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1. INTRODUCTION

Ground Solutions Group (GSG) was commissioned by AJM Regeneration on behalf of Jamestown Metal Resources Ltd. to undertake a review of ground conditions of a proposed redevelopment site known as Pogmoor Works situated in Barnsley, South Yorkshire. The proposed redevelopment of the site is to a residential end use with private gardens.

The site had been subject to both a desk study and previous ground investigations. The most recent study being an intrusive investigation and contamination assessment carried out by Ground Solutions Group in 2005 (D108892/GL/AMM Preliminary Geo-environmental Assessment (May 2005)).

During this initial assessment stands of Japanese knotweed (*Fallopia japonica*) were identified and areas of the site were therefore not investigated. These stands have been subject to repeated herbicide application in the intervening period and the removal of most of the knotweed has allowed investigation in these previously excluded areas.

The purpose of this report is to describe additional site investigation works carried out in May 2006, and review the conclusions of the original contamination assessment based on the new works. In addition, a review of the site with respect to geotechnical issues is provided with identification of potential hazards to site redevelopment along with potential solutions. The geotechnical review is based upon ground observations only and no geotechnical testing has been carried out.

2. SITE LOCATION AND LAYOUT

The site is located off Stocks Lane, Barnsley approximately 1.5km to the west of Barnsley Town Centre and is centred on National Grid Reference SE 333 065 (Figure 1). The site is surrounded on three sides by playing fields to the north, west and south. To the east of the site is residential housing.

The site is currently occupied by an operational lead reprocessing works. It is approximately 1.1ha in size and consists of two main works buildings and an office building (Figure 2). The site is relatively flat with a gentle slope rising up from the southeast to the north west of the site. The majority of the site is covered with hardstanding (tarmac/concrete) although the northern and western edges of the site comprised soft ground.

At the north west of the site is a 2 metre high embankment constructed of fill material, this embankment is overgrown with scrub vegetation. Small pockets of residual Japanese knotweed were present although much of the initial infestation has been eradicated by repeated herbicide application.

The oldest building is to the west of the site, which is an old red-brick built building in poor condition. It is believed that this is an old mine building which was later used as part of a brick works before its current use as a workshop and storage building (see Section 3). The other works building is the main building of operations; it is more modern and consists of 2 linked large open warehouse type structures. At the south of the site adjacent to the main works building is the site office building. The buildings included features which may have been formed from asbestos, including drain pipes and roof material.

3. ENVIRONMENTAL SETTING

3.1 GEOLOGY

Reference to the British Geological Survey 1:50,000 Series, Sheet 87, indicated that the site is underlain by north and north-easterly dipping strata of the Middle Coal Measures. These comprise cyclical sequences dominated by mudstones but supplemented by sandstones, siltstones and thin coal seams. A sandstone horizon is understood to sub-crop in the east of the site, and mudstone beneath the west of the site. The exact thickness of the sandstone beneath the site is not known.

Geological maps also indicate that there is not likely to be significant drift deposits present on the site.

The investigation carried out for the IPPC licence found that there were some patches of sandy clay and stiff grey clay (completely weathered Mudstone), but most of the site consisted of Made Ground underlain directly by Mudstone. The Made Ground comprised gravel, clay and sand layers containing some brick and ash. The thickness of the Made Ground varied across the site reaching 5.6 m to 5.7 m (BGL) in the west and between 0.5 m and 2 m (BGL) across the remainder.

3.2 GROUNDWATER

Reference to the Environment Agency 1:100,000 scale Groundwater Vulnerability Map, Sheet 11, South Pennines, indicated that the strata underlying the site are classified as a Minor Aquifer.

Minor aquifers will seldom produce large quantities of water for abstraction. However, they can be important for both local supplies and in supplying base flow to rivers.

Soils on the site are classified as Soils of High Leaching Potential (U) – Soil information for restored mineral workings and urban areas is based on fewer observations than elsewhere. A worst-case vulnerability classification (H) is therefore assumed until proven otherwise.

Observations during the initial phase of investigation works recorded groundwater levels at between 2.5 m and 3.5 m below ground level.

Environment Agency records show that the site does not lie within a groundwater Source Protection Zone (SPZ).

The mining and quarrying history in the area is likely to have impacted on groundwater quality in the area.

3.3 SURFACE WATER

The nearest major surface watercourse, the River Dearne is located approximately 3 km from the site in an easterly direction.

The Environment Agency's General Quality Assessment Scheme provides assessments for both chemical and biological indicators of water quality for rivers and canals in England and Wales. Based on the 2001 data the stretch of water nearest to the site is classified as non-compliant. Details are provided below.

Site details:

River name	River Dearne
River stretch	New Lodge Old Mill
Years	2000 to 2002
Upstream grid ref.	X:433979, Y:408458
Downstream grid ref.	X:435637, Y:407028
Length	3

Sampling results:

	Average	Standard deviation	Percentile 95	Percentile 90	Percentile 10	Number of samples	Grade
Biochemical oxygen demand (mg/l)	3.00	2.03		5.46		32	C
Ammonia (mgN/l)	0.404	0.332		0.784		31	C
Dissolved oxygen (%age saturation)	82.62	15.86			62.28	32	C

The nearest watercourse to the site is a stream located approximately 150m to the south of the site. This steam is not classified under the EA GQA scheme.

3.4 RADON

Reference to the National Radiological Protection Board's "Radon Atlas of England and Wales" indicated that between 1% and 3% of houses within the 5 km square, which includes the site, have radon concentrations above the action level of 200 Bq/m^3. Based on published guidance it is considered that no special measures, such as radon sump, need be incorporated into buildings.

3.5 OTHER ENVIRONMENTAL INFORMATION

Reference was made to the Envirocheck report provided in a previous report produced by White Young Green (WYG) (Geo-Environmental Desk Study, 2004). Relevant information relating to the sites environmental sensitivity is summarised as follows:

- Water Abstractions: There were 5 groundwater abstraction licences recorded within a 2km of the site. However only 1 of these was currently in use, approximately 610m to the southeast of the site.
- Waste: Fourteen landfill sites were recorded within 1km of the site as well as a number of waste management and transfer sites. Of these seven landfills were recorded within 150 m of the site with some recorded within the site itself.
- Nitrate: Vulnerable Zones: The site is located in a nitrate vulnerable zone.
- Mining: The site is upon ground subject to mining instability.

4. INTRUSIVE INVESTIGATION

4.1 FIELDWORK

The site works were carried out between 4th and 6th April 2005 comprised the following:

- 7 trail pits.

These works were carried out in the area to the north of the site, primarily into the embankment. This area was designated as Zone A in the original contamination assessment and was found to have the highest concentrations of contaminants.

The original investigation carried out in April 2005, comprised the following:

- 4 cable percussion boreholes;
- 16 Window Sample Holes (WS1 to WS16);
- Soil Gas Survey.

The positions of the intrusive works are shown on Figure 2, Exploratory Hole Location Plan.

Trial pits

Seven trail pits were excavated using an excavator. Pits were mainly excavated into the slope forming the northern edge of the site.

Representative samples of the materials encountered were recovered for description and subsequent laboratory inspection and testing purposes.

All pits were backfilled with arisings. Logs of the ground conditions encountered are presented in Appendix 1.

Cable percussion boreholes

Four boreholes (BH 1 to BH4) were excavated to depths of between 3 to 6 m below existing ground level using cable percussion drilling techniques.

During boring temporary steel casing was used to support the sides of the bores. Disturbed samples were recovered at 1 m intervals or every change in strata for description and subsequent laboratory inspection and testing purposes.

Upon completion all four boreholes were fitted with groundwater and gas-monitoring standpipes. The site was revisited after the completion of site works and gas and water levels monitored.

Engineering logs of the borehole are presented in Appendix 2.

Window Sample Holes

Sixteen sample holes (WS1 to W16) were sunk at the site to depths of between 1.5m and 6m using a tracked Archway Competitor rig. The window sampler system involved driving lengths of steel sample barrel into the ground by the action of a percussive hammer. The sample barrels were withdrawn after every successive 1.0 m drive and the recovered material logged. Representative samples were taken for subsequent laboratory inspection and testing.

Groundwater and gas monitoring installations were fitted in WS 1, 4, 9, 10 and 15.

Window sample hole logs are presented in Appendix 3.

Soil Gas Survey

Soil gas monitoring of the window sample holes and boreholes was undertaken on site after site works had been completed. The soil gas was monitored for concentrations of carbon dioxide CO_2, methane CH_4, and oxygen, O_2 using portable gas monitoring equipment (GA2000).

The site was revisited twice after the completion of site works and gas levels monitored.

The gas monitoring results are presented in Appendix 4.

4.2 SUMMARY OF GROUND CONDITIONS

The site works proved the anticipated ground conditions at the site. Representative cross sections of the sites ground based on the data obtained from both phases of investigation are presented in Figures 3 to 7. The proposed final site levels, existing groundwater levels and the approximate position of the proposed residential housing blocks are also shown.

Much of the site is covered with tarmac or hardstanding, below which is Made Ground down to depths of 0.36 m (BGL) at its shallowest to 9.0 m (BGL) at its deepest. The Made Ground comprised brick, ash, coal and slag in a matrix of sand, clay and/or gravel. The Made Ground was encountered at its greatest depth at the west of the site, in and adjacent to the embankment.

The embankment itself comprised a significant thickness of Made Ground, including both below and above ground level fill. The profile of the embankment area indicated a backfilled quarry with fill material forming a land raise. This is consistent with the sites history.

The embankment comprised of much brick, loose ash and domestic refuse. A large deposit of whole and part bricks was also encountered in TP3. A natural rock inclusion was encountered in TP4 (see figure 6). Natural ground beneath the rock had been removed during the historic quarrying at the site and replaced with fill.

Groundwater was encountered during both phases of investigation and during subsequent monitoring at depths of 2.5 m to 3.5 mbgl depending upon the location of the borehole. Information relating to groundwater levels is recorded on the borehole logs (Appendix 2).

Groundwater levels may vary due to seasonal fluctuations in rainfall, but in the shorter term, can be affected by antecedent weather conditions or other causes.

5. CONTAMINATION TESTING

Eighteen samples were selected and scheduled for chemical analysis, which was undertaken by I2 Analytical, Uxbridge. All soil samples were analysed for contaminants considered appropriate to the past history of the site:

Toxic Metals	Phytotoxic Metals	Inorganic Compounds	Organic Compounds
Arsenic Cadmium Chromium (total and hexavalent) Lead Mercury Selenium Nickel	Copper Zinc Nickel Boron (water soluble)	pH Sulphate (soluble)	Polycyclic Aromatic Hydrocarbons (PAH) (speciated) Total Petroleum Hydrocarbons (TPH (carbon banded))

The results of the analytical testing are presented in Appendix 5.

One water sample was taken from a TP5 during the site works and was tested for the same as above suite.

6. GROUD CONTAMINATION ASSESSMENT

6.1 GUIDELINES ON CONTAMINANT LEVELS

The UKs primary contaminated land guidance is contained within the Contaminated Land Exposure Assessment (CLEA) framework. Within this framework a number of Soil Guideline Values (SGVs) have been published for key contaminants along with toxicological guideline values relating to intake thresholds. The soil guideline values provided by the CLEA model represent intervention values for end uses based upon potential human exposure and soil concentrations of a contaminant above these values might represent an unacceptable risk to the health of the site users.

The Environment Agency has an ongoing programme of SGV publication with associated toxicological information for key contaminants. Where SGVs are available then they should be used as the basis for any human health risk assessment. Toxicological information has also been published within the CLEA framework for a range of organic contaminants for which SGVs have not been produced, although the data can be used as the basis for a risk assessment. Published SGVs (in mg/kg) are provided in the table below.

	Proposed site end use			
	Residential (plant uptake)	Residential (no plant uptake)	Allotments	Industrial/ commercial
Arsenic	20	20	20	500
Cadmium (pH 6)	1	30	1	1400
Cadmium (pH 7)	2		2	
Cadmium (pH 8)	8		8	
Chromium (tot)	130	200	130	5000
Lead	450	450	450	750
Mercury	8	15	8	480
Nickel	50	75	50	5000
Selenium	35	260	35	8000

CLEA does not provide guidance for total Polycyclic Aromatic Hydrocarbons (PAHs). CLEA does however provide an index dose for benzo(a)pyrene (BaP) considered to be one of the more toxic of the PAH family of chemicals.

Using the default soil settings (loam, pH 7.0, organic matter 5%) the following initial in house screening values for BaP in a range of potential end uses have been calculated.

	Residential with plant uptake	Residential without plant uptake	Allotments	Commercial/ Industrial
Benzo-a-pyrene (mg/kg)	1.1	1.2	1.2	10

The Landfill (England and Wales) (Amendment) Regulations 2004 provides waste acceptance criteria, which set the limits of contaminants permitted in various waste categories going to landfill. These criteria are of particular use where CLEA guidance has not yet been provided.

For risk assessment purposes we would consider that any materials (soils) containing concentrations of potential contaminants that would result in them being classified as inert would be considered as uncontaminated and therefore representing a low risk to human health. Similarly such material would not be considered to represent a significant risk to water resources. Selected inert waste acceptance criteria as detailed in The Landfill (England and Wales) (Amended) Regulations 2004 are provided below.

Landfill acceptance criteria for inert waste (mg/kg)	
Total organic carbon (TOC)	30,000
BTEX compounds	6
Mineral oils (C10 – C40)	500
PH	>6
PAH	100*

*proposed value

This table is of particular value for assessing soil containing detectible concentrations of petroleum hydrocarbons. Petroleum Hydrocarbons represents a more complex situation being a mixture of a range of compounds, the relative concentrations of which may change over time.

The CLEA framework does not provide a method for the assessment of phytotoxic risks to plants. However maximum permissible concentrations have been published in the Sludge (Use in Agriculture) Regulations 1989 (SI 1989, No. 1263). This legislation enforces the provisions of the EC Directive 86/278/EEC for potentially toxic elements (PTEs) on soils for agricultural use where sewage sludge has been applied (see table below). These limits relate to the potential risk to plants and not human health for which CLEA is the overriding risk assessment model.

Maximum permissible concentration in agricultural soils following sewage sludge application (mg/kg).				
	pH 5.0<5.5	pH 5.5<6.0	pH 6.0-7.0	pH >7.0
Zinc	200	200	200	300
Copper	80	100	135	200
Nickel	50	60	75	110

The potential risks to buried concrete can be assessed by reference to the BRE Special Digest 1 (SD1) entitled 'Concrete in Aggressive Ground'. This document provides a methodology for the specification of concrete based on the ground conditions encountered and is based upon chemical analysis and associated factors (e.g. groundwater). The guidance provides a Design Sulphate Class (DS) based upon the ground conditions and it is considered that a low concentration of sulphate and pH (i.e. DS – 1 and DS – 2) is considered to represent a low risk to buildings.

In addition, where water is supplied in plastic pipes which could come into contact with contaminated ground then this can lead to premature failures, resulting in leakage and loss of water quality. The Water Regulations Advisory Scheme (WRAS) has published an Information and Guidance Note (The Selection of Materials for Water Supply Pipes to be Laid in Contaminated Land (No 9-04-03)) which provides a table of threshold values. If these threshold values are exceeded then consideration should be given to the selection of pipe material. The WRAS threshold values are presented in the table below for a range of potential hazards.

Organic contaminants	Threshold level (mg/kg)	Corrosion	Threshold level (mg/kg)
Coal tar	50	Sulphate	2000
CEM	50	Sulphur	5000
Phenol	5	Sulphide	250
PAH	50	pH	< 5 > 8
TEM	510		
Petroleum hydrocarbons	50		

Soil carbon dioxide and methane concentrations can be compared to the guidance levels stipulated in the British Research Establishment (BRE) Report BR 212 (1991). This document states that for situations where carbon dioxide is present in soil gas concentrations greater than 5% by volume or methane concentrations in excess of 1% by volume, gas protection measures are required. In circumstances where carbon dioxide concentrations exceed 1.5% by volume gas protection measures should be considered.

The analytical and monitoring results have been compared to CLEA Soil Guideline Values for a residential end use with plant uptake.

6.2 SOIL QUALITY

Data obtained from the analysis of samples from both phases of the investigation have been assessed.

Toxic Metals

The concentrations of the potentially toxic metals chromium, mercury and selenium were all below their respective CLEA Soil Guideline Values for a "Residential with Plant Uptake" end use in samples analysed during both phases of intrusive works. These metals are therefore not considered to pose a significant risk of significant harm to human health in the context of Part 2A. Elevated concentrations of arsenic, lead, cadmium (Phase 1 investigation only) and nickel were recorded in a number of samples.

The methodology provided in the Environment Agency's R&D Publication 7 "Assessment of Risks to Human Health from Land Contamination: An Overview of the Development of Soil Guideline Values and Related Research" (CLR7) was followed in order to carry out a Mean and Maximum Value Tests for the arsenic, cadmium, lead and nickel datasets. This test provides a 'true mean' concentration with a 95% confidence based on the data available. The results of these calculations are presented in Appendix 6.

Application of the Mean Value Test for all samples analysed gave the following true mean soil concentrations:

Analyte	Mean Value* (mg/kg)	Maximum Value (mg/kg)	SGV residential (with plant uptake)
Arsenic	34	94	20
Cadmium (pH 7)	0.7	8.4	2
Lead**	2.38	4.20	2.65
Nickel	52	330	50

Calculated using procedure given in "Assessment of Risks to Human Health from Land Contamination: An Overview of the Development of Soil Guideline Values and Related Research" (CLR7) ** Lead data is log transformed and the Geometric Mean calculated.

The calculated mean values for cadmium, lead and nickel in both zones were less than the respective CLEA SGV and these metals are therefore not considered to present a significant risk of significant harm to human health in the context of Part 2A. However, further inspection of the distribution of the data indicated that the site could be treated as two distinct areas, zones A and B (Shown in Figure 3), and that in particular lead was at concentrations which could be considered to represent a significant human health risk in Zone A.

Application of the Mean Value Test on the lead and arsenic data obtained for samples analysed from the two zones gave the following mean value concentrations:

Analyte	Zone A		Zone B		SGV residential (with plant uptake)
	Mean Value* (mg/kg)	Maximum Value (mg/kg)	Mean Value* (mg/kg)	Maximum Value (mg/kg)	
Arsenic	41	94	27	57	20
Lead**	2.68	4.20	2.00	3.18	2.65

*Calculated using procedure given in "Assessment of Risks to Human Health from Land Contamination: An Overview of the Development of Soil Guideline Values and Related Research" (CLR7). ** Lead data is log transformed and the Geometric Mean calculated.

Arsenic exceeded the respective CLEA SGV in both Zones. Lead exceeded the CLEA SGV in Zone A but not in Zone B. The implications of the elevated concentrations of lead and arsenic are discussed in Sections 7 and 8 of this report.

Phytotoxic Metals

Zinc, copper and nickel are considered to be potentially phytotoxic to plants in high concentrations. The Sludge (Use in Agriculture) Regulations 1989 (SI 1989, No. 1263) are used as guidelines for phytotoxic metals since the withdrawal of ICRCL guidelines.

The methodology provided in the Environment Agency's (CLR7) was followed in order to carry out a Mean and Maximum Value Tests for the zinc, copper and nickel datasets. This test provides a 'true mean' concentration with a 95% confidence based on the data available. The results of these calculations are presented in Appendix 6.

Application of the Mean Value Test gave the following true mean soil concentrations of samples analysed:

Analyte	Mean Value* (mg/kg)	Maximum Value (mg/kg)	Sludge disposal limit (pH >7)
Zinc	523	8600	300
Copper	182	1700	200
Nickel	52	330	110

* *calculated using procedure given in "Assessment of Risks to Human Health from Land Contamination: An Overview of the Development of Soil Guideline Values and Related Research" (CLR7)*

The results of the mean value tests indicated that although occasional elevated concentrations of copper and nickel were recorded these metals are do not represent gross contamination of the site as a whole and would not be considered to present a significant risk of significant harm to plant health.

The mean concentration of zinc was above the guidance value.

Organic Compounds

Concentrations of organic compounds were generally low over the whole site with a maximum concentration for total PAH of 500 mg/kg being recorded in WS9 (0.2 m) and a maximum TPH concentration of 2780 mg/kg in TP1 (? m).

Mean concentrations (using the Mean Value Test) for TPH and PAH were calculated for all samples over the site, these were 414.98 mg/kg and 44.75 mg/kg respectively. The results of these calculations are presented in Appendix 7.

Eighteen of the 63 samples tested recoded a Benzo(a)pyrene (B(a)P) above the adopted screening value of 1.1 mg/kg. The maximum concentrations recorded were 45 mg/kg and 22 mg/kg. The mean concentration (calculated using the Mean Value Test) using all data collected from the site was 3.66 mg/kg. The calculated mean values for B(a)P was greater than the respective in-house SGV and are therefore considered to present a significant risk of significant harm to human health in the context of Part 2A.

Further examination of the data and application of the Maximum Value Test indicates that the highest B(a)P was a statistical outlier and not considered representative of the general underlying distribution of the data. As such this single elevated concentration can be considered to represent a B(a)P hotspot and if removed from the data set for the site causes a reduction in the mean value for the site to 2.34 mg/kg.

Comparison of the total TPH data with the values given in The Landfill (England and Wales) (Amendment) Regulations 2004 for mineral oils (C10 – C40) indicated that the site is not grossly contaminated with petroleum derived hydrocarbons and that the site would not be considered to pose a significant risk of significant harm to human health in the context of Part 2A.

Inorganic Compounds

The concentrations of water-soluble sulphate were generally low and ranged from 0.02 g/l to 1.19 g/l. pH values upon all samples over the site were generally alkaline and ranged from 5 to 11.4 units.

Water Samples

Concentrations of metals in the water sample taken from TP5 were less than UK drinking water standards (UKDWS) although boron exceeded the UKDWS of 1000µg/l with a concentration of 2400µg/l detected. Both TPHs and PAHs exceeded the UKDWS of 10 µg/l and 0.1 µg/l respectively with recorded concentrations of 283 µg/l for TPHs and 14 µg/l for PAHs.

No visual oil sheen was noted during the excavation of any of the trial pits.

Soil Gas

The results obtained from the soil gas monitoring indicated that concentrations of methane ranged from <0.25% (v/v) to 0.3% (v/v) and carbon dioxide ranged from <0.25% (v/v) to 6.3% (v/v).

Carbon dioxide was recorded in concentrations in excess of 1.5% (v/v) in 6 of 9 monitoring wells.

Gas flow rates were negligible, ranging from <0.2 to 0.4 l/h.

Observations during the intrusive works did not identify any significant putresicible material within the fill material forming the embankment. The gas regime is considered to be moderate.

7. CONTAMINATION RISK ASSESSMENT

This risk assessment has been undertaken with due regard to the advice relating to groundwater as provided in the Environment Agency's "Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources", the advice provided in the Contaminated Land (England) Regulations 2000, and the associated statutory guidance and Model Procedures fort the Management of Contaminated Land (CLR11). The guidance defines contaminated land as any land that is in such a condition that by reason of substances in, on or under the land:

- significant harm is being caused or there is a significant possibility of such harm being caused; or
- pollution of controlled water is being, or is likely to be caused.

This definition is based on the principles of risk assessment defined as a combination of the probability (or frequency) of occurrence of a defined hazard and the magnitude (including the seriousness) of the consequences. Central to the risk assessment process is the concept of pollutant linkage, that is a linkage between a contaminant and a receptor by means of a pathway.

Statutory definitions relating to pollution linkage.	
Contaminant	"a substance which is in, on or under the land and which has the potential to cause harm or to cause pollution of controlled waters."
Receptor	"a living organism, a group of living organisms, and ecological system or a piece of property" which meets given criteria. "controlled waters which are, or could be, polluted by a contaminant".
Pathway	"one or more routes or means by, or through, which a receptor: • is being exposed to, or affected by, a contaminant, or • could be so exposed or affected".

The relationship between these components is discussed below in order to identify the existence of any source-pathway-receptor linkage on the site, and hence the potential risks associated with any contamination. This risk assessment is based on the proposed redevelopment of the site for residential properties with private gardens.

The significance of the risks to the receptors/targets identified is based on an evaluation of the potential pathways between the contaminant source and receptors based on an residential end use with plant uptake. This represents a detailed quantitative risk assessment.

Potential receptors/targets at the site and in the area in which the site is located include:

- future occupants and the general public;
- construction/maintenance workers;
- groundwater resources and surface watercourses;
- underground services in and around the site;
- built structures at the site.

7.1 CONTAMINANT SOURCES

Potential sources of contamination associated with the site include:

- subsurface contamination of ground due to the operations of the site as an lead processing works, coal mine and clay works.
- Subsurface contamination associated with fill materials in the landfilled section of the site;
- surface, and subsurface contamination, from the depositions of lead works and coal mine related wastes.
- gas generated in landfill areas in and adjacent to the site.

During site works slag material consistent with the operation of the lead works including ash and clinker was identified.

7.2 RISK TO HUMAN HEALTH

In terms of any proposed development, the results of the analysis of the selected soil samples recovered during the site works indicated that the concentrations of metals considered to be potentially toxic to humans were varied.

However, particularly high concentrations of lead, and to a lesser extent other potential metal contaminants were recorded in Zone A, but lower concentrations were recorded in Zone B.

Application of the mean value test indicated that lead was present at potentially harmful concentrations across the whole of the site, with arsenic only a significant potential hazard to human health in Zone A.

In order to reduce the risks to acceptable levels for a residential ensue some level of remediation will be necessary across the whole of the site. Potential remediation measures are considered in Section 9.

The concentrations of organic compounds were generally low although there is considered to be a potential risk to human health due to elevated PAH (notably BaP).

Elevated concentrations of carbon dioxide were recorded in a number of monitoring positions. These values exceeded the BRE guidelines and therefore gas control/management measures are recommended. The monitoring indicted that flow rates were low and therefore it is considered that passive control measures, such as vented sub floor voids or equivalent and gas impermeable membrane, should be incorporated into the design of any buildings.

Site workers involved in the redevelopment of the site may potentially be at greater risk as they could be exposed to a variety of exposure pathways such as direct dermal contact and inhalation of dust. However, it is considered that the provision of standard personal protective equipment and hygiene facilities would adequately control these risks. In particular the age of some of the buildings at the site and the potential for demolition arisings from historic building to be in the Made Ground means that asbestos could be present although none was noted during the works undertaken to date.

An asbestos survey of existing buildings should be carried out prior to any demolition works. All site workers involved in ground works should be made aware of the potential hazards associated with potential contamination in the Made Ground at the site.

7.3 RISKS TO PLANTS

Although some individual samples recorded elevated concentrations the mean concentrations of potentially phytotoxic metals were all below their respective guideline values.

The site was, where sufficient soil was present, covered with healthy vegetation including grasses, shrubs and, around the margins, trees. This observation would suggest no significant phytotoxic risks to be associated with the site. Furthermore, the pH of the site was generally alkaline, and under such conditions the solubility and therefore bioavailability of phytotoxic metals would be reduced.

The generally poor condition of soil across much of the site would mean that topsoil would have to be imported to aid the establishment of ground cover in garden areas and any soft landscaped areas. This clean material would further reduce the risks to plants by providing clean rooting material for plants.

The residual risk to plants following the implementation of the necessary remedial works is considered low.

7.4 RISKS TO WATER RESOURCES

7.4.1 General

Concentrations of potentially mobile inorganic and organic compound contaminants were generally low. The pH of the soils across the site was slightly alkaline and under such conditions the solubility of metals (with the exception of arsenic) would be expected to be reduced.

Furthermore, the results of the leachate testing indicted that, with the exception of two samples, all leachates tested were within UK Drinking Water Standards. Given that significant dilution would occur when any leachate from the ground were to enter underlying groundwater the risks to groundwater is considered to be very low especially as the quality of the receiving groundwater is likely to be poor due to influence of historic mining/waste disposal activities in the area.

The single sample of water which was collected during Phase 2 of works was from water in the infilled quarry area. This recorded slightly elevated concentrations of TPH and PAH as compared to drinking water standards.

7.4.2 Surface Water

There are no major surface waters within the immediate vicinity of the site. The nearest watercourse is a small stream located some 150 m to the south of the site. Based on the topography and ground cover between the site and this stream the risks to surface waters are considered to be low.

7.4.3 Groundwater

Groundwater at the site is in contact with Made Ground within the infilled quarry both within and outside the boundaries of the site. Based on the leachate testing of Made Ground from across much of the site and a single groundwater sample collected from the infilled quarry the risks to groundwater are considered low to moderate.

Mine working in the area are also considered likely to have had an impact on groundwater in the area and would have reduced its quality. The area of the development site on the infilled quarry represents only a small proportion of the total area of the landfill and although down gradient of the majority of the former quarry. The generally low concentrations of the parameters tested suggest that potential contaminants are not readily soluble and therefore represent a low to moderate risks to groundwater.

Elevated concentrations of TPHs and PAHs, which exceeded the UKDWS, were recorded in the water sample recovered from TP5. However the nearest groundwater abstraction point is some 600 m to the south east of the site. The main PAH compounds identified in the water sample were naphthalene and acenaphthene, with a combined concentration of 8 µg/l. Both these compounds have a low molecular weight and therefore are susceptible to natural biodegradation.

TPH concentrations were also elevated and the major component was the mid range C20 to C30 fraction, although the heavier fraction (C30 – C40) was also present consistent with diesel/gas oil contamination.

Given the local topography, and the likely direction of groundwater flow and the distance to the nearest abstraction point it is considered likely that even if the groundwater at the site were in hydraulic continuity with the nearest abstraction point that natural breakdown of the PAH and TPH compounds identified would occur and residual concentrations would not impact on abstraction quality.

7.4.4 Foundations

Guidance on the risk assessment for piled foundations solutions are provided in the Environment Agency's "Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention". This document identifies six potential source - pathway - receptor linkages although also notes that others may exist in particular circumstances. The six potential pollutant linkages are:

1. Creation of preferential pathways, through a low permeability layer (an aquitard), to allow potential contamination of an underlying aquifer;
2. Creation of preferential pathways, through a low permeability surface layer, to allow upward migration of landfill gas, soil gas or contaminant vapours to the surface;
3. Direct contact of site workers and other with contaminated soil arisings which have been brought to the surface;
4. Direct contact of piles or engineered structures with contaminated soil or leachate causing degradation of pile materials (where the secondary effects are to increase the potential for contaminant migration);
5. The driving of solid contaminants into an aquifer during pile driving; and
6. Contamination of groundwater and, subsequently, surface waters by concrete, cement paste or grout.

Given the presence of fill materials it is considered that piled foundations may be required. The Environment Agency summarises the associated indicative hazards associated with piled foundations as follows:

EA – Use of Piles on Contaminated sites		
Pollutant linkage (as above)	Displacement piles	Non Displacement piles
1	B-D (dependant on details of method)	B-C
2	B	B
3	A	B-C
4	B-C (dependant on pile materials and contaminants)	C (dependant on pile materials and contaminants)
5	B	A
6	A	C-D

KEY

A: Pollution scenario not likely to be an issue if using displacement piles provided workmanship and QA/QC measures are appropriate.

B: Subject to appropriate workmanship, mitigation and QA/QC measures, to be outlined in the Foundation Works Risk Assessment report and incorporated in the design and contract specification, this method is acceptable.

C: This method may be considered acceptable, depending on the specific type used and subject to appropriate workmanship, mitigation and QA/QC measures, to be outlined in the Foundation Works Risk Assessment report. However a more suitable piling method may be available.

D: This method should normally be avoided on sites where this pollution scenario is likely to be an issue.

It is recommended that a combination of standard and short length piles be used. Such a foundation solution has the potential to develop contaminant pathways and thereby allow pollutant linkages to be established. However, the water table is relatively shallow and much of the fill is already in contact with groundwater. The use of piled foundation will therefore have only a limited potential to increase the risk to groundwater. In addition, the samples that were tested for leachability recorded a generally low solubility of potentially mobile contaminants so if new pathways were developed were to be developed the movement of contaminants would be limited.

Therefore the risks to groundwater, if piled foundations are used, is considered to be low.

7.5 RISKS TO BUILDINGS & SERVICES

Based on the results of the investigation, it is considered that there is a low/moderate risk of potential contamination affecting buried services at the site from organic compounds such as TPHs, which can degrade/permeate plastics, and other polymeric materials used to supply potable water.

A number of samples recorded concentrations of arsenic, cadmium, lead, mercury, total PAH, petroleum hydrocarbons and pH values above the WRAS threshold levels. Therefore consideration should be given to the selection of pipe material and other risk management measures for potable water supply pipes. The laying of pipes in any clean capping layer would adequately reduce the risk, as would the use of non-plastic (i.e. ductile copper) or laying pipes in clean trench fill.

In addition, organic contamination was limited to the near surface materials. The removal of this prior to any redevelopment would therefore removing the source. Even if this material were retained on site as part of any scheme, the presence of the organic contamination would not pose a significant risk, provided appropriate control measuresare adopted.

The risks to the buried services are therefore considered to be low if the recommendations outlined are followed.

In accordance with BRE Special Digest 1 (SD1:2005) entitled 'Concrete in Aggressive Ground' a design sulphate class for the surface soils of DS-1 is recommended. Using SD1 an ACEC (Aggressive Chemical Environment for Concrete) class of AC-1 is recommended.

7.6 WASTE DISPOSAL

Should an excess volume of soil be required to be disposed of off-site then a formal waste classification from the Environment Agency (EA) may be required.

Depending on the final disposal point, materials may need to be subjected to leachate testing which would give an indication to the soluble component of contaminants and, therefore those most toxic to the environment in the waste. The classification will then allow the appropriate disposal pathway to a suitably licensed disposal facility to be determined.

Based on the results obtained in this investigation, the majority of material requiring off site disposal are likely to be classified as non-hazardous waste depending on its source within the site boundary and assuming soils are removed by blading/box-scrapper to avoid disturbing the underlying materials. This method of removal will result in some mixing. Therefore retesting of soils for off-site disposal will be necessary after removal.

Although the extent of Japanese knotweed has been significantly reduced small isolated clumps were noted at the site and this is considered a contaminant of affected soils. Based on EA guidelines the zone of influence extends some 7 m around the perimeter of plants and to a depth of 3 m. Knotweed infected soils are classified as non-hazardous, non-inert wastes although special disposal management activities are required by the EA.

A programme of knotweed eradication has been initiated at the site and, by the time of site development, all knotweed should have been eliminated. The status of knotweed at the site should be reviewed prior to any site redevelopment works.

8. HAZARD ASSESSMENT

8.1 HAZARD ZONING

Based on the information obtained from the desk study, initial walkover survey, and the ground condition logs, the study area has been zoned based on the potential geotechnical and environmental hazards (Figures 2 and 3). The hazard zoning provides a generic basis for assessment of the site in terms of constraints to development on geotechnical and environmental grounds.

The north-western half of the site has been zoned **RED** and the south-eastern half of the site has been zoned as **AMBER** for potential geotechnical hazards (Figure 8) whilst the contamination risk assessment indicates that Zone A is **RED** whilst Zone B is **AMBER** (Figure 9). A full description of the zoning matrix is presented below:

	GEOTECHNICAL	ENVIRONMENTAL
RED (high)	Significant implications with respect to type and cost of foundations, issues of surface settlements impacting on infrastructure and access roads. Generally require deep piled foundations, possibly rafts together with ground improvement prior to development.	Hazards assessed as high risk and significant further assessment considered necessary. Some level of remediation possibly requiring significant periods of time considered likely to be required prior to site redevelopment. Potential constraint to residential development.
AMBER (medium)	Typically intermediate depth conventional foundations or possibly short piles, for instance where trees on clay soils require deeper foundations. Possibly some special requirements in respect of infrastructure or roads. Additional ground investigation generally moderate in extent and depth.	Hazard assessed as moderate risk and some further assessment considered necessary. Some level of remediation required prior to site redevelopment.
GREEN (low)	Generally suitable for conventional shallow foundation approach subject to local conditions. No special requirements for infrastructure or roads. Additional ground investigation generally limited in extent and depth.	Hazard assessed as low risk and only minimal further assessment considered likely for ground condition parameters.

The hazard zone red represents the greatest potential constraint to development and would be associated with potentially high abnormal costs from both a geotechnical and environmental viewpoint. Amber represents areas where most forms of development end use can be accommodated possibly subject to some remediation works and where some abnormal costs may be incurred.

Green zones represent principal development areas for all end uses subject to limited investigation work. Significant abnormal costs would not be expected in these areas.

The following table indicates preliminary development scenarios, and construction/ remediation recommendations for use in each hazard zone based on the data currently available for the site:

HAZARD ZONE	CONSTRUCTION IMPLICATIONS GEOTECHNICAL	CONSTRUCTION IMPLICATIONS ENVIRONMENTAL
RED (high)	The presence of unconsolidated Made Ground comprising ash and brick rubble (approximately 3.0m to 9m thick) across the north-western half of the site will require treatment below structures, surface beds, paving and roads. Load bearing brickwork structures should be piled. Suitable pile types include steel tube piles or steel 'H' piles (to penetrate the Made Ground) founded in the underlying Sandstone / Mudstone bedrock. Alternatively, for lightly loaded structures (single and double storey load-bearing brickwork buildings), consideration should be given to ground improvement (i.e. dynamic compaction or impact rolling depending on the depth of cover to the groundwater table) to form an earth raft and founding directly onto the treated ground. Where structures span the edge of the backfilled quarry and therefore there is a large variation in thickness of fill beneath the structures, they should be provided with movement joints that will accommodate some differential settlement. Surface beds should be supported on ground beams spanning between the piles, unless ground treatment is selected, in which case the compacted Made Ground is likely to provide a suitable subgrade. The Made Ground should be compacted before supporting roads and parking areas.	Zone A classified as red and will require significant remediation due to elevated concentrations of contaminants, particularly arsenic and lead. Removal of most contaminated material or suitable capping layer will be required to reduce human health risks to acceptable levels.

AMBER (medium)	The unconsolidated Made Ground comprising ash and brick rubble (up to 3.0m thick) in the south-eastern half of the site will also require treatment below structures, surface beds, paving and roads. Load bearing brickwork structures should be supported on either pad and pier foundations or on short piles. Suitable pile types include steel tube piles or steel 'H' piles (to penetrate the Made Ground) founded in the underlying Sandstone / Mudstone bedrock. Again consideration may be given to treatment of the Made Ground by compaction and founding lightly loaded structures (single and double storey load bearing brickwork buildings) on the compacted earth raft. Surface beds should be supported on ground beams spanning between the piles or piers, unless ground treatment is selected, in which case the compacted Made Ground is likely to provide a suitable subgrade. The Made Ground should be compacted before supporting roads and parking areas.	Zone B classified as AMBER. Elevated concentrations of lead recorded although the data does not suggest gross contamination identified during site investigation. Placement of suitable capping layer considered suitable.
GREEN (low)	No GREEN zones with respect to geotechnical considerations	No GREEN zones with respect to environmental considerations

8.2 OTHER CONSIDERATIONS

Given that the contamination at the site represents a greater risk in Zone A consideration could be given to alterations in site layout. The aim of any changes would be co-locate low sensitivity uses (i.e. parking) and high contaminant levels. The low sensitivity use affords far less potential pollutant linkages than high sensitivity uses (i.e. gardens) and therefore the remediation requirements may be reduced.

Similarly public open spaces/landscaping could be incorporated into Zone A where again potential pollutant pathways are reduced and therefore reductions can be made in the level of remediation.

The recycling of demolition arising, comprising both building materials and crushed concreted, would represent a cost effective, sustainable approach to construction thereby fitting in with Government lead aggregate recycling initiatives (i.e. Aggregates programme, a part of the Waste and Resources Action Programme (WRAP)).

9. REMEDIATION OPTIONS

9.1 INTRODUCTION

It is proposed that the site is redeveloped to a residential land use, incorporating private gardens, access roads and parking, and areas of soft landscaping. Due to the potential risks to human health associated with the elevated concentrations of some, notably lead, recorded at the site some remediation is considered necessary.

The data also indicated that the site could be split into two zones with respect to contamination. Zone A to the west of the site was significantly more contaminated with lead than Zone B.

The main remediation options considered suitable for this site are:

(i) Site strip of top 1m of fill/made ground to remove most sources of contamination followed by placement of appropriate ground cover. Disposal of arisings to suitably licensed waste management facility (landfill).

(ii) Zoned site strip, removing all of most contaminated materials.

(iii) Leave the bulk of contaminated material on site and following reworking to obtain development levels cover with a suitable engineered cap.

Any final remediation scheme would require the approval of the Environment Agency particularly where waste licensing regulations are concerned.

The options are described in outline below.

9.2 OPTION 1

This option would result in the removal of the contamination source thereby severing any pollutant linkage. The site would require a significant volume of material to be removed particularly in Zone A and thereby incur significant costs. Additional costs would also be incurred following the importation of clean material to restore site levels.

Validation testing and completion report would be required to prove that all contaminated material had been removed and that the potential risks had been adequately managed.

In addition, the nature of the ground to the north of the site, would mean that it would be difficult to undergo a limited excavation, within the site boundary and effectively remove potential contaminants sources within the backfilled quarry but outside the site boundary.

9.3 OPTION 2

This approach would result in the removal, and subsequent off site disposal of the most contaminated materials. This would focus on Zone A. The scrapping of the Made Ground horizon could result in mixing with cleaner material and therefore the material should be retested to ensure that the appropriate waste disposal route is selected.

Upon completion of strip retesting of stockpiled materials would be required to reassess the potential risks associated with it and waste disposal options. The retesting may identify material that would be suitable for reuse on site.

9.4 OPTION 3

Given the topography of the site and the final development levels it will be possible to reprofile the site. This could allow the placement of an engineered capping layer, thereby reducing the need to remove a significant volume of material off site although detailed calculations would be required.

It is likely that any cap approved by the Statutory Authorities would incorporate a capillary break layer overlain by a clean low permeability barrier layer, overlain by subsoil and topsoil. Soils would only be required in garden and soft landscaped areas. In building and road/car-parking areas then an appropriate structural support layer could replace the soil layers. The final design and thickness of the capping layers would have to be agreed with the Local Authority and Environment Agency.

It is likely that demolition rubble from the removal of site buildings and the concrete slab could be recycled and for incorporated into the cap, in particular crushed and graded demolition arisings could be suitable for use in a capillary break layer.

Imported materials may also be eligible for a waste management licensing exemption, or equivalent due to the nature of the works.

9.5 BENZO(A)PYRENE

Analysis of the data indicates that a single elevated concentrations of B(a)P exists which can, based on the Maximum Value Test, be statistically considered to be an outlier. If this is excluded from the data set for the site as a whole, or the identified zones of contamination then a reduction in coverall capping thickness required can be obtained (see below).

Therefore it is recommended that the area of WS9 be subject to a limited excavation of Made Ground and the arisings of off site disposal at a suitable licenced waste management facility. Validation testing of the edges and base of the excavation will be required to ensure that B(a)P levels are reduced to those acceptable to the statutory authorities. At this stage, given that a capping layer is proposed across the site we would consider that a remediation target of 2.5 mg/kg would be suitable for surface soils.

9.6 PRELIMINARY CAPPING DESIGN

Using the methodology provided in BRE465 *Cover Systems for Land Regeneration*, and using the data obtained from both phases of site investigations calculations for appropriate thicknesses of soil cover in garden and public open space areas are given below.

The mathematical model for cover thickness is:

$X = M(Cg - 1)/(Cg - Cc)$

Where;

X is the thickness of excavation and validated cover.

Cg is the concentration of the contaminant in the existing ground expressed as a multiple of T_v where T_v is the adopted trigger value (i.e. Arsenic = 20.0 mg/kg).

Cc is the desired contamination concentration of validated cover expressed as a proportion of T_v.

Therefore for example arsenic in Zone A;

Cg = 2.07 as the mean As concentration was determined to be 41.45 mg/kg using 95% UCL mean calculation using Zone A site data. Calculations spreadsheet included in Appendix 7.

Cc = 0.8 based on the assumption that the desired concentration of As in the validated clean imported fill would be 80% of the target value of 20 mg/kg for As.

Therefore;

$X = M(2.07 - 1)/(2.07 - 0.8)$

$X = 505.7$ mm

The following table indicates the capping layer thickness for Zone A and Zone B:

	Capping Thickness (mm)	
	Zone A	**Zone B**
Arsenic	506	379
Lead	32	No Capping Required
Nickel	367	No Capping Required
TPH	54	No Capping Required
Benzo(a)pyrene	538	460

Based on the calculations outlined above the maximum required thickness for acceptable capping of the site in garden and open space areas is 538 mm in Zone A and 460 mm in Zone B. If for preliminary design purposes a cap of 600 mm is adopted then we would consider that a capillary break layer of 150 mm, overlain by 150 mm of sub base overlain in turn by 300 mm of topsoil with turf and garden areas would be suitable. Details of the cap design would have to be approved by the Statutory Authorities.

In road and parking suitable engineered and compacted fill, overlain with tarmac, based upon geotechnical testing of the site will provide suitable capping with respect to contamination risk management.

10. CONCLUSIONS

The conclusions and recommendations, which can be drawn from the works carried out at at Pogmoor Works, Barnsley, South Yorkshire are as follows:

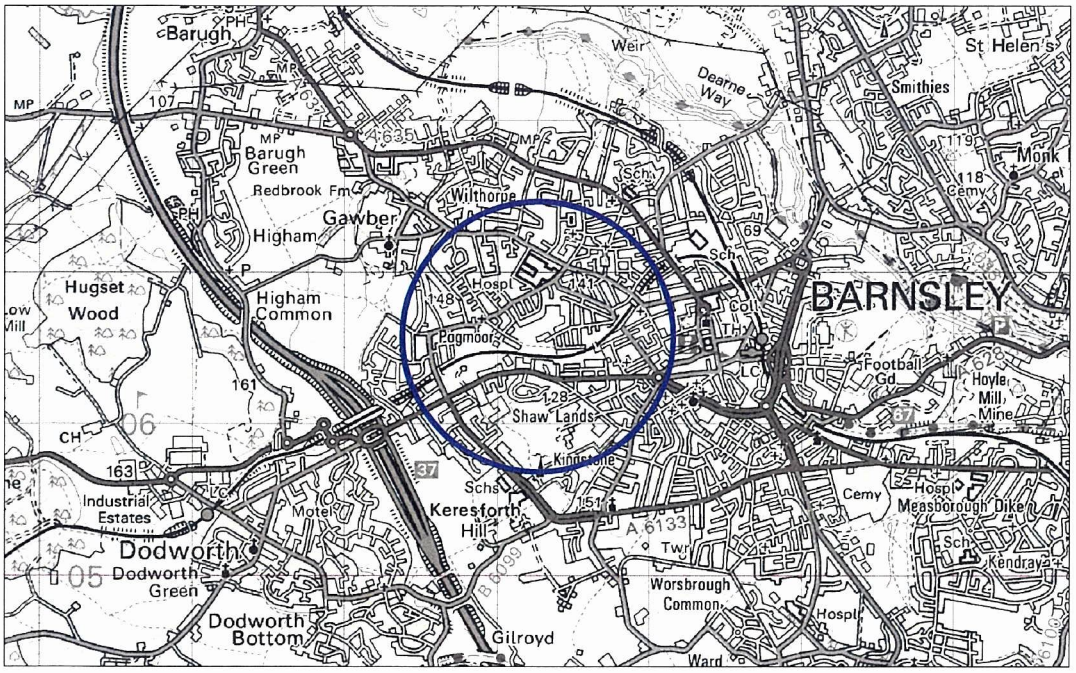
- The site is underlain by north and north-easterly dipping strata of the middle coal measures. These comprise cyclical sequences dominated by mudstones but supplemented by sandstones, siltstones and thin coal seams. A sandstone horizon is understood to sub-crop in the east of the site, and mudstone beneath the west of the site.
- The site had been used for coal mining related activities, which ceased operations by 1931. The site had been used as a brick works and clay pit, which ceased operations by 1956.
- Due to the potential risks to human health associated with the elevated concentrations of some determinants, notably lead, recorded at the site remediation works are considered necessary. These could include a strip of contaminated material from the site and the placement of clean material, or the direct placement of an engineered cap across the site.
- It may be possible to reuse demolition arisings in any capping layer and also import further construction materials within the framework of a waste management license exemption.
- The concentrations of potentially toxic organic compounds such as TPH and PAHs were generally below their respective guideline values, although slightly elevated concentrations of Benzo-a-pyrene was recorded. The excavation and off site disposal of the most elevated B(a)P hotspot material is recommended.
- The concentrations of the potentially harmful soil gas carbon dioxide were above the levels at which gas protection measures are required and passive gas control measures should be incorporated into the design of any building constructed on the site.
- The risks to plants are considered to be low following implementation of an appropriate remediation programme.
- Concentration of the majority of determinants recorded in a water sample recovered from a trial pit were low and within UK Drinking Water Standards. The pH at the site was alkaline and concentrations of potential contaminants in leachate samples were low. The risks to water resources are therefore considered to be low.
- Any materials requiring off site disposal are likely to be classified as non-hazardous waste. However, a formal classification by the Environment Agency would be required to confirm this. To obtain this further testing may be required after removal but prior to off-site disposal.

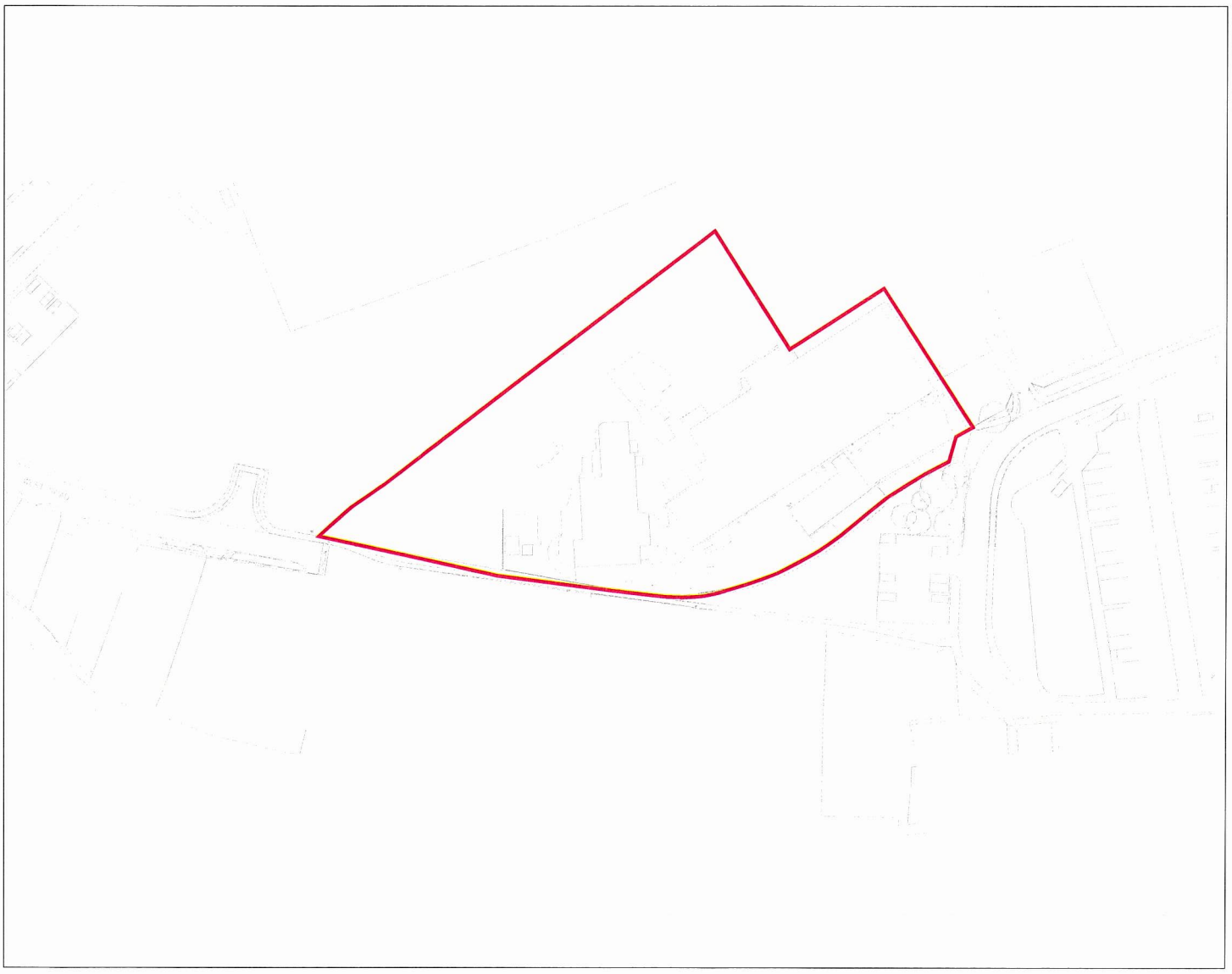
The site has been broadly divided into geotechnical and environmental hazard zones based on desk study research and a review of the available data. These zones represent varying degrees of difficulty with respect to redevelopment in terms of geotechnical and environmental issues.

The north-western half of the site has been zoned **RED** and the south-eastern half of the site has been zoned as **AMBER** for potential geotechnical hazards whilst the contamination risk assessment indicates that Zone A is **RED** whilst Zone B is **AMBER**.

Based on the principles and definitions outlined under Section 57 of the Environment Act 1995, the site, following the implementation of appropriate remediation would not be considered to be "Contaminated Land" based on its redevelopment to the planned residential end use.

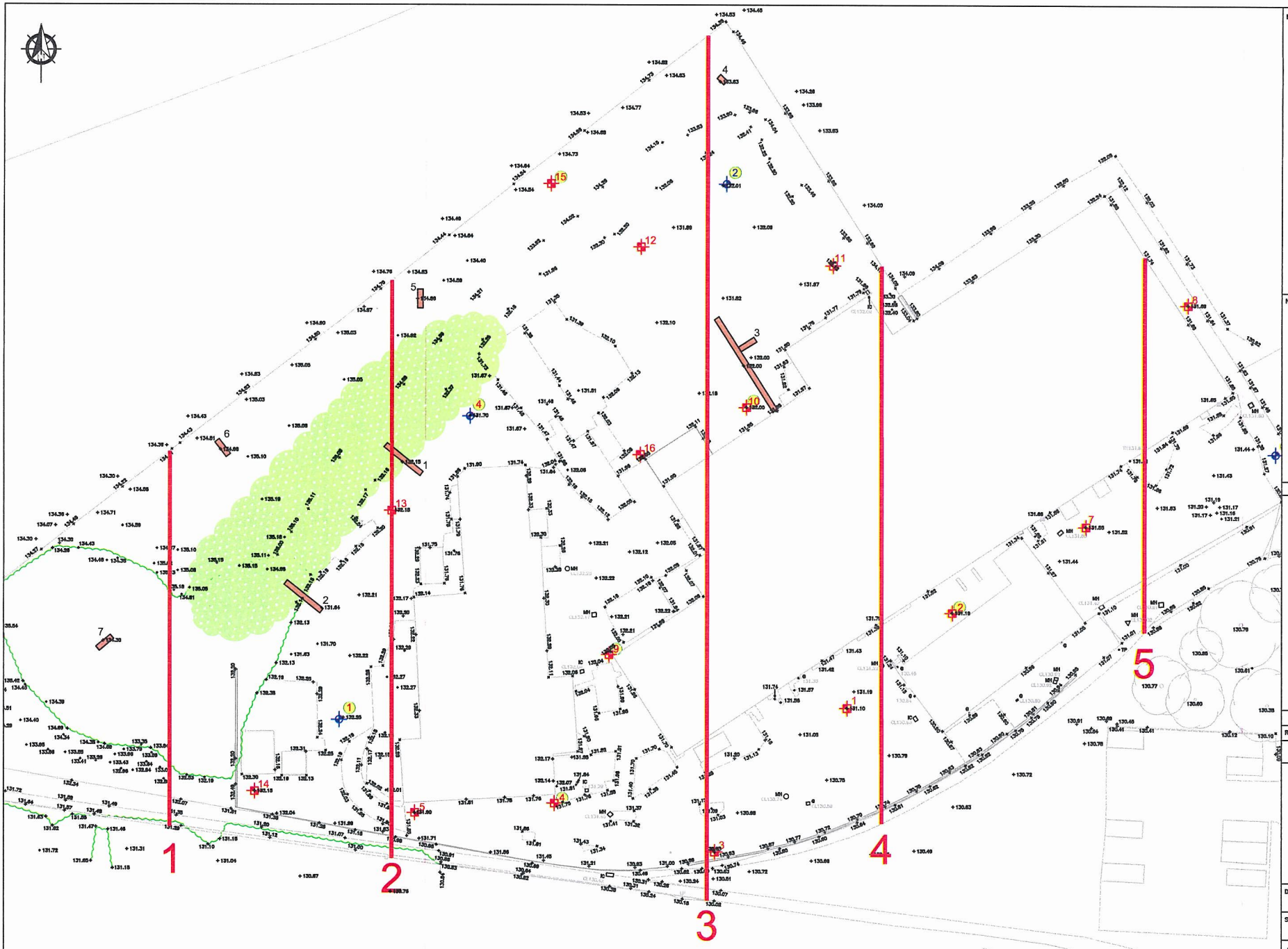
Figure 1 – Site Location Plan





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Figure 2 – Exploratory Hole Location Plan



Legend (where applicable)

- Window Sample
- Borehole
- Trial Pit
- Monitoring equipment installed
- Approximate area of knotweed infestation
- Section line

Notes

Drawing No.	Reference Drawings

Revision Details	By	Check	Date	Rev.

POGMOOR WORKS BARNSLEY

FIGURE 2 EXPLORATORY HOLE LOCATION PLAN

Drawing No.	REV.
D108892/GSG/02	0

Scale (unless otherwise shown) 1:500

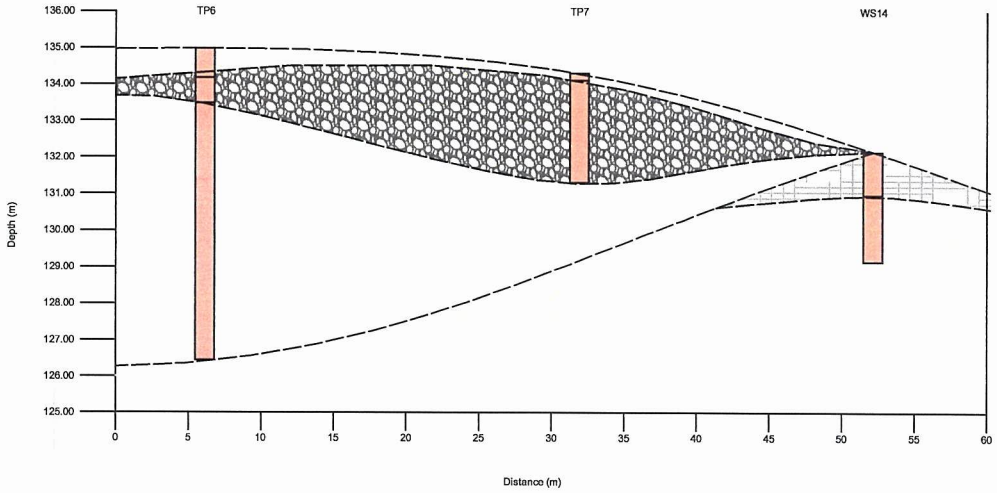
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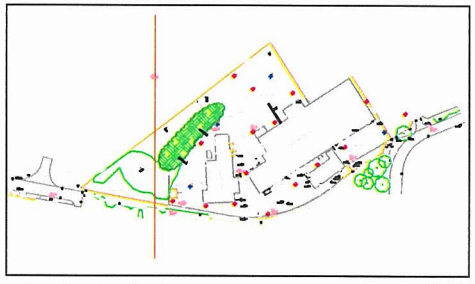
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Figure 3 – Cross Section 1



Cross Section 1



Location of section 1 NTS

Section Key

- Section reference
- Excavation
- Made ground - mixed domestic waste
- Ashy sand
- Compacted fill
- Ash
- Concrete
- Natural
- Sandstone/Mudstone
- Clay cap

Notes

TP - Trial Pit BH - Borehole WS - Window Sample

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FIGURE 3
Section 1

POGMOOR WORKS
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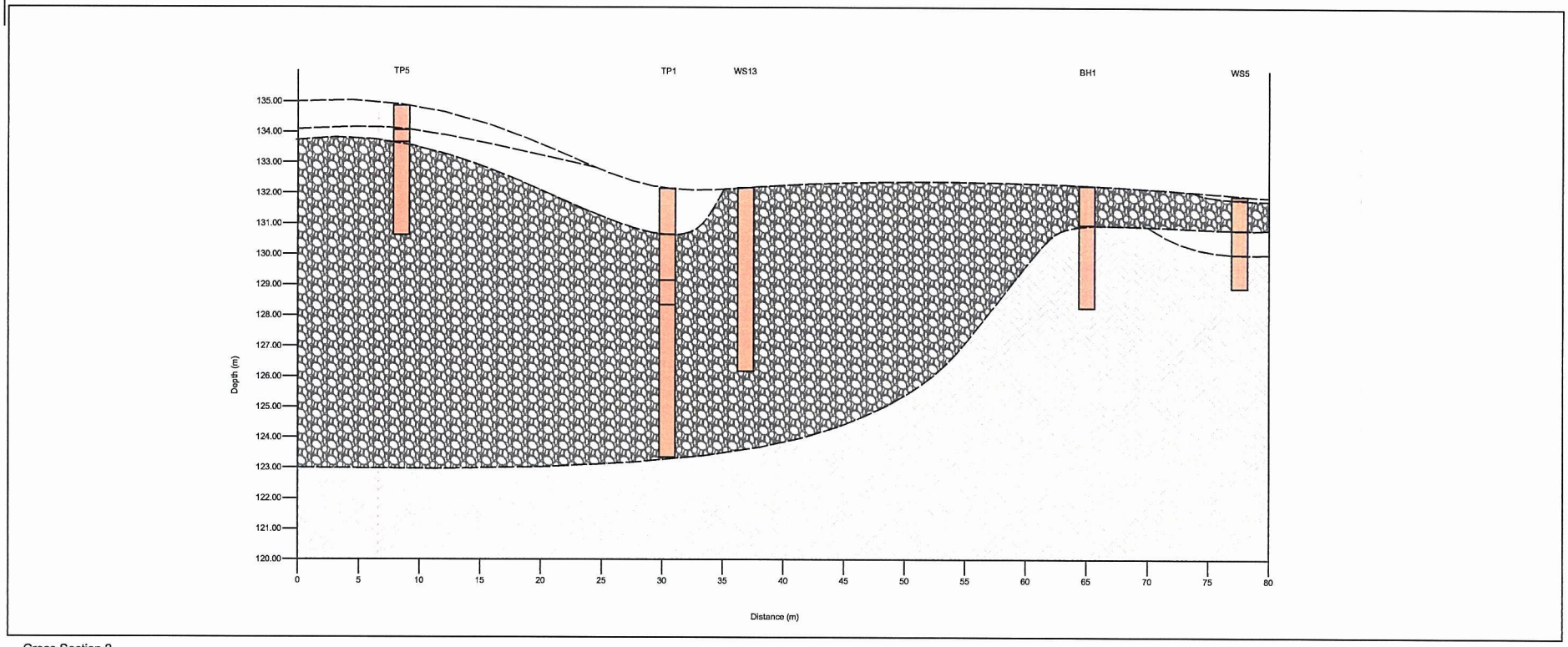
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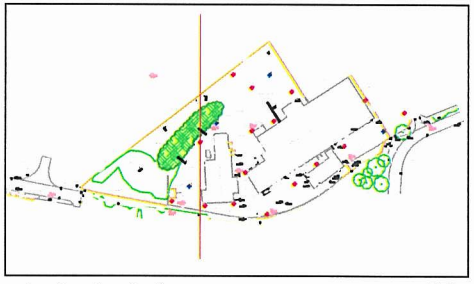
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Figure 4 – Cross Section 2



Cross Section 2



Location of section 2 NTS

Section Key

- Section reference
- Excavation
- Made ground - mixed domestic waste
- Ashy sand
- Compacted fill
- Ash
- Concrete
- Natural
- Sandstone/Mudstone
- Clay cap

Notes

TP - Trial Pit BH - Borehole WS - Window Sample

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FIGURE 3
Section 2

POGMOOR WORKS
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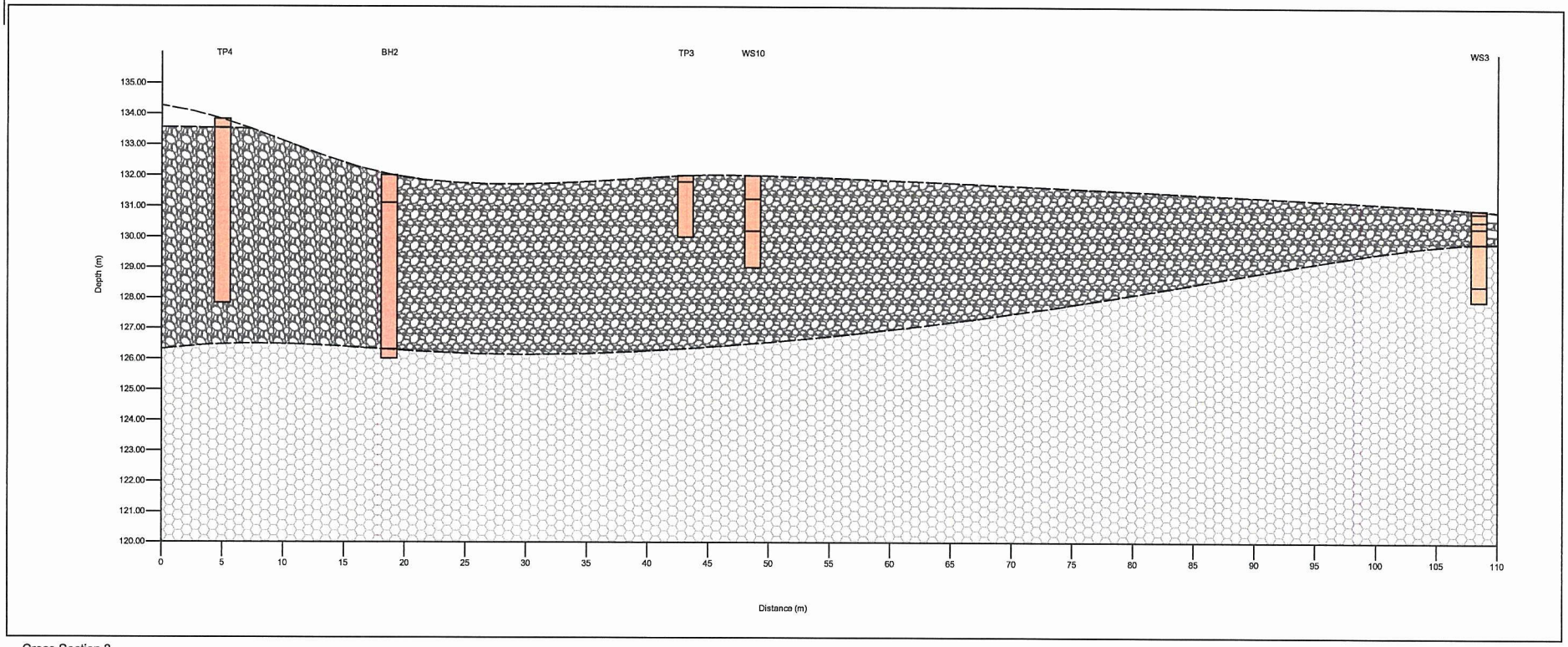
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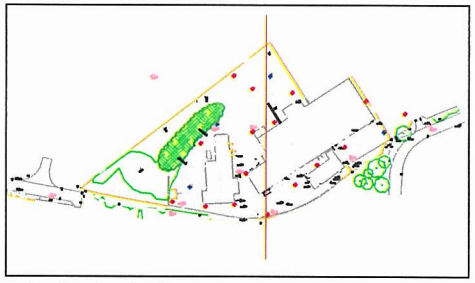
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Figure 5 – Cross Section 3



Cross Section 3



Location of section 3 NTS

Section Key

- Section reference
- Excavation
- Made ground - mixed domestic waste
- Ashy sand
- Compacted fill
- Ash
- Concrete
- Natural
- Sandstone/Mudstone
- Clay cap

Notes

TP - Trial Pit BH - Borehole WS - Window Sample

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Checked	AMM

FIGURE 3
Section 3

POGMOOR WORKS
BARNSLEY

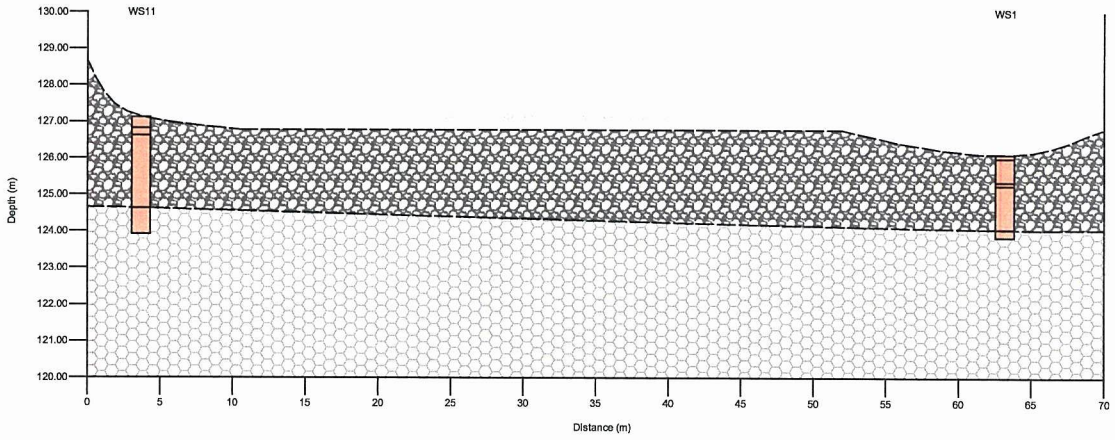
Date: June 2006

Scale: H: 1: 500
V: 1: 200

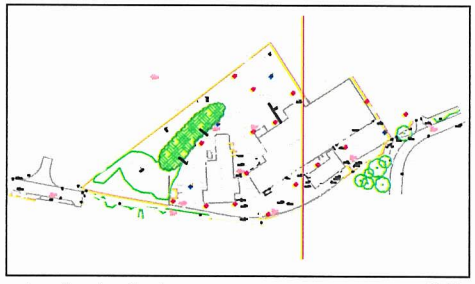
DRG. No.D108892/GSG/03 REV.0

L:\Admin\GSG\Jobs\D108892 Pogmoor Works\c\CAD\SWA(GSG) Ground Contamination\Current\D108892_GSG_03 Sections.dwg, 14/06/2006 11:27:53

Figure 6 – Cross Section 4



Cross Section 4



Location of section 4 NTS

Section Key

- Section reference
- Excavation
- Made ground - mixed domestic waste
- Ashy sand
- Compacted fill
- Ash
- Concrete
- Natural
- Sandstone/Mudstone
- Clay cap

Notes

TP - Trial Pit BH - Borehole WS - Window Sample

GROUND SOLUTIONS GROUP

Topographical Survey, Site Investigation & Environmental Consultancy
Hanover Close, Cobbs Wood Estate, Ashford, KENT. TN23 1EJ

Surveyed	GL/AMM
Drawn	BTW
Checked	AMM

FIGURE 3
Section 4

POGMOOR WORKS
BARNSLEY

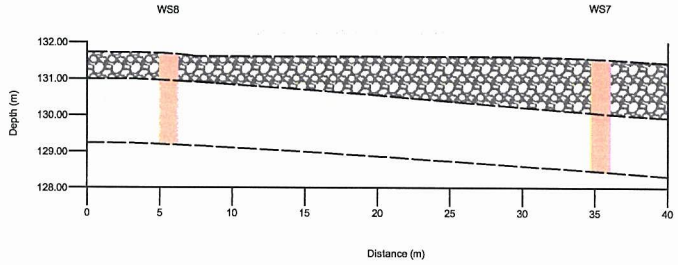
Date: June 2006

Scale: H: 1: 500
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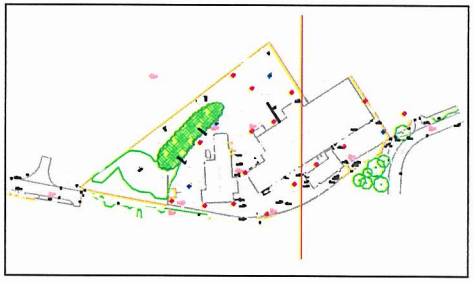
DRG. No.D108892/GSG/03 REV.0

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Figure 7 – Cross Section 5



Cross Section 5



Location of section 5 NTS

Section Key

- Section reference
- Excavation
- Made ground - mixed domestic waste
- Ashy sand
- Compacted fill
- Ash
- Concrete
- Natural
- Sandstone/Mudstone
- Clay cap

Notes

TP - Trial Pit BH - Borehole WS - Window Sample

GSG

GROUND SOLUTIONS GROUP

Topographical Survey, Site Investigation & Environmental Consultancy
Hanover Close, Cobbs Wood Estate, Ashford, KENT. TN23 1EJ

Surveyed	GL/AMM
Drawn	BTW
Checked	AMM

FIGURE 3
Section 5

POGMOOR WORKS
BARNSLEY

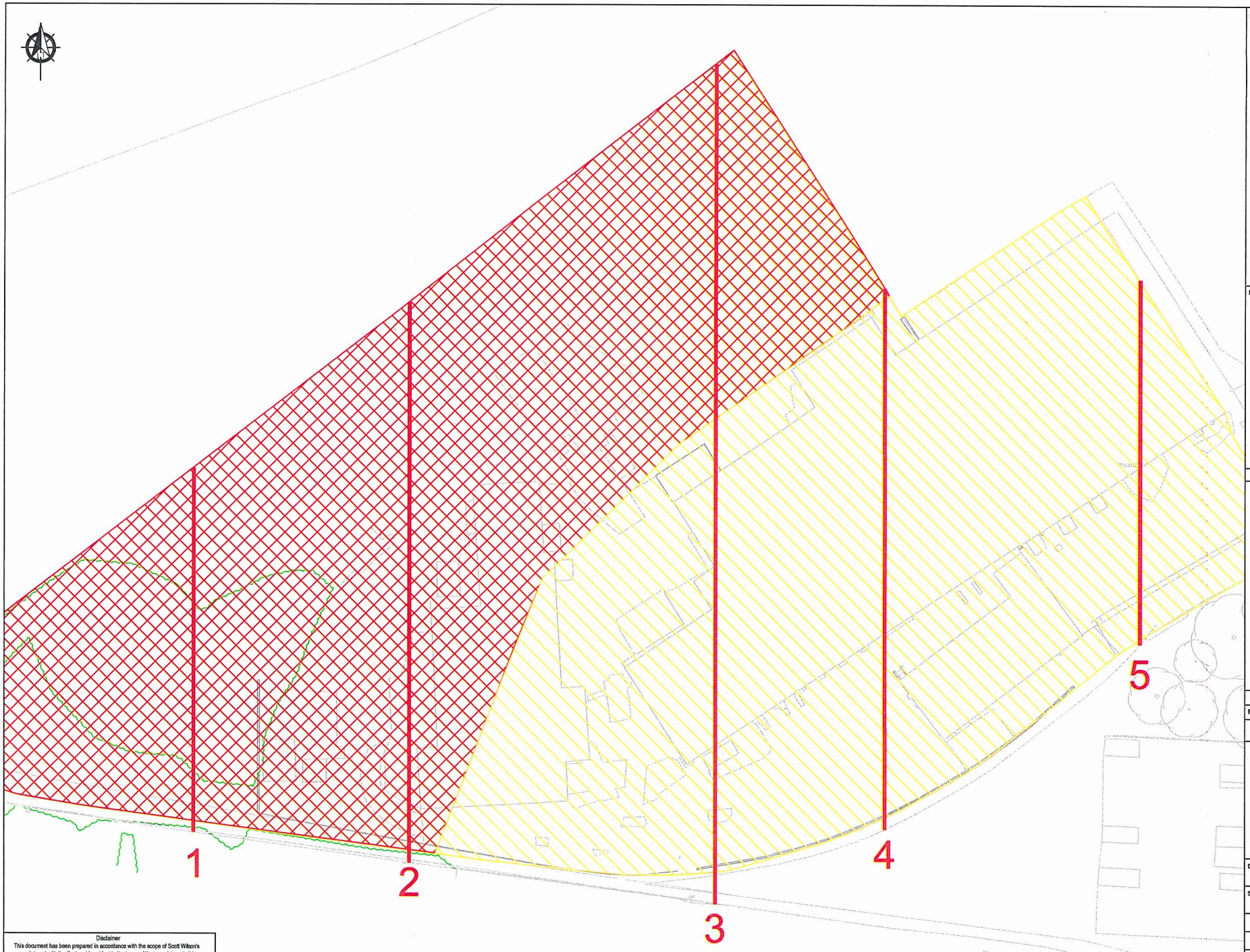
Date: June 2006

Scale: H: 1: 500
V: 1: 200

DRG. No.D108892/GSG/03 REV.0

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Figure 8– Site Zoning Plan



Legend (where applicable)

- High hazard
- Medium hazard
- Low hazard
- Section line

Notes

Drawing No.	Reference Drawings

Revision Details	By / Check	Date	Rev.

POGMOOR WORKS
BARNSLEY

FIGURE 8
GEOTECHNICAL HAZARD ZONING

Drawing No.	REV.
D108892/GSG/08	0

Scale (unless otherwise shown) 1:500

Surveyed		Drawn	BTW	Checked	AMM

GROUND SOLUTIONS GROUP

Topographical Survey, Site Investigation & Environmental Consultancy
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Appendix 1 – Trial Pit Logs

Ground Solutions Group
Hanover Close
Cobbs Wood Estate
Ashford, Kent, TN23 1EJ
Tel: 01233 658270/277
Fax: 01233 658299
eMail: gsg@groundsolutions.co.uk

Trial Pit No. TP 1

Sheet: 1 of 2

Equipment & Methods.
Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 134.00 AOD

Date Started:17/05/2006
Date Completed:17/05/2006

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
1.00	D1	D			MADE GROUND: Firm mottled orange brown sandy clay			(1.50)
1.50	D2	D				132.50		1.50
1.80	D3	D			MADE GROUND: Builders rubble - predominently bricks			(1.50)
2.50	D4	D				131.00		3.00
					MADE GROUND: Brown ashy silty sandy gravel. Gravel is sub rounded to sub angular and coarse of slag, paper, stone, glass and ceramic			(1.00)
						130.00		4.00
					MADE GROUND: mottled orange brown sandy gravel with occasional clay lenses			(5.00)

Remarks:
Hole unstable.
Groundwater encountered at XXXX

Logged By: AM
Checked By:
Scale: 1:35
Approved By:
FIG No. .1

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD TRIAL PIT LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Ground Solutions Group
Hanover Close
Cobbs Wood Estate
Ashford, Kent, TN23 1EJ
Tel: 01233 658270/277
Fax: 01233 658299
eMail: gsg@groundsolutions.co.uk

Trial Pit No. TP 1

Sheet: 2 of 2

Equipment & Methods.
Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 134.00 AOD

Date Started:17/05/2006
Date Completed:17/05/2006

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
					SANDSTONE	125.00		9.00
					End of Trial Pit 9.00 m (Thickness of basal layer not proven)			

Remarks:
Hole unstable.
Groundwater encountered at XXXX

Logged By: AM
Checked By:
Scale: 1:35
Approved By:
FIG No. .2

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD TRIAL PIT LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Ground Solutions Group
Hanover Close
Cobbs Wood Estate
Ashford, Kent, TN23 1EJ
Tel: 01233 658270/277
Fax: 01233 658299
eMail: gsg@groundsolutions.co.uk

Trial Pit No. TP2

Sheet: 1 of 2

Equipment & Methods.
Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 133.50 AOD

Date Started:17/05/2006
Date Completed:17/05/2006

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.10	D1	D			MADE GROUND: Soft to firm mottled orange brown grey sandy gravelly clay with rootlets and occasional large cobbles	133.30		(0.20) 0.20
0.15	D2	D						
0.30	D3	D			MADE GROUND: Mottled orange brown gravelly sand of ash. Gravel is coarse of brick, concrete, metal and stone.	133.00		(0.30) 0.50
0.70	D4	D			MADE GROUND: Mottled red brown gravelly sand with occasional clay lenses. Gravel is coarse of bricks	132.80		(0.20) 0.70
1.20	D5	D			MADE GROUND: Brown gravelly sand of ash. Gravel is coarse of light bulbs, bottles and general household waste			(8.30)

Remarks:
Hole unstable.
Groundwater encountered at XXXX

Logged By: AM
Checked By:
Scale: 1:35
Approved By:
FIG No. .1

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD TRIAL PIT LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

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Hanover Close
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Fax: 01233 658299
eMail: gsg@groundsolutions.co.uk

Trial Pit No. TP2

Sheet: 2 of 2

Equipment & Methods.
Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 133.50 AOD

Date Started:17/05/2006
Date Completed:17/05/2006

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
						124.50		9.00
					End of Trial Pit 9.00 m (Thickness of basal layer not proven)			

Remarks:
Hole unstable.
Groundwater encountered at XXXX

Logged By: AM
Checked By:
Scale: 1:35
Approved By:
FIG No. .2

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD TRIAL PIT LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Ground Solutions Group
Hanover Close
Cobbs Wood Estate
Ashford, Kent, TN23 1EJ
Tel: 01233 658270/277
Fax: 01233 658299
eMail: gsg@groundsolutions.co.uk

Trial Pit No. TP3

Sheet: 1 of 1

Equipment & Methods.
Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 132.00 AOD

Date Started:17/05/2006
Date Completed:17/05/2006

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
					MADE GROUND: Hardcore	131.80		(0.20) 0.20
					MADE GROUND: Mottled black brown very gravelly sand of ash. Gravel is coarse of brick and stone.			(1.80)
0.80	D1	D						
1.00	D2	D						
1.30	D3	D						
2.00	D4	D				130.00		2.00
					MADE GROUND: Whole and broken brick fill.			(2.00)
						128.00		4.00

End of Trial Pit 4.00 m
(Thickness of basal layer not proven)

Remarks:
Hole unstable.
Groundwater encountered at XXXX

Logged By: AM
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD TRIAL PIT LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Ground Solutions Group
Hanover Close
Cobbs Wood Estate
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Fax: 01233 658299
eMail: gsg@groundsolutions.co.uk

Trial Pit No. TP4

Sheet: 1 of 1

Equipment & Methods.
Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 133.84 AOD

Date Started:17/05/2006
Date Completed:17/05/2006

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
					MADE GROUND: Soft brown sandy clay	133.54		(0.30) 0.30
0.40	D1	D			MADE GROUND: Mottled red brown gravelly clayey sand of ash. Gravel is coarse of brick and stone.			
0.60	D2	D						
1.50	D3	D						(5.70)
						127.84		6.00
								End of Trial Pit 6.00 m (Thickness of basal layer not proven)

Remarks:
Hole very unstable.
Groundwater encountered at XXXX.
Natural rock outcrop, undermined by fill, encountered.

Logged By: AM
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD TRIAL PIT LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Ground Solutions Group
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Ashford, Kent, TN23 1EJ
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Trial Pit No. TP5

Sheet: 1 of 1

Equipment & Methods.
Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 134.86 AOD

Date Started:18/05/2006
Date Completed:18/05/2006

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.50	D1	D			MADE GROUND: Firm orange brown sandy clay with rootlets			(0.80)
0.80	D2	D				134.06		0.80
					MADE GROUND: Mottled orange brown sandy clay			(0.40)
						133.66		1.20
1.50	D3	D			MADE GROUND: Mottled black brown orange gravelly sand of ash. Gravel is coarse and angular of glass, stone, metal and brick			(3.80)
2.10	D4	D						
						129.86		5.00

End of Trial Pit 5.00 m
(Thickness of basal layer not proven)

Remarks:
Hole unstable.
Groundwater encountered at XXXX

Logged By: AC
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD TRIAL PIT LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Ground Solutions Group
Hanover Close
Cobbs Wood Estate
Ashford, Kent, TN23 1EJ
Tel: 01233 658270/277
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eMail: gsg@groundsolutions.co.uk

Trial Pit No. TP6

Sheet: 1 of 2

Equipment & Methods.
Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 134.96 AOD

Date Started:18/05/2006
Date Completed:18/05/2006

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.30	D1	D			MADE GROUND: Mottled brown black grey sandy clay			(0.80)
						134.16		0.80
					MADE GROUND: Mottled orange brown sandy clay with rootlets			(0.70)
						133.46		1.50
1.80	D2	D			MADE GROUND: Mottled orange brown gravelly ashy sand. Gravel is coarse of stone, bricks , metal and glass			
2.00	D3	D						
3.00	D4	D						(6.50)

Remarks:
Hole unstable.
Groundwater encountered at XXXX

Logged By: AC
Checked By:
Scale: 1:35
Approved By:
FIG No. .1

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD TRIAL PIT LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Ground Solutions Group
Hanover Close
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Ashford, Kent, TN23 1EJ
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eMail: gsg@groundsolutions.co.uk

Trial Pit No. TP6

Sheet: 2 of 2

Equipment & Methods.
Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 134.96 AOD

Date Started:18/05/2006
Date Completed:18/05/2006

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
						126.96		8.00
					End of Trial Pit 8.00 m (Thickness of basal layer not proven)			

Remarks:
Hole unstable.
Groundwater encountered at XXXX

Logged By: AC
Checked By:
Scale: 1:35
Approved By:
FIG No. .2

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD TRIAL PIT LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Ground Solutions Group
Hanover Close
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Ashford, Kent, TN23 1EJ
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Fax: 01233 658299
eMail: gsg@groundsolutions.co.uk

Trial Pit No. TP7

Sheet: 1 of 1

Equipment & Methods.
Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 134.30 AOD

Date Started:18/05/2006
Date Completed:18/05/2006

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20	D1	D			MADE GROUND: Soft mottled black orange brown sandy clay	134.10		(0.20) 0.20
					MADE GROUND: Black ashy gravelly sand. Gravel is coarse of stone, slag, porclein and brick.			(2.80)
1.20	D2	D						
3.00	D3	D			Soft Orange brown sandy CLAY	131.30		3.00

End of Trial Pit 3.00 m
(Thickness of basal layer not proven)

Remarks:
Hole unstable.
Groundwater encountered at XXXX

Logged By: AC
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD TRIAL PIT LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Appendix 2 - Borehole Logs

Ground Solutions Group
Hanover Close
Cobbs Wood Estate
Ashford, Kent, TN23 1EJ
Tel: 01233 658270/277
Fax: 01233 658299
eMail: gsg@groundsolutions.co.uk

Borehole No. BH1

Sheet: 1 of 2

Equipment & Methods.
Cable percussion drilling rigSupport Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 132.25 AOD

Date Started:04/04/2005
Date Completed:04/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.50 - 0.51		D			MADE GROUND. Dense brick, ash and stone fill.			(1.30)
1.35 - 1.36		D				130.95		1.30
1.50 - 1.51		D			Very weak, thinly laminated brown/grey SANDSTONE.			
2.50 - 2.51		D						(2.70)
3.50 - 3.51		D						
4.00 - 4.01		D				128.25		4.00

End of Borehole 4.00 m
(Thickness of basal layer not proven)

Remarks:
Groundwater/soil gas monitoring standpipe installed.

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No. .1

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD BOREHOLE LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Ground Solutions Group
Hanover Close
Cobbs Wood Estate
Ashford, Kent, TN23 1EJ
Tel: 01233 658270/277
Fax: 01233 658299
eMail: gsg@groundsolutions.co.uk

Borehole No. BH1

Sheet: 2 of 2

Equipment & Methods. Cable percussion drilling rigSupport Used:None	Project Name: Pogmoor Works Contamination Assessment Project Location: Stocks Lane, Barnsley, Yorkshire Client: Jamestown Metal Resources Ltd	Job No: D108892
Co-ordinates: E: N:	Ground Level (m): 132.25 AOD	Date Started:04/04/2005 Date Completed:04/04/2005

Remarks:
Groundwater/soil gas monitoring standpipe installed.

Logged By: GL	Checked By:
Scale: 1:35	Approved By:
FIG No. .2	

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD BOREHOLE LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Ground Solutions Group
Hanover Close
Cobbs Wood Estate
Ashford, Kent, TN23 1EJ
Tel: 01233 658270/277
Fax: 01233 658299
eMail: gsg@groundsolutions.co.uk

Borehole No. BH2

Sheet: 1 of 2

Equipment & Methods.
Cable percussion drilling rigSupport Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 132.01 AOD

Date Started:04/04/2005
Date Completed:04/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.50 - 0.51		D			MADE GROUND. Dense brick and stone fill.			(0.90)
1.00 - 1.01		D			MADE GROUND. Dense black ash and brick fill.	131.11		0.90
2.00 - 2.01		D						
3.00 - 3.01		D						(4.80)
4.00 - 4.01		D						
5.00 - 5.01		D						
5.75 - 5.76		D			Very weak, thinly laminated brown/grey SANDSTONE.	126.31		5.70
6.00 - 6.01		D						(0.30)
						126.01		6.00

End of Borehole 6.00 m
(Thickness of basal layer not proven)

Remarks:
Groundwater/soil gas monitoring standpipe installed.

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No. .1

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD BOREHOLE LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Ground Solutions Group
Hanover Close
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eMail: gsg@groundsolutions.co.uk

Borehole No. BH2

Sheet: 2 of 2

Equipment & Methods.
Cable percussion drilling rigSupport Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 132.01 AOD

Date Started:04/04/2005
Date Completed:04/04/2005

Water Strike Table

Depth of Strike (m)	Casing Depth (m)	Date	Time	Post Strike Depth (m)	Minutes After Strike	Sealed At (m)	Remarks
1.30	2.20	4-4-05			15		
1.30	2.20	4-4-05			20		
1.40	2.20	4-4-05			10		
1.50	2.20	4-4-05			5		
2.50	2.20	4-4-05			0		very fast

Remarks:
Groundwater/soil gas monitoring standpipe installed.

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No. .2

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD BOREHOLE LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

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Fax: 01233 658299
eMail: gsg@groundsolutions.co.uk

Borehole No. BH3

Sheet: 1 of 2

Equipment & Methods.
Cable percussion drilling rigSupport Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 131.30 AOD

Date Started:05/04/2005
Date Completed:04/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.50 - 0.51		D			MADE GROUND. Dense sand, ash and fill material.			(0.80)
						130.50		0.80
1.00 - 1.01		D			MADE GROUND. Dense grey ashey clay fill material.			
2.00 - 2.01		D						(2.60)
3.00 - 3.01		D						
						127.90		3.40
3.50 - 3.51		D			Very weak, thinly laminated brown/grey MUDSTONE.			
4.50 - 4.51		D						(1.60)
5.00 - 5.01		D				126.30		5.00
					End of Borehole 5.00 m (Thickness of basal layer not proven)			

Remarks:
Groundwater/soil gas monitoring standpipe installed.

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No. .1

Notes: For explanation of symbols and abbreviations, see Key Sheet.

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Borehole No. BH3

Sheet: 2 of 2

Equipment & Methods.
Cable percussion drilling rigSupport Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 131.30 AOD

Date Started:05/04/2005
Date Completed:04/04/2005

Water Strike Table

Depth of Strike (m)	Casing Depth (m)	Date	Time	Post Strike Depth (m)	Minutes After Strike	Sealed At (m)	Remarks
3.10	3.00				10		
3.10	3.00				15		
3.10	3.00				20		
3.20	3.00				5		
3.40	3.00				0	4.00	FAST

Remarks:
Groundwater/soil gas monitoring standpipe installed.

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No. .2

Notes: For explanation of symbols and abbreviations, see Key Sheet.

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Borehole No. BH4

Sheet: 1 of 2

Equipment & Methods.
Cable percussion drilling rigSupport Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 131.70 AOD

Date Started:05/04/2005
Date Completed:04/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.30 - 0.31		D			MADE GROUND. Dense sand, ash and fill material.			(0.50)
0.60 - 0.61		D			MADE GROUND. Dense grey ashey clay fill material.	131.20		0.50
								(0.90)
1.50 - 1.51		D			Very weak, thinly laminated brown/grey MUDSTONE.	130.30		1.40
								(1.60)
2.50 - 3.00		D				128.70		3.00

End of Borehole 3.00 m
(Thickness of basal layer not proven)

Remarks:
Groundwater/soil gas monitoring standpipe installed.

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No. .1

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD BOREHOLE LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

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Borehole No. BH4

Sheet: 2 of 2

Equipment & Methods.
Cable percussion drilling rigSupport Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 131.70 AOD

Date Started:05/04/2005
Date Completed:04/04/2005

Remarks:
Groundwater/soil gas monitoring standpipe installed.

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No. .2

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD BOREHOLE LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Appendix 3 – Window Sample Logs

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Window Sampler Log No. WS1

Sheet: 1 of 1

Equipment & Methods.
Track mounted window sampling rig.Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 131.10 AOD

Date Started:04/04/2005
Date Completed:04/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20 - 0.21		D			MADE GROUND. Dense sand, ash and fill material.	131.00		(0.10)
					MADE GROUND. Dense brick, ash and coal.			(0.65)
						130.35		(0.05)
0.90 - 0.90		D			MADE GROUND. Soft reworked grey clay.	130.30		0.80
1.30 - 1.31		D			Very stiff orange mottled grey CLAY, becoming slightly sandy from 1.5m.			(1.20)
2.00 - 2.01		D				129.10		2.00
					Very weak, thinly laminated brown/grey SANDSTONE.			(0.20)
						128.90		2.20

End of W/S 2.20 m
(Thickness of basal layer not proven)

Remarks:

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD WINDOW SAMPLER LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

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Window Sampler Log No. WS10

Sheet: 1 of 1

Equipment & Methods.
Track mounted window sampling rig.Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 132.00 AOD

Date Started:06/04/2005
Date Completed:06/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20 - 0.21		D			MADE GROUND. Dense sand, ash and fill.	131.25		(0.75) 0.75
0.80 - 0.81		D			MADE GROUND. Dense brick and ash.	130.20		(1.05) 1.80
1.50 - 1.51		D			Weak thinly laminated MUDSTONE.	129.00		(1.20) 3.00
2.50 - 2.51		D						

End of W/S 3.00 m
(Thickness of basal layer not proven)

Remarks:
Groundwater/soil gas monitoring standpipe installed.

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

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Window Sampler Log No. WS11

Sheet: 1 of 1

Equipment & Methods.
Track mounted window sampling rig.Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 132.12 AOD

Date Started:06/04/2005
Date Completed:06/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20 - 0.21		D			MADE GROUND. Very stiff reworked clay containing much brick and mudstone/sandstone fragments.	131.82		(0.30) 0.30
					MADE GROUND. Crushed brick.	131.62		(0.20) 0.50
0.90 - 0.91		D			MADE GROUND. Loose ash, slag, brick and coal.			(2.00)
1.30 - 1.31		D						
2.10 - 2.11		D						
2.70 - 2.71		D			Weak, thinly laminated MUDSTONE.	129.62		2.50 (0.70)
						128.92		3.20

End of W/S 3.20 m
(Thickness of basal layer not proven)

Remarks:

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

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Window Sampler Log No. WS12

Sheet: 1 of 1

Equipment & Methods.
Track mounted window sampling rig.Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 131.70 AOD

Date Started:05/04/2005
Date Completed:05/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.50 - 0.51		D			MADE GROUND. Thin layer of grass covered topsoil.	131.60		(0.10)
					MADE GROUND. Mixture of brick, stiff grey clay, ash, coal, slag and reworked mudstone and sandstone.			(4.00)
1.50 - 1.51		D						
2.50 - 2.51		D						
3.50 - 3.51		D						
					Weak thinly laminated MUDSTONE.	127.60		4.10 (0.10)
						127.50		4.20

End of W/S 4.20 m
(Thickness of basal layer not proven)

Remarks:

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

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Window Sampler Log No. WS13

Sheet: 1 of 1

Equipment & Methods.
Track mounted window sampling rig.Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 132.18 AOD

Date Started:06/04/2005
Date Completed:06/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.50 - 0.51		D			MADE GROUND. Mixture of brick, stiff grey clay, ash, coal and slag.			
2.00 - 2.01		D						(6.00)
3.50 - 3.51		D						
5.10 - 5.10		D						
						126.18		6.00
					End of W/S 6.00 m (Thickness of basal layer not proven)			

Remarks:

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD WINDOW SAMPLER LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

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Window Sampler Log No. WS14

Sheet: 1 of 1

Equipment & Methods.
Track mounted window sampling rig.Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 132.15 AOD

Date Started:06/04/2005
Date Completed:06/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20 - 0.21		D			MADE GROUND. Dense fill containing brick, ash and topsoil.			(1.20)
0.80 - 0.81		D						
1.30 - 1.31		D			Very stiff grey mottled orange CLAY becoming weak bands of thinly layered mudstone from 1.9m.	130.95		1.20
1.80 - 1.81		D						(1.80)
2.30 - 2.31		D						
						129.15		3.00

End of W/S 3.00 m
(Thickness of basal layer not proven)

Remarks:

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD WINDOW SAMPLER LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

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Window Sampler Log No. WS15

Sheet: 1 of 1

Equipment & Methods.
Track mounted window sampling rig.Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 134.60 AOD

Date Started:05/04/2005
Date Completed:05/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20 - 0.21		D			MADE GROUND. Thin layer of grassed topsoil.	134.50		(0.10)
					MADE GROUND. Mixture of brick, stiff grey clay, ash, coal, slag and reworked mudstone and sandstone.			
0.80 - 0.81		D						
1.20 - 1.21		D						
1.80 - 1.81		D						
2.20 - 2.21		D						(4.90)
2.80 - 2.81		D						
3.20 - 3.21		D						
3.80 - 3.81		D						
4.20 - 4.21		D						
4.80 - 4.81		D						
					MADE GROUND (No Recovery)	129.60		5.00
								(1.00)
						128.60		6.00
					End of W/S 6.00 m (Thickness of basal layer not proven)			

Remarks:
No recovery between 5 and 6 m.
Groundwater/soil gas monitoring standpipe installed.

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD WINDOW SAMPLER LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

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Window Sampler Log No. WS16

Sheet: 1 of 1

Equipment & Methods.
Track mounted window sampling rig.Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 132.05 AOD

Date Started:05/04/2005
Date Completed:05/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
					MADE GROUND. Concrete.	131.80		(0.25) 0.25
0.50 - 0.51		D			MADE GROUND. Dolomite hardcore.			(0.50)
						131.30		0.75
1.00 - 1.01		D			Very stiff grey CLAY with thinly laminated mudstone bands and natural bands of coal at 1.75m.			(1.25)
1.50 - 1.51		D						
						130.05		2.00

End of W/S 2.00 m
(Thickness of basal layer not proven)

Remarks:

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD WINDOW SAMPLER LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

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Window Sampler Log No. WS2

Sheet: 1 of 1

Equipment & Methods.
Track mounted window sampling rig.Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 131.19 AOD

Date Started:04/04/2005
Date Completed:04/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20 - 0.21		D			MADE GROUND. Tarmac.	131.09		(0.10)
					MADE GROUND. Stiff reworked grey clay containing much ash, coal and brick.			(0.80)
0.80 - 0.81		D				130.29		0.90
					Stiff grey mottled orange CLAY with mudstone fragments.			(1.00)
1.50 - 1.51		D		Faint hydrocarbon odour.				
					Weak thinly laminated MUDSTONE and sandstone layers.	129.29		1.90
2.50 - 2.51		D						(1.00)
						128.29		2.90

End of W/S 2.90 m
(Thickness of basal layer not proven)

Remarks:
Groundwater/soil gas monitoring standpipe installed.

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

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Window Sampler Log No. WS3

Sheet: 1 of 1

Equipment & Methods.
Track mounted window sampling rig.Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 130.93 AOD

Date Started:04/04/2005
Date Completed:04/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
					MADE GROUND. Concrete.	130.83		(0.10)
					MADE GROUND. Dolomite hardcore.			(0.28)
0.40 - 0.41		D				130.55		0.38
					MADE GROUND. Dense purple lead slag.			(0.22)
						130.33		0.60
0.80 - 0.81		D			MADE GROUND. Dense brick, ash and coal slag.			(0.50)
						129.83		1.10
					Very stiff grey mottled red CLAY with thin laminations of MUDSTONE and sandstone bands from 1.5m.			
1.50 - 1.51		D						(1.40)
2.50 - 2.51		D				128.43		2.50
					Weak, thinly laminated brown/grey layers of MUDSTONE and SANDSTONE.			(0.50)
						127.93		3.00

End of W/S 3.00 m
(Thickness of basal layer not proven)

Remarks:

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD WINDOW SAMPLER LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

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Window Sampler Log No. WS4

Sheet: 1 of 1

Equipment & Methods.
Track mounted window sampling rig.Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 131.75 AOD

Date Started:04/04/2005
Date Completed:04/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20 - 0.21		D			MADE GROUND. Concrete.	131.65		(0.10)
					MADE GROUND. Dense brick, ash and reworked soft grey clay.			(1.00)
0.80 - 0.81		D				130.65		1.10
					MADE GROUND. Dense purple lead slag material.			(0.80)
1.50 - 1.51		D				129.85		1.90
					Weak thinly laminated bands of SANDSTONE/MUDSTONE.			(1.10)
2.50 - 2.51		D				128.75		3.00

End of W/S 3.00 m
(Thickness of basal layer not proven)

Remarks:
Groundwater/soil gas monitoring standpipe installed.

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD WINDOW SAMPLER LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

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Window Sampler Log No. WS5

Sheet: 1 of 1

Equipment & Methods.
Track mounted window sampling rig.Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 131.90 AOD

Date Started:04/04/2005
Date Completed:04/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20 - 0.21		D			MADE GROUND. Concrete.	131.80		(0.10)
0.80 - 0.81		D			MADE GROUND. Dense brick, ash and reworked soft grey clay.			(1.00)
1.50 - 1.51		D			Very stiff grey mottled orange CLAY with occasional weak thinly laminated sandstone or siltstone bands.	130.80		1.10 (0.80)
2.50 - 2.51		D			Weak thinly laminated bands of SANDSTONE/MUDSTONE.	130.00		1.90 (1.10)
						128.90		3.00

End of W/S 3.00 m
(Thickness of basal layer not proven)

Remarks:

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD WINDOW SAMPLER LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Ground Solutions Group
Hanover Close
Cobbs Wood Estate
Ashford, Kent, TN23 1EJ
Tel: 01233 658270/277
Fax: 01233 658299
eMail: gsg@groundsolutions.co.uk

Window Sampler Log No. WS6

Sheet: 1 of 1

Equipment & Methods.
Track mounted window sampling rig.Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 130.35 AOD

Date Started:05/04/2005
Date Completed:05/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
					MADE GROUND. Topsoil.	130.25		(0.10)
0.30 - 0.31		D			MADE GROUND. Dense ash, coal, brick and slag material.			(0.40)
						129.85		0.50
					MADE GROUND. Weak thin reworked grey mudstone.			(0.25)
0.80 - 0.81		D				129.60		0.75
					MADE GROUND. Stiff reworked clay containing much ash, coal and brick.			(0.25)
						129.35		1.00
					Soft to firm white mottled orange CLAY.			(0.50)
1.50 - 1.51		D				128.85		1.50
					Bands of weak thinly laminated MUDSTONE and hard clay.			(1.50)
2.50 - 2.51		D						
						127.35		3.00

End of W/S 3.00 m
(Thickness of basal layer not proven)

Remarks:
Groundwater/soil gas monitoring standpipe installed.

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD WINDOW SAMPLER LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Ground Solutions Group
Hanover Close
Cobbs Wood Estate
Ashford, Kent, TN23 1EJ
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Fax: 01233 658299
eMail: gsg@groundsolutions.co.uk

Window Sampler Log No. WS7

Sheet: 1 of 1

Equipment & Methods.
Track mounted window sampling rig.Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 131.55 AOD

Date Started:05/04/2005
Date Completed:05/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20 - 0.21		D			MADE GROUND. Stiff reworked clay containing much brick and mudstone fragments.			(1.50)
0.90 - 0.91		D						
1.20 - 1.21		D						
						130.05		1.50
					MADE GROUND. Dense ash, coal, brick and slag.			(0.50)
1.90 - 1.91		D						
						129.55		2.00
					Very stiff grey CLAY with weak mudstone and sandstone bands.			(1.10)
2.50 - 2.51		D						
						128.45		3.10
								End of W/S 3.10 m (Thickness of basal layer not proven)

Remarks:

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD WINDOW SAMPLER LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Ground Solutions Group
Hanover Close
Cobbs Wood Estate
Ashford, Kent, TN23 1EJ
Tel: 01233 658270/277
Fax: 01233 658299
eMail: gsg@groundsolutions.co.uk

Window Sampler Log No. WS8

Sheet: 1 of 1

Equipment & Methods.
Track mounted window sampling rig.Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 131.69 AOD

Date Started:05/04/2005
Date Completed:05/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
0.20 - 0.21		D			MADE GROUND. Turfed topsoil.	131.59		(0.10)
					MADE GROUND. Dense ash, coal, brick and slag.			(0.65)
0.70 - 0.71		D				130.94		0.75
					Very stiff orange mottled grey CLAY with weak mudstone bands.			
1.50 - 1.51		D						(1.75)
2.50 - 2.51		D				129.19		2.50
					End of W/S 2.50 m (Thickness of basal layer not proven)			

Remarks:

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD WINDOW SAMPLER LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Ground Solutions Group
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Window Sampler Log No. WS9

Sheet: 1 of 1

Equipment & Methods.
Track mounted window sampling rig.Support Used:None

Project Name: Pogmoor Works Contamination Assessment
Project Location: Stocks Lane, Barnsley, Yorkshire
Client: Jamestown Metal Resources Ltd

Job No: D108892

Co-ordinates:
E:
N:

Ground Level (m): 132.05 AOD

Date Started:05/04/2005
Date Completed:05/04/2005

Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)
Depth (m)	No.	Type	Result					
					MADE GROUND. Concrete.	131.95		(0.10)
					MADE GROUND. Crushed concrete and hardcore.			(0.50)
0.50 - 0.51		D				131.45		0.60
					Very stiff grey CLAY becoming weak weathered mudstone from 1.2 m.			
1.00 - 1.01		D						(1.00)
1.50 - 1.51		D				130.45		1.60

Remarks:
Groundwater/soil gas monitoring standpipe installed.

Logged By: GL
Checked By:
Scale: 1:35
Approved By:
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

GSG STANDARD WINDOW SAMPLER LOG V2 POGGMOOR WORKS.GPJ GSG-AGS3-STD TEMPLATE.GDT 10/5/10

Appendix 4 – Soil Gas Monitoring Results

SOIL GAS SURVEY

Project: Pogmoor Works
Location: Barnsley
Job No/JEN D108892

Date: 13/05/2005
Weather: Sunny
Temp: 16c

Equipment Used GA2000
PID

(insert serial numbers)

Monitoring Point No.	CH_4 (% v/v)	O_2 (% v/v)	CO_2 (% v/v)	Flow (l/hr)	H_2S	CO	Photo Ionisation Detector (ppm) *	Depth to Ground Water (mbd)
BH1	NF	NF	NF	NF				-
BH2	0.3	17.3	2.3	<0.2				-
BH3	<0.25	19.5	<0.25	<0.2				-
BH4	0.3	12.7	6.3	0.4				-
WS2	0.3	17.3	2.3	<0.2				
WS4	<0.25	17.3	4.1	<0.2				-
WS6	<0.25	18.3	0.4	<0.2				-
WS9	<0.25	18.6	<0.25	<0.2				-
WS10	<0.25	18.0	1.4	<0.2				-
WS15	0.3	16.6	1.9	0.4				

Site Observations

Time	*Barometric Pressure*
Start	1012 mb
Finish	1012mb

Datum Description:
Elevation of datum wrt ground level:

Comments

NF - BH 1 cover not found

Tested by: GL
Checked by: AMM

mbd = metres below datum

GROUND SOLUTIONS GROUP

Notes: * For indicative purposes only

Accuracy of Readings:- **0-5% CH_4**: the greater of 10% reading or 0.25% CH_4; **5-50% CH_4**: the greater of 10% reading or 1% CH_4; **50-100% CH_4**: 5% reading
0-30% O_2: 0.5% O_2
0-5% CO_2: the greater of 10% reading or 0.25% CO_2; **5-30% CO_2**: the greater of 10% reading or 1% CO_2; **30-100% CO2**: 6% reading

SOIL GAS SURVEY

Project: Pogmoor Works
Location: Barnsley
Job No/JEN D108892

Date: 25/04/2005
Weather: Sunny
Temp: 13c

Equipment Used GA2000
PID

(insert serial numbers)

Monitoring Point No.	CH_4 (% v/v)	O_2 (% v/v)	CO_2 (% v/v)	Flow (l/hr)	H_2S	CO	Photo Ionisation Detector (ppm) *	Depth to Ground Water (mbd)
BH1	<0.25	11.4	6	<0.2				2.3
BH2	<0.25	16.9	2.6	<0.2				2.6
BH3	<0.25	19.5	0.6	<0.2				1.9
BH4	<0.25	15.2	3.8	<0.2				N/D
WS2	<0.25	18.3	2.3	<0.2				1.6
WS4	<0.25	17.0	3.5	<0.2				2.1
WS6	<0.25	19.9	0.6	<0.2				1.3
WS9	<0.25	18.4	<0.25	<0.2				1.1
WS10	<0.25	17.7	1.3	<0.2				2.5
WS15	<0.25	17.6	2.1	<0.2				4.1

Site Observations

Time	*Barometric Pressure*
Start	997mb
Finish	997mb

Datum Description:
Elevation of datum wrt ground level:

Comments

Tested by: GL
Checked by: AMM

mbd = metres below datum

GROUND SOLUTIONS GROUP

Notes: * For indicative purposes only

Accuracy of Readings:- **0-5% CH_4**: the greater of 10% reading or 0.25% CH_4; **5-50% CH_4**: the greater of 10% reading or 1% CH_4; **50-100% CH_4**: 5% reading
0-30% O_2: 0.5% O_2
0-5% CO_2: the greater of 10% reading or 0.25% CO_2; **5-30% CO_2**: the greater of 10% reading or 1% CO_2; **30-100% CO2**: 6% reading

Appendix 5 – Analytical Test Results

Adrian Milton
Ground Solutions Group
The Design Innovation Centre
46 The Calls
Leeds
LS2 7EY

7-Jun-2006

Telephone: 0113 246 1844
Fax: 0113 246 1796

Report Number:	6834	Quote No:	
Your Order No.		Instructions dated:	26-May-2006
Date Sampled:		Soil samples	18
		Water Samples	0
		Other Samples	0
Project Name:	Pogmoor Works		
		Date Received	30-May-2006
Project Code:	D112618	Time Received:	10:00

Nick Watson
Business Manager
For and on behalf of
i2 analytical ltd

Russell Jarvis
Business Development Manager
For and on behalf of
i2 analytical ltd

TEST REPORT

ANALYTICAL RESULTS - SOILS

i2 Report Number: **6834**

Issued 7-Jun-2006

Instructions dated: 26.5.2006

CLIENT: Ground Solutions Group

18 soil samples

Project Name: Pogmoor Works

Project code: D112618

Lab Ref No.		**i2 55210**	**i2 55211**	**i2 55212**	**i2 55213**	**i2 55214**	**i2 55215**	**i2 55216**	**i2 55217**
Sample No.		TP1/D1	TP1/D3	TP1/D4	TP2/D1	TP2/D3	TP2/D5	TP3/D1	TP3/D4
Sample Depth (m)		-	-	-	-	-	-	-	-
Sample Description	**Method**	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
pH Value	L005	7.3	8.1	8.1	7.5	7.9	8.0	7.9	8.1
w/s Sulphate 2:1 (g/l)		0.02	0.27	0.24	0.03	0.07	0.04	0.05	0.05
Speciated PAHs (Dutch 10)	L008	0.53	3.4	281	1.4	2.6	61	0.19	<0.05
Speciated PAHs (EPA-16)	L008	0.60	4.5	387	1.7	3.4	81	0.19	<0.05
Mineral Oil	L015	<10	355	<10	<10	91	37	<10	<10
TPH 4 C10-C20	L015	<10	110	590	10	26	190	29	<10
TPH 4 C20-C30	L015	<10	430	1500	27	150	440	66	<10
TPH 4 C30-C40	L015	<10	170	690	26	160	210	35	<10
Total TPH C10-C40	L015	<10	710	2780	63	336	840	131	<10
w/s Boron	L018	<1	13	2.8	<1	1.6	3.8	1.3	<1
Arsenic	L012	<10	53	46	10	94	40	79	<10
Cadmium	L012	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	L012	25	35	22	21	250	43	23	16
Lead	L012	26	210	250	230	14000	410	26	8.5
Mercury	L012	<0.3	3.15	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Selenium	L012	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Copper	L012	27	250	430	41	1700	690	110	98
Nickel	L012	32	78	38	29	330	45	42	31
Zinc	L012	89	550	560	96	8600	470	25	<10

All results expressed in mg/kg air dried basis except for pH or as indicated.

TEST REPORT

ANALYTICAL RESULTS - SOILS

i2 Report Number: **6834**

Issued 7-Jun-2006

Instructions dated: 26.5.2006

CLIENT: Ground Solutions Group

18 soil samples

Project Name: Pogmoor Works

Project code: D112618

Lab Ref No.		**i2 55218**	**i2 55219**	**i2 55220**	**i2 55221**	**i2 55222**	**i2 55223**	**i2 55224**	**i2 55225**
Sample No.		TP4/D1	TP4/D3	TP5/D1	TP5/D3	TP6/D1	TP6/D2	TP6/D3	TP7/D1
Sample Depth (m)		-	-	-	-	-	-	-	-
Sample Description	**Method**	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
pH Value	L005	7.3	7.6	7.5	7.9	8.0	7.9	8.1	7.9
w/s Sulphate 2:1 (g/l)		0.07	0.07	0.01	0.08	0.22	0.01	0.46	0.03
Speciated PAHs (Dutch 10)	L008	8.5	2.9	0.97	5.0	26	2.2	72.3	33
Speciated PAHs (EPA-16)	L008	12	4.0	1.3	6.8	39	3.0	102	47
Mineral Oil	L015	<10	<10	<10	340	113	139	155	72
TPH 4 C10-C20	L015	34	<10	<10	100	62	40	92	59
TPH 4 C20-C30	L015	84	<10	<10	710	410	140	540	230
TPH 4 C30-C40	L015	36	<10	<10	570	160	130	520	210
Total TPH C10-C40	L015	154	<10	<10	1380	632	310	1152	499
w/s Boron	L018	2.6	1.7	<1	3.2	9.1	<1	4.7	2.3
Arsenic	L012	53	52	13	55	13	15	25	18
Cadmium	L012	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	L012	17	24	20	63	44	23	28	21
Lead	L012	120	240	77	1400	220	860	170	130
Mercury	L012	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Selenium	L012	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Copper	L012	110	91	27	950	220	55	100	71
Nickel	L012	43	37	19	50	27	29	26	21
Zinc	L012	100	86	78	1000	130	140	390	140

All results expressed in mg/kg air dried basis except for pH or as indicated.

TEST REPORT

ANALYTICAL RESULTS - SOILS

i2 Report Number: **6834**

Issued 7-Jun-2006

Instructions dated: 26.5.2006

CLIENT: Ground Solutions Group

18 soil samples

Project Name: Pogmoor Works

Project code: D112618

Lab Ref No.		**i2 55226**	**i2 55227**						
Sample No.		TP7/D2	TP7/D3						
Sample Depth (m)		-	-						
Sample Description	**Method**	Soil	Soil						
pH Value	L005	8.1	8.1						
w/s Sulphate 2:1 (g/l)		0.08	0.03						
Speciated PAHs (Dutch 10)	L008	59	6.8						
Speciated PAHs (EPA-16)	L008	82	10						
Mineral Oil	L015	84	47						
TPH 4 C10-C20	L015	89	39						
TPH 4 C20-C30	L015	390	100						
TPH 4 C30-C40	L015	300	84						
Total TPH C10-C40	L015	779	223						
w/s Boron	L018	2.0	1.9						
Arsenic	L012	43	<10						
Cadmium	L012	<0.5	<0.5						
Chromium	L012	89	20						
Lead	L012	200	50						
Mercury	L012	<0.3	<0.3						
Selenium	L012	<0.5	<0.5						
Copper	L012	140	36						
Nickel	L012	59	18						
Zinc	L012	300	110						

All results expressed in mg/kg air dried basis except for pH or as indicated.

TEST REPORT

ANALYTICAL RESULTS - Speciated PAHs - soils

i2 Report No: 6834

Issued 7-Jun-2006

Instructions dated: 26.5.2006

CLIENT: Ground Solutions Group

18 soil samples

Project Name: Pogmoor Works

Project code: D112618

Lab Ref No.		**i2 55210**	**i2 55211**	**i2 55212**	**i2 55213**	**i2 55214**	**i2 55215**	**i2 55216**	**i2 55217**
Sample No.		TP1/D1	TP1/D3	TP1/D4	TP2/D1	TP2/D3	TP2/D5	TP3/D1	TP3/D4
Sample Depth (m)		-	-	-	-	-	-	-	-
Sample Description		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
PAH	naphthalene	<0.05	0.06	17	0.08	<0.05	5.33	0.05	<0.05
	acenaphthylene	<0.05	<0.05	1.2	<0.05	<0.05	1.3	<0.05	<0.05
	acenaphthene	<0.05	<0.05	14	<0.05	<0.05	0.96	<0.05	<0.05
	fluorene	<0.05	<0.05	16	<0.05	<0.05	2.5	<0.05	<0.05
	phenanthrene	0.05	0.29	66	0.29	0.21	14	0.06	<0.05
	anthracene	<0.05	0.07	22	<0.05	<0.05	3.8	<0.05	<0.05
	fluoranthene	0.11	0.81	68	0.30	0.47	15	<0.05	<0.05
	pyrene	0.07	0.70	52	0.20	0.42	11	<0.05	<0.05
	benzo(a)anthracene	0.06	0.45	32	0.10	0.29	5.6	<0.05	<0.05
	chrysene	0.14	0.56	23	0.20	0.42	5.9	0.08	<0.05
	benzo(b)fluoranthene	<0.05	0.41	20	0.10	0.39	3.7	<0.05	<0.05
	benzo(k)fluoranthene	0.17	0.45	15	0.24	0.33	2.8	<0.05	<0.05
	benzo(a)pyrene	<0.05	0.33	22	<0.05	0.31	4.7	<0.05	<0.05
	indeno(1,2,3-cd)pyrene	<0.05	0.17	8.1	0.06	0.21	2.4	<0.05	<0.05
	dibenzo(a,h)anthracene	<0.05	<0.05	1.7	<0.05	<0.05	0.41	<0.05	<0.05
	benzo(ghi)perylene	<0.05	0.24	8.3	0.10	0.31	2.4	<0.05	<0.05
	Total Dutch-10 PAHs	0.53	3.4	281	1.4	2.6	61	0.19	<0.05
	Total EPA-16 PAHs	0.60	4.5	387	1.7	3.4	81	0.19	<0.05

Results expressed in mg/kg air dried basis

TEST REPORT

ANALYTICAL RESULTS - Speciated PAHs - soils

i2 Report No: **6834**

Issued 7-Jun-2006

Instructions dated: 26.5.2006

CLIENT: Ground Solutions Group

18 soil samples

Project Name: Pogmoor Works

Project code: D112618

Lab Ref No.		**i2 55218**	**i2 55219**	**i2 55220**	**i2 55221**	**i2 55222**	**i2 55223**	**i2 55224**	**i2 55225**
Sample No.		TP4/D1	TP4/D3	TP5/D1	TP5/D3	TP6/D1	TP6/D2	TP6/D3	TP7/D1
Sample Depth (m)		-	-	-	-	-	-	-	-
Sample Description		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
PAH	naphthalene	0.06	<0.05	0.05	0.15	0.09	<0.05	0.27	0.18
	acenaphthylene	0.24	<0.05	<0.05	0.16	0.25	<0.05	0.75	0.21
	acenaphthene	<0.05	<0.05	<0.05	<0.05	1.2	<0.05	0.62	0.66
	fluorene	0.07	<0.05	<0.05	<0.05	1.5	<0.05	0.88	0.61
	phenanthrene	1.3	0.32	0.18	0.15	3.1	0.27	7.1	5.7
	anthracene	0.37	0.08	<0.05	0.27	1.8	0.08	3.3	1.8
	fluoranthene	2.5	0.92	0.21	0.94	7.7	0.49	18	9.1
	pyrene	2.0	0.75	0.17	0.73	6.4	0.31	16	7.4
	benzo(a)anthracene	1.1	0.32	0.09	0.73	3.2	0.16	11	4.1
	chrysene	1.1	0.52	0.20	0.67	3.2	0.26	11	4.3
	benzo(b)fluoranthene	0.79	0.35	0.11	0.83	3.0	0.28	10	4.5
	benzo(k)fluoranthene	0.71	0.20	0.08	0.41	1.4	0.24	4.9	2.1
	benzo(a)pyrene	0.72	0.24	<0.05	0.65	2.8	0.15	9.1	1.1
	indeno(1,2,3-cd)pyrene	0.32	0.10	0.07	0.44	1.3	0.27	3.9	2.0
	dibenzo(a,h)anthracene	<0.05	<0.05	<0.05	0.06	0.51	0.21	1.3	0.68
	benzo(ghi)perylene	0.40	0.16	0.09	0.57	1.5	0.26	3.9	2.2
	Total Dutch-10 PAHs	8.5	2.9	1.0	5.0	26	2.2	72	33
	Total EPA-16 PAHs	12	4.0	1.3	6.8	39	3.0	102	47

Results expressed in mg/kg air dried basis

TEST REPORT

ANALYTICAL RESULTS - Speciated PAHs - soils

i2 Report No: 6834

Issued 7-Jun-2006

Instructions dated: 26.5.2006

CLIENT: Ground Solutions Group

18 soil samples

Project Name: Pogmoor Works

Project code: D112618

Lab Ref No.		**i2 55226**	**i2 55227**						
Sample No.		TP7/D2	TP7/D3						
Sample Depth (m)		-	-						
Sample Description		Soil	Soil						
PAH	naphthalene	0.33	<0.05						
	acenaphthylene	1.2	0.06						
	acenaphthene	0.53	0.05						
	fluorene	1.6	0.05						
	phenanthrene	11	0.84						
	anthracene	3.1	0.26						
	fluoranthene	15	1.8						
	pyrene	12	1.4						
	benzo(a)anthracene	7.5	0.78						
	chrysene	7.2	0.84						
	benzo(b)fluoranthene	7.1	0.91						
	benzo(k)fluoranthene	3.2	0.37						
	benzo(a)pyrene	5.9	0.79						
	indeno(1,2,3-cd)pyrene	2.6	0.55						
	dibenzo(a,h)anthracene	0.62	0.34						
	benzo(ghi)perylene	2.9	0.58						
	Total Dutch-10 PAHs	59	6.8						
	Total EPA-16 PAHs	82	9.6						

Results expressed in mg/kg air dried basis

Adrian Milton
Ground Solutions Group
The Design Innovation Centre
46 The Calls
Leeds
LS2 7EY

1-Jun-2006

Telephone: 0113 246 1844
Fax: 0113 246 1796

Report Number:	6755	Quote No:	
Your Order No.	7473	Instructions dated:	23-May-2006
Date Sampled:		Soil samples	0
		Water Samples	1
		Other Samples	0
Project Name:	Pogmoor Works		
		Date Received	24-May-2006
Project Code:		Time Received:	10:00

Russell Jarvis
Business Development Manager
For and on behalf of
i2 analytical ltd

Les Jones
Technical Director
For and on behalf of
i2 analytical ltd

TEST REPORT

ANALYTICAL RESULTS - WATERS

i2 Report Number: **6755**

Issued 1-Jun-2006

Instructions dated: 23.5.2006

CLIENT: Ground Solutions Group

1 water sample

Project Name: Pogmoor Works

Lab Ref No.		**i2 054867**
Sample No.		WS1
Sample Depth (m)		
Sample Description	**Method**	Water
pH Value	L005	8.1
Sulphate as SO_4	L011	200000
Mineral Oil C10 - C40	L016	240
TPH 4 C10 - C20	L016	46
TPH 4 C20 - C30	L016	140
TPH 4 C30 - C40	L016	97
Total TPH 4 C10 - C40	L016	283
Total PAHs (Dutch 10)	L009	6.6
Total PAHs (EPA-16)	L009	14
Boron		2400
Arsenic	L020	<10
Cadmium	L020	<5
Chromium	L020	<10
Lead	L020	17
Mercury	L020	<0.1
Selenium	L020	<10
Copper	L020	48
Nickel	L020	15
Zinc	L020	51

All results expressed in µg/l except for pH or as indicated.

TEST REPORT

ANALYTICAL RESULTS - Speciated PAHs - waters

i2 Report Number: 6755

Instructions dated: 23.5.2006

1 water sample

Project Name: Pogmoor Works

Issued 1-Jun-2006

CLIENT: Ground Solutions Group

Lab Ref No.		**i2 054867**
Sample No.		WS1
Sample Depth (m)		
Sample Description		Water
PAH	naphthalene	3.1
	acenaphthylene	0.09
	acenaphthene	4.9
	fluorene	0.60
	phenanthrene	0.30
	anthracene	0.19
	fluoranthene	0.60
	pyrene	0.56
	benzo(a)anthracene	0.32
	chrysene	0.26
	benzo(b)fluoranthene	0.93*
	benzo(k)fluoranthene	
	benzo(a)pyrene	1.1
	indeno(1,2,3-cd)pyrene	0.31
	dibenzo(a,h)anthracene	0.11
	benzo(ghi)perylene	0.46
	Total Dutch-10 PAHs	6.6
	Total EPA-16 PAHs	14

Results expressed in µg/l * *Compounds co-eluted*

Appendix 6 – Mean Value Test Sheets

Job number *D112618*
Site *Pogmoor Works*
Parameter *BaP*

Concentrations		
N	X	Y=log(X)
1	0.1	-1.000
2	0.1	-1.000
3	0.1	-1.000
4	1	0.000
5	0.8	-0.097
6	1	0.000
7	0.1	-1.000
8	0.3	-0.523
9	0.5	-0.301
10	0.7	-0.155
11	7.5	0.875
12	1.2	0.079
13	0.1	-1.000
14	0.1	-1.000
15	0.1	-1.000
16	6.9	0.839
17	0.1	-1.000
18	6.4	0.806
19	0.1	-1.000
20	1	0.000
21	1.9	0.279
22	2.4	0.380
23	0.1	-1.000
24	1.3	0.114
25	0.1	-1.000
26	0.1	-1.000
27	0.1	-1.000
28	5.7	0.756
29	0.1	-1.000
30	45	1.653
31	0.6	-0.222
32	0.1	-1.000
33	0.1	-1.000
34	0.1	-1.000
35	0.1	-1.000
36	0.1	-1.000
37	0.1	-1.000
38	3.5	0.544
39	1.6	0.204
40	0.2	-0.699
41	0.1	-1.000
42	0.2	-0.699
43	1.4	0.146
44	2.4	0.380
45	1.1	0.041
46	0.05	-1.301
47	0.33	-0.481
48	22	1.342
49	0.05	-1.301
50	0.31	-0.509
51	4.7	0.672
52	0.05	-1.301
53	0.05	-1.301
54	0.72	-0.143
55	0.24	-0.620
56	0.05	-1.301
57	0.65	-0.187
58	2.8	0.447
59	0.15	-0.824
60	9.1	0.959
61	1.1	0.041
62	5.9	0.771
63	0.79	-0.102

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	2.3	-0.3
Standard Dev. Sx=	6.4	0.8
Max value=	45.0	1.653

n=	63
t=	1.671

MEAN VALUE	UCL = 3.66

MAX VALUE	T (Crit) 5% for N =	2.56
	T (Calc) =	2.65

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *PAH*

Concentrations		
N	X	Y=log(X)
1	7.5	0.875
2	2	0.301
3	3.2	0.505
4	12	1.079
5	12	1.079
6	39	1.591
7	5	0.699
8	6	0.778
9	14	1.146
10	9	0.954
11	100	2.000
12	12	1.079
13	2	0.301
14	8.7	0.940
15	2	0.301
16	49	1.690
17	2	0.301
18	58	1.763
19	2	0.301
20	12	1.079
21	15	1.176
22	33	1.519
23	4.4	0.643
24	17	1.230
25	12	1.079
26	2	0.301
27	2	0.301
28	72	1.857
29	2	0.301
30	500	2.699
31	6.7	0.826
32	2.1	0.322
33	2	0.301
34	2	0.301
35	2	0.301
36	2	0.301
37	2	0.301
38	25	1.398
39	11	1.041
40	14	1.146
41	2.2	0.342
42	2	0.301
43	3.8	0.580
44	21	1.322
45	42	1.623

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	25.7	0.9
Standard Dev. Sx=	75.2	0.6
Max value=	500.0	2.699

n=	45
t=	1.699

MEAN VALUE	US_o = 14.75

MAX VALUE	T (Crit) 5% for N =	2.56
	T (Calc) =	3.08

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *Arsenic*

Concentrations		
N	X	Y=log(X)
1	16	1.204
2	8.1	0.908
3	24	1.380
4	70	1.845
5	36	1.556
6	11	1.041
7	11	1.041
8	15	1.176
9	32	1.505
10	34	1.531
11	36	1.556
12	26	1.415
13	3.6	0.556
14	25	1.398
15	26	1.415
16	5.6	0.748
17	22	1.342
18	9.2	0.964
19	53	1.724
20	16	1.204
21	52	1.716
22	35	1.544
23	17	1.230
24	57	1.756
25	12	1.079
26	3.3	0.519
27	26	1.415
28	11	1.041
29	12	1.079
30	2	0.301
31	7.6	0.881
32	10	1.000
33	54	1.732
34	10	1.000
35	47	1.672
36	23	1.362
37	19	1.279
38	21	1.322
39	46	1.663
40	85	1.929
41	17	1.230
42	17	1.230
43	17	1.230
44	87	1.940
45	29	1.462
46	10	1.000
47	53	1.724
48	46	1.663
49	10	1.000
50	94	1.973
51	40	1.602
52	79	1.898
53	10	1.000
54	53	1.724
55	52	1.716
56	13	1.114
57	55	1.740
58	13	1.114
59	15	1.176
60	25	1.398
61	18	1.255
62	43	1.633
63	10	1.000

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	29.1	1.3
Standard Dev. Sx=	22.4	0.4
Max value=	94.0	1.973

n=	63
t=	1.671

MEAN VALUE	US[illegible]

MAX VALUE	T (Crit) 5% for N =	2.56
	T (Calc) =	1.77

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *Nickel*

Concentrations		
N	X	Y=log(X)
1	48	1.681
2	30	1.477
3	45	1.653
4	57	1.756
5	37	1.568
6	34	1.531
7	31	1.491
8	28	1.447
9	29	1.462
10	38	1.580
11	50	1.699
12	16	1.204
13	22	1.342
14	25	1.398
15	33	1.519
16	24	1.380
17	35	1.544
18	27	1.431
19	63	1.799
20	29	1.462
21	38	1.580
22	27	1.431
23	22	1.342
24	9.1	0.959
25	41	1.613
26	64	1.806
27	31	1.491
28	28	1.447
29	41	1.613
30	34	1.531
31	26	1.415
32	31	1.491
33	50	1.699
34	55	1.740
35	44	1.643
36	30	1.477
37	25	1.398
38	23	1.362
39	31	1.491
40	64	1.806
41	25	1.398
42	40	1.602
43	40	1.602
44	190	2.279
45	57	1.756
46	32	1.505
47	78	1.892
48	38	1.580
49	29	1.462
50	330	2.519
51	45	1.653
52	42	1.623
53	31	1.491
54	43	1.633
55	37	1.568
56	19	1.279
57	50	1.699
58	27	1.431
59	29	1.462
60	26	1.415
61	21	1.322
62	59	1.771
63	18	1.255

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	43.2	1.6
Standard Dev. Sx=	43.6	0.2
Max value=	330.0	2.519

n=	63
t=	1.671

MEAN VALUE	US = 52.37

MAX VALUE	T (Crit) 5% for N = 2.56
	T (Calc) = 4.27

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *Cadmium*

Concentrations		
N	X	Y=log(X)
1	0.5	-0.301
2	0.1	-1.000
3	0.17	-0.770
4	0.1	-1.000
5	0.74	-0.131
6	0.1	-1.000
7	0.24	-0.620
8	0.17	-0.770
9	0.1	-1.000
10	3.3	0.519
11	0.44	-0.357
12	0.1	-1.000
13	0.1	-1.000
14	0.1	-1.000
15	0.1	-1.000
16	0.1	-1.000
17	0.1	-1.000
18	0.1	-1.000
19	0.1	-1.000
20	0.1	-1.000
21	1.3	0.114
22	0.1	-1.000
23	0.46	-0.337
24	0.1	-1.000
25	0.1	-1.000
26	0.1	-1.000
27	0.1	-1.000
28	0.1	-1.000
29	0.17	-0.770
30	0.1	-1.000
31	0.25	-0.602
32	0.1	-1.000
33	0.1	-1.000
34	0.1	-1.000
35	0.1	-1.000
36	0.1	-1.000
37	0.1	-1.000
38	0.1	-1.000
39	0.5	-0.301
40	0.62	-0.208
41	0.1	-1.000
42	0.25	-0.602
43	0.21	-0.678
44	8.4	0.924
45	0.59	-0.229
46	0.5	-0.301
47	0.5	-0.301
48	0.5	-0.301
49	0.5	-0.301
50	0.5	-0.301
51	0.5	-0.301
52	0.5	-0.301
53	0.5	-0.301
54	0.5	-0.301
55	0.5	-0.301
56	0.5	-0.301
57	0.5	-0.301
58	0.5	-0.301
59	0.5	-0.301
60	0.5	-0.301
61	0.5	-0.301
62	0.5	-0.301
63	0.5	-0.301

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	0.5	-0.6
Standard Dev. Sx=	1.1	0.4
Max value=	8.4	0.924

n=	63
t=	1.699

MEAN VALUE	US(=).71

MAX VALUE	T (Crit) 5% for N =	2.56
	T (Calc) =	3.63

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *Zinc*

Concentrations		
N	X	Y=log(X)
1	590	2.771
2	120	2.079
3	110	2.041
4	41	1.613
5	37	1.568
6	78	1.892
7	72	1.857
8	70	1.845
9	81	1.908
10	250	2.398
11	150	2.176
12	35	1.544
13	63	1.799
14	46	1.663
15	47	1.672
16	120	2.079
17	110	2.041
18	76	1.881
19	72	1.857
20	76	1.881
21	280	2.447
22	53	1.724
23	72	1.857
24	24	1.380
25	75	1.875
26	110	2.041
27	65	1.813
28	59	1.771
29	53	1.724
30	76	1.881
31	160	2.204
32	83	1.919
33	72	1.857
34	120	2.079
35	110	2.041
36	67	1.826
37	65	1.813
38	130	2.114
39	79	1.898
40	140	2.146
41	85	1.929
42	160	2.204
43	140	2.146
44	850	2.929
45	360	2.556
46	89	1.949
47	550	2.740
48	560	2.748
49	96	1.982
50	8600	3.934
51	470	2.672
52	25	1.398
53	10	1.000
54	100	2.000
55	86	1.934
56	78	1.892
57	1000	3.000
58	130	2.114
59	140	2.146
60	390	2.591
61	140	2.146
62	300	2.477
63	110	2.041

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	295.3	2.1
Standard Dev. Sx=	1080.1	0.4
Max value=	8600.0	3.934

n=	63
t=	1.671

MEAN VALUE	[illegible]
MAX VALUE	T (Crit) 5% for N = 2.56
	T (Calc) = 4.25

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *Copper*

Concentrations		
N	X	Y=log(X)
1	130	2.114
2	23	1.362
3	57	1.756
4	84	1.924
5	50	1.699
6	21	1.322
7	38	1.580
8	39	1.591
9	52	1.716
10	75	1.875
11	100	2.000
12	33	1.519
13	20	1.301
14	48	1.681
15	55	1.740
16	21	1.322
17	70	1.845
18	26	1.415
19	110	2.041
20	39	1.591
21	160	2.204
22	52	1.716
23	30	1.477
24	36	1.556
25	33	1.519
26	47	1.672
27	120	2.079
28	23	1.362
29	33	1.519
30	28	1.447
31	79	1.898
32	29	1.462
33	72	1.857
34	47	1.672
35	74	1.869
36	32	1.505
37	31	1.491
38	54	1.732
39	61	1.785
40	150	2.176
41	32	1.505
42	63	1.799
43	68	1.833
44	380	2.580
45	140	2.146
46	27	1.431
47	250	2.398
48	430	2.633
49	41	1.613
50	1700	3.230
51	690	2.839
52	110	2.041
53	98	1.991
54	110	2.041
55	91	1.959
56	27	1.431
57	950	2.978
58	220	2.342
59	55	1.740
60	100	2.000
61	71	1.851
62	140	2.146
63	36	1.556

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	128.7	1.8
Standard Dev. Sx=	252.7	0.4
Max value=	1700.0	3.230

n=	63
t=	1.671

MEAN VALUE	$US_{e.} =$ 181.84

MAX VALUE	T (Crit) 5% for N =	2.56
	T (Calc) =	3.44

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmooor Works*
Parameter *Lead*

Concentrations		
N	X	Y=log(X)
1	2500	3.398
2	210	2.322
3	250	2.398
4	50	1.699
5	48	1.681
6	16	1.204
7	53	1.724
8	62	1.792
9	51	1.708
10	16000	4.204
11	3100	3.491
12	55	1.740
13	25	1.398
14	29	1.462
15	150	2.176
16	26	1.415
17	350	2.544
18	31	1.491
19	120	2.079
20	81	1.908
21	550	2.740
22	290	2.462
23	130	2.114
24	34	1.531
25	26	1.415
26	27	1.431
27	66	1.820
28	17	1.230
29	1500	3.176
30	32	1.505
31	1000	3.000
32	150	2.176
33	20	1.301
34	33	1.519
35	360	2.556
36	57	1.756
37	88	1.944
38	740	2.869
39	820	2.914
40	1000	3.000
41	1900	3.279
42	3000	3.477
43	720	2.857
44	840	2.924
45	490	2.690
46	26	1.415
47	210	2.322
48	250	2.398
49	230	2.362
50	14000	4.146
51	410	2.613
52	26	1.415
53	8.5	0.929
54	120	2.079
55	240	2.380
56	77	1.886
57	1400	3.146
58	220	2.342
59	860	2.934
60	170	2.230
61	130	2.114
62	200	2.301
63	50	1.699

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	884.5	2.226
Geo Mean =	168.3	
Standard Dev. Sx=	2670.7	0.73179
Max value=	16000.0	4.204

n=	63
t=	1.671

T (Crit) 5% for N =	2.56
T (Calc) =	2.70

Compiled by:	AMM
Checked by:	AMM
Approved by:	KM

Job number *D112618*
Site *Pogmoor Works*
Parameter *TPH*

Concentrations		
N	X	Y=log(X)
1	380	2.580
2	64	1.806
3	73	1.863
4	100	2.000
5	93	1.968
6	35	1.544
7	230	2.362
8	430	2.633
9	540	2.732
10	400	2.602
11	750	2.875
12	200	2.301
13	20	1.301
14	1800	3.255
15	82	1.914
16	200	2.301
17	28	1.447
18	280	2.447
19	24	1.380
20	31	1.491
21	45	1.653
22	91	1.959
23	35	1.544
24	40	1.602
25	200	2.301
26	22	1.342
27	20	1.301
28	240	2.380
29	20	1.301
30	1500	3.176
31	20	1.301
32	47	1.672
33	34	1.531
34	29	1.462
35	20	1.301
36	20	1.301
37	280	2.447
38	170	2.230
39	20	1.301
40	20	1.301
41	20	1.301
42	120	2.079
43	630	2.799
44	36	1.556
45	66	1.820
46	10	1.000
47	710	2.851
48	2780	3.444
49	63	1.799
50	336	2.526
51	840	2.924
52	131	2.117
53	10	1.000
54	154	2.188
55	10	1.000
56	10	1.000
57	1380	3.140
58	632	2.801
59	310	2.491
60	1152	3.061
61	499	2.698
62	779	2.892
63	223	2.348

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	310.1	2.0
Standard Dev. Sx=	498.4	0.7
Max value=	2780.0	3.444

n=	63
t=	1.671

MEAN VALUE	UP [illegible]
MAX VALUE	T (Crit) 5% for N = 2.56
	T (Calc) = 2.14

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmooor Works*
Parameter *Lead Zone A*

Concentrations		
N	X	Y=log(X)
1	2500	3.398
2	210	2.322
3	250	2.398
4	50	1.699
5	48	1.681
6	16	1.204
7	16000	4.204
8	3100	3.491
9	360	2.556
10	57	1.756
11	88	1.944
12	740	2.869
13	820	2.914
14	1000	3.000
15	1900	3.279
16	3000	3.477
17	720	2.857
18	840	2.924
19	490	2.690
20	26	1.415
21	210	2.322
22	250	2.398
23	230	2.362
24	14000	4.146
25	410	2.613
26	26	1.415
27	8.5	0.929
28	120	2.079
29	240	2.380
30	77	1.886
31	1400	3.146
32	220	2.342
33	860	2.934
34	170	2.230
35	130	2.114
36	200	2.301
37	50	1.699

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	1373.4	2.470
Geo Mean =	294.9	
Standard Dev. Sx=	3406.9	0.75879
Max value=	16000.0	4.204

n=	37
t=	1.699

T (Crit) 5% for N =	2.56
T (Calc) =	2.29

Compiled by:	AMM
Checked by:	AMM
Approved by:	KM

Job number *D112618*
Site *Pogmoor Works*
Parameter *Arsenic Zone A*

Concentrations		
N	X	Y=log(X)
1	16	1.204
2	8.1	0.908
3	24	1.380
4	70	1.845
5	36	1.556
6	11	1.041
7	34	1.531
8	36	1.556
9	47	1.672
10	23	1.362
11	19	1.279
12	21	1.322
13	46	1.663
14	85	1.929
15	17	1.230
16	17	1.230
17	17	1.230
18	87	1.940
19	29	1.462
20	10	1.000
21	53	1.724
22	46	1.663
23	10	1.000
24	94	1.973
25	40	1.602
26	79	1.898
27	10	1.000
28	53	1.724
29	52	1.716
30	13	1.114
31	55	1.740
32	13	1.114
33	15	1.176
34	25	1.398
35	18	1.255
36	43	1.633
37	10	1.000

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	34.7	1.4
Standard Dev. Sx=	24.3	0.3
Max value=	94.0	1.973

n=	37
t=	1.699

MEAN VALUE	US$_{95}$= [illegible]
MAX VALUE	T (Crit) 5% for N = 2.56
	T (Calc) = 1.73

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *Nickel Zone A*

Concentrations		
N	X	Y=log(X)
1	48	1.681
2	30	1.477
3	45	1.653
4	57	1.756
5	37	1.568
6	34	1.531
7	38	1.580
8	50	1.699
9	44	1.643
10	30	1.477
11	25	1.398
12	23	1.362
13	31	1.491
14	64	1.806
15	25	1.398
16	40	1.602
17	40	1.602
18	190	2.279
19	57	1.756
20	32	1.505
21	78	1.892
22	38	1.580
23	29	1.462
24	330	2.519
25	45	1.653
26	42	1.623
27	31	1.491
28	43	1.633
29	37	1.568
30	19	1.279
31	50	1.699
32	27	1.431
33	29	1.462
34	26	1.415
35	21	1.322
36	59	1.771
37	18	1.255

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	50.3	1.6
Standard Dev. Sx=	55.0	0.2
Max value=	330.0	2.519

n=	37
t=	1.699

TEST VALUE	Upper Outlier
MAX VALUE	T (Crit) 5% for N = 2.56
	T (Calc) = 3.74

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *Cadmium Zone A*

Concentrations		
N	X	Y=log(X)
1	0.5	-0.301
2	0.1	-1.000
3	0.17	-0.770
4	0.1	-1.000
5	0.74	-0.131
6	0.1	-1.000
7	3.3	0.519
8	0.44	-0.357
9	0.1	-1.000
10	0.1	-1.000
11	0.1	-1.000
12	0.5	-0.301
13	0.62	-0.208
14	0.1	-1.000
15	0.25	-0.602
16	0.21	-0.678
17	8.4	0.924
18	0.59	-0.229
19	0.1	-1.000

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	0.9	-0.5
Standard Dev. Sx=	2.0	0.6
Max value=	8.4	0.924

n=	19
t=	1.734

[illegible]	[illegible]

[illegible]	T (Crit) 5% for N = 2.5
	T (Calc) = 2.62

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *Copper Zinc A*

Concentrations		
N	X	Y=log(X)
1	130	2.114
2	23	1.362
3	57	1.756
4	84	1.924
5	50	1.699
6	21	1.322
7	75	1.875
8	100	2.000
9	74	1.869
10	32	1.505
11	31	1.491
12	54	1.732
13	61	1.785
14	150	2.176
15	32	1.505
16	63	1.799
17	68	1.833
18	380	2.580
19	140	2.146

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	85.5	1.8
Standard Dev. Sx=	80.8	0.3
Max value=	380.0	2.580

n=	19
t=	1.734

MEAN VALUE	U_{95}= 117.07

MAX VALUE	T (Crit) 5% for N =	2.5
	T (Calc) =	2.46

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *PAH Zone A*

Concentrations		
N	X	Y=log(X)
1	7.5	0.875
2	2	0.301
3	3.2	0.505
4	12	1.079
5	12	1.079
6	39	1.591
7	9	0.954
8	100	2.000
9	2	0.301
10	2	0.301
11	2	0.301
12	25	1.398
13	11	1.041
14	14	1.146
15	2.2	0.342
16	2	0.301
17	3.8	0.580
18	21	1.322
19	42	1.623

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	16.4	0.9
Standard Dev. Sx=	23.6	0.5
Max value=	100.0	2.000

n=	19
t=	1.734

[illegible]	[illegible]

[illegible]	T (Crit) 5% for N = 2.5
	T (Calc) = 2.06

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *BaP Zone A*

Concentrations		
N	X	Y=log(X)
1	0.1	-1.000
2	0.1	-1.000
3	0.1	-1.000
4	1	0.000
5	0.8	-0.097
6	1	0.000
7	0.7	-0.155
8	7.5	0.875
9	0.1	-1.000
10	0.1	-1.000
11	0.1	-1.000
12	2.4	0.380
13	1.1	0.041
14	1.4	0.146
15	0.2	-0.699
16	0.1	-1.000
17	0.2	-0.699
18	1.6	0.204
19	3.5	0.544
20	0.05	-1.301
21	0.33	-0.481
22	22	1.342
23	0.05	-1.301
24	0.31	-0.509
25	4.7	0.672
26	0.05	-1.301
27	0.05	-1.301
28	0.72	-0.143
29	0.24	-0.620
30	0.05	-1.301
31	0.65	-0.187
32	2.8	0.447
33	0.15	-0.824
34	9.1	0.959
35	1.1	0.041
36	5.9	0.771
37	0.79	-0.102

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	1.9	-0.3
Standard Dev. Sx=	4.0	0.7
Max value=	22.0	1.342

n=	37
t=	1.699

MEAN VALUE	US[illegible]
MAX VALUE	T (Crit) 5% for N = 2.56
	T (Calc) = 2.24

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *TPH Zone A*

Concentrations		
N	X	Y=log(X)
1	380	2.580
2	64	1.806
3	73	1.863
4	100	2.000
5	93	1.968
6	35	1.544
7	400	2.602
8	750	2.875
9	20	1.301
10	20	1.301
11	20	1.301
12	280	2.447
13	170	2.230
14	66	1.820
15	20	1.301
16	20	1.301
17	36	1.556
18	630	2.799
19	120	2.079
20	10	1.000
21	710	2.851
22	2780	3.444
23	63	1.799
24	336	2.526
25	840	2.924
26	131	2.117
27	10	1.000
28	154	2.188
29	10	1.000
30	10	1.000
31	1380	3.140
32	632	2.801
33	310	2.491
34	1152	3.061
35	499	2.698
36	779	2.892
37	223	2.348

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	360.2	2.1
Standard Dev. Sx=	536.2	0.7
Max value=	2780.0	3.444

n=	37
t=	1.699

MEAN VALUE	USL95= 760.64
MAX VALUE	T (Crit) 5% for N = 2.56
	T (Calc) = 1.91

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmooor Works*
Parameter *Lead Zone B*

Concentrations		
N	X	Y=log(X)
1	53	1.724
2	62	1.792
3	51	1.708
4	55	1.740
5	25	1.398
6	29	1.462
7	150	2.176
8	26	1.415
9	350	2.544
10	31	1.491
11	120	2.079
12	81	1.908
13	550	2.740
14	290	2.462
15	130	2.114
16	34	1.531
17	26	1.415
18	27	1.431
19	66	1.820
20	17	1.230
21	1500	3.176
22	32	1.505
23	100	2.000
24	150	2.176
25	20	1.301
26	33	1.519

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	154.2	1.841
Geo Mean =	69.3	
Standard Dev. Sx=	300.6	0.48462
Max value=	1500.0	3.176

n=	26
t=	1.708

T (Crit) 5% for N =	2.56
T (Calc) =	2.76

Compiled by:	AMM
Checked by:	AMM
Approved by:	KM

Job number *D112618*
Site *Pogmoor Works*
Parameter *Lead Zone B*

Concentrations		
N	X	Y=log(X)
1	53	1.724
2	62	1.792
3	51	1.708
4	55	1.740
5	25	1.398
6	29	1.462
7	150	2.176
8	26	1.415
9	350	2.544
10	31	1.491
11	120	2.079
12	81	1.908
13	550	2.740
14	290	2.462
15	130	2.114
16	34	1.531
17	26	1.415
18	27	1.431
19	66	1.820
20	17	1.230
21	1500	3.176
22	32	1.505
23	100	2.000
24	150	2.176
25	20	1.301
26	33	1.519

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	154.2	1.8
Standard Dev. Sx=	300.6	0.5
Max value=	1500.0	3.176

n=	26
t=	1.708

[illegible]	[illegible]
[illegible]	T (Crit) 5% for N = 2.56
	T (Calc) = 2.76

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *Nickel Zone B*

Concentrations		
N	X	Y=log(X)
1	31	1.491
2	28	1.447
3	29	1.462
4	16	1.204
5	22	1.342
6	25	1.398
7	33	1.519
8	24	1.380
9	35	1.544
10	27	1.431
11	63	1.799
12	29	1.462
13	38	1.580
14	27	1.431
15	22	1.342
16	9.1	0.959
17	41	1.613
18	64	1.806
19	31	1.491
20	28	1.447
21	41	1.613
22	34	1.531
23	26	1.415
24	31	1.491
25	50	1.699
26	55	1.740

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	33.0	1.5
Standard Dev. Sx=	13.0	0.2
Max value=	64.0	1.806

n=	26
t=	1.708

MEAN VALUE	UCL95= 37.41
MAX VALUE	T (Crit) 5% for N = 2.56
	T (Calc) = 1.80

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *TPH Zone B*

Concentrations		
N	X	Y=log(X)
1	230	2.362
2	430	2.633
3	540	2.732
4	200	2.301
5	20	1.301
6	1800	3.255
7	82	1.914
8	200	2.301
9	28	1.447
10	280	2.447
11	24	1.380
12	31	1.491
13	45	1.653
14	91	1.959
15	35	1.544
16	40	1.602
17	200	2.301
18	22	1.342
19	20	1.301
20	240	2.380
21	20	1.301
22	1500	3.176
23	20	1.301
24	47	1.672
25	34	1.531
26	29	1.462
27	20	1.301

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	230.7	1.9
Standard Dev. Sx=	432.7	0.6
Max value=	1800.0	3.255

n=	27
t=	1.706

SUSPECT VALUE	US_{1800} = 378.78

TOXIC VALUE	T (Crit) 5% for N =	2.56
	T (Calc) =	2.26

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *PAH Zone B*

Concentrations		
N	X	Y=log(X)
1	5	0.699
2	6	0.778
3	7.5	0.875
4	12	1.079
5	2	0.301
6	8.7	0.940
7	2	0.301
8	49	1.690
9	2	0.301
10	58	1.763
11	2	0.301
12	12	1.079
13	15	1.176
14	33	1.519
15	4.4	0.643
16	17	1.230
17	12	1.079
18	2	0.301
19	2	0.301
20	72	1.857
21	2	0.301
22	500	2.699
23	6.7	0.826
24	2.1	0.322
25	2	0.301
26	2	0.301
27	2	0.301

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	31.1	0.9
Standard Dev. Sx=	95.5	0.6
Max value=	500.0	2.699

n=	27
t=	1.706

MEAN VALUE	X_{95}= 92.45
MAX VALUE	T (Crit) 5% for N = 2.56
	T (Calc) = 2.93

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *BaP Zone B*

Concentrations		
N	X	Y=log(X)
1	0.1	-1.000
2	0.3	-0.523
3	0.5	-0.301
4	1.2	0.079
5	0.1	-1.000
6	0.1	-1.000
7	0.1	-1.000
8	6.9	0.839
9	0.1	-1.000
10	6.4	0.806
11	0.1	-1.000
12	1	0.000
13	1.9	0.279
14	2.4	0.380
15	0.1	-1.000
16	1.3	0.114
17	0.1	-1.000
18	0.1	-1.000
19	0.1	-1.000
20	0.1	-1.000
21	5.7	0.756
22	0.1	-1.000
23	45	1.653
24	0.6	-0.222
25	0.1	-1.000
26	0.1	-1.000
27	0.1	-1.000

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	2.8	-0.4
Standard Dev. Sx=	8.7	0.8
Max value=	45.0	1.653

n=	27
t=	1.706

MEAN VALUE	UCL95= 5.1
MAX VALUE	T (Crit) 5% for N = 2.56
	T (Calc) = 2.66

Compiled by:	GL
Checked by:	AMM
Approved by:	

Job number *D112618*
Site *Pogmoor Works*
Parameter *Arsenic ZoneB*

Concentrations		
N	X	Y=log(X)
1	11	1.041
2	15	1.176
3	32	1.505
4	26	1.415
5	3.6	0.556
6	25	1.398
7	26	1.415
8	5.6	0.748
9	22	1.342
10	9.2	0.964
11	53	1.724
12	16	1.204
13	52	1.716
14	35	1.544
15	17	1.230
16	57	1.756
17	12	1.079
18	3.3	0.519
19	26	1.415
20	11	1.041
21	12	1.079
22	2	0.301
23	7.6	0.881
24	10	1.000
25	54	1.732
26	10	1.000

Max value note:
If the value of T (calc) is smaller the critical value (T crit), then the maximum value may be accepted (at the prescribed level of confidence) as a member of the underlying population from which the other measurements were drawn.
If T (calc) is greater than the T(crit) value then the maximum value may be treated as an outlier.

Mean X =	21.3	1.2
Standard Dev. Sx=	16.7	0.4
Max value=	57.0	1.756

n=	26
t=	1.708

MEAN VALUE	UC 95% PCRB
MAX VALUE	T (Crit) 5% for N = 2.56
	T (Calc) = 1.48

Compiled by:	GL
Checked by:	AMM
Approved by:	

Appendix 7 – Capping Layer Calculations

Capping Layer Calculations

X=M(Cg-1)/(Cg-Cc)

M = 600	Capping Thickness									Notes
	Zone A (mm)	Zone B (mm)	*MV (A)*	Cg (A)	*MV (B)*	Cg (B)	*Tv*	Cc (A)	Cc (B)	
As	505.7	379.4	*41.45*	**2.07**	*26.88*	**1.34**	*20*	**0.80**	**0.80**	
Pb	32.1	No Cap	*2.680*	**1.01**	*2.003*	**0.76**	*2.650*	**0.80**	**0.80**	
Ni	366.5	No Cap	*65.70*	**1.31**	*37.41*	**0.75**	*50*	**0.80**	**0.80**	
TPH	54.2	No Cap	*509.94*	**1.02**	*372.73*	**0.75**	*500*	**0.80**	**0.80**	
BaP	538.9	571.2	*3.04*	**2.76**	*5.46*	**4.96**	*1.1*	**0.80**	**0.80**	
BaP	552.5	552.5	*3.66*	**3.33**	*3.66*	**3.33**	*1.1*	**0.80**	**0.80**	all data
BaP all data	509.6	509.6	*2.34*	**2.13**	*2.34*	**2.13**	*1.1*	**0.80**	**0.80**	all data outlier removed
BaP zone B		459.6	*3.04*	**2.76**	*1.82*	**1.65**	*1.1*	**0.80**	**0.80**	outlier removed

MV = Mean Value

Tv = Target Value

Cg = Contaminant Concentration of existing ground (expressed as a multiple of Tv)

Cc = Contaminant Concentration of Cover (expressed as a proportion of Tv, i.e. less than 1)