< 0.01		
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg			< 0.01	< 0.01		
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg			< 0.9	< 0.9		
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg			0.6	0.7		
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg			< 0.6	< 0.6		
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg			< 1.4	9.6		
Aromatic C5-C35	DETSC 3072*	10	mg/kg			< 10	11		
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg			33	11		
C5-C10 Gasoline Range Organics (GRO)	DETSC 3321*	0.1	mg/kg						
C10-C24 Diesel Range Organics (DRO)	DETSC 3311#	10	mg/kg						
C24-C40 Lube Oil Range Organics (LORO)	DETSC 3311#	10	mg/kg						
Benzene	DETSC 3321#	0.01	mg/kg			< 0.01	< 0.01		
Ethylbenzene	DETSC 3321#	0.01	mg/kg			< 0.01	< 0.01		
Toluene	DETSC 3321#	0.01	mg/kg			< 0.01	< 0.01		

Summary of Chemical Analysis

Soil Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217452	1217453	1217454	1217455	1217456	1217457
Sample ID	TP01	TP03	TP04	TP04	TP05	TP07
Depth	0.20	0.50	0.50	0.90	0.70	0.10
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	31/07/17	31/07/17	31/07/17	31/07/17	31/07/17	31/07/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Xylene	DETSC 3321#	0.01	mg/kg			< 0.01	< 0.01		
MTBE	DETSC 3321	0.01	mg/kg			< 0.01	< 0.01		
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		0.6	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		2.3	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		3	0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		15	0.3
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		3.2	0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		19	0.6
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		16	0.6
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		7.9	0.4
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		8.7	0.3
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		6	0.3
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		3.6	0.2
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		7.1	0.4
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		4.5	0.4
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		1	0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1		4	0.2
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6		100	4.1
PCBs									
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg						
PCB 52	DETSC 3401#	0.01	mg/kg						
PCB 101	DETSC 3401#	0.01	mg/kg						
PCB 118	DETSC 3401#	0.01	mg/kg						
PCB 153	DETSC 3401#	0.01	mg/kg						
PCB 138	DETSC 3401#	0.01	mg/kg						
PCB 180	DETSC 3401#	0.01	mg/kg						
PCB 7 Total	DETSC 3401#	0.01	mg/kg						
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3		0.4	0.7

Summary of Chemical Analysis

Soil Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217458	1217459	1217460	1217461	1217462	1217463
Sample ID	TP08	TP09	TP11	TP11	TP11	TP13
Depth	0.40	0.20	0.50	1.80	2.60	0.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	31/07/17	01/08/17	01/08/17	01/08/17	01/08/17	02/08/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Asbestos Quantification	DETSC 1102	0			Y				
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	24	31	13			11
Cadmium	DETSC 2301#	0.1	mg/kg	3.9	4.8	0.2			< 0.1
Chromium	DETSC 2301#	0.15	mg/kg	59	49	48			210
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0			< 1.0
Copper	DETSC 2301#	0.2	mg/kg	120	420	96			41
Lead	DETSC 2301#	0.3	mg/kg	130	710	56			15
Mercury	DETSC 2325#	0.05	mg/kg	0.2	0.81	< 0.05			< 0.05
Nickel	DETSC 2301#	1	mg/kg	43	49	47			14
Selenium	DETSC 2301#	0.5	mg/kg	2	1.2	1.1			4
Zinc	DETSC 2301#	1	mg/kg	230	700	52			32
Inorganics									
pH	DETSC 2008#			9.3	8.1	8.6			10.2
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1			< 0.1
Total Organic Carbon	DETSC 2002	0.1	%	1.1	3	3.7			0.4
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	91	77	86			340
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.11	0.24	0.11			0.8
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg				< 0.01	< 0.01	
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg				< 0.01	< 0.01	
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg				0.07	0.1	
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg				18	6.2	
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg				110	56	
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg				140	71	
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg				51	24	
Aliphatic C5-C35	DETSC 3072*	10	mg/kg				320	160	
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg				< 0.01	< 0.01	
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg				< 0.01	< 0.01	
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg				0.05	0.03	
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg				2.9	2.1	
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg				28	12	
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg				37	18	
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg				14	8.7	
Aromatic C5-C35	DETSC 3072*	10	mg/kg				81	42	
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg				400	200	
C5-C10 Gasoline Range Organics (GRO)	DETSC 3321*	0.1	mg/kg	< 0.1		< 0.1			
C10-C24 Diesel Range Organics (DRO)	DETSC 3311#	10	mg/kg	23		19			
C24-C40 Lube Oil Range Organics (LORO)	DETSC 3311#	10	mg/kg	89		24			
Benzene	DETSC 3321#	0.01	mg/kg				< 0.01	< 0.01	
Ethylbenzene	DETSC 3321#	0.01	mg/kg				< 0.01	< 0.01	
Toluene	DETSC 3321#	0.01	mg/kg				< 0.01	< 0.01	

Summary of Chemical Analysis

Soil Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217458	1217459	1217460	1217461	1217462	1217463
Sample ID	TP08	TP09	TP11	TP11	TP11	TP13
Depth	0.40	0.20	0.50	1.80	2.60	0.30
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	31/07/17	01/08/17	01/08/17	01/08/17	01/08/17	02/08/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Xylene	DETSC 3321#	0.01	mg/kg				< 0.01	< 0.01	
MTBE	DETSC 3321	0.01	mg/kg				< 0.01	< 0.01	
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	0.1	< 0.1			< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1			< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.1			< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.1			< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	0.1			0.7
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1			0.2
Fluoranthene	DETSC 3301	0.1	mg/kg	1.1	3.5	0.2			1.5
Pyrene	DETSC 3301	0.1	mg/kg	1	1.8	0.1			1.3
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	< 0.1			0.6
Chrysene	DETSC 3301	0.1	mg/kg	0.6	< 0.1	< 0.1			0.6
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.6	< 0.1	< 0.1			0.4
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.3	< 0.1	< 0.1			0.2
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	0.6	< 0.1	< 0.1			0.6
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	< 0.1			0.4
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.2	< 0.1	< 0.1			0.2
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	< 0.1			0.3
PAH Total	DETSC 3301	1.6	mg/kg	6.8	5.4	< 1.6			7.1
PCBs									
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg						
PCB 52	DETSC 3401#	0.01	mg/kg						
PCB 101	DETSC 3401#	0.01	mg/kg						
PCB 118	DETSC 3401#	0.01	mg/kg						
PCB 153	DETSC 3401#	0.01	mg/kg						
PCB 138	DETSC 3401#	0.01	mg/kg						
PCB 180	DETSC 3401#	0.01	mg/kg						
PCB 7 Total	DETSC 3401#	0.01	mg/kg						
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	0.7	0.5			0.5

Summary of Chemical Analysis

Soil Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217464	1217465	1217466	1217467	1217468	1217469
Sample ID	TP14	TP15	TP16	TP17	TP18	TP19
Depth	0.15	0.40	0.50	0.40	0.80	0.50
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	02/08/17	02/08/17	02/08/17	02/08/17	02/08/17	02/08/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Asbestos Quantification	DETSC 1102	0							
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	47	26	33	35	31	45
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	0.4	0.3	0.9	< 0.1	1.9
Chromium	DETSC 2301#	0.15	mg/kg	27	55	54	51	69	57
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	250	140	220	450	30	150
Lead	DETSC 2301#	0.3	mg/kg	170	110	250	150	26	240
Mercury	DETSC 2325#	0.05	mg/kg	0.27	0.06	< 0.05	0.18	< 0.05	0.2
Nickel	DETSC 2301#	1	mg/kg	55	42	55	65	44	50
Selenium	DETSC 2301#	0.5	mg/kg	1.4	1.1	0.8	1.3	0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	120	410	130	320	39	370
Inorganics									
pH	DETSC 2008#			8.2	8.5	8.2	8.1	7.8	8.2
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total Organic Carbon	DETSC 2002	0.1	%	7.4	2	3.4	2.4	1.9	1.3
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	58	110	32	23	560	34
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.37	0.16	0.08	0.12	0.26	0.08
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg		< 0.01				< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg		< 0.01				< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg		< 0.01				< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg		< 1.5				< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg		< 1.2				3.7
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg		< 1.5				59
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg		< 3.4				280
Aliphatic C5-C35	DETSC 3072*	10	mg/kg		< 10				350
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg		< 0.01				< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg		< 0.01				< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg		< 0.01				< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg		< 0.9				< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg		< 0.5				0.9
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg		< 0.6				16
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg		< 1.4				130
Aromatic C5-C35	DETSC 3072*	10	mg/kg		< 10				150
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg		< 10				490
C5-C10 Gasoline Range Organics (GRO)	DETSC 3321*	0.1	mg/kg			< 0.1	< 0.1		
C10-C24 Diesel Range Organics (DRO)	DETSC 3311#	10	mg/kg			16	40		
C24-C40 Lube Oil Range Organics (LORO)	DETSC 3311#	10	mg/kg			28	130		
Benzene	DETSC 3321#	0.01	mg/kg		< 0.01				< 0.01
Ethylbenzene	DETSC 3321#	0.01	mg/kg		< 0.01				< 0.01
Toluene	DETSC 3321#	0.01	mg/kg		< 0.01				< 0.01

Summary of Chemical Analysis

Soil Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217464	1217465	1217466	1217467	1217468	1217469
Sample ID	TP14	TP15	TP16	TP17	TP18	TP19
Depth	0.15	0.40	0.50	0.40	0.80	0.50
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	02/08/17	02/08/17	02/08/17	02/08/17	02/08/17	02/08/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Xylene	DETSC 3321#	0.01	mg/kg		< 0.01				< 0.01
MTBE	DETSC 3321	0.01	mg/kg		< 0.01				< 0.01
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	0.1	< 0.1	< 0.1	0.1	< 0.1	0.3
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.1	< 0.1	1.3
Acenaphthene	DETSC 3301	0.1	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.4
Fluorene	DETSC 3301	0.1	mg/kg	0.3	< 0.1	0.1	0.1	< 0.1	0.9
Phenanthrene	DETSC 3301	0.1	mg/kg	0.6	0.3	0.4	0.6	< 0.1	8
Anthracene	DETSC 3301	0.1	mg/kg	0.1	< 0.1	0.2	0.2	< 0.1	2.6
Fluoranthene	DETSC 3301	0.1	mg/kg	0.5	0.6	0.6	1.2	< 0.1	17
Pyrene	DETSC 3301	0.1	mg/kg	0.5	0.6	0.6	1.2	< 0.1	13
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	0.3	0.4	0.4	0.7	< 0.1	7.2
Chrysene	DETSC 3301	0.1	mg/kg	0.3	0.3	0.4	0.8	< 0.1	8.4
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.3	0.3	0.3	0.6	< 0.1	8
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.2	0.2	0.2	0.4	< 0.1	4.7
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	0.4	0.4	0.5	0.8	< 0.1	8.9
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	0.3	< 0.1	< 0.1	0.6	< 0.1	7.6
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.2	< 0.1	< 0.1	0.3	< 0.1	1.9
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	0.4	< 0.1	< 0.1	0.6	< 0.1	7.7
PAH Total	DETSC 3301	1.6	mg/kg	4.7	3.3	3.7	8.4	< 1.6	98
PCBs									
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg				< 0.01		
PCB 52	DETSC 3401#	0.01	mg/kg				< 0.01		
PCB 101	DETSC 3401#	0.01	mg/kg				< 0.01		
PCB 118	DETSC 3401#	0.01	mg/kg				< 0.01		
PCB 153	DETSC 3401#	0.01	mg/kg				< 0.01		
PCB 138	DETSC 3401#	0.01	mg/kg				< 0.01		
PCB 180	DETSC 3401#	0.01	mg/kg				< 0.01		
PCB 7 Total	DETSC 3401#	0.01	mg/kg				< 0.01		
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	0.6	0.7	0.5	< 0.3	< 0.3	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217470	1217471	1217472	1217473	1217474	1217475
Sample ID	TP20	TP20	TP21	TP22	TP23	TP25
Depth	0.10	1.20	1.10	0.20	0.50	0.20
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	02/08/17	02/08/17	02/08/17	03/08/17	03/08/17	03/08/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Asbestos Quantification	DETSC 1102	0							
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	73	50	11	40	27	23
Cadmium	DETSC 2301#	0.1	mg/kg	30	8	1	3.4	0.6	2.8
Chromium	DETSC 2301#	0.15	mg/kg	180	220	28	170	48	190
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	590	120	50	560	150	340
Lead	DETSC 2301#	0.3	mg/kg	480	730	87	710	85	480
Mercury	DETSC 2325#	0.05	mg/kg	0.14	< 0.05	0.08	1.2	0.1	1.3
Nickel	DETSC 2301#	1	mg/kg	99	44	27	130	49	110
Selenium	DETSC 2301#	0.5	mg/kg	4.3	2.3	0.8	1.6	0.6	1.7
Zinc	DETSC 2301#	1	mg/kg	390	110	380	1700	110	2700
Inorganics									
pH	DETSC 2008#			7.8	8.1	7.7	8.2	8.2	7.8
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1
Total Organic Carbon	DETSC 2002	0.1	%	4.6	0.4	1.3	1.6	0.4	1.1
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	100	150	34	54	39	120
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.19	0.21	0.09	0.15	0.06	0.2
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg						
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg						
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg						
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg						
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg						
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg						
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg						
Aliphatic C5-C35	DETSC 3072*	10	mg/kg						
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg						
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg						
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg						
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg						
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg						
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg						
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg						
Aromatic C5-C35	DETSC 3072*	10	mg/kg						
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg						
C5-C10 Gasoline Range Organics (GRO)	DETSC 3321*	0.1	mg/kg	< 0.1					
C10-C24 Diesel Range Organics (DRO)	DETSC 3311#	10	mg/kg	27					
C24-C40 Lube Oil Range Organics (LORO)	DETSC 3311#	10	mg/kg	55					
Benzene	DETSC 3321#	0.01	mg/kg						
Ethylbenzene	DETSC 3321#	0.01	mg/kg						
Toluene	DETSC 3321#	0.01	mg/kg						

Summary of Chemical Analysis

Soil Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217470	1217471	1217472	1217473	1217474	1217475
Sample ID	TP20	TP20	TP21	TP22	TP23	TP25
Depth	0.10	1.20	1.10	0.20	0.50	0.20
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	02/08/17	02/08/17	02/08/17	03/08/17	03/08/17	03/08/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Xylene	DETSC 3321#	0.01	mg/kg						
MTBE	DETSC 3321	0.01	mg/kg						
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.5	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	2.6	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	0.6	< 0.1	< 0.1	0.9	< 0.1	1.5
Anthracene	DETSC 3301	0.1	mg/kg	0.1	< 0.1	< 0.1	0.5	< 0.1	0.6
Fluoranthene	DETSC 3301	0.1	mg/kg	1.1	0.1	< 0.1	1.1	< 0.1	3.7
Pyrene	DETSC 3301	0.1	mg/kg	1	0.1	< 0.1	2.3	< 0.1	3.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	0.6	< 0.1	< 0.1	2.2	< 0.1	2.7
Chrysene	DETSC 3301	0.1	mg/kg	0.8	< 0.1	< 0.1	1.5	< 0.1	1.7
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	< 0.1	2.9	< 0.1	2.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.4	< 0.1	< 0.1	0.7	< 0.1	1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	0.6	< 0.1	< 0.1	1	< 0.1	2.8
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	0.6	< 0.1	< 0.1	1.5	< 0.1	2.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.2	< 0.1	< 0.1	0.4	< 0.1	0.4
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	< 0.1	1.2	< 0.1	1.9
PAH Total	DETSC 3301	1.6	mg/kg	7.4	< 1.6	< 1.6	20	< 1.6	24
PCBs									
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg				0.17		
PCB 52	DETSC 3401#	0.01	mg/kg				< 0.01		
PCB 101	DETSC 3401#	0.01	mg/kg				0.09		
PCB 118	DETSC 3401#	0.01	mg/kg				0.07		
PCB 153	DETSC 3401#	0.01	mg/kg				0.05		
PCB 138	DETSC 3401#	0.01	mg/kg				0.09		
PCB 180	DETSC 3401#	0.01	mg/kg				< 0.01		
PCB 7 Total	DETSC 3401#	0.01	mg/kg				0.47		
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	0.5	< 0.3	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217476	1217477	1217478	1217479	1217480	1217481
Sample ID	TP26	TP27	TP27	TP29	TP31	TP32
Depth	0.90	1.70	2.60	0.10	0.20	0.80
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	03/08/17	03/08/17	03/08/17	03/08/17	04/08/17	04/08/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Asbestos Quantification	DETSC 1102	0					Y		
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	26	45	13	60	21	53
Cadmium	DETSC 2301#	0.1	mg/kg	< 0.1	7.8	0.3	52	0.4	0.4
Chromium	DETSC 2301#	0.15	mg/kg	1100	88	45	370	52	65
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	320	5200	370	330	150	140
Lead	DETSC 2301#	0.3	mg/kg	25	37000	170	1800	170	110
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	11	0.29	0.83	0.1	0.06
Nickel	DETSC 2301#	1	mg/kg	240	66	39	64	69	20
Selenium	DETSC 2301#	0.5	mg/kg	1.3	0.7	0.6	1.5	0.8	2
Zinc	DETSC 2301#	1	mg/kg	210	8700	210	560	150	140
Inorganics									
pH	DETSC 2008#			7.9	7.8	8.3	8.2	8.3	8.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Total Organic Carbon	DETSC 2002	0.1	%	0.5	3.4	1.5	2	5.3	0.2
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	47	540	210	110	38	160
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.05	0.75	0.12	0.2	0.08	0.11
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg						
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg						
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg						
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg						
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg						
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg						
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg						
Aliphatic C5-C35	DETSC 3072*	10	mg/kg						
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg						
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg						
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg						
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg						
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg						
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg						
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg						
Aromatic C5-C35	DETSC 3072*	10	mg/kg						
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg						
C5-C10 Gasoline Range Organics (GRO)	DETSC 3321*	0.1	mg/kg						
C10-C24 Diesel Range Organics (DRO)	DETSC 3311#	10	mg/kg						
C24-C40 Lube Oil Range Organics (LORO)	DETSC 3311#	10	mg/kg						
Benzene	DETSC 3321#	0.01	mg/kg						
Ethylbenzene	DETSC 3321#	0.01	mg/kg						
Toluene	DETSC 3321#	0.01	mg/kg						

Summary of Chemical Analysis

Soil Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217476	1217477	1217478	1217479	1217480	1217481
Sample ID	TP26	TP27	TP27	TP29	TP31	TP32
Depth	0.90	1.70	2.60	0.10	0.20	0.80
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	03/08/17	03/08/17	03/08/17	03/08/17	04/08/17	04/08/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Xylene	DETSC 3321#	0.01	mg/kg						
MTBE	DETSC 3321	0.01	mg/kg						
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	0.2	10	0.2	0.2	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	6	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	0.5	3.5	< 0.1	0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	0.7	0.8	< 0.1	0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	5.3	41	0.6	2.2	0.2	0.6
Anthracene	DETSC 3301	0.1	mg/kg	1.6	12	0.3	0.4	0.2	0.2
Fluoranthene	DETSC 3301	0.1	mg/kg	6.4	78	1.3	4.3	0.4	1.6
Pyrene	DETSC 3301	0.1	mg/kg	5.5	63	1.1	3.2	0.4	1.5
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	2.7	43	0.6	1.8	0.2	0.8
Chrysene	DETSC 3301	0.1	mg/kg	2.9	47	0.7	2.2	0.3	0.9
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	2.1	44	0.7	2.4	0.3	0.7
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	1.2	23	0.4	1.2	0.2	0.4
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	2.7	52	0.8	2.6	0.3	0.9
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	2	42	0.6	2.8	0.2	0.6
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	8.9	0.2	0.3	< 0.1	0.2
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	1.5	39	0.6	2.4	< 0.1	0.7
PAH Total	DETSC 3301	1.6	mg/kg	35	510	8	26	2.7	9
PCBs									
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg	< 0.01					
PCB 52	DETSC 3401#	0.01	mg/kg	< 0.01					
PCB 101	DETSC 3401#	0.01	mg/kg	< 0.01					
PCB 118	DETSC 3401#	0.01	mg/kg	< 0.01					
PCB 153	DETSC 3401#	0.01	mg/kg	< 0.01					
PCB 138	DETSC 3401#	0.01	mg/kg	< 0.01					
PCB 180	DETSC 3401#	0.01	mg/kg	< 0.01					
PCB 7 Total	DETSC 3401#	0.01	mg/kg	< 0.01					
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	2.1	0.5	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Chemical Analysis

Soil Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217483	1217484	1217485	1217486	1217487	1217488
Sample ID	TP33	TP34	TP35	TP36	WS02	WS03
Depth	0.15	1.00	0.20	0.10	0.50	0.80
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	04/08/17	04/08/17	04/08/17	04/08/17	07/08/17	07/08/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Asbestos Quantification	DETSC 1102	0							
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	8.6	46	14	45	23	42
Cadmium	DETSC 2301#	0.1	mg/kg	1.4	7.2	0.6	0.2	< 0.1	0.4
Chromium	DETSC 2301#	0.15	mg/kg	33	150	35	31	26	41
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	78	1300	76	110	110	210
Lead	DETSC 2301#	0.3	mg/kg	93	1800	170	48	26	140
Mercury	DETSC 2325#	0.05	mg/kg	0.09	11	0.44	0.18	< 0.05	0.09
Nickel	DETSC 2301#	1	mg/kg	40	170	28	34	48	77
Selenium	DETSC 2301#	0.5	mg/kg	0.6	1.3	0.9	1.3	< 0.5	1
Zinc	DETSC 2301#	1	mg/kg	270	5300	210	110	47	320
Inorganics									
pH	DETSC 2008#			9.1	8.4	8	8	8.4	7.9
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	0.2	0.2	< 0.1	< 0.1	< 0.1
Total Organic Carbon	DETSC 2002	0.1	%	0.8	1.9	2.7	0.3	0.7	5.3
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	21	120	10	100	73	350
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.04	0.29	0.04	0.09	0.12	0.25
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg						
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg						
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg						
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg						
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg						
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg						
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg						
Aliphatic C5-C35	DETSC 3072*	10	mg/kg						
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg						
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg						
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg						
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg						
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg						
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg						
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg						
Aromatic C5-C35	DETSC 3072*	10	mg/kg						
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg						
C5-C10 Gasoline Range Organics (GRO)	DETSC 3321*	0.1	mg/kg						
C10-C24 Diesel Range Organics (DRO)	DETSC 3311#	10	mg/kg						
C24-C40 Lube Oil Range Organics (LORO)	DETSC 3311#	10	mg/kg						
Benzene	DETSC 3321#	0.01	mg/kg						
Ethylbenzene	DETSC 3321#	0.01	mg/kg						
Toluene	DETSC 3321#	0.01	mg/kg						

Summary of Chemical Analysis

Soil Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217483	1217484	1217485	1217486	1217487	1217488
Sample ID	TP33	TP34	TP35	TP36	WS02	WS03
Depth	0.15	1.00	0.20	0.10	0.50	0.80
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	04/08/17	04/08/17	04/08/17	04/08/17	07/08/17	07/08/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Xylene	DETSC 3321#	0.01	mg/kg						
MTBE	DETSC 3321	0.01	mg/kg						
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	0.8	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	1.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	0.5	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	0.6	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	5.4	0.2	1.6	0.7	0.1	0.4
Anthracene	DETSC 3301	0.1	mg/kg	1.8	< 0.1	0.5	0.4	< 0.1	0.2
Fluoranthene	DETSC 3301	0.1	mg/kg	9.7	0.4	2.9	2.6	0.3	0.7
Pyrene	DETSC 3301	0.1	mg/kg	8.7	0.3	2.6	2.3	0.3	0.6
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	5.3	< 0.1	1.8	1.2	0.2	0.4
Chrysene	DETSC 3301	0.1	mg/kg	5.8	< 0.1	1.7	1.2	0.2	0.4
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	4.5	0.3	1.8	0.9	< 0.1	0.5
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	3.1	0.2	1	0.6	< 0.1	0.3
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	5.6	0.3	2.2	1	< 0.1	0.5
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	4.1	< 0.1	1.4	0.6	< 0.1	0.5
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.9	< 0.1	0.3	0.2	< 0.1	0.2
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	4.2	< 0.1	1.6	0.6	< 0.1	0.5
PAH Total	DETSC 3301	1.6	mg/kg	62	1.7	20	12	< 1.6	5.1
PCBs									
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg					< 0.01	< 0.01
PCB 52	DETSC 3401#	0.01	mg/kg					< 0.01	< 0.01
PCB 101	DETSC 3401#	0.01	mg/kg					< 0.01	< 0.01
PCB 118	DETSC 3401#	0.01	mg/kg					< 0.01	< 0.01
PCB 153	DETSC 3401#	0.01	mg/kg					< 0.01	< 0.01
PCB 138	DETSC 3401#	0.01	mg/kg					< 0.01	< 0.01
PCB 180	DETSC 3401#	0.01	mg/kg					< 0.01	< 0.01
PCB 7 Total	DETSC 3401#	0.01	mg/kg					< 0.01	< 0.01
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	0.4	0.4	0.6	< 0.3	< 0.3	0.6

Summary of Chemical Analysis

Soil Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217489	1217491	1217492	1217493
Sample ID	WS04A	WS11	WS15	TP28
Depth	0.60	0.60	0.20	0.70
Other ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sampling Date	07/08/17	08/08/17	08/08/17	03/08/17
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
Asbestos Quantification	DETSC 1102	0					
Metals							
Arsenic	DETSC 2301#	0.2	mg/kg	17	44	4.5	
Cadmium	DETSC 2301#	0.1	mg/kg	0.6	3.6	< 0.1	
Chromium	DETSC 2301#	0.15	mg/kg	31	180	71	
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	
Copper	DETSC 2301#	0.2	mg/kg	170	1200	15	
Lead	DETSC 2301#	0.3	mg/kg	460	1000	9.2	
Mercury	DETSC 2325#	0.05	mg/kg	1.7	1.5	< 0.05	
Nickel	DETSC 2301#	1	mg/kg	33	91	37	
Selenium	DETSC 2301#	0.5	mg/kg	0.6	1.1	< 0.5	
Zinc	DETSC 2301#	1	mg/kg	210	1400	33	
Inorganics							
pH	DETSC 2008#			8	8.6	8.4	
Cyanide, Free	DETSC 2130#	0.1	mg/kg	0.2	< 0.1	< 0.1	
Total Organic Carbon	DETSC 2002	0.1	%	1.3	2.7	0.3	
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	41	82	24	
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.13	0.15	0.3	
Petroleum Hydrocarbons							
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg				
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg				
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg				
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg				
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg				
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg				
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg				
Aliphatic C5-C35	DETSC 3072*	10	mg/kg				
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg				
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg				
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg				
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg				
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg				
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg				
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg				
Aromatic C5-C35	DETSC 3072*	10	mg/kg				
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg				
C5-C10 Gasoline Range Organics (GRO)	DETSC 3321*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	
C10-C24 Diesel Range Organics (DRO)	DETSC 3311#	10	mg/kg	26	80	12	
C24-C40 Lube Oil Range Organics (LORO)	DETSC 3311#	10	mg/kg	68	210	31	
Benzene	DETSC 3321#	0.01	mg/kg				
Ethylbenzene	DETSC 3321#	0.01	mg/kg				
Toluene	DETSC 3321#	0.01	mg/kg				

Summary of Chemical Analysis

Soil Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217489	1217491	1217492	1217493
Sample ID	WS04A	WS11	WS15	TP28
Depth	0.60	0.60	0.20	0.70
Other ID				
Sample Type	SOIL	SOIL	SOIL	SOIL
Sampling Date	07/08/17	08/08/17	08/08/17	03/08/17
Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
Xylene	DETSC 3321#	0.01	mg/kg				
MTBE	DETSC 3321	0.01	mg/kg				
PAHs							
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	0.3	< 0.1	
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	0.2	< 0.1	
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	0.2	< 0.1	
Phenanthrene	DETSC 3301	0.1	mg/kg	0.4	2.8	< 0.1	
Anthracene	DETSC 3301	0.1	mg/kg	0.2	0.9	< 0.1	
Fluoranthene	DETSC 3301	0.1	mg/kg	0.9	4.7	0.2	
Pyrene	DETSC 3301	0.1	mg/kg	0.7	4.1	0.2	
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	0.4	2.3	< 0.1	
Chrysene	DETSC 3301	0.1	mg/kg	0.5	2.3	< 0.1	
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	0.5	2.1	< 0.1	
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	0.3	1.2	< 0.1	
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	0.5	2.9	< 0.1	
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	0.3	2.2	< 0.1	
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	0.2	0.2	< 0.1	
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	0.4	2	< 0.1	
PAH Total	DETSC 3301	1.6	mg/kg	5.2	29	< 1.6	
PCBs							
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg				< 0.01
PCB 52	DETSC 3401#	0.01	mg/kg				0.02
PCB 101	DETSC 3401#	0.01	mg/kg				0.03
PCB 118	DETSC 3401#	0.01	mg/kg				0.02
PCB 153	DETSC 3401#	0.01	mg/kg				< 0.01
PCB 138	DETSC 3401#	0.01	mg/kg				0.04
PCB 180	DETSC 3401#	0.01	mg/kg				< 0.01
PCB 7 Total	DETSC 3401#	0.01	mg/kg				0.11
Phenols							
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	

Summary of Chemical Analysis

Soil VOC/SVOC Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217454	1217461	1217465	1217467	1217469	1217493
Sample ID	TP04	TP11	TP15	TP17	TP19	TP28
Depth	0.50	1.80	0.40	0.40	0.50	0.70
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	31/07/17	01/08/17	02/08/17	02/08/17	02/08/17	03/08/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
VOCs									
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Summary of Chemical Analysis

Soil VOC/SVOC Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217454	1217461	1217465	1217467	1217469	1217493
Sample ID	TP04	TP11	TP15	TP17	TP19	TP28
Depth	0.50	1.80	0.40	0.40	0.50	0.70
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	31/07/17	01/08/17	02/08/17	02/08/17	02/08/17	03/08/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Naphthalene	DETSC 3431	0.01	mg/kg		< 0.01				< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
MTBE	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
SVOCs									
Phenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Chlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzyl Alcohol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Bis(2-chloroisopropyl)ether	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
3&4-Methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1
2,4-Dimethylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Bis-(dichloroethoxy)methane	DETSC 3433	0.1	mg/kg	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4-Dichlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
1,2,4-Trichlorobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4-Chloro-3-methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Methylnaphthalene	DETSC 3433	0.1	mg/kg	< 0.1	0.2	< 0.1	0.2	0.3	< 0.1
Hexachlorocyclopentadiene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4,6-Trichlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4,5-Trichlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Chloronaphthalene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4-Dinitrotoluene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	DETSC 3433	0.1	mg/kg		< 0.1				0.1
3-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3433	0.1	mg/kg		< 0.1				< 0.1
4-Nitrophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzofuran	DETSC 3433	0.1	mg/kg	< 0.1	0.1	< 0.1	0.1	0.5	< 0.1
2,6-Dinitrotoluene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,3,4,6-Tetrachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Diethylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4-Chlorophenylphenylether	DETSC 3433*	0.1	mg/kg	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3433	0.1	mg/kg		< 0.1				< 0.1

Summary of Chemical Analysis

Soil VOC/SVOC Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217454	1217461	1217465	1217467	1217469	1217493
Sample ID	TP04	TP11	TP15	TP17	TP19	TP28
Depth	0.50	1.80	0.40	0.40	0.50	0.70
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	31/07/17	01/08/17	02/08/17	02/08/17	02/08/17	03/08/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
4-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Methyl-4,6-Dinitrophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Diphenylamine	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4-Bromophenylphenylether	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hexachlorobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pentachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3433	0.1	mg/kg		0.3				0.8
Anthracene	DETSC 3433	0.1	mg/kg		< 0.1				0.2
Di-n-butylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	1.1	0.2
Fluoranthene	DETSC 3433	0.1	mg/kg		0.1				2.1
Pyrene	DETSC 3433	0.1	mg/kg		0.1				1.8
Butylbenzylphthalate	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	DETSC 3433	0.1	mg/kg		< 0.1				1.2
Chrysene	DETSC 3433	0.1	mg/kg		< 0.1				1.2
Bis(2-ethylhexyl)phthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1
Di-n-octylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3433	0.1	mg/kg		< 0.1				2.1
Benzo(k)fluoranthene	DETSC 3433	0.1	mg/kg		< 0.1				0.8
Benzo(a)pyrene	DETSC 3433	0.1	mg/kg		< 0.1				2
Indeno(123cd)pyrene	DETSC 3433	0.1	mg/kg		< 0.1				1.2
Dibenzo(ah)anthracene	DETSC 3433	0.1	mg/kg		< 0.1				< 0.1
Benzo(ghi)perylene	DETSC 3433	0.1	mg/kg		0.1				0.9
1,4-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	0.1	0.1
Dimethylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
1,3-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1
1,2-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,3,5,6-Tetrachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Azobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Carbazole	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.2	0.9	0.1

Summary of Asbestos Analysis

Soil Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1217453	TP03 0.50	SOIL	NAD	none	Paul Dunn
1217457	TP07 0.10	SOIL	NAD	none	Paul Dunn
1217459	TP09 0.20	SOIL	Amosite	Amosite Present in Soil	Paul Dunn
1217460	TP11 0.50	SOIL	NAD	none	Paul Dunn
1217464	TP14 0.15	SOIL	NAD	none	Paul Dunn
1217465	TP15 0.40	SOIL	NAD	none	Paul Dunn
1217466	TP16 0.50	SOIL	NAD	none	Paul Dunn
1217469	TP19 0.50	SOIL	NAD	none	Paul Dunn
1217470	TP20 0.10	SOIL	NAD	none	Paul Dunn
1217476	TP26 0.90	SOIL	NAD	none	Paul Dunn
1217478	TP27 2.60	SOIL	NAD	none	Paul Dunn
1217479	TP29 0.10	SOIL	Chrysotile	Small Bundle of Chrysotile Present in Soil	Paul Dunn
1217482	TP32 1.50	SOIL	NAD	none	Paul Dunn
1217483	TP33 0.15	SOIL	NAD	none	Paul Dunn
1217484	TP34 1.00	SOIL	NAD	none	Paul Dunn
1217485	TP35 0.20	SOIL	NAD	none	Paul Dunn
1217486	TP36 0.10	SOIL	NAD	none	Paul Dunn
1217490	WS08C 0.50	SOIL	NAD	none	Paul Dunn
1217491	WS11 0.60	SOIL	NAD	none	Paul Dunn
1217492	WS15 0.20	SOIL	NAD	none	Paul Dunn

Analysis was carried out at our Lanarkshire laboratory. DETS Newhouse Laboratory (BioCity Scotland, Room 1217, Block 41, Bo'Ness Road, Newhouse, Lanarkshire, ML1 5UH.) Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Summary of Asbestos Quantification Analysis

Soil Samples

Our Ref 17-07828-1

Client Ref C7333

Contract Title Millfield Works, Stockton-on-Tees

Lab No	1217459	1217479
Sample ID	TP09	TP29
Depth	0.20	0.10
Other ID		
Sample Type	SOIL	SOIL
Sampling Date	01/08/17	03/08/17
Sampling Time		

Test	Method	Units		
Total Mass% Asbestos (a+b+c)	DETS 1102	Mass %	< 0.001	< 0.001
Gravimetric Quantification (a)	DETS 1102	Mass %	na	na
Detailed Gravimetric Quantification (b)	DETS 1102	Mass %	<0.001	<0.001
Quantification by PCOM (c)	DETS 1102	Mass %	na	na
Potentially Respirable Fibres (d)	DETS 1102	Fibres/g	na	na
Breakdown of Gravimetric Analysis (a)				
Mass of Sample		g	708.56	553.8
ACMs present*		type		
Mass of ACM in sample		g		
% ACM by mass		%		
% asbestos in ACM		%		
% asbestos in sample		%		
Breakdown of Detailed Gravimetric Analysis (b)				
% Amphibole bundles in sample		Mass %	<0.001	na
% Chrysotile bundles in sample		Mass %	na	<0.001
Breakdown of PCOM Analysis (c)				
% Amphibole fibres in sample		Mass %	na	na
% Chrysotile fibres in sample		Mass %	na	na
Breakdown of Potentially Respirable Fibre Analysis (d)				
Amphibole fibres		Fibres/g	na	na
Chrysotile fibres		Fibres/g	na	na

* Denotes test or material description outside of UKAS accreditation.
 % asbestos in Asbestos Containing Materials (ACMs) is determined by
 by reference to HSG 264.
 Recommended sample size for quantification is approximately 1kg
 # denotes deviating sample

Information in Support of the Analytical Results

Our Ref 17-07828-1

Client Ref C7333

Contract Millfield Works, Stockton-on-Tees

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1217452	TP01 0.20 SOIL	31/07/17	GJ 250ml, PT 1L	Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days)	
1217453	TP03 0.50 SOIL	31/07/17	GJ 250ml, PT 1L	Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days)	
1217454	TP04 0.50 SOIL	31/07/17	GJ 250ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), SVOC (14 days)	
1217455	TP04 0.90 SOIL	31/07/17	GJ 250ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX (14 days)	
1217456	TP05 0.70 SOIL	31/07/17	GJ 250ml, PT 1L	Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days)	
1217457	TP07 0.10 SOIL	31/07/17	GJ 250ml, PT 1L	Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days)	
1217458	TP08 0.40 SOIL	31/07/17	GJ 250ml, PT 1L	BTEX (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), EPH/TPH (14 days)	
1217459	TP09 0.20 SOIL	01/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217460	TP11 0.50 SOIL	01/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217461	TP11 1.80 SOIL	01/08/17	GJ 250ml, PT 1L		
1217462	TP11 2.60 SOIL	01/08/17	GJ 250ml, PT 1L		
1217463	TP13 0.30 SOIL	02/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217464	TP14 0.15 SOIL	02/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217465	TP15 0.40 SOIL	02/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217466	TP16 0.50 SOIL	02/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217467	TP17 0.40 SOIL	02/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217468	TP18 0.80 SOIL	02/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217469	TP19 0.50 SOIL	02/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217470	TP20 0.10 SOIL	02/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217471	TP20 1.20 SOIL	02/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217472	TP21 1.10 SOIL	02/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217473	TP22 0.20 SOIL	03/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217474	TP23 0.50 SOIL	03/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217475	TP25 0.20 SOIL	03/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217476	TP26 0.90 SOIL	03/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217477	TP27 1.70 SOIL	03/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217478	TP27 2.60 SOIL	03/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217479	TP29 0.10 SOIL	03/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217480	TP31 0.20 SOIL	04/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217481	TP32 0.80 SOIL	04/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217482	TP32 1.50 SOIL	04/08/17	GJ 250ml, PT 1L		
1217483	TP33 0.15 SOIL	04/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217484	TP34 1.00 SOIL	04/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217485	TP35 0.20 SOIL	04/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217486	TP36 0.10 SOIL	04/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217487	WS02 0.50 SOIL	07/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217488	WS03 0.80 SOIL	07/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217489	WS04A 0.60 SOIL	07/08/17	GJ 250ml, PT 1L	pH + Conductivity (7 days)	
1217490	WS08C 0.50 SOIL	07/08/17	GJ 250ml, PT 1L		
1217491	WS11 0.60 SOIL	08/08/17	GJ 250ml, PT 1L		

Information in Support of the Analytical Results

Our Ref 17-07828-1
 Client Ref C7333
 Contract Millfield Works, Stockton-on-Tees

Contract - Winfield Works, Stockton - 08/1993					Inappropriate container for tests
Lab No	Sample ID	Date	Containers Received	Holding time exceeded for tests	
		Sampled			
1217492	WS15 0.20 SOIL	08/08/17	GJ 250ml, PT 1L		
1217493	TP28 0.70 SOIL	03/08/17	GJ 250ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 2002	Organic matter	%	0.1	Air Dried	No	Yes	Yes
DETSC 2003	Loss on ignition	%	0.01	Air Dried	No	Yes	Yes
DETSC 2008	pH	pH Units	1	Air Dried	No	Yes	Yes
DETSC 2024	Sulphide	mg/kg	10	Air Dried	No	Yes	Yes
DETSC 2076	Sulphate Aqueous Extract as SO ₄	mg/l	10	Air Dried	No	Yes	Yes
DETSC 2084	Total Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2084	Total Organic Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2119	Ammoniacal Nitrogen as N	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide free	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide total	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes
DETSC 2321	Total Sulphate as SO ₄	%	0.01	Air Dried	No	Yes	Yes
DETSC 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETSC 3049	Sulphur (free)	mg/kg	0.75	Air Dried	No	Yes	Yes
DETSC2123	Boron (water soluble)	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Arsenic	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Barium	mg/kg	1.5	Air Dried	No	Yes	Yes
DETSC2301	Beryllium	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Cadmium Available	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cadmium	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cobalt	mg/kg	0.7	Air Dried	No	Yes	Yes
DETSC2301	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETSC2301	Copper	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Manganese	mg/kg	20	Air Dried	No	Yes	Yes
DETSC2301	Molybdenum	mg/kg	0.4	Air Dried	No	Yes	Yes
DETSC2301	Nickel	mg/kg	1	Air Dried	No	Yes	Yes
DETSC2301	Lead	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC2301	Selenium	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC2301	Zinc	mg/kg	1	Air Dried	No	Yes	Yes
DETSC 3072	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETS 062	Benzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Ethylbenzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Toluene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	m+p Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	o Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3311	C10-C24 Diesel Range Organics (DRO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	C24-C40 Lube Oil Range Organics (LORO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	EPH (C10-C40)	mg/kg	10	As Received	No	Yes	Yes

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 3303	Acenaphthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Acenaphthylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(b)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(k)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(g,h,i)perylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Dibenzo(a,h)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Indeno(1,2,3-c,d)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Naphthalene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Phenanthrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3401	PCB 28 + PCB 31	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 52	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 101	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 118	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 153	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 138	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 180	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB Total	mg/kg	0.01	As Received	No	Yes	Yes

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS. No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.



Certificate of Analysis

Certificate Number 17-10516

22-Sep-17

Client Sirius Geotechnical & Environmental
Russel House
Suite 2
Mill Road
Langley Moor
DH7 8HJ

Our Reference 17-10516

Client Reference C7333

Order No 15746/C7333/MG

Contract Title Millfield Works, Stockton-On-Tees

Description 3 Water samples.

Date Received 16-Sep-17

Date Started 16-Sep-17

Date Completed 22-Sep-17

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Water Samples

Our Ref 17-10516

Client Ref C7333

Contract Title Millfield Works, Stockton-On-Tees

Lab No	1230678	1230679	1230680
Sample ID	CP01	CP03	STREAM
Depth			
Other ID			RIVER
Sample Type	WATER	WATER	WATER
Sampling Date	13/09/17	13/09/17	13/09/17
Sampling Time	1600	1600	1600

Test	Method	LOD	Units			
Metals						
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	1.4	2.6	1.6
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	0.16	0.33	0.04
Chromium, Dissolved	DETSC 2306	0.25	ug/l	12	6.5	9.7
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0	< 7.0	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	3.7	27	13
Lead, Dissolved	DETSC 2306	0.09	ug/l	7.9	1.4	1.8
Mercury, Dissolved	DETSC 2306	0.01	ug/l	0.03	0.02	0.03
Nickel, Dissolved	DETSC 2306	0.5	ug/l	3.1	10	3.4
Selenium, Dissolved	DETSC 2306	0.25	ug/l	0.83	0.37	0.57
Zinc, Dissolved	DETSC 2306	1.3	ug/l	17	37	15
Inorganics						
Conductivity	DETSC 2009	1	uS/cm	2500	1440	530
pH	DETSC 2008			7.5	7.4	7.4
Cyanide, Free	DETSC 2130	20	ug/l	< 20	< 20	< 20
Hardness	DETSC 2303	0.1	mg/l	648	633	169
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.23	0.62	0.63
Sulphate as SO4	DETSC 2055	0.1	mg/l	330	170	61
Petroleum Hydrocarbons						
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.2	< 0.2	< 0.2
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.2	< 0.2	< 0.2
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.2	< 0.2	< 0.2
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.2	< 0.2	< 0.2
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.2	< 0.2	< 0.2
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.2	< 0.2	< 0.2
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	ug/l	< 10	< 10	< 10
Benzene	DETSC 3322	1	ug/l	< 2.0	< 2.0	< 2.0
Toluene	DETSC 3322	1	ug/l	< 2.0	< 2.0	< 2.0
Ethylbenzene	DETSC 3322	1	ug/l	< 2.0	< 2.0	< 2.0
Xylene	DETSC 3322	1	ug/l	< 2.0	< 2.0	< 2.0
MTBE	DETSC 3322	1	ug/l	< 2.0	< 2.0	< 2.0

Summary of Chemical Analysis

Water Samples

Our Ref 17-10516

Client Ref C7333

Contract Title Millfield Works, Stockton-On-Tees

Lab No	1230678	1230679	1230680
Sample ID	CP01	CP03	STREAM
Depth			
Other ID			RIVER
Sample Type	WATER	WATER	WATER
Sampling Date	13/09/17	13/09/17	13/09/17
Sampling Time	1600	1600	1600

Test	Method	LOD	Units			
PAHs						
Naphthalene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.03
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	0.01	0.02
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	0.05	0.03
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	0.03	0.04
Phenanthrene	DETSC 3304	0.01	ug/l	0.02	0.03	0.08
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	0.01	0.01
Fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	0.02	0.04
Pyrene	DETSC 3304	0.01	ug/l	< 0.01	0.01	0.03
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.03
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.02
Indeno(1,2,3-c,d)pyrene	DETSC 3304*	0.01	ug/l	< 0.01	< 0.01	0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304*	0.01	ug/l	< 0.01	< 0.01	0.02
PAH Total	DETSC 3304	0.04	ug/l	< 0.04	0.16	0.39
Phenols						
Phenol	*	0.5	ug/l	< 0.50	< 0.50	< 0.50

Summary of Chemical Analysis

Water Samples

Our Ref 17-10516

Client Ref C7333

Contract Title Millfield Works, Stockton-On-Tees

Lab No	1230678	1230679	1230680
Sample ID	CP01	CP03	STREAM
Depth			
Other ID			RIVER
Sample Type	WATER	WATER	WATER
Sampling Date	13/09/17	13/09/17	13/09/17
Sampling Time	1600	1600	1600

Test	Method	LOD	Units			
VOCs						
Dichlorodifluoromethane	DETS 3432	1	ug/l	< 1	< 1	< 1
Chloromethane	DETS 3432	1	ug/l	< 1	< 1	< 1
Vinyl Chloride	DETS 3432	1	ug/l	< 1	< 1	< 1
Bromomethane	DETS 3432	1	ug/l	< 1	< 1	< 1
Chloroethane	DETS 3432	1	ug/l	< 1	< 1	< 1
Trichlorofluoromethane	DETS 3432*	1	ug/l	< 1	< 1	< 1
1,1-dichloroethylene	DETS 3432	1	ug/l	< 1	< 1	< 1
Trans-1,2-dichloroethylene	DETS 3432	1	ug/l	< 1	< 1	< 1
1,1-dichloroethane	DETS 3432	1	ug/l	< 1	< 1	< 1
Cis-1,2-dichloroethylene	DETS 3432	1	ug/l	< 1	< 1	< 1
2,2-dichloropropane	DETS 3432	2	ug/l	< 2	< 2	< 2
Bromochloromethane	DETS 3432	4	ug/l	< 4	< 4	< 4
Chloroform	DETS 3432	1	ug/l	< 1	< 1	< 1
1,1,1-trichloroethane	DETS 3432	1	ug/l	< 1	< 1	< 1
1,1-dichloropropene	DETS 3432	1	ug/l	< 1	< 1	< 1
Carbon tetrachloride	DETS 3432	1	ug/l	< 1	< 1	< 1
Benzene	DETS 3432	1	ug/l	< 1	< 1	< 1
1,2-dichloroethane	DETS 3432	1	ug/l	< 1	< 1	< 1
Trichloroethylene	DETS 3432*	1	ug/l	< 1	< 1	< 1
1,2-dichloropropane	DETS 3432	1	ug/l	< 1	< 1	< 1
Dibromomethane	DETS 3432	1	ug/l	< 1	< 1	< 1
Bromodichloromethane	DETS 3432	4	ug/l	< 4	< 4	< 4
cis-1,3-dichloropropene	DETS 3432	1	ug/l	< 1	< 1	< 1
Toluene	DETS 3432	1	ug/l	< 1	< 1	< 1
trans-1,3-dichloropropene	DETS 3432	1	ug/l	< 1	< 1	< 1
1,1,2-trichloroethane	DETS 3432	1	ug/l	< 1	< 1	< 1
Tetrachloroethylene	DETS 3432	1	ug/l	< 1	< 1	< 1
1,3-dichloropropane	DETS 3432	1	ug/l	< 1	< 1	< 1
Dibromochloromethane	DETS 3432	1	ug/l	< 1	< 1	< 1
1,2-dibromoethane	DETS 3432	1	ug/l	< 1	< 1	< 1
Chlorobenzene	DETS 3432	1	ug/l	< 1	< 1	< 1
1,1,1,2-tetrachloroethane	DETS 3432	1	ug/l	< 1	< 1	< 1
Ethylbenzene	DETS 3432	1	ug/l	< 1	< 1	< 1
m+p-Xylene	DETS 3432	2	ug/l	< 2	< 2	< 2
o-Xylene	DETS 3432	1	ug/l	< 1	< 1	< 1
Styrene	DETS 3432	1	ug/l	< 1	< 1	< 1
Bromoform	DETS 3432	1	ug/l	< 1	< 1	< 1
Isopropylbenzene	DETS 3432	1	ug/l	< 1	< 1	< 1
1,1,2,2-tetrachloroethane	DETS 3432	1	ug/l	< 1	< 1	< 1
Bromobenzene	DETS 3432	1	ug/l	< 1	< 1	< 1
1,2,3-trichloropropane	DETS 3432	1	ug/l	< 1	< 1	< 1

Summary of Chemical Analysis

Water Samples

Our Ref 17-10516

Client Ref C7333

Contract Title Millfield Works, Stockton-On-Tees

Lab No	1230678	1230679	1230680
Sample ID	CP01	CP03	STREAM
Depth			
Other ID			RIVER
Sample Type	WATER	WATER	WATER
Sampling Date	13/09/17	13/09/17	13/09/17
Sampling Time	1600	1600	1600

Test	Method	LOD	Units			
n-propylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1
2-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1
1,3,5-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1
4-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1
Tert-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1
1,2,4-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1
sec-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1
p-isopropyltoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1
1,3-dichlorobenzene	DETSC 3432	2	ug/l	< 2	< 2	< 2
1,4-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1
n-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1
1,2-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1
1,2-dibromo-3-chloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1
1,2,4-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1
Hexachlorobutadiene	DETSC 3432	1	ug/l	< 1	< 1	< 1
1,2,3-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1
MTBE	DETSC 3432*	1	ug/l	< 1	< 1	< 1

SVOCs

Phenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
Aniline	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
2-Chlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
Benzyl Alcohol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
2-Methylphenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
Bis(2-chloroisopropyl)ether	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
3&4-Methylphenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
Bis(2-chloroethoxy)methane	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
2,4-Dimethylphenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
2,4-Dichlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
4-Chloro-3-methylphenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
2-Methylnaphthalene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
Hexachlorocyclopentadiene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
2,4,6-Trichlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
2,4,5-Trichlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
2-Chloronaphthalene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
2-Nitroaniline	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
2,4-Dinitrotoluene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
3-Nitroaniline	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
4-Nitrophenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
Dibenzofuran	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
2,6-Dinitrotoluene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
2,3,4,6-Tetrachlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0

Summary of Chemical Analysis

Water Samples

Our Ref 17-10516

Client Ref C7333

Contract Title Millfield Works, Stockton-On-Tees

Lab No	1230678	1230679	1230680
Sample ID	CP01	CP03	STREAM
Depth			
Other ID			RIVER
Sample Type	WATER	WATER	WATER
Sampling Date	13/09/17	13/09/17	13/09/17
Sampling Time	1600	1600	1600

Test	Method	LOD	Units			
Diethylphthalate	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
4-Chlorophenylphenylether	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
4-Nitroaniline	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
Diphenylamine	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
4-Bromophenylphenylether	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
Hexachlorobenzene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
Bis(2-ethylhexyl)ester	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
Pentachlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
Di-n-butylphthalate	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
Butylbenzylphthalate	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
Bis(2-ethylhexyl)phthalate	DETS 071*	1	ug/l	1.2	< 1.0	1.6
Di-n-octylphthalate	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
1,4-Dinitrobenzene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
Dimethylphthalate	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
1,3-Dinitrobenzene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
2,3,5,6-Tetrachlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
Azobenzene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
Carbazole	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0
1-Methylnaphthalene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0

Information in Support of the Analytical Results

Our Ref 17-10516
 Client Ref C7333
 Contract Millfield Works, Stockton-On-Tees

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1230678	CP01 WATER	13/09/17	GB 1L, GV, Other (non plastic, non glass)		
1230679	CP03 WATER	13/09/17	GB 1L, GV, Other (non plastic, non glass)		
1230680	STREAM WATER	13/09/17	GB 1L, GV, Other (non plastic, non glass)		

Key: G-Glass B-Bottle V-Vial

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



APPENDIX E

GROUND GAS AND GROUNDWATER MONITORING RESULTS

Ground Gas and Groundwater Monitoring Record Sheet



JOB DETAILS:

Client: TJ Thomson & Son Ltd
Site: Millfield Works, Stockton-On-Tees
Date: 23/08/2017

Job No: C7333
Visit No: 1 of 6 over 3 months
Operator: DB **Project Manager:** MG

Monitoring Point	GAS CONCENTRATIONS												VOLATILES		FLOW DATA				Worst-credible GSVs		WELL AND WATER DATA						Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Reduced level (mAOD)	Water level (mAOD)	Response Zone		
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady											
CP01	ND	ND	ND	ND	7.3	7.3	ND	ND	ND	ND	8.1	8.1	NR	NR	120.0	5.5	39	240	0.12	0.4015	2.73	7.84	NR	NR	Glaciolacustrine clay	Water bailed to 2.93m bgl (6.5 litres).	
CP03	ND	ND	ND	ND	0.8	0.8	ND	ND	ND	ND	19.6	19.6	NR	NR	ND	ND	ND	NA	NA	0.0008	4.28	7.87	NR	NR	Principally granular made ground		
WS01	1.0	1.0	23.1	23.1	0.1	0.1	ND	ND	ND	ND	9.7	9.7	NR	NR	14.9	ND	ND	1	0.149	0.0001	0.18	3.08	NR	NR	Glaciolacustrine clay		
WS03	ND	ND	ND	ND	4.0	4.0	ND	ND	ND	ND	14.8	14.8	NR	NR	ND	ND	ND	NA	NA	0.004	DRY	2.50	NR	NR	Granular made ground		
WS05	ND	ND	ND	ND	7.8	7.8	ND	ND	ND	ND	5.9	5.9	NR	NR	ND	ND	ND	NA	NA	0.0078	2.99	3.08	NR	NR	Granular made ground		
WS08C	ND	ND	ND	ND	2.1	2.1	ND	ND	ND	ND	18.6	18.6	NR	NR	ND	ND	ND	NA	NA	0.0021	2.22	3.06	NR	NR	Principally granular made ground		
WS09	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20.3	20.3	NR	NR	3.0	ND	ND	1	0.003	NA	0.00	3.13	NR	NR	Glaciolacustrine clay	Well submerged below ponded surface water. Water bailed to 3.07m bgl (6.5 litres).	
WS10	ND	ND	1.2	1.2	0.3	0.3	ND	ND	ND	ND	0.1	0.1	NR	NR	-6.7	ND	ND	0	0.0067	0.0003	1.76	3.09	NR	NR	Granular made ground and glaciolacustrine clay		
WS11	ND	ND	ND	ND	9.1	9.1	ND	ND	ND	ND	4.6	4.6	NR	NR	ND	ND	ND	NA	NA	0.0091	3.07	3.08	NR	NR	Granular made ground		
WS13	ND	ND	ND	ND	3.5	3.5	ND	ND	ND	ND	13.4	13.4	NR	NR	ND	ND	ND	NA	NA	0.0035	2.94	3.00	NR	NR	Granular made ground		
WS14	ND	ND	ND	ND	0.2	0.2	ND	ND	ND	ND	20.5	20.5	NR	NR	ND	ND	ND	NA	NA	0.0002	1.20	3.06	NR	NR	Principally granular made ground		
WS15	ND	ND	ND	ND	9.6	9.6	ND	ND	ND	ND	12.1	12.1	NR	NR	ND	ND	ND	NA	NA	0.0096	1.28	3.07	NR	NR	Principally glaciofluvial clay		
Max	1.0	1.0	23.1	23.1	9.6	9.6	ND	ND	ND	ND	20.5	20.5	NR	NR	120.0	5.5	39.0	240	0.1490	0.4015	4.28	7.87	NR	NR			
Min	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1	0.1	NR	NR	ND	ND	ND	NA	NA	NA	DRY	2.50	NR	NR			

ND - Not detected

NR - Not recorded

NA - Non applicable

NB: Where no flow (ND) recorded, GSVs are calculated using equipment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

METEOROLOGICAL AND SITE INFORMATION:

(Select correct box with X or enter data, as applicable)

State of ground: ☒ Dry ☐ Moist ☐ Wet ☐ Snow ☐ Frozen
Wind: ☐ Calm ☒ Light ☐ Moderate ☐ Strong
Cloud cover: ☐ None ☒ Slight ☐ Cloudy ☐ Overcast
Precipitation: ☒ None ☐ Slight ☐ Moderate ☐ Heavy
Time monitoring performed: ☐ Start ☐ End
Barometric pressure (mbar): ☐ 1012 ☐ Start ☐ 1014 ☐ End
Pressure trend (Daily): ☒ Falling ☐ Steady ☐ Rising
Source: www.wunderground.com
Air Temperature (Deg. C): ☐ 19 Before ☐ 22 After

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter: GFM436-12746
Gas Range: ☐ CH₄ ☐ 0-100% ☐ CO₂ ☐ 0-100% ☐ O₂ ☐ 0-25%
Gas Flow range:
Differential Pressure:
Date of last calibration: 01/08/2017
Date of next calibration: 01/09/2017
Ambient air check: ☐ CH₄ ☐ 0.0% ☐ CO₂ ☐ 0.0% ☐ O₂ ☐ 20.7%

Ground Gas and Groundwater Monitoring Record Sheet



JOB DETAILS:

Client: TJ Thomson & Son Ltd
Site: Millfield Works, Stockton-On-Tees
Date: 13/09/2017

Job No: C7333
Visit No: 2 of 6 over 3 months
Operator: DB **Project Manager:** MG

Monitoring Point	GAS CONCENTRATIONS												VOLATILES		FLOW DATA				Worst-credible GSVs		WELL AND WATER DATA						Comments
	Methane (%v/v)		%LEL		Carbon dioxide (%v/v)		Carbon monoxide (ppmv)		Hydrogen sulphide (ppmv)		Oxygen (%v/v)		PID Peak (ppm)	Product thickness (mm)	Flow rate (l/hr)		Differential borehole Pressure (Pa)	Time for flow to equalise (secs)	Methane (l/hr)	CO2 (l/hr)	Water level (mbgl)	Depth of well (m)	Reduced level (mAOD)	Water level (mAOD)	Response Zone		
	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady			Peak	Steady											
CP01	ND	ND	ND	ND	4.3	4.3	ND	ND	ND	ND	11.7	11.7	ND	NR	120.0	4.2	29	180	0.12	0.1806	2.47	7.84	NR	NR	Glaciolacustrine clay		
CP03	ND	ND	ND	ND	0.7	0.7	ND	ND	ND	ND	19.5	19.5	ND	NR	ND	ND	ND	NA	NA	0.0007	4.49	7.87	NR	NR	Principally granular made ground		
WS01	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Glaciolacustrine clay	Well submerged below ponded surface water.	
WS03	ND	ND	ND	ND	4.3	4.3	ND	ND	ND	ND	14.5	14.5	ND	NR	ND	ND	ND	NA	NA	0.0043	DRY	2.50	NR	NR	Granular made ground		
WS05	ND	ND	ND	ND	0.7	0.7	ND	ND	ND	ND	18.7	18.7	ND	NR	ND	ND	ND	NA	NA	0.0007	2.29	3.08	NR	NR	Granular made ground		
WS08C	ND	ND	ND	ND	2.0	2.0	ND	ND	ND	ND	18.6	18.6	ND	NR	ND	ND	ND	NA	NA	0.002	2.23	3.06	NR	NR	Principally granular made ground		
WS09	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Glaciolacustrine clay	Well submerged below ponded surface water.	
WS10	ND	ND	ND	ND	0.3	0.3	ND	ND	ND	ND	2.9	2.9	ND	NR	ND	ND	ND	NA	NA	0.0003	1.37	3.09	NR	NR	Granular made ground and glaciolacustrine clay	Ponded surface water entered well upon removal of gas bung. Water level recorded not representative of groundwater level.	
WS11	ND	ND	ND	ND	9.7	9.7	ND	ND	ND	ND	4.1	4.1	ND	NR	ND	ND	ND	NA	NA	0.0097	3.07	3.08	NR	NR	Granular made ground		
WS13	ND	ND	ND	ND	4.5	4.4	ND	ND	ND	ND	11.4	11.4	ND	NR	ND	ND	ND	NA	NA	0.0044	2.94	3.00	NR	NR	Granular made ground		
WS14	ND	ND	ND	ND	0.5	0.5	ND	ND	ND	ND	12.7	12.7	ND	NR	ND	ND	ND	NA	NA	0.0005	1.37	3.06	NR	NR	Principally granular made ground		
WS15	ND	ND	ND	ND	7.5	7.5	ND	ND	ND	ND	14.2	14.2	ND	NR	ND	ND	ND	NA	NA	0.0075	1.46	3.07	NR	NR	Principally glaciofluvial clay		
Max	ND	ND	ND	ND	9.7	9.7	ND	ND	ND	ND	19.5	19.5	ND	NR	120.0	4.2	29.0	180	0.1200	0.1806	4.49	7.87	NR	NR			
Min	ND	ND	ND	ND	0.3	0.3	ND	ND	ND	ND	2.9	2.9	ND	NR	ND	ND	ND	NA	NA	0.0003	DRY	2.50	NR	NR			

ND - Not detected

NR - Not recorded

NA - Non applicable

NB: Where no flow (ND) recorded, GSVs are calculated using equipment limit of detection (0.1l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

METEOROLOGICAL AND SITE INFORMATION:

(Select correct box with X or enter data, as applicable)

State of ground: ☐ Dry ☐ Moist ☒ Wet ☐ Snow ☐ Frozen
 Wind: ☐ Calm ☐ Light ☒ Moderate ☐ Strong
 Cloud cover: ☐ None ☒ Slight ☐ Cloudy ☐ Overcast
 Precipitation: ☒ None ☐ Slight ☐ Moderate ☐ Heavy
 Time monitoring performed: ☐ Start ☐ End
 Barometric pressure (mbar): 993 ☐ Start ☐ End
 Pressure trend (Daily): ☐ Falling ☐ Steady ☒ Rising
 Source: www.wunderground.com
 Air Temperature (Deg. C): ☐ 18 Before ☐ 18 After

INSTRUMENTATION TECHNICAL SPECIFICATIONS:

Ground gas meter: GFM436-12746
 Gas Range: CH₄ ☐ 0-100% CO₂ ☐ 0-100% O₂ ☐ 0-25%
 Gas Flow range:
 Differential Pressure:
 Date of last calibration: 11/09/2017
 Date of next calibration: 02/10/2017
 Ambient air check: CH₄ ☐ 0.0% CO₂ ☐ 0.0% O₂ ☐ 20.9%



APPENDIX F

SIRIUS GENERIC ASSESSMENT CRITERIA



SIRIUS GENERIC ASSESSMENT CRITERIA

Context

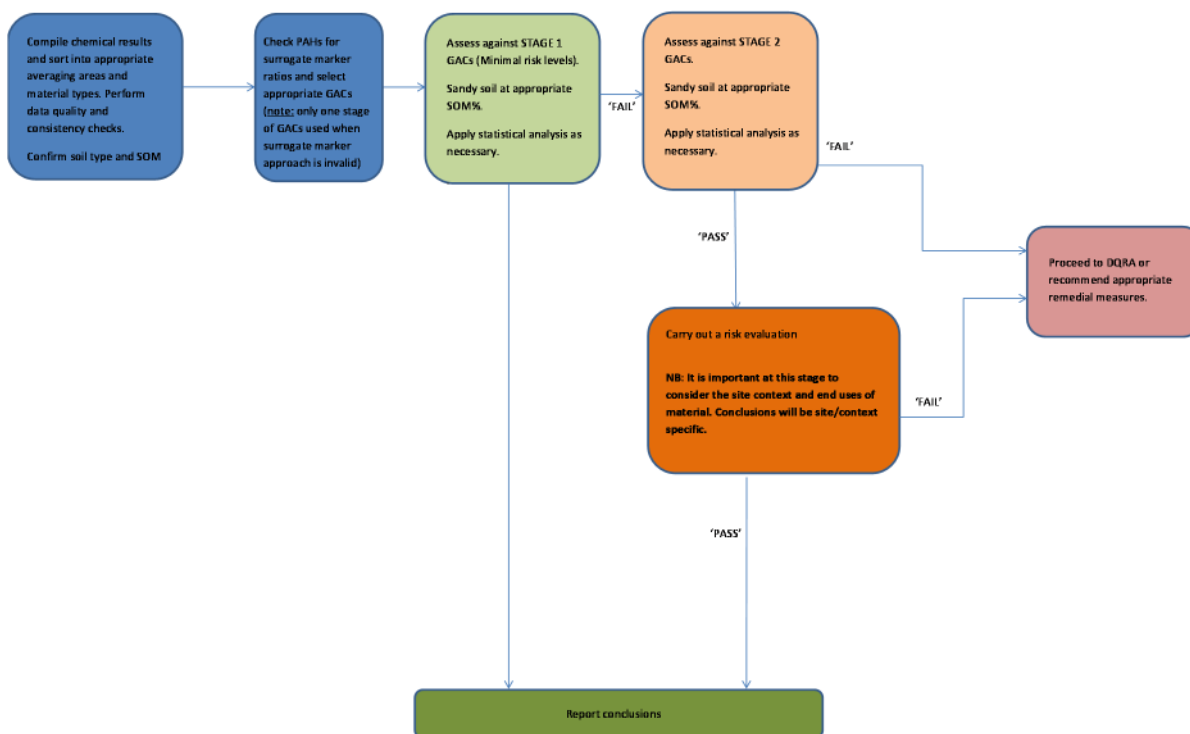
The framework for conducting site investigations, risk assessments and undertaking any necessary remedial works in the UK is provided by Environment Agency report CLR11 “Model Procedures for the Management of Contaminated Land”. This presents a phased approach to risk assessment, involving: identification and qualitative assessment of potential pollutant linkages (source-pathway-receptor relationships) by means of a Conceptual Site Model; Generic Quantitative Risk Assessment (GQRA) of potentially significant pollutant links by comparing contaminant concentrations with appropriate Generic Assessment Criteria (GAC) values; and, if required, a Detailed Quantitative Risk Assessment (DQRA) based on site-specific conditions.

Assessment of Risk to Human Health

Introduction

A staged approach to GQRA has been adopted by Sirius for the evaluation of soil concentration data, as shown schematically in Figure 1.

Figure 1. GQRA Process.





The first stage of GQRA comprises assessment of the data against GAC values derived using toxicological parameter values based on “minimum risk”. Any contaminants exceeding their GACs at this stage are further assessed against Stage 2 GACs, which have been derived using Low Level of Toxicological Concern (LLTC) criteria, where these are available.

With appropriate justification, a contaminant concentration that does not exceed the relevant Stage 2 GAC value may be considered to indicate that the land is “suitable for use”. The appropriate use of LLTC-based criteria within the planning regime is considered reasonable by government agencies, as most recently highlighted in the letter (dated 3rd September 2014) to all local authorities from Lord de Mauley, Parliamentary Under Secretary at DEFRA.

A narrative “risk evaluation” must therefore accompany any Stage 2 assessment to justify the conclusions drawn. Where appropriate, this may provide a basis for eliminating from further consideration those contaminants whose concentrations do not exceed the applicable Stage 2 GAC value.

For the specific case of lead, the Category 4 Screening Level criteria given in CL:AIRE (2014)¹ have been adopted directly as GACs, as these are considered to be based on expert interpretation of current toxicological evidence.

In some areas, background concentrations of lead, other metals and metalloids, and/or individual PAHs may exceed their respective GACs and it may be appropriate to consider relative site and background concentration data as part of a more detailed assessment of the data.

Derivation of GACs

Except where otherwise stated, GACs have been derived by Sirius using CLEA version 1.071.

The GAC values have been derived for a sandy soil type, which will be conservative for the majority of soils (including made ground) encountered on historically contaminated sites. For organic contaminants of concern, criteria have been derived for a number of Soil Organic Matter (SOM) contents.

Genotoxic PAHs are assessed by the “Surrogate Method” using benzo(a)pyrene. Further information on this approach is given below.

Unless specifically stated, chemical properties and Health Criteria Values (HCVs) were obtained from:

- Environment Agency Science Report SC050021 series;
- Nathanail *et al.* (2009) “The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment”, 2nd edition, Land Quality Press, Nottingham;
- CL:AIRE - AGS - EIC (2010) “Soil Generic Assessment Criteria for Human Health Risk Assessment”. CL:AIRE, London.

GACs for arsenic, benzene, benzo(a)pyrene, cadmium and chromium (VI) have been derived using the

¹ CL:AIRE (2014) “Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination”, Report SP1010, rev. 2.



Low Level of Toxicological Concern (LLTC) criteria given in CL:AIRE (2013). These criteria are considered a reasonable basis for assessment as they are still highly precautionary and definitely do not approach an intake level that could be defined as approaching Significant Possibility of Significant Harm to human health in the context of Part 2A of the Environmental Protection Act 1990. It must be further understood that the GACs derived will still incorporate a residual level of conservatism resulting from the exposure parameters used and the assumptions inherent in the model algorithms.

GACs for Genotoxic PAHs

Our approach to the assessment of genotoxic PAHs retains the use of benzo(a)pyrene as a surrogate marker. This approach for genotoxic PAHs is recommended by the HPA (2010)², which we consider to be the authoritative current guidance produced by a UK expert body and note that it was retained in the DEFRA Category 4 Screening Levels project (CL:AIRE, 2014).

The surrogate marker approach allows the assessment of the combined carcinogenic risk associated with all genotoxic PAHs³ present as a mixture within soil, even though detailed toxicological information for many of the individual compounds may be lacking. The approach is based on determining the risk posed by the genotoxic PAH mixture using the concentration of benzo(a)pyrene present as an indicator.

To use the GAC for benzo(a)pyrene as a surrogate marker, a number of requirements must be met (HPA, 2010):

- Benzo(a)pyrene must be present in all soil samples containing genotoxic PAHs for which this method of assessment is being used;
- A similar profile of the genotoxic PAHs relative to benzo(a)pyrene should be present in all of the samples being assessed;
- The PAH profile of PAHs in the soil samples should be similar to that present in the pivotal toxicity study on which toxicological criterion for benzo(a)pyrene was based (Culp *et al.*, 1998⁴). Table 1 provides the basis for defining the acceptable range.

Data indicate that contaminated soils in the UK generally meet these criteria⁵ but the assessor must review their dataset before adopting this approach. If the above criteria are not met, then the surrogate marker approach must not be adopted and individual GAC or SSAC values are to be applied.

² HPA (2010) "Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)", version 5.

³ The genotoxic PAHs included in the USEPA PAH 16 analysis reported by analytical labs are: benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, benzo(a)pyrene, chrysene, dibenz[a,h]anthracene and indeno[1,2,3-c,d]pyrene.

⁴ Culp, S. *et al.* (1998) Carcinogenesis, 19, 117-124.

⁵ Bull, S. & Collins, C. (2013) Environ. Geochem. Health, 31, 101-109.



Table 1. Profile of Genotoxic PAHs Relative to Benzo(a)pyrene that are Considered Acceptable for Application of Benzo(a)pyrene as a Surrogate Marker.

PAH	Acceptable Ratio of PAH Concentration to Benzo(a)pyrene for Application of Surrogate Marker Assessment	
	Lower Limit	Upper Limit
Benz[a]anthracene	0.12	12.43
Benzo[b]fluoranthene	0.11	10.85
Benzo[k]fluoranthene	0.04	3.72
Benzo[g,h,i]perylene	0.08	8.22
Chrysene	0.12	11.61
Dibenz[a,h]anthracene	0.01	1.38
Indeno[1,2,3-c,d]pyrene	0.07	7.27

For further information see: HPA (2010).

Soil Criteria Set for Purposes Other Than Human Health Protection

The Sirius GACs for sulphate, total organic carbon (TOC) and calorific value are set on basis of risks other than human health and their exceedance does not indicate a potential risk to future site users:

- The GAC for sulphate content is based on potential detrimental effects on buried concrete⁶ and must be assessed with reference to the soil pH;
- The GAC for TOC content is provided for indicative assessment of disposal options if off-site landfill of soil were to be considered. This GAC is set at the 'Inert' waste threshold and should be considered as being applied for information purposes only;
- The GAC for calorific value is set to assist in an initial assessment of the potential fire risk posed by made ground or natural soils containing elevated concentrations of potentially combustible organic matter.

Assessment criteria more stringent than those for human health may be set for specific purposes, for example, elimination of nuisance odours or ensuring that potentially mobile free-phase organic products are not present.

Controlled Waters

The Environment Agency's "Remedial Targets Methodology" (2006) provides a framework for assessing the potential for pollution of controlled waters and for deriving remedial target concentrations in soil and groundwater.

There are no generic groundwater or surface water quality standards that are applicable to all sites. Drinking Water Standards and Environmental Quality Standards (EQS) are used by Sirius as assessment criteria where they are appropriate to the contaminant linkages under consideration. Given that these standards apply at the receptor point, this is a conservative approach for samples collected at a source or along a transport pathway.

⁶ BRE (2005) "Concrete in Aggressive Ground", Special Digest No. 1; 3rd Edition.



Soil Leachability

Sirius specifies that the analytical laboratory undertakes leachate preparation by BS EN 12475-2:2002. Where specific circumstances require a different method to be used, then this will be explained and justified within the report body text.

The results of leachate analysis are compared to the relevant GAC values for controlled waters.

The Sirius Group

Stage 1 Generic Assessment Criteria for Soils

Revision:

20th August 2015

Parameter	Residential (mg/kg, unless otherwise stated)						Commercial / Industrial (mg/kg, unless otherwise stated)			Note
	With Homegrown Produce			Without Homegrown Produce						
	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	
Metals/Metalloids										
Arsenic (inorganic)	37			40			630			[1]
Cadmium	11			85			190			[2]
Chromium (III)	910			4000			8600			
Chromium (VI)	6.0			6.1			33			[3]
Copper	200			7100			68000			[4]
Lead	200			310			2300			[5]
Mercury (inorganic)	40			56			1100			[6]
Nickel	130			180			980			[7]
Selenium	250			430			12000			
Vanadium	410			1200			9000			
Zinc	450			40000			750000			[4]
Other Inorganics										
pH	<5 or >9			<5 or >9			<5 or >9			
Total Sulphate	2400			2400			2400			[8]
Water-Soluble Sulphate	0.5 g/l			0.5 g/l			0.5 g/l			[8]
Free Cyanide	34			34			1400			[9]
Organics										
PAHs										
Acenaphthene	200	490	920	2000	3600	4900	75000	92000	100000	
Acenaphthylene	170	400	760	2000	3600	4900	76000	93000	100000	
Anthracene	2300	5300	9400	30000	34000	36000	520000	540000	540000	[10]
Benzo(a)anthracene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Benzo(a)pyrene	2.1	2.1	2.2	2.3	2.3	2.3	27	27	27	[11]
Benzo(b)fluoranthene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Benzo(k)fluoranthene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Benzo(g,h,i)perylene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Chrysene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Dibenzo(a,h)anthracene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Fluoranthene	280	560	820	1500	1600	1600	23000	23000	23000	
Fluorene	170	390	730	2200	3400	4000	60000	67000	70000	
Indeno(1,2,3-c,d)pyrene	Assessed using benzo(a)pyrene as a surrogate marker									[10]
Naphthalene	1.0	2.3	4.6	1.0	2.4	4.7	110	260	510	
Phenanthrene	95	220	380	1300	1400	1500	22000	22000	23000	
Pyrene	620	1200	1900	3700	3800	3800	54000	54000	54000	
BTEX and related										
Benzene	0.063	0.13	0.24	0.16	0.30	0.38	15	28	49	
Toluene	100	240	460	370	830	1100	33000	68000	110000	
Ethylbenzene	26	62	120	34	81	110	3200	7400	14000	
Xylenes (total)	28	67	130	33	78	110	3200	7700	15000	[12]
1,2,4-trimethylbenzene	0.22	0.53	1.1	0.24	0.58	1.2	39	93	170	
Iso-propylbenzene	6.6	16	32	6.8	17	33	1300	3100	6100	
Propylbenzene	21	51	100	23	57	110	3800	9100	17000	
Styrene	6.9	16	32	21	49	93	3100	6100	9500	
TPH										
Aliphatic EC 5-6	24	41	68	24	41	48	2400	4100	6900	
Aliphatic EC >6-8	53	110	210	53	110	150	5300	11000	21000	
Aliphatic EC >8-10	13	31	61	13	31	43	1300	3100	6000	
Aliphatic EC >10-12	62	150	300	62	150	220	6100	15000	28000	
Aliphatic EC >12-16	510	1200	2300	510	1200	1700	43000	72000	85000	
Aliphatic EC >16-35	41000	70000	90000	42000	70000	80000	>1E6	>1E6	>1E6	[13]
Aromatic EC >5-7	53	110	200	150	300	380	15000	28000	48000	
Aromatic EC >7-8	100	240	460	370	820	1100	33000	68000	110000	
Aromatic EC >8-10	20	48	94	22	54	75	2200	5200	9800	
Aromatic EC >10-12	63	150	290	120	290	400	11000	22000	30000	
Aromatic EC >12-16	140	320	570	1100	1900	2100	35000	37000	37000	
Aromatic EC >16-21	260	540	840	1800	1900	1900	28000	28000	28000	
Aromatic EC >21-35	1100	1500	1700	1900	1900	1900	28000	28000	28000	
Chlorinated Organics										
Chlorobenzene	0.19	0.44	0.86	0.19	0.45	0.87	31	71	140	
Dichloromethane (DCM)	0.47	0.78	1.2	1.2	1.7	2.4	250	340	470	
1,1-dichloroethane (DCA)	1.4	2.4	4.0	1.4	2.4	4.1	260	420	690	
1,2-dichloroethane (DCA)	0.0031	0.0048	0.0076	0.0035	0.0053	0.0084	0.34	0.51	0.81	
1,1-dichloroethene (DCE)	0.15	0.26	0.45	0.15	0.26	0.46	24	43	74	
cis-1,2-dichloroethene (DCE)	0.066	0.12	0.20	0.069	0.12	0.21	14	23	38	
trans-1,2-dichloroethene (DCE)	0.11	0.21	0.38	0.12	0.22	0.39	21	37	65	
Pentachlorophenol	0.21	0.52	1.0	27	30	31	400	400	400	
1,1,1,2-tetrachloroethane	0.56	1.3	2.6	0.63	1.5	2.9	59	140	270	

The Sirius Group

Stage 1 Generic Assessment Criteria for Soils

Parameter	Residential (mg/kg, unless otherwise stated)						Commercial / Industrial (mg/kg, unless otherwise stated)			Note
	With Homegrown Produce			Without Homegrown Produce						
	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	
1,1,2,2-tetrachloroethane	0.98	2.1	4.0	1.6	3.4	6.3	150	310	570	
Tetrachloroethene (PCE)	0.074	0.17	0.32	0.07	0.17	0.33	10	23	45	
Tetrachloromethane (CT)	0.011	0.024	0.046	0.011	0.024	0.046	1.6	3.6	6.9	
1,1,1-trichloroethane (TCA)	3.7	7.8	15	3.8	7.9	15	370	770	1400	
1,1,2-trichloroethane (TCA)	0.39	0.85	1.6	0.51	1.1	2.0	89	180	320	
Trichloroethene (TCE)	0.0070	0.015	0.028	0.0071	0.015	0.68	1.5	2.8	44	
Trichloromethane (CF)	0.43	0.80	1.4	0.48	0.89	53	98	170	300	
Vinyl Chloride	0.00034	0.00045	0.00062	0.00037	0.00048	0.00066	0.038	0.049	0.068	
Miscellaneous Organics										
Carbon disulphide	0.066	0.13	0.25	0.066	0.13	0.25	6.7	14	25	
Di-(2-ethylhexyl)-phthalate	290	660	1100	3900	4000	4100	85000	85000	8600	
MTBE	31	55	94	39	68	120	7400	12000	19000	
Phenol	110	190	330	420	440	440	440			[14]
Methylphenols (cresols), total	78	170	330	5600	8200	9900	160000	170000	18000	[15]
2,4-dimethylphenol (m-xylene)	18	43	82	200	430	720	15000	23000	28000	
Other Parameters										
TOC	3% w/w			3% w/w			3% w/w			[16]
Calorific Value	2 MJ/kg			2 MJ/kg			2 MJ/kg			[17]
Asbestos	Fibres present			Fibres present			Fibres present			

All concentration-based criteria are rounded to 2 significant figures.

The criteria assume a sandy soil type, which will be conservative for the great majority of soils (including made ground) encountered on historically contaminated sites.

Except where otherwise stated, criteria have been derived by Sirius using CLEA version 1.06. Parameters for the land use cases are consistent with those given in Environment Agency (2009) "Updated Technical Background to the CLEA Model", report SC050021/SR3 but updated (where relevant) for respiration rate, exposure frequency for dermal contact outdoors, soil adherence factors for children, and plant uptake concentration factors given in CL:AIRE (2014) and Nathanail et al., (2015). No correction has been made for the "Top Two" crop types in the Residential with Homegrown Produce land use and the criteria will therefore be conservative in this regard.

Health Criteria Values (HCVs) and (except where specifically noted) chemical property data were obtained from:

- Environment Agency Science Report SC050021 Series;
- Nathanail et al. (2015);
- CL:AIRE-AGS-EIC (2010).

Footnotes

[1] Based on oral GAC as this is the lower GAC and reflects a cancer risk many orders of magnitude greater than for inhalation.

[2] Determined for lifetime exposure. Plant uptake concentration factors applied were as given in CL:AIRE (2014). The GAC values are based on data for soils having a pH value in the range 6-8; caution should be applied in applying them at pH values outside this range, especially at pH values <5.

[3] Both oral and inhalation HCVs are based on local toxicological effects and therefore the lowest (oral) GAC value is adopted.

[4] For the Residential with Homegrown Produce land use, the GAC values for Cu and Zn are based on potential phytotoxic effects and have been set at the maximum allowable concentrations for sewage sludge-amended soils presented in the "Sludge (Use in Agriculture) Regulations" (SI 1263/1989); these criteria may also be applied in any land use where plants are to be grown. The equivalent GAC values for human health protection in the Residential with Homegrown Produce land use are around an order of magnitude greater.

[5] The Category 4 Screening Levels for lead defined in CL:AIRE (2013) have been adopted directly to provide an acceptable basis for initial assessment of data. Where background concentrations of lead exceed the GAC value, then site-specific evaluation will be required.

[6] The SGV for mercury is based on inorganic mercury which represents the most common form encountered within the environment. This is considered appropriate for most sites as: "...the SGV for inorganic mercury can normally be compared with chemical analysis for total mercury content because the equilibrium concentrations of elemental and methylmercury compounds are likely to be very low" (Environment Agency report SC050021/Mercury SGV). Analysis and specific assessment for elemental or methylated forms of mercury will need to be considered if historical land use or site-specific factors indicate that these forms of mercury are likely to be present.

[7] Toxicological effects by inhalation are localised, therefore the lower of the GAC values for oral and inhalation HCVs have been adopted.

[8] BRE (2005). Sulphate is not considered to pose a potential risk to human health under normal circumstances – this GAC applies to construction cases only and is set at the upper limit for DS-1 Design Sulphate Class concrete.

[9] GAC calculated for acute risk. Further information can be provided upon request.

[10] The genotoxic PAHs (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene) are routinely assessed using benzo(a)pyrene as a surrogate (HPA (2010) "Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)", version 5). Separate information on this approach is provided.

[11] Calculated using a 'minimum risk' oral index dose derived from the application of a 10,000x safety factor to the BMD10 presented in CL:AIRE (2014) for benzo(a)pyrene as a surrogate marker and the inhalation index dose specified in CL:AIRE (2014) and Nathanail et al. (2015). As a conservative measure, the GAC is based on combined exposure pathways to account for systemic carcinogenic effects. Further information on the derivation can be provided upon request.

[12] For screening purposes, a single GAC has been set for total xylene. This is the lowest of the values calculated for the three individual xylene isomers.

[13] "No GAC" indicates that no value has been specified for this land use as the TDSI cannot be exceeded at achievable soil concentrations.

[14] 440mg/kg is the minimum concentration that is protective for direct skin contact with phenol (See Environment Agency SR050021/Phenol SGV) and is adopted where GACs for chronic exposure are higher.

[15] For screening purposes, a single GAC has been set for total methylphenol. This is the lowest of the values calculated for the three individual methylphenol isomers.

[16] The Hazardous Waste (England and Wales) Regulations 2005. TOC content in itself does not represent a potential risk to human health. This GAC is provided for indicative assessment of disposal options, in the case that off-site landfill of soil is undertaken. This GAC is specified at the 'Inert' waste threshold and should be considered as for information purposes only.

[17] ICRCL (1986) Guidance Note 61/84, 2nd Edition, Notes on the Fire Hazards of Contaminated Land. Calorific value is not an indication of direct human health risk but may be useful in assessment of the potential fire risk posed by made ground or natural soils containing elevated concentrations of potentially combustible organic matter.

GAC VALUES FOR CONTROLLED WATERS IN ENGLAND AND WALES

Parameter	GAC (µg/l, unless stated)			Notes
	Inland waters		Coastal and transition waters	
	EQS	DWS	EQS	
Metals and metalloids (dissolved)				
Arsenic	50	10	25	1
Cadmium	See separate table	5	0.2	1, 2
Chromium (total)	4.7	50	N.A.	1, 3
Copper	1.0 (bioavailable)	2000	3.76	1, 4
Lead	1.2 (bioavailable)	10	1.3	1, 4
Mercury	0.07	1.0	0.07	1, 4, 5
Nickel	4.0 (bioavailable)	20	8.6	1, 4
Zinc	10.9 (bioavailable) + background	5000	6.8 + background	1, 4, 6
Misc. inorganics				
Ammonia (total, as N)	See separate table	N.A.	N.A.	7
Ammonia (total, as NH4 ⁺)	N.A.	500	N.A.	
Ammonia (un-ionised (NH3), as N)	N.A.	N.A.	21	7
Cyanide (free)	10	50	10	
Sulphate	N.A.	250 mg/l	N.A.	8
Petroleum hydrocarbons and related				
TPH (speciated analysis) <i>per fraction</i>	10	10	10	9, 10
Benzene	10	1.0	8	
Toluene	74	700	74	11
Xylenes (sum)	N.A.	500	N.A.	11
MTBE	2600	200	2600	12, 13
PAHs				
Anthracene	0.1	N.A.	0.1	
Benzo(b)fluoranthene + Benzo(k)fluoranthene (sum)	N.A.	Sum of 4 = 0.1	N.A.	
Benzo(g,h,i)perylene + indeno(1,2,3-c,d)pyrene (sum)	N.A.		N.A.	
Benzo(a)pyrene	1.7E-04	0.01	1.7E-04	
Fluoranthene	0.0063	N.A.	0.0063	
Naphthalene	2.0	N.A.	2.0	
Phenol				
Phenol	7.7	N.A.	7.7	
Chlorinated organics				
Dichloromethane	20	N.A.	20	
Trichloromethane (chloroform)	2.5	100	2.5	14
Tetrachloromethane (carbon tetrachloride)	12	3.0	12	
1,2-dichloroethane (1,2-DCA)	10	3.0	10	

Cadmium - inland waters EQS	
Hardness (as mg/l CaCO ₃)	EQS (µg/l)
<40	0.08
40-50	0.08
50-100	0.09
100-200	0.15
>=200	0.25

Ammonia - inland waters EQS		
Alkalinity (as mg/l CaCO ₃)	Altitude	EQS (µg/l)
<10	Any	300
10-50	Any	300
50-100	<80m	600
50-100	>80m	300
100-200	<80m	600
100-200	>80m	300
>200	Any	600

Parameter	GAC (µg/l, unless stated)			Notes
	Inland waters		Coastal and transition waters	
	EQS	DWS	EQS	
1,1,1-trichloroethane (1,1,1-TCA)	100	N.A.	100	
1,1,2-trichloroethane (1,1,2-TCA)	400	N.A.	300	
Trichloroethene (TCE)	10	Sum of 2 = 10	10	
Tetrachloroethene (PCE)	10		10	
Vinyl chloride	N.A.	0.5	N.A.	

Notes referenced in table:

1. Metals and metalloid EQS relate to dissolved contamination only (i.e. analysis of filtered samples).
2. Inland waters EQS for cadmium is dependent upon hardness or alkalinity of the receiving surface water. See separate table.
3. Separate EQS standards exist for Cr III and CrVI in fresh water. The fresh water Cr III has been value adopted as the screening value for total Cr analysis as it is normally the predominant form in solution. Specific EQS for Cr VI (3.4µg/l in freshwater; 0.6µg/l in transition and coastal waters) must be applied where relevant.
4. The bioavailable concentration of copper, nickel and zinc in fresh water is dependent upon the pH, DOC and calcium data for the receiving surface water. These data should be collected whenever possible to calculate an equivalent GAC for total metal concentration using the UKTAG m-BAT spreadsheet model. Although the standard indicates that lead should be assessed on a bioavailable basis, no tool is currently available and this criterion should be applied as-is for screening purposes.
5. The value for mercury is the Maximum Acceptable Concentration (MAC) as no annual average EQS is specified in the legislation.
6. The EQS for zinc may be adjusted for the ambient uncontaminated background concentration in the receiving surface water where data are available.
7. EQS for ammonia in inland waters depends on the hardness and altitude of the receiving water body - see separate table. The criteria given here are based on the attainment of "good" chemical quality in the water body.
8. No EQS for sulphate appears in the referenced legislation.
9. No concentration-based EQS values currently exist for TPH. In the absence of specific criteria, our recent discussions with the Environment Agency have led us to adopt 10µg/l *for each individual fraction* determined by speciated TPH (TPHCWG) analysis.
10. No concentration-based DWS exists for TPH. A sum TPH concentration of 200µg/l defines the DW2 Class threshold limit in the Surface Water (Abstraction for Drinking Water) (Classification) Regulations 1996; DW2 waters are generally suitable for abstraction as drinking water supplies, subject to standard filtration and chemical treatment. We therefore consider that the 10µg/l criterion *for each fraction* provides a reasonable and proportionate basis for the initial assessment of risk posed to off-site groundwater and/or surface water potable abstractions that may be impacted at a downgradient abstraction point by TPH contamination originating from the site.
11. The drinking water-based criteria are from World Health Organisation (WHO) Guidelines for Drinking Water Quality, 2008. Taint may result at lower concentrations.
12. The "EQS" given here for MTBE is the PNEC value for fresh and sea water life given in: EU Risk Assessment Report (2002) MTBE, 3rd Priority List, volume 19.
13. DWS for MTBE is a 5-fold dilution of the USEPA (1997) Drinking Water Advisory value for taint, EPA-822-F-97-009. Toxicological thresholds are significantly higher.
14. Sum trihalomethanes limit for drinking water is 100µg/l but chloroform is only compound of this class normally encountered at contaminated sites.

Sources and general comments

Unless otherwise stated, EQS-based GACs are annual average surface water quality criteria given in Table 1 within Part 3 (Priority Substances) or long-term average criteria given in Table 1 within Part 2 (Specific Pollutants) of The Water Framework Directive (Standards and Classification) Directions (England and Wales), 2015.

Unless otherwise stated, drinking water standard-based GACs are taken from the Water Supply (Water Quality) Regulations 2016, and relate to concentration at the supply point and/or consumers' taps.

This list presents recommended GAC values for commonly monitored analytes but is not exhaustive. See the above-referenced legislation for the full lists of criteria.

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