

Magellan Aerospace Limited Wrexham, UK

Soil & Groundwater Environmental Site Investigation and Risk Assessment
Final Report, September 2013

Magellan Aerospace Limited Wrexham, UK

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For and on behalf of Environmental Resources Management Limited

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Signed:



Position: Partner and Technical Fellow

Date: 11 September 2013

Reference: 0209263

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Introduction



Background

- Following submission of a planning application for extension of existing buildings at the Wrexham site, Environmental Resources Management Limited (ERM) understands that to discharge the planning condition related to land contamination, Wrexham City Borough Council (WCBC) require confirmation that any potential contamination issues at the site be adequately dealt with via *'a phased investigation approach to identify the extent of any contamination and any measures required remediating the site including pre-development monitoring'* ⁽¹⁾.
- The objective of the works undertaken by ERM is therefore to support discharge of the planning condition and allow development to proceed.
- ERM's interpretation of WCBC's requirements is that whilst detailed assessment should focus within the planning application areas, a wider review of site conditions is also required. Particularly WCBC is concerned over the recorded concentrations of chlorinated solvents (namely trichloroethene (TCE)) within shallow groundwater that were identified in 2001 and the fact that no subsequent monitoring has been carried out to demonstrate that the impacts do not pose a long-term risk to human health or the surrounding environment.
- The Site Location is shown on the following *Slide* and on *Figure 1*. *Figure 2* shows the planning application areas.

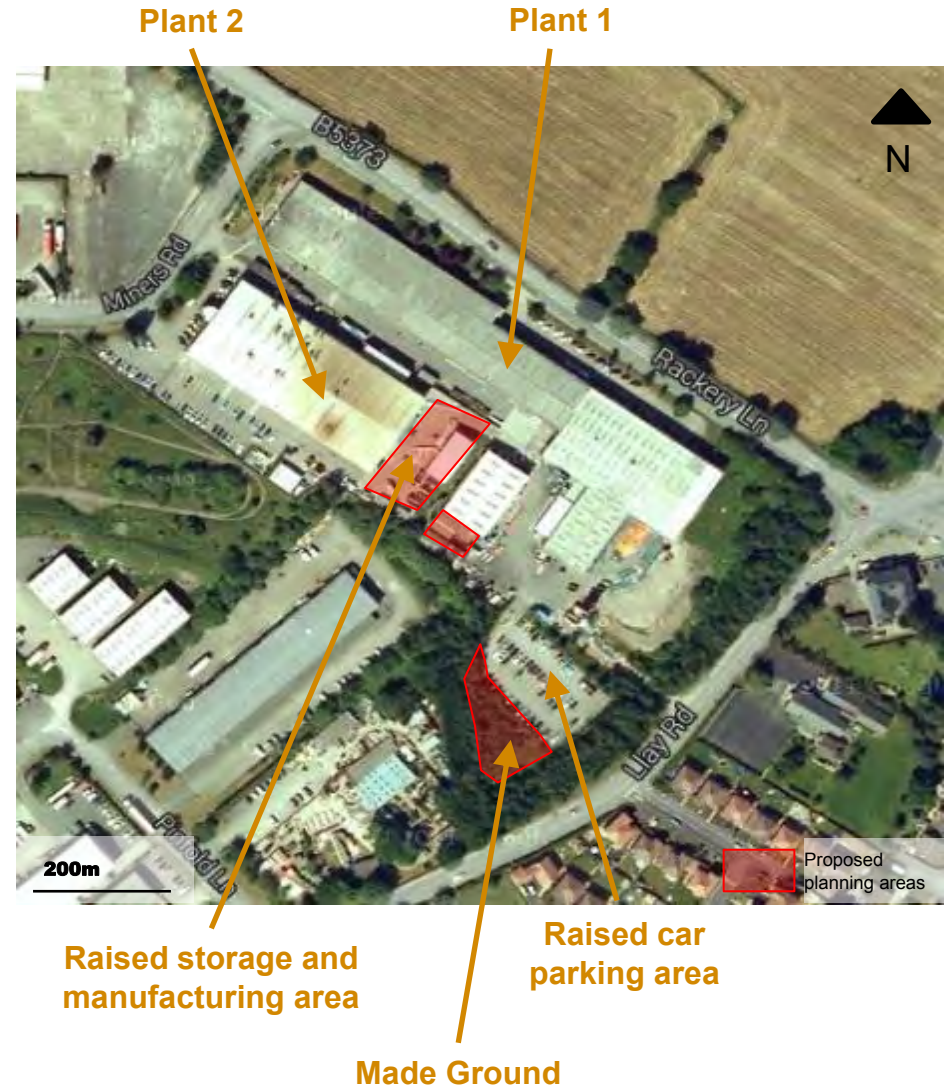
(1) Letter: Paul Siemann (WCBC) to Darren Edwards (Magellan Aerospace Limited), 13 May 2013

Site Location Plan

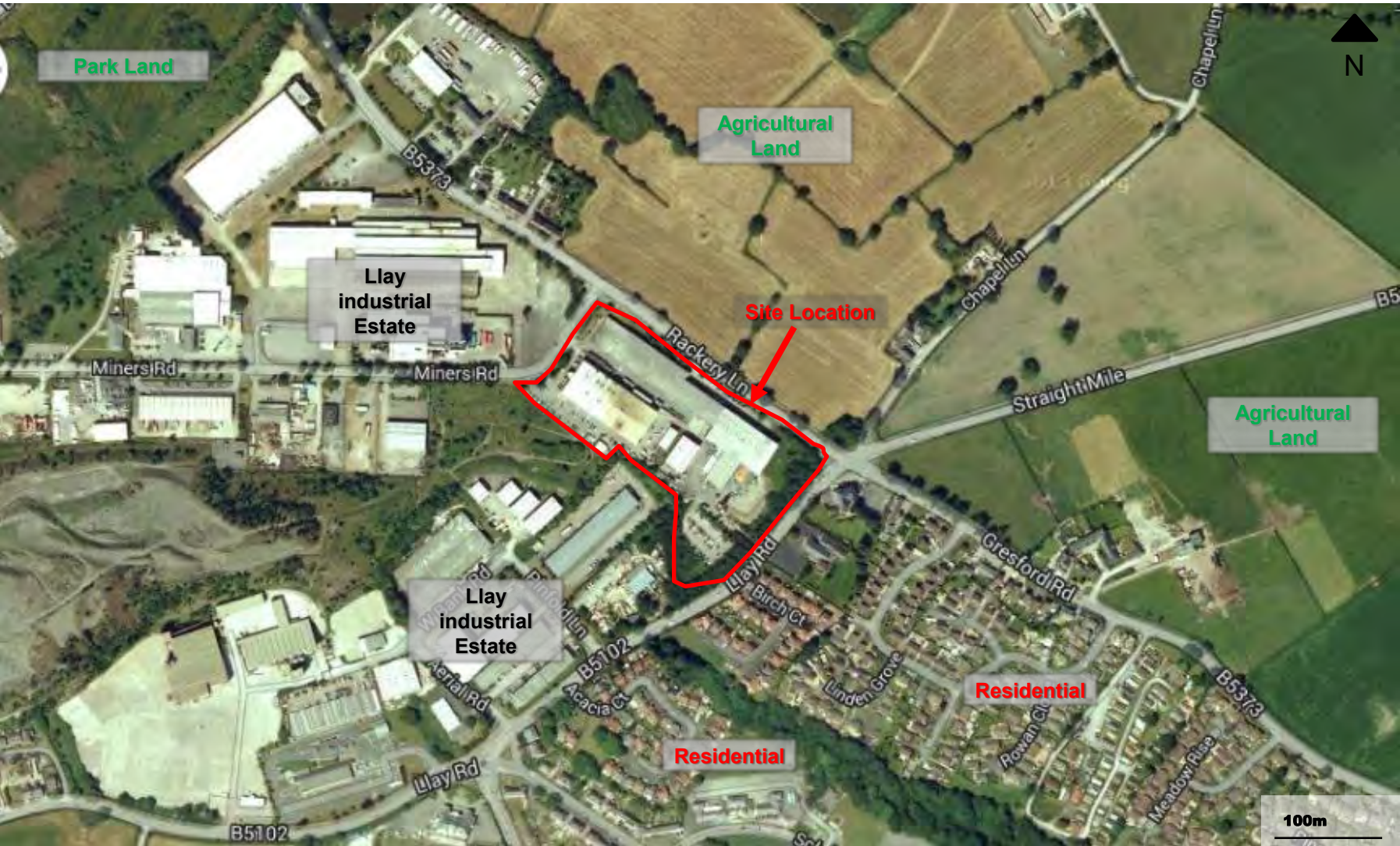


Current Site Layout

Category	Description
Address	Rackery Lane, Llay, Wrexham, Clwyd, LL12 0PB
National Grid Reference	333100E 356340N
Size	3.45 ha
Topography	- Two raised areas are present, one in the south for car parking and one in the central part of the site where storage and manufacturing is carried out and where the building extensions are proposed. - Site wide the topography generally slopes 1 - 2m downwards from south to north/north-west.
Current Status	Operational – manufacturing of aerospace components.
Ground surface	- The site is predominantly covered in hardstanding (asphalt or concrete), with the exception of: - A grassed area with some trees and shrubs along the north-western, northern and south-eastern perimeter; and - Made Ground in the raised car parking area.



Surrounding Area



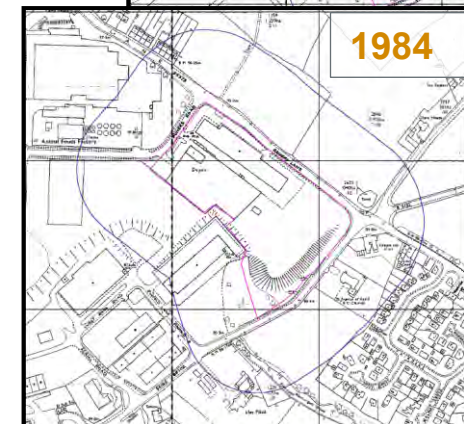
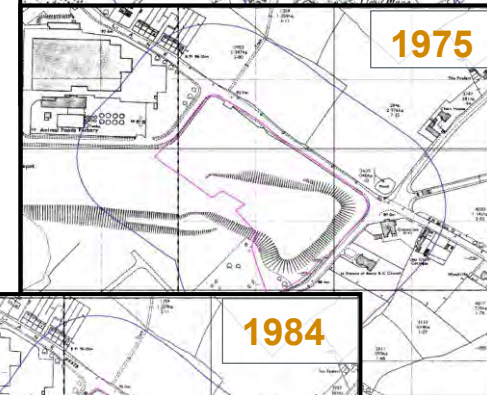
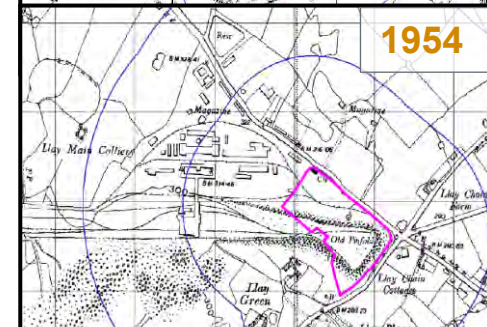
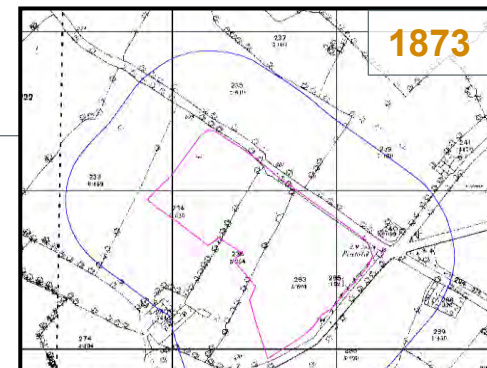
Site History

Onsite

- From 1873 until 1954 the site comprised undeveloped land and several ponds, likely to be used for agricultural use.
- From 1954 evidence of ground workings which extend off site to the east associated with the Llay Main Colliery. An outline of ground workings remains on the site by 1975.
- By 1980 the site supports a depot within the north-eastern corner and over time additional buildings (assumed industrial) have been developed until sometime between 1992 and 2006 when the current site layout is evident.
- Information provided within the RPS 2005 report indicated that historically two underground storage tanks (contents unknown) were present within the south-eastern part of the site. These were decommissioned in 1998 although no records are available.
- According to the Coal Authority, the site is in the likely zone of influence from workings in five seams of coal at depths of between 650 and 920m and last worked in 1966. Ground movement from these past coal workings should by now have ceased. Furthermore there are no known coal mine entries identified on site
- Site management reported that no solvents have been stored onsite since 2012, although trichloroethene (TCE) has been stored historically.

Offsite

- From 1873 until 1938 the surrounding land use was predominantly agricultural until buildings associated with the Llay Main Colliery were evident to the north-west of the site and commercial and residential buildings were present to the south-east.
- By 1954 ground workings and railway lines associated with the colliery were identified.
- By 1981 the colliery was no longer evident and the area had been redeveloped with factories and unspecified works, which by 1992 formed part of the Llay Industrial Estate.
- According to the Coal Authority there are no known coal mines within 20m of the site boundary.
- For further information refer to Envirocheck data contained within Annex A.



Previous Investigations

ERM has carried out a review of previous environmental assessments carried out at the site ⁽¹⁾ ⁽²⁾

- According to the RPS report the site is located above a Secondary A aquifer unit and within 150m of a surface water receptor, the Singret Stream to the south of the Site.
- The results from previous works carried out by RPS in 2001 identified TCE, cis 1,2 dichloroethene, Polycyclic Aromatic Hydrocarbons (PAHs), Total Petroleum Hydrocarbons (TPH) and bis(2-ethyl)phthalate at concentrations above the generic assessment criteria within the north-western part of the site (Plant 1) at depths of between 1.0 and 2.2m below ground level (bgl).
- The works carried out by RPS in 2005 comprised the drilling of eight boreholes using cable percussive drilling techniques. During ERM's site walkover only two of the boreholes, BH7 and BH8, within the northern part of the site could be located and those that were identified were not usable due to the presence of significant silt in the wells.
- The works by CC Geotechnical Limited in September 2011, comprised six trial pits excavated to a depth of 2.5m bgl for the purposes of soil sample collection and four exposure pits excavated to expose existing foundations at depths ranging from 0.53m bgl to 0.96m bgl. The exact location of the trial and exposure pits cannot be determined by ERM given the data available for review. The exposure and trial pits only focused on shallow soil conditions and samples collected did not include analysis of Volatile Organic Compounds (VOCs). A total of five soil samples were collected and results of the soil analysis indicated no contaminant concentrations (specifically metals and petroleum hydrocarbons) exceeding guideline values for risks to human health.
- Given the information reviewed and the requirements of WCBC, ERM recommended the re-establishment of the original groundwater monitoring network installed in 2001 to allow comparative groundwater analysis to be undertaken; and the advancement of borings in the proposed development areas to facilitate the collection of soil and groundwater samples specifically for VOCs and Semi-Volatile Organic Compounds (SVOCs) to provide a full up to date data set for a risk assessment to be completed in line with WCBCs requirements to support the planning application.
- The scope of works is summarised in the next *Section*.

(1) Application Site Report for PPC Application, Magellan Aerospace Metal Treatments, Miners road Llay Industrial Estate, Llay, Wrexham, LL12 0PB, by RPS Health, Safety and Environment, August 2005

(2) Combined Phase I and II Geoenvironmental Report for Land at Magellan Aerospace, Llay, Wrexham. Volume I: Desk Study Data Summary and Factual/Interpretative report, by CC Geotechnical Limited, October 2005

Site Investigation Scope

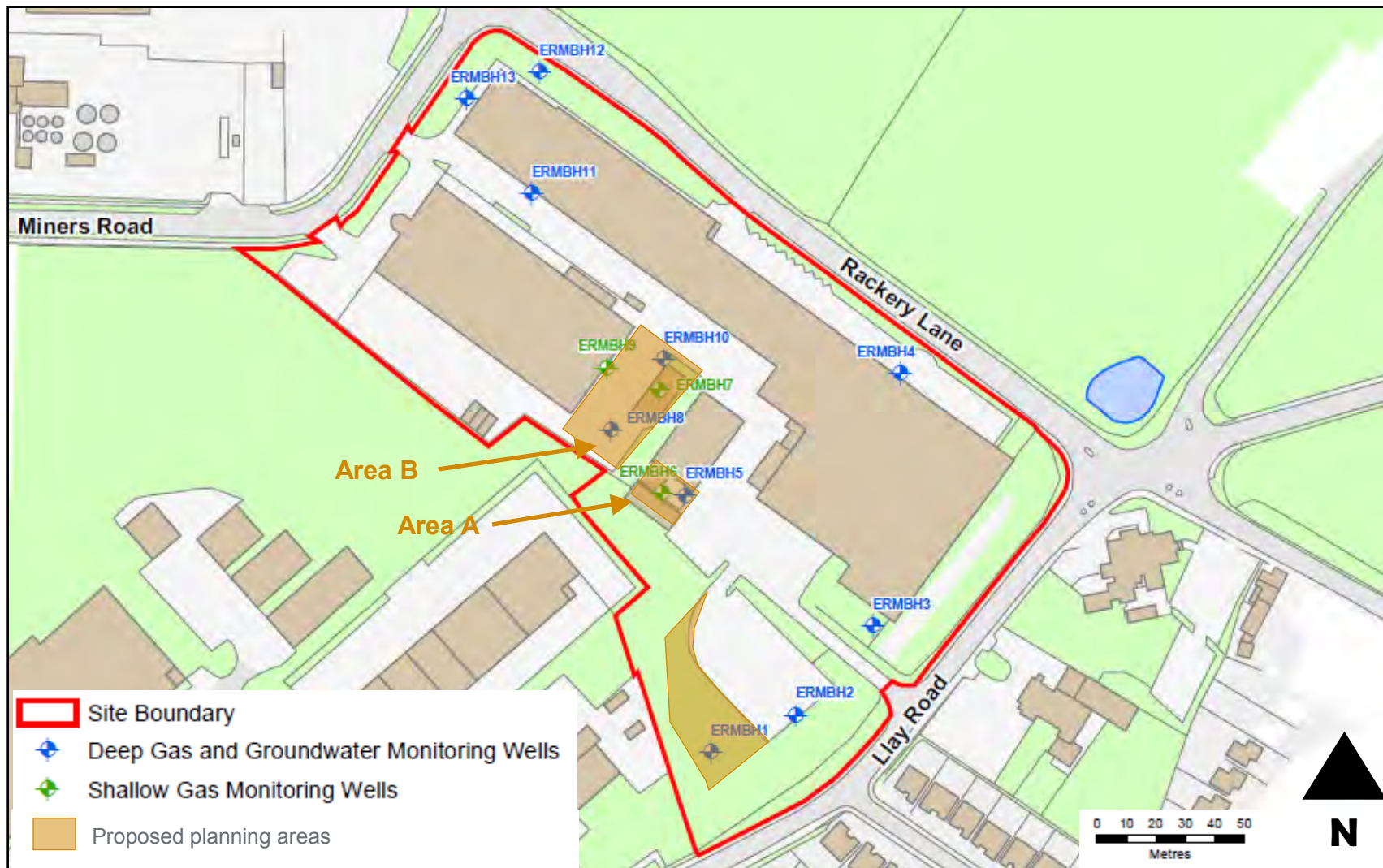


ERM 2013 Investigation: Scope of Works

The scope of works undertaken by ERM comprised the following:

- Drilling of 13 boreholes (ERMBH1 – ERMBH13 – see *Slide 13* and *Figure 3* for locations) comprising six locations within the proposed development areas and seven locations across the wider site area.
 - ERMBH1 covered the proposed extended car park within the southern part of the site;
 - ERMBH5 and ERMBH6 covers proposed extension Area A; and
 - ERMBH7 - ERMBH10 covers proposed extension Area B.
- All boreholes were drilled using percussive window sampling or hollow stem auger techniques to depths varying between 2 and 12m bgl. The depths drilled were based on observed or anticipated groundwater depth.
- Each location was installed to enable soil gas monitoring, with all but three of the wells also installed to enable groundwater samples to be collected, where water was present.
- Soil sampling for laboratory chemical analysis of contaminants of concern.
- Groundwater monitoring and sampling from each installed well where water was present.
- A total of two ground gas monitoring events using all newly installed wells, on the 24 July and 23 August 2013.
- Generic quantitative risk assessment (GQRA) for human health and controlled waters on a site wide basis together with additional assessment of building structures within the planning area.
- Details of the analytical suite and field methodologies are presented in *Annex B*.

ERM 2013 Investigation: Sampling Locations



Environmental Site Setting

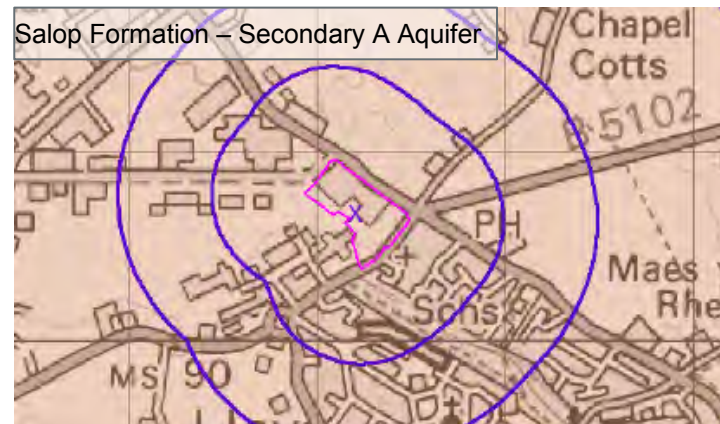


Geology

- Regional British Geological Survey mapping indicates that the site is underlain by superficial glacial deposits, namely Till (*Annex A*).
- The solid geology underlying the site comprises the Salop Formation described as a mudstone and sandstone conglomerate.
- The geology encountered during the ERM intrusive investigation is summarised below and detailed in the borehole logs presented in *Annex C*.
- **Made Ground:**
 - Made Ground generally consists of a light brown sandy gravel with clay becoming evident within the matrix with depth and commonly comprising a mix of coal, ash, reinforcing bar (southern part of the site) and rootlets (northern part of the site).
 - The thickness of Made Ground beneath the site generally increases from south to north with 5.2m of Made Ground identified at borehole ERMBH1 beneath the southern part of the site to 0.5m at borehole ERMBH13 beneath the northern part of the site. Albeit the well identifying the thickest layer of Made Ground was also topographically the highest location on the raised car parking area.
 - The Made Ground identified as being the least thick was noted in all three boreholes (ERMBH11, ERMBH12 and ERMBH13) within the northern part of the site ranging from 0.5m to 0.98m.
 - The Made Ground is considered to be typically colliery spoil from the former on-site and off-site colliery works.
- **Till:**
 - This Formation typically comprises light brown slightly silty clay with interbedded sand or gravel horizons.
 - The presence of this Formation was proven up to a depth of 12.0m bgl.
- The underlying Salop Formation bedrock was not encountered during site works.

Hydrogeology

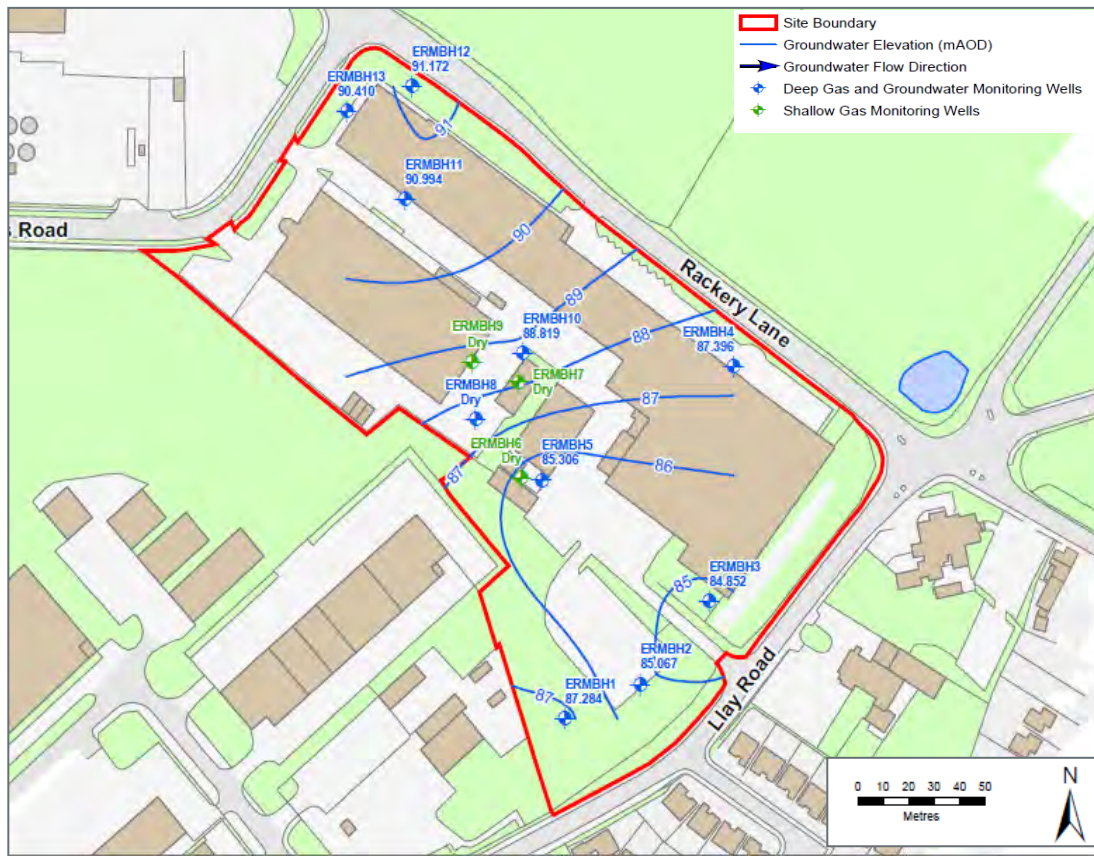
- The superficial glacial Till deposit is classified as 'unproductive strata' - representing deposits that may contain water but are low permeability with negligible significance to water supply.
- The underlying Salop Formation is classified as a Secondary A aquifer – representing deposits that are capable of supporting water supplies at a local rather than strategic scale.
- The Envirocheck Report (Annex A) identified one groundwater abstraction license within a 1km radius of the site. This abstraction is held by Tarmac Topmix Ltd located approximately 720m to the north of the site for process washing.
- Groundwater was encountered at depths between 1.48 and 8.20m bgl (an elevation of between 92.47 and 93.27m AOD).
- Groundwater was present within the Till, although well ERMBH8 located on the raised storage and manufacturing area, installed to 12m depth within the Made Ground and the Till, was dry.
- The three shallow wells (ERMBH6, ERMBH7 and ERMBH9) installed to 2m bgl within the Made Ground were dry and no other wells identified perched water within the Made Ground during drilling.



Hydrogeology (2)

Based on data collected in July 2013 (tabulated in *Annex B*) a contour plot was constructed showing groundwater elevation within the Till (see below and *Figure 4*). The plot suggests:

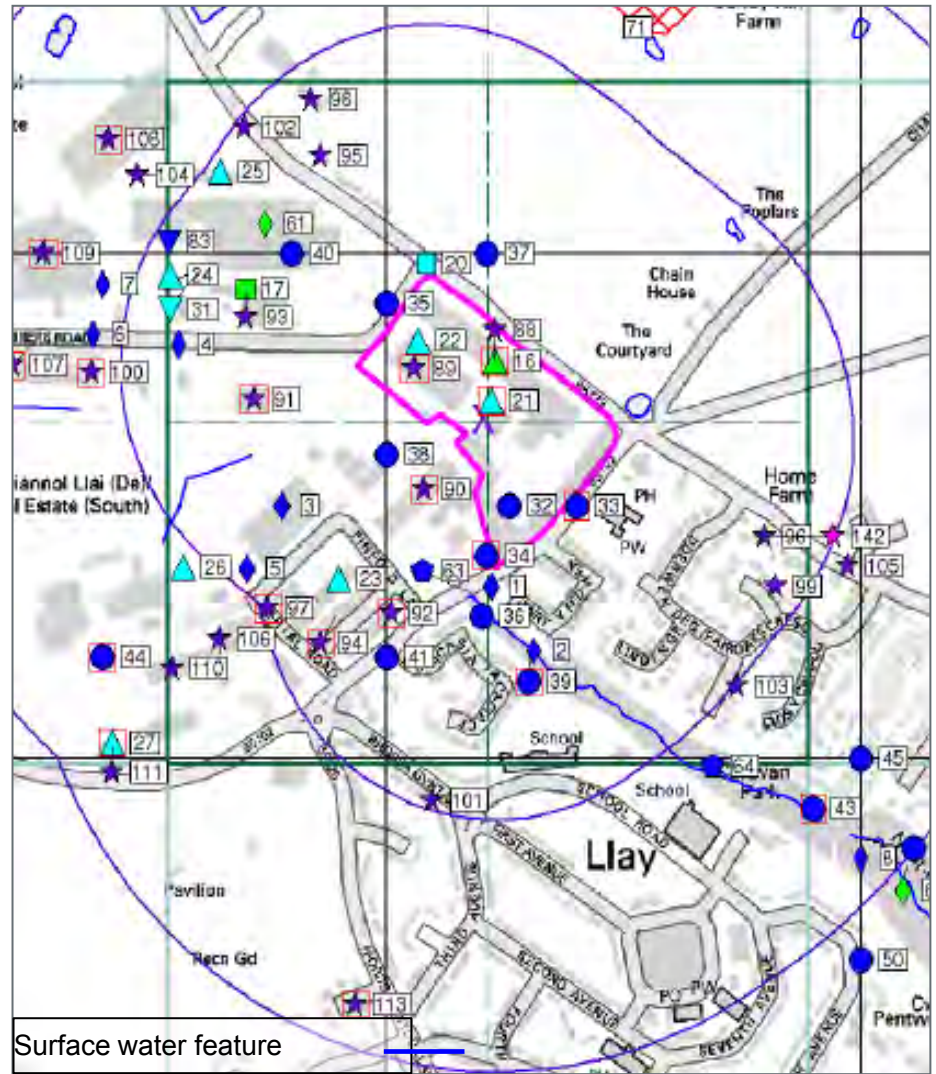
- Groundwater flow direction is from south to north-west under a hydraulic gradient of 0.029.
- Subsurface hydraulic conductivity is higher beneath the northern part of the site (groundwater elevation contours are more widely spaced).



- The southern part of the site is unpaved and precipitation would be direct to the Made Ground. The groundwater contour plot infers the presence of a recharge zone in this location.
- Beneath the central part of the site, which is covered with asphalt and concrete hardstanding recharge would likely be lower.
- Made Ground beneath the central part of the site appears to have a higher clay content, which could explain the absence of water in one well.

Hydrology

- There are no surface water features located on site.
- The nearest surface water feature (pond) is located approximately 20m to the east of the site.
- There are a number of streams within a 1km radius of the site. The nearest hydraulically downgradient surface water course is located approximately 890m to the north of the site.
- There are no surface water abstractions within 1km radius of the site.
- There is no Environment Agency classified river quality data available for review.
- The site is not located in an Environment Agency Indicative Floodplain area.
- For further information refer to Envirocheck data contained within *Annex A*.



Observations & Findings



Findings: Soil Quality

- Field observations and screening data is presented on the borehole logs in *Annex C*.
- A summary of the soil analytical data is provided in *Tables 1 to 6*.

VOCs

- Petroleum hydrocarbons including benzene, toluene, ethylbenzene, xylene (BTEX), isopropylbenzene, 1,2,4 – trimethylbenzene, 1,3,5 trimethylbenzene and naphthalene were detected at relatively low concentrations ranging from 0.004mg/kg to 0.473mg/kg, with these compounds identified in soil samples collected from all boreholes except locations ERMBH11, ERMBH12 and ERMBH13 (all located in the northern part of the site).
- Chlorinated solvents were also detected in several soil samples. Tetrachloroethene (PCE) was identified at relatively low concentrations in a sample collected from boreholes ERMBH3 (0.006mg/kg) and ERMBH5 (0.033 mg/kg), both localised to the central part of the site. TCE was also detected in nine of the 13 wells, with concentrations ranging from 0.005mg/kg (ERMBH7) to 2.197mg/kg (ERMBH5). ERMBH5 is located within the smaller planning area where fuels and various drums and IBCs of unknown liquids are stored.
- Relatively low concentration of chloromethane was also present and this compound was identified within three of the samples collected from locations all situated within the central part of the site. Concentrations ranged between 0.004mg/kg (ERMBH6) and 0.013mg/kg (ERMBH9).

SVOCs

- PAHs were identified in all soil samples with the exception of ERMBH12 and ERMBH13. Individual PAHs were typically detected at concentrations of <10mg/kg with the exception of a sample collected from ERMBH10 (located on the raised area utilised for storage and manufacturing), where the maximum concentration detected was circa 20mg/kg.
- Concentrations of phthalates ranged between 0.01mg/kg (ERMBH13) to 0.72mg/kg (ERMBH10).
- Dibenzofuran was identified in all wells except ERMBH12 and ERMBH13 at concentrations ranging from 0.016mg/kg (ERMBH12) to 0.87mg/kg (ERMBH9). In addition one localised detect of hexachlorobenzene was identified at relatively low concentrations in a sample collected from ERMBH10 (0.03mg/kg).
- ERMBH9 (0.22mg/kg) and ERMBH2 (0.033mg/kg) detected relatively low concentrations of phenols.

Findings: Soil Quality (2)

Metals

- Metals were identified above the laboratory mdl in all soil samples, with the following key detections:
 - Arsenic ranged between 7.9mg/kg (ERMBH13) and 34.1mg/kg (ERMBH2).
 - Chromium VI was detected in one location (ERMBH9) at a concentration of 1.1mg/kg.
 - Lead concentrations ranged between 14mg/kg (ERMBH13) and 54mg/kg (ERMBH5).
 - Mercury was detected in four of the 13 samples collected with concentrations ranging from 0.1mg/kg (ERMBH1,ERMBH2 and ERMBH7) to 0.2mg/kg (ERMBH6).

Total Petroleum Hydrocarbons (TPH)

- Concentrations of aliphatic and aromatic hydrocarbons were recorded in five of the six samples collected (ERMBH5 - ERMBH7, ERMBH9 and ERMBH10). The aliphatic concentrations ranged from 0.3mg/kg (ERMBH9) to 55 mg/kg (ERMBH10) and the aromatic concentrations ranged from 0.1mg/kg (ERMBH9) to 956mg/kg (ERMBH5).
- Overall the results indicate that greater concentrations of aromatic hydrocarbons are present in carbon bands C16 – C35.

Inorganic Compounds

- Sulphate was detected in all six soil samples collected ranging between 1,303mg/kg (ERMBH10) and 10,480mg/kg (ERMBH9).
- Total and free cyanide were below the laboratory mdl in all 13 samples collected.
- Results for pH identified a range between 7.59 to 8.01 with the exception ERMBH9 which recorded a relatively acidic pH of 4.46.

Asbestos Fibres

- Chrysotile asbestos fibres were identified in samples collected from ERMBH1 and ERMBH3 located along the south-eastern boundary of the site and ERMBH10 located within the central part of the site on the raised storage and manufacturing area.

Findings: Groundwater Quality

- A summary of the field results are given in *Annex B*.
- The field parameters taken when sampling identified:
 - Dissolved Oxygen ranged from 3.5% (ERMBH11) to 40.2% (ERMBH2).
 - Oxidation/reduction potential was positive in all but one sample and ranged from 34.0 (ERMBH2) to 154.6mV (ERMBH4). A negative ORP was recorded in ERMBH5 (-45.2mV).
 - pH ranged from 5.41 (ERMBH1) to 7.14 (ERMBH11).
- A summary of the groundwater analytical data is provided in *Tables 7 to 10*.
 - Groundwater results identified that all VOCs and SVOCs were below the laboratory mdl, with the exception of one groundwater sample (ERMBH11) which identified a trace detection of TCE (0.004mg/l) within the central part of the site.
 - A number of metals were detected within wells ERMBH1-ERMBH3, ERMBH5, ERMBH10, and ERMBH13. The most detections of the greatest magnitude were identified within ERMBH1 where nickel (1.34mg/l), zinc (1.29mg/l), cadmium (0.1159mg/l), chromium III (0.095mg/l) and lead (0.076mg/l) were detected.
 - Sulphate was detected in both samples analysed with concentrations 761.36mg/l (ERMBH5) and 94.93mg/l (ERMBH10) identified.
 - Total hardness in the four samples analysed ranged between 639mg/l (ERMBH10) and 3,983mg/l (ERMBH1).

Findings: Summary

Soil

- Detections of several organic and inorganic compounds were identified across the site within soil samples collected from the Made Ground.
- The highest concentrations of VOCs was detected within a soil sample collected from borehole ERMBH10, located on a raised area within the central part of the site.
- VOC detections were identified across all but the northern part of the site, generally with the higher detections located within the central part of the site.

Groundwater

- No detections of VOCs were identified with the exception of a trace TCE detection in a sample taken beneath the northern end of the site near to Plant 1, an area which is reported to store IBCs containing chlorinated solvents.
- Metals were detected at the greatest magnitude and range of compounds in two samples collected from the southern part of the site on the unpaved raised car park area. These may be a result of leaching of Made Ground (colliery spoil) recorded in this area.

Soil Gas Monitoring

- Full gas measurements are provided in *Annex B*.
- Two rounds of gas monitoring using all accessible locations installed were completed on 24 July and 23 August 2013.
- Barometric pressure ranged increased during the July monitoring event (1002 to 1004mb) and was static (1000mb) during the August monitoring round.
- The majority of the newly installed wells were screened across the water table and in this case the gas measurement taken is likely to represent a combination of the soil gas and gas emanating from the groundwater. However, at some locations the wells were dry (ERMBH6, ERMBH7, ERMBH8 and ERMBH9) therefore only soil gas measurements would have been recorded.

The results showed:

- Methane concentrations were recorded to be <0.1% (v/v) in the July and August monitoring events.
- Average carbon dioxide concentrations ranged between 0.4 (ERMBH9) and 16.0% (v/v) (ERMBH1).
- Flow rates were low and recorded to be either <0.1l/hr or 0.1l/hr during both monitoring rounds.

Conceptual Site Model



Overview of Conceptual Site Model

- The CSM has been developed in accordance with industry good practice.
- It is based on the source-pathway-receptor contaminant linkage model drawing on the findings of previous studies and the current ERM site investigation.
- It has been developed to inform the quantitative risk assessment that follows.

Potential Sources (Primary)

Historical Use

- The site historically contained ground workings associated within the Llay Main colliery. Leaching of coillery spoil could cause the observed heavy metal impact, acidic conditions and/or release and displacement of accumulated ground gas.
- Information provided within the RPS 2005 report indicated that historically two underground storage tanks (contents unknown) were present within the south-eastern part of the site. These were decommissioned in 1998, although no records are available.

Current Use

- The site activities currently involve the production of aluminium and titanium parts for the aerospace industry. The aluminium and titanium are processed from blocks and sheets using water soluble fluids for cutting and producing a considerable amount of swarf that was identified across the entire site.
- Information provided within the RPS 2005 report identified the presence of a 154 litre TCE above ground storage tank located within Plant 1, an anodic and wash tank farm located below ground level in Plant 2 and numerous containers across the site holding acids, surface coatings for plating and paint spraying and chlorinated solvents.
- The report identifies that the location of the potential contaminants mentioned were situated on hard standing, the anodic and wash tank farm are brick bunded and the TCE is stored within a double bund. Since early 2012, no chlorinated solvents have been stored on site.

Potential Sources (Secondary)

Evidence of impact identified from current investigations:

- Petroleum hydrocarbons detected within the northern and central parts of the site;
- Localised PCE within the central part of the site;
- TCE identified across the central part of the site and localised beneath the raised car parking area to the north of the site;
- PAHs identified across the majority of the site;
- Phthalates identified within the northern part of the site;
- Localised phenols identified within the central part of the site and within the northern part of the site;
- Detections of heavy metals were identified across the site, although the higher concentrations were identified within the northern part of the site; and
- TPH detected within the central part of the site.

Potential Receptors

Human Health

- Current and future site occupiers
- Current off-site residential land users
- Below ground maintenance workers

Controlled Waters

- Groundwater
- Surface Water

Property

- On-site property and underground services/structures

Potential Contaminant Linkages (1)

Human Health

■ Future on-site occupiers

- The purpose of the assessment is to evaluate the potential risks under continued commercial operation, including focus upon the proposed new development areas.
- As such all plausible pathways have been considered (i.e., direct contact, ingestion and inhalation of potentially impacted soils and groundwater), and the associated dusts, vapours and soil gases, both indoors and outdoors.

■ Off-site Neighbours

- Residential properties are located predominantly to the south and south-east of the site, but are topographically lower than the site. It is therefore considered that a significant lateral migration pathway would not be present for ground gas migration within the unsaturated zone. Vapour risk from migration of groundwater off-site is also considered to be limited, given groundwater flow direction is away from the residential properties and the absence of significant dissolved phase VOCs.

■ Below-ground maintenance workers

- Direct contact, ingestion and inhalation of potentially impacted soils (including asbestos) and groundwater, and associated dusts, vapours and soil gases.
- Exposures of less than one year are likely to be driven by acute exposure factors and chronic criteria are likely to be over-conservative for this scenario. Therefore, protection through control of exposure as Health & Safety working requirements is considered to be more pertinent than through quantitative assessment of long-term chronic exposure and subsequent remediation.

Potential Contaminant Linkages (2)

Controlled Waters

■ Groundwater

- **Discounted as a receptor:** Whilst there is some heavy metal impact and localised dissolved phase VOCs within the underlying Till, this Formation has been classified as 'unproductive strata' and therefore is low yielding. Also, the nearest groundwater abstractions is located 720m to the north and is licensed to abstract 50m³/day and 12,500m³/year, which given the low yield of the Till observed it is likely that this abstraction is drawing water from the underlying Salop Formation classified as a Secondary A aquifer with a higher yield and not from the Till. Therefore, groundwater is not considered to be significant in terms of a current or potential future water resource.

■ Unnamed Streams (off-site)

- **Discounted as a receptor :** The nearest stream is located approximately 150m to the south, however given that this is up gradient to the groundwater flow the risk of impact is considered unlikely. Furthermore the nearest stream down gradient from the site is located at considerably distance (890m to the north).

■ On-site Property and Underground Services/Structures

- Attack on below ground structures (e.g. building foundations or pipes by aggressive chemicals in soil); perched groundwater and/or free phase, (e.g. sulphate and organic compounds).
- Methane and carbon dioxide generated through degradation of organic compounds can build up in confined spaces within buildings. Can pose explosive/asphyxiant risk under certain extreme weather conditions.

Plausible Contaminant Linkages

Potential Contaminant	Pathway	Receptor	Comment
All contaminants	Dermal contact, inhalation and ingestion of surface soil particles and asbestos fibres.	Current and future site users (commercial)	Site largely covered by hard standing. Grassed area with some trees and shrubs along the north-western, northern and south-eastern perimeter , 'soft' Made Ground in the raised car parking area
	Dermal contact, inhalation and ingestion of surface soil particles and asbestos fibres.	Groundworkers during maintenance or development work	Short duration and frequency exposure likely to be acute. Commercial chronic assessment will be protective. Protection through H&S controls during works.
Volatile compounds	Inhalation of vapours from soils and groundwater (indoor and outdoor).	Current and future site users (commercial)	Conservative given that the majority of buildings are large open warehouses where the risk of vapours would be reduced
	Wind-blown migration of vapours (outdoors)	Current and future site users (commercial)	Large dilution in outdoors areas
	Lateral migration of groundwater through ground or service trenches, and subsequent inhalation of vapours (indoor and outdoor).	Current and future site users (commercial)	Conservative given that the majority of buildings are large open warehouses where the risk of vapours would be reduced
	Inhalation of vapours from soils and groundwater (outdoor)	Groundworkers during maintenance or development work	Short duration and frequency exposure likely to be acute. Commercial chronic assessment will be protective. Protection through H&S controls during works.
Corrosive substances	Contact with below ground structures.	Below ground structures and services	Localised potential impact
Soil gas	Explosive / asphyxiant risk	Current and future site users (commercial)	Conservative given that the majority of buildings are large open warehouses where the risk of gas would be reduced.
Asbestos	Inhalation	Ground workers during maintenance or development work	Cement based asbestos was present in localised areas of the site at a depth of 1.0m bgl. This is unlikely to present a significant risk in its current state. However it should be noted that samples ERM BH 1 and ERM BH10 are present within the proposed redevelopment area and appropriate PPE should be worn during these works.

Generic Quantitative Risk Assessment



GQRA Introduction

- This generic quantitative risk assessment (GQRA) is undertaken in accordance with the UK's 'suitable for use' approach following a tiered framework as outlined in CLR11 and DETR 2000.
- Undertaken on current 2013 data only, although findings of previous reports discussed where relevant.

* - Defra & Environment Agency 'Model Procedures for the Management of Land Contamination', CLR11. 2004.
- DETR 'Guidelines for Environmental Risk Assessment and Management'. 2000.

Human Health Risk Assessment



Human Health: Assessment Rationale

- Conducted following the UK CLEA framework. ERM considers that the future potential human receptor exposure frequencies and durations are such that the CLEA generic landuse criteria are applicable or suitably conservative.
- As no published Soil Guideline Values (SGVs) currently exist, ERM has used in-house derived Generic Assessment Criteria (GACs) based upon the guidance laid down by the EA. The exception is petroleum hydrocarbons where some fractions must be assessed as mixtures and so a Hazard Index (HI) approach is used for this parameter. The details of the basis for all derivations are presented in *Annex D*.
- The risks to human health have been evaluated as follows:
 - Given that the site is currently operational for commercial use and the proposed development on site will also be for commercial use in this generic QRA, all results have been analysed against assessment criteria for a commercial end use.
 - Surrounding land uses are utilised for industrial activities to the east and north and residential land uses to the south, south-east and south-west. The above scenario is considered to be protective of the industrial off-site land uses. With regard to the residential properties, as discussed earlier in the report, the properties are up gradient of the groundwater flow and at a lower topographic elevation to the site which reduces the risk of ground gas or vapour migration, and to compare the results to a more conservative criteria would not be required.

Human Health: QRA Results

- A summary of the soil GQRA is presented in *Tables 11 to 14*.
- An assessment of groundwater data is given in *Table 15*.
- Under a commercial land use scenario there were no exceedances of the GAC identified from any of the soil or groundwater samples analysed, therefore there is no risk predicted from the identified impact.

Other Assessments



Ground Gas Risk Assessment

- Full monitoring results are presented in Annex B.
- Risk assessment following CIRIA C665 guidance for commercial use identified the site to be determined as a Characteristic Situation (CS) 2 ('low risk'). The guidance recommends the use of gas protection measures such as appropriate floor slabs and/or gas resistant membranes.
- In regards to the off-site residential land use a risk assessment following the NHBC report which is mainly applicable to low rise residential housing has been undertaken. The worst case scenario Gas Screening Values (GSVs) were determined using the highest flow rate, carbon dioxide and methane concentrations recorded across the site on each monitoring round:

	Maximum CO ₂ (%)	Maximum CH ₄ (%)	Maximum Flow Rate (lhr ⁻¹)	GSV CO ₂ (lhr ⁻¹)	GSV CH ₄ (lhr ⁻¹)	Risk Classification
Round 1 - 24 July						
Wells 1-13	12.0	0.1	0.1	0.012	0.0001	Green/low risk
Round 2 – 23 August					0	
Wells 1-13	16.0	0.1	0.1	0.016	0.0001	Green/low risk

- The developers should take into account during the design stage that under the CIRIA C665 guidance the site is a CS 2 and should be considered for the appropriate gas protection measures.
- The assessment is preliminary – the guidance is designed for multiple sampling events at least some of which should be undertaken during falling barometric conditions.
- However, given the absence of landfilled putrescible material and the relatively low flow rates measured to date, it is not considered likely that gross soil gases will be generated at the site.

Property Effects

- Semi-quantitative assessment undertaken consistent with the guidance contained in EA R&D Technical Report P331, supplemented by BRE 1:2005 and UKWIR:2010.
- Assessment focussed on risk of corrosion to the long term durability of building material particularly concrete and the risk to conventional water supply pipes including effects on drinking water quality.
- **Concrete**
 - Design Sulphate Class (DSC). Water soluble sulphate was ranged from 94.9mg/l to 761mg/l classifying sulphate as DS2.
 - The available data indicates that potentially aggressive ground conditions exist in the Central part of the site in the proposed planning areas, and in the event of development, further consideration and/or specialist concrete materials should be present for developments in this part of the site.
- **Water supply pipes**
 - The available analytical data collected from soils indicates that there is potential for plastic water supply pipes to be affected by chemicals in the ground, including VOCs and PAHs within the central part of the site.
 - Suitable protection measures are likely to include selection of suitable pipe materials for future installations, and the provision of a 'sterile' trench to prevent contact with impacted soils and groundwater.

Summary and Recommendations



Summary Findings (1)

- The site is currently operational and is used for the manufacturing of aerospace components. The site formerly supported ground workings associated with the Llay Main Colliery which extended to the east of the site. The land was then developed and used for industrial processes and previously included two underground storage tanks which were reportedly removed in 1998.
- The site is situated in a mixed use area, with residential properties located at a lower elevation to the south, south-east and south-west of the site, agricultural land to the north of the site and the remainder comprising industrial buildings.
- ERM understands that Magellan Aerospace plan to expand on the site and the ground investigation is to support discharge of the contaminated land planning condition attached to the planning application.
- ERM has reviewed the findings of previous site investigations and given the information reviewed and the requirements of Wrexham County Borough Council (WCRC), ERM recommended the re-establishment of the original groundwater monitoring network installed in 2001 to allow comparative groundwater analysis to be undertaken and to provide a full up to date data set for a risk assessment to be completed in line with WCBCs requirements to support the planning application.

Summary Findings (2)

Geology

- The site is underlain by Made Ground comprising variable sandy gravel, coal, ash, reinforced bar and rootlets. It reaches a thickness of up to 5.2m in the central area of the site, on the raised area utilised for storage and manufacturing. Given the raised areas on site and the change in elevation the thickness of the Made Ground varies from 0.5m to 5.2m, increasing in thickness from south to north.
- The Made Ground is underlain by Glacial Till, comprising a silty clay with interbedded sandstone and gravel horizons was evident to the base of the installed wells, the deepest well was installed to 12.0m bgl.
- Underlying the Till is the Salop Formation described as a mudstone and sandstone conglomerate, the bedrock was not encountered during this investigation.

Hydrogeology and Hydrology

- The Till is classified as 'unproductive strata' and the nearest licenced groundwater abstractions is located 720m to the north, although given the quantity licensed to abstract, the Till is considered to be too low yielding and therefore is expected to abstract from the underlying Salop Formation which is classed as a Secondary A Aquifer.

Summary Findings (3)

Hydrogeology and Hydrology (continued)

- Groundwater was encountered mainly within the Till, with groundwater flow direction. The hydraulic conductivity of saturated deposits within this formation is relatively low, with groundwater flow direction towards the north-west.
- The nearest hydraulically downgradient surface water course is located approximately 890m to the north of the site.

Soil and Groundwater Quality

- Detections of several organic and inorganic compounds were identified across the site within soil samples collected from the Made Ground, but none of these exceeded the generic assessment criteria for commercial land use.
- In groundwater there were no detections of VOCs with the exception of a trace of TCE within northern end of the site.
- Identified concentrations of metals may be related to the presence of Made Ground (colliery spoil) underlying the site.
- Chrysotile asbestos fibre were identified within the Made Ground within ERMBH1 and ERMBH3 located along the south-eastern boundary of the site and ERMBH10 located on the raised central part of the site.

Conclusions

- Following the identification of plausible exposure pathways and assessment of soil and groundwater impact no risks are predicted to human health, assuming on-going commercial use of the site.
- From the gas monitoring data acquired to date under CIRIA C665 guidance the site was classified as a low risk CS 2. Under NHBC guidance which is mainly for the adjacent residential housing the site was classified as a Green Characteristic Gas Situation.
- No significant source-pathway-receptor linkages were identified with respect to ecological receptors. The limited groundwater impact identified at the site is therefore not considered to pose a significant risk.
- Based on the above a detailed QRA and/or remedial measures are not likely to be required in order to undertake the proposed redevelopment, although appropriate PPE should be used as appropriate during these works.
- The results above indicate that the planning conditions attached to the application for the proposed Extension A, B and the extended car park can be discharged.

Tables



Table 1: Soil Analytical Results - VOCs

Location Sample Depth (m bgl) Sample Date		ERM BH1	ERM BH2	ERM BH3	ERM BH4	ERM BH5	ERM BH6	ERM BH7	ERM BH8	ERM BH9	ERM BH10	ERM BH11	ERM BH12	ERM BH13
		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
		17/07/2013	22/07/2013	19/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	18/07/2013	18/07/2013	22/07/2013	18/07/2013	18/07/2013
Analyte	Unit													
VOCs														
Benzene	mg/kg	0.005	15	0.022	0.003	0.009	0.004	0.005	0.007	0.098	0.007	<3	<0.003	<0.003
Toluene	mg/kg	0.016	25	0.073	0.009	0.021	0.014	0.016	0.035	0.362	0.016			
Ethylbenzene	mg/kg	<0.003	5	0.01	<0.003	0.005	<0.003	<0.003	0.005	0.036	0.005	<3	<0.003	<0.003
p/m-Xylene	mg/kg	0.019	26	0.078	0.01	0.02	0.015	0.016	0.035	0.255	0.018	<6	<0.006	<0.006
o-Xylene	mg/kg	0.008	10	0.035	0.005	0.008	0.007	0.008	0.013	0.102	0.008	<3	<0.003	<0.003
Tetrachloroethene (PCE)	mg/kg	<0.003	<3	0.006	<0.003	0.033	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
Trichloroethene (TCE)	mg/kg	0.362	<3	0.369	0.31	2.917	0.01	0.005	0.019	0.009	0.014	<3	<0.003	<0.003
1,1-Dichloroethene (1,1 DCE)	mg/kg	<0.006	<6	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<6	<0.006	<0.006
cis-1-2-Dichloroethene	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
trans-1-2-Dichloroethene	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
Vinyl Chloride	mg/kg	<0.002	<2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<2	<0.002	<0.002
1,1,1,2-Tetrachloroethane	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
1,1,2,2-Tetrachloroethane	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
1,1,1-Trichloroethane	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
1,1,2-Trichloroethane	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
1,1-Dichloroethane	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
1,2-Dichloroethane	mg/kg	<0.004	<4	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<4	<0.004	<0.004
Chloroethane	mg/kg	<0.002	<2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<2	<0.002	<0.002
1,2,3-Trichlorobenzene	mg/kg	<0.007	<7	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<7	<0.007	<0.007
1,2,4-Trichlorobenzene	mg/kg	<0.007	<7	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<7	<0.007	<0.007
1,2-Dichlorobenzene	mg/kg	<0.004	<4	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<4	<0.004	<0.004
1,3-Dichlorobenzene	mg/kg	<0.004	<4	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<4	<0.004	<0.004
1,4-Dichlorobenzene	mg/kg	<0.004	<4	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<4	<0.004	<0.004
Chlorobenzene	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
Carbon tetrachloride	mg/kg	<0.004	<4	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<4	<0.004	<0.004
Chloroform	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
Dichloromethane (DCM)	mg/kg	<0.007	<7	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<7	<0.007	<0.007
Chloromethane	mg/kg	<0.003	<3	<0.003	<0.003	0.005	0.004	<0.003	<0.003	0.013	<0.003	<3	<0.003	<0.003
1,2,3-Trichloropropane	mg/kg	<0.004	<4	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<4	<0.004	<0.004
1,2-Dichloropropane	mg/kg	<0.006	<6	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<6	<0.006	<0.006
2,2-Dichloropropane	mg/kg	<0.004	<4	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<4	<0.004	<0.004
1,3-Dichloropropane	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
1,1-Dichloropropene	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
cis-1-3-Dichloropropene	mg/kg	<0.004	<4	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<4	<0.004	<0.004
trans-1-3-Dichloropropene	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
Bromobenzene	mg/kg	<0.002	<2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<2	<0.002	<0.002
Bromochloromethane	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
Bromodichloromethane	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
Bromoform	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
Bromomethane	mg/kg	<0.001	<1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<1	<0.001	<0.001
n-Butylbenzene	mg/kg	<0.004	<4	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<4	<0.004	<0.004
sec-Butylbenzene	mg/kg	<0.004	<4	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<4	<0.004	<0.004
tert-Butylbenzene	mg/kg	<0.005	<5	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<5	<0.005	<0.005
2-Chlorotoluene	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
4-Chlorotoluene	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
Isopropylbenzene	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.005	<0.003	<3	<0.003	<0.003
1,2-Dibromo-3-chloropropane	mg/kg	<0.004	<4	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<4	<0.004	<0.004
Dibromochloromethane	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
1,2-Dibromoethane	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
Dibromomethane	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
Dichlorodifluoromethane	mg/kg	<0.002	<2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<2	<0.002	<0.002
4-Isopropyltoluene	mg/kg	<0.004	<4	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<4	<0.004	<0.004
Propylbenzene	mg/kg	<0.004	<4	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<4	<0.004	<0.004
Styrene	mg/kg	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
Trichlorofluoromethane	mg/kg	<0.002	<2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<2	<0.002	<0.002
1,2,4-Trimethylbenzene	mg/kg	0.023	<6	0.023	<0.006	<0.006	<0.006	<0.006	0.01	0.048	<0.006	<6	<0.006	<0.006
1,3,5-Trimethylbenzene	mg/kg	0.008	<3	0.008	<0.003	<0.003	<0.003	<0.003	0.004	0.021	<0.003	<3	<0.003	<0.003
Methyl Tertiary Butyl Ether	mg/kg	<0.002	<2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<2	<0.002	<0.002
Hexachlorobutadiene	mg/kg	<0.004	<4	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<4	<0.004	<0.004
Naphthalene	mg/kg	<0.027	<27	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	0.473	<27	<0.027	<0.027

Key

above limit of detection	above limit of detection
mg/kg	milligrams per kilogram
mbgl	metres below ground level

Sample analysis carried out by Jones Environmental Laboratory

Table 2: Soil Analytical Results - TOC

Location	Unit	ERM BH1	ERM BH2	ERM BH3	ERM BH4	ERM BH5	ERM BH6	ERM BH7	ERM BH8	ERM BH9	ERM BH10	ERM BH11	ERM BH12	ERM BH13
Sample Depth (m bgl)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sample Date		17/07/2013	22/07/2013	19/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	18/07/2013	18/07/2013	22/07/2013	18/07/2013	18/07/2013
Total Organic Carbon (TOC)	%	NDP	14.19	NDP	10.13	12.90	16.09	8.46	13.64	16.82	NDP	1.38	0.91	0.39

Key

- above limit of detection

above limit of detection
- %

percentage
- mbgl

metres below ground level
- NDP

No Determination Possible (due to absestos presence)
- Sample analysis carried out by Jones Environmental Laboratory

Table 3: Soil Analytical Results - SVOCs

Location Sample Depth (m bgl) Sample Date	Unit	ERM BH1	ERM BH2	ERM BH3	ERM BH4	ERM BH5	ERM BH6	ERM BH7	ERM BH8	ERM BH9	ERM BH10	ERM BH11	ERM BH12	ERM BH13
		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
		17/07/2013	22/07/2013	19/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	18/07/2013	18/07/2013	22/07/2013	18/07/2013	18/07/2013
Analyte	Units													
SVOCs														
4-Chloro-3-methylphenol	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
2-Chlorophenol	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
2-Methylphenol	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.22	<0.01	<10	<0.01	<0.01
4-Methylphenol	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.11	<0.01	<10	<0.01	<0.01
2,4-Dichlorophenol	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
2,4-Dimethylphenol	mg/kg	<0.01	33	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
2-Nitrophenol	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
4-Nitrophenol	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Pentachlorophenol	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Phenol	mg/kg	<0.01	36	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
2,4,5-Trichlorophenol	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
2,4,6-Trichlorophenol	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
PAHs														
Acenaphthene	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	1.37	<10	<0.01	<0.01
Acenaphthylene	mg/kg	0.02	<10	0.07	0.04	<0.01	0.07	0.02	<0.01	0.07	0.81	<10	<0.01	<0.01
Anthracene	mg/kg	0.09	37	0.07	0.08	0.08	0.1	0.07	0.07	0.09	3.14	<10	<0.01	<0.01
Benzo(a)anthracene	mg/kg	0.23	<10	0.09	0.19	0.08	0.17	0.06	0.06	0.12	8.58	<10	<0.01	<0.01
Benzo(bk)fluoranthene	mg/kg	0.51	21	0.09	0.25	0.14	0.14	0.15	0.08	0.17	16.64	<10	<0.01	<0.01
Benzo(a)pyrene	mg/kg	0.21	23	0.04	0.09	0.06	0.05	0.12	0.02	0.06	9.6	<10	<0.01	<0.01
Benzo(ghi)perylene	mg/kg	0.23	<10	0.07	0.11	0.08	0.11	0.08	0.09	0.29	6.04	<10	<0.01	<0.01
2-Chloronaphthalene	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Chrysene	mg/kg	0.44	188	0.2	0.19	0.16	0.29	0.14	0.14	0.3	9.21	<10	<0.01	<0.01
Dibenzo(ah)anthracene	mg/kg	0.05	<10	0.01	0.03	0.01	0.02	0.02	<0.01	0.03	1.9	<10	<0.01	<0.01
Fluoranthene	mg/kg	0.56	116	0.11	0.23	0.13	0.17	0.12	0.07	0.16	20.06	<10	<0.01	<0.01
Fluorene	mg/kg	<0.01	32	<0.01	0.02	0.02	<0.01	<0.01	0.02	0.13	0.82	<10	<0.01	<0.01
Indeno(123cd)pyrene	mg/kg	0.12	<10	0.02	0.05	0.03	0.02	0.03	<0.01	0.03	4.95	<10	<0.01	<0.01
2-Methylnaphthalene	mg/kg	1.4	2821	2.88	1.52	1.26	3.49	0.87	1.47	3.95	0.33	65	<0.01	<0.01
Naphthalene	mg/kg	1.15	2429	2.12	1.2	1.02	2.5	0.75	1.24	3.66	0.58	53	<0.01	<0.01
Phenanthrene	mg/kg	0.69	870	0.87	0.5	0.48	1.29	0.48	0.52	1.63	6.72	28	<0.01	<0.01
Pyrene	mg/kg	0.57	93	0.13	0.24	0.16	0.22	0.15	0.1	0.2	19.03	<10	<0.01	<0.01
Phthalates														
Bis(2-ethylhexyl) phthalate	mg/kg	0.04	<10	0.04	0.04	0.12	0.02	0.08	0.02	0.06	0.72	<10	0.03	<0.01
Butylbenzyl phthalate	mg/kg	0.04	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Diethyl phthalate	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Dimethyl phthalate	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Di-n-butyl phthalate	mg/kg	0.04	22	0.02	<0.01	0.04	<0.01	<0.01	<0.01	0.03	0.06	23	<0.01	<0.01
Di-n-Octyl phthalate	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Amines														
N-nitrosodi-n-propylamine	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Anilines														
4-Chloroaniline	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
2-Nitroaniline	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
3-Nitroaniline	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
4-Nitroaniline	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Other SVOCs														
Azobenzene	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Bis(2-chloroethoxy)methane	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Carbazole	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Dibenzofuran	mg/kg	0.34	783	0.64	0.32	0.3	0.76	0.27	0.37	0.87	0.28	16	<0.01	<0.01
2,4-Dinitrotoluene	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
2,6-Dinitrotoluene	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Hexachlorobutadiene	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Hexachlorocyclopentadiene	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Isophorone	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Nitrobenzene	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Bis(2-chloroethyl)ether	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	0.01
4-Bromophenylphenylether	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
4-Chlorophenylphenylether	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
Hexachloroethane	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	<10	<0.01	<0.01
Hexachlorobenzene	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
1,2,4-Trichlorobenzene	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
1,2-Dichlorobenzene	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
1,3-Dichlorobenzene	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01
1,4-Dichlorobenzene	mg/kg	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01	<0.01

Key

above limit of detection	above limit of detection
mg/kg	milligrams per kilogram
mbgl	metres below ground level

Sample analysis carried out by Jones Environmental Laboratory

Table 4: Soil Analytical Results - Metals

Location Sample Depth (m bgl) Sample Date	Unit	ERM BH1	ERM BH2	ERM BH3	ERM BH4	ERM BH5	ERM BH6	ERM BH7	ERM BH8	ERM BH9	ERM BH10	ERM BH11	ERM BH12	ERM BH13
		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
		17/07/2013	22/07/2013	19/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	18/07/2013	18/07/2013	22/07/2013	18/07/2013	18/07/2013
Arsenic	mg/kg	25.1	34.1	14.5	17.5	18.6	19.3	5.9	9.5	12.3	16.9	11.4	9.8	7.9
Cadmium	mg/kg	0.5	0.3	0.5	0.5	0.3	0.1	<0.1	0.2	<0.1	0.6	<0.1	<0.1	<0.1
Chromium	mg/kg	22.8	11.5	15.1	20.4	18.7	14.2	22.0	12.4	11.0	28.0	24.1	33.9	33.4
Hexavalent Chromium	mg/kg	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1.1	<0.3	<0.3	<0.3	<0.3
Copper	mg/kg	69	50	56	51	57	54	36	45	46	44	11	23	22
Lead	mg/kg	44	41	35	31	54	31	24	30	24	51	33	20	14
Mercury	mg/kg	0.1	0.1	<0.1	<0.1	<0.1	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	29.0	19.7	34.6	29.6	31.4	33.6	38.0	23.4	28.3	33.8	14.2	35.3	35.1
Selenium	mg/kg	<1	1	<1	<1	<1	1	<1	<1	2	<1	<1	<1	<1
Zinc	mg/kg	78	40	78	84	96	68	67	75	56	187	65	61	58

Key

above limit of detection	above limit of detection
mg/kg	milligrams per kilogram
mbgl	metres below ground level
na	not analysed
Sample analysis carried out by Jones Environmental Laboratory	

Table 5: Soil Analytical Results - TPH

Location	Units	ERM BH1	ERM BH2	ERM BH3	ERM BH4	ERM BH5	ERM BH6	ERM BH7	ERM BH8	ERM BH9	ERM BH10	ERM BH11	ERM BH12	ERM BH13
Sample Depth (m bgl)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sample Date		17/07/2013	22/07/2013	19/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	18/07/2013	18/07/2013	22/07/2013	18/07/2013	18/07/2013
Aliphatics														
>C5-C6	mg/kg	na	na	na	na	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	na	na	na
>C6-C8	mg/kg	na	na	na	na	0.5	<0.1	<0.1	<0.1	0.3	<0.1	na	na	na
>C8-C10	mg/kg	na	na	na	na	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	na	na	na
>C10-C12	mg/kg	na	na	na	na	<0.2	2.3	<0.2	<0.2	6.0	<1.2	na	na	na
>C12-C16	mg/kg	na	na	na	na	8	8	<4	<4	13	<24	na	na	na
>C16-C21	mg/kg	na	na	na	na	9	<7	<7	<7	<7	<42	na	na	na
>C21-C35	mg/kg	na	na	na	na	<7	<7	<7	<7	<7	55	na	na	na
Aromatics														
>C5-EC7	mg/kg	na	na	na	na	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	na	na	na
>EC7-EC8	mg/kg	na	na	na	na	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	na	na	na
>EC8-EC10	mg/kg	na	na	na	na	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	na	na	na
>EC10-EC12	mg/kg	na	na	na	na	1.5	2.5	1.9	<0.2	3.2	<1.2	na	na	na
>EC12-EC16	mg/kg	na	na	na	na	36	20	14	<4	13	<24	na	na	na
>EC16-EC21	mg/kg	na	na	na	na	350	39	29	<7	20	84	na	na	na
>EC21-EC35	mg/kg	na	na	na	na	956	86	74	<7	52	383	na	na	na

Key

above limit of detection

mg/kg

mbgl

na

Sample analysis carried out by Jones Environmental Laboratory

above limit of detection

miligrams per kilogram

metres below ground level

not analysed

Table 6: Soil Analytical Results - Traditionals

Location	Units	ERM BH1	ERM BH2	ERM BH3	ERM BH4	ERM BH5	ERM BH6	ERM BH7	ERM BH8	ERM BH9	ERM BH10	ERM BH11	ERM BH12	ERM BH13
Sample Depth (m bgl)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sample Date		17/07/2013	22/07/2013	19/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	18/07/2013	18/07/2013	22/07/2013	18/07/2013	18/07/2013
Total Sulphate	mg/kg	na	na	na	na	5439	6629	2947	2936	10480	1303	na	na	na
Total Phenols HPLC	mg/kg	na	na	na	na	<1.50	<1.50	<1.50	<0.15	<7.50	<1.50	na	na	na
Chloride	mg/kg	na	na	na	na	36	50	66	49	22	62	na	na	na
Free Cyanide	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Cyanide	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
pH	pH units	na	na	na	na	7.68	7.59	7.89	8.01	4.46	7.97	na	na	na
Asbestos		Chrysotile	NAD	Chrysotile	NAD	NAD	NAD	NAD	NAD	NAD	Chrysotile	NAD	NAD	NAD

Key

above limit of detection	above limit of detection
mg/kg	milligrams per kilogram
mbgl	metres below ground level
na	not analysed
NAD	No Absestos Detected
Sample analysis carried out by Jones Environmental Laboratory	

Table 7: Groundwater Analytical Results - VOCs

Location		ERM BH1	ERM BH2	ERM BH3	ERM BH4	ERM BH5	ERM BH10	ERM BH11	ERM BH12	ERM BH13
Sample Date		25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013
Analyte	Unit									
VOCs										
Benzene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Toluene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
p/m-Xylene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
o-Xylene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene (PCE)	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
Trichloroethene (TCE)	µg/l	<3	<3	<3	<3	<3	<3	4	<3	<3
1,1-Dichloroethene (1,1 DCE)	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
cis-1-2-Dichloroethene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
trans-1-2-Dichloroethene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
Vinyl Chloride	µg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1,1,2-Tetrachloroethane	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
1,1,2,2-Tetrachloroethane	µg/l	<4	<4	<4	<4	<4	<4	<4	<4	<4
1,1,1-Trichloroethane	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
1,1,2-Trichloroethane	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
1,1-Dichloroethane	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
1,2-Dichloroethane	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
Chloroethane	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
1,2,3-Trichlorobenzene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
1,2,4-Trichlorobenzene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
1,2-Dichlorobenzene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
1,3-Dichlorobenzene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
1,4-Dichlorobenzene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
Chlorobenzene	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
Carbon tetrachloride	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
Chloroform	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dichloromethane (DCM)	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
Chloromethane	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
1,2,3-Trichloropropane	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
1,2-Dichloropropane	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
2,2-Dichloropropane	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,3-Dichloropropane	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
1,1-Dichloropropene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
cis-1-3-Dichloropropene	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
trans-1-3-Dichloropropene	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
Bromobenzene	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
Bromochloromethane	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
Bromodichloromethane	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
Bromoform	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
Bromomethane	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
n-Butylbenzene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
sec-Butylbenzene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
tert-Butylbenzene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
2-Chlorotoluene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
4-Chlorotoluene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
Isopropylbenzene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
1,2-Dibromo-3-chloropropane	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dibromochloromethane	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
1,2-Dibromoethane	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dibromomethane	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
Dichlorodifluoromethane	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
4-Isopropyltoluene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
Propylbenzene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
Styrene	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2
Trichlorofluoromethane	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
1,2,4-Trimethylbenzene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
1,3,5-Trimethylbenzene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
Methyl Tertiary Butyl Ether	µg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hexachlorobutadiene	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
Naphthalene	µg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2

Key

above limit of detection

µg/l

Sample analysis carried out by Jones Environmental Laboratory

above limit of detection
micrograms per litre

Table 8: Groundwater Analytical Results - SVOCs

Location		ERM BH1	ERM BH2	ERM BH3	ERM BH4	ERM BH5	ERM BH10	ERM BH11	ERM BH12	ERM BH13
Sample Date		25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013
Analyte	Unit									
SVOCs										
4-Chloro-3-methylphenol	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-Chlorophenol	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
2-Methylphenol	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-Methylphenol	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4-Dichlorophenol	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-Dimethylphenol	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
2-Nitrophenol	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-Nitrophenol	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Pentachlorophenol	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Phenol	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
2,4,5-Trichlorophenol	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4,6-Trichlorophenol	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
PAHs										
Acenaphthene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acenaphthylene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)anthracene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(bk)fluoranthene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo(a)pyrene	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Benzo(ghi)perylene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-Chloronaphthalene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chrysene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenzo(ah)anthracene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(123cd)pyrene	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
2-Methylnaphthalene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenanthrene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phthalates										
Bis(2-ethylhexyl) phthalate	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Butylbenzyl phthalate	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Diethyl phthalate	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dimethyl phthalate	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Di-n-butyl phthalate	µg/l	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Di-n-Octyl phthalate	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Amines										
N-nitrosodi-n-propylamine	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Anilines										
4-Chloroaniline	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
2-Nitroaniline	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
3-Nitroaniline	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
4-Nitroaniline	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Other SVOCs										
Azobenzene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bis(2-chloroethoxy)methane	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Carbazole	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenzofuran	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-Dinitrotoluene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,6-Dinitrotoluene	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Hexachlorobutadiene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
Hexachlorocyclopentadiene	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Isophorone	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nitrobenzene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bis(2-chloroethyl)ether	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
4-Bromophenylphenylether	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
4-Chlorophenylphenylether	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
Hexachloroethane	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
Hexachlorobenzene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2,4-Trichlorobenzene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,2-Dichlorobenzene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,3-Dichlorobenzene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
1,4-Dichlorobenzene	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1

Key

µg/l micrograms per litre
Sample analysis carried out by Jones Environmental Laboratory

Table 9: Groundwater Analytical Results - Metals

Location		ERM BH1	ERM BH2	ERM BH3	ERM BH4	ERM BH5	ERM BH10	ERM BH11	ERM BH12	ERM BH13
Sample Date		25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013
Analyte	Unit									
Metals										
Arsenic	µg/l	<2.5	<2.5	<2.5	<2.5	<2.5	6.9	<2.5	<2.5	2.6
Cadmium	µg/l	115.9	6.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/l	94.7	9.7	<1.5	<1.5	<1.5	5.8	<1.5	<1.5	<1.5
Hexavalent Chromium	µg/l	<30	<30	<30	<30	<30	<30	<30	<30	<30
Total Dissolved Chromium III	µg/l	95	<30	<30	<30	<30	<30	<30	<30	<30
Copper	µg/l	<7	<7	<7	<7	<7	<7	<7	<7	<7
Lead	µg/l	76	<5	<5	<5	<5	<5	<5	<5	<5
Mercury	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1
Nickel	µg/l	1340	417	3	<2	<2	16	<2	<2	<2
Selenium	µg/l	<3	<3	<3	<3	<3	<3	<3	<3	<3
Zinc	µg/l	1288	228	<3	<3	5	12	<3	<3	13

Key

above limit of detection above limit of detection
 µg/l micrograms per litre
 Sample analysis carried out by Jones Environmental Laboratory

Table 10: Groundwater Analytical Results - Traditionals

Analyte	Location	Unit	ERM BH1	ERM BH2	ERM BH3	ERM BH4	ERM BH5	ERM BH10	ERM BH11	ERM BH12	ERM BH13
	Sample Date		25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013
Sulphate		µg/l	na	na	na	na	761360	94930	na	na	na
Total Hardness Dissolved (as CaCO3)		µg/l	3983000	na	na	na	1569000	639000	na	na	779000

Key

above limit of detection	above limit of detection
µg/l	micrograms per litre
na	not analysed
Sample analysis carried out by Jones Environmental Laboratory	

Table 11: Soil Analytical Results, Human Health Assessment- VOCs

Location Sample Depth (m bgl) Sample Date			ERM BH1	ERM BH2	ERM BH3	ERM BH4	ERM BH5	ERM BH6	ERM BH7	ERM BH8	ERM BH9	ERM BH10	ERM BH11	ERM BH12	ERM BH13
			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
			17/07/2013	22/07/2013	19/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	18/07/2013	18/07/2013	22/07/2013	18/07/2013	18/07/2013
Analyte	Unit	ERM GAC Commercial													
VOCs															
Benzene	mg/kg	28	0.005	15	0.022	0.003	0.009	0.004	0.005	0.007	0.098	0.007	<3	<0.003	<0.003
Toluene	mg/kg	419,194	0.016	25	0.073	0.009	0.021	0.014	0.016	0.035	0.362	0.016	<3	<0.003	<0.003
Ethylbenzene	mg/kg	184,722	<0.003	5	0.01	<0.003	0.005	<0.003	<0.003	0.005	0.036	0.005	<3	<0.003	<0.003
p/m-Xylene	mg/kg	305,338	0.019	26	0.078	0.01	0.02	0.015	0.016	0.035	0.255	0.018	<6	<0.006	<0.006
o-Xylene	mg/kg	314,550	0.008	10	0.035	0.005	0.008	0.007	0.008	0.013	0.102	0.008	<3	<0.003	<0.003
Tetrachloroethene (PCE)	mg/kg	164	<0.003	<3	0.006	<0.003	0.033	<0.003	<0.003	<0.003	<0.003	<0.003	<3	<0.003	<0.003
Trichloroethene (TCE)	mg/kg	12	0.362	<3	0.369	0.31	2.917	0.01	0.005	0.019	0.009	0.014	<3	<0.003	<0.003
Chloromethane	mg/kg	0.44	<0.003	<3	<0.003	<0.003	0.005	0.004	<0.003	<0.003	0.013	<0.003	<3	<0.003	<0.003
Isopropylbenzene	mg/kg	184,977	<0.003	<3	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.005	<0.003	<3	<0.003	<0.003
1,2,4-Trimethylbenzene	mg/kg	314	0.023	<6	0.023	<0.006	<0.006	<0.006	<0.006	0.01	0.048	<0.006	<6	<0.006	<0.006
1,3,5-Trimethylbenzene	mg/kg	213	0.008	<3	0.008	<0.003	<0.003	<0.003	<0.003	0.004	0.021	<0.003	<3	<0.003	<0.003
Naphthalene	mg/kg	31,046	<0.027	<27	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	0.473	<27	<0.027	<0.027

Key

above limit of detection

mg/kg

mbgl

Sample analysis carried out by Jones Environmental Laboratory

above limit of detection

milligrams per kilogram

metres below ground level

Table 12: Soil Analytical Results, Human Health Assessment - SVOCs

Location		ERM BH1	ERM BH2	ERM BH3	ERM BH4	ERM BH5	ERM BH6	ERM BH7	ERM BH8	ERM BH9	ERM BH10	ERM BH11	ERM BH12	ERM BH13
Sample Depth (m bgl)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sample Date		17/07/2013	22/07/2013	19/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	18/07/2013	18/07/2013	22/07/2013	18/07/2013	18/07/2013
Analyte	Unit	ERM GAC Commercial												
SVOCs														
2-Methylphenol	mg/kg	180,014	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.22	<0.01	<10	<0.01
4-Methylphenol	mg/kg	183,119	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.11	<0.01	<10	<0.01
2,4-Dimethylphenol	mg/kg	35,823	<0.01	33	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01
Phenol	mg/kg	3,200*	<0.01	36	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01
PAHs		mg/kg												
Acenaphthene	mg/kg	109,142	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	1.37	<10	<0.01	<0.01
Acenaphthylene	mg/kg	109,163	0.02	<10	0.07	0.04	<0.01	0.07	0.02	<0.01	0.07	0.81	<10	<0.01
Anthracene	mg/kg	545,841	0.09	37	0.07	0.08	0.08	0.1	0.07	0.07	0.09	3.14	<10	<0.01
Benzo(a)anthracene	mg/kg	146	0.23	<10	0.09	0.19	0.08	0.17	0.06	0.06	0.12	8.58	<10	<0.01
Benzo(bk)fluoranthene	mg/kg	146	0.51	21	0.09	0.25	0.14	0.14	0.15	0.08	0.17	16.64	<10	<0.01
Benzo(a)pyrene	mg/kg	15	0.21	23	0.04	0.09	0.06	0.05	0.12	0.02	0.06	9.6	<10	<0.01
Benzo(ghi)perylene	mg/kg	681	0.23	<10	0.07	0.11	0.08	0.11	0.08	0.09	0.29	6.04	<10	<0.01
Chrysene	mg/kg	1,485	0.44	188	0.2	0.19	0.16	0.29	0.14	0.14	0.3	9.21	<10	<0.01
Dibenzo(ah)anthracene	mg/kg	15	0.05	<10	0.01	0.03	0.01	0.02	0.02	<0.01	0.03	1.9	<10	<0.01
Fluoranthene	mg/kg	22,734	0.56	116	0.11	0.23	0.13	0.17	0.12	0.07	0.16	20.06	<10	<0.01
Fluorene	mg/kg	72,763	<0.01	32	<0.01	0.02	0.02	<0.01	<0.01	0.02	0.13	0.82	<10	<0.01
Indeno(123cd)pyrene	mg/kg	146	0.12	<10	0.02	0.05	0.03	0.02	0.03	<0.01	0.03	4.95	<10	<0.01
2-Methylnaphthalene	mg/kg	7,217	1.4	2821	2.88	1.52	1.26	3.49	0.87	1.47	3.95	0.33	65	<0.01
Naphthalene	mg/kg	31,046	1.15	2429	2.12	1.2	1.02	2.5	0.75	1.24	3.66	0.58	53	<0.01
Phenanthrene	mg/kg	22,703	0.69	870	0.87	0.5	0.48	1.29	0.48	0.52	1.63	6.72	28	<0.01
Pyrene	mg/kg	54,575	0.57	93	0.13	0.24	0.16	0.22	0.15	0.1	0.2	19.03	<10	<0.01
Phthalates		mg/kg												
Bis(2-ethylhexyl) phthalate	mg/kg	90,777	0.04	<10	0.04	0.04	0.12	0.02	0.08	0.02	0.06	0.72	<10	0.03
Butylbenzyl phthalate	mg/kg	947,996	0.04	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<10	<0.01
Di-n-butyl phthalate	mg/kg	18,342	0.04	22	0.02	<0.01	0.04	<0.01	<0.01	<0.01	0.03	0.06	23	<0.01
Other SVOCs		mg/kg												
Dibenzofuran	mg/kg	3,792	0.34	783	0.64	0.32	0.3	0.76	0.27	0.37	0.87	0.28	16	<0.01
Hexachloroethane	mg/kg	1,072	<0.01	<10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	<10	<0.01

Key

above limit of detection	above limit of detection
mg/kg	milligrams per kilogram
mbgl	metres below ground level
Sample analysis carried out by Jones Environmental Laboratory	
* - unless marked, when a Soil Guideline Value has been used	

Table 13: Soil Analytical Results, Human Health Assessment - Metals

Location Sample Depth (m bgl) Sample Date			ERM BH1	ERM BH2	ERM BH3	ERM BH4	ERM BH5	ERM BH6	ERM BH7	ERM BH8	ERM BH9	ERM BH10	ERM BH11	ERM BH12	ERM BH13			
			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		
			17/07/2013	22/07/2013	19/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	18/07/2013	18/07/2013	22/07/2013	18/07/2013	18/07/2013		
Analyte	Unit	ERM GAC Commercial *																
			Arsenic	mg/kg	640*	25.1	34.1	14.5	17.5	18.6	19.3	5.9	9.5	12.3	16.9	11.4	9.8	7.9
			Cadmium	mg/kg	230	0.5	0.3	0.5	0.5	0.3	0.1	<0.1	0.2	<0.1	0.6	<0.1	<0.1	<0.1
			Chromium	mg/kg	330	22.8	11.5	15.1	20.4	18.7	14.2	22.0	12.4	11.0	28.0	24.1	33.9	33.4
			Hexavalent Chromium	mg/kg	330	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1.1	<0.3	<0.3	<0.3	<0.3
			Copper	mg/kg	72,775	69	50	56	51	57	54	36	45	46	44	11	23	22
			Lead	mg/kg	6,406	44	41	35	31	54	31	24	30	24	51	33	20	14
			Mercury	mg/kg	3600*	0.1	0.1	<0.1	<0.1	<0.1	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
			Nickel	mg/kg	1800*	29.0	19.7	34.6	29.6	31.4	33.6	38.0	23.4	28.3	33.8	14.2	35.3	35.1
			Selenium	mg/kg	13000*	<1	1	<1	<1	<1	1	<1	<1	2	<1	<1	<1	<1
			Zinc	mg/kg	702,236	78	40	78	84	96	68	67	75	56	187	65	61	58

Key

above limit of detection	above limit of detection
mg/kg	milligrams per kilogram
mbgl	metres below ground level
na	not analysed
Sample analysis carried out by Jones Environmental Laboratory	
* - unless marked, when a Soil Guideline Value has been used	

Table 14: Soil Analytical Results, Human Health Assessment - TPH

Location			ERM BH1	ERM BH2	ERM BH3	ERM BH4	ERM BH5	ERM BH6	ERM BH7	ERM BH8	ERM BH9	ERM BH10	ERM BH11	ERM BH12	ERM BH13
Sample Depth (m bgl)			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sample Date			17/07/2013	22/07/2013	19/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	18/07/2013	18/07/2013	22/07/2013	18/07/2013	18/07/2013
Analyte	Unit	TPHCWG Hazard Index													
Aliphatics															
>C5-C6	mg/kg	NRP	na	na	na	na	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	na	na	na
>C6-C8	mg/kg	0	na	na	na	na	0.5	<0.1	<0.1	<0.1	0.3	<0.1	na	na	na
>C8-C10	mg/kg	0	na	na	na	na	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	na	na	na
>C10-C12	mg/kg	0	na	na	na	na	<0.2	2.3	<0.2	<0.2	6.0	<1.2	na	na	na
>C12-C16	mg/kg	0	na	na	na	na	8	8	<4	<4	13	<24	na	na	na
>C16-C21	mg/kg	NRP	na	na	na	na	9	<7	<7	<7	<7	<42	na	na	na
>C21-C35	mg/kg	NRP	na	na	na	na	<7	<7	<7	<7	<7	55	na	na	na
Aromatics															
>C5-EC7	mg/kg	0	na	na	na	na	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	na	na	na
>EC7-EC8	mg/kg	0	na	na	na	na	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	na	na	na
>EC8-EC10	mg/kg	0	na	na	na	na	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	na	na	na
>EC10-EC12	mg/kg	0	na	na	na	na	1.5	2.5	1.9	<0.2	3.2	<1.2	na	na	na
>EC12-EC16	mg/kg	0	na	na	na	na	36	20	14	<4	13	<24	na	na	na
>EC16-EC21	mg/kg	0	na	na	na	na	350	39	29	<7	20	84	na	na	na
>EC21-EC35	mg/kg	0	na	na	na	na	956	86	74	<7	52	383	na	na	na

Key

above limit of detection

mg/kg milligrams per kilogram

mbgl metres below ground level

Sample analysis carried out by Jones Environmental Laboratory

Table 15: Groundwater Analytical Results, Human Health Vapour Assessment - VOCs

Analyte	Location	Unit	Screening Value	ERM BH1	ERM BH2	ERM BH3	ERM BH4	ERM BH5	ERM BH10	ERM BH11	ERM BH12	ERM BH13
	Sample Date			25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013
VOCs												
Trichloroethene (TCE)		µg/l	NRP	<3	<3	<3	<3	<3	<3	4	<3	<3

Key

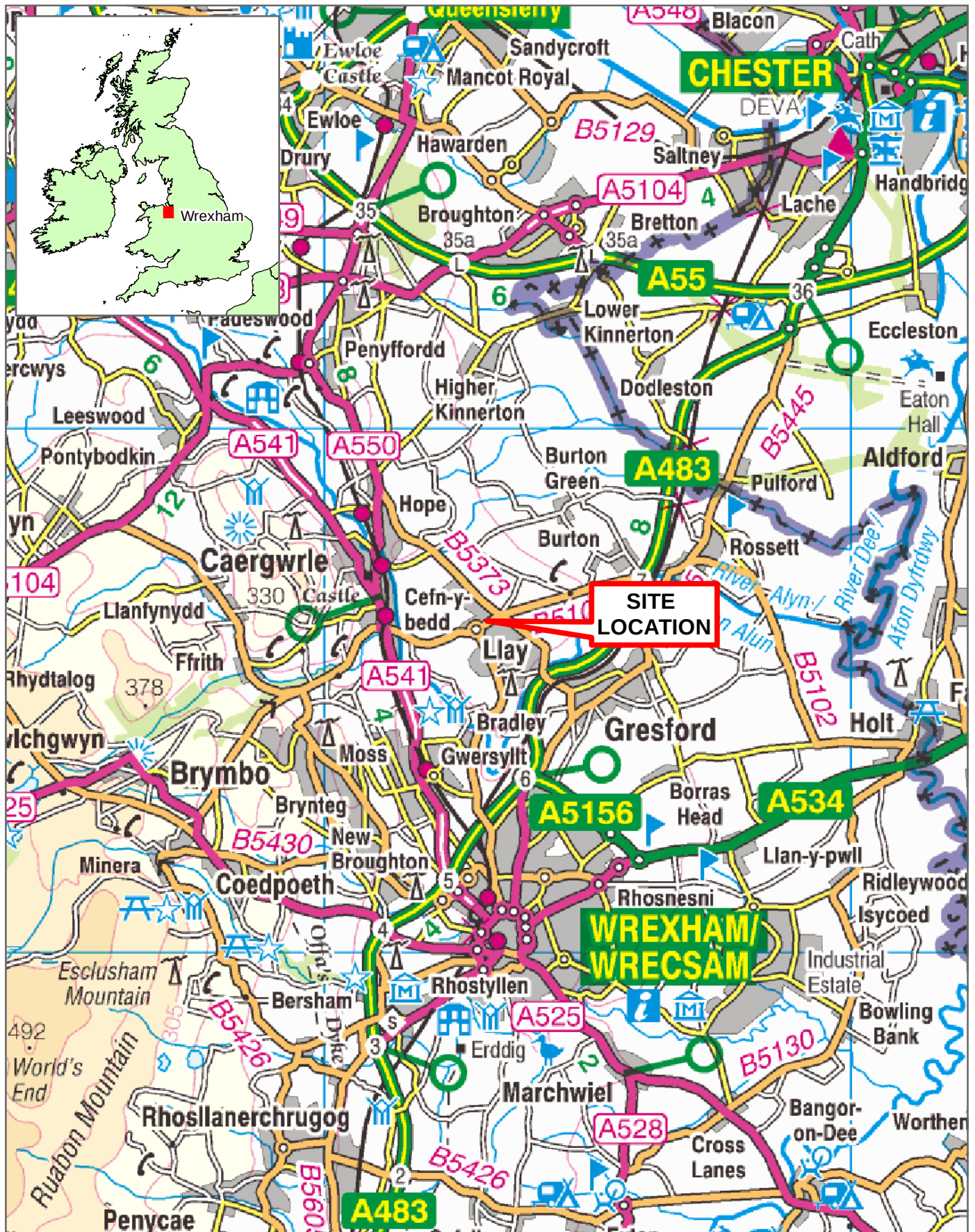
above limit of detection	above limit of detection
µg/l	micrograms per litre

Sample analysis carried out by Jones Environmental Laboratory

NRP - No Risk Predicted

Figures





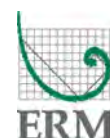
0 0.5 1 1.5 2 2.5
Kilometres



Figure 1
Site Location Plan
Llay, Wrexham,
Clwyd

SIZE: A4
SCALE: 1:100,000
PROJECT:
DATE: 06/08/2013

VERSION: A01
DRAWN: MTC
CHECKED: JP
APPROVED:



CLIENT:
Magellan Aerospace
(UK) Limited



- Site Boundary
- Planning Areas

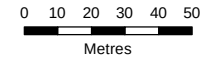


Figure 2
Planning Areas
Llay, Wrexham
Clwyd

SCALE: See Scale Bar
 SIZE: A4
 PROJECT: 0209263
 DATE: 27/08/2013

VERSION: A01
 DRAWN: JL
 CHECKED: JP
 APPROVED:



Magellan Aerospace
 (UK) Limited



- Site Boundary
- ◆ Deep Gas and Groundwater Monitoring Wells
- ◆ Shallow Gas Monitoring Wells

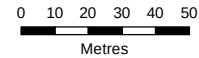


Figure 3
Borehole Location Plan
 Llay, Wrexham
 Clwyd

SCALE: See Scale Bar
 SIZE: A4
 PROJECT: 0209263
 DATE: 27/08/2013

VERSION: A01
 DRAWN: JL
 CHECKED: JP
 APPROVED:



Magellan Aerospace
 (UK) Limited



- Site Boundary
- Groundwater Elevation (mAOD)
- + Deep Gas and Groundwater Monitoring Wells
- + Shallow Gas Monitoring Wells

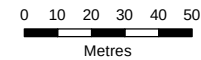


Figure 4
Groundwater Contours
Llay, Wrexham
Clwyd

SCALE: See Scale Bar
SIZE: A4
PROJECT: 0209263
DATE: 27/08/2013

VERSION: A02
DRAWN: JL
CHECKED: JP
APPROVED:



Magellan Aerospace
(UK) Limited

Annex A

Envirocheck Report

To follow on CD

Annex B

Fieldwork Methodologies and Results



B1.1

INTRODUCTION

The site investigation was undertaken by Environmental Resources Management Limited (ERM) between 15th July and 23rd September 2013, comprising the following scope of works:

- 15th - 19th July 2013: Subsurface utility clearance, borehole drilling, collection of soil samples and monitoring well installation;
- 22nd - 26th July 2013: Groundwater monitoring and sampling, and a first soil gas monitoring event;
- 23rd August 2013: Second soil gas monitoring event; and
- 23rd September 2013: Third soil gas monitoring event.

A site specific Health and Safety Plan (HASP) was prepared by ERM prior to commencing works and included task specific Method Statements and Risk Assessments for activities undertaken by ERM and its subcontractors.

Prior to drilling activities, detectable underground services were marked out by Subsight Surveys Limited, a specialist service clearance contractor. The scope and timing of the intrusive investigation was also agreed with Magellan Aerospace Limited site management.

B1.2

INVESTIGATION STRATEGY

B1.2.1

Borehole Advancement

During the investigation, a total of 13 boreholes were drilled to depths varying between 2m below ground level (bgl) to 12 bgl at the locations shown on *Figure 2*. The depths drilled were based on observed or anticipated groundwater elevation. Each borehole was geologically logged by an ERM consultant and representative soil samples were collected from the lithological layers encountered for field screening and selected laboratory analysis (*Section A1.3*) The borehole logs are provided in *Annex B*.

At the completion of drilling, all boreholes were installed as soil gas monitoring locations, with a majority also installed to enable groundwater samples to be collected if water was present. Monitoring wells were completed to ground surface with gas taps and metal headworks.

B1.3

SOIL SAMPLING

B1.3.1

Field Screening

Samples collected from all boreholes were screened in the field for volatile organic vapours using a hand held Photoionisation Detector (PID), calibrated against a 100ppm isobutylene standard gas. The results of this field screening are presented on the borehole logs (*Annex B*). This field method was used as a semi-quantitative screening technique and the results are indicative only of

the presence of elevated concentrations of Volatile Organic Compounds (VOCs). The concentrations are not absolute measurements of volatiles in soil but are representative of relative concentrations. Results are expressed in parts per million isobutylene equivalent units (ppm (v)) and provide an indication of soils impacted by VOCs.

B1.3.2 Laboratory Analysis

Soil samples were submitted to Jones Environmental, a UKAS and MCERTS-accredited laboratory, for chemical analysis on a standard 5-day turnaround.

A total of 13 soil samples were collected to enable risks to human health and in some cases building structures to be assessed, via collection of one sample at a depth of 1.0m bgl from each borehole.

All soil waste was stored within a skip located within the south-eastern part of the site, to be disposed of by Magellan.

The analytical schedule is presented in *Table A.1* below:

Table B1 Soil Sample Analytical Schedule

Analyte	Number of Samples	Borehole IDs
Semi-Volatile Compounds	13	All boreholes (ERMBH1 to ERMBH13)
Volatile Organic Compounds	13	
Total Cyanide	13	
Free Cyanide	13	
Total Organic Carbon	13	
Metals (As, Cd, CrIII, CrVI, Cu, Hg, Ni, Pb, Se, Zn)	13	
Asbestos Screen	13	Boreholes located in planning areas only (see <i>Figure 3</i> - ERMBH5 to ERMBH10)
Total Sulphate	6	
pH	6	
Total Petroleum Hydrocarbons	6	
Chloride	6	
Phenols	6	

B1.4 GROUNDWATER ELEVATION MEASUREMENTS

All wells were monitored to determine the presence or absence of groundwater, and if present depth beneath the site. Groundwater depth was ascertained from all 13 wells on 24th July 2013. The data was collected within a short period of 1 hour, minimising the possibility of natural fluctuations affecting the results, and then used to produce groundwater contour plot (*Figure 4*). The results collected are also presented within *Table A.2* below.

Table B2 **Groundwater Depths**

Borehole ID	Depth to Water (m bgl)	Depth to Base ⁽¹⁾
ERMBH1	6.20	6.98
ERMBH2	8.20	9.39
ERMBH3	6.42	8.01
ERMBH4	3.70	5.07
ERMBH5	6.10	7.00
ERMBH6	Dry	1.99
ERMBH7	Dry	2.06
ERMBH8	Dry	11.95
ERMBH9	Dry	2.04
ERMBH10	4.58	7.97
ERMBH11	1.48	6.42
ERMBH12	1.68	6.94
ERMBH13	2.10	4.99

Note

1) Base may be different to drilled depths (see borehole logs) due to silt ingress

B1.5 **GROUNDWATER SAMPLING STRATEGY**

B1.5.1 **Well Development**

Prior to the collection of groundwater samples, each newly installed monitoring well was developed by the removal of groundwater to remove fines from the drilling process. The development was carried out using a disposable high density polyethylene (HDPE) bailer. The wells were allowed one to two days to settle prior to sampling. Wells were developed until these ran dry or in higher yielding locations, when approximately ten well volumes had been removed from each well.

B1.5.2 **Well Purging**

Where groundwater was encountered, samples were collected through Low Flow Purging and Sampling techniques (ASTM Standard D6771-02) using an Eijkelpomp Peristaltic Pump. However where the groundwater head was 6.0m bgl or less, where suction rate the peristaltic pump was not sufficient, a HDPE bailer was used. During well purging and sampling field measurements were taken using a YSI 556 Multiparameter Meter for pH, oxidation-reduction potential (ORP), dissolved oxygen, electrical conductivity and temperature.

Well purging was considered to have been achieved when the well ran dry, or when groundwater parameters were observed to have stabilised.

The final stable readings obtained from sampling field measurements collected during the purging of each well is present within *Table A.3* below.

Table B3 **Field Measurements**

Borehole ID	Temp °C	Conductivity µs/cm	Dissolved Oxygen %	Dissolved Oxygen mg/l	pH	Oxygen Reduction Potential
ERMBH1	17.3	8,184	15.4	1.45	5.41	41.8
ERMBH2	17.5	3,854	40.2	3.75	6.07	34.0
ERMBH3	15.6	4,027	14.6	1.48	6.61	39.8
ERMBH4	15.6	1,563	26.2	2.62	6.99	154.6
ERMBH5	22.9	3,086	31.2	2.66	6.82	-45.2
ERMBH10	15.1	1,509	8.8	0.89	6.82	110.9
ERMBH11	16.1	1,834	3.5	0.33	7.14	123.6
ERMBH12	14.1	1,109	35.7	3.66	7.07	147.5
ERMBH13	14.0	1,433	22.7	2.77	7.00	129.2

B1.5.3 *Groundwater Sampling*

Samples were submitted to the laboratory for analysis on a standard 5-day turnaround for the analysis shown in *Table A.4* below.

Table B4 **Water Sample Analytical Schedule**

Analyte	Soil	Boreholes Sampled
Semi-Volatile Compounds	9	ERMBH1 – ERMBH and ERMBH10 – ERMBH13
Volatile Organic Compounds	9	
Metals (As, Cd, CrIII, CrVI, Cu, Hg, Ni, Pb, Se, Zn)	9	
Hardness	4	ERMBH1, ERMBH5, ERMBH10 and ERMBH13
Water Soluble Sulphate	2	ERMBH5 and ERMBH10

B1.5.4 *Laboratory Quality Assurance Sampling*

One trip blank sample was submitted to the laboratory for analysis.

Additionally one blind duplicate sample was collected from ERMBH11 (named as ERMBH14) and analysed for the same parameters.

In order to evaluate the duplicate sample results and estimate precision, RPD (Relative Percentage Difference) values were calculated for all compounds.

The USEPA defines acceptable RPD to be no greater than 30% ⁽¹⁾. However given that only one compound was detected (trichlorethene) at low concentrations (<0.01mg/l) this correlation is considered to be reasonable.

(1) U.S. Environmental Protection Agency. 'Uniform Federal Policy for Quality Assurance Project Plans', Intergovernmental Data Quality Task Force, EPA 505-B-04-900A.

B1.6

SOIL GAS MONITORING

Measurements of the gas flow rate, atmospheric pressure and concentrations of oxygen, hydrogen sulphide, methane, carbon dioxide and carbon monoxide were recorded at each of the 13 installations using a GFM435 landfill gas monitor. Soil gas monitoring results are presented in *Table A.5*.

Soil gas flow rates were generally detected to be ≤ 0.1 l/h with the exception of ERMBH2, with a peak flow rate of 0.7 l/h and ERMBH4 with a peak flow rate of 0.4 l/h.

Table B5 *Soil Gas Monitoring Results*

Location	Max CH ₄ (%)	Min O ₂ (%)	Max CO ₂ (%)	Max H ₂ S (ppm)	Max CO (ppm)
Round 1					
ERMBH1	<0.1	13.4	10.3	<0.1	<0.1
ERMBH2	<0.1	17.7	3.3	<0.1	5
ERMBH3	<0.1	6.2	9.2	<0.1	<0.1
ERMBH4	<0.1	16.1	2.3	<0.1	<0.1
ERMBH5	<0.1	15.5	3.8	<0.1	<0.1
ERMBH6	<0.1	17.5	2.4	<0.1	<0.1
ERMBH7	<0.1	17.0	2.2	<0.1	<0.1
ERMBH8	<0.1	5.0	6.3	<0.1	<0.1
ERMBH9	<0.1	20.1	0.4	<0.1	<0.1
ERMBH10	<0.1	11.6	3.9	<0.1	16
ERMBH11	<0.1	10.0	4.1	10	55
ERMBH12	<0.1	19.6	1.2	<0.1	<0.1
ERMBH13	<0.1	18.1	1.6	<0.1	<0.1
Round 2					
ERMBH1	<0.1	10.1	16.0	<0.1	<0.1
ERMBH2	<0.1	11.4	5.3	<0.1	1
ERMBH3	<0.1	1.2	12.3	<0.1	9
ERMBH4	<0.1	15.4	2.9	<0.1	<0.1
ERMBH5	<0.1	15.5	4.3	<0.1	3
ERMBH6	<0.1	14.8	3.4	<0.1	3
ERMBH7	<0.1	10.8	2.8	<0.1	1
ERMBH8	<0.1	4.9	8.9	<0.1	1
ERMBH9	<0.1	16.0	0.8	<0.1	1
ERMBH10	<0.1	16.8	3.2	<0.1	<0.1
ERMBH11	<0.1	10.9	3.9	<0.1	<0.1
ERMBH12	<0.1	19.6	1.9	<0.1	1
ERMBH13	<0.1	16.6	1.3	<0.1	1

B1.7

GENERAL SAMPLING AND DECONTAMINATION PROCEDURES

Sampling and decontamination procedures adopted in the course of the site investigation were designed to minimise the potential for cross-contamination between sampling locations. Soil sampling methodologies applied were based on methods developed by the United States Environmental Protection Agency (US EPA) adapted to European standards of practice. These methods include

detailed decontamination procedures, sample labelling, sample preparation and chain-of-custody documentation.

Samples were collected into labelled laboratory prepared jars and bottles, the details of which were completed onto laboratory supplied Chain-of-Custody documentation. The samples were shipped to the laboratory in laboratory supplied sample cooler boxes containing frozen ice packs.

Annex C

ERM Borehole Logs





Environmental Resources Management

Borehole Log

Borehole No.
ERM BH1
Page 1 of 1

Client: Magellan Aerospace Limited	Drilling Method: Window Sampling / Rotary Auger	Coordinates: 333121.441
Location: Wrexham	Drill Rig Type: Nordmeyer Rotary Rig	356222.750
Project No: 0209263	Borehole Diameter: 50mm	Ground Level: 93.484
	Logged by: JP	Total Depth: 7.0m bgl
	Dates Drilled: 15.07.13	

Description of Strata	Legend	Depth and (thickness of strata) (m)	Depth (m bgl)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
MADE GROUND: Light brown sandy gravel. Gravel is fine to coarse and angular to rounded of brick, metal plastic and wood.		1.0m bgl	93.0	NVO	<0.1				
MADE GROUND: Dark brown sandy slightly clayey gravel. Gravel is fine to coarse and angular to rounded of metal.		1.6m bgl	92.5	NVO	0.4	ERM BH1: 1.0m			
MADE GROUND: Dark brown silty very slightly gravelly clay. Gravel is fine. Evidence of coal and ash.			92.0		1.3				
			91.5						
			91.0						
			90.5	NVO	1.1				
			90.0						
			89.5		0.6				
MADE GROUND: Light brownish grey silty clay. Possible coal or ash pieces.		4.3m bgl	89.0	NVO					
			88.5		0.9				
Very soft, dark brown slightly silty CLAY.		5.2m bgl	88.0	NVO					
			87.5		0.7				
Soft, dark brown silty gravelly CLAY. Gravel is fine.		6.3m bgl	87.0	NVO					
		7.0m bgl	86.5						

Remarks:

Borehole hand dug to 1.5mbgl prior to drilling work.
NVO: No visual or olfactory evidence of impact.
Window Sampling from 1.5m bgl. Rotary Augering from 5.0m bgl.
-

Groundwater:

☒ Strike: -
▼ Depth: 6.20m bgl

mAOD = Metres Above Ordnance Datum

Backfill/Installation Details:

Concrete: 0.0-0.1mbgl
Bentonite: 0.1-0.4mbgl
Gravel: 0.4-7.0mbgl
Plain pipe: 0.0-0.5mbgl
Slotted screen: 0.5-7.0mbgl
Well diameter: 50mm
Slot size: 2mm
Well material: HDPE
Filter pack grain size: Fine Gravel



Environmental Resources Management

Borehole Log

Borehole No.
ERM BH2
Page 1 of 1

Client: **Magellan Aerospace Limited** Drilling Method: **Window Sampling / Rotary Auger** Coordinates: **333151.029**
Location: **Wrexham** Drill Rig Type: **Nordmeyer Rotary Rig** **356235.680**
Project No: **0209263** Borehole Diameter: **50mm** Ground Level: **93.267**
Logged by: **JP** Total Depth: **10.0m bgl**
Dates Drilled: **22.07.13**

Description of Strata	Legend	Depth and (thickness of strata) (m)	Depth (m bgl)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
MADE GROUND: Asphalt.		0.02m bgl 0.27m bgl	93.0	NVO					
MADE GROUND: Gravel. Gravel is fine to coarse and angular to rounded.			92.5		0.1				
MADE GROUND: Dark brown gravelly slightly clayey sand. Gravel is fine to coarse and angular to rounded. Occasional brick, coal and wood fragments.			92.0		0.2	ERM BH2: 1.0m			
			91.5						
			91.0		0.1				
			90.5	NVO					
			90.0		0.3				
			89.5						
			89.0		0.1				
			88.5						
			88.0		1.0				
Soft light brown and dark brown mottled slightly silty CLAY. Becoming firmer with depth.		5.2m bgl	87.5	NVO					
			87.0		0.4				
			86.5						
Soft light brown sandy CLAY.		7.0m bgl	86.0		0.1				
			85.5						
			85.0		<0.1				
			84.5	NVO					
			84.0		<0.1				
			83.5						
		10.0m bgl							

Remarks:

Borehole hand dug to 1.5mbgl prior to drilling work.
NVO: No visual or olfactory evidence of impact.
Window Sampling from 1.5m bgl. Rotary Augering from 5.0m bgl.
-

Groundwater:

☒ Strike:

▼ Depth: 8.20m bgl

mAOD = Metres Above Ordnance Datum

Backfill/Installation Details:

Concrete: 0.0-0.1mbgl
Bentonite: 0.1-0.4mbgl
Gravel: 0.4-10.0mbgl
Plain pipe: 0.0-0.5mbgl
Slotted screen: 0.5-10.0mbgl
Well diameter: 50mm
Slot size: 2mm
Well material: HDPE
Filter pack grain size: Fine Gravel



Environmental Resources Management

Borehole Log

Borehole No.
ERM BH3
Page 1 of 1

Client: **Magellan Aerospace Limited** Drilling Method: **Window Sampling / Rotary Auger** Coordinates: **333177.951**
Location: **Wrexham** Drill Rig Type: **Nordmeyer Rotary Rig** **356267.070**
Project No: **0209263** Borehole Diameter: **50mm** Ground Level: **91.272**
Logged by: **JP** Total Depth: **8.0m bgl**
Dates Drilled: **19.07.13**

Description of Strata	Legend	Depth and (thickness of strata) (m)	Depth (m bgl)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
MADE GROUND: Concrete.		0.19m bgl	91.0	NVO					
MADE GROUND: Dark brown sandy gravel. Gravel is fine to coarse and angular to rounded of brick and coal fragments.		1.0m bgl	90.5	NVO	1.1				
MADE GROUND: Dark brown and light brown mottled slightly gravelly. Gravel is fine to medium and subangular to subrounded of ash and coal.			90.0		0.3	ERM BH3: 1.0m			
			89.5						
			89.0	NVO	0.3				
			88.5						
			88.0		0.8				
Soft dark brown silty slightly gravelly CLAY. Gravel is fine with occasional coal.		3.2m bgl	87.5						
			87.0	NVO	0.3				
			86.5						
Soft light brown slightly silty CLAY.		4.5m bgl	86.0		0.2				
			85.5						
			85.0	NVO	0.8				
			84.5						
			84.0		1.1				
			83.5						
		8.0m bgl							

Remarks:

Borehole hand dug to 1.5mbgl prior to drilling work.
NVO: No visual or olfactory evidence of impact.
Window Sampling from 1.5m bgl. Rotary Augering from 5.0m bgl.
-

Groundwater:

☒ Strike: -

▼ Depth: 6.42m bgl

mAOD = Metres Above Ordnance Datum

Backfill/Installation Details:

Concrete: 0.0-0.1mbgl
Bentonite: 0.1-0.4mbgl
Gravel: 0.4-8.0mbgl
Plain pipe: 0.0-0.5mbgl
Slotted screen: 0.5-8.0mbgl
Well diameter: 50mm
Slot size: 2mm
Well material: HDPE
Filter pack grain size: Fine Gravel



Environmental Resources Management

Borehole Log

Borehole No.
ERM BH4
Page 1 of 1

Client: Magellan Aerospace Limited	Drilling Method: Window Sampling / Rotary Auger	Coordinates: 333187.498
Location: Wrexham	Drill Rig Type: Nordmeyer Rotary Rig	356355.089
Project No: 0209263	Borehole Diameter: 50mm	Ground Level: 91.096
	Logged by: JP	Total Depth: 7.0m bgl
	Dates Drilled: 16.07.13	

Description of Strata	Legend	Depth and (thickness of strata) (m)	Depth (m bgl)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
MADE GROUND: Concrete.		0.1m bgl 0.2m bgl	91.0	NVO					
MADE GROUND: Light brown sandy gravel. Gravel is fine to coarse and angular to rounded.			90.5	NVO	1.7				
MADE GROUND: Dark brown gravelly sandy clay. Gravel is fine to coarse and angular to rounded of clinker, ash and coal.		2.0m bgl	90.0			ERM BH4: 1.0m			
MADE GROUND: Dark brown slightly gravelly silty. Occasional coal and clinker.		2.7m bgl	89.5	NVO	1.4				
Soft light brown slightly silty CLAY. Becoming wetter with depth.			89.0						
			88.5						
			88.0		0.3				
			87.5						
			87.0		0.2				
			86.5	NVO					
			86.0						
			85.5						
			85.0						
			84.5						
		7.0m bgl							

Remarks:

Borehole hand dug to 1.5mbgl prior to drilling work.
Window Sampling from 1.5m bgl. Rotary Augering from 5.0m bgl.
Backfilled with bentonite to 5.0m bgl
NVO: No visual or olfactory evidence of impact

Groundwater:

☒ Strike:

▼ Depth: 3.70m bgl

mAOD = Metres Above Ordnance Datum

Backfill/Installation Details:

Concrete: 0.0-0.1mbgl
Bentonite: 0.1-0.4mbgl
Gravel: 0.4-7.0mbgl
Plain pipe: 0.0-0.5mbgl
Slotted screen: 0.5-5.0mbgl
Well diameter: 50mm
Slot size: 2mm
Well material: HDPE
Filter pack grain size: Fine Gravel



Environmental Resources Management

Borehole Log

Borehole No.
ERM BH5
Page 1 of 1

Client: Magellan Aerospace Limited	Drilling Method: Window Sampling / Rotary Auger	Coordinates: 333112.322
Location: Wrexham	Drill Rig Type: Nordmeyer Rotary Rig	356312.428
Project No: 0209263	Borehole Diameter: 50mm	Ground Level: 91.406
	Logged by: JP	Total Depth: 7.0m bgl
	Dates Drilled: 17.07.13	

Description of Strata	Legend	Depth and (thickness of strata) (m)	Depth (m bgl)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
MADE GROUND: Concrete.		0.27m bgl 0.4m bgl	91.0	NVO					
MADE GROUND: Light greyish brown sandy gravel. Gravel is fine to coarse and angular to rounded.			90.5	NVO	0.1				
MADE GROUND: Dark brown slightly clayey gravelly. Gravel is fine to coarse and angular to rounded with coal pieces.		1.7m bgl	90.0		0.7	ERM BH5: 1.0m			
MADE GROUND: Light brown slightly gravelly. Gravel is fine to medium and subangular to subrounded.		2.3m bgl	89.5	NVO	<0.1				
MADE GROUND: Dark brown slightly gravelly. Gravel is fine to medium and subangular to subrounded with coal pieces.		3.1m bgl	89.0	NVO	0.7				
Soft light brown slightly silty CLAY.			88.5		0.1				
Firm light brown slightly gravelly CLAY. Gravel is fine to medium and subangular to subrounded. Occasional coal pieces.		4.5m bgl	88.0	NVO	<0.1				
			87.5		0.8				
			87.0	NVO					
			86.5						
			86.0						
			85.5						
			85.0						
		7.0m bgl	84.5						

Remarks:

Borehole hand dug to 1.5mbgl prior to drilling work.
NVO: No visual or olfactory evidence of impact.
Window Sampling from 1.5m bgl. Rotary Augering from 5.0m bgl.
-

Groundwater:

☒ Strike: -
▼ Depth: 6.10m bgl

mAOD = Metres Above Ordnance Datum

Backfill/Installation Details:

Concrete: 0.0-0.1mbgl
Bentonite: 0.1-0.4mbgl
Gravel: 0.4-7.0mbgl
Plain pipe: 0.0-0.5mbgl
Slotted screen: 0.5-7.0mbgl
Well diameter: 50mm
Slot size: 2mm
Well material: HDPE
Filter pack grain size: Fine Gravel



Environmental Resources Management

Borehole Log

Borehole No.
ERM BH6
Page 1 of 1

Client: **Magellan Aerospace Limited** Drilling Method: **Window Sampling** Coordinates: **333104.392**
Location: **Wrexham** Drill Rig Type: **Nordmeyer Rotary Rig** **356313.112**
Project No: **0209263** Borehole Diameter: **50mm** Ground Level: **91.488**
Logged by: **JP** Total Depth: **2.0m bgl**
Dates Drilled: **17.07.13**

Description of Strata	Legend	Depth and (thickness of strata) (m)	Depth (m bgl)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
MADE GROUND: Concrete.		0.22m bgl	91.0	NVO					
MADE GROUND: Light brownish yellow sandy gravelly clay. Gravel is fine to coarse and angular to rounded.		0.5m bgl	90.5	NVO	0.2				
MADE GROUND: Dark brown sandy gravel. Gravel is fine to coarse and subangular to subrounded.		2.0m bgl	89.5	NVO	0.3	ERM BH6: 1.0m			

Remarks:

Borehole hand dug to 1.5mbgl prior to drilling work.
NVO: No visual or olfactory evidence of impact.
Window Sampling from 1.5m bgl.
Well was dry

Groundwater:

☒ Strike: -
☒ Depth: -

Backfill/Installation Details:

Concrete: 0.0-0.1mbgl
Bentonite: 0.1-0.4mbgl
Gravel: 0.4-2.0mbgl
Plain pipe: 0.0-0.5mbgl
Slotted screen: 0.5-2.0mbgl
Well diameter: 50mm
Slot size: 2mm
Well material: HDPE
Filter pack grain size: Fine Gravel

mAOD = Metres Above Ordnance Datum

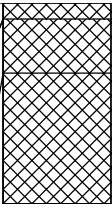
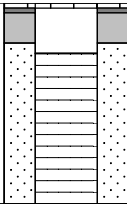
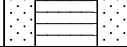


Environmental Resources Management

Borehole Log

Borehole No.
ERM BH7
Page 1 of 1

Client: Magellan Aerospace Limited	Drilling Method: Window Sampling	Coordinates: 333103.229
Location: Wrexham	Drill Rig Type: Nordmeyer Rotary Rig	356349.209
Project No: 0209263	Borehole Diameter: 50mm	Ground Level: 93.439
	Logged by: JP	Total Depth: 2.0m bgl
	Dates Drilled: 18.07.13	

Description of Strata	Legend	Depth and (thickness of strata) (m)	Depth (m bgl)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
MADE GROUND: Concrete.		0.16m bgl	93.0	NVO	0.6				
MADE GROUND: Light brownish grey sandy gravel. Gravel is fine to coarse and angular to rounded.		0.7m bgl	92.5	NVO	0.3	ERM BH7: 1.0m			
MADE GROUND: Dark brown slightly gravelly clayey sand. Gravel is fine to coarse and angular to rounded, with pieces of coal.		2.0m bgl	91.5	NVO	0.3				

Remarks:

Borehole hand dug to 1.5mbgl prior to drilling work.
NVO: No visual or olfactory evidence of impact.
Window Sampling from 1.5m bgl.
Well was dry

Groundwater:

☒ Strike: -
☒ Depth: -

Backfill/Installation Details:

Concrete: 0.0-0.1mbgl
Bentonite: 0.1-0.4mbgl
Gravel: 0.4-2.0mbgl
Plain pipe: 0.0-0.5mbgl
Slotted screen: 0.5-2.0mbgl
Well diameter: 50mm
Slot size: 2mm
Well material: HDPE
Filter pack grain size: Fine Gravel

mAOD = Metres Above Ordnance Datum



Environmental Resources Management

Borehole Log

Borehole No.
ERM BH8
Page 1 of 1

Client: Magellan Aerospace Limited	Drilling Method: Window Sampling / Rotary Auger	Coordinates: 333086.465
Location: Wrexham	Drill Rig Type: Nordmeyer Rotary Rig	356335.263
Project No: 0209263	Borehole Diameter: 50mm	Ground Level: 93.404
	Logged by: JP	Total Depth: 12.0m bgl
	Dates Drilled: 17.07.13	

Description of Strata	Legend	Depth and (thickness of strata) (m)	Depth (m bgl)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
MADE GROUND: Concrete.		0.2m bgl	93.0	NVO					
MADE GROUND: Light greyish brown sandy gravel. Gravel is fine to coarse and subangular to subrounded of concrete.		0.5m bgl	92.5	NVO	1.2				
MADE GROUND: Dark brown slightly clayey gravelly sand. Occasional coal fragments.		2.2m bgl	91.5		1.2	ERM BH8: 1.0m			
MADE GROUND: Soft light brown silty clay.		2.3m bgl	91.0	NVO	0.6				
MADE GROUND: Dark brown slightly clayey gravelly sand. Gravel is fine to medium and angular to rounded.		2.7m bgl	90.5	NVO	<0.1				
MADE GROUND: Soft light brown silty clay.		3.0m bgl	90.0	NVO	0.1				
MADE GROUND: Dark brown gravelly. Gravel is fine to medium and angular to rounded, with coal pieces.		3.5m bgl	89.5	NVO	0.4				
Soft dark brown silty CLAY.		4.5m bgl	89.0		0.3				
Soft light brown silty CLAY.			88.5		0.3				
			88.0		0.3				
			87.5		0.4				
			87.0		0.3				
			86.5		0.3				
			86.0		0.3				
			85.5		0.3				
			85.0		0.3				
			84.5		0.3				
			84.0		0.3				
			83.5		0.3				
			83.0		0.3				
			82.5		0.3				
			82.0		0.3				
			81.5		0.3				

Remarks: Borehole hand dug to 1.5mbgl prior to drilling work. NVO: No visual or olfactory evidence of impact. Window Sampling from 1.5m bgl. Rotary Augering from 5.0m bgl. Well was dry Groundwater: ☒ Strike: - ☒ Depth: -	Backfill/Installation Details: Concrete: 0.0-0.1mbgl Bentonite: 0.1-0.4mbgl Gravel: 0.4-12.0mbgl Plain pipe: 0.0-0.5mbgl Slotted screen: 0.5-12.0mbgl Well diameter: 50mm Slot size: 2mm Well material: HDPE Filter pack grain size: Fine Gravel
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mAOD = Metres Above Ordnance Datum

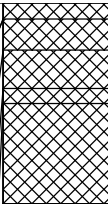


Environmental Resources Management

Borehole Log

Borehole No.
ERM BH9
Page 1 of 1

Client: **Magellan Aerospace Limited** Drilling Method: **Window Sampling** Coordinates: **333085.161**
Location: **Wrexham** Drill Rig Type: **Nordmeyer Rotary Rig** **356356.786**
Project No: **0209263** Borehole Diameter: **50mm** Ground Level: **93.371**
Logged by: **JP** Total Depth: **2.0m bgl**
Dates Drilled: **18.07.13**

Description of Strata	Legend	Depth and (thickness of strata) (m)	Depth (m bgl)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details	
MADE GROUND: Concrete.		0.16m bgl		NVO	0.6	ERM BH9: 1.0m				
MADE GROUND: Light grey sandy gravel. Gravel is fine to coarse and angular to rounded. Occasional rebar.		0.47m bgl		93.0						NVO
		0.85m bgl		92.5						NVO
MADE GROUND: Light brown sandy gravel. Gravel is fine to coarse and angular to rounded.		1.0m bgl		92.0						NVO
		2.0m bgl		91.5						NVO
MADE GROUND: Dark brown slightly gravelly sand, Sand is coarse. Gravel is fine to medium and subangular to subrounded.										
MADE GROUND: Dark brown sand with occasional coal pieces.										

Remarks:

Borehole hand dug to 1.5mbgl prior to drilling work.
NVO: No visual or olfactory evidence of impact.
Window Sampling from 1.5m bgl.
Well was dry

Groundwater:

☒ Strike: -
▼ Depth: -

mAOD = Metres Above Ordnance Datum

Backfill/Installation Details:

Concrete: 0.0-0.1mbgl
Bentonite: 0.1-0.4mbgl
Gravel: 0.4-2.0mbgl
Plain pipe: 0.0-0.5mbgl
Slotted screen: 0.5-2.0mbgl
Well diameter: 50mm
Slot size: 2mm
Well material: HDPE
Filter pack grain size: Fine Gravel



Environmental Resources Management

Borehole Log

Borehole No.
ERM BH10
Page 1 of 1

Client: **Magellan Aerospace Limited** Drilling Method: **Window Sampling / Rotary Auger** Coordinates: **333104.974**
Location: **Wrexham** Drill Rig Type: **Nordmeyer Rotary Rig** **356359.880**
Project No: **0209263** Borehole Diameter: **50mm** Ground Level: **93.399**
Logged by: **JP** Total Depth: **8.0m bgl**
Dates Drilled: **18.07.13**

Description of Strata	Legend	Depth and (thickness of strata) (m)	Depth (m bgl)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
MADE GROUND: Concrete.		0.16m bgl	93.0	NVO	0.1				
MADE GROUND: Light brown sandy gravel. Gravel is fine to coarse and angular to rounded.		0.76m bgl	92.5	NVO	1.0	ERM BH10: 1.0m			
MADE GROUND: Dark brown clayey slightly gravelly sand. Gravel is fine to coarse and angular to rounded.		1.1m bgl	92.0	NVO	0.6				
MADE GROUND: Concrete.		1.4m bgl	91.5	NVO					
MADE GROUND: Dark brown slightly gravelly slightly clayey sand. Gravel is fine to medium and subangular to subrounded with ash and coal.		3.3m bgl	91.0	NVO	1.9				
Soft light brown slightly silty CLAY. Becoming wetter with depth.			90.5	NVO	0.1				
			90.0						
			89.5						
			89.0						
			88.5						
			88.0						
			87.5	Damp from 5.5m bgl.	0.1				
			87.0		0.3				
			86.5						
			86.0		0.2				
			85.5						
		8.0m bgl							

Remarks:

Borehole hand dug to 1.5mbgl prior to drilling work.
NVO: No visual or olfactory evidence of impact.
Window Sampling from 1.5m bgl. Rotary Augering from 5.0m bgl.

Groundwater:

☒ Strike: -

▼ Depth: 4.58m bgl

mAOD = Metres Above Ordnance Datum

Backfill/Installation Details:

Concrete: 0.0-0.1mbgl
Bentonite: 0.1-0.4mbgl
Gravel: 0.4-8.0mbgl
Plain pipe: 0.0-0.5mbgl
Slotted screen: 0.5-8.0mbgl
Well diameter: 50mm
Slot size: 2mm
Well material: HDPE
Filter pack grain size: Fine Gravel



Environmental Resources Management

Borehole Log

Borehole No.
ERM BH11
Page 1 of 1

Client: Magellan Aerospace Limited	Drilling Method: Window Sampling / Rotary Auger	Coordinates: 333058.885
Location: Wrexham	Drill Rig Type: Nordmeyer Rotary Rig	356417.783
Project No: 0209263	Borehole Diameter: 50mm	Ground Level: 92.474
	Logged by: JP	Total Depth: 7.0m bgl
	Dates Drilled: 22.07.13	

Description of Strata	Legend	Depth and (thickness of strata) (m)	Depth (m bgl)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
MADE GROUND: Asphalt.		0.02m bgl		NVO					
MADE GROUND: Light brown sandy gravel. Gravel is fine to coarse and angular to rounded.		0.3m bgl	92.0	NVO	0.1				
MADE GROUND: Dark brown gravelly slightly clayey sand. Gravel is fine to coarse and angular to rounded.		0.98m bgl	91.5		<0.1	ERM BH11: 1.0m			
Soft light brown slightly silty CLAY.			91.0		0.1				
			90.5						
			90.0						
			89.5	NVO	<0.1				
			89.0						
			88.5		<0.1				
			88.0						
			87.5		0.1				
Light brown sandy CLAY.		5.0m bgl	87.0						
			86.5	NVO	0.1				
			86.0						
		7.0m bgl	85.5						

Remarks:

Borehole hand dug to 1.5mbgl prior to drilling work.
NVO: No visual or olfactory evidence of impact.
Window Sampling from 1.5m bgl. Rotary Augering from 5.0m bgl.
-

Groundwater:

Strike:
 Depth: 1.48m bgl

mAOD = Metres Above Ordnance Datum

Backfill/Installation Details:

Concrete: 0.0-0.1mbgl
Bentonite: 0.1-0.4mbgl
Gravel: 0.4-7.0mbgl
Plain pipe: 0.0-0.5mbgl
Slotted screen: 0.5-7.0mbgl
Well diameter: 50mm
Slot size: 2mm
Well material: HDPE
Filter pack grain size: Fine Gravel



Environmental Resources Management

Borehole Log

Borehole No.
ERM BH12
Page 1 of 1

Client: Magellan Aerospace Limited	Drilling Method: Window Sampling / Rotary Auger	Coordinates: 333061.480
Location: Wrexham	Drill Rig Type: Nordmeyer Rotary Rig	356460.049
Project No: 0209263	Borehole Diameter: 50mm	Ground Level: 92.852
	Logged by: JP	Total Depth: 7.0m bgl
	Dates Drilled: 16.07.13	

Description of Strata	Legend	Depth and (thickness of strata) (m)	Depth (m bgl)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
MADE GROUND: Light brown sandy gravel. Gravel is fine to coarse and angular to rounded with rootlets.		0.3m bgl	92.5	NVO					
		0.7m bgl	92.0	NVO	0.4				
MADE GROUND: Dark brown slightly gravelly sand. Gravel is fine to medium and angular to rounded with rootlets.			91.5		<0.1	ERM BH12: 1.0m			
			91.0						
Light brown mottled slightly silty CLAY. Becoming more firm with depth.			90.5		<0.1				
			90.0						
			89.5	NVO	<0.1				
			89.0						
			88.5		<0.1				
			88.0						
			87.5	NVO	<0.1				
			87.0						
			86.5		<0.1				
		7.0m bgl	86.0						

Remarks:

Borehole hand dug to 1.5mbgl prior to drilling work.
NVO: No visual or olfactory evidence of impact.
Window Sampling from 1.5m bgl. Rotary Augering from 5.0m bgl.
-

Groundwater:

☒ Strike: -
▼ Depth: 1.68m bgl

mAOD = Metres Above Ordnance Datum

Backfill/Installation Details:

Concrete: 0.0-0.1mbgl
Bentonite: 0.1-0.4mbgl
Gravel: 0.4-7.0mbgl
Plain pipe: 0.0-0.5mbgl
Slotted screen: 0.5-7.0mbgl
Well diameter: 50mm
Slot size: 2mm
Well material: HDPE
Filter pack grain size: Fine Gravel



Environmental Resources Management

Borehole Log

Borehole No.
ERM BH13
Page 1 of 1

Client: **Magellan Aerospace Limited** Drilling Method: **Window Sampling** Coordinates: **333035.993**
Location: **Wrexham** Drill Rig Type: **Nordmeyer Rotary Rig** **356450.717**
Project No: **0209263** Borehole Diameter: **50mm** Ground Level: **92.510**
Logged by: **JP** Total Depth: **5.0m bgl**
Dates Drilled: **16.07.13**

Description of Strata	Legend	Depth and (thickness of strata) (m)	Depth (m bgl)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
MADE GROUND: Light brown slightly clayey sand. Occasional rootlets.		0.5m bgl	92.5	NVO	<0.1				
Soft mottled light greyish brown slightly silty CLAY. Gravel is fine to medium and subangular to subrounded.		3.2m bgl	92.0	NVO	<0.1	ERM BH3: 1.0m			
Soft, dark brown silty CLAY. Occasional coal pieces.		5.0m bgl	91.5	NVO	<0.1				
			91.0						
			90.5						
			90.0						
			89.5						
			89.0						
			88.5						
			88.0						

Remarks:

Borehole hand dug to 1.5mbgl prior to drilling work.
NVO: No visual or olfactory evidence of impact.
Window Sampling from 1.5m bgl.
-

Groundwater:

☒ Strike:

▼ Depth: 2.10m bgl

Backfill/Installation Details:

Concrete: 0.0-0.1mbgl
Bentonite: 0.1-0.4mbgl
Gravel: 0.4-5.0mbgl
Plain pipe: 0.0-0.5mbgl
Slotted screen: 0.5-5.0mbgl
Well diameter: 50mm
Slot size: 2mm
Well material: HDPE
Filter pack grain size: Fine Gravel

mAOD = Metres Above Ordnance Datum

Annex D

ERM Human Health Generic Quantitative Risk Assessment Methodology

1.1

GENERAL RATIONALE

During the final quarter of 2008 the Environment Agency withdrew the existing guidance on undertaking human health risk assessments detailed within documents CLR7-10 and associated SGV reports and replaced it with updated guidance implementing the approach advocated within DEFRA publication *"Improvements to Contaminated Land Guidance. Outcome of the Way Forward Exercise, July 2008"*. The updated guidance published by the Environment Agency for undertaking the assessment of chronic risks to human health from land contamination collectively commonly referred to as the 'CLEA framework' is contained in the following documents:

- Updated technical background to the CLEA model (SR3), Environment Agency, January 2009;
- Human health toxicological assessment of contaminants in soil (SR2), Environment Agency, January 2009;
- Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values (SR7), November 2008.
- CLEA software (version 1.04) and handbook, Environment Agency, January 2009.

In early 2009, the Environment Agency began publishing the first of a series of updated Soil Guideline Values (SGVs) using the updated approach. The SGVs are an example of authoritative generic assessment criteria used in the preliminary evaluation of the risk to human health from long term exposure to chemicals in soil. However, only a limited number of SGVs have been published to date.

Environment Agency document *"Using Soil Guideline Values"* published in March 2009 states that in the absence of an SGV the simplest option might be to derive a generic assessment criterion using (where appropriate) the generic models used to define SGVs, and based on appropriately sourced physical-chemical and toxicity data.

Due to the limited number of published SGVs, ERM has developed an expanded set of Generic Assessment Criteria (GACs) in accordance with the techniques and protocols set out in the CLEA Framework of publications detailed above. The intention is that these GACs are used in an equivalent way to SGVs in terms of being applicable to the majority of sites and a means of undertaking a generic assessment of chronic risks to human health and help refine any requirement for further DQRA.

The SGVs and ERM's GACs are considered to be guidelines on the level of long term human exposure to individual chemicals in soil that are tolerable or pose a minimal risk to human health. SGVs and GACs do not themselves represent the threshold at which there is a significant possibility of significant harm (SPOSH). Nor do they automatically represent an unacceptable intake in the context of Part 2A of the Environmental Protection Act 1990.

The CLEA framework does not currently include specific guidance for assessing the potential risks to human health via the inhalation of groundwater-derived vapours. In the absence of UK specific guidance ERM has followed the spirit of the methodology to derive a set of GAC_{GW} for groundwater adopting where applicable the same standard land use assumptions detailed within SR3.

The SGVs and GACs rely on predicting the concentration of vapours within the unsaturated zone using partitioning equations. However, due to the inherent uncertainty with estimating vapour partitioning there is growing international consensus that when assessing vapour inhalation risks from land contamination less reliance is placed on predicting contaminant partitioning and greater emphasis on directly measured soil vapour concentrations. Therefore, ERM has also produced Soil Vapour GACs (GAC_{SV}) with respect to assessing the vapour inhalation pathway. The GAC_{SV} have been based on the standard land use assumptions detailed within SR3 and modelling the migration of vapours through the unsaturated zone and subsequent flow inside buildings and into ambient air. The GAC_{SV} enable a tiered approach to

vapour inhalation to be adopted involving an initial assessment based on calculating partitioning from soil and groundwater phases, supplemented where appropriate by the direct assessment of the soil vapour phase. This tiered approach to the assessment of vapour inhalation was the approach suggested within DEFRA way forward publication CLAN 6/06.

1.2

CONCEPTUAL EXPOSURE MODEL

Harmful effects from exposure to hazardous substances may occur as a result of either short-term exposure (acute effects) or long-term exposure (chronic effects). Generally for the vast majority of contaminants the long-term exposure to relatively low levels of the substance is of greatest concern since short-term effects generally occur at much higher concentrations. Any assessment based on the effects of long-term exposure is also likely to be overly protective with respect to the effects from short-term exposure. The assessment of risks to human health for the vast majority of the contaminants of concern is, therefore, based on the assessment of chronic exposure. However, free cyanide may elicit harmful effects from short-term exposure at relatively low concentrations. Therefore, GAC for free cyanide have been derived for both chronic and acute exposure.

The land use behaviour will significantly influence the exposure of end users to soil contaminants and should be reflected in any site specific assessment of those contaminants which represent a hazard as a result of chronic exposure. Influencing factors include: the age and gender of site users; the number of visits to the site; the duration of each visit; and the likely activities that could bring about contact with soil contamination. In the derivation of ERM's GACs three types of 'generic' land use have been included:

- Residential including Consumption of Home-grown Vegetables;
- Residential excluding the Consumption of Home-grown Vegetables; and
- Commercial/Industrial.

The generic land use conceptual exposure models presented within SR3 have been adopted in the derivation of the GAC. *Table 1* presents the exposure pathways included in the derivation of ERM's GAC for each land use.

Table 1 *Exposure Pathways Included For Land Use*

	Residential Land Use with Gardens	Residential Land Use without Gardens	Commercial Land Use
GAC_{Soil} - Exposure from Substances Present in Soils			
Ingestion of Soil and Dust	✓	✓	✓
Ingestion of Home grown Vegetables	✓	-	-
Ingestion of Soil Attached to Vegetables	✓	-	-
Inhalation of Fugitive Dust - Indoors	✓	✓	✓
Inhalation of Fugitive Dust - Outdoors	✓	✓	✓
Inhalation of Vapours - Indoors	✓	✓	✓
Inhalation of Vapours - Outdoors	✓	✓	✓
Dermal contact - Indoors	✓	✓	✓
Dermal contact - Outdoors	✓	✓	✓
GAC_{GW} - Exposure from Substances Present in Groundwaters			
Inhalation of Vapours - Indoors	✓	✓	✓
Inhalation of Vapours - Outdoors	✓	✓	✓
GAC_{SV} - Exposure from Substances Present in Soil Vapours			
Inhalation of Vapours - Indoors	✓	✓	✓
Inhalation of Vapours - Outdoors	✓	✓	✓

The generic human exposure assumptions and building parameters detailed within SR3 for each standard land use have been adopted in the derivation of the GAC.

1.3

CONTAMINANT SPECIFIC PROPERTIES

Toxicological Parameters

Health criteria values (HCV) used to benchmark exposure have been compiled from a review of the scientific and technical literature. Where several health criteria values have been identified, preference has been given to authoritative UK sources where available, as per SR2. In the absence of any appropriate authoritative UK sources, the selection of the most appropriate value has been made with consideration of the following hierarchy:

1. Authoritative UK Sources (e.g. Environment Agency TOX reports, UK Drinking Water Inspectorate, UK Air Quality Strategy);
2. European/International Authoritative Sources (e.g. WHO Drinking Water Guidelines (underlying toxicological data), WHO Air Quality Guidelines for Europe, International Programme on Chemical Safety (IPCS) Environmental Health Criteria Monographs (EHC), IPCS Concise International Chemical Assessment Documents (CICADs));
3. Other National Organisations (e.g. USEPA, RIVM)

In deriving HCVs for non threshold substances, preference was given to the use of an Index Dose (ID) where these were available. Where ID were not available slope factors have been used and amended by multiplying by an appropriate level of excess lifetime cancer risk. SR2 states that, when using human data, the ID is based on estimates of the daily dose corresponding to an excess lifetime cancer risk of 1 in 100,000. This has been used, where required for slope factors in the absence of an ID.

In the absence of appropriate dermal or inhalation HCVs, extrapolated oral values have been adopted as described within SR2. Where available, the dermal absorption fractions presented within SR3 have been adopted. In their absence the default approach adopted within the CLEA model, as outlined within SR3, has been adopted (0.1 for all organic chemicals and zero for inorganic chemicals).

Where required, inhalation HCVs have been converted from reference concentrations quoted in mg/m^{-3} unit risk factors by assuming a 70kg adult typically inhales 20m^3 of air per day.

Where available, the mean daily intakes (MDI) have been sourced from UK diet studies and the Food Standard Agency. In the absence of any UK sources, the IPCS EHC and CICADs have been reviewed to help determine potential background exposure. In accordance with SR2, if no data or information on background information are available, background exposure is considered to be negligible and MDI set to zero for all age groups. If qualitative information is available suggesting background exposure may significantly contribute to overall exposure the pragmatic default outlined within SR2, that land should be allowed to contribute at least half the tolerable daily intake (TDI), has been applied.

Toxicological Equivalents

For non threshold PAHs the index dose has been calculated from published⁽¹⁾ estimated relative potencies to benzo(a)pyrene, and calculated from the ID for benzo(a)pyrene detailed within the DEFRA/EA toxicity report.

Polychlorinated Biphenyls (PCBs) have been assessed according to the Toxicity Equivalency Factor (TEF) approach⁽²⁾ for dioxin-like PCBs (the PCBs considered to represent the greatest health risk). Each of the PCBs toxicity is related to 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), which is considered to be the most carcinogenic dioxin, using a multiplication factor (the TEF). The concentration of each PCB is multiplied by its respective TEF giving a 2,3,7,8-TCDD toxic equivalent (TEQ). The total TEQ for the mixture is compared with the GAC for 2,3,7,8-TCDD.

(1) Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. USEPA, July 1993

(2) Department for Environment, Food and Rural Affairs and the Environment Agency 'Contaminants In Soil: Collation Of Toxicological Data And Intake Values For Humans. Dioxins, Furans And Dioxin-Like PCBs'. TOX 12. March 2003.

The toxicity assumptions presented within the TPH Criteria Working Group have been adopted in the derivation of the GAC for aliphatic and aromatic TPH fractions. The TPH fractions are therefore protective of threshold human health effects and indicator compounds are used to assess non-threshold health effects (in line with Environment Agency publication on assessing petroleum hydrocarbons). An attenuation factor of 10 has been adopted for petroleum hydrocarbons in accordance with the recommendations contained within SR3.

Physico-chemical Parameters

Physico-chemical properties have been compiled from a review of the scientific and technical literature. Where available, the physico-chemical properties have been adopted from the Environment Agency Report SR7 ⁽¹⁾. In their absence, parameters have been sourced from the references detailed within SR7, where available.

Many of the references present a range of values from numerous scientific studies, with the same studies being presented within each reference. Based upon the values presented within the studies and their own professional expertise, Mackay et al ⁽²⁾ provide recommended values for many parameters and have been adopted where available.

Where a range of values have been sourced, consideration has been given to the selection hierarchy detailed within SR7:

1. If all values the same, select this value;
2. Select Value from consistent range;
3. Central value from consistent range;
4. Newest value (if there is no consistent range or no single central value)

Where available, parameters have been sourced at 10°C, which is the assumed annual average temperature of UK soils (SR3) and required for the CLEA model.

Where chemical data was unavailable in the literature, or adjustments needed for temperature (i.e. literature source not at 10°C), property estimation methods and adjustment calculations detailed within SR7 have been used.

1.4 SOIL PROPERTIES

ERM GAC have been developed using a generic set of soil properties which are considered to represent a reasonable conservative scenario. SR3 states that although the sand soil type represents the most conservative choice for modelling diffusion and advection transport processes, it is not geographically widespread. Most common UK sandy soils are closer to a sandy loam and it is this default soil type that is used in the derivation of SGVs by the Environment Agency and has been adopted in the derivation of ERM GAC.

In deriving SGVs, the Environment Agency, have adopted a soil organic matter content of 6%. ERM do not consider this value to be sufficiently conservative for the production of GAC. Therefore, a SOM of 1% (or TOC 0.58%) has been adopted in the derivation of ERM GAC.

1.5 MODELLING APPROACH

In deriving human health GAC for soils, ERM have adopted the CLEA software version 1.04, which implements the modelling approach detailed within SR3 and is used by the Environment Agency to derive Soil Guideline Values.

(1) Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values (SR7). Environment Agency, November 2008.

(2) Handbook of Physical-Chemical Properties and Environmental fate for Organic Chemicals. 2nd edition. Mackay et al, 2006.

The ERM soil vapour GAC (GAC_{SV}) have been back calculated from the indoor and outdoor vapour inhalation soil criteria derived using the CLEA software using the soil to soil vapour partitioning approach detailed within Section 5 of SR3. The results have been directly compared to the soil gas media concentration provided within the CLEA outputs when running the model for vapour inhalation pathways only, to ensure parity.

The ERM GAC for groundwater derived vapours (GAC_{GW}) have been calculated using the groundwater vapour transport algorithms developed by the ASTM (E1739), used by RISC V4.05 and outlined within Appendix E of the RISC user manual. Where applicable the standard CLEA receptor, soil and building properties have been utilised.

For acute exposure to free cyanide the conceptual exposure model assumes a one off ingestion of 2000mg of soil by a 1 to 2 year old female child using the algorithms presented by Beck et al 2006 ⁽¹⁾ and SNIFFER 2000 ⁽²⁾.

1.6

ESTIMATING COMBINED EXPOSURE FROM ALL RELEVANT PATHWAYS

For some chemicals, intake and/or uptake via different routes (via the nose, mouth, or through the skin) may lead to different local effects or may affect different organs. People using a contaminated site may be exposed to the same chemical via all three routes of exposure. If the contaminant exhibits systemic toxicity (i.e. reaches the main blood circulation system unchanged following absorption), each route of exposure may contribute to an aggregate total systemic load that results in adverse systemic effects. The ERM GAC takes this possible effect into account by automatically adopting the methodology used by the CLEA software and the Environment Agency, and combining the reciprocal from each relevant exposure pathway. This helps ensure that the assessment criteria is set at a concentration where the total risk via all relevant routes of entry into the body is mathematically no greater than the risk due to exposure by any single route of entry. The only exception is where an Environment Agency Soil Guideline Value (SGV) report identifies that a single exposure route is more appropriate for an individual contaminant, in such cases the same exposure routes used by the Environment Agency in deriving the SGV have been adopted by ERM in deriving the GAC for the same contaminant.

In instances where the combined assessment criteria of all relevant pathways outputted from the CLEA software is highlighted green or amber and the vapour pathway is not an important contributor, these have been adopted as ERM GAC.

Where the combined assessment criteria exceeds the theoretical saturation limits and the vapour pathway is an important contributor to exposure, the methodology detailed within the CLEA Software Handbook for such circumstances has been adopted:

1. Determining the relevant ADE/HCV ratio at the lower saturation limit
2. Estimate relevant contribution required from other pathways by subtracting this value by 1 (since the contribution from the vapour pathway is capped at the saturation limit)
3. Determine the soil concentration at which the relevant combined HCV/ADE ratio is equal to the value calculated in (2) without the vapour inhalation pathways.

1.7

UNCERTAINTY

As with any form of modelling of the interaction between humans and the wider environment, there is a substantial amount of uncertainty involved. This relates both to the way in which the interaction is modelled (the pathway algorithms) and the input parameters defining the substances, the pathways and the receptors. The CLEA model is deterministic, meaning that in

(1) Human Health Risk Assessment of Cyanide in Water and Soil. Beck et al. *Published in Cyanide in water and Soil, Chemistry Risk and Management, Dzombak et al 2006.*

(2) Framework for Deriving Numeric Targets to Minimise the Adverse Human Health Effects of Long-term Exposure to Contaminants in Soil. SR99(02)F. SNIFFER April 2000.

any calculation a single value is assigned to each variable. Many of these values are assigned on the basis of average or conservative (the most health protective) measurements and by expert judgement.

Historically, in dealing with parameter uncertainty and variability in a deterministic model, it has been good practice to select values representative of a worst case exposure scenario. This has the assumed comfort of being more protective against an unforeseen situation or risks to sensitive individuals. However, the problem with this approach can be that such choices, however defensible individually, tend to be implausible collectively.

Over the recent years there has been an increasing desire on the part of authoritative bodies to move away from modelling a worst case individual to more realistic or reasonable exposure scenarios. This is the approach adopted by the CLEA model and takes into account not only the degree of conservatism from individual choices, but also the collective effect of these choices.

It should be noted that ERM's GACs are not a static set of values, but are reviewed on a regular basis and reissued as more guidance is made available by the Environment Agency, or when improved knowledge of toxicity is published.

Annex E

Laboratory Analytical Certificates





Jones Environmental Laboratory

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No.4225

Attention :	Joanne Pennell
Date :	29th July, 2013
Your reference :	0209263
Our reference :	Test Report 13/6663 Batch 1
Location :	WREXHAM
Date samples received :	20th July, 2013
Status :	Final report
Issue :	1

Twelve samples were received for analysis on 20th July, 2013. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Jamie Williams B.Sc
Project Co-ordinator

Bob Millward B.Sc FRSC
Principal Chemist

Jones Environmental Laboratory

Client Name: ERM

Report : Solid

Reference: 0209263

Location: WREXHAM

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Contact: Joanne Pennell

JE Job No.: 13/6663

J E Sample No.	1-3	4-5	6-9	10-13	14-17	18-21	23-26	27-30	31-32	33-34	Please see attached notes for all abbreviations and acronyms		
Sample ID	ERMBH1-170713-1.0	ERMBH4-170713-1.0	ERMBH5-170713-1.0	ERMBH6-170713-1.0	ERMBH7-170713-1.0	ERMBH8-170713-1.0	ERMBH9-180713-1.0	ERMBH10-180713-1.0	ERMBH12-180713-1.0	ERMBH13-180713-1.0			
Depth	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0			
COC No / misc													
Containers	V J T	V J	V J	V J	V J	V J	V J	V J	V J	V J			
Sample Date	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	18/07/2013	18/07/2013	18/07/2013	18/07/2013			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD	Units	Method No.
Date of Receipt	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013			
Metals													
Arsenic [#]	NDP	17.5	18.6	19.3	5.9	9.5	12.3	NDP	9.8	7.9	<0.5	mg/kg	TM30/PM15
Cadmium [#]	NDP	0.5	0.3	0.1	<0.1	0.2	<0.1	NDP	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Chromium [#]	NDP	20.4	18.7	14.2	22.0	12.4	11.0	NDP	33.9	33.4	<0.5	mg/kg	TM30/PM15
Hexavalent Chromium	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1.1	<0.3	<0.3	<0.3	<0.3	mg/kg	TM38/PM20
Copper [#]	NDP	51	57	54	36	45	46	NDP	23	22	<1	mg/kg	TM30/PM15
Lead [#]	NDP	31	54	31	24	30	24	NDP	20	14	<5	mg/kg	TM30/PM15
Mercury [#]	NDP	<0.1	<0.1	0.2	0.1	<0.1	<0.1	NDP	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Nickel [#]	NDP	29.6	31.4	33.6	38.0	23.4	28.3	NDP	35.3	35.1	<0.7	mg/kg	TM30/PM15
Selenium [#]	NDP	<1	<1	1	<1	<1	2	NDP	<1	<1	<1	mg/kg	TM30/PM15
Zinc [#]	NDP	84	96	68	67	75	56	NDP	61	58	<5	mg/kg	TM30/PM15
TPH CWG													
Aliphatics													
>C5-C6 [#]	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	<0.1	mg/kg	TM36/PM12
>C6-C8 [#]	-	-	0.5	<0.1	<0.1	<0.1	0.3	<0.1	-	-	<0.1	mg/kg	TM36/PM12
>C8-C10	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	<0.1	mg/kg	TM36/PM12
>C10-C12 [#]	-	-	<0.2	2.3	<0.2	<0.2	6.0	<1.2	-	-	<0.2	mg/kg	TM5/PM16
>C12-C16 [#]	-	-	8	8	<4	<4	13	<24	-	-	<4	mg/kg	TM5/PM16
>C16-C21 [#]	-	-	9	<7	<7	<7	<7	<42	-	-	<7	mg/kg	TM5/PM16
>C21-C35 [#]	-	-	<7	<7	<7	<7	<7	55	-	-	<7	mg/kg	TM5/PM16
Total aliphatics C5-35	-	-	<19	<19	<19	<19	19	<114	-	-	<19	mg/kg	TM5/TPM6/PM12/PM15
Aromatics													
>C5-EC7	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	<0.1	mg/kg	TM36/PM12
>EC7-EC8	-	-	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	-	-	<0.1	mg/kg	TM36/PM12
>EC8-EC10 [#]	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	<0.1	mg/kg	TM36/PM12
>EC10-EC12 [#]	-	-	1.5	2.5	1.9	<0.2	3.2	<1.2	-	-	<0.2	mg/kg	TM5/PM16
>EC12-EC16 [#]	-	-	36	20	14	<4	13	<24	-	-	<4	mg/kg	TM5/PM16
>EC16-EC21 [#]	-	-	350	39	29	<7	20	84	-	-	<7	mg/kg	TM5/PM16
>EC21-EC35 [#]	-	-	956	86	74	<7	52	383	-	-	<7	mg/kg	TM5/PM16
Total aromatics C5-35	-	-	1344	148	119	<19	88	467	-	-	<19	mg/kg	TM5/TPM6/PM12/PM15
Total aliphatics and aromatics(C5-35)	-	-	1344	148	119	<38	107	467	-	-	<38	mg/kg	TM5/TPM6/PM12/PM15
Summary													
Arsenic	25.1	-	-	-	-	-	-	16.9	-	-	<0.5	mg/kg	TM30/PM62
Cadmium	0.5	-	-	-	-	-	-	0.6	-	-	<0.1	mg/kg	TM30/PM62
Chromium	22.8	-	-	-	-	-	-	28.0	-	-	<0.5	mg/kg	TM30/PM62
Copper	69	-	-	-	-	-	-	44	-	-	<1	mg/kg	TM30/PM62
Lead	44	-	-	-	-	-	-	51	-	-	<5	mg/kg	TM30/PM62
Mercury	0.1	-	-	-	-	-	-	<0.1	-	-	<0.1	mg/kg	TM30/PM62
Nickel	29.0	-	-	-	-	-	-	33.8	-	-	<0.7	mg/kg	TM30/PM62
Selenium	<1	-	-	-	-	-	-	<1	-	-	<1	mg/kg	TM30/PM62
Total Sulphate [#]	-	-	5439	6629	2947	2936	10480	NDP	-	-	<50	mg/kg	TM50/PM15
Total Sulphate	-	-	-	-	-	-	-	1303	-	-	<50	mg/kg	TM50/PM62
Zinc	78	-	-	-	-	-	-	187	-	-	<5	mg/kg	TM30/PM62

Client Name:	ERM
Reference:	0209263
Location:	WREXHAM
Contact:	Joanne Pennell
JE Job No.:	13/6663

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

Jones Environmental Laboratory

Client Name: ERM

Report : Solid

Reference: 0209263

Location: WREXHAM

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Contact: Joanne Pennell

JE Job No.: 13/6663

J E Sample No.	35-36												
Sample ID	ERMBH3-190713-1.0												
Depth	1.0												
COC No / misc													
Containers	V J												
Sample Date	19/07/2013												
Sample Type	Soil												
Batch Number	1												
Date of Receipt	20/07/2013												
											Please see attached notes for all abbreviations and acronyms		
											LOD	Units	Method No.
Metals													
Arsenic #	NDP										<0.5	mg/kg	TM30/PM15
Cadmium #	NDP										<0.1	mg/kg	TM30/PM15
Chromium #	NDP										<0.5	mg/kg	TM30/PM15
Hexavalent Chromium	<0.3										<0.3	mg/kg	TM38/PM20
Copper #	NDP										<1	mg/kg	TM30/PM15
Lead #	NDP										<5	mg/kg	TM30/PM15
Mercury #	NDP										<0.1	mg/kg	TM30/PM15
Nickel #	NDP										<0.7	mg/kg	TM30/PM15
Selenium #	NDP										<1	mg/kg	TM30/PM15
Zinc #	NDP										<5	mg/kg	TM30/PM15
TPH CWG													
Aliphatics													
>C5-C6 #	-										<0.1	mg/kg	TM36/PM12
>C6-C8 #	-										<0.1	mg/kg	TM36/PM12
>C8-C10	-										<0.1	mg/kg	TM36/PM12
>C10-C12 #	-										<0.2	mg/kg	TM5/PM16
>C12-C16 #	-										<4	mg/kg	TM5/PM16
>C16-C21 #	-										<7	mg/kg	TM5/PM16
>C21-C35 #	-										<7	mg/kg	TM5/PM16
Total aliphatics C5-35	-										<19	mg/kg	TM5/PM16/PM12/PM15
Aromatics													
>C5-EC7	-										<0.1	mg/kg	TM36/PM12
>EC7-EC8	-										<0.1	mg/kg	TM36/PM12
>EC8-EC10 #	-										<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	-										<0.2	mg/kg	TM5/PM16
>EC12-EC16 #	-										<4	mg/kg	TM5/PM16
>EC16-EC21 #	-										<7	mg/kg	TM5/PM16
>EC21-EC35 #	-										<7	mg/kg	TM5/PM16
Total aromatics C5-35	-										<19	mg/kg	TM5/PM16/PM12/PM15
Total aliphatics and aromatics(C5-35)	-										<38	mg/kg	TM5/PM16/PM12/PM15
Arsenic	14.5										<0.5	mg/kg	TM30/PM62
Cadmium	0.5										<0.1	mg/kg	TM30/PM62
Chromium	15.1										<0.5	mg/kg	TM30/PM62
Copper	56										<1	mg/kg	TM30/PM62
Lead	35										<5	mg/kg	TM30/PM62
Mercury	<0.1										<0.1	mg/kg	TM30/PM62
Nickel	34.6										<0.7	mg/kg	TM30/PM62
Selenium	<1										<1	mg/kg	TM30/PM62
Total Sulphate #	-										<50	mg/kg	TM50/PM15
Total Sulphate	-										<50	mg/kg	TM50/PM62
Zinc	78										<5	mg/kg	TM30/PM62

Client Name:	ERM
Reference:	0209263
Location:	WREXHAM
Contact:	Joanne Pennell
JE Job No.:	13/6663

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

J E Sample No.		35-36									Please see attached notes for all abbreviations and acronyms			
Sample ID		ERMBH3-190713-1.0												
Depth		1.0												
COC No / misc														
Containers		V J												
Sample Date		19/07/2013												
Sample Type		Soil												
Batch Number		1										LOD	Units	Method No.
Date of Receipt		20/07/2013												
Methyl Tertiary Butyl Ether #		-									<0.002	mg/kg	TM15/PM10	
Benzene #		-									<0.003	mg/kg	TM15/PM10	
Toluene #		-									<0.003	mg/kg	TM15/PM10	
Ethylbenzene #		-									<0.003	mg/kg	TM15/PM10	
p/m-Xylene #		-									<0.006	mg/kg	TM15/PM10	
o-Xylene #		-									<0.003	mg/kg	TM15/PM10	
Surrogate Recovery Toluene D8		-									<0	%	TM15/PM10	
Surrogate Recovery 4-Bromofluorobenzene		-									<0	%	TM15/PM10	
Total Phenols HPLC		-									<0.15	mg/kg	TM26/PM21	
Chloride #		-									<2	mg/kg	TM38/PM20	
Chloride #		-									<2	mg/kg	TM38/PM60	
Chromium III		15.1									<0.5	mg/kg	NONE/NONE	
Free Cyanide		<0.5									<0.5	mg/kg	TM89/PM45	
Total Cyanide #		<0.5									<0.5	mg/kg	TM89/PM45	
Total Organic Carbon #		NDP									<0.02	%	TM21/PM24	
pH #		-									<0.01	pH units	TM73/PM11	

Client Name: ERM

SVOC Report : Solid

Reference: 0209263

Location: WREXHAM

Contact: Joanne Pennell

JE Job No.: 13/6663

J E Sample No.	1-3	4-5	6-9	10-13	14-17	18-21	23-26	27-30	31-32	33-34	Please see attached notes for all abbreviations and acronyms		
Sample ID	ERMBH1-170713-1.0	ERMBH4-170713-1.0	ERMBH5-170713-1.0	ERMBH6-170713-1.0	ERMBH7-170713-1.0	ERMBH8-170713-1.0	ERMBH9-180713-1.0	ERMBH10-180713-1.0	ERMBH12-180713-1.0	ERMBH13-180713-1.0			
Depth	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0			
COC No / misc													
Containers	V J T	V J	V J	V J	V J	V J	V J	V J	V J	V J			
Sample Date	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	18/07/2013	18/07/2013	18/07/2013	18/07/2013			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	LOD	Units	Method No.
SVOC MS													
Phenols													
4-Chloro-3-methylphenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
2-Chlorophenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
2-Methylphenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.22	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
4-Methylphenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.11	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
2,4-Dichlorophenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
2,4-Dimethylphenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
2-Nitrophenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
4-Nitrophenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Pentachlorophenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Phenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
2,4,5-Trichlorophenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
2,4,6-Trichlorophenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
PAHs													
Acenaphthene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	1.37	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Acenaphthylene	0.02	0.04	<0.01	0.07	0.02	<0.01	0.07	0.81	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Anthracene	0.09	0.08	0.08	0.10	0.07	0.07	0.09	3.14	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Benzo(a)anthracene	0.23	0.19	0.08	0.17	0.06	0.06	0.12	8.58	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Benzo(b)fluoranthene	0.51	0.25	0.14	0.14	0.15	0.08	0.17	16.64	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Benzo(a)pyrene	0.21	0.09	0.06	0.05	0.12	0.02	0.06	9.60	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Benzo(ghi)perylene	0.23	0.11	0.08	0.11	0.08	0.09	0.29	6.04	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
2-Chloronaphthalene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Chrysene	0.44	0.19	0.16	0.29	0.14	0.14	0.30	9.21	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Dibenzo(ah)anthracene	0.05	0.03	0.01	0.02	0.02	<0.01	0.03	1.90	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Fluoranthene	0.56	0.23	0.13	0.17	0.12	0.07	0.16	20.06	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Fluorene	<0.01	0.02	0.02	<0.01	<0.01	0.02	0.13	0.82	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Indeno(123cd)pyrene	0.12	0.05	0.03	0.02	0.03	<0.01	0.03	4.95	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
2-Methylnaphthalene	1.40	1.52	1.26	3.49	0.87	1.47	3.95	0.33	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Naphthalene	1.15	1.20	1.02	2.50	0.75	1.24	3.66	0.58	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Phenanthrene	0.69	0.50	0.48	1.29	0.48	0.52	1.63	6.72	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Pyrene	0.57	0.24	0.16	0.22	0.15	0.10	0.20	19.03	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Phthalates													
Bis(2-ethylhexyl) phthalate	0.04	0.04	0.12	0.02	0.08	0.02	0.06	0.72	0.03	0.01	<0.01	mg/kg	TM16/PM8
Butylbenzyl phthalate	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Diethyl phthalate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Dimethyl phthalate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Di-n-butyl phthalate	0.04	<0.01	0.04	<0.01	<0.01	<0.01	0.03	0.06	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Di-n-Octyl phthalate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Amines													
N-nitrosodi-n-propylamine	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
Anilines													
4-Chloroaniline	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
2-Nitroaniline	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
3-Nitroaniline	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8
4-Nitroaniline	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	TM16/PM8

Client Name:	ERM
Reference:	0209263
Location:	WREXHAM
Contact:	Joanne Pennell
JE Job No.:	13/6663

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SVOC MS													
Phenols													
4-Chloro-3-methylphenol	<0.01										<0.01	mg/kg	TM16/PM8
2-Chlorophenol	<0.01										<0.01	mg/kg	TM16/PM8
2-Methylphenol	<0.01										<0.01	mg/kg	TM16/PM8
4-Methylphenol	<0.01										<0.01	mg/kg	TM16/PM8
2,4-Dichlorophenol	<0.01										<0.01	mg/kg	TM16/PM8
2,4-Dimethylphenol	<0.01										<0.01	mg/kg	TM16/PM8
2-Nitrophenol	<0.01										<0.01	mg/kg	TM16/PM8
4-Nitrophenol	<0.01										<0.01	mg/kg	TM16/PM8
Pentachlorophenol	<0.01										<0.01	mg/kg	TM16/PM8
Phenol	<0.01										<0.01	mg/kg	TM16/PM8
2,4,5-Trichlorophenol	<0.01										<0.01	mg/kg	TM16/PM8
2,4,6-Trichlorophenol	<0.01										<0.01	mg/kg	TM16/PM8
PAHs													
Acenaphthene	<0.01										<0.01	mg/kg	TM16/PM8
Acenaphthylene	0.07										<0.01	mg/kg	TM16/PM8
Anthracene	0.07										<0.01	mg/kg	TM16/PM8
Benzo(a)anthracene	0.09										<0.01	mg/kg	TM16/PM8
Benzo(bk)fluoranthene	0.09										<0.01	mg/kg	TM16/PM8
Benzo(a)pyrene	0.04										<0.01	mg/kg	TM16/PM8
Benzo(ghi)perylene	0.07										<0.01	mg/kg	TM16/PM8
2-Chloronaphthalene	<0.01										<0.01	mg/kg	TM16/PM8
Chrysene	0.20										<0.01	mg/kg	TM16/PM8
Dibenzo(ah)anthracene	0.01										<0.01	mg/kg	TM16/PM8
Fluoranthene	0.11										<0.01	mg/kg	TM16/PM8
Fluorene	<0.01										<0.01	mg/kg	TM16/PM8
Indeno(123cd)pyrene	0.02										<0.01	mg/kg	TM16/PM8
2-Methylnaphthalene	2.88										<0.01	mg/kg	TM16/PM8
Naphthalene	2.12										<0.01	mg/kg	TM16/PM8
Phenanthrene	0.87										<0.01	mg/kg	TM16/PM8
Pyrene	0.13										<0.01	mg/kg	TM16/PM8
Phthalates													
Bis(2-ethylhexyl) phthalate	0.04										<0.01	mg/kg	TM16/PM8
Butylbenzyl phthalate	<0.01										<0.01	mg/kg	TM16/PM8
Diethyl phthalate	<0.01										<0.01	mg/kg	TM16/PM8
Dimethyl phthalate	<0.01										<0.01	mg/kg	TM16/PM8
Di-n-butyl phthalate	0.02										<0.01	mg/kg	TM16/PM8
Di-n-Octyl phthalate	<0.01										<0.01	mg/kg	TM16/PM8
Amines													
N-nitrosodi-n-propylamine	<0.01										<0.01	mg/kg	TM16/PM8
Anilines													
4-Chloroaniline	<0.01										<0.01	mg/kg	TM16/PM8
2-Nitroaniline	<0.01										<0.01	mg/kg	TM16/PM8
3-Nitroaniline	<0.01										<0.01	mg/kg	TM16/PM8
4-Nitroaniline	<0.01										<0.01	mg/kg	TM16/PM8

Client Name: ERM

SVOC Report : Solid

Reference: 0209263

Location: WREXHAM

Contact: Joanne Pennell

JE Job No.: 13/6663

J E Sample No.	35-36										Please see attached notes for all abbreviations and acronyms		
Sample ID	ERM-BH3-190713-1.0												
Depth	1.0												
COC No / misc													
Containers	V J												
Sample Date	19/07/2013												
Sample Type	Soil												
Batch Number	1												
Date of Receipt	20/07/2013										LOD	Units	Method No.
SVOC MS													
Other SVOCs													
Azobenzene	<0.01										<0.01	mg/kg	TM16/PM8
Bis(2-chloroethoxy)methane	<0.01										<0.01	mg/kg	TM16/PM8
Carbazole	<0.01										<0.01	mg/kg	TM16/PM8
Dibenzofuran	0.64										<0.01	mg/kg	TM16/PM8
2,4-Dinitrotoluene	<0.01										<0.01	mg/kg	TM16/PM8
2,6-Dinitrotoluene	<0.01										<0.01	mg/kg	TM16/PM8
Hexachlorobutadiene	<0.01										<0.01	mg/kg	TM16/PM8
Hexachlorocyclopentadiene	<0.01										<0.01	mg/kg	TM16/PM8
Isophorone	<0.01										<0.01	mg/kg	TM16/PM8
Nitrobenzene	<0.01										<0.01	mg/kg	TM16/PM8
Bis(2-chloroethyl)ether	<0.01										<0.01	mg/kg	TM16/PM8
4-Bromophenylphenylether	<0.01										<0.01	mg/kg	TM16/PM8
4-Chlorophenylphenylether	<0.01										<0.01	mg/kg	TM16/PM8
Hexachloroethane	<0.01										<0.01	mg/kg	TM16/PM8
Hexachlorobenzene	<0.01										<0.01	mg/kg	TM16/PM8
1,2,4-Trichlorobenzene	<0.01										<0.01	mg/kg	TM16/PM8
1,2-Dichlorobenzene	<0.01										<0.01	mg/kg	TM16/PM8
1,3-Dichlorobenzene	<0.01										<0.01	mg/kg	TM16/PM8
1,4-Dichlorobenzene	<0.01										<0.01	mg/kg	TM16/PM8

Client Name: ERM
Reference: 0209263
Location: WREXHAM
Contact: Joanne Pennell
JE Job No.: 13/6663

Please see attached notes for all abbreviations and acronyms

QF-PM 3.1.4 v10

Jones Environmental Laboratory

Client Name: ERM

VOC Report : Solid

Reference: 0209263

Location: WREXHAM

Contact: Joanne Pennell

JE Job No.: 13/6663

J E Sample No.	1-3	4-5	6-9	10-13	14-17	18-21	23-26	27-30	31-32	33-34	Please see attached notes for all abbreviations and acronyms		
Sample ID	ERMBH1-170713-1.0	ERMBH4-170713-1.0	ERMBH5-170713-1.0	ERMBH6-170713-1.0	ERMBH7-170713-1.0	ERMBH8-170713-1.0	ERMBH9-180713-1.0	ERMBH10-180713-1.0	ERMBH12-180713-1.0	ERMBH13-180713-1.0			
Depth	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0			
COC No / misc													
Containers	V J T	V J	V J	V J	V J	V J	V J	V J	V J	V J			
Sample Date	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	17/07/2013	18/07/2013	18/07/2013	18/07/2013	18/07/2013			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	20/07/2013	LOD	Units	Method No.
VOC MS													
Other VOCs													
Bromobenzene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/kg	TM15/PM10
Bromochloromethane #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/kg	TM15/PM10
Bromodichloromethane #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/kg	TM15/PM10
Bromoform #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/kg	TM15/PM10
Bromomethane	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	mg/kg	TM15/PM10
n-Butylbenzene #	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	mg/kg	TM15/PM10
sec-Butylbenzene #	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	mg/kg	TM15/PM10
tert-Butylbenzene #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/kg	TM15/PM10
2-Chlorotoluene	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/kg	TM15/PM10
4-Chlorotoluene	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/kg	TM15/PM10
Isopropylbenzene #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.005	<0.003	<0.003	<0.003	<0.003	mg/kg	TM15/PM10
1,2-Dibromo-3-chloropropane #	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	mg/kg	TM15/PM10
Dibromochloromethane #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/kg	TM15/PM10
1,2-Dibromoethane #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/kg	TM15/PM10
Dibromomethane #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/kg	TM15/PM10
Dichlorodifluoromethane	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/kg	TM15/PM10
4-Isopropyltoluene #	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	mg/kg	TM15/PM10
Propylbenzene #	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	mg/kg	TM15/PM10
Styrene	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/kg	TM15/PM10
Trichlorofluoromethane #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/kg	TM15/PM10
1,2,4-Trimethylbenzene #	0.023	<0.006	<0.006	<0.006	<0.006	0.010	0.048	<0.006	<0.006	<0.006	<0.006	mg/kg	TM15/PM10
1,3,5-Trimethylbenzene #	0.008	<0.003	<0.003	<0.003	<0.003	0.004	0.021	<0.003	<0.003	<0.003	<0.003	mg/kg	TM15/PM10
Methyl Tertiary Butyl Ether #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/kg	TM15/PM10
Hexachlorobutadiene	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	mg/kg	TM15/PM10
Naphthalene	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	0.473	<0.027	<0.027	<0.027	mg/kg	TM15/PM10
Surrogate Recovery Toluene D8	100	106	97	96	108	94	87	100	103	111	<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	83	88	81	78	83	74	73	105	119	133	<0	%	TM15/PM10

QF-PM 3.1.4 v10

Jones Environmental Laboratory

Client Name: ERM
Reference: 0209263
Location: WREXHAM
Contact: Joanne Pennell
JE Job No.: 13/6663

VOC Report : Solid

J E Sample No.	35-36												
Sample ID	ERMBH3-190713-1.0												
Depth	1.0												
COC No / misc													
Containers	V J												
Sample Date	19/07/2013												
Sample Type	Soil												
Batch Number	1												
Date of Receipt	20/07/2013												
											Please see attached notes for all abbreviations and acronyms		
VOC MS											LOD	Units	Method No.
Other VOCs													
Bromobenzene	<0.002										<0.002	mg/kg	TM15/PM10
Bromochloromethane #	<0.003										<0.003	mg/kg	TM15/PM10
Bromodichloromethane #	<0.003										<0.003	mg/kg	TM15/PM10
Bromoform #	<0.003										<0.003	mg/kg	TM15/PM10
Bromomethane	<0.001										<0.001	mg/kg	TM15/PM10
n-Butylbenzene #	<0.004										<0.004	mg/kg	TM15/PM10
sec-Butylbenzene #	<0.004										<0.004	mg/kg	TM15/PM10
tert-Butylbenzene #	<0.005										<0.005	mg/kg	TM15/PM10
2-Chlorotoluene	<0.003										<0.003	mg/kg	TM15/PM10
4-Chlorotoluene	<0.003										<0.003	mg/kg	TM15/PM10
Isopropylbenzene #	<0.003										<0.003	mg/kg	TM15/PM10
1,2-Dibromo-3-chloropropane #	<0.004										<0.004	mg/kg	TM15/PM10
Dibromochloromethane #	<0.003										<0.003	mg/kg	TM15/PM10
1,2-Dibromoethane #	<0.003										<0.003	mg/kg	TM15/PM10
Dibromomethane #	<0.003										<0.003	mg/kg	TM15/PM10
Dichlorodifluoromethane	<0.002										<0.002	mg/kg	TM15/PM10
4-Isopropyltoluene #	<0.004										<0.004	mg/kg	TM15/PM10
Propylbenzene #	<0.004										<0.004	mg/kg	TM15/PM10
Styrene	<0.003										<0.003	mg/kg	TM15/PM10
Trichlorofluoromethane #	<0.002										<0.002	mg/kg	TM15/PM10
1,2,4-Trimethylbenzene #	0.023										<0.006	mg/kg	TM15/PM10
1,3,5-Trimethylbenzene #	0.008										<0.003	mg/kg	TM15/PM10
Methyl Tertiary Butyl Ether #	<0.002										<0.002	mg/kg	TM15/PM10
Hexachlorobutadiene	<0.004										<0.004	mg/kg	TM15/PM10
Naphthalene	<0.027										<0.027	mg/kg	TM15/PM10
Surrogate Recovery Toluene D8	89										<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	73										<0	%	TM15/PM10

Asbestos Analysis

Note:

Opinions lie outside the scope of our UKAS accreditation.

If asbestos fibres are reported at trace levels there will not be enough fibres to quantify and will be less than 0.001%.

Signed on behalf of Jones Environmental Laboratory:

Gemma Newsome
Asbestos Team Leader

QF-PM 3.1.15 v3 Please include all sections of this report if it is reproduced 15 of 19

Jones Environmental Laboratory

Client Name: ERM

Reference: 0209263

Location: WREXHAM

Contact: Joanne Pennell

NDP Reason Report

Matrix : Solid

[illegible]

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 13/6663

SOILS

Please note we are only MCERTS accredited for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. If we are instructed to keep samples, a storage charge of £1 (1.5 Euros) per sample per month will be applied until we are asked to dispose of them.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

WATERS

Please note we are not a Drinking Water Inspectorate (DWI) Approved Laboratory. It is important that detection limits are carefully considered when requesting water analysis.

UKAS accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

NOTE

Data is only accredited when all the requirements of our Quality System have been met. In certain circumstances where the requirements have not been met, the laboratory may issue the data in an interim report but will remove the accreditation, in this instance results should be considered indicative only. Where possible samples will be re-extracted and a final report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

ABBREVIATIONS and ACRONYMS USED

#	UKAS accredited.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance.
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
CO	Suspected carry over
OC	Outside Calibration Range
NFD	No Fibres Detected

JE Job No 13/6663

[illegible]



Jones Environmental Laboratory

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Fax: +44 (0) 1244 833781



No.4225

Attention :	Joanne Pennell
Date :	30th July, 2013
Your reference :	0209263
Our reference :	Test Report 13/6730 Batch 1
Location :	WREXHAM
Date samples received :	24th July, 2013
Status :	Final report
Issue :	1

Two samples were received for analysis on 24th July, 2013. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Paul Lee-Boden B.Sc
Project Manager

Bob Millward B.Sc FRSC
Principal Chemist

Client Name:	ERM
Reference:	0209263
Location:	WREXHAM
Contact:	Joanne Pennell
JE Job No.:	13/6730

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

Jones Environmental Laboratory

Client Name: ERM
Reference: 0209263
Location: WREXHAM
Contact: Joanne Pennell
JE Job No.: 13/6730

SVOC Report : Solid

J E Sample No.	1-2	3-4									Please see attached notes for all abbreviations and acronyms		
Sample ID	ERM BH2	ERM BH11											
Depth	1.0	1.0											
COC No / misc													
Containers	V J	V J											
Sample Date	22/07/2013	22/07/2013											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	24/07/2013	24/07/2013									LOD	Units	Method No.
SVOC MS													
Phenols													
2-Chlorophenol	<10	<10									<10	ug/kg	TM16/PM8
2-Methylphenol	<10	<10									<10	ug/kg	TM16/PM8
2-Nitrophenol	<10	<10									<10	ug/kg	TM16/PM8
2,4-Dichlorophenol	<10	<10									<10	ug/kg	TM16/PM8
2,4-Dimethylphenol	33	<10									<10	ug/kg	TM16/PM8
2,4,5-Trichlorophenol	<10	<10									<10	ug/kg	TM16/PM8
2,4,6-Trichlorophenol	<10	<10									<10	ug/kg	TM16/PM8
4-Chloro-3-methylphenol	<10	<10									<10	ug/kg	TM16/PM8
4-Methylphenol	<10	<10									<10	ug/kg	TM16/PM8
4-Nitrophenol	<10	<10									<10	ug/kg	TM16/PM8
Pentachlorophenol	<10	<10									<10	ug/kg	TM16/PM8
Phenol	36	<10									<10	ug/kg	TM16/PM8
PAHs													
2-Chloronaphthalene	<10	<10									<10	ug/kg	TM16/PM8
2-Methylnaphthalene	2821	65									<10	ug/kg	TM16/PM8
Naphthalene	2429	53									<10	ug/kg	TM16/PM8
Acenaphthylene	<10	<10									<10	ug/kg	TM16/PM8
Acenaphthene	<10	<10									<10	ug/kg	TM16/PM8
Fluorene	32	<10									<10	ug/kg	TM16/PM8
Phenanthrene	870	28									<10	ug/kg	TM16/PM8
Anthracene	37	<10									<10	ug/kg	TM16/PM8
Fluoranthene	116	<10									<10	ug/kg	TM16/PM8
Pyrene	93	<10									<10	ug/kg	TM16/PM8
Benzo(a)anthracene	<10	<10									<10	ug/kg	TM16/PM8
Chrysene	188	<10									<10	ug/kg	TM16/PM8
Benzo(bk)fluoranthene	21	<10									<10	ug/kg	TM16/PM8
Benzo(a)pyrene	23	<10									<10	ug/kg	TM16/PM8
Indeno(123cd)pyrene	<10	<10									<10	ug/kg	TM16/PM8
Dibenzo(ah)anthracene	<10	<10									<10	ug/kg	TM16/PM8
Benzo(ghi)perylene	<10	<10									<10	ug/kg	TM16/PM8
Phthalates													
Bis(2-ethylhexyl) phthalate	<10	<10									<10	ug/kg	TM16/PM8
Butylbenzyl phthalate	<10	<10									<10	ug/kg	TM16/PM8
Di-n-butyl phthalate	22	23									<10	ug/kg	TM16/PM8
Di-n-Octyl phthalate	<10	<10									<10	ug/kg	TM16/PM8
Diethyl phthalate	<10	<10									<10	ug/kg	TM16/PM8
Dimethyl phthalate	<10	<10									<10	ug/kg	TM16/PM8

Client Name:	ERM
Reference:	0209263
Location:	WREXHAM
Contact:	Joanne Pennell
JE Job No.:	13/6730

Please see attached notes for all abbreviations and acronyms

Client Name: ERM
Reference: 0209263
Location: WREXHAM
Contact: Joanne Pennell
JE Job No.: 13/6730

Please see attached notes for all abbreviations and acronyms

Client Name: ERM
Reference: 0209263
Location: WREXHAM
Contact: Joanne Pennell
JE Job No.: 13/6730

VOC Report : Solid

Please see attached notes for all abbreviations and acronyms

[illegible]

Asbestos Analysis

Client Name: ERM
Reference: 209263
Location: WREXHAM
Contact: Joanne Pennell

Note:

Analysis was carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Jones Environmental Laboratory consultant, Jones Environmental Laboratory cannot be responsible for inaccurate or unrepresentative sampling.

If asbestos fibres are reported at trace levels there will not be enough fibres to quantify and will be less than 0.001%.

Signed on behalf of Jones Environmental Laboratory:

Gemma Newsome
Asbestos Team Leader

[illegible]

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 13/6730

SOILS

Please note we are only MCERTS accredited for sand, loam and clay and any other matrix is outside our scope of accreditation.

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It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. If we are instructed to keep samples, a storage charge of £1 (1.5 Euros) per sample per month will be applied until we are asked to dispose of them.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

WATERS

Please note we are not a Drinking Water Inspectorate (DWI) Approved Laboratory. It is important that detection limits are carefully considered when requesting water analysis.

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As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

NOTE

Data is only accredited when all the requirements of our Quality System have been met. In certain circumstances where the requirements have not been met, the laboratory may issue the data in an interim report but will remove the accreditation, in this instance results should be considered indicative only. Where possible samples will be re-extracted and a final report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

ABBREVIATIONS and ACRONYMS USED

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++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
CO	Suspected carry over
OC	Outside Calibration Range
NFD	No Fibres Detected

JE Job No 13/6730

[illegible]



Jones Environmental Laboratory

Unit 3 Deeside Point
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Tel: +44 (0) 1244 833780
Fax: +44 (0) 1244 833781

No.4225

Attention :	Joanne Pennell
Date :	10th September, 2013
Your reference :	0209263
Our reference :	Test Report 13/6730 Batch 1 Schedule B
Location :	WREXHAM
Date samples received :	24th July, 2013
Status :	Final report
Issue :	1

Two samples were received for analysis on 24th July, 2013. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Paul Lee-Boden BSc
Project Manager

Bob Millward BSc FRSC
Principal Chemist

Client Name: ERM
Reference: 0209263
Location: WREXHAM
Contact: Joanne Pennell
JE Job No.: 13/6730

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

Metals

Hexavalent Chromium

 ≤ 0 . ≤ 0.3 <0.3

mg/kg

TM38/PM20

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 13/6730

SOILS

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Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

WATERS

Please note we are not a Drinking Water Inspectorate (DWI) Approved Laboratory. It is important that detection limits are carefully considered when requesting water analysis.

UKAS accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

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Data is only accredited when all the requirements of our Quality System have been met. In certain circumstances where the requirements have not been met, the laboratory may issue the data in an interim report but will remove the accreditation, in this instance results should be considered indicative only. Where possible samples will be re-extracted and a final report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

ABBREVIATIONS and ACRONYMS USED

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DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance.
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
CO	Suspected carry over
OC	Outside Calibration Range
NFD	No Fibres Detected

JE Job No 13/6730

[illegible]



Jones Environmental Laboratory

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No.4225

Attention :	Joanne Pennell
Date :	2nd August, 2013
Your reference :	0209263
Our reference :	Test Report 13/6859 Batch 1
Location :	WREXHAM
Date samples received :	27th July, 2013
Status :	Final report
Issue :	1

Twelve samples were received for analysis on 27th July, 2013. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Jamie Williams B.Sc
Project Co-ordinator

Bob Millward B.Sc FRSC
Principal Chemist

Jones Environmental Laboratory

Client Name: ERM

SVOC Report : Liquid

Reference: 0209263

Location: WREXHAM

Contact: Joanne Pennell

JE Job No.: 13/6859

J E Sample No.	1-4	5-8	9-12	13-16	17-20	21-24	25-28	29-32	33-36	37-40	Please see attached notes for all abbreviations and acronyms		
Sample ID	ERMBH1	ERMBH2	ERMBH3	ERMBH4	ERMBH5	ERMBH10	ERMBH11	ERMBH12	ERMBH13	ERMBH14			
Depth													
COC No / misc													
Containers	VPG	VPG	VPG	VPG	VPG	VPG	VPG	VPG	VPG	VPG			
Sample Date	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013			
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	LOD	Units	Method No.
SVOC MS													
Phenols													
4-Chloro-3-methylphenol #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2-Chlorophenol #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
2-Methylphenol #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
4-Methylphenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM16/PM30
2,4-Dichlorophenol #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2,4-Dimethylphenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM16/PM30
2-Nitrophenol #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
4-Nitrophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM16/PM30
Pentachlorophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM16/PM30
Phenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM16/PM30
2,4,5-Trichlorophenol #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2,4,6-Trichlorophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM16/PM30
PAHs													
Acenaphthene #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Acenaphthylene #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Anthracene #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Benzo(a)anthracene #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Benzo(k)fluoranthene #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Benzo(a)pyrene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM16/PM30
Benzo(ghi)perylene #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2-Chloronaphthalene #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Chrysene #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Dibenzo(ah)anthracene #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Fluoranthene #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Fluorene #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Indeno(123cd)pyrene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM16/PM30
2-Methylnaphthalene #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Naphthalene #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Phenanthrene #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Pyrene #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Phthalates													
Bis(2-ethylhexyl) phthalate	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM16/PM30
Butylbenzyl phthalate	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM16/PM30
Diethyl phthalate #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM16/PM30
Dimethyl phthalate	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM16/PM30
Di-n-butyl phthalate #	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	ug/l	TM16/PM30
Di-n-Octyl phthalate	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM16/PM30
Amines													
N-nitrosodi-n-propylamine #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Anilines													
4-Chloroaniline	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM16/PM30
2-Nitroaniline	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM16/PM30
3-Nitroaniline	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	ug/l	TM16/PM30
4-Nitroaniline #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30

Please include all sections of this report if it is reproduced

Client Name: ERM
Reference: 0209263
Location: WREXHAM
Contact: Joanne Pennell
JE Job No.: 13/6859

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Jones Environmental Laboratory

Client Name: ERM
Reference: 0209263
Location: WREXHAM
Contact: Joanne Pennell
JE Job No.: 13/6859

VOC Report : Liquid

J E Sample No.	1-4	5-8	9-12	13-16	17-20	21-24	25-28	29-32	33-36	37-40	Please see attached notes for all abbreviations and acronyms		
Sample ID	ERMBH1	ERMBH2	ERMBH3	ERMBH4	ERMBH5	ERMBH10	ERMBH11	ERMBH12	ERMBH13	ERMBH14			
Depth													
COC No / misc													
Containers	V P G	V P G	V P G	V P G	V P G	V P G	V P G	V P G	V P G	V P G			
Sample Date	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013			
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water			
Batch Number	1	1	1	1	1	1	1	1	1	1			
Date of Receipt	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	LOD	Units	Method No.
VOC MS													
BTEX													
Benzene #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM15/PM10
Toluene #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM15/PM10
Ethylbenzene #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM15/PM10
p/m-Xylene #	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM15/PM10
o-Xylene #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ug/l	TM15/PM10
Chloroethenes													
Tetrachloroethene (PCE) #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
Trichloroethene (TCE) #	<3	<3	<3	<3	<3	<3	4	<3	<3	6	<3	ug/l	TM15/PM10
1,1-Dichloroethene (1,1 DCE) #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
cis-1-2-Dichloroethene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
trans-1-2-Dichloroethene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
Vinyl Chloride	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ug/l	TM15/PM10
Chloroethanes													
1,1,1,2-Tetrachloroethane #	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
1,1,2,2-Tetrachloroethane	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	ug/l	TM15/PM10
1,1,1-Trichloroethane #	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
1,1,2-Trichloroethane #	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
1,1-Dichloroethane #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
1,2-Dichloroethane #	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
Chloroethane #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
Chlorobenzenes													
1,2,3-Trichlorobenzene	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
1,2,4-Trichlorobenzene	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
1,2-Dichlorobenzene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
1,3-Dichlorobenzene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
1,4-Dichlorobenzene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
Chlorobenzene #	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
Chloromethanes													
Carbon tetrachloride #	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
Chloroform #	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
Dichloromethane (DCM) #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
Chloromethane #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
Chloropropanes													
1,2,3-Trichloropropane #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
1,2-Dichloropropane #	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
2,2-Dichloropropane	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM15/PM10
1,3-Dichloropropane #	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
Chloropropenes													
1,1-Dichloropropene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
cis-1-3-Dichloropropene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
trans-1-3-Dichloropropene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10

Jones Environmental Laboratory

Client Name: ERM

VOC Report : Liquid

Reference: 0209263

Location: WREXHAM

Contact: Joanne Pennell

JE Job No.: 13/6859

J E Sample No.	1-4	5-8	9-12	13-16	17-20	21-24	25-28	29-32	33-36	37-40	Please see attached notes for all abbreviations and acronyms		
Sample ID	ERMBH1	ERMBH2	ERMBH3	ERMBH4	ERMBH5	ERMBH10	ERMBH11	ERMBH12	ERMBH13	ERMBH14			
Depth													
COC No / misc													
Containers	V P G	V P G	V P G	V P G	V P G	V P G	V P G	V P G	V P G	V P G			
Sample Date	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013	25/07/2013			
Sample Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water			
Batch Number	1	1	1	1	1	1	1	1	1	1	LOD	Units	Method No.
Date of Receipt	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013	27/07/2013			
VOC MS													
Other VOCs													
Bromobenzene #	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
Bromochloromethane #	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
Bromodichloromethane #	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
Bromoform #	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
Bromomethane	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	ug/l	TM15/PM10
n-Butylbenzene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
sec-Butylbenzene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
tert-Butylbenzene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
2-Chlorotoluene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
4-Chlorotoluene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
Isopropylbenzene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
1,2-Dibromo-3-chloropropane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
Dibromochloromethane #	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
1,2-Dibromoethane #	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
Dibromomethane #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
Dichlorodifluoromethane	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
4-Isopropyltoluene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
Propylbenzene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
Styrene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
Trichlorofluoromethane #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
1,2,4-Trimethylbenzene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
1,3,5-Trimethylbenzene #	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
Methyl Tertiary Butyl Ether #	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	ug/l	TM15/PM10
Hexachlorobutadiene	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	ug/l	TM15/PM10
Naphthalene	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	ug/l	TM15/PM10
Surrogate Recovery Toluene D8	101	102	100	104	102	105	101	105	103	105	<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	107	106	103	109	107	110	107	110	110	111	<0	%	TM15/PM10

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 13/6859

SOILS

Please note we are only MCERTS accredited for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. If we are instructed to keep samples, a storage charge of £1 (1.5 Euros) per sample per month will be applied until we are asked to dispose of them.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

WATERS

Please note we are not a Drinking Water Inspectorate (DWI) Approved Laboratory. It is important that detection limits are carefully considered when requesting water analysis.

UKAS accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

NOTE

Data is only accredited when all the requirements of our Quality System have been met. In certain circumstances where the requirements have not been met, the laboratory may issue the data in an interim report but will remove the accreditation, in this instance results should be considered indicative only. Where possible samples will be re-extracted and a final report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

ABBREVIATIONS and ACRONYMS USED

#	UKAS accredited.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance.
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
CO	Suspected carry over
OC	Outside Calibration Range
NFD	No Fibres Detected

JE Job No 13/6859

[illegible]