ARCADIS Design & Consultancy for natural and built assets

METALS PROCESSING AREA, FORMER STEELWORKS, REDCAR

Phase II Environmental Site Assessment Deep Soils and Controlled Waters

South Tees Development Corporation

REPORT NO. 10035117-AUK-XX-XX-RP-ZZ-0233-01-MRA_Deep_Soils

DECEMBER 2020

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Metals Processing Area Deep Soils and Controlled Waters, Former Steelworks Redcar, Environmental Site Assessment

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APPENDICES

1 Introduction

1.1 Project Background

The Metals Processing Area (MPA) (the site) is a land parcel situated at the Former Redcar Steelworks located within the Redcar, Lackenby, Grangetown and South Bank conurbations of the Borough of Redcar & Cleveland, within the industrial area generally known as 'South Tees'. Figure 1 in Appendix A provides details of the site location.

The "South Tees Regeneration Master Plan" dated November 2019 has been developed detailing the industrial-led regeneration of the Former Redcar Steelworks into a world class employment-generating zone and economic growth enabler for the Tees Valley.

The Masterplan has identified the MPA as being located within the South Bank Zone. The site is a priority development area and Arcadis understands this report is to be used within a detailed planning application for "*Demolition of existing buildings/ structures and engineering operations associated with ground remediation and preparation of land for development".*

1.2 Contract Details

Arcadis (UK) Limited (Arcadis) was appointed by South Tees Development Corporation (STDC) to oversee and manage a ground investigation undertaken by Allied Exploration and Geotechnics Limited (AEG) and to provide consultancy advice on the redevelopment of the site.

The work was carried out in accordance with the "*Prairie Site, Warrenby Site and the SLEMS Ground Investigations Provision of Consultancy Services"* Agreement between Tees Valley Combined Authority and Arcadis.

The scope of works was defined by Arcadis, on behalf of STDC, as presented in "Metals Recovery Area – PM and Technical Support (updated)" dated 1st July 2020. At the request of STDC the investigation was split into two phases, an initial investigation of shallow soils (completed) and a subsequent investigation of deeper soils and groundwater (this phase) to be conducted when further certainty on redevelopment scenarios had been confirmed.

1.3 Projects Aims and Objectives

As technical consultant, our specific objectives of this phase of works were to:

- Manage and technically supervise the site works, undertaken by AEG, on behalf of STDC;
- Direct the site works to ensure compliance by the ground investigation contractors with existing site management protocols and procedures;
- Specify the requirements for laboratory analysis;
- Analyse the results of ground investigations; and,
- Prepare interpretative technical reports, namely;
    - Prepare an interpretative technical report including an assessment of identified environmental risks associated with the site considering the findings of the initial shallow soils investigation (*Arcadis report ref: 10035117-AUK-XX-XX-RP-ZZ-0125-02-MPA_Shallow_Soils, issued November 2020*).
    - Prepare an interpretative technical report including an assessment of identified environmental risks associated with the site considering the findings of the subsequent deep soils (>4.5m bgl) and groundwater investigation (*this document*),

1.4 Report Aims

The aim of this environmental site assessment report is to use the available information to develop a conceptual site model (CSM) for the site and identify the potential significance of any source-pathway-receptor (SPR) linkages identified by the CSM in relation to deep soils and groundwater at the site. Where significant,

and potentially complete pollutant linkages are identified, suitable risk management/remediation recommendations are to be made.

1.5 Reliability / Limitations of Information

A complete list of Arcadis Study Limitations is presented in Appendix B.

It should be noted that ground conditions between exploratory holes may vary from those identified during this ground investigation; any design should take this into consideration.

2 Site Conceptualisation

No specific Phase I Environmental Site Assessment (ESA) exists for the site. However, the northern portion of the site is covered by the following document supplied by STDC:

- TS4 South Bank – Phase 1 Geo-Environmental Desk Study, prepared by CH2M Hill for the Homes and Communities Agency, report ref. 678079_TS4_002 dated August 2017 and marked Final.

The site is also considered in:

- South Industrial Zone ES - Vol 2 - Chapter H (Ground Conditions and Remediation), prepared by Arcadis for STDC and dated July 2020.
- Metals Processing Area, Former Steelworks, Redcar – Phase II Environmental Site Assessment (Shallow Soils), prepared by Arcadis for STDC, report ref. 10035117-AUK-XX-XX-RP-ZZ-0125-02-MPA_Shallow_Soils dated November 2020.

In addition, STDC also supplied the following documents:

- Former Steelworks Land, South Tees Outline Remedial Strategy, Prepared for South Tees Development Corporation by Wood, Ref 41825-wood-XX-XX-RP-OC-0001_S0_P01 dated 25th June 2019 [Wood 2019].

This section incorporates a review of the above reports, publicly available records, and data collected as part of the site investigation works by AEG. At the time of issue AEG's final factual ground investigation report [AEG, in press] was not available for review. This report has been completed based on **draft data** and will be updated when the final ground investigation factual report is available.

The scope completed by AEG included:

- 9no. boreholes drilled by a sonic rig, to a target depth of 20-25m bgl, or until rockhead was encountered; and,
- Soil sampling for in-field assessment and submission to Derwentside Environmental Testing Services (DETS), AEG in-house Geotechnical Laboratory and Thomas Research Services (TRS) laboratories for chemical and geotechnical testing.

2.1 Site Location

The MPA is located in the south west of the Former Redcar Steelworks and is bound by land occupied by MGT Teesside to the north, PD Ports to the east, the SLEMs and Cleveland Channel to the south and the wider South Bank site to the west. The site elevation generally ranges from approximately 7m to 12m above Ordnance Datum (AOD).

The centre of site is located at National Grid Reference: 454600, 522600; and an indicative post code for the site is TS10 5QW.

A Site Location Plan is presented on Figure 1 within Appendix A.

2.2 Site Description

The site is approximately 21.5 hectares in size and approximately rectangular in shape tapering to the south. The southern boundary is marked by a rapid change in level to the Cleveland Channel (approx. 2 to 3m AOD) with the SLEMs facility beyond. The Cleveland Channel discharges into the Lackenby Channel which runs parallel to the eastern boundary of the site. Both the Cleveland and Lackenby channels are tidal and discharge into the River Tees a short distance north of the site.

PD Ports facilities are located to the east (beyond the Cleveland Channel) and include a utility corridor, port buildings and wharf facilities. The area north of the site is currently under development as a biomass power station operated by MGT Teesside. A third party landfill (land rise) Highfield Environmental is located to the south of the site, the landfill is understood to accept wastes types including domestic and special.

At the time of the siteworks the site is covered by stockpiles of aggregates from the steelmaking process, which are being processed by a contractor. There are infrequent concrete structures including a large viewing

platform in the centre of the site, south of which are four buildings. With the exception of the viewing platform and the stockpiles the area is generally level and covered with aggregates of steel biproducts.

2.3 Site History

Based on a review of the documents in Section 2.1, the site was originally part of the Tees Estuary and comprised of sand. The site was reclaimed from the Tees between 1896 and 1938 by the assumed deposition of waste products from the steelmaking process. A number of small structures and a gun emplacement are shown on mapping from 1952 along with railway lines from 1959. The site is shown in its approximate current layout from 1991.

The site is understood to have been leased from Tata Steel to Harsco who undertook “recycling materials from iron and steelmaking for recovery of metals” under permit PP3338MTuntil 2020.

2.4 UXO Assessment

Mapping indicates that the slag deposits were placed at the site prior to the Second World War. Due to the perceived risk of encountering unexploded ordnance (UXO) on site, a down hole magnetometer was used at all exploratory locations which involved drilling into natural superficial deposits. An explosive ordnance engineer reviewed the magnetometer readings as drilling progressed to identify any magnetic anomalies which might indicate the presence of buried ordnance. No anomalies were encountered but two have been encountered elsewhere on the Redcar site.

2.5 Geology

Review of the British Geological Survey (BGS) data suggests that the majority of the site is underlain by Tidal Flat Deposits predominantly comprising sand and clay This is anticipated to be underlain by Glaciolacustrine Deposits and Glacial Till based on data from historic boreholes in the vicinity of the MPA.

Bedrock beneath the site is anticipated to comprise Mercia Mudstone. Excerpts from the BGS mapping data are presented as Figure 2 below and in Appendix A.

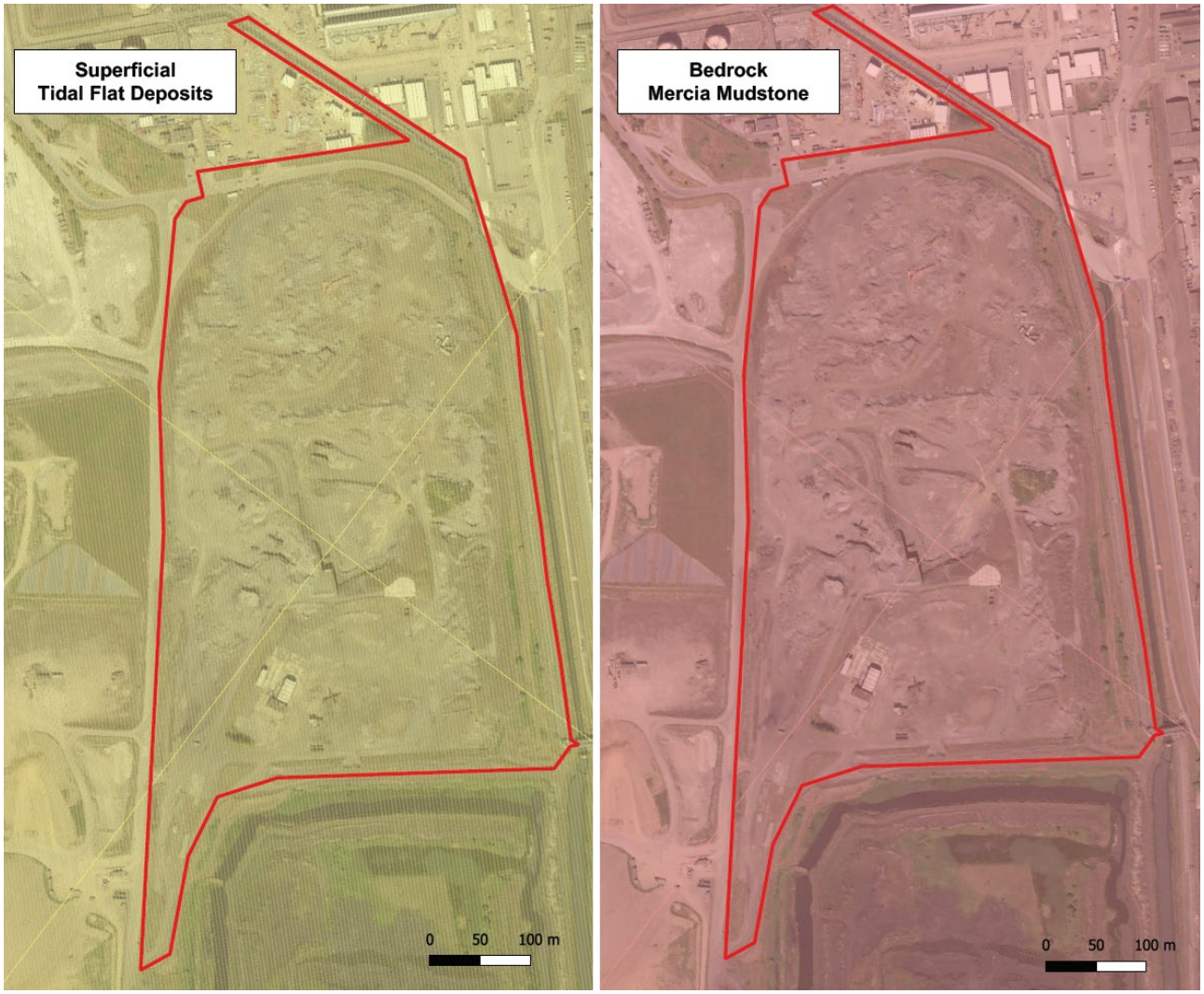


Figure 2: Excerpts from BGS Mapping

The following table provides an overview of the site-specific geology encountered during the investigation across the site. The full geology encountered is provided on the **draft** borehole logs within Appendix C.

Interpreted Unit	Minimum Basal Depth (m bgl)	Maximum Basal Depth (m bgl)	Comment
Made Ground	5.3	9.3	The Made Ground in all locations comprised slag rich deposits which contained close to 100% slag recovered as sandy gravel and cobbles. Slag was vesicular and noted to be predominantly grey but with green and brown colouration. The sand was noted to comprise of crushed slag.
Tidal Flat Deposits (Secondary A Aquifer)	5.8	14.7	Encountered in all 9 boreholes. Generally comprised soft silty sand or sandy silt. Identified to be widely distributed across the site below the Made Ground. The deposit was noted to be less than 1m thick in MPA_AUK_BH102, MPA_AUK_BH102 and MPA_AUK_BH106.

Interpreted Unit	Minimum Basal Depth (m bgl)	Maximum Basal Depth (m bgl)	Comment
Glaciolacustrine Deposits (Unproductive strata)	9.7	12.5	Glaciolacustrine Deposits were recorded in 5 boreholes below the Tidal Flat Deposits. The deposits were generally described as a soft to firm brown laminated clay.
Glacial Till (Unproductive strata)	10.45	17.6	Glacial Till was identified in all 9 boreholes below the Glaciolacustrine Deposits (if present) or Tidal Flat Deposits. Glacial Till was described as a firm to very stiff orange brown slightly sandy slightly gravelly clay, with gravel composed of mixed lithologies, including sandstone and mudstone. Glacial Till is distributed widely across the site overlying the bedrock. The deposits were noted to be less than 1m thick in MPA_AUK_BH104, MPA_AUK_BH105, MPA_AUK_BH106 and MPA_AUK_BH109.
Mercia Mudstone (Secondary (B) Aquifer)	13.2	20.7	An extremely weak to weak red brown mudstone partially to highly weathered with numerous bands of white gypsum.

Made Ground was encountered in all intrusive locations and proven to a thickness of up to 9.3m. The base of the Made Ground was proven in all 9 boreholes, however greater thickness of made ground material may exist beneath the site.

One type of Made Ground was noted:

- **Slag-dominant material:** Generally ranging from gravel to boulder size fragments of slag. The slag material generally ranged from light grey to dark grey/black in colour, but a wide range of other colours were also noted including blue, brown, green, and purple. Discolouration of the slag surface was also noted with white crystallisation/discolouration often noted on the outer surface along with occasional iron rich areas. Slag is estimated to comprise 75 - 100% of the soil matrix, weighted towards the latter.

2.6 Hydrogeology

The site is not located within a Groundwater Source Protection Zone and given the proximity to the Tees Estuary groundwater is likely to be tidally influenced and potentially subject to saline intrusion.

Superficial Deposits

Groundwater levels recorded within the Made Ground and shallow superficial deposits (Tidal Flat Deposits and Glaciolacustrine Deposits) during the site investigation are shown in the table below and on Figure 3 in Appendix A. The Tidal Flat Deposits were noted continuous across the site but frequently were of limited thickness. It is therefore expected that although a Secondary (A) Aquifer is present regionally in the vicinity of the site the Tidal Flat Deposits are considered to be of limited resource value beneath the site itself, similar findings were noted on the Prairie site to the south indicating the aquifer may also be of limited resource value regionally (10035117-AUK-XX-XX-RP-ZZ-0088-01-Prairie_Risk Assessment) .

Although groundwater may be present within the Glaciolacustrine Deposits this unit is classified as unproductive strata and is unlikely to be the source of significant transmission of groundwater. The Glacial Till is also classified as unproductive strata which may hold limited amounts of water but with very little transmissivity, as such no wells were screened across this unit.

Borehole	Aquifer	9th Nov 2020 Groundwater Elevation (m AOD)	Visit 2 Groundwater Elevation (m AOD)	Visit 3 Groundwater Elevation (m AOD)	Range in Depth to Groundwater (m bgl)
Superficial Deposits					
MPA_AUK_BH101S	Made Ground	1.63	TBC	TBC	7.31
MPA_AUK_BH101D	TDF	1.60	TBC	TBC	7.34
MPA_AUK_BH102S	Made Ground	1.8	TBC	TBC	5.57
MPA_AUK_BH103S	Made Ground/TDF	2.49	TBC	TBC	4.21
MPA_AUK_BH104S	Made Ground	TBC	TBC	TBC	TBC
MPA_AUK_BH104D	TDF	TBC	TBC	TBC	TBC
MPA_AUK_BH105S	Made Ground	TBC	TBC	TBC	TBC
MPA_AUK_BH106S	Made Ground	1.7	TBC	TBC	5.81
MPA_AUK_BH106M	GL	1.7	TBC	TBC	5.81
MPA_AUK_BH107S	Made Ground	1.71	TBC	TBC	5.09
MPA_AUK_BH107M	TDF	1.68	TBC	TBC	5.12
MPA_AUK_BH108S	Made Ground	1.64	TBC	TBC	4.68
MPA_AUK_BH108M	TDF	1.6	TBC	TBC	4.72
MPA_AUK_BH109S and MPA_AUK_BH109D	Not accessible during sampling				

Water was noted within the Made Ground, Tidal Flat Deposits and Glaciolacustrine although the latter geological unit is classified as unproductive strata. Groundwater flow within the Made Ground is indicated to the north to northwest. Groundwater flow within the Tidal Flat Deposits could not be confirmed based on the current elevation dataset but likely has a northerly component. The Tidal Flat Deposits are considered to be in hydraulic continuity with the Made Ground, within twin installations the resting groundwater level in the Made Ground was in some cases noted to be above that in the Tidal Flat Deposits. This may be linked to differences in porosity affecting the rate of response to tidal influence, and will be investigated further during subsequent monitoring visits.

Bedrock

The hydrogeological map for the area (Sheet 1: Hydrogeological Map of England and Wales, 1:625,000 scale) indicates that groundwater beneath the site within the Mercia Mudstone Formation is at an elevation of approximately 0m AOD with groundwater elevation contours indicating a flow to the north. Based on the thickness of the Tidal Flat Deposits identified at the site the Mercia Mudstone is considered the continuous water body present in significant thickness.

Groundwater levels recorded within the bedrock deposits during the site investigation are shown in the table below and on Figure 3 in Appendix A. The resting groundwater levels in the monitoring wells screened across

the Mercia Mudstone are noted to be above the slotted section of the well pipe indicating the phreatic surface rests above the upper surface of the mudstone itself. It was noted that the resting groundwater elevations within the Mercia Mudstone were recorded both below and marginally above (MPA_AUK_BH108) those in the Made Ground and Tidal Flat Deposits indicating the potential for downward vertical migration between the units where a downward head is present.

Borehole	Aquifer	9th Nov 2020 Groundwater Elevation (m AOD)	2020 Groundwater Elevation (m AOD)	2020 Groundwater Elevation (m AOD)	Range in Groundwater Elevation (m bgl)
MPA_AUK_BH102D	Mercia Mudstone	1.13	TBC	TBC	6.24
MPA_AUK_BH103D	Mercia Mudstone	1.35	TBC	TBC	5.35
MPA_AUK_BH105D	Mercia Mudstone	TBC	TBC	TBC	TBC
MPA_AUK_BH106D	Mercia Mudstone	1.61	TBC	TBC	5.90
MPA_AUK_BH107D	Mercia Mudstone	0.91	TBC	TBC	5.89
MPA_AUK_BH108D	Mercia Mudstone	1.65	TBC	TBC	4.67

The elevation data did not indicate a clear flow direction within the Mercia Mudstone.

Summary

Water was noted to be variably present in Made Ground. The Tidal Flat Deposits are present continuously across the site but at a limited thickness and as such, water within the deposits is considered a limited resource value. Although unproductive strata, the site data indicates the potential for localised horizontal and vertical migration of groundwater within more permeable horizons of the Glaciolacustrine Deposits and is also inferred within Glacial Till deposits. Aquifer permeability testing of the subsurface geology is proposed during the next round of monitoring to quantify this further. The underlying bedrock of the Mercia Mudstone is considered the most sensitive aquifer unit at the site and shows an indicative flow direction to the north and the River Tees.

It should be noted the inferred flow directions within the bedrock, Superficial Deposits, and Made Ground are based on elevations from just a limited number of monitoring wells given the size of the site and may be influenced by local ground conditions. Two further elevation surveys are to be conducted to refine the assessment.

2.7 Slug Testing

Permeability testing of the aquifer was not complete at the time of report issue and will be included in an updated document.

2.8 Tidal Influence

Groundwater monitoring for potential tidal influence was not complete at the time of report issue and will be included in an updated document.

2.9 Aquifer Salinity

The salinity of the aquifers underlying the site has been calculated using concentrations of chloride (Cl^-) measured in the groundwater samples collected assuming all chloride resulted from NaCl. The concentration of sodium chloride, the most abundant salt in marine waters, was calculated using these concentrations and used to determine whether the groundwater underlying the site was likely to be saline, brackish or fresh.

Equation

$$At\ 1\ litre\ mass = concentration$$

$$n_{(Cl^-)} = m_{(Cl^-)} / M_{(Cl^-)}$$

$$Assume\ all\ free\ chloride\ results\ from\ NaCl\ therefore:\ n_{(NaCl)} = n_{(Cl^-)}$$

$$Therefore\ m_{(NaCl)} = M_{(NaCl)} * n_{(NaCl)}$$

$$Where\ n = no.\ of\ moles$$

$$m = mass\ (g)$$

$$M = Molecular\ weight$$

$$Molecular\ weight\ of\ sodium\ (Na) = 22.99$$

$$Molecular\ weight\ of\ chloride\ (Cl) = 35.5$$

The results of the calculation are presented in the table below:

Borehole	Aquifer	Concentration NaCl (mg/l) 10 -12 November 2020
MPA_AUK_BH101D	Tidal Flat Deposits	1,055
MPA_AUK_BH102D	Mercia Mudstone	6,594
MPA_AUK_BH103D	Mercia Mudstone	577
MPA_AUK_BH104D	Tidal Flat Deposits	2,473
MPA_AUK_BH105D	Mercia Mudstone	4,121
MPA_AUK_BH106M	Glaciolacustrine Deposits	544
MPA_AUK_BH106D	Mercia Mudstone	577
MPA_AUK_BH107M	Tidal Flat Deposits	4,286
MPA_AUK_BH107D	Mercia Mudstone	2,308
MPA_AUK_BH108M	Tidal Flat Deposits	758
MPA_AUK_BH108(D)	Mercia Mudstone	791

Freshwater: <500 mg/l
Brackish Water: 500 to 30,000 mg/l
Saline Water: 30,000 – 50,000 mg/l

All water samples recovered from the site are indicated to be brackish.

2.10 Hydrology

The closest surface water features to the site are the Cleveland Channel which forms the southern boundary of the site and the Lackenby Channel which is located approximately 40m to the east of the site. The Cleveland Channel flows into the Tees via the Lackenby Channel. Anecdotal data indicates both the Cleveland and Lackenby channels are tidally influenced.

The surface water features flow through an area that was reclaimed from the Tees Estuary by the placement of biproducts from the steel making process. The surface water features are considered to run within the Made Ground deposits and are likely in continuity with water within both the Made Ground and the Tidal Flat deposits. This will be confirmed by a further elevation survey conducted to refine the assessment.

2.11 Potential Areas of Concern

Based on a review of the documents listed in Section 2.1 above and the DEFRA Magic Website https://magic.defra.gov.uk/MagicMap.aspx accessed 17th November 2020 the following potential areas of concern in relation to land contamination (Environmental PAOC) have been identified for the site and are summarised on Figure 4 below and in Appendix A.

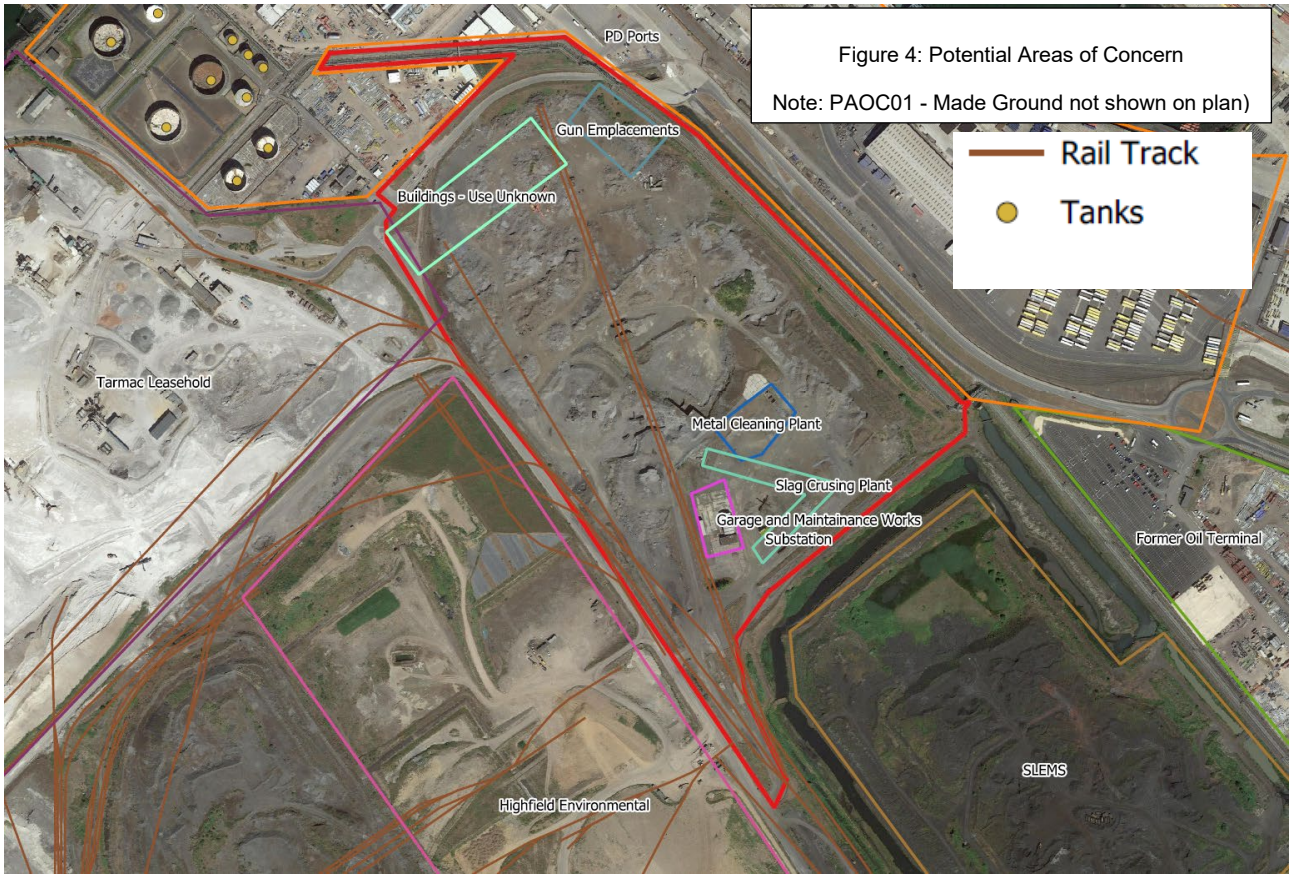


Figure 4: Potential Areas of Concern

Note: PAOC01 - Made Ground not shown on plan)

The significance of these potential sources is considered further in Section 3.2.

3 Environmental Site Condition Assessment

3.1 Introduction

This section summarises the findings of Section 2 in the form of an environmental (land contamination) Conceptual Site Model (CSM).

The CSM allows a qualitative evaluation of potentially active “pollutant linkages” at the site; these being plausible scenarios whereby a contamination source is connected to a possible receptor by one or more pathways:

- Potential sources of contamination: these include any actual or potentially contaminating materials and activities, located either on or in the vicinity of the site;
- Potential pathways for contamination migration: these comprise the routes or mechanisms by which contaminants may migrate from the source to the receptor including environmental migration pathways and human health exposure pathways; and
- Potential receptors of contamination: these include present and/or future land users, ecological systems, water resources and property.

The potential significance of these source-pathway-receptor linkages will be assessed in the Section 4.

3.2 Contamination Sources

Based on the information reviewed in this report the following potential contamination sources have been identified:

3.2.1 On-Site

On-site sources have been identified associated with Made Ground and potential contaminants of concern (CoC) associated with former site uses. The table below summarises the most significant potential on-site sources and the primary contaminants associated with these sources. The identified CoC are considered to represent those likely to be present from other less significant sources.

Potential On-Site sources	Primary Contaminants
Made Ground including slag deposits	Metals (including heavy metals), polycyclic aromatic hydrocarbons (PAHs), cyanide, thiocyanate, sulphate, pH, ammonia, and asbestos. Potential source of ground gas if found to have a high organic content.
Substation	Hydrocarbons, asbestos, and polychlorinated biphenyls (PCBs)
Buildings of unknown use	Metals, and asbestos
Gun emplacement	Unexploded ordnance
Garage and maintenance workshop	Metals, asbestos, TPH, PAH, acids and bases, VOCs, SVOCs, pH
Slag crushing and metal cleaning plant	Metals (including heavy metals), cyanide, thiocyanate, sulphate, pH, and ammonia.
Railway lines and sidings	Metals, asbestos, TPH, PAH, VOC, SVOC, PCB, and pH.

3.2.2 Off-Site

Potentially contaminative land uses have been identified in the vicinity of the site, the most pertinent of which are presented in the table with potentially associated contaminants:

Potential On-Site sources	Primary Contaminants
Highfield Environmental	Metals (including heavy metals), PAH, cyanide, thiocyanate, sulphate, pH, ammonia, asbestos, total petroleum hydrocarbons (TPH), volatile organic compounds (VOC), semi volatile organic compounds (SVOC), and ground gas.
SLEMS / CLE9 – The SLEMS facility processes BOS Oxide. BOS material and other steelmaking biproducts are stockpiled on site. The SLEMS is understood to be located on top of the former CLE9 landfill.	Metals (including heavy metals), PAH, cyanide, thiocyanate, sulphate, pH, ammonia, asbestos, total petroleum hydrocarbons (TPH), volatile organic compounds (VOC), semi volatile organic compounds (SVOC), and ground gas if found to have a high organic content.
Former Oil Terminal and tanks	Metals, asbestos, TPH, PAH, acids and bases, VOCs, SVOCs, pH and PCBs
PD Ports and Tarmac leasehold	Metals, asbestos, TPH, PAH, acids and bases, VOCs, SVOCs, pH and PCBs

Contaminants of concern in green are of generally low environmental mobility and have therefore been discounted for the sources in question based on the distance from the site.

3.3 Contamination Sources Assessment

The contamination assessment will be undertaken in two ways – contaminants that are dependent upon the material composition (e.g. metals, inorganics, asbestos and PAHs) will be assessed separately for each material type and contaminants that are associated with a particular point source (e.g. hydrocarbons) will be assessed based on the likely source. This report is focused on deep soils and does not fully assess the potential risks associated with shallow soil. Groundwater and soil leachate testing was conducted to consider potential risk to Controlled Waters.

The laboratory certificates are presented in Appendix C.

3.3.1 Made Ground

Asbestos

Asbestos was not identified in any of the samples tested, however asbestos fibres were identified by the shallow soils investigation, reference should be made to 10035117-AUK-XX-XX-RP-ZZ-0125-02-MPA_Shallow_Soils.

Metals and Inorganics

Metals that were identified in all of the soil samples included aluminium, arsenic, barium, boron, chromium, copper, iron, lead, magnesium, manganese, silicon, vanadium and zinc.

Levels of cyanide and thiocyanate were within the same order of magnitude as the method detection limit (MDL) where detected across the site, though more variation was noted in soluble sulphate concentrations. Soil samples were on average strongly alkaline ranging between pH 8.2 and 11.9.

Leachability testing showed the majority of metals were present in the leachate from made ground samples. Leached concentrations of metals were noted in all samples tested with barium, copper, magnesium and manganese leaching in all samples. The pH of leachate samples was noted to be slightly alkaline and slightly lower than the corresponding soil samples.

Polyaromatic Hydrocarbons

Concentrations of PAH were measured in 2 of the 8 soil samples analysed, and in all four samples of soil leachate; comprising a broad range of both light, mid and heavy end compounds.

Total Petroleum Hydrocarbons

Concentrations of TPH were measured in 1 of the 8 soil samples analysed at a concentration of 3000mg/kg (MPA_AUK_BH102_SO_0520).

Total petroleum hydrocarbons were not measured above the MDL in soil leachate.

Other Contaminants

No concentrations of VOC, SVOC, or PCBs considered as elevated were measured in any of the soil samples with the exception of carbazole, 2-Methylnaphthalene and dibenzofuran detected just above the MDL in MPA_AUK_BH102_SO_0520.

3.3.2 Superficial Deposits

Concentrations of metals within the Superficial Deposits were measured in 4no. samples and were generally lower than those observed in Made Ground. Concentrations of asbestos, PAHs and TPH were all below the MDL.

3.3.3 Groundwater

Five wells are screened across the Superficial Deposits, and six across the bedrock.

Metals and Inorganics

Metals were measured in all groundwater samples; metals boron, calcium, magnesium, manganese, sodium, and iron were measured at the highest concentrations and in all groundwater samples. Metals concentrations in the Superficial Deposits and bedrock were generally noted to be within the same order of magnitude.

Elevated levels of sulphate and chloride were measured in all samples. The pH of the groundwater in wells screened across natural deposits was neutral to slightly basic and ranged between pH7.4 and pH10.8 with the majority of the samples showing a pH<9.

Organics

Concentrations of TPH were below the MDL in all groundwater samples: Polycyclic aromatic hydrocarbons were the most frequent organic compounds detected measured in seven monitoring wells at levels just above the limit of detection.

Phenols were detected in five monitoring wells at concentrations ranging between 140µg/l (MPA_AUK_BH104D) and 680µg/l (MPA_AUK_BH102D). No VOC or SVOC were detected in any of the groundwater samples with the exception of a single detection of methylene chloride in MPA_AUK_BH107M at the MDL.

3.3.4 Surface Water

Five surface water samples were collected from upstream and adjacent to the site, no downstream sample could be collected from the Lackenby Channel at the time of writing as the sample point lies on third party land and access could not be arranged. A summary of the data is presented in the table below, sample locations are shown on Figure 5 in Appendix A.

	Units	SLEMS_SW01 Up Stream Cleveland Channel	SLEMS_SW02 Up Stream Lackenby Channel	SLEMS_SW03 Down Stream Cleveland Channel	SLEMS_SW04 Up Stream Lackenby Channel Down stream Cleveland Channel	SLEMS_SW06 Down Stream Cleveland Channel
Arsenic, Dissolved	ug/l	3.7	1.3	2.3	1.7	1.8

	Units	SLEMS_SW01 Up Stream Cleveland Channel	SLEMS_SW02 Up Stream Lackenby Channel	SLEMS_SW03 Down Stream Cleveland Channel	SLEMS_SW04 Up Stream Lackenby Channel Down stream Cleveland Channel	SLEMS_SW06 Down Stream Cleveland Channel
Barium, Dissolved	ug/l	43	40	25	31	32
Boron, Dissolved	ug/l	330	310	400	370	310
Cadmium, Dissolved	ug/l	0.08	0.04	< 0.03	0.03	0.03
Chromium, Dissolved	ug/l	2.1	1.5	0.25	0.63	0.47
Copper, Dissolved	ug/l	3.4	2.7	0.9	2.6	2.9
Iron, Dissolved	ug/l	63	200	120	170	130
Lead, Dissolved	ug/l	0.36	1.5	0.91	1.1	0.77
Manganese, Dissolved	ug/l	120	71	110	120	120
Molybdenum, Dissolved	ug/l	15	23	4.2	15	17
Nickel, Dissolved	ug/l	2.6	6.3	1.8	8.6	8.4
Zinc, Dissolved	ug/l	12	13	17	15	13
Ammoniacal Nitrogen as N	mg/l	0.14	0.11	0.088	0.22	< 0.015
Sulphate as SO4	mg/l	390	62	110	71	71
TPH Ali/Aro Total	ug/l	< 10	7000	< 10	180	420
PAH Total	ug/l	0.82	< 0.80	0.48	< 0.20	0.58

Metals and Inorganics

Metals were measured in all groundwater samples; metals boron, magnesium, manganese, and iron were measured at the highest concentrations and in all groundwater samples. Metals concentrations were generally consistent within the same order of magnitude and no decrease in water quality was observed as the surface water features pass the south of the site.

Organics

Concentrations of TPH were measured in three surface water samples and appeared to be associated with the adjacent SLEMS site: Polycyclic aromatic hydrocarbons were measured in all surface water samples at levels just above the limit of detection. Concentrations of PAH did not indicate a decrease in water quality was observed as the surface water features pass the south of the site.

3.4 Pathways

Potential migration pathways based on a future commercial / industrial end use are discussed below.

3.4.1 Airborne Migration Pathways

- The majority of the site is currently not formally surfaced, as such, particulate inhalation due to dust generation is a potentially active pathway if hardstanding or buildings are not present across the site in a future development scenario.
- Vapour inhalation pathways in relation to contaminants in soil and groundwater are potentially active, both for an exposure scenario in a future outdoor or indoor air space.
- During potential re-development works, sub-surface soils could be exposed at the surface due to trenching and or re-profiling requirements and therefore dust has the potential to be generated. Notwithstanding this, typical dust suppression techniques should be employed so that exposures would be minimised.
- Future migration and accumulation of permanent ground gases originating from the made ground on site in confined spaces leading to asphyxiation and/or explosion is considered potentially active.

3.4.2 Direct Contact Exposure Pathways

- The proposed site surfacing under any potential re-development scenario is unknown; should a significant portion of the site area remain uncovered or be covered in some form soft landscaping without a suitable depth of cover soils, dermal contact and ingestion pathways in relation to soil would be considered potentially active. Given the depth to groundwater (greater than 4.5m bgl, unless the final ground elevation is reduced significantly), direct contact pathways in relation to groundwater are not considered active.
- Direct contact pathways with soils could be active throughout a potential redevelopment; typical mitigation measures such as personal protective equipment (PPE; overalls, gloves etc.) could be used to mitigate this risk. If unexpected contamination (such as non-aqueous phase liquids (NAPL)) were identified during redevelopment works, additional PPE may be required as mitigation.

3.4.3 Aqueous Migration Pathways

- Leaching of contaminants in the shallow soils to groundwater within the Tidal Flat Deposits is considered potentially active.
- The thickness of Glacial Till on-site between the Tidal Flat Deposits and the underlying Mercia Mudstone is not well delineated therefore the potential for vertical migration of contaminants to the underlying Secondary (B) Aquifer is considered potentially active.
- Given the granular nature of the identified and thickness of the Made Ground and the permeability of the Tidal Flat Deposits, lateral migration of off-site impacts onto the site from nearby PAOC is considered potentially active. The most likely source would be the SLEMS and Highfield Environmental waste facilities located hydraulically up gradient of the site.
- Lateral migration of on-site impacts towards the Cleveland and Lackenby watercourses is considered potentially active given the identified thickness and nature of the Made Ground. The potential for infiltration of CoC into watercourses *via* surface runoff or migration of rainfall through the made ground is considered potentially active.
- Lateral migration of on-site impacts towards the Cleveland and Lackenby watercourses via the Tidal Flat Deposits is considered potentially active.
- Lateral migration of on-site impacts off site in the Mercia Mudstone or Tidal Flat Deposits is considered potentially active.
- Depending on pile design for future structures, vertical migration of impacts down foundation piles is considered potentially active unless appropriately designed.

3.5 Receptors

The potential receptors to be considered in any contaminated land scenario can be summarised as follows:

3.5.1 Human Health

For the purposes of this assessment it is assumed that the proposed development will comprise a commercial or industrial end use, and as such commercial and industrial workers are the primary receptor of concern for any chronic exposure contamination risk. The risk would be influenced by the duration and location of the staff work regimes.

Users of the adjacent buildings (industrial workers and neighbouring residents) could also be at risk. However, for exposure to occur, active cross-boundary migration pathways would be required, the assessment criteria for onsite human health receptors are considered to be sufficiently protective of offsite commercial land uses. It is noted that the current neighbouring residents are situated over 1km from the site, and as such are not considered to be at significant risk from the site.

3.5.2 Property (buildings, etc)

The proposed development will include new structures and associated infrastructure, which could be subject to potential sulphate attack in relation to buried concrete. Given the presence of slag deposits within the Made Ground the potential for expansive slag to impact structures is considered potentially active, the risks from ground gas are also considered potentially active. It is understood that mitigation of risks to property will be the responsibility of the developer.

3.5.3 Controlled Water

While groundwater is a Controlled Water, it is the classification of the aquifer within which the groundwater is present which drives the conclusion as to whether there is a potential water resource receptor present. At this site, the underlying geology comprises Tidal Flat Deposits which are classified as a Secondary (A) Aquifer and the Mercia Mudstone Formation classified as a Secondary (B) Aquifer both of which are considered groundwater receptors at the site. It is noted that the site is not located within a Source Protection Zone (SPZ) and no SPZ's have been identified within 1km of the site. Additionally, the site is not located in a drinking water protected area or a drinking water safeguard zone, and neither zone is present within 1km of the site. The site adjoins a tidal section of the River Tees and therefore there is the potential for saline intrusion into the underlying aquifers limiting their resource value, this is corroborated by the salinity data reported in section 2.9 which indicates groundwater to be brackish.

Surface water courses are also considered Controlled Water receptors; given its presence at the site boundary the Cleveland and Lackenby channels are considered the primary surface water receptor for the site.

3.5.4 Ecological

The Cleveland and Teesmouth Coast SSSI, SPA, and RAMSAR is located approximately 350m to the north of the site.

Based on the distance from the site the risk to ecological receptors is considered low. In addition, potential discharges from the site to the Teesmouth and Cleveland Coast SPA and RAMSAR via the River Tees are likely to be limited by tidal exchange and the large volume of the River Tees receiving water. This is in line with the findings of Wood 2019.

3.6 Obstructions

This investigation did not encounter any obstructions within the exploratory holes drilled however it should be noted that obstructions may be encountered in areas not investigated.

3.7 Ground Gas Assessment

A single ground gas monitoring event was conducted at the site, two further monitoring events are planned and will be reported under an updated cover. In monitoring well MPA_AUK_BH106M, MPA_AUK_BH107M and MPA_AUK_BH108M groundwater was resting above the top of the well slotted section indicating the data recorded is not representative of the shallow sub surface ground gas condition, this is expected as the monitoring well was designed to assess groundwater conditions within the superficial deposits rather than made ground.

Methane levels within the boreholes were recorded to be <0.1% in all monitoring wells. Carbon dioxide levels within the boreholes were recorded between <0.1% and 0.3%, with the highest concentration being recorded within MPA_AUK_BH107M.

Hydrogen sulphide was recorded below the detection limit on all occasions and carbon monoxide was recorded at the detection limit in three locations and at 5ppm in MPA_AUK_BH101S.

Flow rates were observed to range between 0.0l/hr and 0.1l/hr.

Given the proposed remedial strategy for the site (10035117-AUK-XX-XX-RP-ZZ-0181-MPA_ROA and Strategy) comprising the excavation processing and replacement of a significant proportion of the made ground, further monitoring is recommended once this is complete based on the specific requirements of a particular redevelopment.

3.8 Slag Testing Data

A total of 5 samples of slag recovered from trial pits from the shallow soils investigation were submitted for examination the results are presented in AEG 2020 and summarised below.

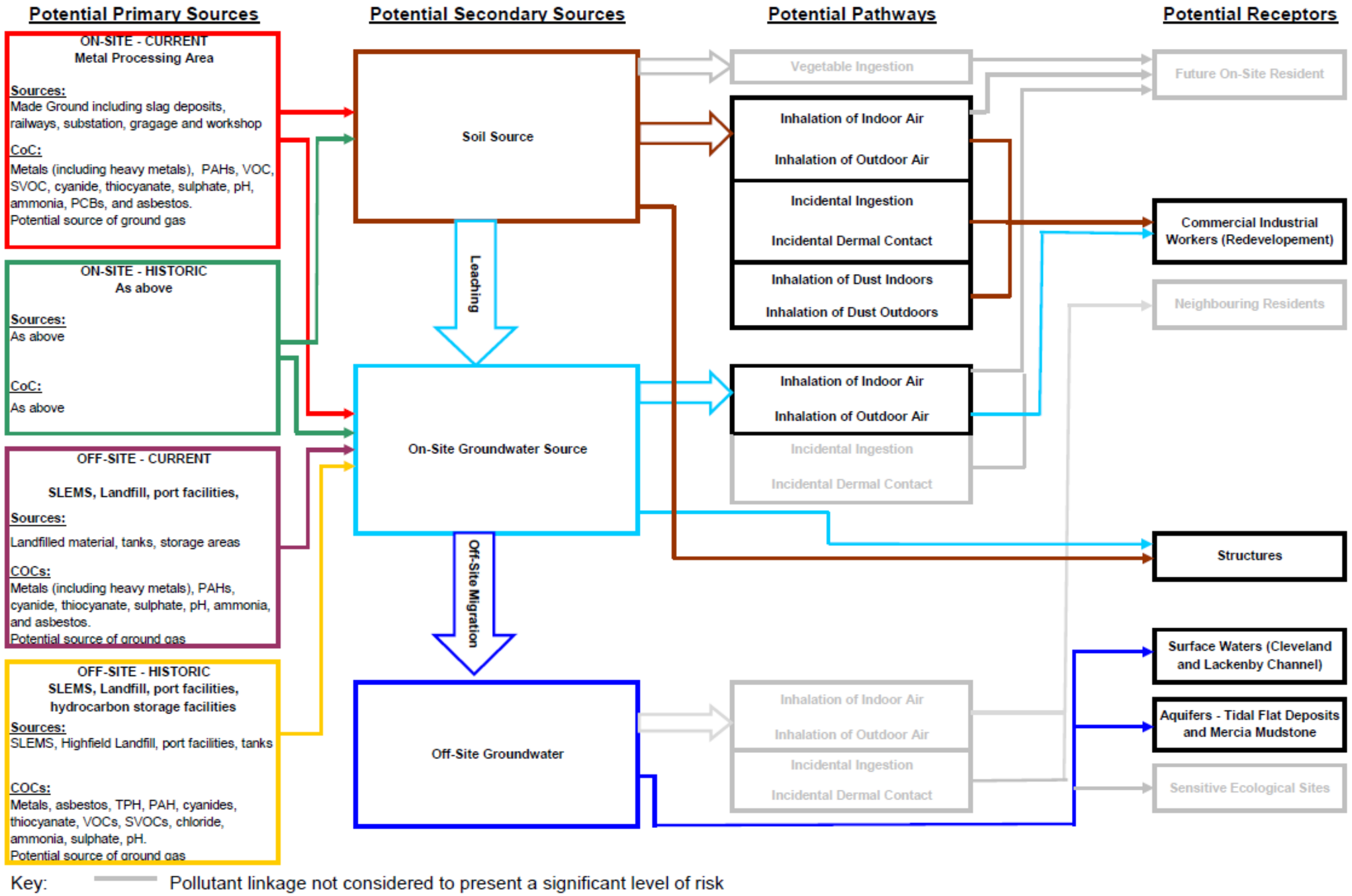
Sample	Depth	AEG Estimated % Slag
MPA_AUK_TP101	1.9	100%
MPA_AUK_TP107	1.5	100%
MPA_AUK_TP119	2.0	100%
MPA_AUK_TP120	3.8	100%
MPA_AUK_TP122	3.8	100%

- In three of the 5 samples blast furnace slag was a dominant constituent, the remaining two samples contained very small quantities of blast furnace slag but basic steel slag was a dominant constituent in these samples.
- Very small quantities of basic refractory materials were noted in the one slag sample.
- Three samples were subject to 28 day expansion tests and showed expansions between 0.29% and 0.9%.
- None of the samples tested contained traces of Ettringite indicating expansion has not occurred in the past.
- Two of the samples tested contained free CaO and MgO up to 1.4% and 0.9% respectively.
- The composition of the slags indicate a low-medium expansion potential.

3.9 Conceptual Site Model

The above data has been used to produce an initial CSM (based on chronic exposure pathways) for the site, this is presented below as Figure 6. The assessment of risk to on site commercial works is considered sufficiently conservative to protect off site commercial workers.

Figure 6
Outline Conceptual Site Model - Commercial Industrial End Use



4 Generic Quantitative Risk Assessment

4.1 Tiered Approach

The purpose of this assessment is to quantify potential risks to the human health, controlled waters and future built receptors identified in the CSM in relation to the redevelopment of the site for a generic commercial/industrial use.

The following scenarios are not considered in this section:

- Risks to Construction Workers – any redevelopment and construction work should be conducted in full recognition of HS(G)66.
- Nuisance health effects – the Statutory Nuisance Act considered olfactory impacts from odours and allows comparison of enclosed space air concentrations with odour threshold concentrations.
- An assessment of the geotechnical development constraints which is outside the scope of this document.

Quantitative assessment of risks arising from soil and groundwater contamination are assessed in accordance with the framework presented in Contaminated Land Report 11 (CLR 11) (EA, 2004) and Land Contamination: Risk Management (LC:RM) (EA, 2020). This sets out a tiered approach to quantitative risk assessment comprising:

- Generic Quantitative Risk Assessment (GQRA) - Comparison of site contaminant levels against generic standards and compliance criteria including an assessment of risk using a source-pathway-receptor model.
- Detailed Quantitative Risk Assessment (DQRA) - Derivation of site-specific risk assessment criteria and calculation of site specific clean-up goals.

In this report, a GQRA has been carried out. The potential pollutant linkages identified in the preliminary CSM for human health and controlled water receptors have been assessed by comparison against relevant generic assessment criteria (GAC). These have been derived using conservative assumptions to enable potential pollutant pathways that do not pose unacceptable risks to receptors to be identified and discounted. Exceedance of a GAC does not imply that an unacceptable risk is necessarily present, rather that further assessment may be required to verify the potential risk.

It is assumed that the site will be redeveloped as a typical commercial industrial development comprising office buildings, hardstanding and some areas of soft landscaping. The site has not been zoned at this stage and all data has been considered on an individual sample basis.

4.2 Human Health Risks

4.2.1 Selection of Soil GAC

Potentially active pollutant linkages and contaminants of concern (CoC) in relation to human health risks have been identified in the initial CSM as:

A. Vapour inhalation of indoor and outdoor air from volatile contaminants in soils, (potential CoC include volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs))

B. Vapour inhalation of indoor and outdoor air from volatile contaminants in groundwater, (potential CoC include VOCs and SVOCs)

C. Dermal contact/ingestion of soil (potential CoC include heavy metals, organic/inorganic compounds)

D. Dust inhalation (potential CoC include asbestos, volatiles, and heavy metals)

For the purposes of this assessment it is assumed that future re-development will comprise a commercial or industrial end use and, as such, commercial and industrial workers are the primary receptor of concern for any contamination risk. The risk would be influenced by the duration and location of the staff work regimes. For the basis of this assessment, it is assumed that site workers will be on-site for a “standard” 8 hour working day.

Commercial end use assumes a pre-1970s commercial property is present at the site with some open areas uncovered by hardstanding and is therefore regarded as conservative for a redevelopment scenario as new structures are assumed to be constructed to current standards.

To assess potential linkages A, C and D above, GAC have been chosen, based on an assumed industrial/commercial end use. Criteria published by authoritative industry bodies and commonly accepted by regulators for use under the planning regime for development sites have been used first. For contaminants for which no published values are available, Arcadis derived criteria (developed following the CLEA framework (v1.07)) or foreign national criteria have been used.

The GAC comprise (in order of priority):

- LQM/CIEH Suitable for Use Levels (S4UL) (LQM / CIEH, 2015),
- Department of Environment Food and Rural Affairs (DEFRA) Category 4 Screening Levels (C4SL) (DEFRA, 2012),
- Arcadis derived generic assessment criteria based on CLEA v1.07,
- United States Environmental Protection Agency (U.S. EPA) Regional Screening Levels (RSLs) (USEPA, 2018)

Soil organic matter recorded in 12No. soil samples obtained from the site ranged from 0.2 to 4.1 % SOM. As such, the S4UL selected as GAC are those for a commercial end use assuming 1% SOM.

It is noted that the USEPA RSLs do not consider the risk to human health via the inhalation of vapour pathway. As such, should concentrations of volatile or semi-volatile CoC be measured above MDL for which only a USEPA RSL GAC is available, further consideration may need to be given to the risk to human health from inhalation of vapours.

The selected human health GAC for soil are presented in Appendix D:

4.2.2 Soil Risk Assessment

Contaminant concentrations in soil samples have been compared with the soil GAC in Appendix D. Contaminants which were measured in excess of the GAC are summarised below. Contaminants that have not been identified in excess of their respective GAC are not considered to represent a significant risk to identified human health receptors and as such do not require further assessment in relation to the redevelopment of the site unless the above assumptions are not valid.

The following samples were analysed:

- 8 No. samples of slag-dominated Made Ground
- 4 No. samples of superficial deposits (Tidal Flat Deposits and Glaciolacustrine Deposits)

None of concentrations of CoC measured in the 12 soils samples were in excess of the soil GAC for the contaminants for which screening criteria are available, therefore there is not considered to be a significant risk to human health from these measured concentrations of CoC in deep soils. The maximum recorded concentrations in soil for all contaminants are listed in Appendix D.

Contaminants for which no screening criteria were available have been reviewed. Most contaminants, including polychlorinated biphenyls (PCBs) and VOCs were recorded below the method detection limit (MDL) in all soil samples.

Contaminants measured in soil at concentrations above MDL, for which no screening criteria were available were aluminium, iron, magnesium, manganese, silicon, total cyanide, sulphate, and carbazole. Potential human health risks from these are qualitatively assessed in Section 4.2.4.

4.2.3 Asbestos in Soil

A total of 12No. soils samples were screened by polarised light microscopy in accordance with HSG248 for the presence of asbestos (HSE, 2005). None of the samples measured the presence of asbestos and therefore the pollutant linkage D (dust inhalation) is considered to be inactive with respect to asbestos in deep soils.

4.2.4 Qualitative Risk Assessment for Substances in Soil without GACs

As shown in Appendix D, several contaminants including some PCBs, VOCs and SVOCs do not have a GAC available, but were recorded at less than the MDL in all soil samples. Based on a review of the MDLs, these are not considered to pose a significant risk to human health and are likely to indicate an absence of that contaminant group on the site, especially given the relatively low MDLs obtained.

The following were recorded at concentrations in excess of their MDL and with no readily available GAC identified for comparison: aluminium, iron, magnesium, manganese, silicon, total cyanide, sulphate, and carbazole. With the exception of total cyanide, and carbazole, these are all elements present naturally in soil and some are biologically required nutrients. They may be elevated above natural levels where slag and other steelmaking wastes are incorporated into soil due to the site's former use, particularly manganese and iron. However, regardless of these elevations, their typically low toxicity is likely to mean these occurrences present a low risk of adverse harm to the development.

Total cyanide is known to be less toxic than free cyanide. When compared to the Arcadis site specific assessment criteria for free cyanide derived for the Prairie site (10035117-AUK-XX-XX-RP-ZZ-0088-01-Prairie_Risk Assessment), the concentrations of total cyanide are not in excess. As such, the measured concentrations of total cyanide are not considered to represent a significant risk to human health receptors.

The SVOCs carbazole was detected slightly above the MDL in one sample. This is indicative of incomplete combustion products and therefore consistent with the presence of steelmaking wastes. The compound is just marginally above the MDL. Given that the single concentration of carbozole measured at such a low concentration in comparison to the GACs for other SVOCs, the risk to human health from concentrations of carbozole is also considered to be low.

Other effects, such as phytotoxicity, are not assessed as the Made Ground encountered at the site is likely to be unsuitable as a growing medium and some form of capping with "clean" soil is likely to be incorporated into any future development.

4.2.5 Selection of Groundwater GAC

To assess the potential risk to human health via pollutant linkage B above (inhalation of volatile contaminants in groundwater), inhalation GAC have been derived by Arcadis for volatile contaminants in groundwater.

These have been derived by Arcadis using the CLEA process and industry standard vapour transport modelling (Johnson & Ettinger model). The same assumptions relating to a commercial end use of the site have been included in the model and an on-site commercial worker has been considered as the receptor which should be protective of off-site commercial workers as well.

The inhalation GAC are listed in Appendix F.

4.2.6 Groundwater Risk Assessment

Concentrations of volatile contaminants in 11 groundwater samples were screened against the inhalation GAC described above (where GAC have been derived).

The vapour inhalation GAC are designed to determine whether there is a significant risk of harm to human health from inhaling volatile contaminants emanating from groundwater beneath the site (potential pollutant linkage B in the preliminary CSM in Section 4.2).

None of the concentrations of volatile contaminants measured in groundwater were in excess of the inhalation GAC for on-site commercial workers. As such, the risk to human health from measured concentrations of CoC in groundwater is not considered to be significant.

Methylene chloride, a volatile contaminant for which no GAC is readily available, was measured at the MDL. The risk to human health from this contaminant will be considered further in Section 4.2.7.

4.2.7 Qualitative Risk Assessment for Substances in Groundwater Without GAC

As shown in Appendix F, several contaminants including some metals and VOCs do not have a GAC available. Many were not measured above MDL in groundwater. Based on a review of the MDLs, these are not considered to pose a significant risk, especially given the relatively low MDLs obtained.

Methylene chloride did not have a GAC and was recorded in one groundwater sample however the contaminant was measured at the MDL and as such is not considered to represent a significant risk to human health.

4.2.8 Discussion

None of the potential contaminants of concern analysed in the soil or groundwater samples were in excess of available GAC protective of human health via potential pollutant linkages in Section 4.2.2 above. On the basis of the data collected, these linkages are not considered active for deep soils and are unlikely to pose a significant risk to human health.

Acute risks to construction workers arising from short-term contact with contaminated soils during demolition and redevelopment of the site are not assessed by the chronic risk assessment methods in this report. During construction works, site workers should remain vigilant to the possible risk of encountering isolated areas of contaminated material. Should potentially contaminated material be encountered, further testing may be required to assess the risk to health and safety of the site workers and the environment. All persons engaged in site construction works should be made aware of the findings of the intrusive investigation and the hazards associated with handling potentially contaminated materials. It is recommended that all works are conducted in accordance with the Health and Safety Executive publication entitled “Protection of Workers and the General Public during the Development of Contaminated Land” (HSE, 1991).

4.3 Risks to Controlled Waters

4.3.1 Selection of GAC

Potentially active pollutant linkages in relation to Controlled Waters have been identified in the initial CSM as:

1) Leaching of CoC from Made Ground to groundwater in Tidal Flat Deposits
2) Vertical Migration of CoC to the Mercia Mudstone
3) Horizontal Migration of contaminated groundwater to the Cleveland and Lackenby Channel watercourses in either Made Ground or the Tidal Flat Deposits.
4) Migration of CoC in groundwater onto site from off-site sources
5) Migration of CoC in groundwater off site in the Tidal Flat Deposits and Mercia Mudstone.

An assessment of the potential for soluble contaminants in the Made Ground and slag on the site to impact the Controlled Waters receptors identified in the CSM (on-site surface water and underlying Secondary Aquifers (Tidal Flat Deposits and Mercia Mudstone)) has been undertaken.

Concentrations of leachable contaminants from soil leaching tests and groundwater samples have been compared to adopted Water Quality Standards (WQS).

The WQS chosen are UK Drinking Water Standards (DWS) protective of aquifer water resources, and Environmental Quality Standards (EQS) considered protective of surface waterbody quality. The EQS are for saline waters protective of the Tees Estuary receptor. The WQS are listed in Appendix E, F and G.

4.3.2 Soil Leachate

The results of 14No. soil leachate tests were compared to the WQS as shown in Appendix E. Contaminant concentrations that exceeded the WQS are shown in the table below. All of the samples were slag-dominated Made Ground. Samples tested were taken across the site from depths ranging from 0.6 m to 6m bgl and

includes those collected as part of the shallow soils investigation 10035117-AUK-XX-XX-RP-ZZ-0125-02-MPA_Shallow_Soils.

Contaminant	Unit	No. Samples Exceeding	WQS Exceeded		Sample	Concentration
Arsenic	µg/l	1/14	DWS	10	MPA_AUK_TP124_SO_0080	23
Cadmium	µg/l	1/14	EQS	0.2	MPA_AUK_BH107_SO_0600	0.21
Copper	µg/l	10/14	EQS	3.76	MPA_AUK_BH107_SO_0600 MPA_AUK_BH106_SO_0510 MPA_AUK_TP103_SO_0080 MPA_AUK_TP108_SO_0100 MPA_AUK_TP115_SO_0060 MPA_AUK_TP111_SO_0120 MPA_AUK_TP117_SO_0060 MPA_AUK_TP119_SO_0100 MPA_AUK_TP121_SO_0080 MPA_AUK_TP123_SO_0100	4 4.7 12 9 4.1 13 7.4 9.9 9.7 6.6
Lead	µg/l	6/14	EQS	1.3	MPA_AUK_BH107_SO_0600 MPA_AUK_TP103_SO_0080 MPA_AUK_TP111_SO_0120 MPA_AUK_TP121_SO_0080 MPA_AUK_TP123_SO_0100 MPA_AUK_TP124_SO_0080	1.7 2.2 11 61 2.2 2.6
Zinc	µg/l	1/14	EQS	7.9	MPA_AUK_BH106_SO_0510	240
Mercury	µg/l	1/14	EQS	0.07	MPA_AUK_TP117_SO_0060	0.07
Molybdenum	µg/l	1/14	DWS	70	MPA_AUK_TP121_SO_0080	95
pH	pH units	9/14	EQS	6 – 8.5	MPA_AUK_BH105_SO_0500 MPA_AUK_TP103_SO_0080 MPA_AUK_TP108_SO_0100 MPA_AUK_TP106_SO_0100 MPA_AUK_TP111_SO_0120 MPA_AUK_TP115_SO_0060 MPA_AUK_TP117_SO_0060 MPA_AUK_TP121_SO_0080 MPA_AUK_TP123_SO_0100	9.2 11.3 11.8 9.6 12.3 11.9 11.4 12.2 11.3

Contaminant	Unit	No. Samples Exceeding	WQS Exceeded		Sample	Concentration
Naphthalene	µg/l	1/14	EQS DWS	2	MPA_AUK_TP123_SO_0100	85
Anthracene	µg/l	2/14	EQS	0.1	MPA_AUK_TP106_SO_0100 MPA_AUK_TP123_SO_0100	0.46 0.46
Fluoranthene	µg/l	10/14	EQS	0.0063	MPA_AUK_BH105_SO_0500 MPA_AUK_TP103_SO_0080 MPA_AUK_TP106_SO_0100 MPA_AUK_TP111_SO_0120 MPA_AUK_TP115_SO_0060 MPA_AUK_TP117_SO_0060 MPA_AUK_TP119_SO_0100 MPA_AUK_TP121_SO_0080 MPA_AUK_TP123_SO_0100 MPA_AUK_TP124_SO_0080	0.02 0.01 2.5 0.01 0.09 0.02 0.54 0.01 0.07 0.04
Benzo(b)fluoranthene	µg/l	5/14	EQS DWS	0.017 0.025	MPA_AUK_TP106_SO_0100 MPA_AUK_TP115_SO_0060 MPA_AUK_TP119_SO_0100 MPA_AUK_TP123_SO_0100 MPA_AUK_TP124_SO_0080	3.3 0.05 0.02 0.03 0.01
Benzo(a)pyrene	µg/l	5/14	EQS DWS	0.017 0.01	MPA_AUK_TP106_SO_0100 MPA_AUK_TP115_SO_0060 MPA_AUK_TP119_SO_0100 MPA_AUK_TP123_SO_0100 MPA_AUK_TP124_SO_0080	1.0 0.74 0.24 0.03 0.01
Indeno(1,2,3-c,d)pyrene	µg/l	3/14	DWS	0.025	MPA_AUK_TP106_SO_0100 MPA_AUK_TP115_SO_0060 MPA_AUK_TP119_SO_0100	2.1 0.03 0.4
Benzo(g,h,i)perylene	µg/l	6/14	EQS DWS	0.00082 0.025	MPA_AUK_TP106_SO_0100 MPA_AUK_TP115_SO_0060 MPA_AUK_TP117_SO_0060 MPA_AUK_TP119_SO_0100 MPA_AUK_TP123_SO_0100 MPA_AUK_TP124_SO_0080	2.2 0.04 0.02 0.5 0.01 0.02

An exceedance of the EQS for seven metals and six PAH were recorded.

As the WQS are protective of water quality within the receptor (the water body for EQS or the customer's tap for DWS); direct comparison with soil leachate results is a conservative assessment as it does not take into account dilution and attenuation along the pathway.

The EQS for copper is based on the bioavailable fraction which is likely to be less than the total dissolved concentrations recorded in the results. As not all the copper is likely to be bioavailable the EQS can therefore be regarded as conservative.

Concentrations of CoC measured above MDL for which no GAC was readily available are qualitatively assessed in Section 4.3.3. Discussion of the concentrations of CoC measured in leachate which are in excess of WQS is included in Section 4.3.4.

4.3.3 Groundwater

Eleven groundwater samples were obtained from monitoring wells and analysed for a range of contaminants (MPA_AUK_BH109 could not be accessed during the monitoring visit). The monitoring wells screen subsurface geology as shown in the table below.

Borehole	Aquifer
MPA_AUK_BH101D	Tidal Flat Deposits
MPA-AUK_BH102D	Mercia Mudstone
MPA_AUK_BH103D	Mercia Mudstone
MPA-AUK_BH104D	Tidal Flat Deposits
MPA_AUK_BH105D	Mercia Mudstone
MPA-AUK_BH106M	Glaciolacustrine Deposits
MPA_AUK_BH106D	Mercia Mudstone
MPA-AUK_BH107M	Tidal Flat Deposits
MPA_AUK_BH107D	Mercia Mudstone
MPA-AUK_BH108M	Tidal Flat Deposits
MPA_AUK_BH108D	Mercia Mudstone

Contaminant concentrations were compared to the WQS in Appendix F and exceedances are summarised below.

Contaminant	Unit	No. Samples Exceeding	WQS Exceeded		Sample	Concentration (µg/l)
Boron	µg/l	6 / 11	DWS	700	MPA_AUK_BH101D MPA_AUK_BH103D MPA_AUK_BH106M MPA_AUK_BH106D MPA_AUK_BH108S MPA_AUK_BH108D	1,500 2,200 1,900 1,900 1,100 4,500
Iron	µg/l	1 / 11	EQS	1,000	MPA_AUK_BH106D	1,400

Contaminant	Unit	No. Samples Exceeding	WQS Exceeded		Sample	Concentration (µg/l)
			DWS	200		
Lead	µg/l	1 / 11	EQS	1.3	MPA_AUK_BH106D	1.4
Manganese	µg/l	9 / 11	DWS	50	MPA_AUK_BH102D MPA_AUK_BH103D MPA_AUK_BH104D MPA_AUK_BH105D MPA_AUK_BH106M MPA_AUK_BH106D MPA_AUK_BH107M MPA_AUK_BH107D MPA_AUK_BH108S	1,200 51 250 270 270 380 580 160 200
pH		7 / 11	EQS	6.0 – 8.5	MPA_AUK_BH101D MPA_AUK_BH103D MPA_AUK_BH104D MPA_AUK_BH106M MPA_AUK_BH106D MPA_AUK_BH108S MPA_AUK_BH108D	10.8 8.9 8.9 8.7 8.8 9.0 9.6
Ammoniacal Nitrogen*	µg/l	6 / 11	DWS	0.5	MPA_AUK_BH102D MPA_AUK_BH104D MPA_AUK_BH105D MPA_AUK_BH107M MPA_AUK_BH107D MPA_AUK_BH108S	1.9 1.5 1.2 1.8 0.78 0.83
Phenol - monohydric	µg/l	5/11	EQS DWS	50 10	PA_AUK_BH102D MPA_AUK_BH104D MPA_AUK_BH105D MPA_AUK_BH107M MPA_AUK_BH107D	680 140 320 300 160
Fluoranthene	µg/l	6 / 11	EQS	0.0063	MPA_AUK_BH101D MPA_AUK_BH103D MPA_AUK_BH104D MPA_AUK_BH105D MPA_AUK_BH106M MPA_AUK_BH106D	0.02 0.01 0.04 0.22 0.02 0.05

Contaminant	Unit	No. Samples Exceeding	WQS Exceeded		Sample	Concentration (µg/l)
Benzo(b)fluoranthene	µg/l	2 / 11	DWS EQS	0.025 0.017	MPA_AUK_BH104D MPA_AUK_BH105D	0.02 0.14
Benzo(k)fluoranthene	µg/l	1/11	DWS EQS	0.025 0.017	MPA_AUK_BH105D	0.06
Benzo(a)pyrene	µg/l	30/11	EQS and DWS	0.027 0.01	MPA_AUK_BH103D MPA_AUK_BH104D MPA_AUK_BH105D	0.01 0.01 0.09
Indeno(1,2,3-c,d)pyrene	µg/l	3/11	DWS	0.025	MPA_AUK_BH105D	0.11
Benzo(g,h,i)perylene	µg/l	3/11	EQS DWS	0.00082 0.025	MPA_AUK_BH103D MPA_AUK_BH104D MPA_AUK_BH105D	0.01 0.01 0.09

* DWS for Ammoniacal Nitrogen is for Ammonium as NH_4.

Concentrations of boron and manganese and ammoniacal nitrogen have been measured in excess of WQS in more than half of the water samples collected from the site. Concentrations of other heavy metals, phenol, and PAHs were also measured in excess of WQS. It is noted that the groundwater pH is neutral to slightly basic.

4.3.4 Surface water

Surface water monitoring was completed co-located with the sediment sampling and the results are presented in Appendix C. Measured concentrations were compared to the WQS as shown in Appendix G.

Contaminant concentrations that exceeded the WQS are shown in the table below.

Contaminant	Unit	No. Samples Exceeding	WQS Exceeded		Sample	Concentration
Cadmium	µg/l	4/6	EQS	0.2	SLEMS_SW01_200720 SLEMS_SW02_200720 SLEMS_SW04_200720	0.08 0.08 0.03
Chromium (hexavalent)	µg/l	1/6	EQS	0.6	SLEMS_SW02_200720	8.6
Copper	µg/l	1/6	EQS	3.76	SLEMS_SW05_200720	7.1
Iron	µg/l	2/6	DWS	200	SLEMS_SW02_200720	200
Lead	µg/l	2/6	EQS	1.3	SLEMS_SW02_200720	1.5
Manganese	µg/l	6/6	DWS	50	SLEMS_SW01_200720 SLEMS_SW02_200720 SLEMS_SW03_200720 SLEMS_SW04_200720 SLEMS_SW06_200720	120 71 110 120 120

Contaminant	Unit	No. Samples Exceeding	WQS Exceeded		Sample	Concentration
Nickle	µg/l	1/6	EQS	8.6	SLEMS_SW04_200720	8.6
Zinc	µg/l	6/6	EQS	7.9	SLEMS_SW01_200720 SLEMS_SW02_200720 SLEMS_SW03_200720 SLEMS_SW04_200720 SLEMS_SW06_200720	12 13 17 15 13
TPH	µg/l	10/15	EQS and DWS	50 10	SLEMS_SW02_200720 SLEMS_SW03_200720 SLEMS_SW04_200720	7,000 180 420
Fluoranthene	µg/l	12/15	EQS	0.0063	SLEMS_SW01_200720 SLEMS_SW03_200720 SLEMS_SW04_200720 SLEMS_SW06_200720	0.13 0.07 0.02 0.09
Benzo(b)fluoranthene	µg/l	10/15	EQS DWS	0.017 0.025	SLEMS_SW01_200720 SLEMS_SW03_200720 SLEMS_SW06_200720	0.1 0.04 0.08
Benzo(k)fluoranthene	µg/l	18/15	EQS DWS	0.017 0.025	SLEMS_SW01_200720 SLEMS_SW03_200720 SLEMS_SW06_200720	0.04 0.02 0.03
Benzo(a)pyrene	µg/l	5/15	EQS DWS	0.017 0.01	SLEMS_SW01_200720 SLEMS_SW03_200720 SLEMS_SW06_200720	0.05 0.02 0.05
Indeno(1,2,3-c,d)pyrene	µg/l	3/15	DWS	0.025	SLEMS_SW01_200720 SLEMS_SW06_200720	0.05 0.04
Benzo(g,h,i)perylene	µg/l	6/15	EQS DWS	0.00082 0.025	SLEMS_SW01_200720 SLEMS_SW03_200720 SLEMS_SW06_200720	0.06 0.02 0.04

Concentrations of CoC measured above MDL for which no GAC was readily available are qualitatively assessed in Section 4.3.4. Discussion of the concentrations of CoC measured in leachate which are in excess of WQS is included in Section 4.3.5

4.3.5 Qualitative Risk Assessment for Substances in Leachate, Surface and Groundwater without WQS

As shown in Appendix E, F, and G for several contaminants including some metals (beryllium and magnesium) and inorganics (chloride, and sulphate) WQS are not readily available for comparison. The following compounds did not have readily available GAC and were recorded at concentrations in excess of their MDL:

calcium, magnesium, sodium, sulphate and chloride, these elements and compounds are present naturally in groundwater. Considering the site setting (close to saline coastal environment) these compounds are not considered to pose a significant risk to water resources.

Given a number of PAHs do not have readily available WQS, assessment of the risk to water resources will be made using PAHs in groundwater that have available WQS. This is considered to be sufficiently protective of water resources. Benzyl alcohol for which no GAC is available was measured in one surface water sample and will be considered in Section 4.3.6.

None of the contaminants without WQS are expected to pose a significant risk to Controlled Waters under a commercial redevelopment scenario and therefore further assessment of the contaminants in deep soils is not warranted.

4.3.6 Discussion

PAH

Concentrations of PAH have been measured in excess of WQS in ten leachate, six groundwater, and five surface water samples. Of the measured concentrations of PAH in excess, they are considered to be marginally in excess of the WQS. Given this, and that PAH are generally of low mobility in the natural environment, the risk to water resources receptors from these contaminants is considered to be low even for PAH without WQS detected above MDL.

Heavy Metals

Of the heavy metals, arsenic, cadmium, copper, lead, mercury, molybdenum, and zinc were measured in excess of the WQS in leachate. Of these, only lead was measured in excess of the WQS in groundwater, and this was in a single location and only marginally above the WQS (1.4µg/l against a WQS of 1.3µg/l). As such the concentrations of heavy metals in leachate are not considered to pose a risk to controlled waters, further consideration of molybdenum is required.

Concentrations of boron, iron, and manganese have been measured in excess of WQS in groundwater. None of these concentrations were measured in excess of WQS when compared to soil leachate. As such, the source of elevated concentrations of heavy metals in the groundwater is unlikely to have been identified as part of these works, as such further consideration should be given as to the risk to water resources.

Concentrations of cadmium, chromium (VI), copper, iron, lead, manganese, nickel, and zinc were measured in excess of the WQS in surface water. Of these cadmium, chromium (VI), copper, nickel, and zinc were not measured above the EQS in groundwater at the site and therefore are the site is not considered a likely source for these metals in surface water.

Manganese was measured in groundwater sampled from nine wells at the site, boron from six wells, and lead and iron from one well apiece. Whilst it is noted that these elements are naturally occurring and may not result from the site further consideration should be given as to the risk to surface water.

Inorganic compounds

Concentrations of ammoniacal nitrogen were marginally in excess of the WQS in six of the eleven groundwater samples tested; concentrations were marginally below the WQS in leachate testing completed on fourteen samples. Whilst it is noted that ammoniacal nitrogen can be naturally occurring, the risk to water resources from concentrations of ammoniacal nitrogen measured in groundwater requires further consideration.

Phenols

Phenol was measured at concentrations an order of magnitude above the WQS in groundwater sampled from five of the eleven monitoring wells sampled. Phenol was not measured above the MDL in soil or leachate samples tested or in surface water. As such, the source of the phenol in the groundwater does not appear to be related to the soil sampled at the site. Given the location of the site in a heavily industrialised area, it is possible that the phenol concentrations measured in the groundwater are a result of contaminants migrating onto site from off-site sources or that there is an unidentified source of phenol on site. The risk to water resources from concentrations of phenol warrants further consideration.

4.4 Ground Gas

The concentrations of ground gasses and flow rates observed in section 3.7 do not identify an unacceptable risk to human health or built receptors from the accumulation of ground gas. However, as the ground investigation was not designed with a particular redevelopment scenario in mind, the gas data monitoring was limited and may not be representative of the entire extent of the site under a particular redevelopment.

Given the proposed remedial strategy for the site (10035117-AUK-XX-XX-RP-ZZ-0181-MPA_ROA and Strategy) comprising the excavation processing and replacement of a significant proportion of the made ground, further monitoring is recommended once this is complete based on the specific requirements of a particular redevelopment.

4.5 Built Receptors

Certain forms of land contamination can pose a risk to subsurface structures and services, where these are in direct contact with soil and/or groundwater. Substances such as dissolved metals, sulphate, cations, phenols and hydrocarbons in high concentrations can adversely affect in-ground materials such as concrete, metal and plastics.

One potential built receptor is plastic water supply pipes, which can be affected by permeation of hydrocarbons and organic solvents into the pipe. The available chemical data for soil samples has been reviewed against the UK Water Industry Research (UKWIR) criteria to provide an indication of the potential acceptability of polyethylene (PE) pipes in brownfield land (Water UK, 2014), although an exact comparison is not possible due to differences in the determinand suites tested.

Concentrations of petroleum hydrocarbons, and SVOC measured in some soil samples are above the criteria for unprotected PE water pipes with between 8% (SVOC) and 5% (petroleum hydrocarbons) of soil samples in excess of UKWIR criteria. It is also noted the Made Ground at the site can be alkaline (up to a pH of 12.5). Therefore, additional testing should be carried along the route of any proposed new water supply pipe, or barrier pipe or similar could be used.

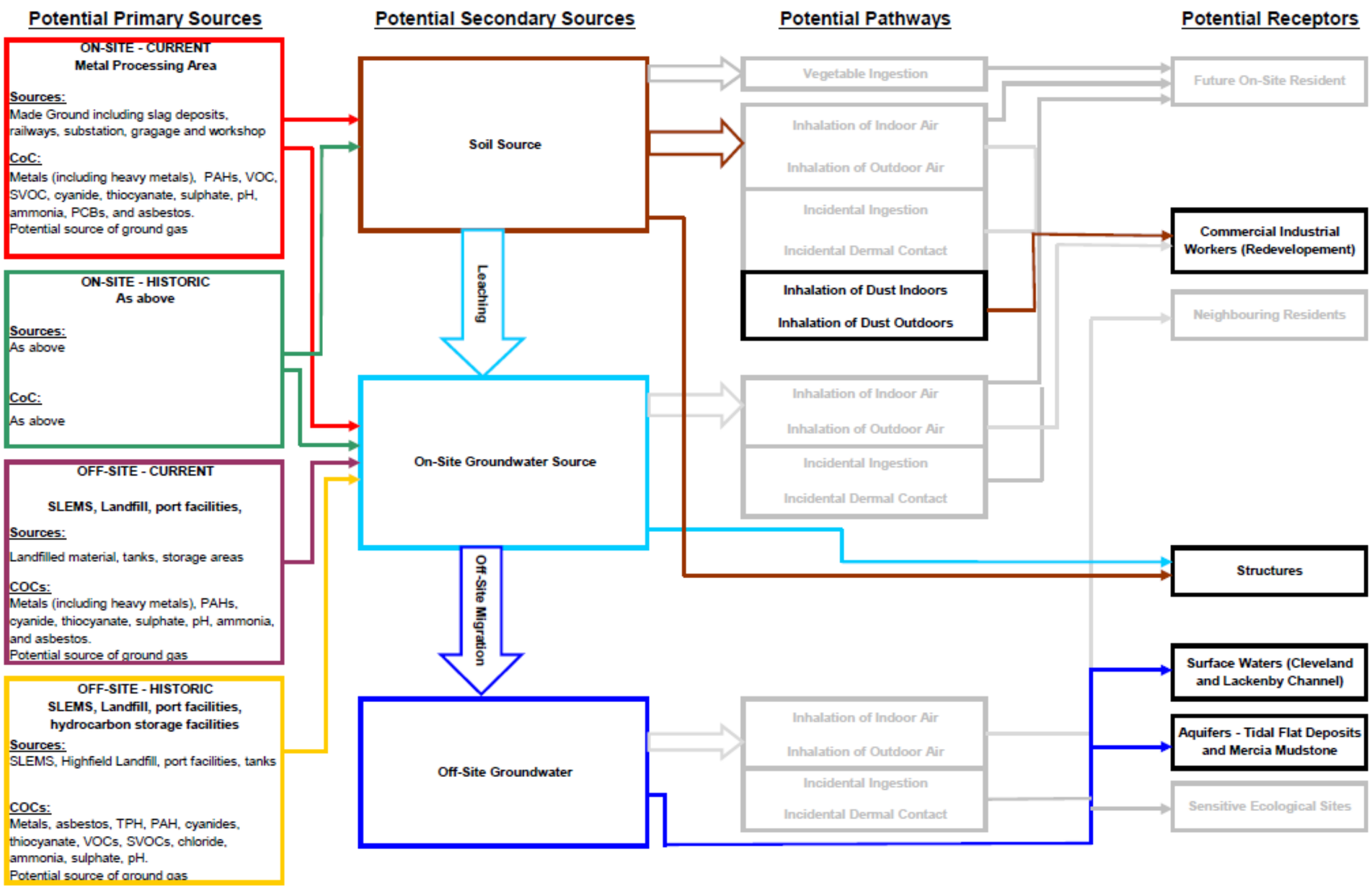
The potential for the ground conditions to generate an aggressive chemical environment for concrete (sulphate attack) is outside the scope of this report.

Potential pollutant linkage E (attack on subsurface structures) cannot be discounted at this stage and appropriate mitigation measures may be required, these will be dependent on the redevelopment scenario and may require further assessment to define.

5 Updated Conceptual Site Model

An updated CSM has been developed, using the findings of the above assessments, and is presented below as Figure 7. Pollutant linkages that have been shown to be inactive or not a significant risk have been removed.

Figure 7
Updated Conceptual Site Model - Commercial Industrial End Use



6 Conclusions

This report has used **DRAFT** information obtained from the recent ground investigation to assess the potential contamination risks to human health, Controlled Waters, ecological receptors and built property from contaminants in deep soils and groundwater. The assessment has been undertaken based on a future generic commercial end use which is considered to be sufficiently conservative to also cover industrial end uses. Based upon this assessment of data, the CSM has been updated to identify the pollutant linkages considered to be potentially complete – dependent on the final development design (previous page).

Heavy metals have been recorded in soil and dissolved in soil leachate samples across the site. These are likely associated with the slag within the Made Ground. The probable source is historical placement of material from the steelmaking process.

6.1 Human Health Risk

Potential risks to human health via intake of a range of contaminants from deep soils (Made Ground including slag materials) and groundwater were assessed using Generic Assessment Criteria (GAC). None of the contaminants for which GAC are available exceeded the criteria and therefore no unacceptable risks have been identified from contact with or ingestion of soils on the site based on the current dataset. Soil pH was noted to be basic / alkaline, groundwater pH was noted to be neutral to slightly alkaline / basic. Contaminants without GACs have been qualitatively reviewed and no potentially significant risks have been identified based on the current dataset.

6.2 Controlled Waters

Several exceedances of Water Quality Standards (WQS) were recorded in soil leachate samples from Made Ground and groundwater samples from the Mercia Mudstone Formation and Tidal Flat Deposits. Some, but not all, dissolved contaminants in groundwater are consistent with soil leachate analysis results indicating that some leaching is occurring into shallow groundwater from the slag deposits. For some contaminants such as phenol, and manganese, concentrations were significantly lower in leachate than in groundwater indicating either that the source of these contaminants has not yet been identified or that they represent a residual source that has previously leached from soils.

Whilst concentrations of CoC have been measured in excess of Drinking Water Standards (DWS) in groundwater samples collected from the site, taking the wider environmental setting into account including the brackish nature of the identified water within both the Mercia Mudstone and Tidal Flat Deposits and proximity to the estuary and coast, the resource value of the aquifer is likely to be low.

Based on the groundwater elevation data for the Made Ground data the groundwater flow is expected to have a northerly component towards the River Tees and potentially the Lackenby Channel. Based on the current data set groundwater flow could not be confirmed for either the Tidal Flat Deposits or the Mercia Mudstone.

Given that concentrations of certain contaminants have been measured above the WQS including heavy metals, ammoniacal nitrogen, PAH and phenol, that groundwater flow is potentially towards the River tees and potentially also the Lackenby Channel, and that some of these contaminants have been measured in surface water, further assessment of the risk to surface water is warranted. However, it is noted that surface water quality has not been noted to deteriorate as it passes the southern section of the site.

6.3 Recommendations

1. Additional groundwater and surface water monitoring should be conducted to create a broader temporal data set for the site, and further refine the interaction between these controlled waters.
2. Depending on the redevelopment scenario further ground investigation including ground gas monitoring of shallow soils may need to be carried out prior to redevelopment to quantify the ground gas risk on the site in the context of the proposed layout and design.
3. If new foundations penetrating the Glacial Till are proposed, a foundation works risk assessment should be carried out to enable appropriate mitigation measures to be designed that will prevent

contaminant migration *via* a preferential pathway down into the underlying Mercia Mudstone Formation aquifer.

4. Appropriate UXO mitigation measures should be implemented during any excavation / piling works at the site where a UXO encounter is possible in order to reduce the risk to as low as reasonable possible (ALARP).

APPENDIX A

Figures

Legend

Site Boundary

Metals Processing Area

Notes:

CONTACT ARCADIS IN CASE OF ANY QUERIES.

N

Title: MPA - Site Location Plan

Site:
Redcar Steelworks - MPA

Client:
South Tees Developement Corporation

Project: 10035117	**Figure 1**

Date: 07/08/2020
Drawn By: JALM
DRG No: 10035117-AUK-XX-XX-DR-ZZ-0127-01-MPA_SLP

ARCADIS Design & Consultancy for natural and built assets

Legend

Redline

Metals Recovery Area

Hatching Shows Artificial Ground

Notes:

CONTACT ARCADIS IN CASE OF ANY QUERIES.

Title: MPA - Anticipated Geology

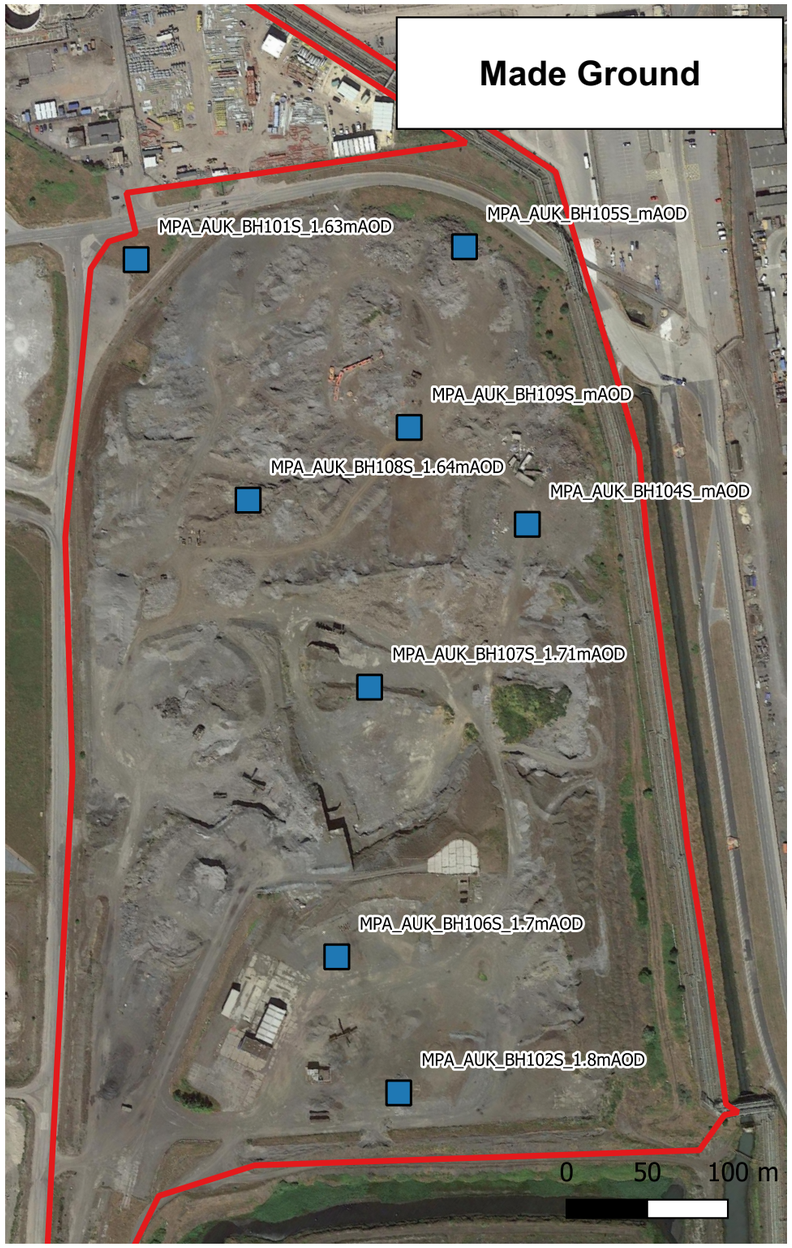
Site:
Redcar Steelworks - MPA

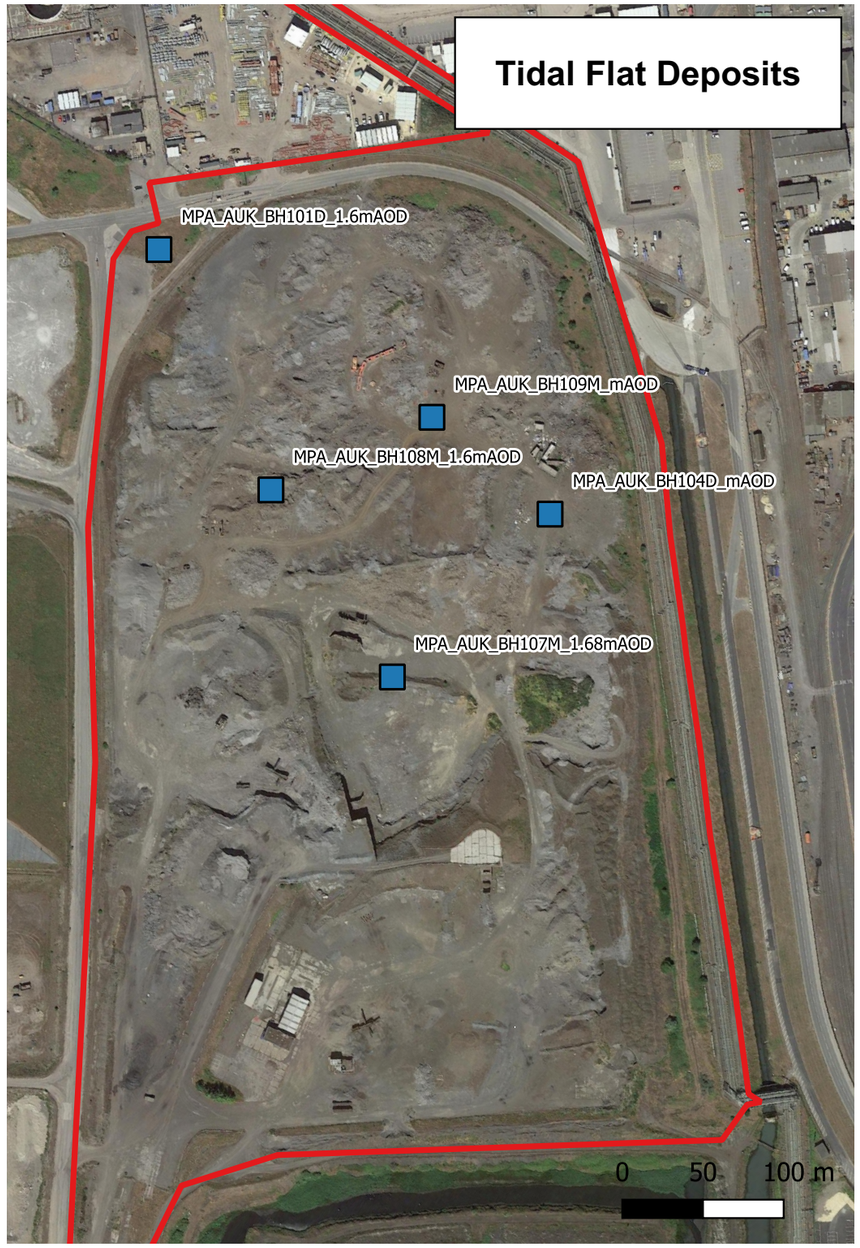
Client:
South Tees Developement Corporation

Project: 10035117	**Figure 2**

Date: 01/04/2020
Drawn By: JALM
DRG No: 10035117-AUK-XX-XX-DR-ZZ-0126-01-MPA_Geology

ARCADIS Design & Consultancy for natural and built assets





Legend

GI data files

Visual Observation

Monitoring Well

Maps

Google Sat

Plans

Redline

Metals Recovery Area

Notes:

CONTACT ARCADIS IN CASE OF ANY QUERIES.

Elevation data not available for MPA_AUK_BH104 / MPA_AUK_BH106 / MPA_AUK_BH107 as time of issue.

Title: MPA - Hydrogeology

Site:
Redcar Steelworks - MPA

Client:
South Tees Developement Corporation

Project:
10035117

Figure 3

Date: 07/12/2020
Drawn By: JALM
DRG No: 10035117-AUK-XX-XX-DR-ZZ-0249-01-MPA_Hydro

ARCADIS Design & Consultancy for natural and built assets

Legend

STDC Shapefile Data

- Rail Track
- Tanks

Redline

- Metals Recovery Area

Notes:

REPRODUCED FROM OS MASTERMAP BY PERMISSION OF ORDNANCE SURVEY® ON BEHALF OF THE CONTROLLER OF HER MAJESTY'S STATIONERY OFFICE. © CROWN COPYRIGHT. ALL RIGHTS RESERVED. LICENCE NUMBER GD 100024393.

CONTACT ARCADIS IN CASE OF ANY QUERIES.

Not shown PAOC - Made Ground

N

Title: MPA - Potential Areas of Concern (PAOC)

Site:
Redcar Steelworks - MPA

Client:
South Tees Developement Corporation

Project:
37774100

Figure 4

Date: 3/08/2020
Drawn By: JALM
DRG No: 10035117-AUK-XX-XX-DR-ZZ-0125-01-MPA_PAOC

ARCADIS Design & Consultancy for natural and built assets

SLEMS_SW04
SLEMS_SW06
SLEMS_SW03
SLEMS_SW02
SLEMS_SW01

Legend

GI data files	Plans	Maps
Sample Location	Redline	Google Sat
Surface Water	Metals Recovery Area	

Notes:

CONTACT ARCADIS IN CASE OF ANY QUERIES.

N

Title: MPA - Surface Water Sampling Locations

Site:
Redcar Steelworks - MPA

Client:
South Tees Developement Corporation

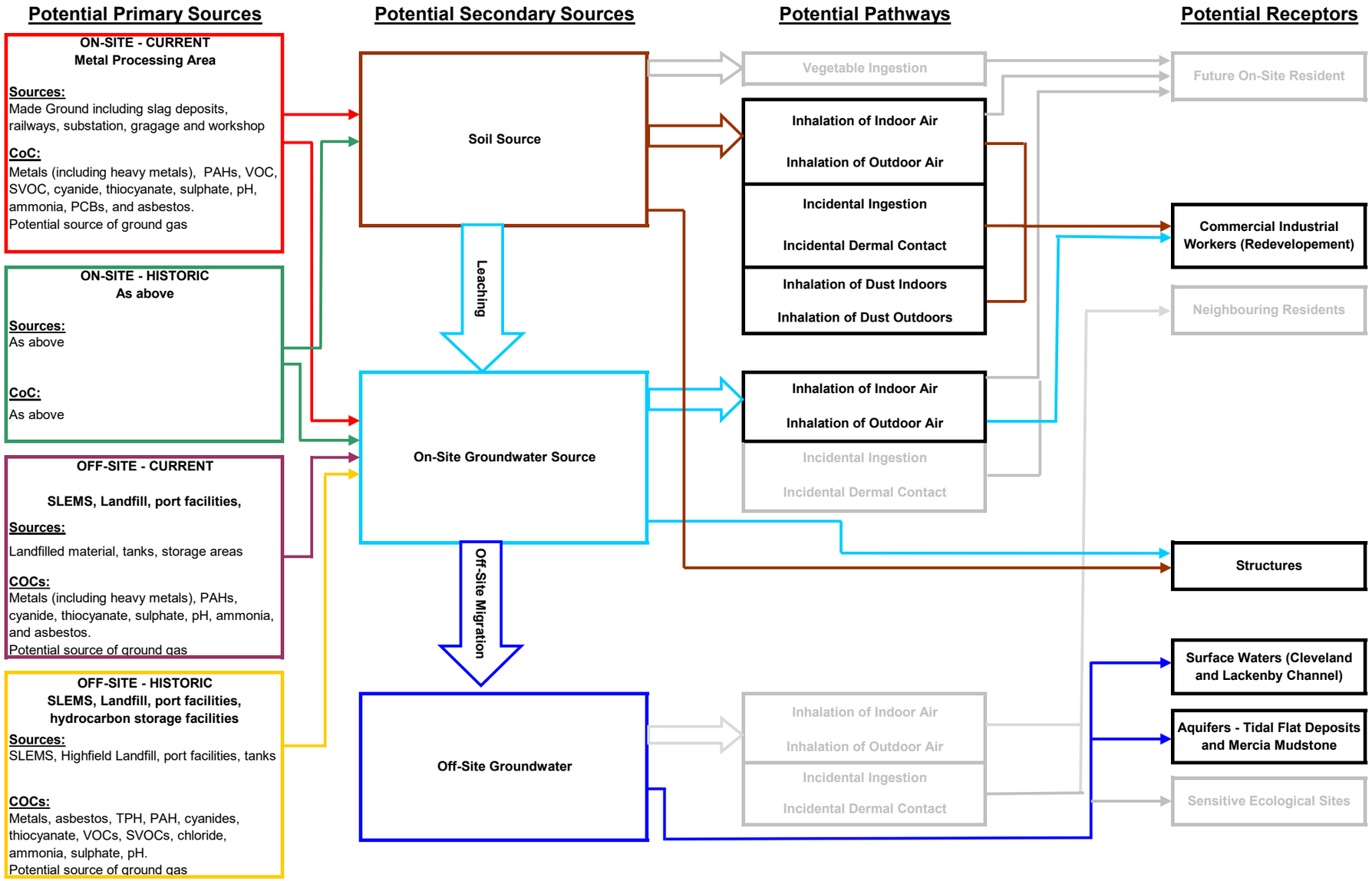
Project:
37774100

Figure 5

Date: 3/08/2020
Drawn By: JALM
DRG No: 10035117-AUK-XX-XX-DR-ZZ-0247-01-MPA_SW_Loc

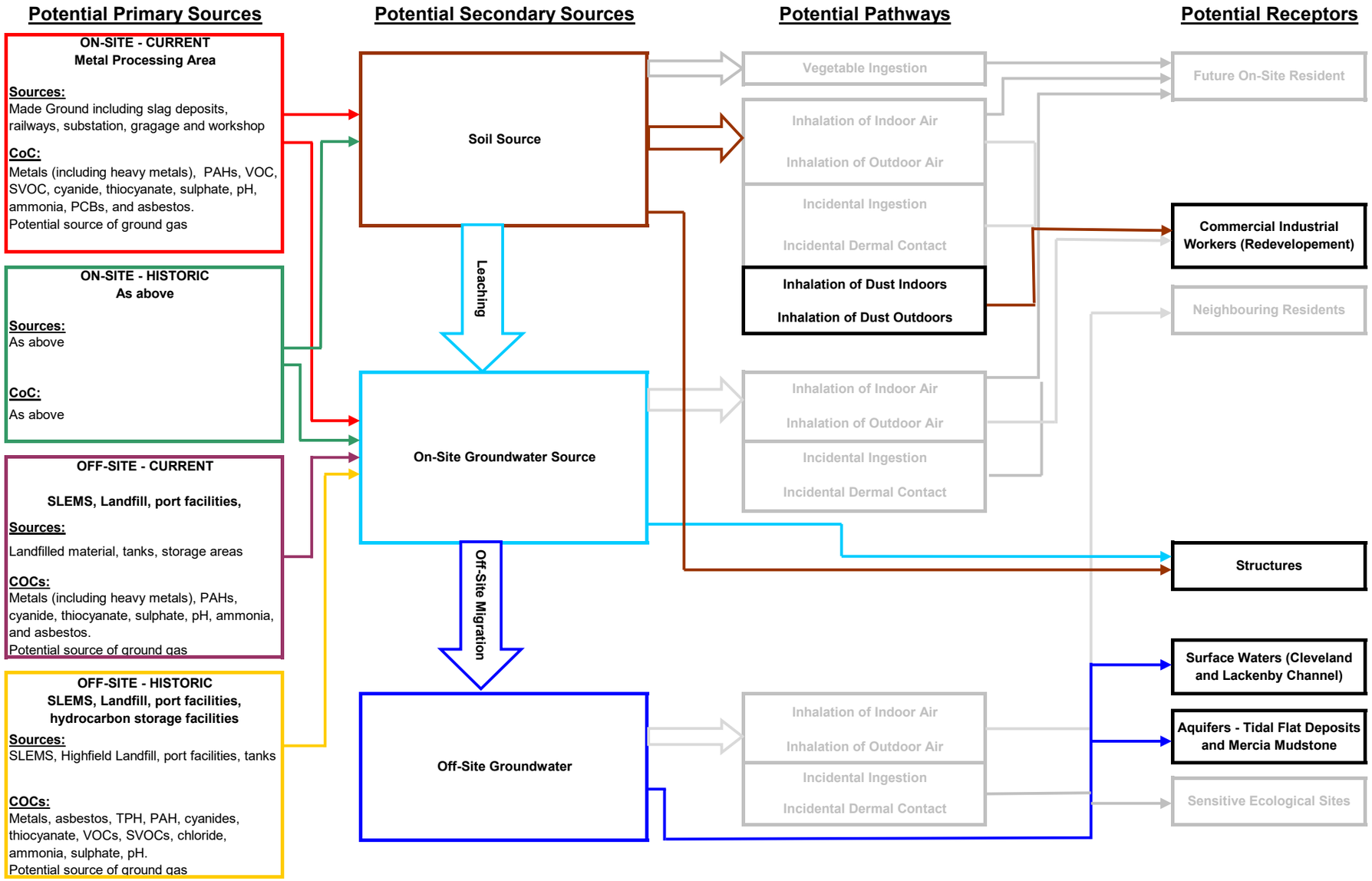
ARCADIS Design & Consultancy for natural and built assets

Figure 6
Outline Conceptual Site Model - Commercial Industrial End Use



Key: Pollutant linkage not considered to present a significant level of risk

Figure 7
Updated Conceptual Site Model - Commercial Industrial End Use



Key: Pollutant linkage not considered to present a significant level of risk

APPENDIX B

Study Limitations

IMPORTANT: This section should be read before reliance is placed on any of the information, opinions, advice, recommendations or conclusions contained in this report.

1. This report has been prepared by Arcadis UK Ltd (Arcadis), with all reasonable skill, care and diligence within the terms of the Appointment and with the resources and manpower agreed with **STDC** (the 'Client'). Arcadis does not accept responsibility for any matters outside the agreed scope.

2. This report has been prepared for the sole benefit of the Client unless agreed otherwise in writing.

3. Unless stated otherwise, no consultations with authorities or funders or other interested third parties have been carried out. Arcadis are unable to give categorical assurance that the findings will be accepted by these third parties as such bodies may have unpublished, more stringent objectives. Further work may be required by these parties.

4. All work carried out in preparing this report has used, and is based on, Arcadis' professional knowledge and understanding of current relevant legislation. Changes in legislation or regulatory guidance may cause the opinion or advice contained in this report to become inappropriate or incorrect. In giving opinions and advice, pending changes in legislation, of which Arcadis is aware, have been considered. Following delivery of the report, Arcadis have no obligation to advise the Client or any other party of such changes or their repercussions.

5. This report is only valid when used in its entirety. Any information or advice included in the report should not be relied upon until considered in the context of the whole report.

6. Whilst this report and the opinions made are correct to the best of Arcadis' belief, Arcadis cannot guarantee the accuracy or completeness of any information provided by third parties.

7. This report has been prepared based on the information reasonably available during the project programme. All information relevant to the scope may not have been received.

8. This report refers, within the limitations stated, to the condition of the Site at the time of the inspections. No warranty is given as to the possibility of changes in the condition of the Site since the time of the investigation.

9. The content of this report represents the professional opinion of experienced environmental consultants. Arcadis does not provide specialist legal or other professional advice. The advice of other professionals may be required.

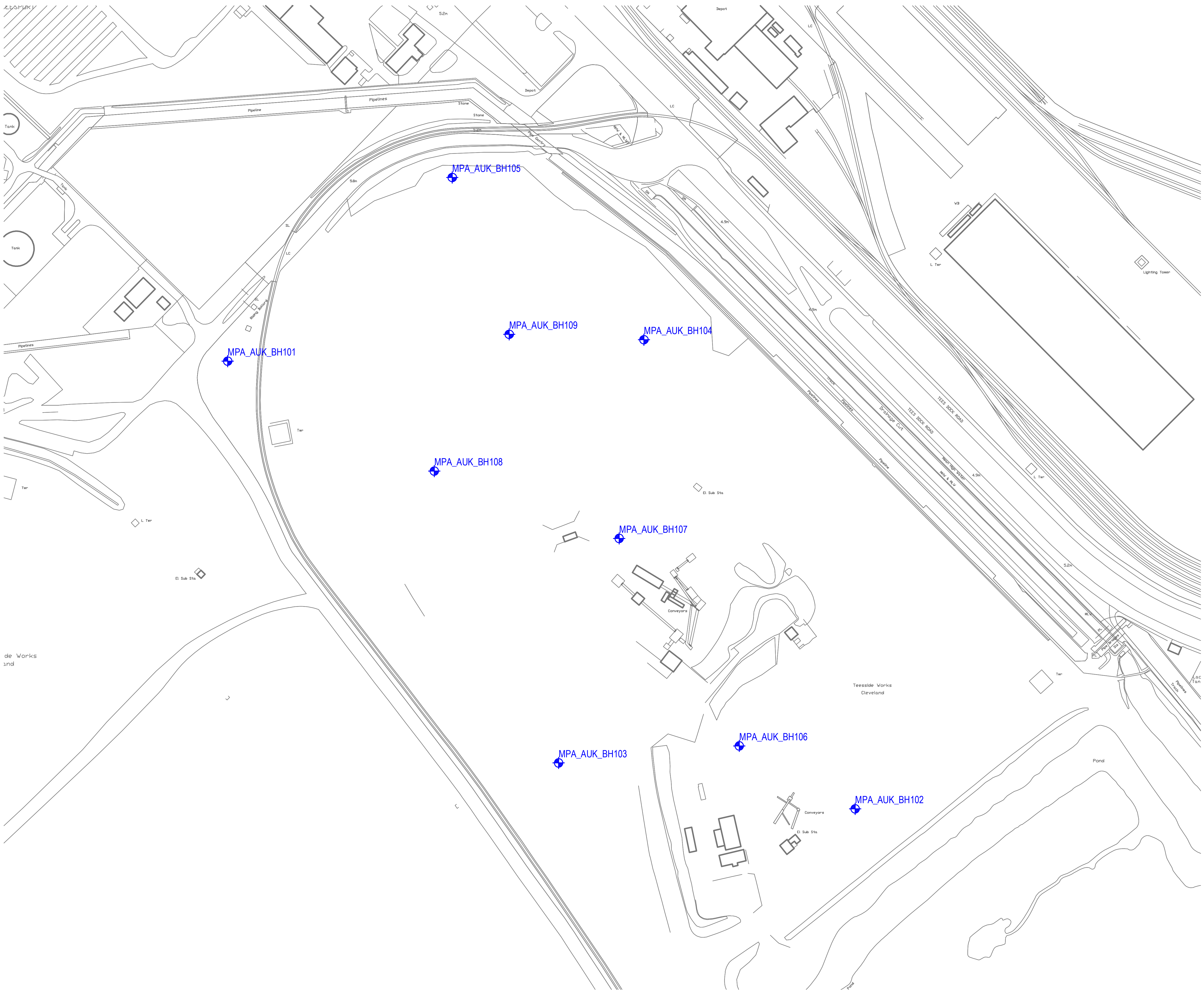
10. Where intrusive investigation techniques have been employed they have been designed to provide a reasonable level of assurance on the conditions. Given the discrete nature of sampling, no investigation technique is capable of identifying all conditions present in all areas. In some cases the investigation is further limited by site operations, underground obstructions and above ground structures. Unless otherwise stated, areas beyond the boundary of the site have not been investigated.

11. If below ground intrusive investigations have been conducted as part of the scope, service tracing for safe location of exploratory holes has been carried out. The location of underground services shown on any drawing in this report has been determined by visual observations and electromagnetic techniques. No guarantee can be given that all services have been identified. Additional services, structures or other below ground obstructions, not indicated on the drawing, may be present on Site.

12. Unless otherwise stated the report provides no comment on the nature of building materials, operational integrity of the facility or on any regulatory compliance issue

APPENDIX C

DRAFT AEG Data



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Chester - Le - Street
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DH2 2RG
(Tel): 0191 387 4700
(Fax): 0191 387 4710
(Email): enquiries@aeg.uk.net

KEY:

SONIC SAMPLING HOLE

N W E S

Base Plan Supplied by Consulting Engineer

Drawing Title:	ENC 01 : Exploratory Hole Location Plan
Drawing No.:	AEG/4291/01
Contract Title:	Metal Processing Area Shallow Soils Investigation
Client:	South Tees Development Corporation
Consultant:	Arcadis 1 Whitehall Riverside Leeds, LS1 4BN
Contract No.:	4291
Scale:	1:2500 @A3
Date:	07/12/2020

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20 Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454302.810 N:522861.775		**MPA_AUK_BH101**
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 8.941	**Start Date:** 16/10/2020	**Sheet:** 1 of 10

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
0.00-1.20	$U1_{(SS)}$						MADE GROUND (Brown green and grey sandy gravel and cobbles. Sand is fine to coarse and includes crushed slag. Gravel is fine to coarse subangular and includes slag. Cobbles are subrounded and includes slag. Slag content is 75-100%. Slag is vesicular).	
0.60	$J1_{(U1)}$							
0.80	$B2_{(U1)}$							
1.00	PID	<0.1ppm						
1.20-2.70	U2						at c.1.20m BGL ... very dense/cobble obstruction.	
1.20	S	50/150mm						
2.00	PID	<0.1ppm						
2.70-4.20	$U3_{(SS)}$						at c.2.70m BGL ... very dense/cobble obstruction.	
2.70	S	50/90mm						
3.00	PID	<0.1ppm						
3.60	$J3_{(U3)}$							
3.80	$B4_{(U3)}$							
4.00	PID	0.6ppm						
4.20-5.70	$U4_{(SS)}$							
4.20	S	50/120mm						
						(9.30)		
4.70	$ES5_{(U4)}$							
5.00	PID	0.5ppm						
5.70-7.20	$U5_{(SS)}$						at c.5.70m BGL ... dense.	
5.70	S	N47						
6.00	PID	<0.1ppm						
6.60	$J6_{(U5)}$							
6.80	$B7_{(U5)}$							
7.00	PID	<0.1ppm						
7.20-8.70	U6						at c.7.20m BGL ... very dense/cobble obstruction.	
7.20	S	50/185mm						

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
16/10/2020	0.00	0.00	178	

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
0.00 - 1.20	150	100	Yes
1.20 - 2.70	150	100	No
2.70 - 4.20	150	100	Yes
4.20 - 5.70	150	100	Yes
5.70 - 7.20	150	100	Yes
7.20 - 8.70	150	100	No

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.00-9.00m and 1 No. 50mm diameter slotted standpipe installed between 12.00-15.00m BGL respectively.
(4) UXO testing during drilling.
(5) Advanced using water flush.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

Print Date and Time: 07/12/2020 13:29:35

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20 Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation		**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454302.810 N:522861.775	**MPA_AUK_BH101**
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 8.941 / **Start Date:** 16/10/2020	**Sheet:** 2 of 10

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
8.00	PID	<0.1ppm					MADE GROUND (Brown green and grey sandy gravel and cobbles. Sand is fine to coarse and includes crushed slag. Gravel is fine to coarse subangular and includes slag. Cobbles are subrounded and includes slag. Slag content is 75-100%. Slag is vesicular). *(continued)*	
8.70-10.20	$U7_{(SS)}$							
8.70	S	N14					at c.8.70m BGL ... medium dense.	
9.00	PID	<0.1ppm		-0.36		9.30		
							Medium dense grey brown silty SAND with silt lenses and some fragments of shell. Sand is fine to coarse.	
9.60	$J8_{(U7)}$							
9.80	$B9_{(U7)}$							
10.00	PID	<0.1ppm						
10.20-11.70	$U8_{(SS)}$							
10.20	S	N25						
10.60	$ES10_{(U8)}$							
11.70-13.20	$U9_{(SS)}$							
11.70	S	50/280mm				(5.40)	at c.11.70m BGL ... very dense.	
12.60	$J11_{(U9)}$							
12.80	$B12_{(U9)}$							
13.20-14.70	U10							
13.20	S	N36					at c.13.20m BGL ... dense.	
				-5.76		14.70		
14.70-16.20	$U11_{(SS)}$						Firm to stiff brown orange slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to medium subrounded and includes sandstone and mudstone.	
14.70	S	N18						
15.00	$J13_{(U11)}$							
15.50	$B14_{(U11)}$							

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
16/10/2020	11.70	11.70	178	6.20
19/10/2020	11.70	11.70	178	7.59

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
8.70 - 10.20	150	73	Yes
10.20 - 11.70	150	100	Yes
11.70 - 13.20	150	100	Yes
13.20 - 14.70	150	100	No
14.70 - 16.20	150	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.00-9.00m and 1 No. 50mm diameter slotted standpipe installed between 12.00-15.00m BGL respectively.
(4) UXO testing during drilling.
(5) Advanced using water flush.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454302.810 N:522861.775		**MPA_AUK_BH101**
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 8.941	**Start Date:** 16/10/2020	**Sheet:** 3 of 10

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
16.20-17.70 16.20	U12 S	N28				(2.90)	Firm to stiff brown orange slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to medium subrounded and includes sandstone and mudstone. *(continued)*	
				-8.66		17.60		
17.70-19.20 17.70	U13$_{(SS)}$ S	50/261mm				(1.60)	Red brown very clayey GRAVEL/very gravelly CLAY. Gravel is fine to medium angular and includes mudstone weathered. (Engineer notes weathering profile of an extremely weak mudstone).	
18.50	J15$_{(U13)}$							
18.70	B16$_{(U13)}$							
				-10.26		19.20		
19.20	S	50/90mm					*Complete at 19.20m BGL.*	

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
19/10/2020	19.20	19.20	178	

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
16.20 - 17.70	150	100	No
17.70 - 19.20	150	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.00-9.00m and 1 No. 50mm diameter slotted standpipe installed between 12.00-15.00m BGL respectively.
(4) UXO testing during drilling.
(5) Advanced using water flush.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454302.810 N:522861.775		**MPA_AUK_BH101**
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 8.941	**Start Date:** 16/10/2020	**Sheet:** 4 of 10

Figure MPA_AUK_BH101.1
MPA_AUK_BH101 0.00-1.20m BGL

Figure MPA_AUK_BH101.2
MPA_AUK_BH101 1.20-2.70m BGL

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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH101
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454302.810 N:522861.775		
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 8.941	**Start Date:** 16/10/2020	**Sheet:** 5 of 10

Figure MPA_AUK_BH101.3
MPA_AUK_BH101 2.70-4.20m BGL

Figure MPA_AUK_BH101.4
MPA_AUK_BH101 4.20-5.70m BGL

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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH101
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454302.810 N:522861.775		
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 8.941	**Start Date:** 16/10/2020	**Sheet:** 6 of 10

Figure MPA_AUK_BH101.5
MPA_AUK_BH101 5.70-7.20m BGL

Figure MPA_AUK_BH101.6
MPA_AUK_BH101 7.20-8.70m BGL

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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH101
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454302.810 N:522861.775		
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 8.941	**Start Date:** 16/10/2020	**Sheet:** 7 of 10

Figure MPA_AUK_BH101.7
MPA_AUK_BH101 8.70-10.20m BGL

Figure MPA_AUK_BH101.8
MPA_AUK_BH101 10.20-11.70m BGL

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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH101
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454302.810 N:522861.775		
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 8.941	**Start Date:** 16/10/2020	**Sheet:** 8 of 10

Figure MPA_AUK_BH101.9
MPA_AUK_BH101 11.70-13.20m BGL

Figure MPA_AUK_BH101.10
MPA_AUK_BH101 13.20-14.70m BGL

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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH101
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454302.810 N:522861.775		
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 8.941	**Start Date:** 16/10/2020	**Sheet:** 9 of 10

Figure MPA_AUK_BH101.11
MPA_AUK_BH101 14.70-16.20m BGL

Figure MPA_AUK_BH101.12
MPA_AUK_BH101 16.20-17.70m BGL

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SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH101
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454302.810 N:522861.775		
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 8.941	**Start Date:** 16/10/2020	**Sheet:** 10 of 10

Figure MPA_AUK_BH101.13
MPA_AUK_BH101 17.70-19.20m BGL

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SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454743.455 N:522547.488		**MPA_AUK_BH102**
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 7.367	**Start Date:** 15/10/2020	**Sheet:** 1 of 7

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
0.00-1.20	$U1_{(SS)}$			7.17		0.20	MADE GROUND (Grey concrete).	
							MADE GROUND (Brown green and grey sandy gravel and cobbles. Sand is fine to coarse and includes crushed slag. Gravel is fine to coarse subangular and includes slag. Cobbles are subrounded and includes slag. Slag content is 75-100%. Slag is vesicular).	
1.00	$J1_{(U1)}$							
1.00	PID	<0.1ppm						
1.20	$B2_{(U2)}$						at c.1.20m BGL ... very dense/cobble obstruction.	
1.20-2.70	$U2_{(SS)}$							
1.20	S	50/110mm						
2.00	PID	<0.1ppm						
2.70-4.20	$U3_{(SS)}$						at c.2.70m BGL ... very dense/cobble obstruction.	
2.70	S	50/185mm						
3.00	PID	<0.1ppm				(6.30)		
4.00	$J3_{(U3)}$							
4.00	PID	<0.1ppm						
4.20	$B4_{(U4)}$						at c.4.20m BGL ... medium dense.	
4.20-5.70	$U4_{(SS)}$							
4.20	S	N28						
5.00	PID	<0.1ppm						
5.20	$ES5_{(U4)}$							
5.70-7.20	$U5_{(SS)}$						at c.5.70m BGL ... medium dense.	
5.70	S	N19						
6.00	PID	<0.1ppm						
				0.87		6.50		
						(0.70)	Grey brown silty SAND with lenses of silt and fragments of shell. Sand is fine to coarse.	
7.00	$J6_{(U5)}$			0.17		7.20		
7.00	PID	<0.1ppm					Soft laminated red brown CLAY.	
7.10	$B7_{(U5)}$							
7.20-8.70	$U6_{(SS)}$							
7.20	S	N9						
7.30	$ES8_{(U6)}$							
7.40	$J9_{(U6)}$							

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
15/10/2020	0.00	0.00	178	

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
0.00 - 1.20	116	100	Yes
1.20 - 2.70	116	100	Yes
2.70 - 4.20	116	100	Yes
4.20 - 5.70	116	100	Yes
5.70 - 7.20	116	100	Yes
7.20 - 8.70	116	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.00-7.00m and 1 No. 50mm diameter slotted standpipe installed between 13.70-14.70m BGL respectively.
(4) UXO testing during drilling.
(5) Advanced using water flush.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454743.455 N:522547.488		**MPA_AUK_BH102**
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 7.367	**Start Date:** 15/10/2020	**Sheet:** 2 of 7

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
7.50 8.00	$B10_{(U6)}$ PID	<0.1ppm					Soft laminated red brown CLAY. *(continued)*	
8.70-10.20 8.70	U7 S	N7				(3.50)		
10.20-11.70 10.20	$U8_{(SS)}$ S	N7		-3.33		10.70		
10.80 11.00	$J11_{(U8)}$ $B12_{(U8)}$						Firm brown orange slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to medium subrounded and includes sandstone and mudstone.	
11.70-13.20 11.70	U9 S	N19				(2.15)		
13.20-14.70 13.20 13.50 13.60	$U10_{(SS)}$ S $J13_{(U10)}$ $B14_{(U10)}$	N34		-5.48		12.85	Red brown very clayey GRAVEL/very gravelly CLAY. Gravel is fine to medium angular and includes mudstone weathered. (Engineer notes weathering profile of an extremely weak mudstone).	
14.70	S	50/55mm		-7.33		(1.85) 14.70	*Complete at 14.70m BGL.*	

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
15/10/2020	14.70	14.70	178	4.50

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
8.70 - 10.20	116	100	No
10.20 - 11.70	116	100	Yes
11.70 - 13.20	116	100	No
13.20 - 14.70	116	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.00-7.00m and 1 No. 50mm diameter slotted standpipe installed between 13.70-14.70m BGL respectively.
(4) UXO testing during drilling.
(5) Advanced using water flush.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH102
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454743.455 N:522547.488		
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 7.367	**Start Date:** 15/10/2020	**Sheet:** 3 of 7

Figure MPA_AUK_BH102.1
MPA_AUK_BH102 0.00-1.20m BGL

Figure MPA_AUK_BH102.2
MPA_AUK_BH102 1.20-2.70m BGL

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH102
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454743.455 N:522547.488		
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 7.367	**Start Date:** 15/10/2020	**Sheet:** 4 of 7

Figure MPA_AUK_BH102.3
MPA_AUK_BH102 2.70-4.20m BGL

Figure MPA_AUK_BH102.4
MPA_AUK_BH102 4.20-5.70m BGL

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH102
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454743.455 N:522547.488		
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 7.367	**Start Date:** 15/10/2020	**Sheet:** 5 of 7

Figure MPA_AUK_BH102.5
MPA_AUK_BH102 5.70-7.20m BGL

Figure MPA_AUK_BH102.6
MPA_AUK_BH102 7.20-8.70m BGL

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH102
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454743.455 N:522547.488		
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 7.367	**Start Date:** 15/10/2020	**Sheet:** 6 of 7

Figure MPA_AUK_BH102.7
MPA_AUK_BH102 8.70-10.20m BGL

Figure MPA_AUK_BH102.8
MPA_AUK_BH102 10.20-11.70m BGL

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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH102
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454743.455 N:522547.488		
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 7.367	**Start Date:** 15/10/2020	**Sheet:** 7 of 7

Figure MPA_AUK_BH102.9
MPA_AUK_BH102 11.70-13.20m BGL

Figure MPA_AUK_BH102.10
MPA_AUK_BH102 13.20-14.70m BGL

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454535.206 N:522579.746		**MPA_AUK_BH103**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.700	**Start Date:** 14/10/2020	**Sheet:** 1 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
0.00-1.20	$U1_{(SS)}$						MADE GROUND (Brown green and grey sandy gravel and cobbles. Sand is fine to coarse and includes crushed slag. Gravel is fine to coarse subangular and includes slag. Cobbles are subrounded and includes slag. Slag content is 75-100%. Slag is vesicular).	
0.60	$J1_{(U1)}$							
0.80	$B2_{(U1)}$							
1.00	PID	<0.1ppm						
1.20-2.70	U2						at c.1.20m BGL ... very dense/cobble obstruction.	
1.20	S	70/225mm						
2.00	PID	<0.1ppm						
						(5.30)		
2.70-4.20	$U3_{(SS)}$						at c.2.70m BGL ... very dense/cobble obstruction.	
2.70	S	50/165mm						
3.00	PID	<0.1ppm						
3.60	$J3_{(U3)}$							
3.80	$B4_{(U3)}$							
4.00	PID	<0.1ppm						
4.20-5.70	$U4_{(SS)}$						at c.4.20m BGL ... dense.	
4.20	S	N40						
5.00	$ES5_{(U4)}$							
5.00	PID	<0.1ppm		1.40		5.30		
						(0.50)	Grey brown silty SAND with silt lenses. Sand is fine to coarse.	
				0.90		5.80		
5.70-7.20	$U5_{(SS)}$						Soft laminated red brown CLAY.	
5.70	S	N5						
6.00	PID	<0.1ppm						
6.60	$J6_{(U5)}$							
6.80	$B7_{(U5)}$							
7.00	PID	<0.1ppm						
7.20-8.70	$U6_{(SS)}$							
7.20	$ES8_{(U6)}$							
7.20	S	N8						
						(3.90)		

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
14/10/2020	0.00	0.00	178	

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
0.00 - 1.20	116	100	Yes
1.20 - 2.70	116	100	No
2.70 - 4.20	116	100	Yes
4.20 - 5.70	116	100	Yes
5.70 - 7.20	116	100	Yes
7.20 - 8.70	116	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.00-6.00m and 1 No. 50mm diameter slotted standpipe installed between 13.40-17.40m BGL respectively.
(4) UXO testing during drilling.
(5) Advanced between 0.00-11.70m BGL using water flush.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454535.206 N:522579.746		**MPA_AUK_BH103**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.700	**Start Date:** 14/10/2020	**Sheet:** 2 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
8.00	PID	<0.1ppm					Soft laminated red brown CLAY. *(continued)*	
8.70-10.20 8.70	U7(SS) S	N13						
9.50 9.60	J9(U7) B10(U7)			-3.00		9.70		
9.90 10.00	J11(U7) B12(U7)					(1.10)	Firm brown orange slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to medium subrounded and includes sandstone and mudstone.	
10.20-11.70 10.20	U8(SS) S	N25		-4.10		10.80		
11.00 11.20	J13(U8) B14(U8)					(0.90)	Red brown very clayey GRAVEL/very gravelly CLAY. Gravel is fine to medium angular and includes mudstone weathered. (Engineer notes weathering profile of an extremely weak mudstone).	
				-5.00		11.70		
							Boring complete at 11.70m BGL - continued by rotary drilling.	

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
14/10/2020	11.70	11.70	178	

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
8.70 - 10.20	116	100	Yes
10.20 - 11.70	116	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.00-6.00m and 1 No. 50mm diameter slotted standpipe installed between 13.40-17.40m BGL respectively.
(4) UXO testing during drilling.
(5) Advanced between 0.00-11.70m BGL using water flush.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

Print Date and Time: 07/12/2020 13:30:45

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation		**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454535.206 N:522579.746	**MPA_AUK_BH103**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.700 / **Start Date:** 14/10/2020	**Sheet:** 1 of 7

RUN DETAILS			Water	STRATA				
Depth & (Core Ø)	TCR (SCR) RQD	Fracture Index		Reduced Level	Legend	Depth (Thickness)	Description: Discontinuity Detail	Description: Main	Instrument/ Backfill
11.70	100 (87) 63	NI		-5.00		11.70	11.70-11.90m ... non-intact.	Extremely weak red and grey/green MUDSTONE partially to distinctly weathered.	
(92mm)		6					11.90-13.20m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough open and tight infilled (clay) discontinuities.		
13.20	97 (90) 65	NR					13.20-13.25m ... no recovery.		
		NI					13.25-13.30m ... non-intact.		
		8					13.30-13.70m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough open and tight infilled (clay) discontinuities.		
		NI					13.70-13.80m ... non-intact.		
(92mm)		8					13.80-14.70m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough open and tight infilled (clay) discontinuities.		
14.70						(5.70)			
	100 (50) 43	NI					14.70-15.45m ... non-intact.		
(92mm)		9					15.45-16.20m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough open and tight infilled (clay) discontinuities.		

Drilling Progress and Water Observations

Date	Depth	Casing	Water Standing
14/10/2020	11.70	11.70	

Standard Penetration Test

Depth	Type	Result
11.70	S	50/245mm

Flush

From - To	Type	Returns (%)
11.70 - 17.40	Water	100

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.00-6.00m and 1 No. 50mm diameter slotted standpipe installed between 13.40-17.40m BGL respectively.
(4) UXO testing during drilling.
(5) Advanced between 0.00-11.70m BGL using water flush.

All dimensions in metres Scale 1:25.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation		**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454535.206 N:522579.746	**MPA_AUK_BH103**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.700 / **Start Date:** 14/10/2020	**Sheet:** 2 of 7

RUN DETAILS			Water	STRATA					Instrument/ Backfill
Depth & (Core Ø)	TCR (SCR) RQD	Fracture Index		Reduced Level	Legend	Depth (Thickness)	Description: Discontinuity Detail	Description: Main	
16.20								Extremely weak red and grey/green MUDSTONE partially to distinctly weathered. *(continued)*	
(92mm)	100 (50) 25	NI					16.20-16.80m ... non-intact.		
		8					16.80-17.40m ... subhorizontal (10-20 degrees) Closely spaced planar and irregular rough undulating smooth and rough open and tight infilled (clay) discontinuities.		
				-10.70		17.40			
								Complete at 17.40m BGL.	

Drilling Progress and Water Observations				Standard Penetration Test			Flush			General Remarks
Date	Depth	Casing	Water Standing	Depth	Type	Result	From - To	Type	Returns (%)	
14/10/2020	17.40	11.70	3.07	17.40	S	50/130mm				(1) Description derived from drillers daily report. (2) Inspection pit dug prior to drilling. (3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.00-6.00m and 1 No. 50mm diameter slotted standpipe installed between 13.40-17.40m BGL respectively. (4) UXO testing during drilling. (5) Advanced between 0.00-11.70m BGL using water flush.

All dimensions in metres Scale 1:25.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454535.206 N:522579.746		**MPA_AUK_BH103**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.700	**Start Date:** 14/10/2020	**Sheet:** 3 of 7

Figure MPA_AUK_BH103.1
MPA_AUK_BH103 0.00-1.20m BGL

Figure MPA_AUK_BH103.2
MPA_AUK_BH103 1.20-2.70m BGL

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DRILLHOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH103
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454535.206 N:522579.746		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.700	**Start Date:** 14/10/2020	**Sheet:** 4 of 7

Figure MPA_AUK_BH103.3
MPA_AUK_BH103 2.70-4.20m BGL

Figure MPA_AUK_BH103.4
MPA_AUK_BH103 4.20-5.70m BGL

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH103
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454535.206 N:522579.746		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.700	**Start Date:** 14/10/2020	**Sheet:** 5 of 7

Figure MPA_AUK_BH103.5
MPA_AUK_BH103 5.70-7.20m BGL

Figure MPA_AUK_BH103.6
MPA_AUK_BH103 7.20-8.70m BGL

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454535.206 N:522579.746		**MPA_AUK_BH103**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.700	**Start Date:** 14/10/2020	**Sheet:** 6 of 7

Figure MPA_AUK_BH103.7
MPA_AUK_BH103 8.70-10.20m BGL

Figure MPA_AUK_BH103.8
MPA_AUK_BH103 10.20-11.70m BGL

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DRILLHOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH103
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454535.206 N:522579.746		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.700	**Start Date:** 14/10/2020	**Sheet:** 7 of 7

Figure MPA_AUK_BH103.9
MPA_AUK_BH103 11.70-14.70m BGL

Figure MPA_AUK_BH103.10
MPA_AUK_BH103 14.70-17.40m BGL

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SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454595.142 N:522876.762		**MPA_AUK_BH104**
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 6.289	**Start Date:** 13/10/2020	**Sheet:** 1 of 7

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
0.00-1.20	$U1_{(SS)}$						MADE GROUND (Brown and grey sandy gravel and cobbles. Sand is fine to coarse and includes crushed slag. Gravel is fine to coarse subangular and includes slag. Cobbles are subrounded and include slag. Slag content is 75-100%. Slag is vesicular).	
0.60	$J1_{(U1)}$							
0.80	$B2_{(U1)}$							
1.00	PID	<0.1ppm						
1.20-2.70	U2						at c.1.20m BGL ... very dense/cobble obstruction.	
1.20	S	50/100mm						
2.00	PID	<0.1ppm						
2.70-4.20	$U3_{(SS)}$						at c.2.70m BGL ... very dense/cobble obstruction.	
2.70	S	50/15mm						
3.00	PID	<0.1ppm				(6.10)		
3.60	$J3_{(U3)}$							
3.80	$B4_{(U3)}$							
4.00	PID	<0.1ppm						
4.20-5.70	$U4_{(SS)}$						at c.4.20m BGL ... dense.	
4.20	S	N41						
5.00	PID	<0.1ppm						
5.50	$ES5_{(U4)}$							
5.70-7.20	$U5_{(SS)}$						at c.5.70m BGL ... loose.	
5.70	S	N8						
6.00	PID	<0.1ppm		0.19		6.10		
6.60	$J6_{(U5)}$						Medium dense grey brown silty SAND with lenses of silt. Sand is fine to coarse.	
6.80	$B7_{(U5)}$							
7.00	PID	<0.1ppm						
7.20-8.70	$U6_{(SS)}$							
7.20	S	N11				(3.60)		

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
13/10/2020	0.00	0.00	178	

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
0.00 - 1.20	116	100	Yes
1.20 - 2.70	116	100	No
2.70 - 4.20	116	100	Yes
4.20 - 5.70	116	100	Yes
5.70 - 7.20	116	100	Yes
7.20 - 8.70	116	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.00-6.00m and 1 No. 50mm diameter slotted standpipe installed between 6.50-9.00m BGL respectively.
(4) UXO testing during drilling.
(5) Advanced using water flush - 0% returns.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation		**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454595.142 N:522876.762	**MPA_AUK_BH104**
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 6.289 / **Start Date:** 13/10/2020	**Sheet:** 2 of 7

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
8.00 8.00	ES8 (U6) PID	<0.1ppm					Medium dense grey brown silty SAND with lenses of silt. Sand is fine to coarse. *(continued)*	
8.70-10.20 8.70	U7 (SS) S	N20		-3.41		9.70		
9.80	J9 (U7)						Soft laminated brown CLAY.	
10.00	B10 (U7)							
10.20-11.70 10.20	U8 (SS) S	N7		-4.96		(1.55) 11.25		
11.40	J11 (U8)					(0.45)	Firm to stiff brown orange slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to medium subrounded and includes sandstone and mudstone.	
11.60	B12 (U8)			-5.41		11.70		
11.70-13.20 11.70	U9 (SS) S	N27					Red brown orange very clayey GRAVEL/very gravelly CLAY. Gravel is fine to medium angular and includes mudstone weathered. (Engineer notes weathering profile of an extremely weak mudstone).	
12.60	J13 (U9)					(1.50)		
12.80	B14 (U9)							
13.20	S	50/120mm		-6.91		13.20	*Complete at 13.20m BGL.*	

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
13/10/2020	13.20	13.20	178	2.09

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
8.70 - 10.20	116	100	Yes
10.20 - 11.70	116	100	Yes
11.70 - 13.20	116	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.00-6.00m and 1 No. 50mm diameter slotted standpipe installed between 6.50-9.00m BGL respectively.
(4) UXO testing during drilling.
(5) Advanced using water flush - 0% returns.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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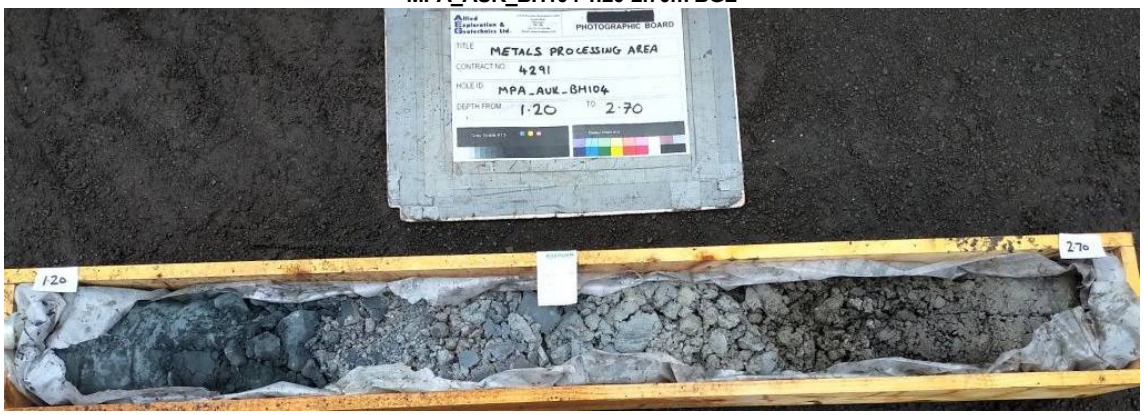
SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454595.142 N:522876.762		**MPA_AUK_BH104**
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 6.289	**Start Date:** 13/10/2020	**Sheet:** 3 of 7

Figure MPA_AUK_BH104.1
MPA_AUK_BH104 0.00-1.20m BGL

Figure MPA_AUK_BH104.2
MPA_AUK_BH104 1.20-2.70m BGL



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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH104
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454595.142 N:522876.762		
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 6.289	**Start Date:** 13/10/2020	**Sheet:** 4 of 7

Figure MPA_AUK_BH104.3
MPA_AUK_BH104 2.70-4.20m BGL

Figure MPA_AUK_BH104.4
MPA_AUK_BH104 4.20-5.70m BGL

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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH104
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454595.142 N:522876.762		
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 6.289	**Start Date:** 13/10/2020	**Sheet:** 5 of 7

Figure MPA_AUK_BH104.5
MPA_AUK_BH104 5.70-7.20m BGL

Figure MPA_AUK_BH104.6
MPA_AUK_BH104 7.20-8.70m BGL

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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH104
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454595.142 N:522876.762		
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 6.289	**Start Date:** 13/10/2020	**Sheet:** 6 of 7

Figure MPA_AUK_BH104.7
MPA_AUK_BH104 8.70-10.20m BGL

Figure MPA_AUK_BH104.8
MPA_AUK_BH104 10.20-11.70m BGL

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Regional Office: Unit 20 Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH104
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454595.142 N:522876.762		
Method (Equipment): Sonic Coring (Boart Longyear LS250)	**Ground Level (m):** 6.289	**Start Date:** 13/10/2020	**Sheet:** 7 of 7

Figure MPA_AUK_BH104.9
MPA_AUK_BH104 11.70-13.20m BGL

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SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454460.535 N:522990.661		**MPA_AUK_BH105**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.368	**Start Date:** 08/10/2020	**Sheet:** 1 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
0.00-1.20	$U1_{(SS)}$					(0.55)	MADE GROUND (Grey green sandy gravel and cobbles. Sand is fine to coarse and includes crushed slag. Gravel is fine to coarse subangular and includes slag. Cobbles are subrounded and include slag. Slag content is 75-100%. Slag is vesicular).	
				5.82		0.55		
0.70	$J1_{(U1)}$						MADE GROUND (Brown and grey sandy gravel and cobbles. Sand is fine to coarse and includes crushed slag. Gravel is fine to coarse subangular and includes slag. Slag content is 100%. Slag is vesicular. Cobbles are subrounded and include slag. Slag content is 100%. Slag is vesicular).	
0.80	$B2_{(U1)}$							
1.00	PID	<0.1ppm						
1.20-2.70	U2							
1.20	S	25/35mm					at c.1.20m BGL ... very dense/cobble obstruction.	
2.00	PID	<0.1ppm						
2.70-4.20	$U3_{(SS)}$						at c.2.70m BGL ... very dense/cobble obstruction.	
2.70	S	50/25mm						
3.00	PID	<0.1ppm						
						(5.95)		
3.70	$J3_{(U3)}$							
3.80	$B4_{(U3)}$							
4.00	PID	<0.1ppm						
4.20-5.70	$U4_{(SS)}$						at c.4.20m BGL ... very dense/cobble obstruction.	
4.20	S	N51						
5.00	$ES5_{(U4)}$							
5.00	PID	<0.1ppm						
5.70-7.20	$U5_{(SS)}$						at c.5.70m BGL ... loose and medium dense.	
5.70	S	N10						
6.00	PID	<0.1ppm						
				-0.13		6.50		
6.60	$J6_{(U5)}$						Medium dense grey brown silty SAND with lenses of silt. Sand is fine to coarse.	
6.80	$B7_{(U5)}$							
7.00	PID	<0.1ppm						
7.20-8.70	$U6_{(SS)}$							
7.20	S	N27						

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
08/10/2020	0.00	0.00	178	
08/10/2020	1.20	0.00	178	Dry
09/10/2020	1.20	0.00	178	Dry

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
0.00 - 1.20	116	100	Yes
1.20 - 2.70	116	100	No
2.70 - 4.20	116	100	Yes
4.20 - 5.70	116	100	Yes
5.70 - 7.20	116	100	Yes
7.20 - 8.70	116	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.00-6.50m and 1 No. 50mm diameter slotted standpipe installed between 16.70-20.70m BGL respectively.
(4) UXO testing during drilling.
(5) Advanced using water flush.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D.P/K.R.C	Contract No. **4291**

Print Date and Time: 07/12/2020 13:40:24

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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454460.535 N:522990.661		**MPA_AUK_BH105**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.368	**Start Date:** 08/10/2020	**Sheet:** 2 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
8.00	PID	<0.1ppm					Medium dense grey brown silty SAND with lenses of silt. Sand is fine to coarse. *(continued)*	
8.50	ES8 (U6)							
8.70-10.20	U7 (SS)						at c.8.70m BGL ... dense.	
8.70	S	N43				(5.00)		
9.60	J9 (U7)							
9.80	B10 (U7)							
10.20-11.70	U8						at c.10.20m BGL ... very dense.	
10.20	S	N65						
				-5.13		11.50		
				-5.33		11.70	Firm brown orange slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to medium subrounded and includes sandstone and mudstone.	
11.70-13.20	U9 (SS)						Red brown orange very clayey GRAVEL/very gravelly CLAY. Gravel is fine to medium angular and includes mudstone. (Engineer notes weathering profile of an extremely weak mudstone).	
11.70	S	N30						
12.60	J11 (U9)							
12.80	B12 (U9)					(3.00)		
13.20-14.70	U10							
13.20	S	50/275mm						
				-8.33		14.70		
							Boring complete at 14.70m BGL - continued by rotary drilling.	

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
09/10/2020	13.20	13.20	178	2.53
12/10/2020	13.20	13.20	178	3.05
12/10/2020	14.70	14.70	178	3.05

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
8.70 - 10.20	116	100	Yes
10.20 - 11.70	116	100	No
11.70 - 13.20	116	100	Yes
13.20 - 14.70	116	100	No

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.00-6.50m and 1 No. 50mm diameter slotted standpipe installed between 16.70-20.70m BGL respectively.
(4) UXO testing during drilling.
(5) Advanced using water flush.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D.P/K.R.C	Contract No. **4291**

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation		**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454460.535 N:522990.661	**MPA_AUK_BH105**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.368 / **Start Date:** 08/10/2020	**Sheet:** 1 of 8

RUN DETAILS				STRATA					
Depth & (Core Ø)	TCR (SCR) RQD	Fracture Index	Water	Reduced Level	Legend	Depth (Thickness)	Description: Discontinuity Detail	Description: Main	Instrument/ Backfill
14.70	100 (85) 85	5		-8.33		14.70	14.70-15.35m ... horizontal to subhorizontal (0-10 degrees) medium spaced planar locally undulating smooth closed discontinuities.	extremely weak to weak red brown MUDSTONE distinctly weathered to residual with green grey glauconitic interbeds.	
(92mm)		NI					15.35-15.45m ... non-intact.		
		5					15.45-16.10m ... horizontal to subhorizontal (0-10 degrees) medium spaced planar locally undulating smooth closed discontinuities.		
16.20		NI					16.10-16.15m ... non-intact.		
	100 (67) 47	6					16.15-16.30m ... horizontal to subhorizontal (0-10 degrees) medium spaced planar locally undulating smooth closed discontinuities.		
		NI					16.30-16.55m ... non-intact.		
(92mm)		6					16.55-16.70m ... horizontal to subhorizontal (0-10 degrees) medium spaced planar locally undulating smooth closed discontinuities.		
		NI					16.60-16.70m ... 1 No. horizontal to subhorizontal (0-10 degrees) very closely spaced discontinuity.		
		6					16.70-16.85m ... non-intact.		
							16.85-17.70m ... horizontal to subhorizontal (0-10 degrees) medium spaced planar locally undulating smooth closed discontinuities.		
17.70						(6.00)			
	100 (75) 62	8					17.70-18.30m ... horizontal to subhorizontal (0-10 degrees) closely to very closely spaced undulating smooth locally stained (red brown) discontinuities.		
(92mm)		NI					18.30-18.40m ... non-intact.		
		8					18.40-18.67m ... horizontal to subhorizontal (0-10 degrees) closely to very closely spaced undulating smooth locally stained (red brown) discontinuities.		
							18.56-18.60m ... non-intact.		

Drilling Progress and Water Observations			
Date	Depth	Casing	Water Standing
12/10/2020	14.70	14.70	3.05

Standard Penetration Test		
Depth	Type	Result

Flush		
From - To	Type	Returns (%)
14.70 - 20.70	Water	100

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.00-6.50m and 1 No. 50mm diameter slotted standpipe installed between 16.70-20.70m BGL respectively.
(4) UXO testing during drilling.
(5) Advanced using water flush.

All dimensions in metres Scale 1:25.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D.P/K.R.C	Contract No. **4291**

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454460.535 N:522990.661		**MPA_AUK_BH105**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.368	**Start Date:** 08/10/2020	**Sheet:** 2 of 8

RUN DETAILS			Water	STRATA					Instrument/ Backfill
Depth & (Core Ø)	TCR (SCR) RQD	Fracture Index		Reduced Level	Legend	Depth (Thickness)	Description: Discontinuity Detail	Description: Main	
		NI					18.67-18.73m ... non-intact. 18.73-18.86m ... horizontal to subhorizontal (0-10 degrees) closely to very closely spaced undulating smooth locally stained (red brown) discontinuities. 18.86-18.93m ... non-intact. 18.93-19.06m ... horizontal to subhorizontal (0-10 degrees) closely to very closely spaced undulating smooth locally stained (red brown) discontinuities. 19.06-19.12m ... non-intact. 19.12-19.20m ... horizontal to subhorizontal (0-10 degrees) closely to very closely spaced undulating smooth locally stained (red brown) discontinuities. 19.20-19.50m ... non-intact.	extremely weak to weak red brown MUDSTONE distinctly weathered to residual with green grey glauconitic interbeds. *(continued)*	
		6							
		NI							
		6							
19.20		NI							
		6							
(92mm)	100 (67) 44	NI					19.50-19.85m ... horizontal to subhorizontal (0-10 degrees) closely to very closely spaced undulating smooth locally stained (red brown) discontinuities. 19.55-19.57m ... non-intact. 19.62-19.66m ... non-intact.	from c.19.50m BGL ... weak with locally medium strong occasional white mineral veins.	
		6							
		NI					19.85-19.90m ... non-intact. 19.90-20.70m ... horizontal to subhorizontal (0-10 degrees) closely to very closely spaced undulating smooth locally stained (red brown) discontinuities. 20.02-20.04m ... non-intact.		
		6		-14.33		20.70			
								Complete at 20.70m BGL.	

Drilling Progress and Water Observations				Standard Penetration Test			Flush			General Remarks
Date	Depth	Casing	Water Standing	Depth	Type	Result	From - To	Type	Returns (%)	
12/10/2020	20.70	14.70								(1) Description derived from drillers daily report. (2) Inspection pit dug prior to drilling. (3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.00-6.50m and 1 No. 50mm diameter slotted standpipe installed between 16.70-20.70m BGL respectively. (4) UXO testing during drilling. (5) Advanced using water flush.

All dimensions in metres Scale 1:25.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D.P/K.R.C	Contract No. **4291**

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH105
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454460.535 N:522990.661		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.368	**Start Date:** 08/10/2020	**Sheet:** 3 of 8

Figure MPA_AUK_BH105.1
MPA_AUK_BH105 0.00-1.20m BGL

Figure MPA_AUK_BH105.2
MPA_AUK_BH105 1.20-2.70m BGL

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH105
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454460.535 N:522990.661		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.368	**Start Date:** 08/10/2020	**Sheet:** 4 of 8

Figure MPA_AUK_BH105.3
MPA_AUK_BH105 2.70-4.20m BGL

Figure MPA_AUK_BH105.4
MPA_AUK_BH105 4.20-5.70m BGL

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH105
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454460.535 N:522990.661		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.368	**Start Date:** 08/10/2020	**Sheet:** 5 of 8

Figure MPA_AUK_BH105.5
MPA_AUK_BH105 5.70-7.20m BGL

Figure MPA_AUK_BH105.6
MPA_AUK_BH105 7.20-8.70m BGL

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454460.535 N:522990.661		**MPA_AUK_BH105**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.368	**Start Date:** 08/10/2020	**Sheet:** 6 of 8

Figure MPA_AUK_BH105.7
MPA_AUK_BH105 8.70-10.20m BGL

Figure MPA_AUK_BH105.8
MPA_AUK_BH105 10.20-11.70m BGL

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH105
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454460.535 N:522990.661		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.368	**Start Date:** 08/10/2020	**Sheet:** 7 of 8

Figure MPA_AUK_BH105.9
MPA_AUK_BH105 11.70-13.20m BGL

Figure MPA_AUK_BH105.10
MPA_AUK_BH105 13.20-14.70m BGL

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DRILLHOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH105
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454460.535 N:522990.661		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.368	**Start Date:** 08/10/2020	**Sheet:** 8 of 8

Figure MPA_AUK_BH105.11
MPA_AUK_BH105 14.70-17.70m BGL

Figure MPA_AUK_BH105.12
MPA_AUK_BH105 17.70-20.70m BGL

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SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454662.064 N:522591.697		**MPA_AUK_BH106**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.511	**Start Date:** 26/10/2020	**Sheet:** 1 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
0.00-1.20	U1 (SS)						MADE GROUND (Brown green and grey sandy gravel and cobbles. Sand is fine to coarse and includes crushed slag. Gravel is fine to coarse subangular and includes slag. Cobbles are subrounded and include slag. Slag content is 75-100%. Slag is vesicular).	
0.60	J1 (U1)							
0.80	B2 (U1)							
1.00	PID	<0.1ppm						
1.20-2.70	U2						at c.1.20m BGL ... very dense/cobble obstruction.	
1.20	S	50/75mm						
2.00	PID	<0.1ppm						
2.70-4.20	U3 (SS)						at c.2.70m BGL ... medium dense.	
2.70	S	N18						
3.00	PID	<0.1ppm						
						(7.00)		
3.60	J3 (U3)							
3.80	B4 (U3)							
4.00	PID	<0.1ppm						
4.20-5.70	U4 (SS)						at c.4.20m BGL ... very dense/cobble obstruction.	
4.20	S	50/150mm						
5.00	PID	<0.1ppm						
5.10	ES5 (U4)							
5.70-7.20	U5 (SS)						at c.5.70m BGL ... medium dense.	
5.70	S	N17						
6.00	PID	<0.1ppm						
6.60	J6 (U5)							
6.80	B7 (U5)			0.51		7.00		
7.00	PID	<0.1ppm					Grey black slightly sandy SILT. Sand is fine to medium.	
7.20-8.70	U6 (SS)			0.21		7.30		
7.20	S	N6					Soft red brown laminated CLAY.	

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
26/10/2020	0.00	0.00	178	

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
0.00 - 1.20	116	100	Yes
1.20 - 2.70	116	100	No
2.70 - 4.20	116	100	Yes
4.20 - 5.70	116	100	Yes
5.70 - 7.20	116	100	Yes
7.20 - 8.70	116	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Triple installation: 2 No. 25mm diameter slotted standpipes installed between 1.00-6.00and 7.50-9.50m and 1 No. 50mm diameter slotted standpipe installed between 16.40-20.40m BGL respectively.
(4) UXO testing during drilling.
(5) Advanced using water flush.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

Print Date and Time: 07/12/2020 13:40:27

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SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation		**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454662.064 N:522591.697	**MPA_AUK_BH106**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.511 / **Start Date:** 26/10/2020	**Sheet:** 2 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
8.00	J8 (U6)						Soft red brown laminated CLAY. *(continued)*	
8.20	B9 (U6)							
8.70-10.20	U7 (SS)							
8.70	S	N11						
9.00	ES10 (U7)					(5.20)		
10.20-11.70	U8 (SS)							
10.20	S	N8						
11.00	J11 (U8)							
11.20	B12 (U8)							
11.70-13.20	U9 (SS)							
11.70	S	N15						
				-4.99		12.50		
						(0.70)	Firm brown orange slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to medium subrounded and includes sandstone and mudstone.	
13.00	J13 (U9)			-5.69		13.20		
13.20-14.70	U10 (SS)						Red brown very clayey GRAVEL/very gravelly CLAY. Gravel is fine to medium angular and includes mudstone weathered. (Engineer notes weathering profile of an extremely weak mudstone).	
13.20	B14 (U10)							
13.20	S	50/195mm				(1.50)		
14.00	J15 (U10)							
14.50	B16 (U10)			-7.19		14.70		
							Boring complete at 14.70m BGL - continued by rotary drilling.	

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
26/10/2020	14.70	14.70	178	2.00

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
8.70 - 10.20	116	100	Yes
10.20 - 11.70	116	100	Yes
11.70 - 13.20	116	100	Yes
13.20 - 14.70	116	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Triple installation: 2 No. 25mm diameter slotted standpipes installed between 1.00-6.00and 7.50-9.50m and 1 No. 50mm diameter slotted standpipe installed between 16.40-20.40m BGL respectively.
(4) UXO testing during drilling.
(5) Advanced using water flush.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation		**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454662.064 N:522591.697	**MPA_AUK_BH106**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.511 / **Start Date:** 26/10/2020	**Sheet:** 1 of 8

RUN DETAILS				STRATA					
Depth & (Core Ø)	TCR (SCR) RQD	Fracture Index	Water	Reduced Level	Legend	Depth (Thickness)	Description: Discontinuity Detail	Description: Main	Instrument/ Backfill
14.70 (92mm)	100 (40) 30	NI		-7.19		14.70	14.70-15.60m ... non-intact.	Extremely weak red and green MUDSTONE partially to distinctly weathered with gypsum veining.	
		7					15.60-16.20m ... subhorizontal (10-20 degrees) closey spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
16.20 (92mm)	100 (50) 33	NI					16.20-16.30m ... non-intact.		
		10					16.30-16.50m ... subhorizontal (10-20 degrees) closey spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
		NI					16.50-16.95m ... non-intact.		
		10					16.95-17.35m ... subhorizontal (10-20 degrees) closey spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
17.40 (92mm)	100 (87) 60	NI					17.35-17.40m ... non-intact.		
		10				(5.70)	17.40-17.60m ... subhorizontal (10-20 degrees) closey spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
		NI					17.60-17.80m ... non-intact.		
		9					17.80-19.95m ... subhorizontal (10-20 degrees) closey spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		

Drilling Progress and Water Observations			
Date	Depth	Casing	Water Standing
27/10/2020	14.70	14.70	

Standard Penetration Test		
Depth	Type	Result
14.70	S	50/105mm

Flush		
From - To	Type	Returns (%)
14.70 - 20.40	Water	100

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Triple installation: 2 No. 25mm diameter slotted standpipes installed between 1.00-6.00and 7.50-9.50m and 1 No. 50mm diameter slotted standpipe installed between 16.40-20.40m BGL respectively.
(4) UXO testing during drilling.
(5) Advanced using water flush.

All dimensions in metres Scale 1:25.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation		**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454662.064 N:522591.697	**MPA_AUK_BH106**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.511 / **Start Date:** 26/10/2020	**Sheet:** 2 of 8

RUN DETAILS			Water	STRATA					Instrument/ Backfill
Depth & (Core Ø)	TCR (SCR) RQD	Fracture Index		Reduced Level	Legend	Depth (Thickness)	Description: Discontinuity Detail	Description: Main	
18.90								Extremely weak red and green MUDSTONE partially to distinctly weathered with gypsum veining. *(continued)*	
(92mm)	100 (87) 47	NI					19.95-20.15m ... non-intact.		
		12					20.15-20.40m ... subhorizontal (10-20 degrees) closey spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
				-12.89		20.40			
								Complete at 20.40m BGL.	

Drilling Progress and Water Observations				Standard Penetration Test			Flush			General Remarks
Date	Depth	Casing	Water Standing	Depth	Type	Result	From - To	Type	Returns (%)	
27/10/2020	20.40	14.70	2.00	20.40	S	50/100mm				(1) Description derived from drillers daily report. (2) Inspection pit dug prior to drilling. (3) Triple installation: 2 No. 25mm diameter slotted standpipes installed between 1.00-6.00and 7.50-9.50m and 1 No. 50mm diameter slotted standpipe installed between 16.40-20.40m BGL respectively. (4) UXO testing during drilling. (5) Advanced using water flush.

All dimensions in metres Scale 1:25.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454662.064 N:522591.697		**MPA_AUK_BH106**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.511	**Start Date:** 26/10/2020	**Sheet:** 3 of 8

Figure MPA_AUK_BH106.1
MPA_AUK_BH106 0.00-1.20m BGL

Figure MPA_AUK_BH106.2
MPA_AUK_BH106 1.20-2.70m BGL

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH106
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454662.064 N:522591.697		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.511	**Start Date:** 26/10/2020	**Sheet:** 4 of 8

Figure MPA_AUK_BH106.3
MPA_AUK_BH106 2.70-4.20m BGL

Figure MPA_AUK_BH106.4
MPA_AUK_BH106 4.20-5.70m BGL

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454662.064 N:522591.697		**MPA_AUK_BH106**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.511	**Start Date:** 26/10/2020	**Sheet:** 5 of 8

Figure MPA_AUK_BH106.5
MPA_AUK_BH106 5.70-7.20m BGL

Figure MPA_AUK_BH106.6
MPA_AUK_BH106 7.20-8.70m BGL

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454662.064 N:522591.697		**MPA_AUK_BH106**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.511	**Start Date:** 26/10/2020	**Sheet:** 6 of 8

Figure MPA_AUK_BH106.7
MPA_AUK_BH106 8.70-10.20m BGL

Figure MPA_AUK_BH106.8
MPA_AUK_BH106 10.20-11.70m BGL

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454662.064 N:522591.697		**MPA_AUK_BH106**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.511	**Start Date:** 26/10/2020	**Sheet:** 7 of 8

Figure MPA_AUK_BH106.9
MPA_AUK_BH106 11.70-13.20m BGL

Figure MPA_AUK_BH106.10
MPA_AUK_BH106 13.20-14.70m BGL

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DRILLHOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH106
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454662.064 N:522591.697		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.511	**Start Date:** 26/10/2020	**Sheet:** 8 of 8

Figure MPA_AUK_BH106.11
MPA_AUK_BH106 14.70-17.40m BGL

Figure MPA_AUK_BH106.12
MPA_AUK_BH106 17.40-20.40m BGL

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SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454577.760 N:522737.339		**MPA_AUK_BH107**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.800	**Start Date:** 22/10/2020	**Sheet:** 1 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
0.00-1.20	U1 (SS)						MADE GROUND (Brown and grey sandy gravel and cobbles. Sand is fine to coarse and includes crushed slag. Gravel is fine to coarse subangular and includes slag. Cobbles are subrounded and includes slag. Slag content is 75-100%. Slag is vesicular).	
0.60	J1 (U1)							
0.80	B2 (U1)							
1.00	PID	<0.1ppm						
1.20-2.70	U2						at c.1.20m BGL ... very dense/cobble obstruction.	
1.20	S	50/35mm						
2.00	PID	<0.1ppm						
2.70-4.20	U3 (SS)						at c.2.70m BGL ... very dense/cobble obstruction.	
2.70	S	50/85mm						
3.00	PID	<0.1ppm				(6.60)		
3.60	J3 (U3)							
3.80	B4 (U3)							
4.00	PID	<0.1ppm						
4.20-5.70	U4						at c.4.20m BGL ... very dense/cobble obstruction.	
4.20	S	50/25mm						
5.00	PID	<0.1ppm						
5.70-7.20	U5 (SS)							
6.00	ES5 (U5)							
6.00	PID	<0.1ppm		0.20		6.60		
6.70	J6 (U5)						Very loose and loose grey brown very silty SAND with lenses of silt and soft brown clay. Sand is fine to coarse.	
6.90	B7 (U5)							
7.00	PID	<0.1ppm						
7.20-8.70	U6 (SS)							
7.20	S	N4				(1.80)		

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
22/10/2020	0.00	0.00	178	

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
0.00 - 1.20	116	100	Yes
1.20 - 2.70	116	100	No
2.70 - 4.20	116	100	Yes
4.20 - 5.70	116	27	No
5.70 - 7.20	116	100	Yes
7.20 - 8.70	116	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Triple installation: 2 No. 25mm diameter slotted standpipe installed between 1.00-6.00 and 7.00-8.00m and 1 No. 50mm diameter slotted standpipe installed between 15.20-19.20m BGL respectively.
(4) UXO testing undertaken during drilling.
(5) Advanced using water flush.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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SONIC SAMPLE HOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454577.760 N:522737.339		**MPA_AUK_BH107**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.800	**Start Date:** 22/10/2020	**Sheet:** 2 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
8.00	ES8 (U6)			-1.60		8.40	Very loose and loose grey brown very silty SAND with lenses of silt and soft brown clay. Sand is fine to coarse. *(continued)*	
8.70-10.20	U7 (SS)						Soft laminated brown CLAY.	
8.70	S	N11						
9.00	J9 (U7)							
9.20	B10 (U7)					(2.30)		
10.20-11.70	U8 (SS)							
10.20	S	N9		-3.90		10.70		
11.00	J11 (U8)						Firm to stiff brown orange slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to medium subrounded and includes sandstone and mudstone.	
11.20	B12 (U8)					(1.00)		
11.70-13.20	U9 (SS)			-4.90		11.70		
11.70	S	N42					Red brown orange very clayey GRAVEL/very gravelly CLAY. Gravel is fine to medium angular and includes mudstone weathered. (Engineer notes weathering profile of an extremely weak mudstone).	
12.00	J13 (U9)							
12.20	B14 (U9)					(1.50)		
				-6.40		13.20		
							Boring complete at 13.20m BGL - continued by rotary drilling.	

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
22/10/2020	10.20	10.20	178	2.30
23/10/2020	10.20	10.20	178	5.60
23/10/2020	13.20	13.20	178	5.60

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
8.70 - 10.20	116	100	Yes
10.20 - 11.70	116	100	Yes
11.70 - 13.20	116	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Triple installation: 2 No. 25mm diameter slotted standpipe installed between 1.00-6.00 and 7.00-8.00m and 1 No. 50mm diameter slotted standpipe installed between 15.20-19.20m BGL respectively.
(4) UXO testing undertaken during drilling.
(5) Advanced using water flush.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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Regional Office: Unit 20 Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation		**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454577.760 N:522737.339	**MPA_AUK_BH107**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.800 / **Start Date:** 22/10/2020	**Sheet:** 1 of 8

RUN DETAILS			Water	STRATA					Instrument/ Backfill
Depth & (Core Ø)	TCR (SCR) RQD	Fracture Index		Reduced Level	Legend	Depth (Thickness)	Description: Discontinuity Detail	Description: Main	
13.20	100 (73) 50	NI		-6.40		13.20	13.20-13.60m ... non-intact.	Extremely weak red and green MUDSTONE partially to distinctly weathered with gypsum veining.	
		6					13.60-14.70m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
(92mm)									
14.70									
	100 (80) 23	NI					14.70-15.00m ... non-intact.		
		7					15.00-16.20m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
(92mm)									
16.20						(6.00)			
	100 (70) 53	NI					16.20-16.65m ... non-intact.		
		6					16.65-17.70m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
(92mm)									

Drilling Progress and Water Observations			
Date	Depth	Casing	Water Standing
23/10/2020	13.20	13.20	5.60

Standard Penetration Test		
Depth	Type	Result
13.20	S	50/45mm

Flush		
From - To	Type	Returns (%)
13.20 - 19.20	Water	100

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Triple installation: 2 No. 25mm diameter slotted standpipe installed between 1.00-6.00 and 7.00-8.00m and 1 No. 50mm diameter slotted standpipe installed between 15.20-19.20m BGL respectively.
(4) UXO testing undertaken during drilling.
(5) Advanced using water flush.

All dimensions in metres Scale 1:25.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation		**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454577.760 N:522737.339	**MPA_AUK_BH107**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.800 / **Start Date:** 22/10/2020	**Sheet:** 2 of 8

RUN DETAILS			Water	STRATA					Instrument/ Backfill
Depth & (Core Ø)	TCR (SCR) RQD	Fracture Index		Reduced Level	Legend	Depth (Thickness)	Description: Discontinuity Detail	Description: Main	
17.70								Extremely weak red and green MUDSTONE partially to distinctly weathered with gypsum veining. *(continued)*	
(92mm)	100 (87) 40	NI					17.70-17.90m ... non-intact.		
		6					17.90-19.20m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
				-12.40		19.20			
								Complete at 19.20m BGL.	

Drilling Progress and Water Observations				Standard Penetration Test			Flush			General Remarks
Date	Depth	Casing	Water Standing	Depth	Type	Result	From - To	Type	Returns (%)	
23/10/2020	19.20	13.20		19.20	S	50/20mm				(1) Description derived from drillers daily report. (2) Inspection pit dug prior to drilling. (3) Triple installation: 2 No. 25mm diameter slotted standpipe installed between 1.00-6.00 and 7.00-8.00m and 1 No. 50mm diameter slotted standpipe installed between 15.20-19.20m BGL respectively. (4) UXO testing undertaken during drilling. (5) Advanced using water flush.

All dimensions in metres Scale 1:25.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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Regional Office: Unit 20 Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454577.760 N:522737.339		**MPA_AUK_BH107**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.800	**Start Date:** 22/10/2020	**Sheet:** 3 of 8

Figure MPA_AUK_BH107.1
MPA_AUK_BH107 0.00-1.20m BGL

Figure MPA_AUK_BH107.2
MPA_AUK_BH107 1.20-2.70m BGL

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DRILLHOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH107
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454577.760 N:522737.339		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.800	**Start Date:** 22/10/2020	**Sheet:** 4 of 8

Figure MPA_AUK_BH107.3
MPA_AUK_BH107 2.70-4.20m BGL

Figure MPA_AUK_BH107.4
MPA_AUK_BH107 4.20-5.70m BGL

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DRILLHOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH107
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454577.760 N:522737.339		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.800	**Start Date:** 22/10/2020	**Sheet:** 5 of 8

Figure MPA_AUK_BH107.5
MPA_AUK_BH107 5.70-7.20m BGL

Figure MPA_AUK_BH107.6
MPA_AUK_BH107 7.20-8.70m BGL

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DRILLHOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH107
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454577.760 N:522737.339		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.800	**Start Date:** 22/10/2020	**Sheet:** 6 of 8

Figure MPA_AUK_BH107.7
MPA_AUK_BH107 8.70-10.20m BGL

Figure MPA_AUK_BH107.8
MPA_AUK_BH107 10.20-11.70m BGL

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DRILLHOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH107
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454577.760 N:522737.339		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.800	**Start Date:** 22/10/2020	**Sheet:** 7 of 8

Figure MPA_AUK_BH107.9
MPA_AUK_BH107 11.70-13.20m BGL

Figure MPA_AUK_BH107.10
MPA_AUK_BH107 13.20-16.20m BGL

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH107
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454577.760 N:522737.339		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.800	**Start Date:** 22/10/2020	**Sheet:** 8 of 8

Figure MPA_AUK_BH107.11
MPA_AUK_BH107 16.20-19.20m BGL

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SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454447.904 N:522784.595		**MPA_AUK_BH108**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.324	**Start Date:** 21/10/2020	**Sheet:** 1 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
0.00-1.20	$U1_{(SS)}$						MADE GROUND (Brown green and grey sandy gravel and cobbles. Sand is fine to coarse and includes crushed slag. Gravel is fine to coarse subangular and includes slag. Cobbles are subrounded and include slag. Slag content is 75-100%. Slag is vesicular).	
0.60	$J1_{(U1)}$							
0.80	$B2_{(U1)}$							
1.00	PID	<0.1ppm						
1.20-2.70	U2						at c.1.20m BGL ... very dense/cobble obstruction.	
1.20	S	50/85mm						
2.00	PID	<0.1ppm						
2.70-4.20	$U3_{(SS)}$						at c.2.70m BGL ... very dense/cobble obstruction.	
2.70	S	50/120mm				(6.00)		
3.00	PID	<0.1ppm						
3.60	$J3_{(U3)}$							
3.80	$B4_{(U3)}$							
4.00	PID	<0.1ppm						
4.20-5.70	$U4_{(SS)}$						at c.4.20m BGL ... very dense/cobble obstruction.	
4.20	S	50/175mm						
5.00	PID	<0.1ppm						
5.50	$ES5_{(U4)}$							
5.70-7.20	$U5_{(SS)}$						at c.5.70m BGL ... dense.	
5.70	S	N39		0.32		6.00		
6.00	PID	<0.1ppm					Medium dense grey brown silty SAND with lenses of silt and fragments of shell. Sand is fine to coarse.	
6.60	$J6_{(U5)}$							
6.80	$B7_{(U5)}$							
7.00	PID	<0.1ppm						
7.20-8.70	$U6_{(SS)}$					(2.70)		
7.20	S	N20						

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
21/10/2020	0.00	0.00	178	

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
0.00 - 1.20	116	100	Yes
1.20 - 2.70	116	100	No
2.70 - 4.20	116	100	Yes
4.20 - 5.70	116	100	Yes
5.70 - 7.20	116	100	Yes
7.20 - 8.70	116	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Triple installation: 2 No. 25mm diameter slotted standpipes installed between 1.00-5.00 and 6.00-8.00m and 1 No. 50mm diameter slotted standpipe installed between 13.70-17.70m BGL respectively.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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ALLIED EXPLORATION & GEOTECHNICS LIMITED

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SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454447.904 N:522784.595		**MPA_AUK_BH108**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.324	**Start Date:** 21/10/2020	**Sheet:** 2 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
8.00	ES8 (U6)			-2.38		8.70	Medium dense grey brown silty SAND with lenses of silt and fragments of shell. Sand is fine to coarse. *(continued)*	
8.70-10.20	U7 (SS)						Firm brown orange slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to medium subrounded and includes sandstone and mudstone. (Engineer notes evidence of structure/laminae within the fabric of the clay).	
8.70	S	N19				(1.75)		
9.60	J9 (U7)							
9.80	B10 (U7)							
10.20-11.70	U8 (SS)							
10.20	S	N23		-4.13		10.45		
10.60	J11 (U8)						Red brown very clayey GRAVEL/very gravelly CLAY. Gravel is fine to medium angular and includes mudstone weathered. (Engineer notes weathering profile of an extremely weak mudstone).	
10.80	B12 (U8)					(1.25)		
				-5.38		11.70		
							Boring complete at 11.70m BGL - continued by rotary drilling.	

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
21/10/2020	11.70	11.70	178	2.10

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
8.70 - 10.20	116	100	Yes
10.20 - 11.70	116	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Triple installation: 2 No. 25mm diameter slotted standpipes installed between 1.00-5.00 and 6.00-8.00m and 1 No. 50mm diameter slotted standpipe installed between 13.70-17.70m BGL respectively.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

Print Date and Time: 07/12/2020 13:30:54

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation		**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454447.904 N:522784.595	**MPA_AUK_BH108**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.324 / **Start Date:** 21/10/2020	**Sheet:** 1 of 7

RUN DETAILS			Water	STRATA					Instrument/ Backfill
Depth & (Core Ø)	TCR (SCR) RQD	Fracture Index		Reduced Level	Legend	Depth (Thickness)	Description: Discontinuity Detail	Description: Main	
11.70 (92mm)	100 (87) 30	10		-5.38		11.70	11.70-11.90m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.	Extremely weak red and green MUDSTONE partially to distinctly weathered with gypsum veining.	
		NI					11.90-12.00m ... non-intact.		
		10					12.00-12.10m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
		NI					12.10-12.20m ... non-intact.		
		8					12.20-13.20m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
13.20 (92mm)	100 (70) 60	NI					13.20-13.65m ... non-intact.		
		4					13.65-14.70m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
14.70 (92mm)	100 (93) 57	NI				(6.00)	14.70-14.80m ... non-intact.		
		6					14.80-16.20m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		

Drilling Progress and Water Observations			
Date	Depth	Casing	Water Standing
21/10/2020	11.70	11.70	
21/10/2020	13.20	11.70	2.10
22/10/2020	13.20	11.70	5.00

Standard Penetration Test		
Depth	Type	Result
11.70	S	50/100mm

Flush		
From - To	Type	Returns (%)
11.70 - 13.20	Water	50
13.20 - 17.70	Water	100

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Triple installation: 2 No. 25mm diameter slotted standpipes installed between 1.00-5.00 and 6.00-8.00m and 1 No. 50mm diameter slotted standpipe installed between 13.70-17.70m BGL respectively.

All dimensions in metres Scale 1:25.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation		**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454447.904 N:522784.595	**MPA_AUK_BH108**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.324 / **Start Date:** 21/10/2020	**Sheet:** 2 of 7

RUN DETAILS			Water	STRATA					Instrument/ Backfill
Depth & (Core Ø)	TCR (SCR) RQD	Fracture Index		Reduced Level	Legend	Depth (Thickness)	Description: Discontinuity Detail	Description: Main	
16.20								Extremely weak red and green MUDSTONE partially to distinctly weathered with gypsum veining. *(continued)*	
(92mm)	100 (80) 43	NI					16.20-16.40m ... non-intact.		
		10					16.40-16.50m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
		NI					16.50-16.70m ... non-intact.		
		6					16.70-17.70m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
				-11.38		17.70			
								Complete at 17.70m BGL.	

Drilling Progress and Water Observations				Standard Penetration Test			Flush			General Remarks
Date	Depth	Casing	Water Standing	Depth	Type	Result	From - To	Type	Returns (%)	
22/10/2020	17.70	11.70		17.70	S	50/10mm				(1) Description derived from drillers daily report. (2) Inspection pit dug prior to drilling. (3) Triple installation: 2 No. 25mm diameter slotted standpipes installed between 1.00-5.00 and 6.00-8.00m and 1 No. 50mm diameter slotted standpipe installed between 13.70-17.70m BGL respectively.

All dimensions in metres Scale 1:25.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

Print Date and Time: 07/12/2020 13:32:39

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454447.904 N:522784.595		**MPA_AUK_BH108**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.324	**Start Date:** 21/10/2020	**Sheet:** 3 of 7

Figure MPA_AUK_BH108.1
MPA_AUK_BH108 0.00-1.20m BGL

Figure MPA_AUK_BH108.2
MPA_AUK_BH108 1.20-2.70m BGL

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454447.904 N:522784.595		**MPA_AUK_BH108**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.324	**Start Date:** 21/10/2020	**Sheet:** 4 of 7

Figure MPA_AUK_BH108.3
MPA_AUK_BH108 2.70-4.20m BGL

Figure MPA_AUK_BH108.4
MPA_AUK_BH108 4.20-5.70m BGL

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DRILLHOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH108
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454447.904 N:522784.595		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.324	**Start Date:** 21/10/2020	**Sheet:** 5 of 7

Figure MPA_AUK_BH108.5
MPA_AUK_BH108 5.70-7.20m BGL

Figure MPA_AUK_BH108.6
MPA_AUK_BH108 7.20-8.70m BGL

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH108
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454447.904 N:522784.595		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.324	**Start Date:** 21/10/2020	**Sheet:** 6 of 7

Figure MPA_AUK_BH108.7
MPA_AUK_BH108 8.70-10.20m BGL

Figure MPA_AUK_BH108.8
MPA_AUK_BH108 10.20-11.70m BGL

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DRILLHOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH108
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454447.904 N:522784.595		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 6.324	**Start Date:** 21/10/2020	**Sheet:** 7 of 7

Figure MPA_AUK_BH108.9
MPA_AUK_BH108 11.70-14.70m BGL

Figure MPA_AUK_BH108.10
MPA_AUK_BH108 14.70-17.70m BGL

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454500.525 N:522880.604		**MPA_AUK_BH109**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.200	**Start Date:** 20/10/2020	**Sheet:** 1 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
0.00-1.20	$U1_{(SS)}$						MADE GROUND (Brown green and grey sandy gravel and cobbles. Sand is fine to coarse and includes crushed slag. Gravel is fine to coarse subangular and includes slag. Cobbles are subrounded and includes slag. Slag content is 75-100%. Slag is vesicular).	
0.60	$J1_{(U1)}$							
0.80	$B2_{(U1)}$							
1.00	PID	<0.1ppm						
1.20-2.70	U2						at c1.20m BGL ... very dense/cobble obstruction.	
1.20	S	50/125mm						
2.00	PID	<0.1ppm						
2.70-4.20	$U3_{(SS)}$						at c.2.70m BGL ... very dense/cobble obstruction.	
2.70	S	50/165mm						
3.00	PID	<0.1ppm						
						(6.95)		
3.60	$J3_{(U3)}$							
3.80	$B4_{(U3)}$							
4.00	PID	<0.1ppm						
4.20-5.70	U4						at c.4.20m BGL ... medium dense.	
4.20	S	N29						
5.00	PID	<0.1ppm						
5.70-7.20	$U5_{(SS)}$						at c.5.70m BGL ... very dense/cobble obstruction.	
5.70	S	50/35mm						
6.00	$ES5_{(U5)}$							
6.00	PID	<0.1ppm						
6.60	$J6_{(U5)}$							
6.80	$B7_{(U5)}$			0.25		6.95		
7.00	PID	<0.1ppm					Medium dense grey brown silty SAND with silt lenses and fragments of shell. Sand is fine to coarse.	
7.20-8.70	$U6_{(SS)}$							
7.20	S	N19						
7.40	$J8_{(U6)}$							
7.50	$B9_{(U6)}$							

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
20/10/2020	0.00	0.00	178	

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
0.00 - 1.20	116	100	Yes
1.20 - 2.70	116	100	No
2.70 - 4.20	116	100	Yes
4.20 - 5.70	116	100	No
5.70 - 7.20	116	100	Yes
7.20 - 8.70	116	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.50-6.50m and 1 No. 50mm diameter slotted standpipe installed between 7.50-11.50m BGL respectively.
(4) UXO testing during drilling.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

Print Date and Time: 07/12/2020 13:30:56

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20 Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

SONIC SAMPLE HOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454500.525 N:522880.604		**MPA_AUK_BH109**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.200	**Start Date:** 20/10/2020	**Sheet:** 2 of 2

SAMPLES & TESTS			Water	STRATA				Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	Description	
8.00	ES10(U6)						Medium dense grey brown silty SAND with silt lenses and fragments of shell. Sand is fine to coarse. *(continued)*	
8.70-10.20	U7						at c.8.70m BGL ... dense.	
8.70	S	N32				(4.25)		
10.20-11.70	U8(SS)							
10.20	S	N13						
10.40	J11(U8)							
10.50	B12(U8)			-4.00		11.20		
11.40	J13(U8)					(0.50)	Firm brown orange slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to medium subrounded and includes sandstone and mudstone. (Engineer notes evidence of structure/laminae within the fabric of the clay).	
11.50	B14(U8)			-4.50		11.70		
11.70-13.20	U9(SS)							
11.70	S	N36					Red brown very clayey GRAVEL/very gravelly CLAY. Gravel is fine to medium angular and includes mudstone weathered. (Engineer notes weathering profile of an extremely weak mudstone).	
12.50	J15(U9)					(1.50)		
12.60	B16(U9)			-6.00		13.20		
							Boring complete at 13.20m BGL - continued by rotary drilling.	

Boring Progress and Water Observations

Date	Depth	Casing	Casing Dia (mm)	Water Standing
20/10/2020	13.20	13.20	178	2.50

Liner Sample Information

From - To	Internal Dia (mm)	Recovery (%)	Subsampled
8.70 - 10.20	116	100	No
10.20 - 11.70	116	100	Yes
11.70 - 13.20	116	100	Yes

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.50-6.50m and 1 No. 50mm diameter slotted standpipe installed between 7.50-11.50m BGL respectively.
(4) UXO testing during drilling.

All dimensions in metres Scale 1:50.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

Print Date and Time: 07/12/2020 13:30:56

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Regional Office: Unit 20 Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation		**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454500.525 N:522880.604	**MPA_AUK_BH109**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.200 / **Start Date:** 20/10/2020	**Sheet:** 1 of 8

RUN DETAILS			Water	STRATA					Instrument/ Backfill
Depth & (Core Ø)	TCR (SCR) RQD	Fracture Index		Reduced Level	Legend	Depth (Thickness)	Description: Discontinuity Detail	Description: Main	
13.20 (92mm)	100 (63) 37	NI		-6.00		13.20	13.20-13.75m ... non-intact.	Extremely weak red MUDSTONE partially to distinctly weathered.	
		5					13.75-14.70m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
14.70 (92mm)	97 (77) 57	NI					14.70-15.05m ... non-intact.		
		5					15.05-16.20m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
16.20 (92mm)	100 (87) 60	NI				(6.00)	16.20-16.40m ... non-intact.		
		6					16.40-18.70m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		

Drilling Progress and Water Observations			
Date	Depth	Casing	Water Standing
20/10/2020	13.20	13.20	

Standard Penetration Test		
Depth	Type	Result
13.20	S	50/50mm

Flush		
From - To	Type	Returns (%)

General Remarks

(1) Description derived from drillers daily report.
(2) Inspection pit dug prior to drilling.
(3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.50-6.50m and 1 No. 50mm diameter slotted standpipe installed between 7.50-11.50m BGL respectively.
(4) UXO testing during drilling.

All dimensions in metres Scale 1:25.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

Print Date and Time: 07/12/2020 13:32:48

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation		**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454500.525 N:522880.604	**MPA_AUK_BH109**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.200 / **Start Date:** 20/10/2020	**Sheet:** 2 of 8

RUN DETAILS			Water	STRATA					Instrument/ Backfill
Depth & (Core Ø)	TCR (SCR) RQD	Fracture Index		Reduced Level	Legend	Depth (Thickness)	Description: Discontinuity Detail	Description: Main	
17.70								Extremely weak red MUDSTONE partially to distinctly weathered. *(continued)*	
(92mm)	100 (93) 63	NI 2		-12.00		19.20	18.70-18.80m ... non-intact. 18.80-19.20m ... subhorizontal (10-20 degrees) closely spaced planar and irregular rough undulating smooth and rough tight infilled (clay) discontinuities.		
								Complete at 19.20m BGL.	

Drilling Progress and Water Observations				Standard Penetration Test			Flush			General Remarks
Date	Depth	Casing	Water Standing	Depth	Type	Result	From - To	Type	Returns (%)	
20/10/2020	19.20	13.20	2.50	19.20	S	50/20mm				(1) Description derived from drillers daily report. (2) Inspection pit dug prior to drilling. (3) Double installation: 1 No. 25mm diameter slotted standpipe installed between 1.50-6.50m and 1 No. 50mm diameter slotted standpipe installed between 7.50-11.50m BGL respectively. (4) UXO testing during drilling.

All dimensions in metres Scale 1:25.00	For explanation of symbols and abbreviations see Key Sheets	Checked by:	Logged by: D. Portsmouth	Contract No. **4291**

Print Date and Time: 07/12/2020 13:32:49

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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DRILLHOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH109
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454500.525 N:522880.604		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.200	**Start Date:** 20/10/2020	**Sheet:** 3 of 8

Figure MPA_AUK_BH109.1
MPA_AUK_BH109 0.00-1.20m BGL

Figure MPA_AUK_BH109.2
MPA_AUK_BH109 1.20-2.70m BGL

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Regional Office: Unit 20 Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH109
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454500.525 N:522880.604		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.200	**Start Date:** 20/10/2020	**Sheet:** 4 of 8

Figure MPA_AUK_BH109.3
MPA_AUK_BH109 2.70-4.20m BGL

Figure MPA_AUK_BH109.4
MPA_AUK_BH109 4.20-5.70m BGL

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DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH109
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454500.525 N:522880.604		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.200	**Start Date:** 20/10/2020	**Sheet:** 5 of 8

Figure MPA_AUK_BH109.5
MPA_AUK_BH109 5.70-7.20m BGL

Figure MPA_AUK_BH109.6
MPA_AUK_BH109 7.20-8.70m BGL

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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DRILLHOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH109
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454500.525 N:522880.604		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.200	**Start Date:** 20/10/2020	**Sheet:** 6 of 8

Figure MPA_AUK_BH109.7
MPA_AUK_BH109 8.70-10.20m BGL

Figure MPA_AUK_BH109.8
MPA_AUK_BH109 10.20-11.70m BGL

ALLIED EXPLORATION & GEOTECHNICS LIMITED

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DRILLHOLE RECORD

Status:- PRELIM2

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.** MPA_AUK_BH109
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454500.525 N:522880.604		
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.200	**Start Date:** 20/10/2020	**Sheet:** 7 of 8

Figure MPA_AUK_BH109.9
MPA_AUK_BH109 11.70-13.20m BGL

Figure MPA_AUK_BH109.10
MPA_AUK_BH109 13.20-16.20m BGL

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20 Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

DRILLHOLE RECORD

Status:- **PRELIM2**

Project: Metal Processing Area Deep Soil and Groundwater Investigation			**Exploratory Hole No.**
Client: South Tees Development Corporation	**Location:** Former Redcar Steelworks, Redcar E:454500.525 N:522880.604		**MPA_AUK_BH109**
Method (Equipment): Sonic/Coring (Boart Longyear LS250)	**Ground Level (m):** 7.200	**Start Date:** 20/10/2020	**Sheet:** 8 of 8

Figure MPA_AUK_BH109.11
MPA_AUK_BH109 16.20-19.20m BGL

Certificate of Analysis

Certificate Number	20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-21736	09-Nov-20

Client Allied Exploration & Geotechnics Limited
Unit 25
Stella Gill Industrial Estate
Pelton Fell
DH2 2RG

Our Reference	20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-2
Client Reference	4291
Order No	(not supplied)
Contract Title	Metal Processing Area Deep Soil and Groundwater Investigation
Description	10 Soil samples, 4 Leachate samples.

Date Received	13-Oct-20
Date Started	13-Oct-20
Date Completed	09-Nov-20
Test Procedures	Identified by prefix DETSn (details on request).

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

Approved By

Adam Fenwick
Contracts Manager

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

UKAS TESTING
2139

Summary of Chemical Analysis

Matrix Descriptions

Our Ref 20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-21736
Client Ref 4291
Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

Sample ID	Other ID	Depth	Lab No	Completed	Matrix Description
MPA_AUK_BH105	5	5	1743676	03/11/2020	Dark grey gravelly SAND
MPA_AUK_BH105	8	8.5	1743677	03/11/2020	Dark brown SAND
MPA_AUK_BH102	5	5.2	1748193	03/11/2020	Dark brown very gravelly SAND
MPA_AUK_BH101	5	4.7	1748195	03/11/2020	Dark grey very gravelly SAND (Possible made ground - slag)
MPA_AUK_BH109	5	6	1749536	03/11/2020	Dark grey GRAVEL (sample matrix outside MCERTS scope of accreditation)
MPA_AUK_BH109	10	8	1749537	03/11/2020	Dark brown SAND
MPA_AUK_BH108	5	5.5	1750159	03/11/2020	Dark grey sandy GRAVEL (sample matrix outside MCERTS scope of accreditation)
MPA_AUK_BH107	5	6	1750643	03/11/2020	Dark grey sandy GRAVEL (sample matrix outside MCERTS scope of accreditation)
MPA_AUK_BH107	8	8	1750644	03/11/2020	Dark brown sandy CLAY
MPA_AUK_BH106	5	5.1	1752052	03/11/2020	Grey sandy, clayey GRAVEL (sample matrix outside MCERTS scope of accreditation)

Summary of Chemical Analysis
Soil Samples

Our Ref 20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-21736
Client Ref 4291
Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1743676	1743677	1748193	1748195	1749536
			Sample ID	MPA_AUK_BH 105	MPA_AUK_BH 105	MPA_AUK_B H102	MPA_AUK_B H101	MPA_AUK_BH 109
			Depth	5.00	8.50	5.20	4.70	6.00
			Other ID	5	8	5	5	5
			Sample Type	ES	ES	ES	ES	SOIL
			Sampling Date	09/10/2020	09/10/2020	15/10/2020	19/10/2020	20/10/2020
			Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Metals								
Aluminium	DETSC 2301*	1	mg/kg	54000	760	78000	7900	60000
Antimony	DETSC 2301*	1	mg/kg	< 1.0	< 1.0	< 1.0	7.0	< 1.0
Arsenic	DETSC 2301#	0.2	mg/kg	7.4	4.4	14	3.6	4.3
Barium	DETSC 2301#	1.5	mg/kg	250	6.6	480	75	820
Beryllium	DETSC 2301#	0.2	mg/kg	6.9	< 0.2	8.8	1.1	7.7
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	6.2	0.7	2.1	0.3	9.4
Cadmium	DETSC 2301#	0.1	mg/kg	0.1	< 0.1	0.1	0.4	< 0.1
Chromium	DETSC 2301#	0.15	mg/kg	8.6	2.6	12	520	4.3
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	8.9	6.2	11	14	8.8
Iron	DETSC 2301	25	mg/kg	2100	4700	5100	48000	2200
Lead	DETSC 2301#	0.3	mg/kg	4.2	2.6	7.9	6.6	1.7
Magnesium	DETSC 2301*	1	mg/kg	27000	3900	35000	34000	31000
Manganese	DETSC 2301#	20	mg/kg	1000	100	3800	21000	4900
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Molybdenum	DETSC 2301#	0.4	mg/kg	< 0.4	< 0.4	0.7	< 0.4	< 0.4
Nickel	DETSC 2301#	1	mg/kg	1.1	2.3	2.9	7.6	< 1.0
Silicon	DETSC 2301*	10	mg/kg	66000	190000	56000	53000	58000
Vanadium	DETSC 2301#	0.8	mg/kg	37	8.4	63	4500	23
Zinc	DETSC 2301#	1	mg/kg	14	17	24	29	7.1
Inorganics								
pH	DETSC 2008#		pH	10.0	8.2	11.1	11.9	10.2
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Thiocyanate	DETSC 2130#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Organic matter	DETSC 2002#	0.1	%	0.4	0.2	1.8	1.5	0.5
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	1200	110	400	12	620
Sulphur (free)	DETSC 3049#	0.75	mg/kg	18	4.4	29	< 0.75	22

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-21736
Client Ref 4291
Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1743676	1743677	1748193	1748195	1749536
			Sample ID	MPA_AUK_BH 105	MPA_AUK_BH 105	MPA_AUK_B H102	MPA_AUK_B H101	MPA_AUK_BH 109
			Depth	5.00	8.50	5.20	4.70	6.00
			Other ID	5	8	5	5	5
			Sample Type	ES	ES	ES	ES	SOIL
			Sampling Date	09/10/2020	09/10/2020	15/10/2020	19/10/2020	20/10/2020
			Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Petroleum Hydrocarbons								
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	29	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	700	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	730	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	24	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	120	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	2100	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	2300	< 10	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	3000	< 10	< 10
PAHs								
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.83	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	1.4	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	1.6	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	5.2	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	1.7	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	5.0	0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	3.6	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	1.7	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	1.2	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	1.1	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.52	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.98	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.33	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.10	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.36	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	26	< 0.10	< 0.10

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-21736
Client Ref 4291
Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1743676	1743677	1748193	1748195	1749536
			Sample ID	MPA_AUK_BH 105	MPA_AUK_BH 105	MPA_AUK_B H102	MPA_AUK_B H101	MPA_AUK_BH 109
			Depth	5.00	8.50	5.20	4.70	6.00
			Other ID	5	8	5	5	5
			Sample Type	ES	ES	ES	ES	SOIL
			Sampling Date	09/10/2020	09/10/2020	15/10/2020	19/10/2020	20/10/2020
			Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
PCBs								
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg			< 0.01		
PCB 52	DETSC 3401#	0.01	mg/kg			< 0.01		
PCB 101	DETSC 3401#	0.01	mg/kg			< 0.01		
PCB 118	DETSC 3401#	0.01	mg/kg			< 0.01		
PCB 153	DETSC 3401#	0.01	mg/kg			< 0.01		
PCB 138	DETSC 3401#	0.01	mg/kg			< 0.01		
PCB 180	DETSC 3401#	0.01	mg/kg			< 0.01		
PCB 7 Total	DETSC 3401#	0.01	mg/kg			< 0.01		
Phenols								
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Chemical Analysis
Soil Samples

Our Ref 20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-21736
Client Ref 4291

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1749537	1750159	1750643	1750644	1752052
				MPA_AUK_BH	MPA_AUK_B	MPA_AUK_BH	MPA_AUK_BH	MPA_AUK_BH
			Sample ID	109	H108	107	107	106
			Depth	8.00	5.50	6.00	8.00	5.10
			Other ID	10	5	5	8	5
			Sample Type	SOIL	ES	SOIL	SOIL	ES
			Sampling Date	20/10/2020	21/10/2020	22/10/2020	22/10/2020	26/10/2020
			Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Metals								
Aluminium	DETSC 2301*	1	mg/kg	1400	20000	63000	8700	67000
Antimony	DETSC 2301*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	DETSC 2301#	0.2	mg/kg	4.5	3.6	3.4	8.8	3.2
Barium	DETSC 2301#	1.5	mg/kg	16	490	380	110	270
Beryllium	DETSC 2301#	0.2	mg/kg	< 0.2	7.0	7.4	0.7	7.0
Boron, Water Soluble	DETSC 2311#	0.2	mg/kg	1.3	6.3	7.4	7.0	3.7
Cadmium	DETSC 2301#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.1	< 0.1
Chromium	DETSC 2301#	0.15	mg/kg	3.6	4.6	8.7	17	9.2
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	7.5	9.3	9.2	15	1200
Iron	DETSC 2301	25	mg/kg	5600	2000	3500	20000	1600
Lead	DETSC 2301#	0.3	mg/kg	5.7	1.5	6.7	15	1.1
Magnesium	DETSC 2301*	1	mg/kg	3600	12000	31000	8900	26000
Manganese	DETSC 2301#	20	mg/kg	120	2400	1800	340	1800
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Molybdenum	DETSC 2301#	0.4	mg/kg	< 0.4	< 0.4	0.4	1.4	< 0.4
Nickel	DETSC 2301#	1	mg/kg	3.0	< 1.0	1.3	19	< 1.0
Silicon	DETSC 2301*	10	mg/kg	170000	49000	65000	160000	61000
Vanadium	DETSC 2301#	0.8	mg/kg	10	21	35	32	60
Zinc	DETSC 2301#	1	mg/kg	18	11	15	61	110
Inorganics								
pH	DETSC 2008#		pH	8.3	10.3	10.9	8.7	9.7
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Thiocyanate	DETSC 2130#	0.6	mg/kg	0.9	< 0.6	< 0.6	< 0.6	< 0.6
Organic matter	DETSC 2002#	0.1	%	0.6	0.2	0.5	2.6	0.5
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	220	1700	720	680	2000
Sulphur (free)	DETSC 3049#	0.75	mg/kg	26	37	45	5.2	130

Summary of Chemical Analysis
Soil Samples

Our Ref 20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-21736
Client Ref 4291
Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1749537	1750159	1750643	1750644	1752052
			Sample ID	MPA_AUK_BH 109	MPA_AUK_BH108	MPA_AUK_BH 107	MPA_AUK_BH 107	MPA_AUK_BH 106
			Depth	8.00	5.50	6.00	8.00	5.10
			Other ID	10	5	5	8	5
			Sample Type	SOIL	ES	SOIL	SOIL	ES
			Sampling Date	20/10/2020	21/10/2020	22/10/2020	22/10/2020	26/10/2020
			Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Petroleum Hydrocarbons								
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10
PAHs								
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-21736
Client Ref 4291
Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

	Lab No	1749537	1750159	1750643	1750644	1752052
	Sample ID	MPA_AUK_BH 109	MPA_AUK_BH108	MPA_AUK_BH 107	MPA_AUK_BH 107	MPA_AUK_BH 106
	Depth	8.00	5.50	6.00	8.00	5.10
	Other ID	10	5	5	8	5
	Sample Type	SOIL	ES	SOIL	SOIL	ES
	Sampling Date	20/10/2020	21/10/2020	22/10/2020	22/10/2020	26/10/2020
	Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
PCBs								
PCB 28 + PCB 31	DETSC 3401#	0.01	mg/kg			< 0.01		
PCB 52	DETSC 3401#	0.01	mg/kg			< 0.01		
PCB 101	DETSC 3401#	0.01	mg/kg			< 0.01		
PCB 118	DETSC 3401#	0.01	mg/kg			< 0.01		
PCB 153	DETSC 3401#	0.01	mg/kg			< 0.01		
PCB 138	DETSC 3401#	0.01	mg/kg			< 0.01		
PCB 180	DETSC 3401#	0.01	mg/kg			< 0.01		
PCB 7 Total	DETSC 3401#	0.01	mg/kg			< 0.01		
Phenols								
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Chemical Analysis
Soil VOC/SVOC Samples

20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-
Our Ref 21736
Client Ref 4291

Metal Processing Area Deep Soil
Contract Title and Groundwater Investigation

			Lab No	1748193	1749536	1750643
			Sample ID	MPA_AUK_BH102	MPA_AUK_BH109	MPA_AUK_BH107
			Depth	5.20	6.00	6.00
			Other ID	5	5	5
			Sample Type	ES	SOIL	SOIL
			Sampling Date	15/10/2020	20/10/2020	22/10/2020
			Sampling Time	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**			
VOCs						
Vinyl Chloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1 Dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Trans-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Cis-1,2-dichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
2,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Bromochloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Chloroform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1,1-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Carbon tetrachloride	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Benzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Trichloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Dibromomethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Bromodichloromethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
cis-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Toluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
trans-1,3-dichloropropene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1,2-trichloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Tetrachloroethylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,3-dichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Dibromochloromethane	DETSC 3431	0.01	mg/kg	0.02	< 0.01	< 0.01
1,2-dibromoethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Chlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,1,1,2-tetrachloroethane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Ethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
m+p-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
o-Xylene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Styrene	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Bromoform	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Isopropylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Bromobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2,3-trichloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis
Soil VOC/SVOC Samples

20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-
Our Ref 21736
Client Ref 4291

Metal Processing Area Deep Soil
Contract Title and Groundwater Investigation

			Lab No	1748193	1749536	1750643
			Sample ID	MPA_AUK_BH102	MPA_AUK_BH109	MPA_AUK_BH107
			Depth	5.20	6.00	6.00
			Other ID	5	5	5
			Sample Type	ES	SOIL	SOIL
			Sampling Date	15/10/2020	20/10/2020	22/10/2020
			Sampling Time	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**			
n-propylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
2-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,3,5-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
4-chlorotoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Tert-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2,4-trimethylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
sec-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
p-isopropyltoluene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,3-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,4-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
n-butylbenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2-dibromo-3-chloropropane	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2,4-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Hexachlorobutadiene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
1,2,3-trichlorobenzene	DETSC 3431	0.01	mg/kg	< 0.01	< 0.01	< 0.01
MTBE	DETSC 3431*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
SVOCs						
Phenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Aniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2-Chlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Benzyl Alcohol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2-Methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Bis(2-chloroisopropyl)ether	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
3&4-Methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2,4-Dimethylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Bis-(dichloroethoxy)methane	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2,4-Dichlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
1,2,4-Trichlorobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
4-Chloro-3-methylphenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2-Methylnaphthalene	DETSC 3433	0.1	mg/kg	0.5	< 0.1	< 0.1
Hexachlorocyclopentadiene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2,4,6-Trichlorophenol	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2,4,5-Trichlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2-Chloronaphthalene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis
Soil VOC/SVOC Samples

20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-

Our Ref 21736

Client Ref 4291

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1748193	1749536	1750643
			Sample ID	MPA_AUK_BH102	MPA_AUK_BH109	MPA_AUK_BH107
			Depth	5.20	6.00	6.00
			Other ID	5	5	5
			Sample Type	ES	SOIL	SOIL
			Sampling Date	15/10/2020	20/10/2020	22/10/2020
			Sampling Time	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**			
2-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2,4-Dinitrotoluene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
3-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
4-Nitrophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Dibenzofuran	DETSC 3433	0.1	mg/kg	1.3	< 0.1	< 0.1
2,6-Dinitrotoluene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2,3,4,6-Tetrachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Diethylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
4-Chlorophenylphenylether	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
4-Nitroaniline	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2-Methyl-4,6-Dinitrophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Diphenylamine	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
4-Bromophenylphenylether	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Hexachlorobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Pentachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Di-n-butylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Butylbenzylphthalate	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Bis(2-ethylhexyl)phthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Di-n-octylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
1,4-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Dimethylphthalate	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
1,3-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
1,2-Dinitrobenzene	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
2,3,5,6-Tetrachlorophenol	DETSC 3433*	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Azobenzene	DETSC 3433	0.1	mg/kg	< 0.1	< 0.1	< 0.1
Carbazole	DETSC 3433*	0.1	mg/kg	0.8	< 0.1	< 0.1

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis
Leachate Samples

20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-
Our Ref 21736
Client Ref 4291

Metal Processing Area Deep Soil
Contract Title and Groundwater Investigation

	Lab No	1743678	1748194	1750645	1752053
	Sample ID	MPA_AUK_BH 105	MPA_AUK_BH102	MPA_AUK_BH 107	MPA_AUK_BH 106
	Depth	5.00	5.20	6.00	5.10
	Other ID	5	5	5	5
	Sample Type	ES	ES	LEACHATE	ES
	Sampling Date	09/10/2020	15/10/2020	22/10/2020	26/10/2020
	Sampling Time	n/s	n/s	n/s	n/s

Test	Method	LOD	Units				
Preparation							
Leachate 2:1 250g Non-WAC	DETSC 1009*			Y	Y	Y	Y
Metals							
Antimony, Dissolved	DETSC 2306	0.17	ug/l	< 0.17	< 0.17	0.72	0.33
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	< 0.16	< 0.16	0.75	0.52
Barium, Dissolved	DETSC 2306	0.26	ug/l	24	1.1	75	40
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	< 0.1	< 0.1	0.1	< 0.1
Boron, Dissolved	DETSC 2306*	12	ug/l	95	< 12	170	47
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	< 0.03	0.21	0.09
Chromium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25	2.3	2.7
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0	< 7.0	< 7.0	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	0.9	1.6	4.0	4.7
Iron, Dissolved	DETSC 2306	5.5	ug/l	< 5.5	8.6	21	53
Lead, Dissolved	DETSC 2306	0.09	ug/l	< 0.09	< 0.09	1.7	0.58
Magnesium, Dissolved	DETSC 2306	0.02	mg/l	0.27	0.09	0.56	0.77
Manganese, Dissolved	DETSC 2306	0.22	ug/l	1.2	2.0	19	38
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01	0.02	0.02
Molybdenum, Dissolved	DETSC 2306	1.1	ug/l	< 1.1	< 1.1	6.2	2.6
Nickel, Dissolved	DETSC 2306	0.5	ug/l	< 0.5	< 0.5	2.1	1.3
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	0.9	< 0.6	3.8	3.1
Zinc, Dissolved	DETSC 2306	1.3	ug/l	< 1.3	< 1.3	3.1	240
Inorganics							
pH	DETSC 2008		pH	9.2	7.7	8.5	8.4
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40	< 40	< 40
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.020	0.040	0.060	0.033
Chloride	DETSC 2055	0.1	mg/l	7.8	3.5	11	37
Sulphate as SO4	DETSC 2055	0.1	mg/l	73	180	54	160

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis
Leachate Samples

20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-

Our Ref 21736

Client Ref 4291

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1743678	1748194	1750645	1752053
				MPA_AUK_BH	MPA_AUK_B	MPA_AUK_BH	MPA_AUK_BH
			Sample ID	105	H102	107	106
			Depth	5.00	5.20	6.00	5.10
			Other ID	5	5	5	5
			Sample Type	ES	ES	LEACHATE	ES
			Sampling Date	09/10/2020	15/10/2020	22/10/2020	26/10/2020
			Sampling Time	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Petroleum Hydrocarbons							
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10
PAHs							
Naphthalene	DETSC 3304	0.05	ug/l	0.12	0.05	0.26	< 0.05
Acenaphthylene	DETSC 3304	0.01	ug/l	0.05	< 0.01	< 0.01	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	0.07	< 0.01	0.01	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	0.40	< 0.01	< 0.01	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	0.79	0.01	0.02	0.03
Anthracene	DETSC 3304	0.01	ug/l	0.05	< 0.01	< 0.01	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	0.02	< 0.01	< 0.01	< 0.01
Pyrene	DETSC 3304	0.01	ug/l	0.07	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	0.01	< 0.01	< 0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	0.04	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis
Leachate Samples

20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-

Our Ref 21736

Client Ref 4291

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1743678	1748194	1750645	1752053
			Sample ID	MPA_AUK_BH 105	MPA_AUK_BH102	MPA_AUK_BH 107	MPA_AUK_BH 106
			Depth	5.00	5.20	6.00	5.10
			Other ID	5	5	5	5
			Sample Type	ES	ES	LEACHATE	ES
			Sampling Date	09/10/2020	15/10/2020	22/10/2020	26/10/2020
			Sampling Time	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
PAH Total	DETSC 3304	0.2	ug/l	1.7	< 0.20	0.36	< 0.20
Phenols							
Phenol - Monohydric	DETSC 2130	100	ug/l	< 100	< 100	< 100	< 100

Key: * -not accredited. n/s -not supplied.

Summary of Asbestos Analysis

Soil Samples

Our Ref 20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-21736
Client Ref 4291
Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

Lab No	Sample ID	Sample Location	Material Type	Result	Comment*	Analyst
1743676	MPA_AUK_BH105 5 5.00	MPA_AUK_BH105_SO_0500	SOIL	NAD	none	A Christodoulou
1743677	MPA_AUK_BH105 8 8.50	MPA_AUK_BH105_SO_0850	SOIL	NAD	none	A Christodoulou
1748193	MPA_AUK_BH102 5 5.20	MPA_AUK_BH102_SO_0520	SOIL	NAD	none	Lee Kerridge
1748195	MPA_AUK_BH101 5 4.70	MPA_AUK_BH101_SO_0470	SOIL	NAD	none	Lee Kerridge
1749536	MPA_AUK_BH109 5 6.00	MPA_AUK_BH109_SO_0600	SOIL	NAD	none	Lee Kerridge
1749537	MPA_AUK_BH109 10 8.00	MPA_AUK_BH109_SO_0800	SOIL	NAD	none	Lee Kerridge
1750159	MPA_AUK_BH108 5 5.50	MPA_AUK_BH108_SO_0550	SOIL	NAD	none	D Wilkinson
1750643	MPA_AUK_BH107 5 6.00	MPA_AUK_BH107_SO_0600	SOIL	NAD	none	Steven Lambert
1750644	MPA_AUK_BH107 8 8.00	MPA_AUK_BH107_SO_0800	SOIL	NAD	none	Steven Lambert
1752052	MPA_AUK_BH106 5 5.10	MPA_AUK_BH106_SO_0510	SOIL	NAD	none	Lee Kerridge

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 20-20302,20-21040,20-21041,20-21312,20-21397,20-21491,20-21736
Client Ref 4291
Contract Metal Processing Area Deep Soil and Groundwater Investigation

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1743676	MPA_AUK_BH105 5.00 SOIL	09/10/20	GJ 250ml x2, GJ 60ml x2, PT 1L x2		
1743677	MPA_AUK_BH105 8.50 SOIL	09/10/20	GJ 250ml x2, GJ 60ml x2, PT 1L x2		
1743678	MPA_AUK_BH105 5.00 LEACHATE	09/10/20	GJ 250ml x2, GJ 60ml x2, PT 1L x2		
1748193	MPA_AUK_BH102 5.20 SOIL	15/10/20	GJ 250ml x2, GJ 60ml x2, PT 1L x2		
1748194	MPA_AUK_BH102 5.20 LEACHATE	15/10/20	GJ 250ml x2, GJ 60ml x2, PT 1L x2		
1748195	MPA_AUK_BH101 4.70 SOIL	19/10/20	GJ 250ml x2, GJ 60ml x2, PT 1L x2		
1749536	MPA_AUK_BH109 6.00 SOIL	20/10/20	GJ 250ml x2, GJ 60ml x2, PT 1L x2		
1749537	MPA_AUK_BH109 8.00 SOIL	20/10/20	GJ 250ml x2, GJ 60ml x2, PT 1L x2		
1750159	MPA_AUK_BH108 5.50 SOIL	21/10/20	GJ 250ml x2, GJ 60ml x2, PT 1L x2		
1750643	MPA_AUK_BH107 6.00 SOIL	22/10/20	GJ 250ml x2, GJ 60ml x2, PT 1L x2		
1750644	MPA_AUK_BH107 8.00 SOIL	22/10/20	GJ 250ml x2, GJ 60ml x2, PT 1L x2		
1750645	MPA_AUK_BH107 6.00 LEACHATE	22/10/20	GJ 250ml x2, GJ 60ml x2, PT 1L x2		
1752052	MPA_AUK_BH106 5.10 SOIL	26/10/20	GJ 250ml x2, GJ 60ml x2, PT 1L x2		
1752053	MPA_AUK_BH106 5.10 LEACHATE	26/10/20	GJ 250ml x2, GJ 60ml x2, PT 1L x2		

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

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

Soil Analysis Notes

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

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

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

Disposal

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

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

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 2002	Organic matter	%	0.1	Air Dried	No	Yes	Yes
DETSC 2003	Loss on ignition	%	0.01	Air Dried	No	Yes	Yes
DETSC 2008	pH	pH Units	1	Air Dried	No	Yes	Yes
DETSC 2024	Sulphide	mg/kg	10	Air Dried	No	Yes	Yes
DETSC 2076	Sulphate Aqueous Extract as SO4	mg/l	10	Air Dried	No	Yes	Yes
DETSC 2084	Total Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2084	Total Organic Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2119	Ammoniacal Nitrogen as N	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide free	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide total	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes
DETSC 2321	Total Sulphate as SO4	%	0.01	Air Dried	No	Yes	Yes
DETSC 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETSC 3049	Sulphur (free)	mg/kg	0.75	Air Dried	No	Yes	Yes
DETSC2123	Boron (water soluble)	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Arsenic	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Barium	mg/kg	1.5	Air Dried	No	Yes	Yes
DETSC2301	Beryllium	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Cadmium Available	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cadmium	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cobalt	mg/kg	0.7	Air Dried	No	Yes	Yes
DETSC2301	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETSC2301	Copper	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Manganese	mg/kg	20	Air Dried	No	Yes	Yes
DETSC2301	Molybdenum	mg/kg	0.4	Air Dried	No	Yes	Yes
DETSC2301	Nickel	mg/kg	1	Air Dried	No	Yes	Yes
DETSC2301	Lead	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC2301	Selenium	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC2301	Zinc	mg/kg	1	Air Dried	No	Yes	Yes
DETSC 3072	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETS 062	Benzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Ethylbenzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Toluene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	m+p Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	o Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3311	C10-C24 Diesel Range Organics (DRO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	C24-C40 Lube Oil Range Organics (LORO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	EPH (C10-C40)	mg/kg	10	As Received	No	Yes	Yes

Appendix A - Details of Analysis

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

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

End of Report

Certificate of Analysis

Certificate Number 20-22920

24-Nov-20

Client Allied Exploration & Geotechnics Limited
Unit 25
Stella Gill Industrial Estate
Pelton Fell
DH2 2RG

Our Reference 20-22920

Client Reference 4291

Order No (not supplied)

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

Description 2 Water samples.

Date Received 12-Nov-20

Date Started 12-Nov-20

Date Completed 24-Nov-20

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

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

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING
2139

Summary of Chemical Analysis

Water Samples

Our Ref 20-22920
Client Ref 4291

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

				Lab No	1759822	1759823
				.Sample ID	MPA_AUK_BH101	MPA_AUK_BH108
				Depth	7.34	4.67
				Other ID	100	100
				Sample Type	EW	EW
				Sampling Date	10/11/2020	10/11/2020
				Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Metals					
Antimony, Dissolved	DETSC 2306	0.17	ug/l	< 0.17	< 0.17
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	1.1	1.8
Barium, Dissolved	DETSC 2306	0.26	ug/l	55	28
Boron, Dissolved	DETSC 2306*	12	ug/l	1500	4500
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	< 0.03
Calcium, Dissolved	DETSC 2306	0.09	mg/l	470	330
Chromium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	0.47
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	< 0.4	0.9
Iron, Dissolved	DETSC 2306	5.5	ug/l	38	19
Lead, Dissolved	DETSC 2306	0.09	ug/l	< 0.09	< 0.09
Magnesium, Dissolved	DETSC 2306	0.02	mg/l	8.3	4.3
Manganese, Dissolved	DETSC 2306	0.22	ug/l	3.4	4.4
Mercury, Dissolved	DETSC 2306	0.01	ug/l	0.04	0.02
Molybdenum, Dissolved	DETSC 2306	1.1	ug/l	18	17
Nickel, Dissolved	DETSC 2306	0.5	ug/l	1.3	2.8
Sodium, Dissolved	DETSC 2306	0.07	mg/l	620	420
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	13	9.8
Zinc, Dissolved	DETSC 2306	1.3	ug/l	1.8	2.5
Inorganics					
pH	DETSC 2008		pH	10.8	9.6
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40
Cyanide, Free	DETSC 2130	20	ug/l	< 20	< 20
Thiocyanate	DETSC 2130	20	ug/l	< 20	< 20
Dissolved Organic Carbon	DETSC 2085	2	mg/l	3.9	3.2
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.34	0.046
Chloride	DETSC 2055	0.1	mg/l	640	480
Nitrate as N	*	0.1	mg/l	< 0.10	0.27
Nitrite as N	DETSC 2201	0.035	mg/l	< 0.035	< 0.035
Salinity (Calculated)	DETSC 2017*	0.01	%	2.5	2.0
Sulphate as SO4	DETSC 2055	0.1	mg/l	1300	1200
Sulphur (free)	DETSC 3049	84	ug/l	< 84	< 84

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis

Water Samples

Our Ref 20-22920
Client Ref 4291

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1759822	1759823
			.Sample ID	MPA_AUK_BH101	MPA_AUK_BH108
			Depth	7.34	4.67
			Other ID	100	100
			Sample Type	EW	EW
			Sampling Date	10/11/2020	10/11/2020
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Petroleum Hydrocarbons					
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	ug/l	< 10	< 10
PAHs					
Naphthalene	DETSC 3304	0.05	ug/l	0.07	0.06
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	0.02	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	0.01	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	0.03	< 0.01
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	0.02	< 0.01
Pyrene	DETSC 3304	0.01	ug/l	0.01	< 0.01
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
PAH Total	DETSC 3304	0.2	ug/l	< 0.20	< 0.20
Phenols					

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis

Water Samples

Our Ref 20-22920
Client Ref 4291

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1759822	1759823
			.Sample ID	MPA_AUK_BH101	MPA_AUK_BH108
			Depth	7.34	4.67
			Other ID	100	100
			Sample Type	EW	EW
			Sampling Date	10/11/2020	10/11/2020
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Phenol - Monohydric	DETSC 2130	100	ug/l	< 100	< 100

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis

Water Samples

Our Ref 20-22920
Client Ref 4291

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

				Lab No	1759822	1759823
				.Sample ID	MPA_AUK_BH101	MPA_AUK_BH108
				Depth	7.34	4.67
				Other ID	100	100
				Sample Type	EW	EW
				Sampling Date	10/11/2020	10/11/2020
				Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
VOCs					
Dichlorodifluoromethane	DETSC 3432	1	ug/l	< 1	< 1
Chloromethane	DETSC 3432	1	ug/l	< 1	< 1
Vinyl Chloride	DETSC 3432	1	ug/l	< 1	< 1
Bromomethane	DETSC 3432	1	ug/l	< 1	< 1
Chloroethane	DETSC 3432	1	ug/l	< 1	< 1
Trichlorofluoromethane	DETSC 3432*	1	ug/l	< 1	< 1
1,1-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1
Methylene Chloride	DETSC 3432*	27	ug/l	< 27	< 27
Trans-1,2-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1
1,1-dichloroethane	DETSC 3432	1	ug/l	< 1	< 1
Cis-1,2-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1
2,2-dichloropropane	DETSC 3432	2	ug/l	< 2	< 2
Bromochloromethane	DETSC 3432	4	ug/l	< 4	< 4
Chloroform	DETSC 3432	1	ug/l	< 1	< 1
1,1,1-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1
1,1-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1
Carbon tetrachloride	DETSC 3432	1	ug/l	< 1	< 1
Benzene	DETSC 3432	1	ug/l	< 1	< 1
1,2-dichloroethane	DETSC 3432	1	ug/l	< 1	< 1
Trichloroethylene	DETSC 3432*	1	ug/l	< 1	< 1
1,2-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1
Dibromomethane	DETSC 3432	1	ug/l	< 1	< 1
Bromodichloromethane	DETSC 3432	4	ug/l	< 4	< 4
cis-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1
Toluene	DETSC 3432	1	ug/l	< 1	< 1
trans-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1
1,1,2-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1
Tetrachloroethylene	DETSC 3432	1	ug/l	< 1	< 1
1,3-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1
Dibromochloromethane	DETSC 3432	1	ug/l	< 1	< 1
1,2-dibromoethane	DETSC 3432	1	ug/l	< 1	< 1
Chlorobenzene	DETSC 3432	1	ug/l	< 1	< 1
1,1,1,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1
Ethylbenzene	DETSC 3432	1	ug/l	< 1	< 1
m+p-Xylene	DETSC 3432	2	ug/l	< 2	< 2
o-Xylene	DETSC 3432	1	ug/l	< 1	< 1

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis

Water Samples

Our Ref 20-22920
Client Ref 4291

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1759822	1759823
			.Sample ID	MPA_AUK_BH101	MPA_AUK_BH108
			Depth	7.34	4.67
			Other ID	100	100
			Sample Type	EW	EW
			Sampling Date	10/11/2020	10/11/2020
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Styrene	DETSC 3432	1	ug/l	< 1	< 1
Bromoform	DETSC 3432	1	ug/l	< 1	< 1
Isopropylbenzene	DETSC 3432	1	ug/l	< 1	< 1
1,1,2,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1
Bromobenzene	DETSC 3432	1	ug/l	< 1	< 1
1,2,3-trichloropropane	DETSC 3432	1	ug/l	< 1	< 1
n-propylbenzene	DETSC 3432	1	ug/l	< 1	< 1
2-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1
1,3,5-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1
4-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1
Tert-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1
1,2,4-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1
sec-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1
p-isopropyltoluene	DETSC 3432	1	ug/l	< 1	< 1
1,3-dichlorobenzene	DETSC 3432	2	ug/l	< 2	< 2
1,4-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1
n-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1
1,2-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1
1,2-dibromo-3-chloropropane	DETSC 3432	1	ug/l	< 1	< 1
1,2,4-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1
Hexachlorobutadiene	DETSC 3432	1	ug/l	< 1	< 1
1,2,3-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1
MTBE	DETSC 3432*	1	ug/l	< 1	< 1
SVOCs					
Phenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Aniline	DETSC 3434*	1	ug/l	< 1.0	< 1.0
2-Chlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Benzyl Alcohol	DETSC 3434*	1	ug/l	< 1.0	< 1.0
2-Methylphenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Bis(2-chloroisopropyl)ether	DETSC 3434*	1	ug/l	< 1.0	< 1.0
3&4-Methylphenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Bis(2-chloroethoxy)methane	DETSC 3434*	1	ug/l	< 1.0	< 1.0
2,4-Dimethylphenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0
2,4-Dichlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0
1,2,4-Trichlorobenzene	DETSC 3434*	1	ug/l	< 1.0	< 1.0
4-Chloro-3-methylphenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0
2-Methylnaphthalene	DETSC 3434*	1	ug/l	< 1.0	< 1.0

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis

Water Samples

Our Ref 20-22920
Client Ref 4291

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1759822	1759823
			.Sample ID	MPA_AUK_BH101	MPA_AUK_BH108
			Depth	7.34	4.67
			Other ID	100	100
			Sample Type	EW	EW
			Sampling Date	10/11/2020	10/11/2020
			Sampling Time	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Hexachlorocyclopentadiene	DETSC 3434*	1	ug/l	< 1.0	< 1.0
2,4,6-Trichlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0
2,4,5-Trichlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0
2-Chloronaphthalene	DETSC 3434*	1	ug/l	< 1.0	< 1.0
2-Nitroaniline	DETSC 3434*	1	ug/l	< 1.0	< 1.0
2,4-Dinitrotoluene	DETSC 3434*	1	ug/l	< 1.0	< 1.0
3-Nitroaniline	DETSC 3434*	1	ug/l	< 1.0	< 1.0
4-Nitrophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Dibenzofuran	DETSC 3434*	1	ug/l	< 1.0	< 1.0
2,6-Dinitrotoluene	DETSC 3434*	1	ug/l	< 1.0	< 1.0
2,3,4,6-Tetrachlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Diethylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0
4-Chlorophenylphenylether	DETSC 3434*	1	ug/l	< 1.0	< 1.0
4-Nitroaniline	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Diphenylamine	DETSC 3434*	1	ug/l	< 1.0	< 1.0
4-Bromophenylphenylether	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Hexachlorobenzene	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Bis(2-ethylhexyl)ester	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Pentachlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Di-n-butylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Butylbenzylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Bis(2-ethylhexyl)phthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Di-n-octylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0
1,4-Dinitrobenzene	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Dimethylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0
1,3-Dinitrobenzene	DETSC 3434*	1	ug/l	< 1.0	< 1.0
2,3,5,6-Tetrachlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Azobenzene	DETSC 3434*	1	ug/l	< 1.0	< 1.0
Carbazole	DETSC 3434*	1	ug/l	< 1.0	< 1.0
1-Methylnaphthalene	DETSC 3434*	1	ug/l	< 1.0	< 1.0

Key: * -not accredited. n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 20-22920
Client Ref 4291
Contract Metal Processing Area Deep Soil and Groundwater Investigation

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1759822	MPA_AUK_BH101 7.34 WATER	10/11/20	GB 1L x2, GV x2, PB 1L, PU	pH/Cond/TDS (1 days)	
1759823	MPA_AUK_BH108 4.67 WATER	10/11/20	GB 1L x2, GV x2, PB 1L, PU	pH/Cond/TDS (1 days)	

Key: G-Glass P-Plastic B-Bottle V-Vial U-Tube

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

Disposal

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

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

End of Report

Certificate of Analysis

Certificate Number	20-23090
	24-Nov-20
Client	Allied Exploration & Geotechnics Limited Unit 25 Stella Gill Industrial Estate Pelton Fell DH2 2RG
Our Reference	20-23090
Client Reference	4291
Order No	(not supplied)
Contract Title	Metal Processing Area Deep Soil and Groundwater Investigation
Description	5 Water samples.
Date Received	13-Nov-20
Date Started	13-Nov-20
Date Completed	24-Nov-20
Test Procedures	Identified by prefix DETSn (details on request).
Notes	Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING
2139

Summary of Chemical Analysis

Water Samples

Our Ref 20-23090
Client Ref 4291

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1760950	1760951	1760952	1760953	1760954
			.Sample ID	MPA_AUK_BH104	MPA_AUK_BH105	MPA_AUK_BH107	MPA_AUK_BH107	MPA_AUK_BH108
			Depth					
			Other ID	100	100	100	100	100
			Sample Type	EW	EW	EW	EW	EW
			Sampling Date	11/11/2020	11/11/2020	11/11/2020	11/11/2020	11/11/2020
			Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Metals								
Antimony, Dissolved	DETSC 2306	0.17	ug/l	0.32	< 0.17	< 0.17	0.22	0.28
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	0.79	0.44	0.43	0.60	1.2
Barium, Dissolved	DETSC 2306	0.26	ug/l	63	35	44	68	51
Boron, Dissolved	DETSC 2306*	12	ug/l	300	830	450	520	1100
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	0.04	0.03	< 0.03	< 0.03
Calcium, Dissolved	DETSC 2306	0.09	mg/l	370	910	480	300	310
Chromium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25	0.50	< 0.25	< 0.25
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0	< 7.0	< 7.0	< 7.0	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	< 0.4	< 0.4	1.2	< 0.4	< 0.4
Iron, Dissolved	DETSC 2306	5.5	ug/l	26	16	96	49	33
Lead, Dissolved	DETSC 2306	0.09	ug/l	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09
Magnesium, Dissolved	DETSC 2306	0.02	mg/l	69	830	440	360	23
Manganese, Dissolved	DETSC 2306	0.22	ug/l	250	270	160	580	200
Mercury, Dissolved	DETSC 2306	0.01	ug/l	0.01	0.01	0.01	< 0.01	0.02
Molybdenum, Dissolved	DETSC 2306	1.1	ug/l	29	9.3	13	13	30
Nickel, Dissolved	DETSC 2306	0.5	ug/l	0.9	1.8	1.7	1.9	1.8
Sodium, Dissolved	DETSC 2306	0.07	mg/l	2000	2900	2500	4300	610
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	1.4	1.8	2.1	< 0.6	2.5
Zinc, Dissolved	DETSC 2306	1.3	ug/l	< 1.3	3.5	3.6	< 1.3	< 1.3
Inorganics								
pH	DETSC 2008		pH	8.9	7.4	7.6	7.7	9.0
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40	< 40	< 40	< 40
Cyanide, Free	DETSC 2130	20	ug/l	< 20	< 20	< 20	< 20	< 20
Thiocyanate	DETSC 2130	20	ug/l	47	< 20	< 20	31	43
Dissolved Organic Carbon	DETSC 2085	2	mg/l	4.4	< 2.0	< 2.0	3.1	4.0
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	1.5	1.2	0.78	1.8	0.83
Chloride	DETSC 2055	0.1	mg/l	1500	2500	1400	2600	460
Nitrate as N	*	0.1	mg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Nitrite as N	DETSC 2201	0.035	mg/l	< 0.035	< 0.035	0.068	< 0.035	< 0.035
Salinity (Calculated)	DETSC 2017*	0.01	%	4.3	7.7	5.3	6.8	2.1
Sulphate as SO4	DETSC 2055	0.1	mg/l	920	1400	1500	1000	770
Sulphur (free)	DETSC 3049	84	ug/l	< 84	< 84	< 84	< 84	< 84

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis

Water Samples

Our Ref 20-23090
Client Ref 4291

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1760950	1760951	1760952	1760953	1760954
			.Sample ID	MPA_AUK_BH104	MPA_AUK_BH105	MPA_AUK_BH107	MPA_AUK_BH107	MPA_AUK_BH108
			Depth					
			Other ID	100	100	100	100	100
			Sample Type	EW	EW	EW	EW	EW
			Sampling Date	11/11/2020	11/11/2020	11/11/2020	11/11/2020	11/11/2020
			Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Petroleum Hydrocarbons								
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10	< 10
PAHs								
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05	< 0.05	< 0.05	< 0.05	0.07
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	0.03	< 0.01	< 0.01	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	0.01	< 0.01	< 0.01	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	0.02	0.09	< 0.01	< 0.01	< 0.01
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	0.02	< 0.01	< 0.01	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	0.04	0.22	< 0.01	< 0.01	< 0.01
Pyrene	DETSC 3304	0.01	ug/l	0.04	0.20	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	0.01	0.08	< 0.01	< 0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	0.01	0.09	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	0.02	0.14	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	0.06	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	0.01	0.09	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	0.02	0.11	< 0.01	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	0.02	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	0.01	0.09	< 0.01	< 0.01	< 0.01
PAH Total	DETSC 3304	0.2	ug/l	0.23	1.3	< 0.20	< 0.20	< 0.20
Phenols								

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis

Water Samples

Our Ref 20-23090
Client Ref 4291

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

				Lab No	1760950	1760951	1760952	1760953	1760954
				.Sample ID	MPA_AUK_BH104	MPA_AUK_BH105	MPA_AUK_BH107	MPA_AUK_BH107	MPA_AUK_BH108
				Depth					
				Other ID	100	100	100	100	100
				Sample Type	EW	EW	EW	EW	EW
				Sampling Date	11/11/2020	11/11/2020	11/11/2020	11/11/2020	11/11/2020
				Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Phenol - Monohydric	DETSC 2130	100	ug/l		140	320	160	300	< 100

Summary of Chemical Analysis

Water Samples

Our Ref 20-23090
Client Ref 4291

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1760950	1760951	1760952	1760953	1760954
			.Sample ID	MPA_AUK_BH104	MPA_AUK_BH105	MPA_AUK_BH107	MPA_AUK_BH107	MPA_AUK_BH108
			Depth					
			Other ID	100	100	100	100	100
			Sample Type	EW	EW	EW	EW	EW
			Sampling Date	11/11/2020	11/11/2020	11/11/2020	11/11/2020	11/11/2020
			Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
VOCs								
Dichlorodifluoromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Chloromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Vinyl Chloride	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Bromomethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Chloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Trichlorofluoromethane	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Methylene Chloride	DETSC 3432*	27	ug/l	< 27	< 27	< 27	27	< 27
Trans-1,2-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1-dichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Cis-1,2-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
2,2-dichloropropane	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2
Bromochloromethane	DETSC 3432	4	ug/l	< 4	< 4	< 4	< 4	< 4
Chloroform	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1,1-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Carbon tetrachloride	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Benzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2-dichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Trichloroethylene	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Dibromomethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Bromodichloromethane	DETSC 3432	4	ug/l	< 4	< 4	< 4	< 4	< 4
cis-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Toluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
trans-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1,2-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Tetrachloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,3-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Dibromochloromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2-dibromoethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Chlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1,1,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Ethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
m+p-Xylene	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2
o-Xylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis

Water Samples

Our Ref 20-23090
Client Ref 4291

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1760950	1760951	1760952	1760953	1760954
			.Sample ID	MPA_AUK_BH104	MPA_AUK_BH105	MPA_AUK_BH107	MPA_AUK_BH107	MPA_AUK_BH108
			Depth					
			Other ID	100	100	100	100	100
			Sample Type	EW	EW	EW	EW	EW
			Sampling Date	11/11/2020	11/11/2020	11/11/2020	11/11/2020	11/11/2020
			Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Styrene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Bromoform	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Isopropylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1,2,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Bromobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2,3-trichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
n-propylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
2-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,3,5-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
4-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Tert-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2,4-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
sec-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
p-isopropyltoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,3-dichlorobenzene	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2
1,4-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
n-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2-dibromo-3-chloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2,4-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Hexachlorobutadiene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2,3-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
MTBE	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1	< 1
SVOCs								
Phenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aniline	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzyl Alcohol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Methylphenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bis(2-chloroisopropyl)ether	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
3&4-Methylphenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bis(2-chloroethoxy)methane	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4-Dimethylphenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4-Dichlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Chloro-3-methylphenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Methylnaphthalene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis

Water Samples

Our Ref 20-23090
Client Ref 4291

Contract Title Metal Processing Area Deep Soil and Groundwater Investigation

			Lab No	1760950	1760951	1760952	1760953	1760954
			.Sample ID	MPA_AUK_BH104	MPA_AUK_BH105	MPA_AUK_BH107	MPA_AUK_BH107	MPA_AUK_BH108
			Depth					
			Other ID	100	100	100	100	100
			Sample Type	EW	EW	EW	EW	EW
			Sampling Date	11/11/2020	11/11/2020	11/11/2020	11/11/2020	11/11/2020
			Sampling Time	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Hexachlorocyclopentadiene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4,6-Trichlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4,5-Trichlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Chloronaphthalene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Nitroaniline	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4-Dinitrotoluene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
3-Nitroaniline	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Nitrophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibenzofuran	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,6-Dinitrotoluene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,3,4,6-Tetrachlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Diethylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorophenylphenylether	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Nitroaniline	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Diphenylamine	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Bromophenylphenylether	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobenzene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bis(2-ethylhexyl)ester	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Pentachlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Di-n-butylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bis(2-ethylhexyl)phthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Di-n-octylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dinitrobenzene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dimethylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dinitrobenzene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,3,5,6-Tetrachlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Azobenzene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbazole	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1-Methylnaphthalene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Key: * -not accredited. n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 20-23090
Client Ref 4291
Contract Metal Processing Area Deep Soil and Groundwater Investigation

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1760950	MPA_AUK_BH104 WATER	11/11/20	GB 1L x2, GV x2, PB 1L, P(other)	pH/Cond/TDS (1 days)	
1760951	MPA_AUK_BH105 WATER	11/11/20	GB 1L x2, GV x2, PB 1L, P(other)	pH/Cond/TDS (1 days)	
1760952	MPA_AUK_BH107 WATER	11/11/20	GB 1L x2, GV x2, PB 1L, P(other)	pH/Cond/TDS (1 days)	
1760953	MPA_AUK_BH107 WATER	11/11/20	GB 1L x2, GV x2, PB 1L, P(other)	pH/Cond/TDS (1 days)	
1760954	MPA_AUK_BH108 WATER	11/11/20	GB 1L x2, GV x2, PB 1L, P(other)	pH/Cond/TDS (1 days)	

Key: G-Glass P-Plastic B-Bottle V-Vial

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

Disposal

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

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

End of Report

Certificate of Analysis

Certificate Number	20-23332	24-Nov-20
Client	Allied Exploration & Geotechnics Limited Unit 25 Stella Gill Industrial Estate Pelton Fell DH2 2RG	
Our Reference	20-23332	
Client Reference	4291	
Order No	4291	
Contract Title	Former Redcar Steelworks - Metal Processing Area	
Description	4 Water samples.	
Date Received	17-Nov-20	
Date Started	17-Nov-20	
Date Completed	24-Nov-20	
Test Procedures	Identified by prefix DETSn (details on request).	
Notes	Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.	

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Water Samples

Our Ref 20-23332
Client Ref 4291
Contract Title Former Redcar Steelworks - Metal Processing Area

			Lab No	1762069	1762070	1762071	1762072
			.Sample ID	MPA_AUK_BH103D	MPA_AUK_BH106D	MPA_AUK_BH106S	MPA_AUK_BH102
			Depth				
			Other ID	100	100	100	100
			Sample Type	EW	EW	EW	EW
			Sampling Date	12/11/2020	12/11/2020	12/11/2020	12/11/2020
			Sampling Time	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Metals							
Antimony, Dissolved	DETSC 2306	0.17	ug/l	< 0.17	0.30	0.23	< 0.17
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	1.2	0.99	0.99	0.38
Barium, Dissolved	DETSC 2306	0.26	ug/l	25	46	41	48
Boron, Dissolved	DETSC 2306*	12	ug/l	2200	1900	1900	370
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	< 0.03	< 0.03	0.10
Calcium, Dissolved	DETSC 2306	0.09	mg/l	250	240	240	680
Chromium, Dissolved	DETSC 2306	0.25	ug/l	0.43	5.5	0.41	< 0.25
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0	< 7.0	< 7.0	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	0.4	0.7	< 0.4	0.6
Iron, Dissolved	DETSC 2306	5.5	ug/l	20	1400	62	41
Lead, Dissolved	DETSC 2306	0.09	ug/l	< 0.09	1.4	< 0.09	0.22
Magnesium, Dissolved	DETSC 2306	0.02	mg/l	62	87	92	1000
Manganese, Dissolved	DETSC 2306	0.22	ug/l	51	380	270	1200
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01	0.01	< 0.01
Molybdenum, Dissolved	DETSC 2306	1.1	ug/l	8.9	8.8	8.7	2.2
Nickel, Dissolved	DETSC 2306	0.5	ug/l	6.7	4.8	4.4	3.9
Sodium, Dissolved	DETSC 2306	0.07	mg/l	460	490	520	3100
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	2.1	3.0	0.9	2.3
Zinc, Dissolved	DETSC 2306	1.3	ug/l	< 1.3	4.3	< 1.3	3.9
Inorganics							
pH	DETSC 2008		pH	8.9	8.8	8.7	7.4
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40	< 40	< 40
Cyanide, Free	DETSC 2130	20	ug/l	< 20	< 20	< 20	< 20
Thiocyanate	DETSC 2130	20	ug/l	< 20	< 20	< 20	< 20
Dissolved Organic Carbon	DETSC 2085	2	mg/l	9.3	5.9	23	< 2.0
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.055	0.38	0.35	1.9
Chloride	DETSC 2055	0.1	mg/l	350	350	330	4000
Nitrate as N	*	0.1	mg/l	0.32	0.23	0.22	0.22
Nitrite as N	DETSC 2201	0.035	mg/l	< 0.035	< 0.035	< 0.035	< 0.035
Salinity (Calculated)	DETSC 2017*	0.01	%	1.8	1.8	1.8	7.3
Sulphate as SO4	DETSC 2055	0.1	mg/l	1000	1100	780	1400
Sulphur (free)	DETSC 3049	84	ug/l	< 84	< 84	< 84	< 84
Petroleum Hydrocarbons							
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis
Water Samples

Our Ref 20-23332
Client Ref 4291
Contract Title Former Redcar Steelworks - Metal Processing Area

			Lab No	1762069	1762070	1762071	1762072
			.Sample ID	MPA_AUK_BH103D	MPA_AUK_BH106D	MPA_AUK_BH106S	MPA_AUK_BH102
			Depth				
			Other ID	100	100	100	100
			Sample Type	EW	EW	EW	EW
			Sampling Date	12/11/2020	12/11/2020	12/11/2020	12/11/2020
			Sampling Time	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10
PAHs							
Naphthalene	DETSC 3304	0.05	ug/l	0.05	0.06	0.13	< 0.05
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	0.02	< 0.01	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	0.03	0.05	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	0.03	0.02	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	0.01	0.02	0.02	< 0.01
Anthracene	DETSC 3304	0.01	ug/l	0.02	0.03	0.02	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	0.01	0.05	0.02	< 0.01
Pyrene	DETSC 3304	0.01	ug/l	0.01	0.04	0.02	0.01
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	0.01	0.01	0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	0.02	0.02	< 0.01	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	0.01	0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	0.01	< 0.01	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	0.01	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	0.01	< 0.01	< 0.01	< 0.01
PAH Total	DETSC 3304	0.2	ug/l	0.24	0.35	0.34	< 0.20
Phenols							
Phenol - Monohydric	DETSC 2130	100	ug/l	< 100	< 100	< 100	680

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Summary of Chemical Analysis
Water Samples

Our Ref 20-23332
Client Ref 4291
Contract Title Former Redcar Steelworks - Metal Processing Area

			Lab No	1762069	1762070	1762071	1762072
			.Sample ID	MPA_AUK_BH103D	MPA_AUK_BH106D	MPA_AUK_BH106S	MPA_AUK_BH102
			Depth				
			Other ID	100	100	100	100
			Sample Type	EW	EW	EW	EW
			Sampling Date	12/11/2020	12/11/2020	12/11/2020	12/11/2020
			Sampling Time	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
VOCs							
Dichlorodifluoromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Chloromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Vinyl Chloride	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Bromomethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Chloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Trichlorofluoromethane	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1
1,1-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Methylene Chloride	DETSC 3432*	27	ug/l	< 27	< 27	< 27	< 27
Trans-1,2-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
1,1-dichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Cis-1,2-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
2,2-dichloropropane	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2
Bromochloromethane	DETSC 3432	4	ug/l	< 4	< 4	< 4	< 4
Chloroform	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
1,1,1-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
1,1-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Carbon tetrachloride	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Benzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
1,2-dichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Trichloroethylene	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1
1,2-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Dibromomethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Bromodichloromethane	DETSC 3432	4	ug/l	< 4	< 4	< 4	< 4
cis-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Toluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
trans-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
1,1,2-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Tetrachloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
1,3-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Dibromochloromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
1,2-dibromoethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Chlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
1,1,1,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Ethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
m+p-Xylene	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2
o-Xylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Styrene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Bromoform	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Isopropylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis
Water Samples

Our Ref 20-23332
Client Ref 4291
Contract Title Former Redcar Steelworks - Metal Processing Area

			Lab No	1762069	1762070	1762071	1762072
			.Sample ID	MPA_AUK_BH103D	MPA_AUK_BH106D	MPA_AUK_BH106S	MPA_AUK_BH102
			Depth				
			Other ID	100	100	100	100
			Sample Type	EW	EW	EW	EW
			Sampling Date	12/11/2020	12/11/2020	12/11/2020	12/11/2020
			Sampling Time	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
1,1,2,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Bromobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
1,2,3-trichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
n-propylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
2-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
1,3,5-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
4-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Tert-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
1,2,4-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
sec-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
p-isopropyltoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
1,3-dichlorobenzene	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2
1,4-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
n-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
1,2-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
1,2-dibromo-3-chloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
1,2,4-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
Hexachlorobutadiene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
1,2,3-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1
MTBE	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1
SVOCs							
Phenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aniline	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Benzyl Alcohol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
2-Methylphenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Bis(2-chloroisopropyl)ether	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
3&4-Methylphenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Bis(2-chloroethoxy)methane	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
2,4-Dimethylphenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
2,4-Dichlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
4-Chloro-3-methylphenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
2-Methylnaphthalene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorocyclopentadiene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
2,4,6-Trichlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
2,4,5-Trichlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
2-Chloronaphthalene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
2-Nitroaniline	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
2,4-Dinitrotoluene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis
Water Samples

Our Ref 20-23332
Client Ref 4291
Contract Title Former Redcar Steelworks - Metal Processing Area

			Lab No	1762069	1762070	1762071	1762072
			.Sample ID	MPA_AUK_BH103D	MPA_AUK_BH106D	MPA_AUK_BH106S	MPA_AUK_BH102
			Depth				
			Other ID	100	100	100	100
			Sample Type	EW	EW	EW	EW
			Sampling Date	12/11/2020	12/11/2020	12/11/2020	12/11/2020
			Sampling Time	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
3-Nitroaniline	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
4-Nitrophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Dibenzofuran	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
2,6-Dinitrotoluene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
2,3,4,6-Tetrachlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Diethylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorophenylphenylether	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
4-Nitroaniline	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Diphenylamine	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
4-Bromophenylphenylether	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobenzene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Bis(2-ethylhexyl)ester	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Pentachlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Di-n-butylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Bis(2-ethylhexyl)phthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Di-n-octylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dinitrobenzene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Dimethylphthalate	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dinitrobenzene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
2,3,5,6-Tetrachlorophenol	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Azobenzene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Carbazole	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
1-Methylnaphthalene	DETSC 3434*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0

Key: * -not accredited. n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 20-23332
Client Ref 4291
Contract Former Redcar Steelworks - Metal Processing Area

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1762069	MPA_AUK_BH103D WATER	12/11/20	GB 1L x2, GV x2, PB 1L, PU	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Kone (4 days), pH/Cond/TDS (1 days), Nitrite as N (2 days), PAH MS (4 days)	
1762070	MPA_AUK_BH106D WATER	12/11/20	GB 1L x2, GV x2, PB 1L, PU	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Kone (4 days), pH/Cond/TDS (1 days), Nitrite as N (2 days), PAH MS (4 days)	
1762071	MPA_AUK_BH106S WATER	12/11/20	GB 1L x2, GV x2, PB 1L, PU	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Kone (4 days), pH/Cond/TDS (1 days), Nitrite as N (2 days), PAH MS (4 days)	
1762072	MPA_AUK_BH102 WATER	12/11/20	GB 1L x2, GV x2, PB 1L, PU	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Kone (4 days), pH/Cond/TDS (1 days), Nitrite as N (2 days), PAH MS (4 days)	

Key: G-Glass P-Plastic B-Bottle V-Vial U-Tube

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

Disposal

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

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

End of Report

ALLIED EXPLORATION & GEOTECHNICS LIMITED

Head Office: Unit 25 Stella Gill Industrial Estate, Pelton Fell, Chester-le-Street, Co. Durham, DH2 2RG **Tel:** 0191 387 4700 **Fax:** 0191 387 4710
Regional Office: Unit 20 Business Development Centre, Eanam Wharf, Blackburn, BB1 5BL **Tel:** 01772 735 300 **Fax:** 01772 735 999

GROUNDWATER MONITORING RESULTS

Monitoring Point	Date and Time	Depth and Type of Well	Ground Level (mAOD)	Water Depth (mBGL)	Reduced Water Level (mAOD)	Remarks
MPA_AUK_BH101	09/11/2020 11:39	15.00m 50mm SP	8.94	7.34	1.60	
MPA_AUK_BH101	09/11/2020 11:39	9.00m 25mm SP	8.94	7.31	1.63	
MPA_AUK_BH102	09/11/2020 15:38	14.70m 50mm SP	7.37	6.24	1.13	
MPA_AUK_BH102	09/11/2020 15:38	7.00m 25mm SP	7.37	5.57	1.80	
MPA_AUK_BH103	09/11/2020 14:42	17.40m 50mm SP	6.70	5.35	1.35	
MPA_AUK_BH103	09/11/2020 14:42	6.00m 25mm SP	6.70	4.21	2.49	
MPA_AUK_BH106	09/11/2020 15:16	20.40m 50mm SP	7.51	5.90	1.61	
MPA_AUK_BH106	09/11/2020 15:16	9.50m 25mm SP	7.51	5.81	1.70	
MPA_AUK_BH106	09/11/2020 15:16	6.00m 25mm SP	7.51	5.81	1.70	
MPA_AUK_BH107	09/11/2020 14:17	19.20m 50mm SP	6.80	5.89	0.91	
MPA_AUK_BH107	09/11/2020 14:17	8.00m 25mm SP	6.80	5.12	1.68	
MPA_AUK_BH107	09/11/2020 14:17	6.00m 25mm SP	6.80	5.09	1.71	
MPA_AUK_BH108	09/11/2020 12:13	17.70m 50mm SP	6.32	4.67	1.65	
MPA_AUK_BH108	09/11/2020 12:13	8.00m 25mm SP	6.32	4.72	1.60	
MPA_AUK_BH108	09/11/2020 12:13	5.00m 25mm SP	6.32	4.68	1.64	

SP = Standpipe - SPIE = Standpipe Piezometer.

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Metal Processing Area Deep Soil and Groundwater Investigation	South Tees Development Corporation

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		4291

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GAS MONITORING RESULTS

Monitoring Point	Date and Time	Weather Condition	Temperature °C	Depth and Type of Well	Ground Level (mAOD)	Water Depth (mBGL)	Reduced Water Level (mAOD)	Flow Range (l/hr)	Diff Pressure (mbar)	ATM Pressure Range (mbar)	Methane % v/v		Methane % LEL		Carbon Dioxide % v/v		Oxygen % v/v		Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	Photo-Ionisation Detector (ppm)	Remarks
											(P)	(S)	(P)	(S)	(P)	(S)	(D)	(S)				
MPA_AUK_BH101	09/11/2020 11:39	Clear, Sunny spells	10-13	9.00m 25mm SP	8.94	7.31	1.63	0.1	0.36	1020	<0.1	<0.1	<2.0	<2.0	<0.1	<0.1	20.0	20.0	<1.0	5.0	0.1	
MPA_AUK_BH102	09/11/2020 15:38	Clear, Sunny spells	10-13	7.00m 25mm SP	7.37	5.57	1.80	0.1	0.21	1018	<0.1	<0.1	<2.0	<2.0	<0.1	<0.1	19.3	19.4	<1.0	<1.0	0.4	
MPA_AUK_BH103	09/11/2020 14:42	Clear, Sunny spells	10-13	6.00m 25mm SP	6.70	4.21	2.49	0.0	0.16	1019	<0.1	<0.1	<2.0	<2.0	<0.1	<0.1	19.5	19.6	<1.0	1.0	<0.1	
MPA_AUK_BH106	09/11/2020 15:16	Clear, Sunny spells	10-13	9.50m 25mm SP	7.51	5.81	1.70	0.1	0.36	1019	<0.1	<0.1	<2.0	<2.0	0.1	0.1	19.9	19.9	<1.0	<1.0	<0.1	
MPA_AUK_BH106	09/11/2020 15:16	Clear, Sunny spells	10-13	6.00m 25mm SP	7.51	5.81	1.70	0.0	0.02	1019	<0.1	<0.1	<2.0	<2.0	0.1	0.1	20.4	20.4	<1.0	<1.0	0.1	
MPA_AUK_BH107	09/11/2020 14:17	Clear, Sunny spells	10-13	8.00m 25mm SP	6.80	5.12	1.68	0.1	0.09	1019	<0.1	<0.1	<2.0	<2.0	0.3	0.3	19.8	19.8	<1.0	1.0	0.8	
MPA_AUK_BH107	09/11/2020 14:17	Clear, Sunny spells	10-13	6.00m 25mm SP	6.80	5.09	1.71	0.1	0.04	1019	<0.1	<0.1	<2.0	<2.0	0.2	0.2	20.1	20.1	<1.0	<1.0	1.7	
MPA_AUK_BH108	09/11/2020 12:13	Clear, Sunny spells	10-13	8.00m 25mm SP	6.32	4.72	1.60	0.1	0.08	1020	<0.1	<0.1	<2.0	<2.0	0.1	0.1	18.4	18.4	<1.0	1.0	<0.1	
MPA_AUK_BH108	09/11/2020 12:13	Clear, Sunny spells	10-13	5.00m 25mm SP	6.32	4.68	1.64	0.1	0.14	1020	<0.1	<0.1	<2.0	<2.0	0.1	0.1	17.8	17.8	<1.0	<1.0	0.4	

See attached Calibration Certificate for Model No. and any other details. SP = Standpipe - SPIE = Standpipe Piezometer. (P) = Peak - (S) = Steady - (D) = Decline.

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IN-SITU WATER QUALITY PARAMETER MONITORING RESULTS

Date of Test:	10/11/2020	**Operator:**	A.M.
Weather Condition (inc temperature):		**(12-13°C) Overcast**	

Monitoring Point	Time	pH	Temp (°C)	Electrical Conductivity (µs)	Redox Potential (mv)	Dissolved Oxygen (%)
MPA_AUK_ BH101	13:10:00	11.34	12.60	56982	-334.0	8.5
	13:13:00	11.35	12.59	57470	-343.0	9.2
	13:16:00	11.35	12.54	57882	-288.8	10.3
MPA_AUK_ BH108 (50mm)	14:22:00	10.21	12.40	48620	-68.4	56.4
	14:25:00	10.20	12.32	48579	-62.0	56.7
	14:28:00	10.20	12.35	48624	-56.9	55.8

Remarks :	

Contract Title: **Metal Processing Area Deep Soil and Groundwater Investigation**	Client: **South Tees Development Corporation**

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IN-SITU WATER QUALITY PARAMETER MONITORING RESULTS

Date of Test:	11/11/2020	**Operator:**	A.M.
Weather Condition (inc temperature):		**(12-13°C) Overcast**	

Monitoring Point	Time	pH	Temp (°C)	Electrical Conductivity (µs)	Redox Potential (mv)	Dissolved Oxygen (%)
MPA_AUK_ BH104	13:17:00	9.34	12.16	94721	-170.1	6.4
	13:20:00	9.18	12.12	86334	-171.0	5.5
	13:23:00	9.39	12.13	97889	-185.7	5.8
MPA_AUK_ BH105	11:49:00	7.65	12.08	173276	-51.8	6.3
	11:52:00	7.66	12.08	173002	-59.4	6.9
	11:55:00	7.65	12.07	172948	-67.8	6.4
MPA_AUK_ BH107 (25mm)	15:27:00	8.21	12.12	158217	-66.0	4.4
	15:30:00	8.21	12.13	158454	-69.7	2.8
	15:33:00	8.20	12.11	157181	-75.2	2.3
MPA_AUK_ BH107 (50mm)	15:03:00	7.91	12.29	120553	-9.7	6.5
	15:06:00	7.91	12.26	119787	-7.5	6.1
	15:09:00	7.90	12.26	120064	-5.7	7.3
MPA_AUK_ BH108 (25mm)	10:47:00	9.48	12.00	52532	-186.4	2.5
	10:50:00	9.56	12.03	52468	-196.1	1.9
	10:53:00	9.62	12.04	51960	-202.1	1.6

Remarks :

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IN-SITU WATER QUALITY PARAMETER MONITORING RESULTS

Date of Test:	12/11/2020	**Operator:**	A.M.
Weather Condition (inc temperature):		**(12-16°C) Overcast**	

Monitoring Point	Time	pH	Temp (°C)	Electrical Conductivity (µs)	Redox Potential (mv)	Dissolved Oxygen (%)
MPA_AUK_ BH102	12:56:00	7.10	11.64	168939	2.4	6.9
	12:59:00	7.11	11.66	169087	6.3	6.9
	13:02:00	7.11	11.67	168442	9.4	6.6
MPA_AUK_ BH103	10:04:00	9.72	11.35	45832	64.8	67.6
	10:07:00	9.72	11.36	45774	64.8	68.0
	10:10:00	9.73	11.34	45725	64.9	68.2
MPA_AUK_ BH106 (25mm)	11:45:00	9.35	11.70	45371	-181.7	16.7
	11:48:00	9.36	11.73	41256	-189.9	15.0
	11:51:00	9.37	11.77	42105	-194.1	15.7
MPA_AUK_ BH106 (50mm)	11:20:00	9.32	11.72	37795	-67.9	16.5
	11:23:00	9.32	11.86	36638	-82.8	16.4
	11:26:00	9.31	11.90	34019	-96.2	15.3

Remarks :	

Contract Title: **Metal Processing Area Deep Soil and Groundwater Investigation**		Client: **South Tees Development Corporation**	
Checked By:		Approved By:	
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TRS REPORT

Report Ref: BG0G/AEG/MAR/TRS/09/20/RP1
Date Issued: 11 September 2020
TRS Sample Refs: BG0G05-09
Order No: Job 4291

PETROLOGICAL EXAMINATION OF FIVE SAMPLES

FROM

4291 MAP SITE, REDCAR

FOR

ALLIED EXPLORATION & GEOTECHNICS LTD

Thomas Research Services Ltd.
Tel: +44 (0) 1469 532 929
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Unit 7, Tattershall Castle Court, Morgan Way, New Holland,
North Lincolnshire, DN19 7PZ, United Kingdom

A Limited Company registered in England. Company Registration No: 2518421

PETROLOGICAL EXAMINATION OF FIVE SAMPLES FROM 4291 MAP SITE, REDCAR FOR ALLIED EXPLORATION & GEOTECHNICS LTD

1. BACKGROUND

Five bulk samples were received from the above site on 31st July 2020. Each sample was weighed and allocated a unique TRS reference number, the details of which are recorded below:-

TRS Ref	Site Ref	Depth/m	Mass/kg
BG0G01	TP101 B5	1.9	19.5
BG0G02	TP107 B5	1.5	18.9
BG0G03	TP119 B6	2.0	17.9
BG0G04	TP120 B9	3.8	11.0
BG0G05	TP122 B9	3.8	12.0

There was a delay in processing these samples due to the Coronovirus lockdown.

The purpose of the exercise was to identify the range and relative concentrations of any iron and steelmaking slags present in the samples, and whether there was any potential for volumetric instability from the materials.

2. SAMPLE PREPARATION & PROGRAMME OF ANALYSIS

The samples were primary crushed to reduce particle size down to <50mm, portions then being selected and dried at low temperature to constant weight. The dried material was subjected to a regime of stage crushing and quartering to further reduce particle size down to <5mm. Portions of this <5mm material

were made up into resin bound blocks, one face of which was ground flat and polished using diamond pastes. Further portions of the <5mm material were milled to a fine powder. Fractions of material were extracted throughout the preparation procedure to provide the materials necessary for further tests and analyses that may subsequently be required.

A petrological examination was made of the polished blocks using reflected light microscopy, the complete findings of which are recorded in appendix A.

3. DISCUSSION OF RESULTS

3.1 Petrology

A petrological examination was made of the five samples using reflected light microscopy. The complete findings of this examination are recorded in appendix A.

Blast furnace slag was present in all five samples, with substantial quantities present in samples BG0G 06, 08 & 09 and small amounts in samples BG0G 05 & 07. The blast furnace slag was predominantly crystalline with only minor amounts of glassy material seen. Secondary alteration due to weathering was moderate, consisting mainly of pore infill and surface rinds. Products of alteration included calcite and gypsum, with other products being difficult to identify specifically under the microscope. Old weathered blast furnace slag may occasionally contain pockets of potentially expansive material (see appendix B). This potential can only be assessed by direct expansion testing. The unaltered slag consisted predominantly of melilite, along with more minor amounts of spinel, metallic iron and sulphides.

Basic steel slag was present in four of the five samples. Samples BG0G 05 & 07 contained very large amounts, with samples BG0G 08 & 09 containing small

amounts. The slag was extensively altered due to weathering, the secondary phases being difficult to identify specifically under the microscope. The unaltered basic steel slag consisted largely of dicalcium silicate, along with more minor amounts of RO & R_3O_4 phase, CaF phase, lime phase and periclase. The mineralogy of the basic steel slag would suggest that it may have significant potential for expansion (see appendix B). This potential can only be assessed by direct expansion testing.

A small amount of basic refractory material was seen in sample BG0G 09. This material, even in minor amounts, can have significant potential for expansion (see appendix B).

Other constituents seen in the samples, generally in minor concentrations, included alumino-silicate brick, quartz, iron ore, metal, coal and coke. A cementitious material often bound the smaller particles together. This material appeared similar to the slag alteration products.

4. CONCLUSIONS & RECOMMENDATIONS

The following conclusions can be drawn:-

- Blast furnace slag was a dominant constituent in three of the samples (BG0G 06, 08 & 09) and a minor constituent in the remaining two. The slag was mainly crystalline although minor amounts of glassy material were seen. The slag showed some alteration due to weathering. Old weathered blast furnace slag may occasionally contain pockets of potentially expansive material. Potential for expansion can only be assessed with direct expansion testing.
- Basic steel slag was the dominant constituent in samples BG0G 05 and 07. It was also present in small amounts in samples 08 & 09. This material is likely to present a significant risk of expansion. Potential for expansion can only be assessed with direct expansion testing.
- Minor amounts of basic refractory material were seen in sample BG0G 09. This product can be a significant source of expansion, even when present in relatively small amounts.
- Other products were seen in the samples in minor amounts including alumino-silicate brick, quartz, iron ore, metal, coal and coke.

The following recommendations are made:-

Samples BG0G 06, 08 & 09 should be subjected to the following tests & analyses to assess the potential for expansion of the blast furnace slag.

- Water soluble sulphate
- Acid soluble sulphate
- Total sulphur
- Thermal analysis (DTA & TGA)
- TRS accelerated expansion test

Samples BG0G 05 & 07 should be subjected to the following tests & analyses to assess the potential for expansion of the basic steel slag.

- Free CaO
- Free MgO
- Thermal analysis (DTA & TGA)
- TRS accelerated expansion test

Note

These conclusions apply only to the samples tested and may not represent the bulk of the material on the site from which they were taken.

Ian D. Thomas

Ian D Thomas BSc(Hons) **11 September 2020**

APPENDIX A

PETROLOGICAL REPORT ON SAMPLES BG0G 05-09

A petrological examination has been carried out of five samples BG0G 05 to 09.

Polished blocks were prepared using particulate material crushed to a nominal size of –5mm. Representative material was made up into resin-bonded blocks. One face of each of these was ground flat and polished using diamond pastes. In addition, the surfaces were selectively etched with water and 0.1%N HCl in order to help with the phase identification.

The detailed results are given in the accompanying Table.

Samples 06, 08 and 09 consist largely of blast furnace slag and its alteration products.

Samples 05 & 07 are mainly basic steel slag. Very little basic refractory material was seen.

Blast furnace slag
The unaltered blast furnace slag consists mainly of crystalline melilite (Ca,Mg,Al silicate). Also, some spinel ($MgAl_2O_4$) occurs as a primary phase. The matrix, the space between the melilite crystals, is partly occupied by silicate glass and partly with other silicates. The slag contains minor amounts of iron metal occurring as tiny globules and prills and, also, dendritic crystals of Ca,Mn sulphide. Secondary alteration is moderate. It is mainly restricted to pore infill and the formation of thin rinds, especially the larnite. The secondary products are mostly finely granular and are difficult to identify specifically under the microscope. Minor amounts of calcite ($CaCO_3$) and well-crystallised gypsum ($CaSO_4.2H_2O$) are present.

Basic steel slag
The unaltered basic steel slag consists mainly of dicalcium silicate, RO and R_3O_4 phases (FeO and Fe_3O_4 with some Al, Mn, Mg and Ca in solid solution) and CaF phases (complex Ca alumino-ferrites). Individual particles vary considerably in composition. Lime phase (CaO with some Fe, Mn and Mg in solid solution) is present in minor amounts. It occurs mainly as granular particles up to about 0.1 mm in size. Periclase (MgO with some Fe in solid solution) is more common. Some metal is present as prills. The slag is extensively altered to secondary products that are difficult to identify specifically and are, probably, mainly hydrated silicates.

Other constituents

These include quartz, iron ore and coke. The particles are bonded together by cementitious material that is similar to the slag alteration products but probably also includes some clay. It consists mostly of complex hydrates difficult to identify under the optical microscope.

TRS SAMPLES BG0G 05-09

	5	**6**	**7**	**8**	**9**
BLAST FURNACE SLAG					
Amount	***s***	***L***	***s***	***L***	***l***
Phases present:-					
Melilite	l	L	L	L	L
Matrix & other silicates	s	s	s	s	s
Ca sulphide	-	vs	-	vs	vs
Metallic iron	-	s	-	s	vs
Spinel	s	s	-	s	vs
Glassy slag	-	s	-	-	-
Alteration products	s	s	s	m	s
Calcite	-	-	s	-	-
Gypsum	-	-	-	s	-
BASIC STEEL SLAG					
Amount	***L***	***-***	***L***	***s***	***s***
Phases present:-					
Dicalcium silicate	l	-	l	l	m
Tricalcium silicate	s	-	-	-	-
Unetched silicate	-	-	s	-	-
RO phase	m	-	m	m	m
CaF phase	s	-	s	s	s
R3O4 phase	s	-	s	s	-
Metal & rust	s	-	vs	-	vs
Lime phase	vs	-	vs	-	-
Periclase	s	-	s	s	s
Alteration products	m	-	s	l	l
BASIC REFRACTORIES					
Amount	***-***	***-***	***-***	***-***	***s***
OTHER CONSTITUENTS					
Alumino-silicate brick	-	s	-	-	-
Quartz, etc.	s	vs	vs	-	vs
Intermediate slag	s		-	-	-
Metal, rust, scale, etc.	s	-	vs	vs	s
Iron ore, ironstone, etc.	-	-	-	-	vs
Shale, etc.	m	-	-	-	-
Coke	s	-	-	-	vs
Coal & char	-	s	-	-	-
Cementitious alteration products	s	vs	s	s	s

L = very large, l = large, m = medium, s = small and vs = very small amounts

GENERAL EXPLANATION

L = very large, l = large, m = medium, s = small and vs = very small amounts.

Blast furnace slag. When present this consists mainly of melilite (Ca,Mg,Al silicate ranging in composition between $Ca_2Al_2SiO_7$ and $Ca_2MgSi_2O_7$). Other common phases are merwinite ($Ca_3MgSi_2O_8$), The matrix often consists of some of the above phases, especially melilite, but may also contain other phases such as wollastonite ($CaSiO_3$), anorthite ($CaAl_2Si_2O_8$) and pyroxene ($(CaMg)SiO_3$). Spinel ($MgAl_2O_4$) may be present. Sulphides and metal usually occur and are mostly finely dispersed, but the metal sometimes occurs as prills and may contain some graphite and Ti carbo-nitride (TiCN). Material reported as ceramic in appearance is very finely crystalline. The alteration products often include calcite and gypsum but are mostly silicate and/or sulpho-aluminate hydrates that are difficult to identify specifically under the microscope.

Basic steel slag. When present this consists mainly of dicalcium silicate, mostly the ß-form (larnite) but sometimes the alpha form. Phosphoric slags may contain nagelschmidtite (Ca_2SiO_4 with $Ca_3P_2O_8$ in solid solution). Other silicate often present in small amounts, unetched by dilute HCl, is probably melilite. RO, R_3O_4 and RF phases are typically present and are mainly FeO and Fe_3O_4 with some Mg, Mn, Ca, etc. in solid solution and complex Ca alumino-ferrites. There may also be some Fe_2O_3 and spinel ($(Mg,Fe)Al_2O_4$). The slag typically carries minor amounts of periclase (MgO with some Fe in solid solution) and lime phase (CaO with some Fe, Mn & Mg in solid solution). Other possible minor constituents include fluorite (CaF_2) and apatite (Ca fluoro-phosphate), the last present in phosphoric slags. The alteration products are, again, difficult to identify specifically but are probably, mainly, hydrated silicates. Portlandite ($Ca(OH)_2$) may be present.

Basic refractory material. When present, this is mainly magnesian and consists of granular periclase (MgO) with interstitial silicates. Sometimes samples contain chrome-magnesia material with chromite present in addition to the other phases. Hot face material (from close to the furnace) may also occur. The periclase and interstitial silicates show secondary alteration similar to that of the basic steel slag. Brucite ($Mg(OH)_2$ is likely.

Acid steel slag. When present this consists mainly of fayalite ($(Fe,Mn)_2SiO_4$), Fe,Mn oxides and cristobalite (high temperature SiO_2).

Other slags. The 'intermediate slag' (probably primary flush slags from steel furnaces) has a variable phase assemblage, being mainly formed of silicates, particularly dicalcium silicate, melilite, merwinite and a complex olivine phase together with spinel and wustite (FeO). Sometimes it contains significant amounts of periclase, well embedded in the slag. The 'ferrous slag' (probably from foundry operations) has similar silicates but much more substantial content of iron oxides, usually wustite. It is often associated with scale (iron oxides formed on the surface of steel during reheating/cooling). When present, the 'cindery slag' consists of various silicates and silicate glass with Fe oxides, hercynite ($FeAl_2O_4$) and, sometimes, corundum (Al_2O_3). It is usually derived from heating furnaces and is often associated with burnt shale. When present, the 'siliceous clinker' is similar but devoid of iron oxides.

Other constituents The alumino-silicate brick includes a range of refractory firebrick, common brick and alumina-rich refractories. The 'quartz, sandstone, etc.' may include used silica refractory material consisting of quartz and its high temperature forms. Sometimes there is a distinct granular texture and it is derived from silcrete, a kind of chert. Cementitious material may bond the finer particles together. It is similar to the other alteration products consisting mostly of complex hydrates difficult to identify under the microscope Sometimes some is used Portland cement recognised by the relict textures of the clinker and the embedded quartz sand.

APPENDIX B

MECHANISMS OF VOLUMETRIC INSTABILITY IN IRON AND STEEL INDUSTRY SLAGS

Volumetric change with time can occur in some types of iron and steel industry slags. These mechanisms are briefly described in this section.

Blast Furnace Slags

Fresh-make air-cooled, i.e. crystalline, blast furnace slags are almost always volumetrically stable after cooling. The two mechanisms for volumetric instability listed in BS1047:1983 – "Air Cooled Blast furnace Slag for use in Construction" are:-

a) Beta to gamma inversion of dicalcium silicate.

b) Iron unsoundness.

a) Research by G H Thomas on this phase transformation has shown the transformation to be athermal rather than isothermal. In practical terms this means that inversion, and the expansion associated with it, can only occur during the cooling cycle. In fully cooled material there would appear to be no further risk of instability from this mechanism.

b) Iron unsoundness is a very rare form of instability frequently associated with operating problems in the blast furnace. TRS know of only one instance in over 40 years. The mechanism, which is a hydrolysis reaction, is immediately triggered off by the presence of water. Once water has initiated the reaction, the mechanism proceeds to completion. It is impossible to arrest the process once started; at least by methods operating in normal ambient conditions.

It follows that the risk of late expansion from either of these mechanisms in blast furnace slag is remote.

c) Sulphoaluminate Type Activity

Some years ago, G. H. Thomas discovered a third mechanism that may give rise to volumetric instability. The process is possible only in some old blast furnace slag altered

by weathering. When the sulphide sulphur in the blast furnace slags is oxidised during weathering to sulphate, under some circumstances reactions can take place within the slag to produce an 'ettringite' type product. The process is somewhat analogous to sulphatic attack on concrete and has a similar result - expansion of the mass and associated disruption.

For the mechanism to have any significance, the slag needs to have residual potential for this reaction. Evidence of past activity does not necessarily indicate further reaction is possible.

The TRS accelerated expansion test is, we believe, uniquely capable of identifying such slags, as well as instability attributable to free CaO and free MgO in steel slag & etc.

Basic Steel Slags

Basic steel slags commonly contain significant quantities of free CaO and free MgO. These free oxides are well known for the massive expansion associated with their hydration. In practical terms, it is impossible to forecast when hydration will take place, but it can be up to decades after the material was cooled – or placed. The reasons are complex, but include the varying density of the oxides, due to the variation in temperatures at which the products have been held in the furnace. Other factors influencing rate of hydration include:-

- the protection of slags by a reaction product at the oxide interface with the slag.
- the presence of the oxides as lime or magnesia rich solid solutions instead of the pure oxide.

The result is potential future volumetric instability but at an unforeseeable date. Periclase, i.e. free MgO, is relatively much slower than free CaO to hydrate.

Scrap High Magnesia Refractories

These are particularly undesirable components in fill as they commonly result in high concentrations of free MgO. The problems associated with these concentrations are similar to those where periclase is found in basic steel slag.

TRS REPORT

Report Ref: BG0G/AEG/MPR/TRS/10/20/RP2
Date Issued: 11 September 2020
TRS Sample Refs: BG0G05-09
Order No: Job 4291

EXAMINATION OF FIVE SAMPLES

FROM

4291 MPA SITE, REDCAR

FOR

ALLIED EXPLORATION & GEOTECHNICS LTD

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EXAMINATION OF FIVE SAMPLES
FROM
4291 MPA SITE, REDCAR
FOR
ALLIED EXPLORATION & GEOTECHNICS LTD

1. BACKGROUND

Five bulk samples were received from the above site on 31st July 2020. Each sample was weighed and allocated a unique TRS reference number, the details of which are recorded below:-

TRS Ref	Site Ref	Depth/m	Mass/kg
BG0G05	TP101 B5	1.9	19.5
BG0G06	TP107 B5	1.5	18.9
BG0G07	TP119 B6	2.0	17.9
BG0G08	TP120 B9	3.8	11.0
BG0G09	TP122 B9	3.8	12.0

There was a delay in processing these samples due to the Coronovirus lockdown.

The purpose of the exercise was to identify the range and relative concentrations of any iron and steelmaking slags present in the samples, and whether there was any potential for volumetric instability from the materials.

2. SAMPLE PREPARATION & PROGRAMME OF ANALYSIS

The samples were primary crushed to reduce particle size down to <50mm, portions then being selected and dried at low temperature to constant weight. The dried material was subjected to a regime of stage crushing and quartering to further reduce particle size down to <5mm. Portions of this <5mm material

were made up into resin bound blocks, one face of which was ground flat and polished using diamond pastes. Further portions of the <5mm material were milled to a fine powder. Fractions of material were extracted throughout the preparation procedure to provide the materials necessary for the further tests and analyses required in the programme.

A petrological examination was made of the polished blocks using reflected light microscopy, the complete findings of which are recorded in appendix A. The results of this examination were discussed in our report of 11th September 2020. On the basis of that report, and after discussions with the client, the following tests and analyses were carried out on the samples:-

Samples BG0G09 was subjected to the following tests & analyses to assess the potential for expansion of the blast furnace slag.

- Water soluble sulphate (table 1)
- Acid soluble sulphate (table 1)
- Total sulphur (table 1)
- Thermal analysis (table 3)
- TRS accelerated expansion test (table 4)

Samples BG0G05 & 07 were subjected to the following tests & analyses to assess the potential for expansion of the basic steel slag.

- Free CaO (table 2)
- Free MgO (table 2)
- Thermal analysis (table 3)
- TRS accelerated expansion test (table 4)

3. DISCUSSION OF RESULTS

3.1 Petrology

A petrological examination was made of the five samples using reflected light microscopy. The complete findings of this examination are recorded in appendix A.

Blast furnace slag was present in all five samples, with substantial quantities present in samples BG0G 06, 08 & 09 and small amounts in samples BG0G 05 & 07. The blast furnace slag was predominantly crystalline with only minor amounts of glassy material seen. Secondary alteration due to weathering was moderate, consisting mainly of pore infill and surface rinds. Products of alteration included calcite and gypsum, with other products being difficult to identify specifically under the microscope. Old weathered blast furnace slag may occasionally contain pockets of potentially expansive material (see appendix B). This potential can only be assessed by direct expansion testing (see sections 3.2-3.5). The unaltered slag consisted predominantly of melilite, along with more minor amounts of spinel, metallic iron and sulphides.

Basic steel slag was present in four of the five samples. Samples BG0G 05 & 07 contained very large amounts, with samples BG0G 08 & 09 containing small amounts. The slag was extensively altered due to weathering, the secondary phases being difficult to identify specifically under the microscope. The unaltered basic steel slag consisted largely of dicalcium silicate, along with more minor amounts of RO & R_3O_4 phase, CaF phase, lime phase and periclase. The mineralogy of the basic steel slag would suggest that it may have significant potential for expansion (see appendix B). This potential can only be assessed by direct expansion testing (see sections 3.3 to 3.5).

A small amount of basic refractory material was seen in sample BG0G 09. This material, even in minor amounts, can have significant potential for expansion (see appendix B).

Other constituents seen in the samples, generally in minor concentrations, included alumino-silicate brick, quartz, iron ore, metal, coal and coke. A cementitious material often bound the smaller particles together. This material appeared similar to the slag alteration products.

3.2 Sulphur Species

The following range of analyses were performed on samples BG0G09 (this sample contained significant amounts of blast furnace slag). The results are recorded in table 1:-

- Water soluble sulphate
- Acid soluble sulphate
- Total sulphur

Total sulphur recorded was 0.77 percent. Acid soluble sulphate was 0.85 percent, with a corresponding water soluble sulphate of 0.57 g/l. These sulphate and sulphur values were fairly typical for blast furnace slag. However, care should be taken when specifying concrete that may come into contact with the slag. Calculations show that 44 percent of the available sulphur is present as sulphate.

3.3 Thermal Analysis

Simultaneous differential thermal analysis (DTA) and thermo-gravimetric analysis (TGA) were performed on samples BG0G05, 07 & 09. The results are recorded in table three.

No ettringite or gypsum was seen in any of the samples.

Calcium hydroxide was recorded in samples BG0G05 & 07 at trace and 0.6 percent. Magnesium hydroxide was measured in the same samples both at trace level. These values were used to correct the free CaO and free MgO analyses recorded in table 2.

Calcite was present in all three samples examined at between 0.2 and 3.4 percent. This product is an indicator as to the weathered state of the slag.

3.4 Free CaO & Free MgO

Free CaO & free MgO analyses were carried out on samples BG0G05 & 07 (These samples contained significant mounts of basic steel slag). The results are recorded in table 2. Both original and corrected values are recorded. The original values include both the oxide **(**CaO and MgO**)** and the hydroxide **(**($Ca(OH)_2$ and $Mg(OH)_2$)**)** contents. The corrected values report only the oxide content **(**CaO and MgO**)** after correction using the hydroxide values from the thermal analyses. These corrected values are the more significant, as it is only the oxides that are still free to hydrate, i.e. expand.

Free lime was recorded in the samples at 1.4 and 0.8 percent. Free magnesia was recorded at 0.9 percent. These corrected free lime and free magnesia levels record oxides that are potentially still free to hydrate (i.e. expand).

3.5 TRS Accelerated Expansion Test

The TRS accelerated expansion test was performed on samples BG0G05, 07 & 09. The results are recorded in table four. Note that the test measures potential for future expansion, and is not a measure of expansion that may have taken place in the past.

Sample BG0G09 (consisting predominantly of blast furnace slag, with minor amounts of basic steel slag and basic refractory material) recorded an expansion result of 0.29 percent. The samples containing significant basic steel slag recorded expansion results of 0.76 and 0.90 percent.

4. CONCLUSIONS

The following conclusions can be drawn:-

- Blast furnace slag was a dominant constituent in three of the samples (BG0G 06, 08 & 09) and a minor constituent in the remaining two. The slag was mainly crystalline although minor amounts of glassy material were seen. The slag showed some alteration due to weathering. Old weathered blast furnace slag may occasionally contain pockets of potentially expansive material.
- Further testing of sample BG0G09 consisting predominantly of blast furnace slag (with minor basic steel slag & basic refractory) recorded an expansion result of 0.29 percent. The sulphate values should be taken into consideration when specifying concrete that may come into contact with the slag.
- Basic steel slag was the dominant constituent in samples BG0G 05 and 07. It was also present in small amounts in samples 08 & 09. This material is likely to present a significant risk of expansion.

- Expansion testing of samples (BG0G05 & 07) consisting mainly of basic steel slag recorded expansion results of 0.76 and 0.90 percent.
- Minor amounts of basic refractory material were seen in sample BG0G 09. This product can be a significant source of expansion, even when present in relatively small amounts.
- Other products were seen in the samples in minor amounts including alumino-silicate brick, quartz, iron ore, metal, coal and coke.

Note

These conclusions apply only to the samples tested and may not represent the bulk of the material on the site from which they were taken.

Ian D. Thomas

Ian D Thomas BSc(Hons) **21 October 2020**

TABLE 1 **SULPHUR SPECIES ANALYSES**

TRS Ref	Site Ref	Water Sol. SO_3 (g/l)	Acid Sol. SO_3 (%)	Total S (%)
BG0G05	**TP101 B5**	-	-	-
BG0G07	**TP119 B6**	-	-	-
BG0G09	**TP122 B9**	0.57	0.85	0.77

TABLE 2 **ANALYSIS FOR FREE CaO AND FREE MgO**

TRS Ref	Site Ref	Free CaO Original (%)	Free CaO Corrected (%)	Free MgO Original (%)	Free MgO Corrected (%)
BG0G05	**TP101 B5**	1.4	1.4	0.9	0.9
BG0G07	**TP119 B6**	1.3	0.8	0.9	0.9
BG0G09	**TP122 B9**	-	-	-	-

TABLE 3 **RESULTS FROM THERMAL ANALYSIS**

TRS Ref	Site Ref	Mass % by Thermal Analysis						
		L.O.I.	Ettringite	Gypsum	Calcite	$Ca(OH)_2$	$Mg(OH)_2$	Others
BG0G05	**TP101 B5**	1.42	0.0	0.0	1.1	trace	0.0	-
BG0G07	**TP119 B6**	0.97	0.0	0.0	0.2	0.6	trace	-
BG0G09	**TP122 B9**	6.44	0.0	0.0	3.4	0.0	trace	-

TABLE 4 **TRS ACCELERATED EXPANSION TEST**

TRS Ref	Site Ref	7 day (%)	14 day (%)	21 day (%)	28 day (%)
BG0G05	**TP101 B5**	0.55	0.69	0.74	0.76
BG0G07	**TP119 B6**	0.42	0.72	0.83	0.90
BG0G09	**TP122 B9**	0.17	0.28	0.29	0.29

APPENDIX A

PETROLOGICAL REPORT ON SAMPLES BG0G 05-09

A petrological examination has been carried out of five samples BG0G 05 to 09.

Polished blocks were prepared using particulate material crushed to a nominal size of –5mm. Representative material was made up into resin-bonded blocks. One face of each of these was ground flat and polished using diamond pastes. In addition, the surfaces were selectively etched with water and 0.1%N HCl in order to help with the phase identification.

The detailed results are given in the accompanying Table.

Samples 06, 08 and 09 consist largely of blast furnace slag and its alteration products.

Samples 05 & 07 are mainly basic steel slag. Very little basic refractory material was seen.

Blast furnace slag
The unaltered blast furnace slag consists mainly of crystalline melilite (Ca,Mg,Al silicate). Also, some spinel ($MgAl_2O_4$) occurs as a primary phase. The matrix, the space between the melilite crystals, is partly occupied by silicate glass and partly with other silicates. The slag contains minor amounts of iron metal occurring as tiny globules and prills and, also, dendritic crystals of Ca,Mn sulphide. Secondary alteration is moderate. It is mainly restricted to pore infill and the formation of thin rinds, especially the larnite. The secondary products are mostly finely granular and are difficult to identify specifically under the microscope. Minor amounts of calcite ($CaCO_3$) and well-crystallised gypsum ($CaSO_4.2H_2O$) are present.

Basic steel slag
The unaltered basic steel slag consists mainly of dicalcium silicate, RO and R_3O_4 phases (FeO and Fe_3O_4 with some Al, Mn, Mg and Ca in solid solution) and CaF phases (complex Ca alumino-ferrites). Individual particles vary considerably in composition. Lime phase (CaO with some Fe, Mn and Mg in solid solution) is present in minor amounts. It occurs mainly as granular particles up to about 0.1 mm in size. Periclase (MgO with some Fe in solid solution) is more common. Some metal is present as prills. The slag is extensively altered to secondary products that are difficult to identify specifically and are, probably, mainly hydrated silicates.

Other constituents
These include quartz, iron ore and coke. The particles are bonded together by cementitious material that is similar to the slag alteration products but probably also includes some clay. It consists mostly of complex hydrates difficult to identify under the optical microscope.

TRS SAMPLES BG0G 05-09

	5	**6**	**7**	**8**	**9**
BLAST FURNACE SLAG					
Amount	***s***	***L***	***s***	***L***	***l***
Phases present:-					
Melilite	l	L	L	L	L
Matrix & other silicates	s	s	s	s	s
Ca sulphide	-	vs	-	vs	vs
Metallic iron	-	s	-	s	vs
Spinel	s	s	-	s	vs
Glassy slag	-	s	-	-	-
Alteration products	s	s	s	m	s
Calcite	-	-	s	-	-
Gypsum	-	-	-	s	-
BASIC STEEL SLAG					
Amount	***L***	***-***	***L***	***s***	***s***
Phases present:-					
Dicalcium silicate	l	-	l	l	m
Tricalcium silicate	s	-	-	-	-
Unetched silicate	-	-	s	-	-
RO phase	m	-	m	m	m
CaF phase	s	-	s	s	s
R3O4 phase	s	-	s	s	-
Metal & rust	s	-	vs	-	vs
Lime phase	vs	-	vs	-	-
Periclase	s	-	s	s	s
Alteration products	m	-	s	l	l
BASIC REFRACTORIES					
Amount	***-***	***-***	***-***	***-***	***s***
OTHER CONSTITUENTS					
Alumino-silicate brick	-	s	-	-	-
Quartz, etc.	s	vs	vs	-	vs
Intermediate slag	s		-	-	-
Metal, rust, scale, etc.	s	-	vs	vs	s
Iron ore, ironstone, etc.	-	-	-	-	vs
Shale, etc.	m	-	-	-	-
Coke	s	-	-	-	vs
Coal & char	-	s	-	-	-
Cementitious alteration products	s	vs	s	s	s

L = very large, l = large, m = medium, s = small and vs = very small amounts

GENERAL EXPLANATION

L = very large, l = large, m = medium, s = small and vs = very small amounts.

Blast furnace slag. When present this consists mainly of melilite (Ca,Mg,Al silicate ranging in composition between $Ca_2Al_2SiO_7$ and $Ca_2MgSi_2O_7$). Other common phases are merwinite ($Ca_3MgSi_2O_8$), The matrix often consists of some of the above phases, especially melilite, but may also contain other phases such as wollastonite ($CaSiO_3$), anorthite ($CaAl_2Si_2O_8$) and pyroxene ($(CaMg)SiO_3$). Spinel ($MgAl_2O_4$) may be present. Sulphides and metal usually occur and are mostly finely dispersed, but the metal sometimes occurs as prills and may contain some graphite and Ti carbo-nitride (TiCN). Material reported as ceramic in appearance is very finely crystalline. The alteration products often include calcite and gypsum but are mostly silicate and/or sulpho-aluminate hydrates that are difficult to identify specifically under the microscope.

Basic steel slag. When present this consists mainly of dicalcium silicate, mostly the ß-form (larnite) but sometimes the alpha form. Phosphoric slags may contain nagelschmidtite (Ca_2SiO_4 with $Ca_3P_2O_8$ in solid solution). Other silicate often present in small amounts, unetched by dilute HCl, is probably melilite. RO, R_3O_4 and RF phases are typically present and are mainly FeO and Fe_3O_4 with some Mg, Mn, Ca, etc. in solid solution and complex Ca alumino-ferrites. There may also be some Fe_2O_3 and spinel ($(Mg,Fe)Al_2O_4$). The slag typically carries minor amounts of periclase (MgO with some Fe in solid solution) and lime phase (CaO with some Fe, Mn & Mg in solid solution). Other possible minor constituents include fluorite (CaF_2) and apatite (Ca fluoro-phosphate), the last present in phosphoric slags. The alteration products are, again, difficult to identify specifically but are probably, mainly, hydrated silicates. Portlandite ($Ca(OH)_2$) may be present.

Basic refractory material. When present, this is mainly magnesian and consists of granular periclase (MgO) with interstitial silicates. Sometimes samples contain chrome-magnesia material with chromite present in addition to the other phases. Hot face material (from close to the furnace) may also occur. The periclase and interstitial silicates show secondary alteration similar to that of the basic steel slag. Brucite ($Mg(OH)_2$ is likely.

Acid steel slag. When present this consists mainly of fayalite ($(Fe,Mn)_2SiO_4$), Fe,Mn oxides and cristobalite (high temperature SiO_2).

Other slags. The 'intermediate slag' (probably primary flush slags from steel furnaces) has a variable phase assemblage, being mainly formed of silicates, particularly dicalcium silicate, melilite, merwinite and a complex olivine phase together with spinel and wustite (FeO). Sometimes it contains significant amounts of periclase, well embedded in the slag. The 'ferrous slag' (probably from foundry operations) has similar silicates but much more substantial content of iron oxides, usually wustite. It is often associated with scale (iron oxides formed on the surface of steel during reheating/cooling). When present, the 'cindery slag' consists of various silicates and silicate glass with Fe oxides, hercynite ($FeAl_2O_4$) and, sometimes, corundum (Al_2O_3). It is usually derived from heating furnaces and is often associated with burnt shale. When present, the 'siliceous clinker' is similar but devoid of iron oxides.

Other constituents The alumino-silicate brick includes a range of refractory firebrick, common brick and alumina-rich refractories. The 'quartz, sandstone, etc.' may include used silica refractory material consisting of quartz and its high temperature forms. Sometimes there is a distinct granular texture and it is derived from silcrete, a kind of chert. Cementitious material may bond the finer particles together. It is similar to the other alteration products consisting mostly of complex hydrates difficult to identify under the microscope Sometimes some is used Portland cement recognised by the relict textures of the clinker and the embedded quartz sand.

APPENDIX B

MECHANISMS OF VOLUMETRIC INSTABILITY IN IRON AND STEEL INDUSTRY SLAGS

Volumetric change with time can occur in some types of iron and steel industry slags. These mechanisms are briefly described in this section.

Blast Furnace Slags

Fresh-make air-cooled, i.e. crystalline, blast furnace slags are almost always volumetrically stable after cooling. The two mechanisms for volumetric instability listed in BS1047:1983 – "Air Cooled Blast furnace Slag for use in Construction" are:-

a) Beta to gamma inversion of dicalcium silicate.

b) Iron unsoundness.

a) Research by G H Thomas on this phase transformation has shown the transformation to be athermal rather than isothermal. In practical terms this means that inversion, and the expansion associated with it, can only occur during the cooling cycle. In fully cooled material there would appear to be no further risk of instability from this mechanism.

b) Iron unsoundness is a very rare form of instability frequently associated with operating problems in the blast furnace. TRS know of only one instance in over 40 years. The mechanism, which is a hydrolysis reaction, is immediately triggered off by the presence of water. Once water has initiated the reaction, the mechanism proceeds to completion. It is impossible to arrest the process once started; at least by methods operating in normal ambient conditions.

It follows that the risk of late expansion from either of these mechanisms in blast furnace slag is remote.

c) Sulphoaluminate Type Activity

Some years ago, G. H. Thomas discovered a third mechanism that may give rise to volumetric instability. The process is possible only in some old blast furnace slag altered

by weathering. When the sulphide sulphur in the blast furnace slags is oxidised during weathering to sulphate, under some circumstances reactions can take place within the slag to produce an 'ettringite' type product. The process is somewhat analogous to sulphatic attack on concrete and has a similar result - expansion of the mass and associated disruption.

For the mechanism to have any significance, the slag needs to have residual potential for this reaction. Evidence of past activity does not necessarily indicate further reaction is possible.

The TRS accelerated expansion test is, we believe, uniquely capable of identifying such slags, as well as instability attributable to free CaO and free MgO in steel slag & etc.

Basic Steel Slags

Basic steel slags commonly contain significant quantities of free CaO and free MgO. These free oxides are well known for the massive expansion associated with their hydration. In practical terms, it is impossible to forecast when hydration will take place, but it can be up to decades after the material was cooled – or placed. The reasons are complex, but include the varying density of the oxides, due to the variation in temperatures at which the products have been held in the furnace. Other factors influencing rate of hydration include:-

- the protection of slags by a reaction product at the oxide interface with the slag.
- the presence of the oxides as lime or magnesia rich solid solutions instead of the pure oxide.

The result is potential future volumetric instability but at an unforeseeable date. Periclase, i.e. free MgO, is relatively much slower than free CaO to hydrate.

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APPENDIX D

GQRA – Summary of Soil Screen

Table D1: Soil GAC Protective of Human Health

Contaminant of Concern	MDL	Units	Human Health (Commercial Worker)	GAC Source	Detections	Maximum Concentration Measured	Maximum Concentration Measured (Slag Dominant Made Ground)	Mean Concentration Measured (Slag Dominant Made Ground)	Standard Deviation (Slag Dominant Made Ground)	Maximum Concentration Measured (TFD)
Metals										
Aluminium	1	mg/kg			12	78,000	78,000	51,863	22,988	16,000
Antimony	1	mg/kg	470	USEPA	2	7.0	7.0	7.0	0.0	1.2
Arsenic	0.2	mg/kg	640	S4UL	12	14.0	14.0	5.5	3.5	8.8
Barium	2	mg/kg	19,000	Arcadis	12	820	820	367	218	200
Beryllium	0.2	mg/kg	12	S4UL	9	8.8	8.8	6.7	2.2	1.2
Boron, Water Soluble	0.2	mg/kg	240,000	S4UL	10	9.4	9.4	4.9	2.8	7.0
Cadmium	0.1	mg/kg	190	S4UL	0	0.4	0.4	0.2	0.1	0.2
Chromium	0.15	mg/kg	8,600	S4UL	12	520	520	73	169	26
Chromium, Hexavalent	1	mg/kg	33	S4UL	0	<MDL	<MDL	na	na	<MDL
Copper	0.2	mg/kg	68,000	S4UL	12	1,200	1,200	159	393	31
Iron	25	mg/kg			12	48,000	48,000	8,500	14,968	36,000
Lead	0.3	mg/kg	2,300	C4SL	12	25.0	7.9	4.1	2.5	25.0
Magnesium	1	mg/kg			12	37,000	37,000	29,125	7,373	8,900
Manganese	20	mg/kg			12	21,000	21,000	4,925	6,184	660
Mercury	0.05	mg/kg	*58**	S4UL	0	<MDL	<MDL	na	na	<MDL
Molybdenum	0.4	mg/kg	5,540	Arcadis	1	1.4	0.7	0.6	0.2	1.4
Nickel	1	mg/kg	980	S4UL	9	37.0	7.6	2.8	2.5	37.0
Silicon	10	mg/kg			12	190,000	66,000	58,750	5,517	190,000
Vanadium	0.8	mg/kg	9,000	S4UL	12	4,500	4,500	604	1,473	32
Zinc	1	mg/kg	730,000	S4UL	12	110	110	29	31	95
Inorganics										
pH		pH	-		12	11.9	12	11	0.7	8.7
Cyanide, Total	0.1	mg/kg	-		0	0.2	0.2	0.2	0.0	<MDL
Cyanide, Free	0.1	mg/kg	66	DQRA	0	<MDL	<MDL	na	na	<MDL
Thiocyanate	0.6	mg/kg	230	USEPA	0	0.9	0.0	na	na	0.9
Organic matter	0.1	%	-		12	4.1	1.8	0.8	0.5	4.1
Sulphate Aqueous Extract as SO4	10	mg/l	-		12	2,000.0	2,000	1,032	656	680
Sulphur (free)	0.01	%	-		10	130.0	130	42	37	26
Petroleum Hydrocarbons										
Aliphatic C5-C6	0.01	mg/kg	*3200***	S4UL	0	<MDL	<MDL	na	na	<MDL
Aliphatic C6-C8	0.01	mg/kg	*7800***	S4UL	0	<MDL	<MDL	na	na	<MDL
Aliphatic C8-C10	0.01	mg/kg	*2000***	S4UL	0	<MDL	<MDL	na	na	<MDL
Aliphatic C10-C12	1.5	mg/kg	*9700***	S4UL	0	<MDL	<MDL	na	na	<MDL
Aliphatic C12-C16	1.2	mg/kg	*59000***	S4UL	0	<MDL	<MDL	na	na	<MDL
Aliphatic C16-C21	1.5	mg/kg	1,600,000	S4UL	1	29	29	29	0.0	<MDL
Aliphatic C21-C35	3.4	mg/kg	1,600,000	S4UL	1	700	700	700	0.0	<MDL
Aliphatic C5-C35	10	mg/kg	na		1	730	730	730	0.0	<MDL
Aromatic C5-C7	0.01	mg/kg	*26000***	S4UL	0	<MDL	<MDL	na	na	<MDL
Aromatic C7-C8	0.01	mg/kg	*56000***	S4UL	0	<MDL	<MDL	na	na	<MDL
Aromatic C8-C10	0.01	mg/kg	*3500***	S4UL	0	<MDL	<MDL	na	na	<MDL
Aromatic C10-C12	0.9	mg/kg	*16000***	S4UL	0	<MDL	<MDL	na	na	<MDL
Aromatic C12-C16	0.5	mg/kg	*36000***	S4UL	1	24	24	24	0.0	<MDL
Aromatic C16-C21	0.6	mg/kg	28,000	S4UL	1	120	120	120	0.0	<MDL
Aromatic C21-C35	1.4	mg/kg	28,000	S4UL	1	2,100	2,100	2,100	0.0	<MDL
Aromatic C5-C35	10	mg/kg	na		1	2,300	2,300	2,300	0.0	<MDL
TPH Ali/Aro Total	10	mg/kg	na		1	3,000	3,000	3,000	0.0	<MDL
PAHs										
Naphthalene	0.03	mg/kg	*1,900*	Wood	1	0.8	0.8	0.8	0.0	<MDL
Acenaphthylene	0.03	mg/kg	*83000***	S4UL	0	<MDL	<MDL	na	na	<MDL
Acenaphthene	0.03	mg/kg	*84000***	S4UL	1	1.4	1.4	1.4	0.0	<MDL
Fluorene	0.03	mg/kg	*63000***	S4UL	1	1.6	1.6	1.6	0.0	<MDL
Phenanthrene	0.03	mg/kg	22,000	S4UL	1	5.2	5.2	5.2	0.0	<MDL
Anthracene	0.03	mg/kg	520,000	S4UL	1	1.7	1.7	1.7	0.0	<MDL
Fluoranthene	0.03	mg/kg	23,000	S4UL	2	5.0	5.0	2.5	2.5	<MDL
Pyrene	0.03	mg/kg	54,000	S4UL	1	3.6	3.6	3.6	0.0	<MDL
Benzo(a)anthracene	0.03	mg/kg	170	S4UL	1	1.7	1.7	1.7	0.0	<MDL
Chrysene	0.03	mg/kg	350	S4UL	1	1.2	1.2	1.2	0.0	<MDL
Benzo(b)fluoranthene	0.03	mg/kg	44	S4UL	1	1.1	1.1	1.1	0.0	<MDL
Benzo(k)fluoranthene	0.03	mg/kg	1,200	S4UL	1	0.5	0.5	0.5	0.0	<MDL
Benzo(a)pyrene	0.03	mg/kg	77	Wood	1	1.0	1.0	1.0	0.0	<MDL
Indeno(1,2,3-c,d)pyrene	0.03	mg/kg	500	S4UL	1	0.3	0.3	0.3	0.0	<MDL
Dibenzo(a,h)anthracene	0.03	mg/kg	3.5	S4UL	1	0.1	0.1	0.1	0.0	<MDL
Benzo(g,h,i)perylene	0.03	mg/kg	3,900	S4UL	1	0.4	0.4	0.4	0.0	<MDL
PAH - USEPA 16, Total	0.1	mg/kg	na		1	26.0	26	26	0.0	<MDL
PCBs										
PCB 28 + PCB 31	0.01	mg/kg	-		0	0.00	<MDL	na	na	<MDL
PCB 52	0.01	mg/kg	-		0	0.00	<MDL	na	na	<MDL
PCB 101	0.01	mg/kg	-		0	0.00	<MDL	na	na	<MDL
PCB 118	0.01	mg/kg	-		0	0.00	<MDL	na	na	<MDL
PCB 153	0.01	mg/kg	-		0	0.00	<MDL	na	na	<MDL
PCB 138	0.01	mg/kg	-		0	0.00	<MDL	na	na	<MDL
PCB 180	0.01	mg/kg	-		0	0.00	<MDL	na	na	<MDL
PCB 7 Total	0.01	mg/kg	na		0	0.00	<MDL	na	na	<MDL
Phenols										
Phenol - Monohydric	0.3	mg/kg	760	S4UL	0	0	0.0	na	na	0.0

The following GACs have been used in order of availablity:

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C4SL: (Commerical End	Department for Environment, Food and Rural Affairs (DEFRA) (2014) SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document, December 2014
Arcadis	Where published criteria above are not available, Arcadis has derived GAC based on EA guidance and assumptions in line with current industry standards and standard CLEA inputs for a commerical land use.
USEPA	GAC based on US Environmental Protection Agency (USEPA) Regional Screening Levels (RSL). Available at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

Wood derived GAC based on CLEA v1.07 were presented in the Wood 2019 report for benzo(a)pyrene and naphthalene. It is understood that these values were acceptable to the regulator for this site and as such they have been retained here.

Notes

GAC	Generic Assessment Criteria
na	Comprises multiple contaminant, no applicable GAC
*123**	S4UL exceeds the vapour saturation limit
*123***	S4UL exceeds the solubility saturation limit
-	No applicable GAC readily available
	Elements present naturally in soil with typically low toxicity
<MDL	Concentration less then the method detection limit
	Contaminant of Concern in excess of Human Health GAC

Table D2: Soil GAC Protective of Human Health

Contaminant of Concern	MDL	Units	Human Health (Commercial Worker)	GAC Source	Maximum Concentration Measured
VOCs					
Vinyl Chloride	0.01	mg/kg	0.059	S4UL	<MDL
1,1 Dichloroethylene	0.01	mg/kg	1,000	USEPA	<MDL
Trans-1,2-dichloroethylene	0.01	mg/kg	23,000	USEPA	<MDL
1,1-dichloroethane	0.01	mg/kg	16	USEPA	<MDL
Cis-1,2-dichloroethylene	0.01	mg/kg	2,300	USEPA	<MDL
2,2-dichloropropane	0.01	mg/kg	-		<MDL
Bromochloromethane	0.01	mg/kg	630	USEPA	<MDL
Chloroform	0.01	mg/kg	99	S4UL	<MDL
1,1,1-trichloroethane	0.01	mg/kg	660	S4UL	<MDL
1,1-dichloropropene	0.01	mg/kg	-		<MDL
Carbon tetrachloride	0.01	mg/kg	2.9	S4UL	<MDL
Benzene	0.01	mg/kg	27	S4UL	<MDL
1,2-dichloroethane	0.01	mg/kg	0.67	S4UL	<MDL
Trichloroethylene	0.01	mg/kg	1.2	S4UL	<MDL
1,2-dichloropropane	0.01	mg/kg	11.0	USEPA	<MDL
Dibromomethane	0.01	mg/kg	99.0	USEPA	<MDL
Bromodichloromethane	0.01	mg/kg	1.3	USEPA	<MDL
cis-1,3-dichloropropene	0.01	mg/kg	8.2	USEPA	<MDL
Toluene	0.01	mg/kg	56,000	S4UL	<MDL
trans-1,3-dichloropropene	0.01	mg/kg	8.2	USEPA	<MDL
1,1,2-trichloroethane	0.01	mg/kg	5	USEPA	<MDL
Tetrachloroethylene	0.01	mg/kg	19	S4UL	<MDL
1,3-dichloropropane	0.01	mg/kg	23,000	USEPA	<MDL
Dibromochloromethane	0.01	mg/kg	39	USEPA	0.02
1,2-dibromoethane	0.01	mg/kg	0.16	USEPA	<MDL
Chlorobenzene	0.01	mg/kg	56	S4UL	<MDL
1,1,1,2-tetrachloroethane	0.01	mg/kg	110	S4UL	<MDL
Ethylbenzene	0.01	mg/kg	5,700	S4UL	<MDL
m+p-Xylene	0.01	mg/kg	5,900	S4UL	<MDL
o-Xylene	0.01	mg/kg	6,600	S4UL	<MDL
Styrene	0.01	mg/kg	35,000	USEPA	<MDL
Bromoform	0.01	mg/kg	86	USEPA	<MDL
Isopropylbenzene	0.01	mg/kg	-		<MDL
Bromobenzene	0.01	mg/kg	1,800	USEPA	<MDL
1,2,3-trichloropropane	0.01	mg/kg	0.11	USEPA	<MDL
n-propylbenzene	0.01	mg/kg	-		<MDL
2-chlorotoluene	0.01	mg/kg	23,000	USEPA	<MDL
1,3,5-trimethylbenzene	0.01	mg/kg	1,500	USEPA	<MDL
4-chlorotoluene	0.01	mg/kg	23,000	USEPA	<MDL
Tert-butylbenzene	0.01	mg/kg	120,000	USEPA	<MDL
1,2,4-trimethylbenzene	0.01	mg/kg	1,800	USEPA	<MDL
sec-butylbenzene	0.01	mg/kg	120,000	USEPA	<MDL
p-isopropyltoluene	0.01	mg/kg	-		<MDL
1,3-dichlorobenzene	0.01	mg/kg	30	S4UL	<MDL
1,4-dichlorobenzene	0.01	mg/kg	4,400	S4UL	<MDL
n-butylbenzene	0.01	mg/kg	58,000	USEPA	<MDL
1,2-dichlorobenzene	0.01	mg/kg	2,000	S4UL	<MDL
1,2-dibromo-3-chloropropane	0.01	mg/kg	0.06	USEPA	<MDL
1,2,4-trichlorobenzene	0.01	mg/kg	220	S4UL	<MDL
Hexachlorobutadiene	0.01	mg/kg	31	S4UL	<MDL
1,2,3-trichlorobenzene	0.01	mg/kg	102	S4UL	<MDL
MTBE	0.01	mg/kg	210	USEPA	<MDL

The following GACs have been used in order of availablity:

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Arcadis	Where published criteria above are not available, Arcadis has derived GAC based on EA guidance and assumptions in line with current industry standards and standard CLEA inputs for a commerical land use.
USEPA	GAC based on US Environmental Protection Agency (USEPA) Regional Screening Levels (RSL). Available at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

Notes

GAC	Generic Assessment Criteria
na	Comprises multiple contaminant, no applicable GAC
*123**	S4UL exceeds the vapour saturation limit
*123***	S4UL exceeds the solubility saturation limit
-	No applicable GAC readily available
	Elements present naturally in soil with typically low toxicity
	Contaminant of Concern in excess of Human Health GAC

Table D3: Soil GAC Protective of Human Health

Contaminant of Concern	MDL	Units	Human Health (Commercial Worker)	GAC Source	Maximum Concentration Measured
Phenol	0.1	mg/kg	760	S4UL	<MDL
Aniline	0.1	mg/kg	400	USEPA	<MDL
2-Chlorophenol	0.1	mg/kg	3,500	S4UL	<MDL
Benzyl Alcohol	0.1	mg/kg	82,000	USEPA	<MDL
2-Methylphenol	0.1	mg/kg	41,000	USEPA	<MDL
Bis(2-chloroisopropyl)ether	0.1	mg/kg	47,000	USEPA	<MDL
3&4-Methylphenol	0.1	mg/kg	82,000	USEPA	<MDL
2,4-Dimethylphenol	0.1	mg/kg	16,000	USEPA	<MDL
Bis-(dichloroethoxy)methane	0.1	mg/kg	-		<MDL
2,4-Dichlorophenol	0.1	mg/kg	2,500	USEPA	<MDL
1,2,4-Trichlorobenzene	0.1	mg/kg	110	USEPA	<MDL
4-Chloro-3-methylphenol	0.1	mg/kg	82,000	USEPA	<MDL
2-Methylnaphthalene	0.1	mg/kg	3,000	USEPA	0.50
Hexachlorocyclopentadiene	0.1	mg/kg	8	USEPA	<MDL
2,4,6-Trichlorophenol	0.1	mg/kg	210	USEPA	<MDL
2,4,5-Trichlorophenol	0.1	mg/kg	82,000	USEPA	<MDL
2-Chloronaphthalene	0.1	mg/kg	60,000	USEPA	<MDL
2-Nitroaniline	0.1	mg/kg	8,000	USEPA	<MDL
2,4-Dinitrotoluene	0.1	mg/kg	7.4	USEPA	<MDL
3-Nitroaniline	0.1	mg/kg	-		<MDL
4-Nitrophenol	0.1	mg/kg	-		<MDL
Dibenzofuran	0.1	mg/kg	1,000	USEPA	1.30
2,6-Dinitrotoluene	0.1	mg/kg	1.50	USEPA	<MDL
2,3,4,6-Tetrachlorophenol	0.1	mg/kg	25,000	USEPA	<MDL
Diethylphthalate	0.1	mg/kg	660,000	USEPA	<MDL
4-Chlorophenylphenylether	0.1	mg/kg	-		<MDL
4-Nitroaniline	0.1	mg/kg	110	USEPA	<MDL
2-Methyl-4,6-Dinitrophenol	0.1	mg/kg	-		<MDL
Diphenylamine	0.1	mg/kg	82,000	USEPA	<MDL
4-Bromophenylphenylether	0.1	mg/kg	-		<MDL
Hexachlorobenzene	0.1	mg/kg	110	S4UL	<MDL
Pentachlorophenol	0.1	mg/kg	400	S4UL	<MDL
Di-n-butylphthalate	0.1	mg/kg	-		<MDL
Butylbenzylphthalate	0.1	mg/kg	1,200	USEPA	<MDL
Bis(2-ethylhexyl)phthalate	0.1	mg/kg	160	USEPA	<MDL
Di-n-octylphthalate	0.1	mg/kg	8,200	USEPA	<MDL
1,4-Dinitrobenzene	0.1	mg/kg	82	USEPA	<MDL
Dimethylphthalate	0.1	mg/kg	-		<MDL
1,3-Dinitrobenzene	0.1	mg/kg	82	USEPA	<MDL
1,2-Dinitrobenzene	0.1	mg/kg	82	USEPA	<MDL
2,3,5,6-Tetrachlorophenol	0.1	mg/kg	-		<MDL
Azobenzene	0.1	mg/kg	26	USEPA	<MDL
Carbazole	0.1	mg/kg	-		0.80

The following GACs have been used in order of availablity:

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Arcadis	Where published criteria above are not available, Arcadis has derived GAC based on EA guidance and assumptions in line with current industry standards and standard CLEA inputs for a commerical land use.
USEPA	GAC based on US Environmental Protection Agency (USEPA) Regional Screening Levels (RSL). Available at https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

Notes

GAC	Generic Assessment Criteria
na	Comprises multiple contaminant, no applicable GAC
*123**	S4UL exceeds the vapour saturation limit
*123***	S4UL exceeds the solubility saturation limit
-	No applicable GAC readily available
	Elements present naturally in soil with typically low toxicity
	Contaminant of Concern in excess of Human Health GAC

APPENDIX E

GQRA – Summary of Soil Leachate Screen

Table E1: Leachate GAC Protective of Human Health and Water Resources

Contaminant of Concern	MDL	Units	Human Health Inhalation GAC (On-site Commerical Worker)	EQS (Estuaries and Coastal Waters)	DWS	Maximum Concentration Measured
Metals						
Antimony, Dissolved	0.17	ug/l	NVP	-	5	0.72
Arsenic, Dissolved	0.16	ug/l	NVP	25	10	0.75
Barium, Dissolved	0.26	ug/l	NVP	-	700	75
Beryllium, Dissolved	0.1	ug/l	NVP	-	-	0.1
Boron, Dissolved	12	ug/l	NVP	7000	1000	170
Cadmium, Dissolved	0.03	ug/l	NVP	0.2	5	**0.21**
Chromium, Dissolved	0.25	ug/l	NVP	-	50	2.7
Chromium, Hexavalent	7	ug/l	-	0.6		0.0
Copper, Dissolved	0.4	ug/l	NVP	3.76	2000	**4.7**
Iron, Dissolved	5.5	ug/l	NVP	1000	200	53
Lead, Dissolved	0.09	ug/l	NVP	1.3	10	**1.7**
Magnesium, Dissolved	0.02	mg/l	NVP	-	-	0.77
Manganese, Dissolved	0.22	ug/l	NVP	-	50	38
Mercury, Dissolved	0.01	ug/l	NVP	0.07	1	0.02
Molybdenum, Dissolved	1.1	ug/l	-	-	70	6.2
Nickel, Dissolved	0.5	ug/l	NVP	8.6	20	2.1
Vanadium, Dissolved	0.6	ug/l	NVP	100	-	3.8
Zinc, Dissolved	1.3	ug/l	NVP	7.9	3000	**240**
Inorganics						
pH	-	pH	-	6 - 8.5	-	**9.2**
Cyanide, Total	40	ug/l	-	1	50	<MDL
Ammoniacal Nitrogen as N	0.015	mg/l	-	-	0.5	0.06
Chloride	0.1	mg/l	-	-	-	37
Sulphate as SO4	0.1	mg/l	-	-	-	180
Petroleum Hydrocarbons						
Aliphatic C5-C6	0.1	ug/l	>SOL	#	#	<MDL
Aliphatic C6-C8	0.1	ug/l	>SOL	#	#	<MDL
Aliphatic C8-C10	0.1	ug/l	>SOL	#	#	<MDL
Aliphatic C10-C12	1	ug/l	>SOL	#	#	<MDL
Aliphatic C12-C16	1	ug/l	>SOL	#	#	<MDL
Aliphatic C16-C21	1	ug/l	NR	#	#	<MDL
Aliphatic C21-C35	1	ug/l	NR			<MDL
Aromatic C5-C7	0.1	ug/l	57000	8	1	<MDL
Aromatic C7-C8	0.1	ug/l	>SOL	74	700	<MDL
Aromatic C8-C10	0.1	ug/l	>SOL	#	#	<MDL
Aromatic C10-C12	1	ug/l	>SOL	#	#	<MDL
Aromatic C12-C16	1	ug/l	>SOL	#	#	<MDL
Aromatic C16-C21	1	ug/l	NR	#	#	<MDL
Aromatic C21-C35	1	ug/l	NR	#	#	<MDL
TPH Ali/Aro Total	10	ug/l	na	50*	10**	<MDL
PAHs						
Naphthalene	0.05	ug/l	>SOL	2	2	0.26
Acenaphthylene	0.01	ug/l	>SOL	-	-	0.05
Acenaphthene	0.01	ug/l	>SOL	-	-	0.07
Fluorene	0.01	ug/l	>SOL	-	-	0.4
Phenanthrene	0.01	ug/l	>SOL	-	-	0.79
Anthracene	0.01	ug/l	>SOL	0.1	-	0.05
Fluoranthene	0.01	ug/l	>SOL	0.0063	-	**0.02**
Pyrene	0.01	ug/l	>SOL	-	-	0.07
Benzo(a)anthracene	0.01	ug/l	>SOL	-	-	0.01
Chrysene	0.01	ug/l	>SOL	-	-	0.04
Benzo(b)fluoranthene	0.01	ug/l	>SOL	0.017	0.025	<MDL
Benzo(k)fluoranthene	0.01	ug/l	>SOL	0.017	0.025	<MDL
Benzo(a)pyrene	0.01	ug/l	>SOL	0.027	0.01	<MDL
Indeno(1,2,3-c,d)pyrene	0.01	ug/l	>SOL	-	0.025	<MDL
Dibenzo(a,h)anthracene	0.01	ug/l	>SOL	-	-	<MDL
Benzo(g,h,i)perylene	0.01	ug/l	>SOL	0.00082	0.025	<MDL
PAH Total	0.2	ug/l	>SOL	na		1.7
Phenols						
Phenol - Monohydric	100	ug/l	>SOL	7.7	7.7	<MDL

The following GACs have been used:
Arcadis

Where published criteria above are not available, Arcadis has derived GAC based on EA guidance and assumptions in line with current industry standards and standard CLEA inputs for a commerical land use.

Notes

GAC	Generic Assessment Criteria
DWS	Drinking Water Standard
EQS	Environmental Quality Standard (Estuaries and Coastal Waters)
NVP	Contaminant has low vapour phase in groundwater
>SOL	Target acceptable risk not exceeded at the theoretical solubility concentration
NR	No appropriate inhalation reference dose identified during review of toxicological data
na	Comprises multiple contaminant, no applicable GAC
-	No water quality standard identified as suitable for deriving generic assessment criteria
#	No GAC for individua TPH fractions given that the compliacne criteria is for sum TPH
<MDL	Concentration less then the method detection limit
	Contaminant of Concern in excess of Human Health GAC
1.23	Contaminant of Concern in excess of DWS
1.23	Contaminant of Concern in excess of EQS
1.23	Contaminant of Concern in excess of DWS and EQS
*	EC Surface Water Directive, 1975
**	Water Supply (Water Quality) Regulation, 1989

APPENDIX F

GQRA – Summary Groundwater Screen

Table F1: Groundwater GAC Protective of Human Health and Water Resources

Contaminant of Concern	MDL	Units	Human Health Inhalation GAC (On-site Commerical Worker)	EQS (Estuaries and Coastal Waters)	DWS	Maximum Concentration Measured
Metals						
Antimony, Dissolved	0.17	ug/l	NVP	-	5	0.32
Arsenic, Dissolved	0.16	ug/l	NVP	25	10	1.80
Barium, Dissolved	0.26	ug/l	NVP	-	700	68.0
Boron, Dissolved	12	ug/l	NVP	7000	1000	4,500
Cadmium, Dissolved	0.03	ug/l	NVP	0.2	5	0.10
Calcium			-	-	-	910
Chromium, Dissolved	0.25	ug/l	NVP	-	50	5.5
Chromium, Hexavalent	7	ug/l	-	0.6		0.0
Copper, Dissolved	0.4	ug/l	NVP	3.76	2000	1.2
Iron, Dissolved	5.5	ug/l	NVP	1000	200	1,400
Lead, Dissolved	0.09	ug/l	NVP	1.3	10	**1.4**
Magnesium, Dissolved	0.02	mg/l	NVP	-	-	1,000
Manganese, Dissolved	0.22	ug/l	NVP	-	50	1,200
Mercury, Dissolved	0.01	ug/l	NVP	0.07	1	0.04
Molybdenum, Dissolved	1.1	ug/l	-	-	70	30
Nickel, Dissolved	0.5	ug/l	NVP	8.6	20	6.7
Sodium	0.6	ug/l	-	-	-	4,300
Vanadium, Dissolved	0.25	ug/l	NVP	100	-	13
Zinc, Dissolved	1.3	ug/l	NVP	7.9	3000	4.3
Inorganics						
pH	-	pH	-	6 - 8.5	-	**10.8**
Cyanide, Total	40	ug/l	-	1	50	<MDL
Cyanide, Free	20	ug/l	-	-	-	<MDL
Thiocyanate	20	ug/l	-	-	-	47
Dissolved Organic Carbon	2	mg/l	-	-	-	23
Ammoniacal Nitrogen as N	0.015	mg/l	-	-	0.5	1.9
Chloride	0.1	mg/l	-	-	-	4,000
Nitrate as N	0.1	mg/l	-	-	-	0.32
Nitrite as N	0.035	mg/l	-	-	-	0.068
Salinity (Calculated)			-	-	-	7.7
Silicate as SiO2	0.1	mg/l	-	-	-	<MDL
Sulphate as SO4	0.1	mg/l	-	-	-	1,500
Sulphur Free	84	ug/l	-	-	-	<MDL
Petroleum Hydrocarbons						
Aliphatic C5-C6	0.1	ug/l	>SOL	#	#	<MDL
Aliphatic C6-C8	0.1	ug/l	>SOL	#	#	<MDL
Aliphatic C8-C10	0.1	ug/l	>SOL	#	#	<MDL
Aliphatic C10-C12	1	ug/l	>SOL	#	#	<MDL
Aliphatic C12-C16	1	ug/l	>SOL	#	#	<MDL
Aliphatic C16-C21	1	ug/l	NR	#	#	<MDL
Aliphatic C21-C35	1	ug/l	NR			<MDL
Aromatic C5-C7	0.1	ug/l	57000	8	1	<MDL
Aromatic C7-C8	0.1	ug/l	>SOL	74	700	<MDL
Aromatic C8-C10	0.1	ug/l	>SOL	#	#	<MDL
Aromatic C10-C12	1	ug/l	>SOL	#	#	<MDL
Aromatic C12-C16	1	ug/l	>SOL	#	#	<MDL
Aromatic C16-C21	1	ug/l	NR	#	#	<MDL
Aromatic C21-C35	1	ug/l	NR	#	#	<MDL
TPH Ali/Aro Total	10	ug/l	na	50*	10**	<MDL
PAHs						
Naphthalene	0.05	ug/l	>SOL	2	2	0.13
Acenaphthylene	0.01	ug/l	>SOL	-	-	0.03
Acenaphthene	0.01	ug/l	>SOL	-	-	0.05
Fluorene	0.01	ug/l	>SOL	-	-	0.03
Phenanthrene	0.01	ug/l	>SOL	-	-	0.03
Anthracene	0.01	ug/l	>SOL	0.1	-	0.03
Fluoranthene	0.01	ug/l	>SOL	0.0063	-	**0.22**
Pyrene	0.01	ug/l	>SOL	-	-	0.2
Benzo(a)anthracene	0.01	ug/l	>SOL	-	-	0.08
Chrysene	0.01	ug/l	>SOL	-	-	0.09
Benzo(b)fluoranthene	0.01	ug/l	>SOL	0.017	0.025	0.14
Benzo(k)fluoranthene	0.01	ug/l	>SOL	0.017	0.025	0.06
Benzo(a)pyrene	0.01	ug/l	>SOL	0.027	0.01	0.09
Indeno(1,2,3-c,d)pyrene	0.01	ug/l	>SOL	-	0.025	0.11
Dibenzo(a,h)anthracene	0.01	ug/l	>SOL	-	-	0.02
Benzo(g,h,i)perylene	0.01	ug/l	>SOL	0.00082	0.025	0.09
PAH Total	0.2	ug/l	>SOL	na		1
Phenols						
Phenol - Monohydric	100	ug/l	>SOL	7.7	7.7	680

The following GACs have been used:

Arcadis — Where published criteria above are not available, Arcadis has derived GAC based on EA guidance and assumptions in line with current industry standards and standard CLEA inputs for a commerical land use.

Notes

GAC	Generic Assessment Criteria
DWS	Drinking Water Standard
EQS	Environmental Quality Standard (Estuaries and Coastal Waters)
NVP	Contaminant has low vapour phase in groundwater
>SOL	Target acceptable risk not exceeded at the theoretical solubility concentration
NR	No appropriate inhalation reference dose identified during review of toxicological data
na	Comprises multiple contaminant, no applicable GAC
-	No water quality standard identified as suitable for deriving generic assessment criteria
#	No GAC for individua TPH fractions given that the compliacne criteria is for sum TPH
<MDL	Concentration less then the method detection limit
	Contaminant of Concern in excess of Human Health GAC
1.23	Contaminant of Concern in excess of DWS
1.23	Contaminant of Concern in excess of EQS
1.23	Contaminant of Concern in excess of DWS and EQS
*	EC Surface Water Directive, 1975
**	Water Supply (Water Quality) Regulation, 1989

Table F1: Groundwater GAC Protective of Human Health and Water Resources

Contaminant of Concern	MDL	Units	Human Health Inhalation GAC (On-site Commerical Worker)	EQS (Estuaries and Coastal Waters)	DWS	Maximum Concentration Measured
VOCs						
Dichlorodifluoromethane	1	ug/l	-	-	-	<MDL
Chloromethane	1	ug/l	-	-	-	<MDL
Vinyl Chloride	1	ug/l	5000	-	0.5	<MDL
Bromomethane	1	ug/l	-	-	-	<MDL
Chloroethane	1	ug/l	-	-	-	<MDL
Trichlorofluoromethane	1	ug/l	-	-	-	<MDL
1,1-dichloroethylene	1	ug/l	740000	-	140	<MDL
Methylene Chloride	27	ug/l	-	-	-	27.0
Trans-1,2-dichloroethylene	1	ug/l	430000	-	25 [2]	<MDL
1,1-dichloroethane	1	ug/l	1600000	-	2.7	<MDL
Cis-1,2-dichloroethylene	1	ug/l	120000	-	25 [2]	<MDL
2,2-dichloropropane	1	ug/l				<MDL
Bromochloromethane	2	ug/l	-	-	-	<MDL
Chloroform	4	ug/l	820000	2.5	100 [3]	<MDL
1,1,1-trichloroethane	1	ug/l	>SOL	100	2000	<MDL
1,1-dichloropropene	1	ug/l	-	-	-	<MDL
Carbon tetrachloride	1	ug/l	-	-	-	<MDL
Benzene	1	ug/l	57000	8	1	<MDL
1,2-dichloroethane	1	ug/l	3600	10	3	<MDL
Trichloroethylene	1	ug/l	13000	10	5 [2]	<MDL
1,2-dichloropropane	1	ug/l	-	-	-	<MDL
Dibromomethane	1	ug/l	-	-	-	<MDL
Bromodichloromethane	1	ug/l	-	-	-	<MDL
cis-1,3-dichloropropene	4	ug/l	-	-	-	<MDL
Toluene	1	ug/l	>SOL	74	700	<MDL
trans-1,3-dichloropropene	1	ug/l	-	-	-	<MDL
1,1,2-trichloroethane	1	ug/l	-	300	-	<MDL
Tetrachloroethylene	1	ug/l	140000	10	5 [2]	<MDL
1,3-dichloropropane	1	ug/l	-	-	-	<MDL
Dibromochloromethane	1	ug/l	-	-	-	<MDL
1,2-dibromoethane	1	ug/l	-	-	-	<MDL
Chlorobenzene	1	ug/l	130000	-	100	<MDL
1,1,1,2-tetrachloroethane	1	ug/l	-	-	-	<MDL
Ethylbenzene	1	ug/l	>SOL	-	300	<MDL
m+p-Xylene	1	ug/l	>SOL	30	500	<MDL
o-Xylene	2	ug/l	>SOL			<MDL
Styrene	1	ug/l	-	-	-	<MDL
Bromoform	1	ug/l	-	-	-	<MDL
Isopropylbenzene	1	ug/l	-	-	-	<MDL
1,1,2,2-tetrachloroethane	1	ug/l	-	-	-	<MDL
Bromobenzene	1	ug/l	-	-	-	<MDL
1,2,3-trichloropropane	1	ug/l	-	-	-	<MDL
n-propylbenzene	1	ug/l	-	-	-	<MDL
2-chlorotoluene	1	ug/l	-	-	-	<MDL
1,3,5-trimethylbenzene	1	ug/l	-	-	-	<MDL
4-chlorotoluene	1	ug/l	-	-	-	<MDL
Tert-butylbenzene	1	ug/l	-	-	-	<MDL
1,2,4-trimethylbenzene	1	ug/l	-	-	-	<MDL
sec-butylbenzene	1	ug/l	-	-	-	<MDL
p-isopropyltoluene	1	ug/l	-	-	-	<MDL
1,3-dichlorobenzene	1	ug/l	-	-	-	<MDL
1,4-dichlorobenzene	2	ug/l	-	-	-	<MDL
n-butylbenzene	1	ug/l	-	-	-	<MDL
1,2-dichlorobenzene	1	ug/l	-	-	-	<MDL
1,2-dibromo-3-chloropropane	1	ug/l	-	-	-	<MDL
1,2,4-trichlorobenzene	1	ug/l	-	0.4 [1]	-	<MDL
Hexachlorobutadiene	1	ug/l	-	0.6	-	<MDL
1,2,3-trichlorobenzene	1	ug/l	-	0.4 [1]	-	<MDL
MTBE	1	ug/l	24000000	-	15	<MDL

The following GACs have been used:

Arcadis — Where published criteria above are not available, Arcadis has derived GAC based on EA guidance and assumptions in line with current industry standards and standard CLEA inputs for a commerical land use.

Notes

GAC	Generic Assessment Criteria
DWS	Drinking Water Standard
EQS	Environmental Quality Standard (Estuaries and Coastal Waters)
NVP	Contaminant has low vapour phase in groundwater
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na	Comprises multiple contaminant, no applicable GAC
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#	No GAC for individua TPH fractions given that the compliacne criteria is for sum TPH
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1.23	Contaminant of Concern in excess of DWS
1.23	Contaminant of Concern in excess of EQS
1.23	Contaminant of Concern in excess of DWS and EQS
*	EC Surface Water Directive, 1975
**	Water Supply (Water Quality) Regulation, 1989
1	Based on values of 0.4µg/l for sum trichlorobenzene
2	Based on values of 10µg/l combined for TCE and PCE and 50µg/l combined for cis-DCE and trans-DCE
3	Total value for trihalomethanes (chloroform, bromoform, dibromochloromethane and bromodichloromethane).

Table F1: Groundwater GAC Protective of Human Health and Water Resources

Contaminant of Concern	MDL	Units	Human Health Inhalation GAC (On-site Commerical Worker)	EQS (Estuaries and Coastal Waters)	DWS	Maximum Concentration Measured
SVOCs						
Phenol	1	ug/l	>SOL	7.7	7.7	<MDL
Aniline	1	ug/l	-	-	-	<MDL
2-Chlorophenol	1	ug/l	-	50	-	<MDL
Benzyl Alcohol	1	ug/l	-	-	-	<MDL
2-Methylphenol	1	ug/l	-	-	-	<MDL
Bis(2-chloroisopropyl)ether	1	ug/l	-	-	-	<MDL
3&4-Methylphenol	1	ug/l	-	-	-	<MDL
Bis(2-chloroethoxy)methane	1	ug/l	-	-	-	<MDL
2,4-Dimethylphenol	1	ug/l	-	-	-	<MDL
2,4-Dichlorophenol	1	ug/l	-	0.42	-	<MDL
1,2,4-Trichlorobenzene	1	ug/l	-	-	-	<MDL
4-Chloro-3-methylphenol	1	ug/l	-	40	-	<MDL
2-Methylnaphthalene	1	ug/l	-	-	-	<MDL
Hexachlorocyclopentadiene	1	ug/l	-	-	-	<MDL
2,4,6-Trichlorophenol	1	ug/l	-	-	-	<MDL
2,4,5-Trichlorophenol	1	ug/l	-	-	-	<MDL
2-Chloronaphthalene	1	ug/l	-	-	-	<MDL
2-Nitroaniline	1	ug/l	-	-	-	<MDL
2,4-Dinitrotoluene	1	ug/l	-	-	-	<MDL
3-Nitroaniline	1	ug/l	-	-	-	<MDL
4-Nitrophenol	1	ug/l	-	-	-	<MDL
Dibenzofuran	1	ug/l	-	-	-	<MDL
2,6-Dinitrotoluene	1	ug/l	-	-	-	<MDL
2,3,4,6-Tetrachlorophenol	1	ug/l	-	-	-	<MDL
Diethylphthalate	1	ug/l	-	-	-	<MDL
4-Chlorophenylphenylether	1	ug/l	-	-	-	<MDL
4-Nitroaniline	1	ug/l	-	-	-	<MDL
Diphenylamine	1	ug/l	-	-	-	<MDL
4-Bromophenylphenylether	1	ug/l	-	-	-	<MDL
Hexachlorobenzene	1	ug/l	-	-	-	<MDL
Bis(2-ethylhexyl)ester	1	ug/l	-	-	-	<MDL
Pentachlorophenol	1	ug/l	-	-	-	<MDL
Di-n-butylphthalate	1	ug/l	-	-	-	<MDL
Butylbenzylphthalate	1	ug/l	-	-	-	<MDL
Bis(2-ethylhexyl)phthalate	1	ug/l	-	-	-	<MDL
Di-n-octylphthalate	1	ug/l	-	-	-	<MDL
1,4-Dinitrobenzene	1	ug/l	-	-	-	<MDL
Dimethylphthalate	1	ug/l	-	-	-	<MDL
1,3-Dinitrobenzene	1	ug/l	-	-	-	<MDL
2,3,5,6-Tetrachlorophenol	1	ug/l	-	-	-	<MDL
Azobenzene	1	ug/l	-	-	-	<MDL
Carbazole	1	ug/l	-	-	-	<MDL
1-Methylnaphthalene	1	ug/l	-	-	-	<MDL

The following GACs have been used:

Arcadis	Where published criteria above are not available, Arcadis has derived GAC based on EA guidance and assumptions in line with current industry standards and standard CLEA inputs for a commerical land use.

Notes

GAC	Generic Assessment Criteria
DWS	Drinking Water Standard
EQS	Environmental Quality Standard (Estuaries and Coastal Waters)
NVP	Contaminant has low vapour phase in groundwater
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	Contaminant of Concern in excess of Human Health GAC
1.23	Contaminant of Concern in excess of DWS
1.23	Contaminant of Concern in excess of EQS
1.23	Contaminant of Concern in excess of DWS and EQS

APPENDIX G

GQRA – Summary Surface Water Screen

Table G1: Leachate GAC Protective of Human Health and Water Resources

Contaminant of Concern	MDL	Units	EQS (Estuaries and Coastal Waters)	DWS	Maximum Concentration Measured	SLEMS_SW01	SLEMS_SW02	SLEMS_SW03	SLEMS_SW04	SLEMS_SW06
Metals										
Aluminium, Dissolved	10	ug/l	-	-	34	32	34	11	19	18
Antimony, Dissolved	0.17	ug/l	-	5	1	1	0.58	0.64	0.91	0.92
Arsenic, Dissolved	0.16	ug/l	25	10	3.7	3.7	1.3	2.3	1.7	1.8
Barium, Dissolved	0.26	ug/l	-	700	43	43	40	25	31	32
Beryllium, Dissolved	0.1	ug/l	-	-	<MDL	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron, Dissolved	12	ug/l	7000	1000	400	330	310	400	370	310
Cadmium, Dissolved	0.03	ug/l	0.2	5	0.1	0.08	0.04	< 0.03	0.03	0.03
Chromium, Dissolved	0.25	ug/l	-	50	2.1	2.1	1.5	0.25	0.63	0.47
Chromium, Hexavalent	7	ug/l	0.6		**8.6**	< 7.0	**8.6**	< 7.0	< 7.0	< 7.0
Copper, Dissolved	0.4	ug/l	3.76	2000	3.4	3.4	2.7	0.9	2.6	2.9
Iron, Dissolved	5.5	ug/l	1000	200	200	63	200	120	170	130
Lead, Dissolved	0.09	ug/l	1.3	10	1.5	0.36	1.5	0.91	1.1	0.77
Magnesium, Dissolved	0.02	mg/l	-	-	120	28	32	120	58	59
Manganese, Dissolved	0.22	ug/l	-	50	120	120	71	110	120	120
Mercury, Dissolved	0.01	ug/l	0.07	1	0.02	0.02	0.01	< 0.01	< 0.01	< 0.01
Molybdenum, Dissolved	1.1	ug/l	-	70	23	15	23	4.2	15	17
Nickel, Dissolved	0.5	ug/l	8.6	20	**8.6**	2.6	6.3	1.8	**8.6**	8.4
Vanadium, Dissolved	0.6	ug/l	100	-	22	22	5.5	0.7	2.3	2.2
Zinc, Dissolved	1.3	ug/l	7.9	3000	**17**	**12**	**13**	**17**	**15**	**13**
Inorganics										
pH	-	pH	6 - 8.5	-	8.0	7.9	7.9	8	8	8
Cyanide, Total	40	ug/l	1	50	<MDL	< 40	< 40	< 40	< 40	< 40
Cyanide, Free	20	ug/l	-	-	<MDL	< 20	< 20	< 20	< 20	< 20
Thiocyanate	20	ug/l	-	-	<MDL	< 20	< 20	< 20	< 20	< 20
Ammoniacal Nitrogen as N	0.015	mg/l	-	0.5	0.2	0.14	0.11	0.088	0.22	< 0.015
Chloride	0.1	mg/l	-	-	260	150	260	86	180	220
Silicate as SiO2	0.1	mg/l	-	-	12	12	7.7	11	8.4	8.1
Sulphate as SO4	0.1	mg/l	-	-	390	390	62	110	71	71
Sulphur Free	84	ug/l	-	-	<MDL	< 84	< 84	< 84	< 84	< 84
Petroleum Hydrocarbons										
Aliphatic C5-C6	0.1	ug/l	#	#	<MDL	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8	0.1	ug/l	#	#	<MDL	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	0.1	ug/l	#	#	<MDL	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	1	ug/l	#	#	7.7	< 1.0	6.3	< 1.0	7.7	6.8
Aliphatic C12-C16	1	ug/l	#	#	27	< 1.0	27	< 1.0	1.7	3.7
Aliphatic C16-C21	1	ug/l	#	#	300	< 1.0	300	< 1.0	9	18
Aliphatic C21-C35	1	ug/l			4,700	< 1.0	4700	< 1.0	160	290
Aromatic C5-C7	0.1	ug/l	8	1	<MDL	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C7-C8	0.1	ug/l	74	700	<MDL	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C8-C10	0.1	ug/l	#	#	<MDL	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C10-C12	1	ug/l	#	#	1.6	< 1.0	1.6	< 1.0	< 1.0	< 1.0
Aromatic C12-C16	1	ug/l	#	#	22	< 1.0	22	< 1.0	< 1.0	3.4
Aromatic C16-C21	1	ug/l	#	#	170	< 1.0	170	< 1.0	< 1.0	7.3
Aromatic C21-C35	1	ug/l	#	#	1,800	< 1.0	1800	< 1.0	< 1.0	94
TPH Ali/Aro Total	10	ug/l	50*	10**	7,000	< 10	7,000	< 10	180	420
PAHs										
Naphthalene	0.05	ug/l	2	2	0.05	< 0.05	0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	0.01	ug/l	-	-	0.03	0.03	< 0.05	0.01	< 0.01	< 0.01
Acenaphthene	0.01	ug/l	-	-	0.03	0.03	< 0.05	< 0.01	< 0.01	< 0.01
Fluorene	0.01	ug/l	-	-	0.04	0.04	< 0.05	0.01	< 0.01	< 0.01
Phenanthrene	0.01	ug/l	-	-	0.08	0.03	0.08	0.01	< 0.01	0.03
Anthracene	0.01	ug/l	0.1	-	0.04	0.04	< 0.05	0.02	< 0.01	< 0.01
Fluoranthene	0.01	ug/l	0.0063	-	**0.13**	**0.13**	< 0.05	**0.07**	**0.02**	**0.09**
Pyrene	0.01	ug/l	-	-	0.1	0.1	< 0.05	0.06	0.02	0.08
Benzo(a)anthracene	0.01	ug/l	-	-	0.06	0.05	< 0.05	0.03	< 0.01	0.06
Chrysene	0.01	ug/l	-	-	0.15	0.06	< 0.05	0.15	< 0.01	0.06
Benzo(b)fluoranthene	0.01	ug/l	0.017	0.025	0.1	0.1	< 0.05	0.04	< 0.01	0.08
Benzo(k)fluoranthene	0.01	ug/l	0.017	0.025	0.04	0.04	< 0.05	**0.02**	< 0.01	0.03
Benzo(a)pyrene	0.01	ug/l	0.027	0.01	0.05	0.05	< 0.05	0.02	< 0.01	0.05
Indeno(1,2,3-c,d)pyrene	0.01	ug/l	-	0.025	0.05	0.05	< 0.05	0.02	< 0.01	0.04
Dibenzo(a,h)anthracene	0.01	ug/l	-	-	<MDL	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	0.01	ug/l	0.00082	0.025	0.06	0.06	< 0.05	**0.02**	< 0.01	0.04
PAH Total	0.2	ug/l	na		0.82	0.82	< 0.80	0.48	< 0.20	0.58
Phenols										
Phenol - Monohydric	100	ug/l	7.7	7.7	<MDL	< 100	< 100	< 100	< 100	< 100

Notes

GAC	Generic Assessment Criteria
DWS	Drinking Water Standard
EQS	Environmental Quality Standard (Estuaries and Coastal Waters)
NVP	Contaminant has low vapour phase in groundwater
>SOL	Target acceptable risk not exceeded at the theoretical solubility concentration
NR	No appropriate inhalation reference dose identified during review of toxicological data
na	Comprises multiple contaminant, no applicable GAC
-	No water quality standard identified as suitable for deriving generic assessment criteria
#	No GAC for individua TPH fractions given that the compliacne criteria is for sum TPH
<MDL	Concentration less then the method detection limit
	Contaminant of Concern in excess of Human Health GAC
1.23	Contaminant of Concern in excess of DWS
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*	EC Surface Water Directive, 1975
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Table G1: Leachate GAC Protective of Human Health and Water Resources

Contaminant of Concern	MDL	Units	EQS (Estuaries and Coastal Waters)	DWS	Maximum Concentration Measured	SLEMS_SW01	SLEMS_SW02	SLEMS_SW03	SLEMS_SW04	SLEMS_SW06
VOCs										
Dichlorodifluoromethane	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Chloromethane	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Vinyl Chloride	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Bromomethane	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Chloroethane	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Trichlorofluoromethane	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
1,1-dichloroethylene	1	ug/l	-	140	<MDL	< 1	< 1	< 1	< 1	< 1
Methylene Chloride	27	ug/l	-	-	<MDL	< 27	< 27	< 27	< 27	< 27
Trans-1,2-dichloroethylene	1	ug/l	-	25 [2]	<MDL	< 1	< 1	< 1	< 1	< 1
1,1-dichloroethane	1	ug/l	-	2.7	<MDL	< 1	< 1	< 1	< 1	< 1
Cis-1,2-dichloroethylene	1	ug/l	-	25 [2]	<MDL	< 1	< 1	< 1	< 1	< 1
2,2-dichloropropane	2	ug/l	-	-	<MDL	< 2	< 2	< 2	< 2	< 2
Bromochloromethane	4	ug/l	-	-	<MDL	< 4	< 4	< 4	< 4	< 4
Chloroform	1	ug/l	2.5	100 [3]	2.0	1	2	< 1	< 1	< 1
1,1,1-trichloroethane	1	ug/l	100	2000	<MDL	< 1	< 1	< 1	< 1	< 1
1,1-dichloropropene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Carbon tetrachloride	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Benzene	1	ug/l	8	1	<MDL	< 1	< 1	< 1	< 1	< 1
1,2-dichloroethane	1	ug/l	10	3	<MDL	< 1	< 1	< 1	< 1	< 1
Trichloroethylene	1	ug/l	10	5 [2]	<MDL	< 1	< 1	< 1	< 1	< 1
1,2-dichloropropane	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Dibromomethane	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Bromodichloromethane	4	ug/l	-	-	<MDL	< 4	< 4	< 4	< 4	< 4
cis-1,3-dichloropropene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Toluene	1	ug/l	74	700	<MDL	< 1	< 1	< 1	< 1	< 1
trans-1,3-dichloropropene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
1,1,2-trichloroethane	1	ug/l	300	-	<MDL	< 1	< 1	< 1	< 1	< 1
Tetrachloroethylene	1	ug/l	10	5 [2]	<MDL	< 1	< 1	< 1	< 1	< 1
1,3-dichloropropane	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Dibromochloromethane	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
1,2-dibromoethane	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Chlorobenzene	1	ug/l	-	100	<MDL	< 1	< 1	< 1	< 1	< 1
1,1,1,2-tetrachloroethane	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Ethylbenzene	1	ug/l	-	300	<MDL	< 1	< 1	< 1	< 1	< 1
m+p-Xylene	2	ug/l	30	500	<MDL	< 2	< 2	< 2	< 2	< 2
o-Xylene	1	ug/l			<MDL	< 1	< 1	< 1	< 1	< 1
Styrene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Bromoform	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Isopropylbenzene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
1,1,2,2-tetrachloroethane	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Bromobenzene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
1,2,3-trichloropropane	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
n-propylbenzene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
2-chlorotoluene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
1,3,5-trimethylbenzene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
4-chlorotoluene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
Tert-butylbenzene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
1,2,4-trimethylbenzene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
sec-butylbenzene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
p-isopropyltoluene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
1,3-dichlorobenzene	2	ug/l	-	-	<MDL	< 2	< 2	< 2	< 2	< 2
1,4-dichlorobenzene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
n-butylbenzene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
1,2-dichlorobenzene	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
1,2-dibromo-3-chloropropane	1	ug/l	-	-	<MDL	< 1	< 1	< 1	< 1	< 1
1,2,4-trichlorobenzene	1	ug/l	0.4 [1]	-	<MDL	< 1	< 1	< 1	< 1	< 1
Hexachlorobutadiene	1	ug/l	0.6	-	<MDL	< 1	< 1	< 1	< 1	< 1
1,2,3-trichlorobenzene	1	ug/l	0.4 [1]	-	<MDL	< 1	< 1	< 1	< 1	< 1
MTBE	1	ug/l	-	15	<MDL	< 1	< 1	< 1	< 1	< 1

Notes

GAC	Generic Assessment Criteria
DWS	Drinking Water Standard
EQS	Environmental Quality Standard (Estuaries and Coastal Waters)
NVP	Contaminant has low vapour phase in groundwater
>SOL	Target acceptable risk not exceeded at the theoretical solubility concentration
NR	No appropriate inhalation reference dose identified during review of toxicological data
na	Comprises multiple contaminant, no applicable GAC
-	No water quality standard identified as suitable for deriving generic assessment criteria
#	No GAC for individua TPH fractions given that the compliacne criteria is for sum TPH
<MDL	Concentration less then the method detection limit
	Contaminant of Concern in excess of Human Health GAC
1.23	Contaminant of Concern in excess of DWS
1.23	Contaminant of Concern in excess of EQS
1.23	Contaminant of Concern in excess of DWS and EQS
*	EC Surface Water Directive, 1975
**	Water Supply (Water Quality) Regulation, 1989

Table G1: Leachate GAC Protective of Human Health and Water Resources

Contaminant of Concern	MDL	Units	EQS (Estuaries and Coastal Waters)	DWS	Maximum Concentration Measured	SLEMS_SW01	SLEMS_SW02	SLEMS_SW03	SLEMS_SW04	SLEMS_SW06
SVOCs										
Phenol	1	ug/l	7.7	7.7	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Aniline	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
2-Chlorophenol	1	ug/l	50	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Benzyl Alcohol	1	ug/l	-	-	2.6	< 2.0	< 2.0	2.6	< 1.0	< 1.0
2-Methylphenol	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Bis(2-chloroisopropyl)ether	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
3&4-Methylphenol	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Bis(2-chloroethoxy)methane	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
2,4-Dimethylphenol	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
2,4-Dichlorophenol	1	ug/l	0.42	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
4-Chloro-3-methylphenol	1	ug/l	40	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
2-Methylnaphthalene	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Hexachlorocyclopentadiene	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
2,4,6-Trichlorophenol	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
2,4,5-Trichlorophenol	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
2-Chloronaphthalene	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
2-Nitroaniline	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
2,4-Dinitrotoluene	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
3-Nitroaniline	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
4-Nitrophenol	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Dibenzofuran	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
2,6-Dinitrotoluene	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
2,3,4,6-Tetrachlorophenol	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Diethylphthalate	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
4-Chlorophenylphenylether	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
4-Nitroaniline	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Diphenylamine	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
4-Bromophenylphenylether	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Hexachlorobenzene	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Bis(2-ethylhexyl)ester	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Pentachlorophenol	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Di-n-butylphthalate	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Butylbenzylphthalate	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Bis(2-ethylhexyl)phthalate	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Di-n-octylphthalate	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
1,4-Dinitrobenzene	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Dimethylphthalate	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
1,3-Dinitrobenzene	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
2,3,5,6-Tetrachlorophenol	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Azobenzene	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
Carbazole	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0
1-Methylnaphthalene	1	ug/l	-	-	<MDL	< 2.0	< 2.0	< 2.0	< 1.0	< 1.0

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