



Galliford Try Building North West

Wrexham Custody Facility

Remediation Strategy

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Prepared by	Checked by	Approved By
Sara Hegewald BSc (Hons) MSc FGS Senior Environmental Consultant	Kathryn Ellis BSc (Hons) MSc CSci FGS Principal Environmental Consultant	Richard Jarrett BSc (Hons) MSc EurIng, CEng MICE UK Registered Ground Engineering Adviser
<i>S. Hegewald</i>	<i>K. Ellis</i>	<i>R. A. Jarrett</i>
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Sara Hegewald BSc (Hons) MSc FGS Senior Environmental Consultant	Kathryn Ellis BSc (Hons) MSc CSci FGS Principal Environmental Consultant	Richard Jarrett BSc (Hons) MSc EurIng, CEng MICE UK Registered Ground Engineering Adviser
<i>S. Hegewald</i>	<i>K. Ellis</i>	<i>R. A. Jarrett</i>
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B1305210/AR/050.001 – Proposed Site Development Plan

1. Introduction

1.1 Instruction

WYG Environment Planning Transport Ltd (WYG) was commissioned by Galliford Try Building North West to undertake environmental consultancy services including the production of a Remediation Strategy for the development of a new custody facility in Llay, near Wrexham. A site location plan is enclosed as Drawing No. A098075-MAN-01.

In addition to the above, to further delineate the possible presence of hydrocarbon impacted groundwater and carry out further soil chemical analysis of the Made Ground associated with the use of the site, further sampling and assessment was also undertaken to inform the remediation strategy (as reported in Section 4).

Attention is drawn to the report conditions included in Appendix A. This report has been prepared in response to the conditions associated with planning permission P/2015/0583 and subsequent liaison with the relevant regulators (provided in Appendix B).

This report should be read in conjunction with the following reports and correspondence:

- Phase 1 Geo-Environmental Appraisal, New Police Facility, Llay Industrial Site, Capita Symonds, June 2013;
- Report on Ground Investigation, North Wales Police New Custody Suite & Administration office, Llay Wrexham, Ian Farmer Associates, February 2015;
- Ground Investigation Report, Police and Crime Commissioner for North Wales Eastern Command & Custody Facility, Llay, Wrexham, Ian Farmer Associates, February 2016;
- Wrexham County Borough Council Memorandum (ref: WK/201602135), dated 17th March 2016 (provided in Appendix B);
- Technical Peer Review, Wrexham Custody Facility: Geo-Environmental Land Contamination, WYG, July 2016;
- Email from Angela Guy, Contaminated Land Officer, Wrexham County Borough Council, dated 2nd August 2016 (provided in Appendix B); and,
- Letter from Angela Guy, Contaminated Land Office, Wrexham County Borough Council, dated 26th October 2016 (provided in Appendix B).

WYG has used the information provided in the Capita Symonds and Ian Farmer reports in good faith, but is not responsible for the completeness or accuracy of the information they contain.

1.2 Proposed Development

It is proposed that the site is redeveloped with construction of a new custody facility comprising police offices, storage, custody building with ancillary parking and new access.

The new custody building will replace the former Sharp Precision warehouse located in the eastern part of the site.

The proposed development layout with associated landscaping is shown on Drawing No. B13052/AR/050.001 – Proposed Site Plan, prepared by Jacobs.

It is proposed that cut and fill earthworks are to be undertaken to enable development of the site comprising:

- Cut and fill of the area of proposed piling mat (eastern part of proposed custody facility);
- Soil arisings from foundation excavations of the proposed custody building to be used as fill below the proposed car park in the northern part of the site;
- Fill across the area of proposed bund in the south eastern part of site, and;
- Cut of material from area of proposed drainage running along perimeter of proposed custody facility.

Further details of the proposed cut and fill operations are included in Section 5.1.

1.3 Remediation Strategy Objectives

The objectives of this Remediation Strategy are to:

- Report on the additional site investigation undertaken to delineate the extents of potentially unacceptable contamination identified in the previous investigations, and;
- Set out the required criteria for the re-development works, which establish conditions such that risks associated with any contamination present are practically reduced and controlled, thus enabling the proposed end use, but without seeking to remove or treat materials unnecessarily.

The remediation works are intended to provide an appropriate balance between economics, long term client/investor requirements and statutory obligations. This report also addresses the testing of imported soils so that the risks to human health and controlled waters are minimised.

The main aim of the report is to enable planning condition 3 (planning application no. P/2015/0583) to be discharged and to set out what will be undertaken to enable condition 4 to be discharged. These conditions are detailed in full in Appendix B and are summarised below:

- Condition 3: Additional Investigation and Remediation Strategy including Materials Management Plan (MMP).
- Condition 4: Implementation of Remediation Strategy and Verification Reporting.

2. Site Details and Environmental Setting

A description of the site and the main findings of the previous environmental assessments are summarised below.

2.1 Site Location and Description

The site is located off Davy Way / Rackery Lane (B5373) in Llay Industrial Estate, approximately 6km northwest of Wrexham Town Centre. It comprises a former warehouse in the east and associated land with a pond and drain in the west. The site is bounded to the north west by Davy Way and to the north east by Rackery Lane, beyond which are undeveloped fields. To the south east, south and south west of the site are commercial / industrial premises.

2.2 Site History

The site was formerly undeveloped land with a marsh area in the south west and a pond in the north eastern part of the site. From circa 1980's, the site was part of the Llay Industrial Estate with an industrial building located in the western part of the site.

2.3 Published, Geology, Hydrogeology and Hydrology

2.3.1 Geology

The site is underlain by superficial Glacial Till with Alluvium immediately to the north west of the site. Bedrock of the Salop Formation (Sandstone, Mudstone and Conglomerate) is present beneath the site with the Etruria Formation present beneath the north western part of the site.

2.3.2 Hydrogeology

Sources indicate that the Glacial Till deposits are designated as a Secondary Undifferentiated Aquifer and the bedrock as a Secondary A Aquifer.

The site is not located within a Source Protection Zone (SPZ) for a potable groundwater drinking supply.

2.3.3 Hydrology

The nearest surface water feature is approximately 110m south of the site boundary with a further spring and watercourse approximately 350m southwest of the site.

2.4 Historical Site Investigation Works

2.4.1 Ground Conditions

The ground conditions described below are based upon information from the 2015 and 2016 ground investigations completed at the site by Ian Farmer Associates (IFA). During the 2015 investigation, ground conditions across the site generally comprised either a topsoil or hardstanding cover with Made Ground up to 6.0m bgl beneath (predominantly reworked clay). Occasional peaty/organic pockets/organic silt were encountered, with peat deposits reported in 4 no. exploratory holes. Natural Clay was encountered from 1.80m to 9.95m below ground level (bgl) with dense Sand at depth.

In 2016, ground conditions encountered by IFA comprised concrete underlain by a gravel sub-base up to 1.0m thick with reworked Clay beneath the existing building slab. Elsewhere a thin layer of Made Ground (up to 0.75m bgl) was encountered, underlain by Clay with Sand and Gravel. Rock head of Sandstone was encountered in one location at 19.8m bgl.

Groundwater was identified at depths of between surface and 6m bgl during the most recent ground investigation by IFA.

2.4.2 Contaminants of Concern

During the 2016 IFA investigation, hydrocarbon impacted groundwater was identified in the vicinity of PLT02 (located beneath the footprint of the former building).

Elevated ground gases (methane and carbon dioxide) were recorded in the central and southern parts of the site. It is understood that gas monitoring data for the site have been interpreted as equating to Characteristic Situation 4 (CS4) in accordance with CIRIA C665. In accordance with BS8485:2015, the proposed development has been classified provisionally as a Type C Building (commercial/public building with central building management control of any alterations to the building or its uses and central building management control of the maintenance of the building). A minimum gas protection score of 4.5 is required for this type of building.

Published data (Indicative Atlas of Radon in England and Wales, HPA and BGS, 2007, Map 13 North Welsh Marches and Liverpool) indicate that the site is located in an area where 10-30% of homes are at or above the Action Level. A radon report for the site has determined that 5-10% of properties in that area are above the Action level and that basic radon protection measures are required.

2.4.3 Ground Contamination Summary

Based on the historical information provided above, the site is considered to pose an overall **low** to **moderate** risk to identified receptors with the exception of the following:

- The risk posed to controlled waters and human health from hydrocarbon impacted groundwater is considered to be **Moderate**.
- The risk from radon is considered to be **Moderate**.
- The risk from ground gases (CS4) is considered to be **High**.

3. Additional Site Investigation

3.1 Introduction

Following a recent WYG gap analysis of the ground investigation data previously collected (Technical Peer Review, WYG, July 2016) it was noted that:

- There were insufficient data on the shallow hydrocarbon impacted groundwater in the vicinity of PLT02 (IFA Ground Investigation Report, February 2016).
- The site had recently been used for manufacturing but no Semi- Volatile Organic Carbons (SVOC), Volatile Organic Carbons (VOC) or Polychlorinated Biphenyls (PCB) analysis was undertaken.

In relation to the above, it was recommended that delineation of shallow hydrocarbon impacted groundwater and additional chemical analysis of shallow soils be carried out. The scope of the proposed additional works was submitted to Wrexham County Borough Council CLO through the planning process including agreement to the scope of physical site investigation works, additional soil and groundwater sampling (as described below). Copies of regulatory correspondence are provided in Appendix B.

The additional intrusive works were undertaken on 25th August 2016 under the full-time supervision of WYG with subsequent groundwater monitoring by WYG of the newly installed monitoring wells.

The site investigation works were undertaken in general accordance with BS 10175: Code of Practice for Site Investigations of Potentially Contaminative Sites, BS5930, BS EN1997-2, BS EN ISO 14688/9 and BS 8576. The works comprised the following:

- Drilling and installation of 3 No. groundwater monitoring wells (WS101 to WS103) in a triangular configuration around PLT02. One soil sample was taken from WS101 which was analysed for SVOCs, VOCs and PCBs (WHO 12) with a further four samples (WS102 at 0.4m and 0.9m bgl and WS103 at 0.4m and 1.0m bgl) analysed for TPH CWG. Samples of shallow groundwater were taken from WS101 to WS103 and analysed for TPH CWG, Speciated PAHs, SVOCs and VOCs.
- Drilling of an additional dynamic sample hole (WS104) to further delineate the area of potential impact in vicinity of PLT02.
- Excavation of 6 no. hand dug pits up to 1.0m bgl (4 no. of which were located at the former warehouse building). One sample of the Made Ground was analysed from each location for SVOCs, VOCs and PCBs (WHO 12). Additional soil testing was carried out at HDP106 for the

analysis of metals, pH, cyanide, water soluble sulphate, phenol, 16 Polycyclic Aromatic Hydrocarbons (PAHs) and EPH (C8-C40).

An Exploratory Hole Location Plan is presented as Drawing No. A098075-MAN-N-01 with detailed engineering logs presented in Appendix C.

Groundwater monitoring and sampling was undertaken on 31st August 2016. The groundwater monitoring summary sheet is provided in Appendix D.

Chemical analysis was chosen based on field observations with soil and groundwater testing being undertaken at Jones Environmental Laboratory, a MCERTS/UKAS accredited laboratory in Deeside. Full copies of chemical testing results are presented in Appendix E.

3.2 Delineation of Impacted Groundwater

3.2.1 Ground Conditions

Made Ground within WS101 to WS104 comprised concrete over light grey sandy fine to coarse Gravel which was underlain by reworked sandy gravelly Clay up to 2.35m bgl.

Generally superficial deposits of firm sandy gravelly Clay were encountered in each exploratory hole location (WS101 to WS104) up to 5.45m bgl. This was interbedded with a spongy fibrous dark brown Peat in locations WS101 to WS103. Bedrock was not encountered in any of the exploratory hole locations.

3.2.2 Observed Contamination

During drilling, a slight chemical (sweet) odour was reported between 0.20m and 0.62m bgl in soil in WS101 and a slight hydrocarbon odour was noted between 0.70m and 0.90m bgl in WS103. A slight organic odour was noted between 2.05m and 2.78m bgl in WS104 linked with organic debris in this location. A human health risk assessment for these observations is provided in Section 3.3.3. No other visual or olfactory observations of contamination were noted in the dynamic sample holes.

Soil screening using a PID did not identify any readings above the instrument's limit of detection (0.1ppm).

3.2.3 Monitoring and Laboratory Results

During the drilling works, three exploratory boreholes (WS101 to WS103) were installed with standpipes, as summarised in Table 3.1 below. Groundwater was observed at 1m bgl in WS101 and WS102. No significant chemicals of potential concern were identified in the groundwater during drilling.

Groundwater levels were monitored on 31st August 2016. Each well was purged and sampled using a low flow pump. During well purging activities, water was monitored for pH, conductivity, dissolved oxygen and oxidation/reduction potential (Redox) using designated water quality meters. Groundwater monitoring data are presented as Appendix D. Following sufficient recharge, groundwater samples were collected and were submitted for laboratory analysis. Chemical laboratory reports are presented in Appendix E. No visual evidence of contamination was reported during the monitoring of WS101 and WS103. A strong sulphurous odour was reported during the monitoring of WS102.

Table 3.1 – Groundwater Monitoring Installations

Exploratory Hole	Groundwater Level (during drilling)	Installation Details		Monitored Groundwater Level (during sampling)
		Depth Range	Stratum Installed Into	
	m bgl	m bgl		m bgl
WS101	1.00	0.50-2.00	Made Ground: sandy gravelly Clay	0.68
WS102	1.00	0.50-1.50	Made Ground: slightly sandy slightly gravelly Clay	0.67
WS103	-	0.30-1.30	Made Ground: Sandy Gravel/slightly sandy slightly gravelly Clay	0.68

3.2.4 Tier 1 Controlled Waters Risk Assessment

The site is considered to be located in a sensitive area with respect to controlled waters due to the presence of the bedrock beneath the site (Secondary A Aquifer) and the surface watercourse located approximately 110m south of the site. Groundwater laboratory results were therefore screened against the lowest of the drinking water values or the freshwater threshold values as per the Water Framework Directive (England and Wales) to target each receptor.

The screening values used are colour coded for sources above the TSV on the groundwater screening sheet presented in Appendix F.

The concentrations of the groundwater determinands analysed did not exceed the applicable screening values for groundwater quality, apart from the following exceedances presented in Table 3.2 below.

Table 3.2 Summary of Groundwater Screening Exceedances

Determinand	TSV (µg/l)	Range of Results (µg/l)	Location of Exceedance
TPH (C10-C12) Aliphatic	10	<5 - 109	WS102 – WS103
TPH (C12-C16) Aliphatic	10	<10 - 530	WS102 – WS103
TPH (C16-C21) Aliphatic	10	<10 - 420	WS102
TPH (C21-C35) Aliphatic	10	<10 - 12270	WS102 – WS103
TPH (EC10-EC12) Aromatic	2	<5	WS101 – WS103
TPH (EC16-EC21) Aromatic	0.00017	<10 - 30	WS101 – WS103
TPH (EC21-EC35) Aromatic	0.0082	<10 - 3430	WS101 – WS103
Bis(2-ethylhexyl) phthalate	-	<5 - 7	WS102
Di-n-butyl phthalate	-	<1.5 - 2.4	WS102 – WS103
Diethyl phthalate	-	<1 - 10	WS101
Dimethyl phthalate	-	<1 - 9	WS101

A screening value is not available for the SVOCs reported above the laboratory limit of detection (LOD); however, the exceedances are within one order of magnitude above the LOD and are not considered to pose a risk to controlled waters receptors.

It is considered unlikely that a significant risk is posed to the Secondary A Aquifer due to its lower sensitivity and presence of overlying Glacial clay limiting contaminant migration; however, a potential risk to the nearby surface water may be present (albeit low to moderate given the distance to the receptor). A Detailed Quantitative Risk Assessment (DQRA) has been undertaken for hydrocarbons due to no published Tier 1 screening value protective of surface waters being available for TPH.

3.2.5 DQRA for Controlled Waters

To assess the potential risks posed by contaminants to nearby surface water receptors, the Environment Agency R & D Publication 20 guidance document (P20) 'Remedial Targets Methodology Hydrogeological Risk Assessment for Land Contamination', EA 2006 and Remedial Targets Worksheet V3.2 User Manual, EA 2006 have been used for impacted groundwater. The spreadsheet back-calculates the maximum concentration allowable on site that will remain protective of the receptor under assessment. The Ogata Banks fate and transport equations have been used in the model, conservatively assuming a steady state solution with no source depletion.

Analysis of soils from WS102 and WS103 for TPH did not report any significantly elevated concentrations above the LOD. Therefore, it is not considered that there is a significant source of soil hydrocarbon contamination which may impact on groundwater quality.

The source, pathways and receptor points are characterised in the sections below with a detailed sensitivity analysis to assess the relative importance of the different parameters presented in Appendix H.

Source Zone Characterisation

The contaminants of concern and source areas have been identified in the Tier 1 assessment previously undertaken on the groundwater information. The source area is associated with impacted groundwater identified in the vicinity of historical location - PLT2, predominantly reported in groundwater retrieved from newly installed WS102.

The following determinands have been identified in the groundwater which may pose a risk to controlled waters: TPH (C10-C35) Aliphatic and TPH (EC10-EC12 and EC16-EC35). TPH (C10-C12) Aliphatic and TPH (C21-C35) Aliphatic are the only determinands modelled however as the lighter end fractions are representative of more mobile compounds and the heavier end TPH is representative of the greatest exceedances of the screening criteria used.

It is assumed that the source area is approximately 5m wide by 5m long based on site observations.

Pathway Characterisation

Parameters defining the saturated zone have to be specified in order to quantify likely contaminant movement within the groundwater. The saturated zone for this assessment (~1.5m) is defined as the difference between the saturated base of the Made Ground (approximately 2.0m bgl) and the top of the water table (0.5m bgl). The unsaturated (vadose) zone identified comprises the Made Ground above the groundwater table (~0.5m bgl). The P20 model can only be used to assess a single soil type. Therefore, the vadose zone is classified as Made Ground (gravelly clay) for the purposes of this assessment based on site observations.

It is considered reasonable to assume that the groundwater movement through the subsurface is likely to be predominantly through the Made Ground flowing towards the south to the surface watercourse approximately 110m down gradient of the site.

Consideration of environmental degradation has been taken into account; the average half-lives provided within the Environment Agency document P5-079/TR1 have been used for the site.

Compliance Criteria

The compliance criteria form the basis of the derived Site Specific Target Levels (SSTLs) and are defined as UK Drinking Water Standards as a suitably conservative published value.

Table 3.3 below details the parameters used and the justification for main modelling input parameters.

Table 3.3 Input Parameters

Table 5.5 Input Parameters			
Parameter	Units	Value	Justification
Fraction Organic Carbon	-	0.02	Site soil average from historical data
Hydraulic conductivity	m/d	0.173	ConSim database – published value
Hydraulic gradient	-	0.01	Calculated from site data
Bulk density of aquifer	g/cm ³	2.0	ConSim database – mean value
Saturated aquifer thickness	m	1.5	Depth of water table to Made Ground
Plume thickness at source	m	1.0	Calculated head of groundwater
Half-life for degradation in water	days	360 – TPH C10-C12	EA P5-079/TR1 (pg. 46)
		1250 – TPH C21-C35	
Compliance Point			
Receptor – Surface water course 110m south & Secondary A Aquifer (bedrock)	m	110	Approximate distance to brook

Model Output

The P20 modelling worksheets detailing model outputs and the derived SSTLs for each contaminant are presented in Appendix H. A summary of the results of the P20 assessment is presented in Table 3.4 below.

Table 3.4 Derived SSTLs

Determinand	TSV (µg/l)	Tier 3 GW SSTLs (µg/l)	Exceedances compared to Tier 3 SSTLs
TPH (C10-C12) Aliphatic	10 (UK DWS)	-	No impact
TPH (C21-C35) Aliphatic	10 (UK DWS)	-	No impact

The results show that at the 110m compliance point, TPH Aliphatic fractions (C10-C12 and C21-C35) do not pose a risk to controlled waters.

3.3 Additional Soil Sampling

3.3.1 Ground Conditions

Ground conditions beneath the existing building footprint (HDP101 and HDP103) comprised Made Ground (concrete over sandy fine to coarse Gravel over reworked sandy gravelly Clay).

Ground conditions in areas of soft standing comprised Made Ground (Topsoil over sandy gravelly Clay (HDP104 & HDP106) or Topsoil over Sand underlain by slightly gravelly sandy Clay (HDP102)). Ground conditions beneath the existing car park comprised Made Ground of Asphalt over gravelly Sand which was underlain by slightly sandy slightly gravelly Clay.

Groundwater seepage was encountered in HDP102 at 0.76m bgl.

3.3.2 Observed Contamination

A strong chemical (sweet) odour was reported between 0.18m and 0.43m bgl in HDP101, however, no further visual or olfactory observations of contamination were noted in the other hand pits excavated across the site.

Soil screening using a PID did not identify any readings above the instrument's limit of detection (0.1ppm).

3.3.3 Laboratory Results

Samples from all hand dug pits were scheduled for chemical analysis in addition to a sample from WS101 due to a slight chemical (sweet) odour being reported between 0.20m and 0.62m bgl.

Soil concentrations have been screened initially against WYG Tier 1 soil screening values (TSVs). These principally comprise LQM S4ULs and DEFRA with Contaminated Land: In Real Environments (CL:AIRE) published Category 4 Screening Levels (C4SLs). The values used are based on an acceptably low risk for a commercial end use scenario.

The screening value used and its source are colour coded for the above TSV sources on the soil screening sheet presented in Appendix F.

An assessment of the chemical results has been undertaken for the soil samples collected. No determinands were reported above the screening criteria for a commercial end-use. As previously reported, a chemical (sweet) odour was identified in WS101 and HDP101, no determinands analysed

which may be considered sources of the odour (i.e. TCE) were reported above the screening criteria. Similarly, where hydrocarbon odours were reported in WS103, laboratory analysis of TPH-CWG did not report any elevated concentrations of concern. Organic odours within WS104 were linked to organic material within the borehole and are not considered to be a source of contamination. A risk therefore to human health is considered unlikely.

Concentrations of 2-methylnaphthalene (56µg/kg) and dibenzofuran (54µg/kg) in soil from HDP101 were reported above the laboratory detection limit (LOD) of 10 µg/kg. Screening criteria for both determinands are not available, however, as 2-methylnaphthalene is a naphthalene related compound, the screening value for naphthalene has been utilised (22,000 µg/kg). Concentrations of 2-methylnaphthalene do not exceed the screening criteria. Although screening values of dibenzofuran are not available, the concentrations are only reported in one sample within one order of magnitude. A risk to human health therefore is considered unlikely.

3.4 Residual Risk Assessment

3.4.1 Contaminant Sources

The following sources have been identified:

- Made Ground associated with former industrial building on site;
- Hydrocarbon impacted groundwater; and,
- Ground gases, vapours and radon.

3.4.2 Contamination Pathways

Contamination pathways are listed below, considering the future use of the site:

- Dermal contact;
- Ingestion of soils/dust;
- Inhalation of vapours/dust;
- Leaching to groundwater;
- Lateral and vertical migration of groundwater; and,
- Ground gas and vapour migration and accumulation.

3.4.3 Contamination Receptors

Receptors that may be affected by potential contamination are:

- Future site users (commercial end use);
- Construction workers;
- Secondary A Aquifer;
- Surface watercourse (110m south); and,
- Built structures/services.

3.4.4 Contamination Risk Assessment

By considering the sources, pathways and receptors, a refined assessment of the environmental risk is made with reference to the significance and degree of the risk. This assessment is based on consideration of whether the source contamination can reach a receptor and hence whether it is of major or minor significance.

The risk assessment has been carried out by assessing the severity of the potential consequence, the sensitivity of the target and the likelihood of occurrence, based on the categories given below (Tables 3.5 to 3.7). A summary of the refined risk assessment on-site sources is given in Table 3.8.

Table 3.5: Potential Hazard Severity Definition

Category	Definition
Severe	Acute risks to human health, catastrophic damage to buildings/property, major pollution of controlled waters
Medium	Chronic risk to human health, pollution of sensitive controlled waters, significant effects on sensitive ecosystems or species.
Mild	Pollution of non-sensitive waters, significant damage to buildings or structures
Minor	Requirement for protective equipment during site works to mitigate health effects, damage to non-sensitive ecosystems or species, minor damage to buildings or structures

The likelihood of an event (probability) takes into account both the presence of the hazard and target and the integrity of the pathway and has been assessed based on the categories given below.

Table 3.6: Probability of Risk Definition

Category	Definition
High likelihood	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Low likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable

The potential severity of the risk and the probability of the risk occurring have been combined in accordance with the following matrix in order to give a level of risk for each potential hazard.

Table 3.7: Level of Risk for Potential Hazard Definition

		Potential Severity			
		Severe	Medium	Mild	Minor
Probability of Risk	High Likelihood	High	High	Moderate	Low/Moderate
	Likely	High	Moderate	Low/Moderate	Low
	Low Likelihood	Moderate	Low/Moderate	Low	Low
	Unlikely	Low/Moderate	Low	Low	Low

3.4.5 Summary of Residual Risk Assessment

The risk assessment is summarised in Table 3.8. It is based on the currently notified development proposals. Overall the site is considered to pose a **low** risk to all receptors with the exception of the risk from ground conditions to future water supply pipelines which is considered **low to moderate** without Statutory Undertaker liaison and that from ground gases, vapours and radon which poses a **moderate to high** risk. These risks would require remediation/mitigation.

Table 3.8: Summary of Residual Risk Assessment

Source	Pathway	Receptor	Severity	Probability	Risk	Justification
Residual Ground Conditions (Made Ground)	Dermal contact, ingestion and/or inhalation of dusts	Human Health – Future site users	Medium	Unlikely	Low	Following further chemical testing of Made Ground across the site, no determinands were found to exceed the relevant screening criteria for the proposed end use despite field observations recorded.
		Human Health – maintenance workers excavating ground	Minor	Unlikely	Low	It is assumed that, in line with good practice, appropriate working procedures and PPE will be adopted during construction works to mitigate this risk.
Hydrocarbon Impacted Groundwater	Leaching and lateral and vertical migration of groundwater	Controlled Waters – Surface Waters	Medium	Unlikely	Low	The DQRA has determined that a risk to surface waters at the 50m compliance point is not present. As the surface watercourse is approximately 110m south of the site, a risk to this receptor does not exist.
		Controlled Waters – Secondary A Aquifer	Mild	Unlikely	Low	Given the presence of low permeability clay overlying the aquifer and the local resource potential of the Secondary A Aquifer, a risk from on-site sources to the receptor is considered unlikely.
		Potable water supply	Medium	Low	Low to Moderate	There is visual and olfactory evidence of hydrocarbons which could impact on future potable water supplies. It is recommended that the Contractor liaises with the Statutory Undertaker in the provision of these.
Ground gas/radon/vapour generation and accumulation/migration	Generation and migration / accumulation of ground gases and vapours	Human Health – Future site users	Medium	Likely	Moderate	Historical information has determined that the site is Characteristic Situation 4 and therefore gas protection measures should be installed at the site. The gas measures should also be protective against radon (basic protection) and be vapour resistant due to presence of in-ground hydrocarbons. Based on on-site PID readings, it is not considered that a significant source of vapours is present.
		Future Buildings & Installations	Severe	Likely	High	
		Human Health – Construction Workers	Minor	Likely	Low	It is assumed that, in line with good practice, appropriate working procedures and PPE will be adopted during construction works to mitigate this risk.

4. Remediation Strategy

4.1.1 Ground Gas Mitigation

Based on previous reports, the site is considered Characteristic Situation 4. In accordance with BS8485:2015, the proposed extension has been classified provisionally as a Type C Building (commercial building with central building management control of any alterations to the building or its uses and central building management control of the maintenance of the building). A minimum gas protection score of 4.5 is required for this type of building. It has also been determined that basic radon protection measures are required for the proposed building.

Based upon BR211:2015 guidance; a damp proof membrane is considered suitable to mitigate the effects of radon. In order to mitigate against the effects of elevated carbon dioxide, methane and hydrocarbons at the site, a gas resistant membrane is recommended which is compliant with CIRIA C748 and BS8485:2015 guidance.

Gas protection measures for the proposed building will therefore comprise the following:

1. Ground bearing Slab – 0.5 points
2. Active sub-floor ventilation – 2.5 points
3. Gas resistant membrane (gas, radon and hydrocarbon resistant) – 2.0 points

The active sub-floor venting system will comprise a full cover of geo-composite void former connected to 100mm diameter HDPE gas collection manifold pipes leading to gas extraction fans (4 no.) on one elevation and ground level vent boxes on the opposite elevation. A conventional cast in-situ ground bearing slab will be employed as a minimum with gas resistant membrane (5 points in total).

Gas mitigation design information supplied by the proposed Principal Contractor is included in Appendix G. The gas protection measures will be installed by ACS Lining Limited in accordance with the manufacturer's instructions.

During construction, validation of the membrane will be required as outlined in Section 6.1. This will be compliant with CIRIA C735 and BS8485:2015 guidance.

Ground gas mitigation will also be included in the design of any service/drainage runs or other ancillary confined spaces within the proposed building.

Long term maintenance of the gas mitigation system is required; operation and maintenance details for the fan units are presented in Appendix G. A maintenance manual shall be prepared on completion

of the works which will detail requirements for inspection and routine maintenance of the sub-slab gas venting system. This will include for weekly inspections of the fans and ground level vent boxes. This information will be submitted to the LPA for review. The North Wales Police will be responsible for the duties noted above.

4.1.2 Site Services

Services should be installed to prevent the creation of preferential pathways and to avoid contact with any residual contamination. Reference should be made to Welsh Water documentation and guidelines for the selection of water supply pipelines to be used in brownfield sites. It is anticipated that due to the elevated TPH reported in the groundwater at the site, this may involve upgraded water supply pipes (barrier pipe).

4.1.3 Dealing with Unexpected Contamination

In the event of any unforeseen circumstances (e.g. encountering unexpected contamination, or variations to remediation methodology), the Regulatory Bodies will be notified. If necessary, changes to the Remediation Strategy will be made in consultation with Wrexham County Borough Council, the Environment Agency and WYG. These changes should be detailed in the verification report for the works.

Any soil containing significant contamination not previously identified will be excavated and stockpiled separately to prevent cross contamination and environmental impacts. The use of skips and bunds should be implemented. Testing of the materials will be carried out and the materials will be dealt with according to the levels of contamination recorded.

Where soils do not meet the geotechnical specification for the proposed earthworks, these may also be subject to treatment to render them suitable for reuse.

4.1.4 Supervision

The Contractor is to appoint a suitable person when undertaking tasks that require validation, to check that the appropriate remediation standards and environmental controls are achieved and that the works are undertaken in accordance with this document.



4.1.5 Health, Safety and Environmental Protection Considerations

All remediation works will be conducted in accordance with the Construction (Design and Management) Regulations. Consideration will be given to the potential short term environmental impacts of the scheme to allow the works to be undertaken in a manner which will minimise potential for pollution of the environment and/or nuisance to neighbouring land users. Section 7.0 details site set up and environmental controls.

5. Earthworks Requirements

5.1 General

As part of the works, excavation of materials will be required from within the area of the proposed building to raise the level beneath the proposed car parking area on site. In addition, arisings associated with the attenuation tank and drainage will be reused in the area of proposed bund (200m³) in the south eastern part of site (subject to suitability).

The bund will be formed to enhance the ecological status of the site in line with BREEAM requirements. The bund will be designed to create a suitable habitat for invertebrates (particularly Dingy Skipper) encountered on site. It will be constructed using soils excavated for the foundations of the development, predominantly gravelly Clay.

The existing concrete slab (1350m³) and existing service road (75m³) will be broken up and the crushed concrete will be reused as the piling mat beneath the proposed building footprint.

It is proposed that the reuse of soils at the site can be undertaken in accordance with CL:AIRE Definition of Waste Code of Practice (DoW CoP) as demonstrated using a Materials Management Plan (MMP).

All soils excavated and reused as soft standing on site and/or imported will meet the earthworks specification and require validation to demonstrate that they do not pose an unacceptable risk as detailed in Section 6.

Proposed areas of cut and fill earthworks are shown on Drawing Nos. A098075-001-004 Cut and Fill Layout Sheets 1 to 4 inclusive.

Temporary stockpiles of material are to be constructed and managed in such a manner so as to avoid degradation, weathering, increase or decrease in moisture content or mixing of materials rendering them unacceptable or enable contaminant migrations (if present) of impacted run off.

Imported soils will be subject to validation as detailed in Section 6.3.

5.2 Excavation and Reuse

The following materials (including soil) are unsuitable when excavated as part of the works, they shall be removed from site to suitably licensed facilities, treated to render them suitable or placed beneath a soil cover system to break exposure pathways:

- Peat, material from swamps, marshes and bogs;
- Logs, stumps, vegetation, timber, wood and perishable material or organic waste;
- Materials in a frozen condition or containing ice;
- Wet clay and silt;
- Materials with a liquid limit in excess of 80% and/or plasticity index in excess of 55%;
- Materials containing visual or olfactory evidence of tar or hydrocarbons;
- Materials that contain visual evidence of asbestos and/or asbestos >0.1%;
- Materials containing more than 1% by mass of foreign objects including wood, plaster, plastic, metal, rubber and domestic waste and slag waste;
- Materials susceptible to combustion;
- Materials containing contaminants at concentrations exceeding the agreed Validation Criteria.

In order to limit the amount of imported materials required and the requirements to dispose of geotechnically unsuitable materials, further classification testing will be undertaken, works will comply with an earthworks specification and the Contractor shall process as much site won materials as practical by mechanical, chemical or other means to render them suitable for re-use in the permanent works.

5.3 Control of Water

Based on monitored groundwater levels, there is potential for shallow groundwater to be present. The Contractor is to ensure that groundwater removed from excavations is dealt with under a duty of care prior to disposal or discharge. This process will require the approval and licensing from the EA or statutory undertaker depending upon the discharge route selected. Details of measures used for the management of contaminated water should be provided in the verification report.

The Contractor will be responsible for the control of all surface water within the working area during the Works. Pumping/dewatering operations will be used as required in the works areas, stockpile areas and soil treatment areas.

Until proven otherwise by laboratory analysis, all surface water, groundwater and leachate arising on site will be considered to be contaminated and therefore potentially hazardous. The Contractor will ensure that potentially contaminated waters and leachate from excavations, compacted areas or



stockpiles do not reach watercourses, drains, rivers etc. The Contractor shall ensure such contaminated waters do not discharge onto ground external to the site. All such waters will be transferred by tanker for off-site disposal, or treated on site for subsequent disposal to sewer.

Direct discharge of waste waters is not permitted into foul or surface water sewers or any other standing body of water without specific consent or approval. It will be the Contractor's responsibility to ensure that all necessary consents are in place.

Water impacted by organic compounds (e.g. oil) is likely to require separators, interceptors or skimming. Water impacted by inorganics is likely to require carbon filtration or similar.

5.4 Sub-Surface Concrete

Based on previously reported sulphate concentrations and pH values at the site (Report refs: Report on Ground Investigation, IFA, February 2015 and Ground Investigation Report, IFA, February 2016) in accordance with BRE Special Digest 1 (2005), a design classification of DS-1 and an ACEC class of AC-1 is produced.

6. Validation Requirements

6.1 Gas Validation

During construction, installation of the gas protection measures will be undertaken by ACS Lining Limited in line with the manufacturer's instructions. Validation of the gas and radon protection installation will be undertaken including the assessment of lapping, sealing and taping of joints and sealing arrangements at penetrations. In accordance with BS8485:2015 and CIRIA C735, the gas protection measures will be tested and validated by a qualified person from MEC Environmental Limited. The information will be included in the verification report.

The test and inspection regime of the gas membrane will be recorded during installation on the 'Non Laser Validation Plan' presented in Appendix G.

6.2 Soil Chemical Validation

All excavated soils (topsoil and subsoil) for re-use and all imported soils will be tested at a frequency given below for the suite shown in Appendix I. The testing suite for site-won soils is based on a general suite of potential contaminants of concern which could be present. The testing suite for imported soils is in accordance with the guidance provided in Welsh Land Contamination Working Group Document, May 2013.

Site won soils for re-use

- Site won soils – 1 test per 250m³ of soil or a minimum of 3 No. samples per excavation area or source type (e.g. cohesive/granular, topsoil/Made Ground/natural soil etc).

Site won soils for re-use on bund

- Site won soils – 3 tests for the 200m³ of soil required to produce the bund (e.g. cohesive/granular, topsoil/Made Ground/natural soil etc).

Imported Soils

For greenfield and brownfield sources of material, the following sampling frequency should be adopted in accordance with guidance provided in Welsh Land Contamination Working Group Document, May 2013:

Table 6.1 Sampling Frequencies for Imported Material

	DEVELOPMENT TYPE				
	Residential	Allotments	Parks, Play Areas and POS	Commercial (with landscaping)	Commercial (hardstanding only)
QUANTITY TO BE IMPORTED	NUMBER OF SAMPLES REQUIRED				
Less than 20m ³	Please contact CLO/EHO to agree sampling requirements				
Between 20m ³ – 250m ³	4	4	3	2	2
More than 250m ³	4 per 250m ³	4 per 250m ³	4 per 250m ³	4 per 250m ³	4 per 250m ³
>1000m ³	An appropriate sampling scheme should be agreed with the CLO/EHO.				

For material from a natural quarried source a certification of source and soil or rock type should be provided by the supplier, with documentary record of visual inspection on arrival of each load. No testing is required on this material.

Topsoil shall be chemically tested at the frequency given above. In addition, it will be checked by the Contractor for acceptability and compliance with BS3882:2015 at the frequency given above and/or the presentation of appropriate certificates from the source supplier.

The Contractor (or environmental Consultant where instructed by the Contractor) will carry out sampling and testing to demonstrate that the agreed acceptance criteria have been achieved. This will be demonstrated in the verification report. Validation testing will be undertaken with a laboratory results turnaround time of 10 days' maximum.

The Contractor will accurately record the position, depth and date of all validation samples obtained from stockpiles, excavations and surfaces. The samples shall be placed into suitable sample containers and preservation procedures are to be followed in line with the receiving laboratory's requirements.

Assessment of test data to determine suitability for re-use will be undertaken by comparing the data to the acceptance criteria outlined in Appendix I. The test results will be screened initially against WYG Tier 1 soil screening values (TSVs). These principally comprise LQM S4ULs and DEFRA with Contaminated Land: In Real Environments (CL:AIRE) published Category 4 Screening Levels (C4SLs). Contaminant concentrations below C4SLs are considered to pose an acceptably low risk to human health. The values used are based on a commercial end use.

It is proposed that site won crushed demolition arisings will be used at the site. The contractor therefore must demonstrate that the arisings do not include any deleterious materials including

asbestos, bituminous material, evidence of staining, oils etc. The demolition records including an asbestos report will be included in the Verification Report.

6.3 Compliance with Criteria

All analytical test results for chemical parameters must be shown to comprise part of an overall data set that is compliant with the applicable Remediation Criteria. To this end, the use of statistical analysis methods (CLEA 95%UCL or ProUCL software) may be adopted to assess if minor exceedances are significant or not.

Test results will be deemed non-compliant if:

1. The result is shown to be an outlier that exceeds the applicable Remediation Criteria;
2. The overall data for each zone set is shown to have a 95% UCL (using a suitable statistical analysis method) that exceeds the applicable Remediation Criteria.

It will be the responsibility of the Contractor to provide evidence demonstrating compliance with the criteria (including evidence of any statistical analysis undertaken). The use of any statistical analysis methods is subject to the agreement of the Local Planning Authority.

The validation criteria for imported soils do not include a specification for engineering properties or performance specification. Imported soils or aggregates that are to be used for engineering purposes should conform to the requirements of the project specification as regards engineering properties, methodology for placement and compaction relative to material class, required performance criteria etc. The Contractor is responsible for achieving these.

Where soils for reuse fail the validation criteria, they may be used beneath the proposed areas of hardstanding, subject to Local Authority Regulatory Control approval.

6.4 Verification Reporting

On completion of the remediation works, a verification report will be compiled. This will provide full details of the remediation works that were undertaken and the status of the site. The report will provide verification that all works associated with dealing with the contamination issues have been carried out in accordance with this Remediation Strategy. A revised residual risk assessment will be provided as validation (see Section 3.4.4 for methodology).



In summary the report content will be as follows:

- Demolition records including pre demolition asbestos survey;
- A copy of the Qualified Person MMP CL:AIRE declaration;
- A summary of all earthworks undertaken including cut and fill e.g. volumes used, where taken from and placed etc;
- Ground gas/radon mitigation installation validation records;
- Validation of reused and imported soils including assessment of chemical test results;
- Details of Statutory Undertaker liaison and potable pipeline construction;
- Details of all wastes sent for off-site disposal including copies of waste transfer notes;
- Environmental Permits;
- Any necessary and agreed variations to this strategy due to encountering unforeseen ground conditions; and,
- An assessment of residual risks.

7. Principles of Environmental Control

7.1 Environmental Controls

7.1.1 General

Remediation operating procedures will be based around guidance contained within the document entitled Protection of Workers and the General Public During the Redevelopment of Contaminated Land (HS(G)66). The Contractor will be required to provide information regarding his Environmental Management Systems.

The mitigation of any significant temporary impacts upon the overall local environment during remediation is an important consideration for this site.

Similarly other environmental considerations will be assessed and monitored with control measures put in place to limit the impacts from such. Emphasis will be placed on prevention and control at source rather than mitigation following release. Site operations will be conducted in order to reduce such environmental impacts to a practical minimum.

Environmental control measures will be carried out in accordance with CIRIA Publication C650 Environmental Good Practice on Site and The Control of Asbestos Regulations including CIRIA and CL:AIRE asbestos guidance; and will incorporate the following:

Table 7.1 – Environmental Control Measures

Potential Environmental Considerations	Monitoring & Control Measures (to be implemented as necessary)
Dust, airborne fibres, litter, air emissions	Damping down, covering of exposed work faces, litter screens if necessary, noting wind direction. Dust monitoring and airborne fibre monitoring.
Odours	Regular walkovers on site boundaries to assess odours. Odour suppression or masking may be required if odours are being generated from earthworks.
Noise and vibration	Recommendations as detailed in BS5228. Use of appropriate construction techniques.
Mud	Wheel washing, designated site haulage routes. Outer surfaces of soil stockpiles should be compacted or sheeted to reduce impacts and run-off from rain

Contaminated soils shall be stockpiled only in suitable skips or on bunded areas of hardstanding or areas specifically prepared by the laying of heavy duty plastic sheeting. Run off from these areas shall be collected and disposed of appropriately. The bunds surrounding the stockpiles shall be of sufficient height and the stockpiling shall allow for sufficient space to remain such that contaminated run off does not escape the bunded areas even during periods of heavy or prolonged rainfall.

The contractor shall uphold their duty of care in relation to the presence of asbestos associated with that currently present in the soil.

7.1.2 Traffic Management

Loading of vehicles will be performed in manner so as to prevent the spread of contaminants. All loads leaving the site will be sheeted and wheels to be cleaned if required prior to leaving. The sheeting of these loads shall be checked and recorded by the Contractor to confirm appropriate and complete coverage of the load.

The sheeting shall be of durable construction, undamaged, continuous and of sufficient size to completely cover the enclosed load. The sheeting shall be tied down in an appropriate manner and with sufficient tension to confirm that there will be no loss of material during transport.

7.2 Site Waste Management

The contractor is to hold appropriate Environmental Permits or exemptions from such associated with earthworks and stockpiling activities including any sorting, screening or crushing of soils and demolition arisings.

Earthworks will be managed under the CL:AIRE Definition of Waste Code of Practice in the management of excess soil that is appropriate for use. This would be done through the production of a Materials Management Plan (MMP) with an independent Qualified Person (QP) sign off and declaration.

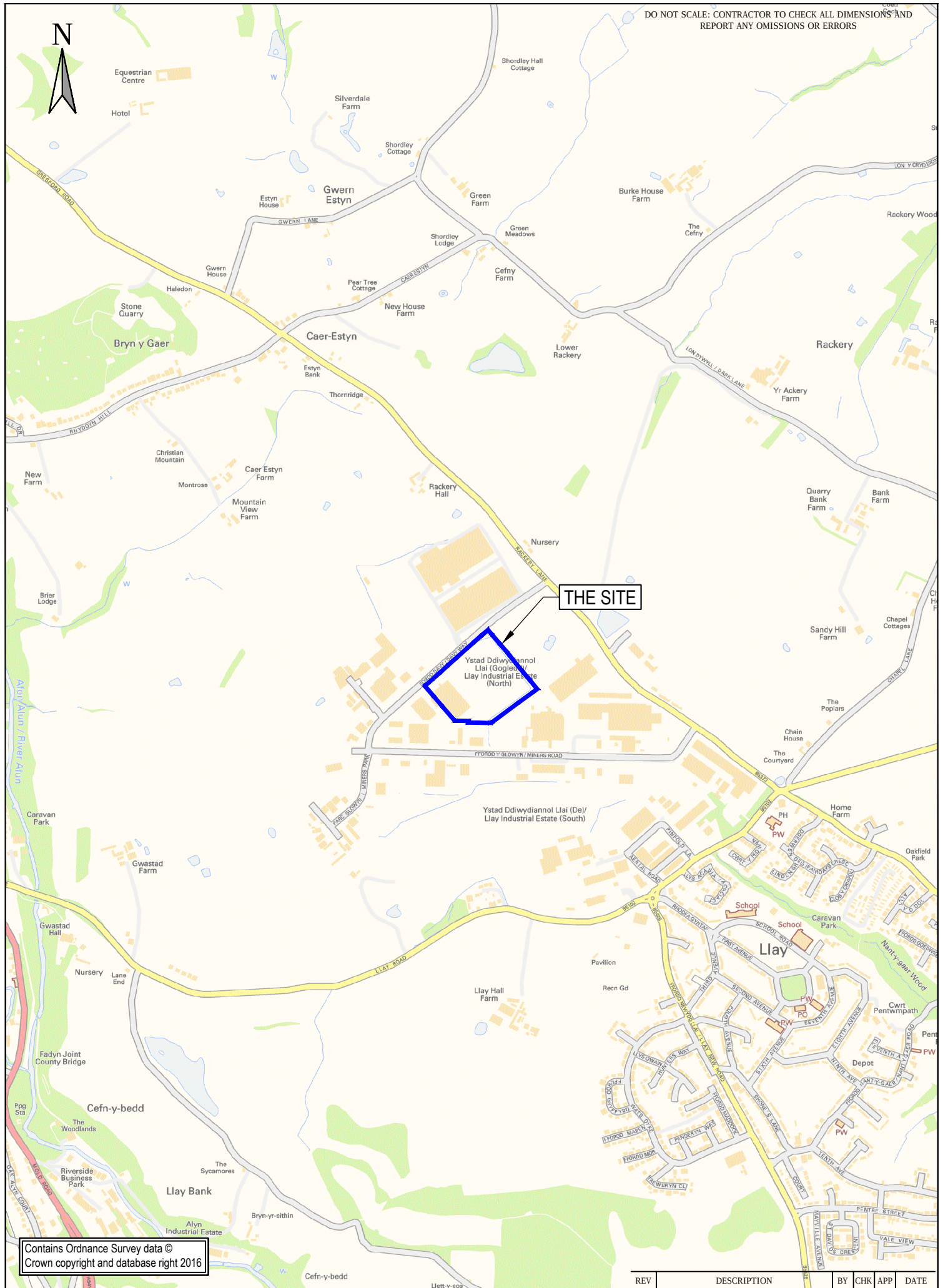
Materials classified as unacceptable will be subject to the appropriate testing to determine the most appropriate disposal route.

7.3 Personnel Protective Equipment

The contractor shall ensure that all workers are provided with and use the appropriate equipment in the work zone given the findings of the previous site investigations.



Drawings



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QUAY WEST at MediaCity UK
TRAFFORD WHARF ROAD
MANCHESTER
M17 1HH
TEL: +44 (0)161 872 3223
FAX: +44 (0)161 872 3193
e-mail: manchester@wyg.com



Client:
**GALLIFORD TRY BUILDING
NORTHWEST**

Project: A098075
WREXHAM CUSTODY FACILITY

Drawing Title:
SITE LOCATION PLAN

REV	DESCRIPTION	BY	CHK	APP	DATE
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Scale @ A4 1:20,000	Drawn PMC	Date 07.09.16	Checked SH	Date 07.09.16	Approved CM	Date 07.09.16
Project No. A098075	Office MAN	Type N	Drawing No. 01	Revision		

KEY



APPROXIMATE SITE
BOUNDARY



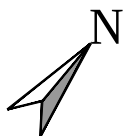
DYNAMIC SAMPLE HOLE



HAND PIT



INDICATES INSTALLATION



DAVY WAY (FFORDD DAVY)

Visitor Parking

Staff Parking

Police Station

Operational Parking

HDP101

WS104

WS101

WS102

WS103

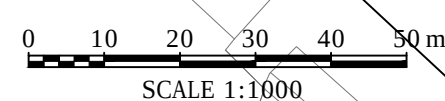
HDP104

HDP102

HDP103

HDP106

HDP105



REV	DESCRIPTION	BY	CHK	APP	DATE
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Client:

GALLIFORD TRY BUILDING NORTHWEST

QUAY WEST at MediaCity UK
TRAFFORD WHARF ROAD
TRAFFORD PARK
MANCHESTER
M17 1HH
TEL: +44 (0)161 872 3223
FAX: +44 (0)161 872 3193
e-mail: manchester@wyg.com



Project: A098075

WREXHAM CUSTODY FACILITY

Drawing Title:

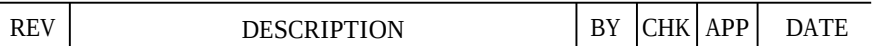
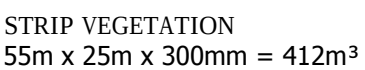
EXPLORATORY HOLE LOCATION PLAN

Scale @ A3 1:1,000	Drawn PMC	Date 07.09.16	Checked SH	Date 07.09.16	Approved CM	Date 07.09.16
Project No. A098075	Office LDS	Type N	Drawing No. 02		Revision	



1. **DO NOT SCALE.** ALL DIMENSIONS ARE IN MILLIMETRES.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT CONTRACT DRAWINGS.
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4. THE CONTRACTOR SHALL CONFORM TO ALL STATUTORY AUTHORITY REQUIREMENTS, CHECKING WITH THE EMPLOYER/CLIENT TO IDENTIFY BOTH THE LOW VOLTAGE AND OVERHEAD SERVICES. CONTRACTOR TO FULLY COMPLY WITH ALL CDM, HAS AND PARTY WALL ACTS THAT ARE CURRENT. ALL BS REFERENCES ARE TO CURRENT EDITIONS.
5. ALL TEMPORARY WORKS FOR FORMWORK, EXCAVATIONS ETC., TO BE THE DESIGN RESPONSIBILITY OF THE CONTRACTOR.
6. ALL LEVELS ARE IN METRES (A.O.D.)

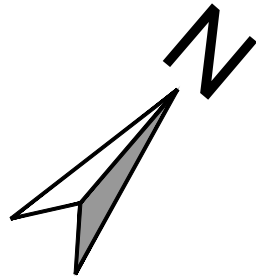
BREAK UP EXISTING SLAB
50m x 90m x 300mm = 1350m³



Project:
WREXHAM CUSTODY FACILITY

Drawing Title:
CUT & FILL LAYOUT
SHEET 1

Scale @ A1 1:200	Drawn RJ	Date 19.09.16	Checked PS	Date 19.09.16	Approved SH	Date 19.09.16
Project No. A098075	Office 81	Type C	Drawing No. 001	Revision -		

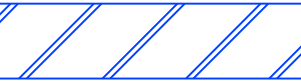


DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS

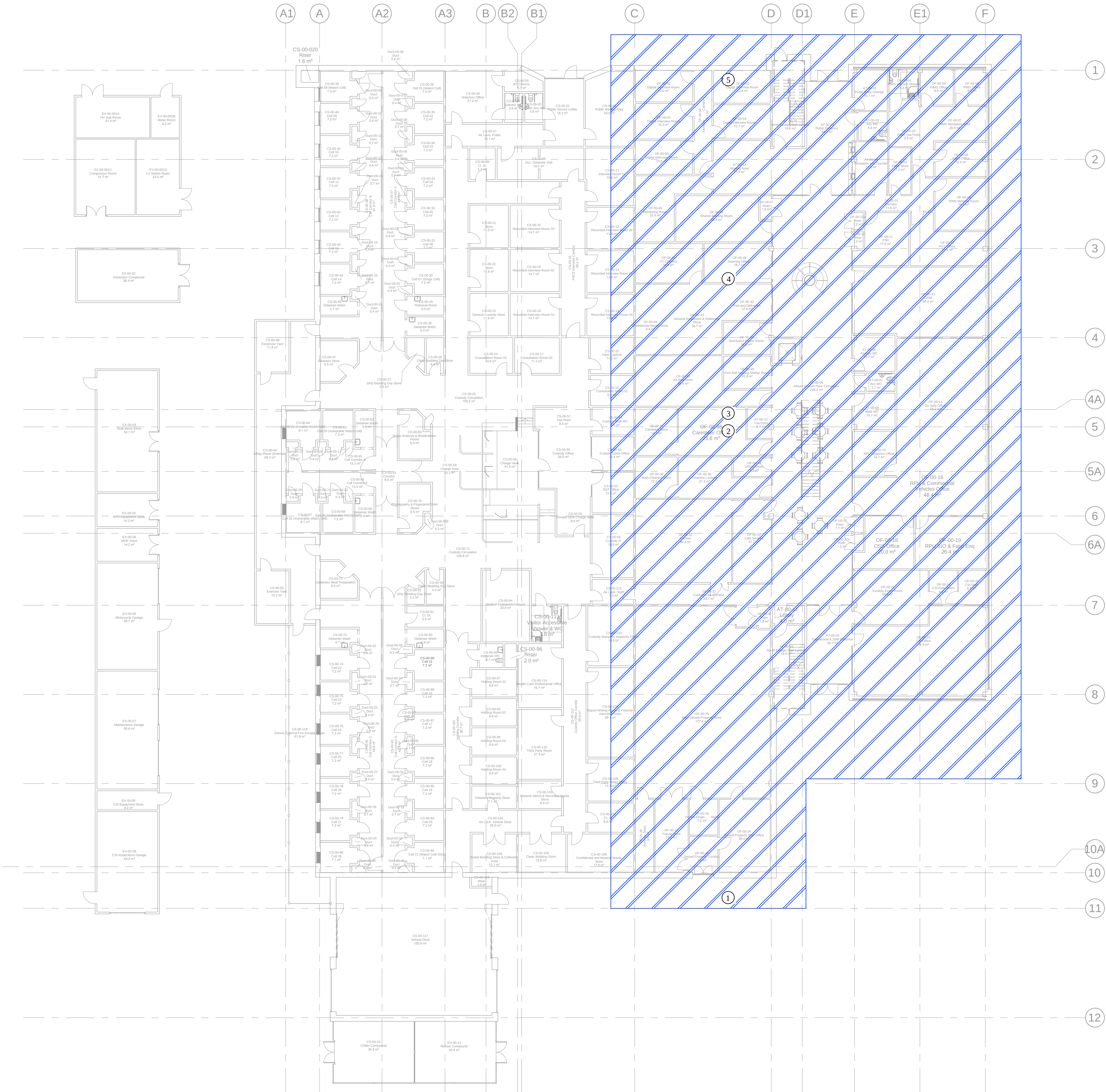
GENERAL NOTES

1. DO NOT SCALE. ALL DIMENSIONS ARE IN MILLIMETRES.
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4. THE CONTRACTOR SHALL CONFORM TO ALL STATUTORY AUTHORITY REQUIREMENTS, CHECKING WITH THE EMPLOYER/CLIENT TO IDENTIFY BOTH BELOW GROUND AND OVERHEAD SERVICES. CONTRACTOR TO FULLY COMPLY WITH ALL CDM, H&S AND PARTY WALL ACTS THAT ARE CURRENT. ALL BS REFERENCES ARE TO CURRENT EDITIONS.
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6. ALL LEVELS ARE IN METRES (A.O.D.)

KEY



PILING MAT @ 94.900m WOULD REQUIRE APPROXIMATELY 1500m³



PILING MAT LEVELS

- 1: 95.000m - 400mm = 94.600m WILL HAVE TO STRIP TO 94.300m TO GIVE A PILING PLATFORM 600mm THICK
2: 94.873m - 400mm = 94.473m WILL HAVE TO STRIP TO 94.300m TO GIVE A PILING PLATFORM 600mm THICK
3: 94.031m - 200mm = 93.831m = ADDITIONAL STONE BUILD UP 500mm
4: 94.418m - 200mm = 94.218m = ADDITIONAL STONE BUILD UP 100mm
5: 95.163m - 400mm = 94.763m WILL HAVE TO STRIP TO 94.300m TO GIVE A PILING PLATFORM 600mm THICK

REV	DESCRIPTION	BY	CHK	APP	DATE
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POLICE AND CRIME COMMISSIONER OF NORTH WALES

GENEVA BUILDING,
LAKE VIEW DRIVE,
SHERWOOD BUSINESS PARK,
ANNESLEY, NOTTINGHAMSHIRE
NG15 0ED

TEL: +44 (0)1623 684 550
e-mail: nottingham@wyg.com



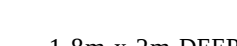
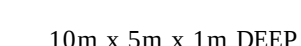
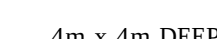
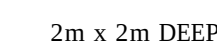
Project:
WREXHAM CUSTODY FACILITY

Drawing Title:
CUT & FILL LAYOUT
SHEET 2

Scale @	A1	Drawn	Date	Checked	Date	Approved	Date
1:200	RJ	19.09.16	PS	19.09.16	SH	19.09.16	
Project No.	Office	Type	Drawing No.	Revision			
A098075	81	C	002	-			

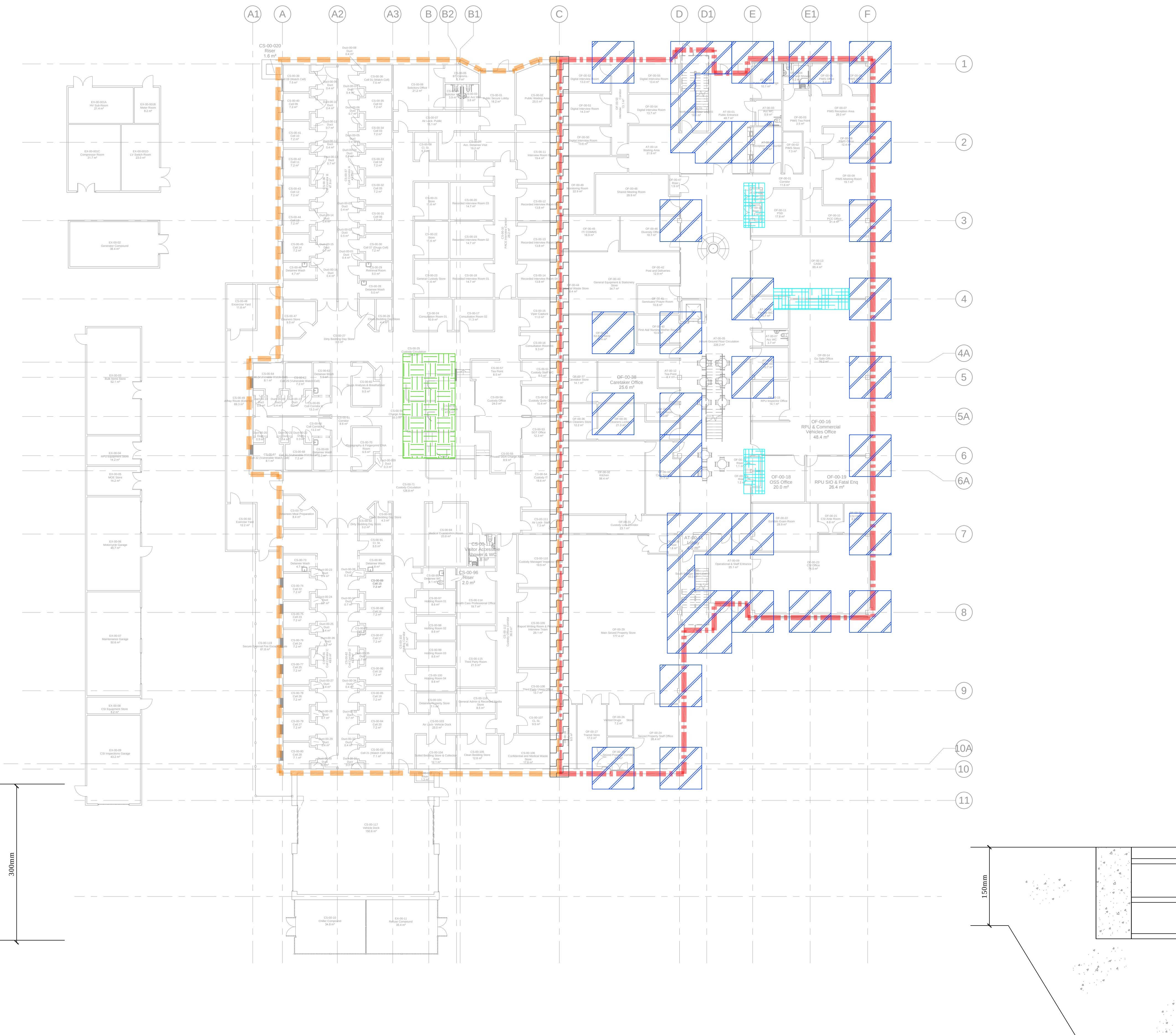
GENERAL NOTES

- KEY



150mm THICK GROUND BEARING SLAB

300mm THICK RAFT SOLUTION



300mm THICK RAFT SECTION
(NTS)

150mm THICK GROUND
BEARING SLAB
(NTS)

POLICE AND CRIME COMMISSIONER OF
NORTH WALES



Project:

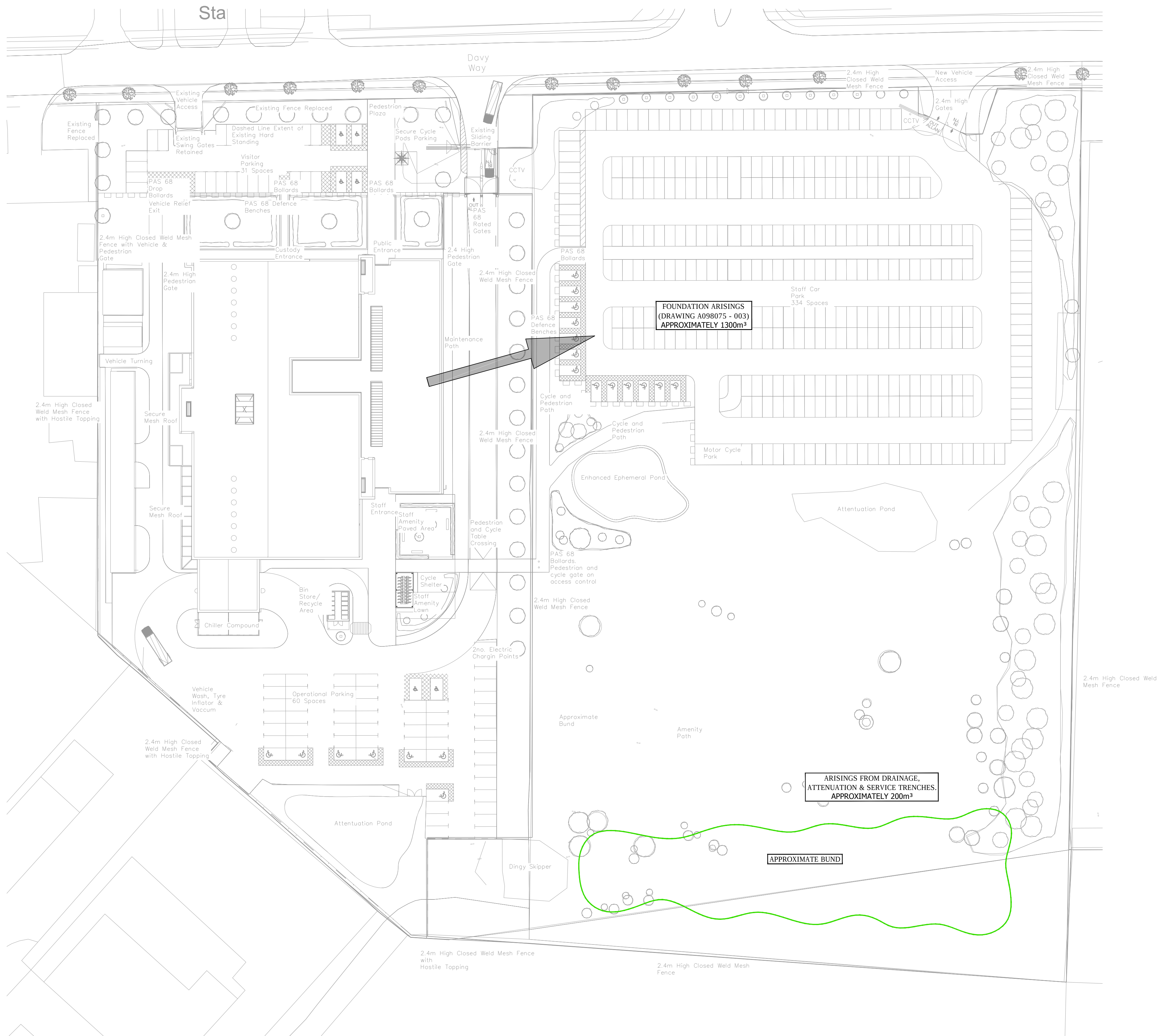
WREXHAM CUSTODY FACILITY

Drawing Title:

CUT & FILL LAYOUT

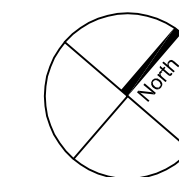
SHEET 3

Scale @ A1 1:200	Drawn RJ	Date 19.09.16	Checked PS	Date 19.09.16	Approved SH	Date 19.09.16
Project No. A098075	Office 81	Type C	Drawing No. 003		Revision -	



ALL LEVELS ARE IN METRES (A.O.D.)

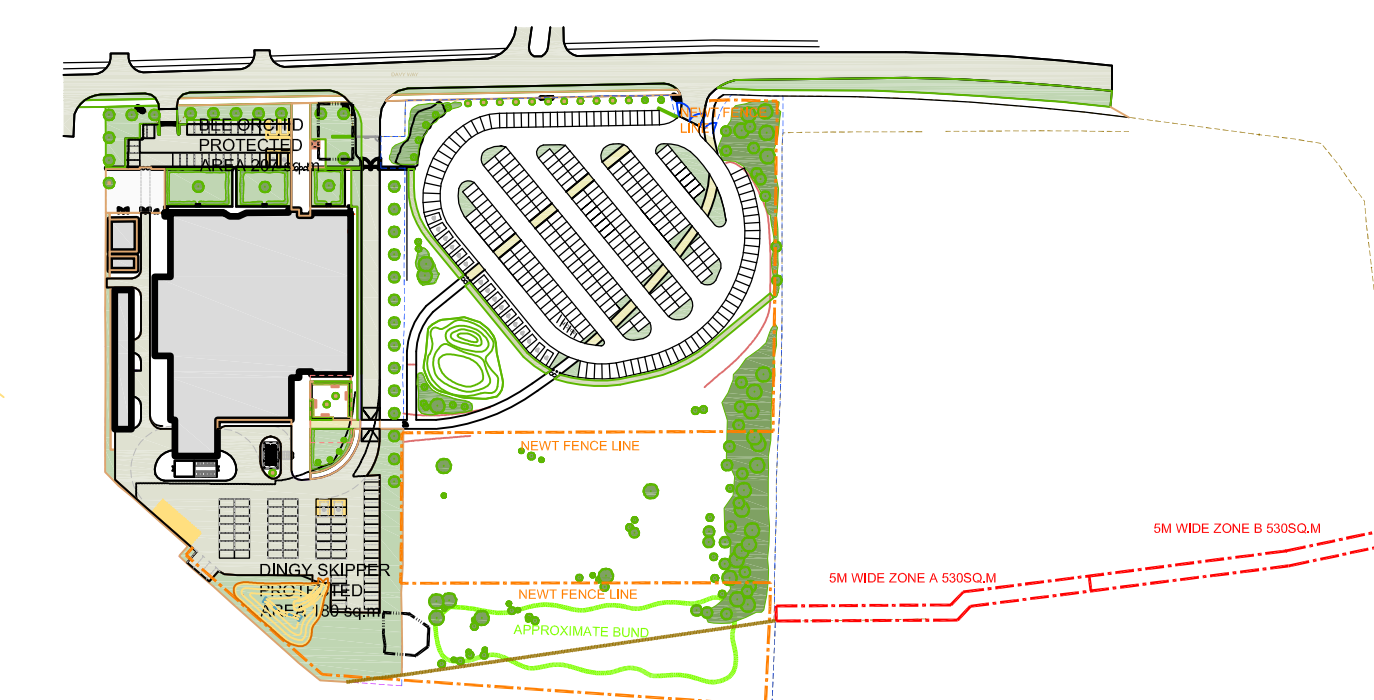
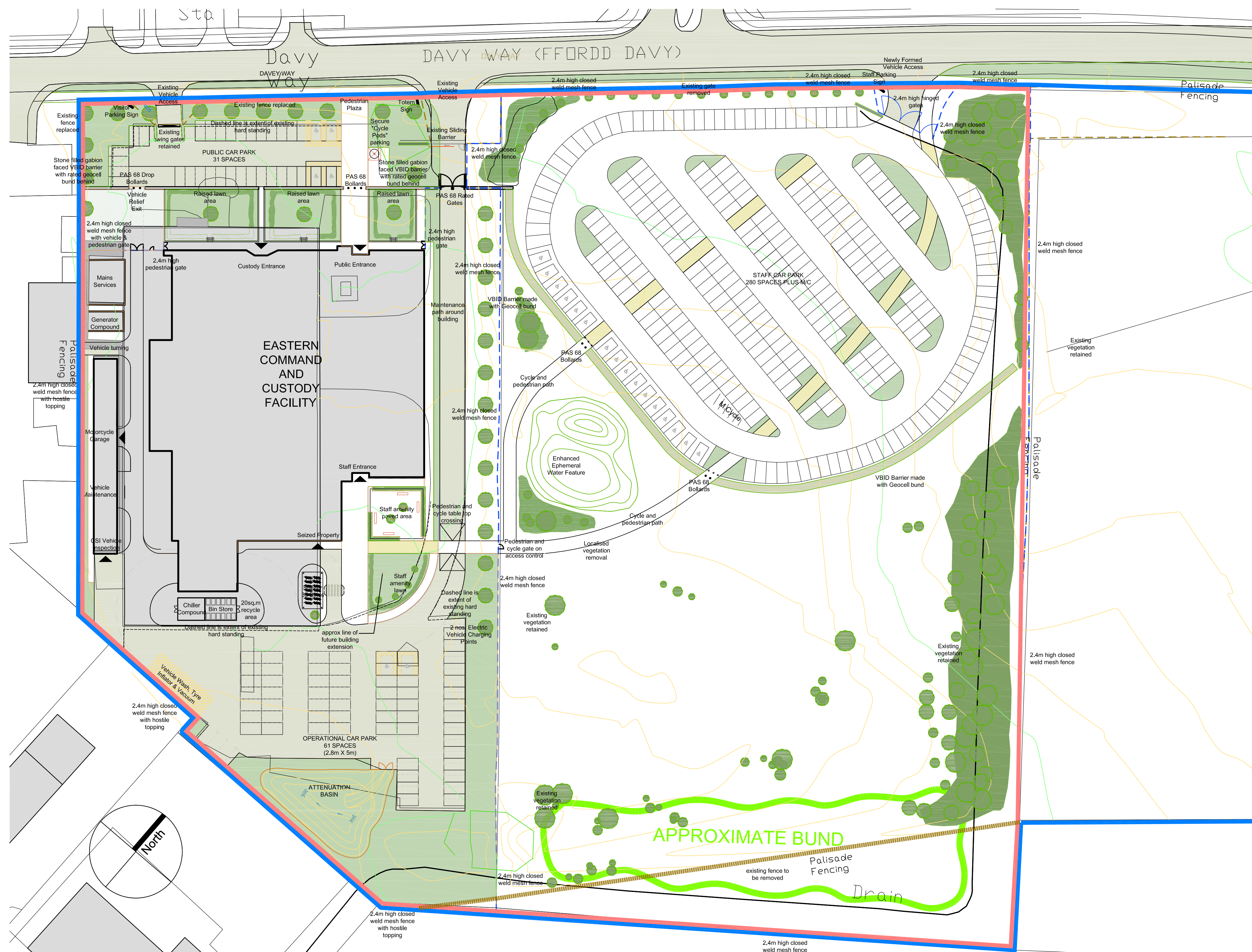
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Project No. A098075	Office 81	Type C	Drawing No. 004	Revision -		



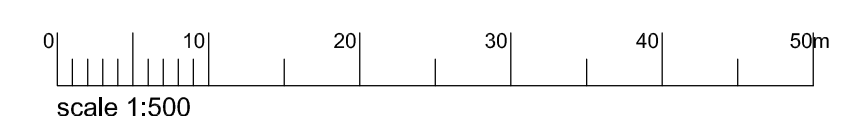
NOTES:

1. All dimensions are to be checked on site prior to preparing any working or shop drawings or commencing work on site.

2. This drawing is to be read in conjunction with all relevant Architect's, M&E and Structural Engineers' drawings and specifications.



1 Full Site Key Plan



T1	07.12.2015	ISSUED FOR TENDER			JW	ST	DH
Rev	Rev Date	Purpose of revision			Drawn	Check'd	Review/Approv

JACOBS'

Client

POLICE AND CRIME COMMISSIONER
OF NORTH WALES

Project	EASTERN COMMAND AND CUSTODY FACILITY
---------	--------------------------------------

Drawing title **PROPOSED SITE PLAN**

Drawing Status	TENDER ISSUE
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Scale	1 : 500	@ A1	DO NOT SCALE
Job No.	R1305210		

Jacobus No.	D1000210		
JPI No.			
Drawing Number	Sheet No.		Rev

B1305210/AR/050.001

T.

This drawing is not to be used in whole or part other than for the intended purpose and project as defined on this drawing. Refer to the contract for full terms and conditions.

1 Proposed Site Plan



Appendices



Appendix A – Report Conditions

REPORT CONDITIONS

This report is produced solely for the benefit of **Galliford Try Building North West** and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to WYG. In time improved practices, fresh information or amended legislation may necessitate a re-assessment. Opinions and information provided in this report are on the basis of WYG using due skill and care in the preparation of the report.

This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections. Environmental conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

This report is limited to those aspects reported on, within the scope and limits agreed with the client under our appointment. It is necessarily restricted and no liability is accepted for any other aspect. It is based on the information sources indicated in the report. Some of the opinions are based on unconfirmed data and information and are presented as the best obtained within the scope for this report.

Reliance has been placed on the documents and information supplied to WYG by others but no independent verification of these has been made and no warranty is given on them. No liability is accepted or warranty given in relation to the performance, reliability, standing etc of any products, services, organisations or companies referred to in this report.

Whilst skill and care have been used, no investigative method can eliminate the possibility of obtaining partially imprecise, incomplete or not fully representative information. Any monitoring or survey work undertaken as part of the commission will have been subject to limitations, including for example timescale, seasonal and weather related conditions.

Although care is taken to select monitoring and survey periods that are typical of the environmental conditions being measured, within the overall reporting programme constraints, measured conditions may not be fully representative of the actual conditions. Any predictive or modelling work, undertaken as part of the commission will be subject to limitations including the representativeness of data used by the model and the assumptions inherent within the approach used. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicate in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions.

The potential influence of our assessment and report on other aspects of any development or future planning requires evaluation by other involved parties.

The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of workmanship and compliance with the specifications on site during construction. WYG accept no liability for issues with performance arising from such factors.



Appendix B – Planning Conditions & Regulatory Correspondence

In pursuance of its powers under the Acts and Orders referred to below, the County Borough Council as Local Planning Authority, hereby determines your application in accordance with the particulars and plans comprising the application

Applicant	MRS LIZ BRYAN WREXHAM POLICE STATION	Code Number	LLA P/2015/0583
Agent	MR SAM THOMAS 1180 ESKDALE ROAD WINNERSH UK RG41 5TU	Date Received	27/07/2015
		Decision Date	17/12/2015

Town and Country Planning Act, 1990

Location of application

SITE OF FORMER SHARP PRECISION WAREHOUSE, DAVY WAY, LLAY INDUSTRIAL ESTATE, LLAY, WREXHAM, LL12 0PB

Description of application

DEMOLITION OF EXISTING PORTAL FRAME WAREHOUSE AND RE-DEVELOPMENT TO PROVIDE POLICE OFFICE, STORAGE, CUSTODY BUILDING WITH ANCILLARY PARKING AND NEW ACCESS FROM DAVY WAY

In reaching this decision the Council has had regard to the relevant policies in the Wrexham Unitary Development Plan which are as follows:-

E1	Employment allocations
E4	Employment development within settlements
EC4	Hedgerows, Trees and Woodland
EC6	Biodiversity Conservation
GDP1	Development objectives

Particulars of decision that permission be GRANTED Subject to the following:-

Condition(s)

1. The development hereby permitted shall be commenced before the expiry of five years from the date of this permission.
2. The development shall be carried out in strict accordance with the following approved drawings:
 - i) Drawing no. B1305210/AR/050.001 Revision PL4: Proposed Site Plan
 - ii) Drawing no. B1305210/AR Sheet no.P050.002 Revision PL1: Proposed Site Sections

Applicant	MRS LIZ BRYAN WREXHAM POLICE STATION	Code Number	LLA P/2015/0583
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		Decision Date	17/12/2015

- iii) Drawing no. B1305210/AR/ Sheet no.P140.001 Revision PL1: Proposed Elevations
- iv) Drawing no. B1305210/AR/ Sheet no.P100.001 Revision PL1: Proposed Ground Floor Plan
- v) Drawing no. B1305210/AR/ Sheet no.P100.002 Revision PL1: Proposed First Floor Plan
- vi) Drawing no. B1305210/AR/ Sheet no.P100.003 Revision PL1: Proposed Second Floor Plan
- vii) Drawing no. B1305210/AR/ Sheet no.P100.004 Revision PL1: Proposed Roof Plan
- vii) Drawing no. B1305210/CE/170.006 Revision P0: Proposed Pavement Construction Details.
- ix) Drawing no. B1305210/CE/170.007 Revision P0: Pavement & Kerb Construction Details Sheet 1 of 1.
- x) Drawing no. B1305210/CE/170.010 Revision P0: Proposed Highway Junction Detail Layouts
- xi) B1305210/SK/E204 Revision PL1: External Services Layout

3. No part of the development shall commence until a scheme to deal with potential contamination at the site has been submitted to and approved in writing by the Local Planning Authority. This scheme shall include a phased investigation approach to identify the extent of contamination and any measures required to remediate the site, including post-development monitoring.

4. No part of the development shall be occupied until a Verification Report which demonstrates that the remedial works approved as part of condition no. 03 above have been satisfactorily carried out, has been submitted to and approved in writing by the Local Planning Authority.

5. No part of the development shall commence until the following have been submitted to and approved in writing by the Local Planning Authority:
- i) A timetable for the implementation of the ecological mitigation and habitat creation measures set out in section 5. Recommendations of the Capita Llay Industrial Estate & Former Sharp Site Ecological Survey and Report December 2015 and those shown on approved drawing no. B1305210/AR/050.001 Revision PL4; and
 - ii) A Biosecurity Risk Assessment.

The development shall thereafter be carried out in strict accordance with the details as are approved.

Applicant	MRS LIZ BRYAN WREXHAM POLICE STATION	Code Number	LLA P/2015/0583
Agent	MR SAM THOMAS 1180 ESKDALE ROAD WINNERSH UK RG41 5TU	Date Received	27/07/2015
		Decision Date	17/12/2015

6. No part of the development shall commence until a long term Ecological Management and Monitoring Plan in respect of the ecological mitigation and habitat creation measures set out in section 5. Recommendations of the Capita Llay Industrial Estate & Former Sharp Site Ecological Survey and Report December 2015 and those shown on approved drawing no. B1305210/AR/050.001 Revision PL4 has been submitted to and approved in writing by the Local Planning Authority. The ecological mitigation and habitat creation measures shall be retained in perpetuity solely for the purpose of ecological mitigation and managed and monitored in strict accordance with Ecological Management and Monitoring Plan as approved.
7. No equipment, machinery, plant or materials of any kind in connection with the development shall be brought onto the site until tree protection fencing and ground protection measures have been implemented in strict accordance with details which have been submitted to and approved in writing by the Local Planning Authority. The details should include specification and location for the fencing. Nothing shall be stored or placed in any area fenced in accordance with this condition and the ground levels within those areas shall not be altered, nor shall any excavations be made.
8. No part of the development shall commence until a Construction Traffic Management Plan including provisions for contractor parking has been submitted to and approved in writing by the Local Planning Authority and the Plan as is approved has been fully implemented.
9. Notwithstanding the submitted plans, no part of the development shall commence until a scheme for the comprehensive and integrated drainage of the site indicating provision for foul water, surface water and land drainage has been submitted to and approved in writing by the Local Planning Authority. Prior to the submission of those details, an assessment shall be carried out into the potential for disposing of surface water by means of Sustainable urban Drainage Systems (SuDS) in accordance with the principles of sustainable drainage systems set out in Technical Advice Note 15: Development and Flood Risk, and the results of the assessment shall be submitted in writing to the Local Planning Authority. Where a SuDS scheme is to be implemented, the submitted details shall:
- i) Provide information about the design storm period and intensity, the method employed to delay and control the surface water discharged from the site and the measures taken to prevent pollution of receiving ground water and/or surface waters;
 - ii) Specify the responsibilities of each party for the implementation of the SuDS scheme, together with a timetable for that implementation; and,

Applicant	MRS LIZ BRYAN WREXHAM POLICE STATION	Code Number	LLA P/2015/0583
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		Decision Date	17/12/2015

iii) Provide a timescale for implementation, management and maintenance plan for the lifetime of the development which shall include the arrangements for adoption by any public authority or statutory undertaker and any other arrangements to secure the operation of the scheme throughout its lifetime.

10. No facing or roofing materials shall be used other than those detailed on the application form and within the approved application documentation.

11. Prior to first use of the development, the proposed vehicular access shall be laid out in strict accordance with approved plan no.

B1305210/CE/170.010 Revision P0. The visibility splays shall thereafter be permanently retained free of all obstruction in excess of 1 metre in height.

12. The vehicular parking and turning areas as shown on approved drawing(s) No(s). B1305210/AR/050.001 Revision PL4 shall be fully laid out, surfaced and drained prior to first use of the development. These areas shall thereafter be permanently retained and kept free of any obstruction, and made available solely for the parking and turning of motor vehicles at all times.

13. Within three months of commencement of development a scheme of hard and soft landscaping, to include a timescale for implementation, shall be submitted to and approved in writing by the Local Planning Authority. Hard and soft landscaping shall thereafter be carried out in strict accordance with the scheme as approved.

14. A Final Travel Plan shall be submitted to and approved in writing by the Local Planning Authority following the first anniversary of first use of the development.

15. No private surface water run off shall be permitted to flow from the development site onto the adjoining highway. An Aco drain or similar shall be provided across the approved access to intercept any such run off prior to first use of the development.

Reason(s)

1. To comply with Section 91(3) of the Town and Country Planning Act, 1990.

2. To ensure that the development fully complies with the appropriate policies and standards.

3. In the interests of the amenities of the future occupants of the buildings.

4. In the interests of the amenities of the future occupants of the buildings.

Applicant	MRS LIZ BRYAN WREXHAM POLICE STATION	Code Number	LLA P/2015/0583
Agent	MR SAM THOMAS 1180 ESKDALE ROAD WINNERSH UK RG41 5TU	Date Received	27/07/2015
		Decision Date	17/12/2015

5. In order to protect wildlife interests, which are afforded special protection.
6. In order to protect wildlife interests, which are afforded special protection.
7. To ensure that the retained trees are adequately protected during development in the interests of amenity.
8. In the interests of highway safety.
9. To ensure satisfactory drainage of the site and to avoid flooding.
10. To ensure a satisfactory standard of appearance of the development in the interests of the visual amenities of the area.
11. To ensure the formation of a safe and satisfactory access.
12. To provide for the parking and turning of vehicles clear of the highway and to ensure that reversing by vehicles into or from the highway is rendered unnecessary in the interest of traffic safety.
13. To ensure a satisfactory standard of appearance of the development in the interests of the visual amenities of the area and in order to protect wildlife interests, which are afforded special protection.
14. To support the Council's approved Integrated Transport Strategy and to reduce dependency on the motor vehicle.
15. In the interests of highway safety.

Note(s) to applicant

The tree protection fencing and ground protection measures required by condition 05 shall be put in place to protect the Root Protection Area of tree T9 as identified in the Jacobs BS5827:2012 Preliminary Tree Survey Report dated 22nd October 2015.

You should ensure that any difference between the plans approved under the Town and Country Planning Acts and under the Building Regulations is resolved prior to commencement of development, by formal submission of amended plans.

The proposed development lies within an area that has been defined by The Coal Authority as containing potential hazards arising from former coal mining activity. These hazards can include: mine entries (shafts and adits); shallow coal workings; geological features (fissures and break lines); mine gas and previous surface mining sites. Although such hazards are seldom readily visible, they can often be present and problems can occur in the future, particularly as a result of development taking place.

Applicant	MRS LIZ BRYAN WREXHAM POLICE STATION	Code Number	LLA P/2015/0583
Agent	MR SAM THOMAS 1180 ESKDALE ROAD WINNERSH UK RG41 5TU	Date Received	27/07/2015
		Decision Date	17/12/2015

It is recommended that information outlining how the former mining activities affect the proposed development, along with any mitigation measures required (for example the need for gas protection measures within the foundations), be submitted alongside any subsequent application for Building Regulations approval (if relevant). Your attention is drawn to The Coal Authority Policy in relation to new development and mine entries available at: <https://www.gov.uk/government/publications/building-on-or-within-the-influencing-distance-of-mine-entries>

Any intrusive activities which disturb or enter any coal seams, coal mine workings or coal mine entries (shafts and adits) requires a Coal Authority Permit. Such activities could include site investigation boreholes, digging of foundations, piling activities, other ground works and any subsequent treatment of coal mine workings and coal mine entries for ground stability purposes. Failure to obtain a Coal Authority Permit for such activities is trespass, with the potential for court action.

Property specific summary information on past, current and future coal mining activity can be obtained from: www.groundstability.com

If any of the coal mining features are unexpectedly encountered during development, this should be reported immediately to The Coal Authority on 0345 762 6848. Further information is available on The Coal Authority website at: www.gov.uk/government/organisations/the-coal-authority.



**Officer Appointed for this purpose
Head of Community Wellbeing and Development**

**Refer to the Statement of Applicant's Rights and General Information enclosed
or refer to the following link:-**

**[http://www.wrexham.gov.uk/english/planning_portal/publications/info_sheets.h
tm](http://www.wrexham.gov.uk/english/planning_portal/publications/info_sheets.htm)**

MEMORANDUM



From:	Head of Housing and Public Protection	To:	Head of Community Wellbeing and Development
Our Ref:	WK/201602135	Your Ref:	P/2016/0183
Date:	17th March 2016		

Town and Country Planning Act 1990

Town and Country Planning (General Development Procedure) Order 1996

Re: Sharp Manufacturing Company of UK Sharp House Davy Way Llay Industrial Estate Llay Wrexham LL12 0PG

Environmental Protection

No comments

Contaminated Land

With regard to Condition 3 of Planning Permission P/2015/0583, please find below my comments on the report prepared by Ian Farmers Associates dated February 16 'Eastern Command & Custody Facility, Llay, Wrexham - Ground Investigation Report', Ref: 41788v2. Please note that the report covers geo-technical matters and foundation design recommendations, my comments do not cover these issues since they are outside my remit.

1. A phased contamination assessment should commence with a Preliminary Risk Assessment (also known as a Phase 1 Desk Study), this will then develop a conceptual model which will then be the basis for further assessment if necessary. In paragraphs 2.3.1 of the above report there is reference to a report prepared by Capita Symonds and subsequent paragraphs provide some details about a PRA so it appears that this information may be within the Capita Symonds report. Paragraph 2.3.10 refers to identified pollutant linkages and these would be encompassed with a conceptual site model. Paragraph 2.3.2 states that the land was farmland until the current building was constructed, however it is not apparent what the previous use of the building was and therefore what the potential contamination sources are from this past use. A copy of the Capita Symonds report should be provided and this will then be reviewed to establish if the matters raised here are addressed.

2. It is noted that a gas risk assessment has been carried out and some potentially significant risks have been identified and the report surmises that these are likely to be associated with the presence on peat/marshland. It is also noted that paragraph 2.3.9 states that basic radon protection for properties would be required in this area, although it is not clear whether this type of development meets this requirement. I do not have any specific comments with regard to the scope of the gas risk assessment and findings other than there is limited discussion on the influence of the atmospheric pressure at the time of the monitoring.

3. The report refers to some localised hydrocarbon contamination (paragraph 6.7.15) but discussion on this in relation to the possible source (with reference to the PRA) has not been provided. It does not appear to be a significant issue but further comment on this, particularly in relation to the PRA, should be provided. In relation to item 5. below, the management of the contaminated water during the construction works needed to be included within the Remediation Strategy (as referred to in paragraph 6.3.2 and 6.7.15).

4. Provided that the PRA (referred to above in item 1) does not indicate any potential concerns that have not been assessed by the work undertaken in this ground investigation (or the previous one by Ian Farmer Associates), then overall I am satisfied with the assessment undertaken and the requirement to obtain specialist advice for the design of suitable gas protection measures which take into account the gas source/generation, proposed end use and foundation design.

5. A Remediation Strategy to outline the gas protection measures required and to also include protection against sulphate attack (paragraph 6.6.4) and management of hydrocarbon contaminated water should be submitted to the Council for approval. This Strategy should also provide an outline of the subsequent verification process that will be in place to ensure all remedial measures are installed/ carried out to a satisfactory standard. In due course a Verification Report will then need to be submitted detailing these checks and providing relevant evidence of the remediation measures installed/works undertaken to fulfil the requirements of Condition 4.

6. Finally I would recommend that advice is sought by the developer from NRW regarding the re-use of materials on site, a Materials Management Plan or Waste Exemption may be required.

.....
Head of Housing and Public Protection

Enc.

sara.hegewald

From: kathryn.ellis
Sent: 02 August 2016 19:24
To: Angela Guy
Cc: Matthew Phillips; Gary Thorogood (Galliford Try); sara.hegewald
Subject: RE: Wrexham Police Custody Facility (2015/0583)

Thanks Angela.

The SI works can now go ahead and findings will be included in the remediation strategy. Submission of which will be included in the formal discharge request by my client.

Kind Regards,

Kathryn Ellis

Principal Environmental Consultant

WYG

Quay West at MediaCityUK, Trafford Wharf Road, Trafford Park, Manchester, M17 1HH

Tel: +44 161 874 8749

Fax: +44 161 872 3193

www.wyg.com

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From: Angela Guy [mailto:Angela.Guy@wrexham.gov.uk]
Sent: 02 August 2016 11:57
To: kathryn.ellis
Cc: Matthew Phillips
Subject: RE: Wrexham Police Custody Facility (2015/0583)

Kathryn

Thank you for your letter received on the 20th July 2016. Apologies for the delay in responding, I have been on leave for much of the time until now.

1. Thank you for providing a copy of the Capita Symonds Phase 1 report dated June 2013. I have the following comments to make on this report.
 - a. The potential contaminants associated with the sites former use as an electronics manufacturing factory have not specifically been identified, it is noted that your proposed works (mentioned in item 4 below) are aimed at addressing this matter. I trust the positions chosen for the pits will be explained and that the scope of works is kept flexible to allow consideration of any issues found on site at the time.

- b. 2.8.3 states that the Astbury Quarry/Dark Lane landfill appears to be operational, however it is a closed landfill although the license/permit has not been surrendered. It should be noted that whilst a large area of the site was an engineered landfill (known as Astbury), the area operated at the time the site was known as Dark Lane is much older and I understand was regulated under the old COPA regime as a dilute and disperse site, however I believe it is encompassed within the current license/permit boundary.
 - c. Paragraph 3.2.3 does not state that the natural strata may also have the potential to generate gas, however based on the more recent gas risk assessment work it is noted that this matter is covered anyway.
- 2. Your review of the gas risk assessment undertaken by IFA along with the additional comments on the findings is sufficient and it is noted that the proposed gas protection measures will be designed by a specialist company and details of these will be included in the Remediation Strategy.
 - 3. This approach to deal with the hydrocarbon contamination is satisfactory and I will provide further comment on the findings of the additional investigation works and proposed remediation measures in due course when the details are submitted for approval. I trust the assessment will include potential impacts on water supply pipes.
 - 4. The further investigation works proposed are satisfactory and I will provide comment on the findings of these in due course when the details are submitted for approval.
 - 5. For clarity Condition 3 requires a satisfactory contamination assessment to be undertaken and Remediation Strategy prepared for approval. Condition 4 requires that when the remediation works are complete, a validation report to be submitted for approval to demonstrate the works have been carried out to a satisfactory standard and in accordance with the Remediation Strategy. Therefore Condition 3 can be discharged first when the required documents have been submitted and approved. Condition 4 will be discharged at a later date.
 - 6. It is noted that earthworks are to be undertaken and that these will be appropriately documented. In addition to the Remediation Strategy please can you forward a copy of the MMP to the Council when this has been prepared.

I look forward to receiving your report on the further SI works and Remediation Strategy in due course.

Kind regards Angela

Ms Angela Guy

Contaminated Land Officer - Environmental Protection

Swyddog Tir wedi ei Halogi - Diogelu'r Amgylchedd



01978 297433



Environment and Planning Department, Ruthin Road, Wrexham LL13 7TU



Adran Amgylchedd a Chynllunio, Ffordd Rhuthun, Wrecsam LL13 7TU



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From: kathryn.ellis

Sent: 28 July 2016 08:04:15 (UTC) Dublin, Edinburgh, Lisbon, London

To: Stacey Inglis

Cc: Helen Bradshawe

Subject: Wrexham Police Custody Facility (2015/0583)

Stacey,

I issued the attached letter in response to the Council's memo in relation to planning permission 2015/0583. Can you let me know which officer is dealing with it as we would like agreement of the additional SI works so we can move the remediation strategy along.

Thanks

Kathryn Ellis

Principal Environmental Consultant

WYG

Quay West at MediaCityUK, Trafford Wharf Road, Trafford Park, Manchester, M17 1HH

Tel: +44 161 874 8749

Fax: +44 161 872 3193

www.wyg.com

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Rydym yn croesawu gohebiaeth yn Gymraeg. Byddwn yn ymateb i unrhyw ohebiaeth yn Gymraeg ac ni fydd hyn yn arwain at unrhyw oedi.

Ewch i weld - mi fedrwch chi dalu, rhoi gwybod, gwneud cais, dweud eich dweud, a dod o hyd i wybodaeth ar-lein yn www.wreccsam.gov.uk. Arbedwch bapur - meddylwch cyn argraffu!

Mae'r neges e-bost hon ac unrhyw atodiadau wedi eu bwriadu ar gyfer yr unigolyn neu'r sefydliad y?i cyfeirir atynt yn unig. Am yr amodau llawn yngl?n ? chynnwys a defnyddio?r neges e-bost hon, ac unrhyw atodiadau, cyfeiriwch at www.wreccsam.gov.uk/top_navigation/disclaimersw.htm

We welcome correspondence in Welsh. We will respond to any correspondence in Welsh and this will not lead to any delay.

Take a look - you can pay, report, request, have your say and find information online at www.wrexham.gov.uk. Save paper - think before you print!

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Sara Hegewald
WYG
Quay West at MediaCityUK
Trafford Wharf Road
Trafford Park
Manchester
M17 1HH

Eich Cyf/Your Ref
Ein Cyf/Our Ref
Dyddiad/Date
Gofynner am/Ask for
Rhif Union/Direct Dial
E-bost/E-mail

A098075
P/2015/0583
26 October 2016
Angela Guy
01978 297433
angela.guy@wrexham.gov.uk

SENT BY EMAIL ONLY

Dear Sara

**P/2015/0583 WREXHAM CUSTODY FACILITY: REMEDIATION STRATEGY,
SEPTEMBER 2016**

Thank you for providing a copy of the above report. As stated in my email dated 12 October 2016, I understand the Planning Team have not yet received a formal submission for the discharge of condition 3, therefore the following comments on this report are provided for information only and do not mean that the requirements of the Condition has been met. Should you require any further advice in respect to the formal submission and discharge of the condition please contact Matthew Phillips.

1. The second paragraph of Section 4.1.1 states that a damp proof membrane is suitable to mitigate the effects of radon, based upon BRE Report BR211 (2015) Radon: Protective measures for new buildings guidance. It then goes on to state "Gas protection measures for the proposed building will therefore comprise either the following Option 1.... Or Option 2...". Neither of the options refer to a membrane therefore I interpret this as the damp proof membrane being the membrane that protects against methane and carbon dioxide gas ingress.

However BR211 does not provide guidance on measures for methane, carbon dioxide and hydrocarbon vapours and reference should be made to the appropriate guidance such as BS8485:2015 (Table 7 states the membrane is required to be impervious to the relevant gases (i.e. methane and carbon dioxide)) and CIRIA VOC guidance (with regard to protection against the risk from hydrocarbon vapours).

It is noted that Spilman Associates Ltd report in Appendix G does however reference this guidance but little if any mention is made of the verification being in compliance with CIRIA C735.

Therefore final clarification on the type of gas protection membrane to be used is required and what verification will be undertaken.

2. As is stated, both of the two options proposed involve active measures which will therefore require long term maintenance programmes to be in place for the lifetime of the building. Therefore provision for this long term maintenance should be made and information supplied to the Council which will demonstrate that this provision is in place.
3. In accordance with BS8485, the installation of the gas membrane should be by a qualified person. In addition reference has not been made to undertaking the installation in accordance with the manufacturers instructions, just that it will be done in general general accordance with BS8485.
4. In 3.2.2 and 3.3.2 it is noted that some contamination has been observed however there is limited discussion about this in relation to the findings of the SI and therefore it is not clear what risk assessment has been undertaken of these areas.
5. It is noted that a brief procedure for dealing with unexpected contamination is provided in section 4.1.3 and this is sufficient, in addition to notifying the Council should any unforeseen contamination be found, the checks and records on this this matter should be detailed in the Verification Report required to be submitted under Condition 4.
6. It is noted that section 6.2 provides details of the proposed testing regime for excavated and imported soils, this is not in accordance with the Councils adopted guidance, a copy of which is enclosed.
7. There is a bund shown on the proposed development drawings, what is this for and what will be used to construct it? Depending on the response to these queries will depend on what requirements will be in place for verification purposes.
8. Details of what measures were in place and used for the management of contaminated water (referred to in section 5.3) should be provided in the Verification Report.

Should you have any queries regarding this letter then please do not hesitate to contact me.

Yours sincerely



Angela Guy
Contaminated Land Officer

cc Matthew Phillips, Planning Officer



Appendix C – Exploratory Hole Logs

WYG ENVIRONMENT

Quay West, Trafford Wharf Road, Salford Quays

Tel: 0161 8723223 Fax: 0161 8723193

Exploratory Hole Number

HDP101



Project : Wrexham Custody Facility, Wrexham
Project Number : A098075
Client : Galliford Try Building
Method : Hand Excavation
Co-ordinates :
Level :

Scale 1:50 **Sheet** 1 of 1

Logged By : NS
Checked By : SH
Start Date : 25/08/16
Finish Date : 25/08/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Installation/ Backfill	Sample Test		Notes / Remarks
						Depth	Type	
MADE GROUND: CONCRETE. Reinforced.			0.18					
MADE GROUND: Light greyish brown very sandy fine to coarse GRAVEL of sub-angular to sub-rounded limestone and concrete. Sand is fine to medium. - Strong sweet chemical odour between 0.18m and 0.43m bgl.			0.43			0.30	ES	PID=0.0ppm
			1.00			0.90	ES	PID=0.0ppm
MADE GROUND: Firm brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium angular to sub-rounded coal, mudstone, siltstone and sandstone. Sand is fine to medium.								
End of Trial Pit at 1.00 m								
Observations / Remarks 1. Hand dug pit was backfilled with arisings upon completion. 2. Groundwater was not observed.	Excavation Information					Groundwater		
	Length : 0.34m Width : 0.35m Orientation : - Stability : Stable Shoring : Not required					Struck	Rising to	Time

WYG ENVIRONMENT

Quay West, Trafford Wharf Road, Salford Quays

Tel: 0161 8723223 Fax: 0161 8723193

Exploratory Hole Number

HDP102



Project : Wrexham Custody Facility, Wrexham
Project Number : A098075
Client : Galliford Try Building
Method : Hand Excavation
Co-ordinates :
Level :

Scale 1:50 **Sheet** 1 of 1

Logged By : NS
Checked By : SH
Start Date : 25/08/16
Finish Date : 25/08/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Installation/Backfill	Sample Test		Notes / Remarks
						Depth	Type	
MADE GROUND: Firm dark brown slightly sandy slightly gravelly clayey TOPSOIL. Gravel is fine to medium sub-angular to rounded sandstone, mudstone and coal. Sand is fine to medium.			0.19	 0.76		0.10	ES	PID=0.0ppm
			0.43			0.30	ES	PID=0.0ppm
			1.00			0.80	ES	PID=0.0ppm
MADE GROUND: Yellowish brown fine to coarse SAND.								
MADE GROUND: Firm brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium sub-angular to sub-rounded coal, mudstone, sandstone and quartzite. Sand is fine to medium. Slight organic odour. - Slightly damp below 0.76m bgl.								
End of Trial Pit at 1.00 m								
Observations / Remarks 1. Hand dug pit was backfilled with arisings upon completion. 2. Groundwater seepage was encountered at 0.76m bgl.	Excavation Information					Groundwater		
	Length : 0.40m Width : 0.36m Orientation : - Stability : Stable Shoring : Not required					Struck	Rising to	Time
						0.76	-	-

Tel: 0161 8723223 Fax: 0161 8723193

HDP103



Project : Wrexham Custody Facility, Wrexham
Project Number : A098075
Client : Galliford Try Building
Method : Hand Excavation
Co-ordinates :
Level :

Logged By : NS
Checked By: SH
Start Date : 25/08/16
Finish Date : 25/08/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Installation/ Backfill	Sample Test		Notes / Remarks
						Depth	Type	
MADE GROUND: CONCRETE. Reinforced.			0.21					
MADE GROUND: Light grey very sandy fine to coarse GRAVEL with low cobble content. Gravel of angular to sub-rounded limestone and concrete. Sand is fine to coarse.			0.53			0.40	ES	PID=0.0ppm
			1.00			0.90	ES	PID=0.0ppm
MADE GROUND: Firm reddish brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to sub-rounded coal, mudstone, siltstone and sandstone. Sand is fine to coarse (reworked).								
End of Trial Pit at 1.00 m								
Observations / Remarks Excavation Information Length : 0.50m Width : 0.40m Orientation : - Stability : Stable. Shoring : Not required. Groundwater Struck Rising to Time Remarks								

Tel: 0161 8723223 Fax: 0161 8723193

HDP104



Project : Wrexham Custody Facility, Wrexham
Project Number : A098075
Client : Galliford Try Building
Method : Hand Excavation
Co-ordinates :
Level :

Logged By : NS
Checked By: SH
Start Date : 25/08/16
Finish Date : 25/08/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Installation/ Backfill	Sample Test		Notes / Remarks
						Depth	Type	
MADE GROUND: Firm brown slightly gravelly sandy clayey TOPSOIL. Gravel of fine to coarse sub-angular to rounded sandstone, mudstone and coal with occasional rootlets. Sand is fine to medium.			0.35			0.30	ES	PID=0.0ppm
MADE GROUND: Firm dark brown slightly sandy slightly gravelly CLAY with low cobble content. Gravel is of fine to coarse angular to sub-rounded coal, mudstone, sandstone and siltstone.			1.00			0.90	ES	PID=0.0ppm
End of Trial Pit at 1.00 m								

Observations / Remarks

- Hand dug pit was backfilled with arisings upon completion.
- Groundwater was not observed.

Excavation Information			Groundwater			
Length	Width	Orientation	Struck	Rising to	Time	Remarks
: 0.36m	: 0.43m	-				
Stability	: Stable.					
Shoring	: Not required.					

WYG ENVIRONMENT

Quay West, Trafford Wharf Road, Salford Quays

Tel: 0161 8723223 Fax: 0161 8723193

Exploratory Hole Number

HDP105



Project : Wrexham Custody Facility, Wrexham
Project Number : A098075
Client : Galliford Try Building
Method : Hand Excavation
Co-ordinates :
Level :

Scale 1:50 **Sheet** 1 of 1

Logged By : NS
Checked By : SH
Start Date : 25/08/16
Finish Date : 25/08/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Installation/ Backfill	Sample Test		Notes / Remarks
						Depth	Type	
MADE GROUND: ASPHALT			0.10					
MADE GROUND: Whitish brown very gravelly fine to coarse SAND with low cobble content. Gravel is fine to coarse angular to sub-angular concrete, quartzite, and limestone. Cobbles are sub-angular to sub-rounded limestone.			0.69			0.40	ES	PID=0.0ppm
			1.00			0.90	ES	PID=0.0ppm
MADE GROUND: Firm reddish brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse angular to sub-rounded mudstone, coal and sandstone. Sand is fine to medium (reworked).								
End of Trial Pit at 1.00 m								
Observations / Remarks 1. Hand dug pit was backfilled with arisings upon completion. 2. Groundwater was not observed.	Excavation Information					Groundwater		
	Length : 0.50m Width : 0.50m Orientation : - Stability : Stable. Shoring : Not required.					Struck	Rising to	Time

WYG ENVIRONMENT

Quay West, Trafford Wharf Road, Salford Quays

Tel: 0161 8723223 Fax: 0161 8723193

Exploratory Hole Number

HDP106



Project : Wrexham Custody Facility, Wrexham
Project Number : A098075
Client : Galliford Try Building
Method : Hand Excavation
Co-ordinates :
Level :

Scale 1:50 **Sheet** 1 of 1

Logged By : NS
Checked By : SH
Start Date : 25/08/16
Finish Date : 25/08/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Water Strike (m)	Installation/ Backfill	Sample Test		Notes / Remarks
						Depth	Type	
MADE GROUND: Firm to stiff reddish brown slightly sandy slightly gravelly clayey TOPSOIL. Gravel is of fine to medium sub-angular to sub-rounded sandstone, mudstone and coal. Rare fine rootlets.			0.32			0.20	ES	PID=0.0ppm
MADE GROUND: Firm reddish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is of fine to medium sub-angular to sub-rounded sandstone, coal, mudstone and siltstone. Sand is fine to medium.			1.00			0.80	ES	PID=0.0ppm
End of Trial Pit at 1.00 m								
Observations / Remarks 1. Hand dug pit was backfilled with arisings upon completion. 2. Groundwater was not observed.	Excavation Information					Groundwater		
	Length : 0.47m Width : 0.42m Orientation : - Stability : Stable. Shoring : Not required.					Struck	Rising to	Time



Project : Wrexham Custody Facility, Wrexham
Project Number : A098075
Client : Galliford Try Building
Method : Dynamic Sampling Rig
Co-ordinates :
Level :

From	To	Method
0.00m	1.20m	Hand Excavation
1.20m	5.45m	Dynamic Sampling Rig

Logged By : NS
Checked By: SH
Start Date : 25/08/16
Finish Date : 25/08/16

[illegible]

Tel: 0161 8723223 Fax: 0161 8723193

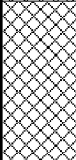
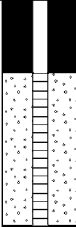
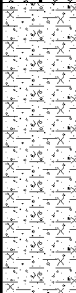
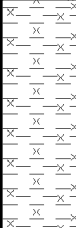
WS102



Project : Wrexham Custody Facility, Wrexham
Project Number : A098075
Client : Galliford Try Building
Method : Dynamic Sampling Rig
Co-ordinates :
Level :

From	To	Method
0.00m	1.20m	Hand Excavation
1.20m	5.45m	Dynamic Sampling Rig

Logged By : NS
Checked By: SH
Start Date : 25/08/16
Finish Date : 25/08/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Casing (m)	Water Strike (m)	Installation Backfill	Sample Test		Notes / Remarks
							Depth	Type	
MADE GROUND: CONCRETE. Reinforced.			0.20						
MADE GROUND: Light greyish brown very sandy fine to coarse GRAVEL of angular to sub-angular limestone, sandstone and mudstone. Sand is fine to coarse.			0.74				0.40	ES	PID=0ppm
MADE GROUND: Soft reddish brown to brown slightly sandy slightly gravelly CLAY. Gravel is fine to medium sub-angular to angular sandstone, mudstone, coal, siltstone and quartzite. Sand is fine to medium (reworked).					1.00		0.90	ES	PID=0ppm
							1.20	S D	N=4 (1,1,1,1,1,1)
							1.50	ES	PID=0ppm
Firm brown mottled grey slightly sandy slightly gravelly silty CLAY. Gravel of fine to medium sub-angular to sub-rounded sandstone, mudstone and coal. Slight organic odour.							2.00	S D	N=3 (0,0,0,1,1,1)
							2.50	ES	PID=0ppm
							3.00	S D	N=11 (3,3,2,3,3,3)
							3.50	ES	PID=0ppm
							3.73		
							3.92		
Spongy fibrous dark brown silty clayey PEAT.			3.92				3.80	ES	PID=0ppm
Firm greyish brown silty CLAY. Slight organic odour.							4.00	S D	N=8 (2,2,2,2,2,2)
							4.50	ES	PID=0ppm
							5.00	S D	N=14 (3,3,3,3,4,4)
End of Window Sample at 5.45 m			5.45						
Observations / Remarks 1. Inspection pit hand excavated to 1.2m bgl prior to drilling. 2. Slight groundwater seepage at 1.0m bgl. 3. Upon completion exploratory hole installed with 50mm monitoring well.	Window Sampler Runs					Groundwater			
	From	To	Diameter	Recovery	Remarks	Struck	Rising to	Time	Remarks
	0.00m	1.20m	200mm	100%		1.00m	-	-	
	1.20m	2.00m	87mm	100%					
	2.00m	3.00m	77mm	100%					
	3.00m	4.00m	67mm	100%					
	4.00m	5.45m	57mm	100%					

Tel: 0161 8723223 Fax: 0161 8723193

WS103



Project : Wrexham Custody Facility, Wrexham
Project Number : A098075
Client : Galliford Try Building
Method : Dynamic Sampling Rig
Co-ordinates :
Level :

From	To	Method
0.00m	1.20m	Hand Excavation
1.20m	5.00m	Dynamic Sampling Rig

Logged By : NS
Checked By: SH
Start Date : 25/08/16
Finish Date : 25/08/16

Strata Description	Legend	Reduced Level (mOD)	Depth (m)	Casing (m)	Water Strike (m)	Installation Backfill	Sample Test		Notes / Remarks
							Depth	Type	
MADE GROUND: CONCRETE. Reinforced.			0.20						
MADE GROUND: Light greyish brown very sandy fine to coarse GRAVEL of angular to sub-angular limestone and sandstone. Sand is fine to coarse. - Damp with slight hydrocarbon odour between 0.7m and 0.9m bgl.			0.90				0.40	ES	PID=0ppm
MADE GROUND: Soft reddish brown slightly sandy slightly gravelly CLAY. Gravel is of fine to medium sub-angular to rounded sandstone, mudstone, coal and siltstone. Sand is fine to medium. - Sandstone cobble at 1.74m bgl.							1.10 1.20	ES S D	PID=0ppm N=6 (1,1,1,2,1,2)
			1.84				1.50	ES	PID=0ppm
Soft brownish grey slightly sandy slightly silty slightly gravelly CLAY. Gravel is of fine to medium sub-angular to sub-rounded sandstone, coal and mudstone. Rare organic matter with slight organic odour. - Sandstone cobble at 2.92m bgl.							2.00	S D	N=3 (0,0,1,0,1,1)
							2.50	ES	PID=0ppm
							3.00	S D	N=7 (2,2,1,2,2,2)
			3.38						
Soft dark greyish brown slightly sandy slightly silty CLAY with organic odour. Sand is fine to medium.			3.90				3.50	ES	PID=0ppm
Spongy fibrous brown PEAT.			4.10				4.00	S D	N=8 (2,2,2,2,2,2)
Firm greyish brown silty CLAY with organic odour.							4.50	ES	PID=0ppm
			5.00						
----- End of Window Sample at 5.00 m									
Observations / Remarks	Window Sampler Runs					Groundwater			
	From	To	Diameter	Recovery	Remarks	Struck	Rising to	Time	Remarks
	0.00m	1.20m	200mm	100%					
	1.20m	2.00m	87mm	100%					
	2.00m	3.00m	77mm	100%					
	3.00m	4.00m	67mm	100%					
	4.00m	5.00m	57mm	100%					

WYG ENVIRONMENT

Quay West, Trafford Wharf Road, Salford Quays

Tel: 0161 8723223 Fax: 0161 8723193

Exploratory Hole Number

WS104



Project : Wrexham Custody Facility, Wrexham
Project Number : A098075
Client : Galliford Try Building
Method : Dynamic Sampling Rig
Co-ordinates :
Level :

Hole Information

From	To	Method
0.00m	1.20m	Hand Excavation
1.20m	5.45m	Dynamic Sampling Rig

Scale 1:50 **Sheet** 1 of 1

Logged By : NS
Checked By : SH
Start Date : 25/08/16
Finish Date : 25/08/16

Strata Description

Legend	Reduced Level (mOD)	Depth (m)	Casing (m)	Water Strike (m)	Installation Backfill	Sample Test		Notes / Remarks
						Depth	Type	
		0.21						
						0.50	ES	PID=0ppm
		0.87						
						1.00	ES	PID=0ppm
						1.20	S D	N=5 (1,1,1,1,1,2)
						1.50	ES	PID=0ppm
						2.00	S D	N=7 (2,1,1,2,2,2)
						2.40	ES	PID=0ppm
						3.00	S D	N=17 (3,3,4,4,4,5)
						3.50	ES	PID=0ppm
						4.00	S D	N=20 (4,4,4,5,5,6)
						4.50	ES	PID=0ppm
						5.00	S D	N=27 (4,6,6,6,7,8)
		5.45						

End of Window Sample at 5.45 m

Observations / Remarks

1. Inspection pit hand excavated to 1.2m bgl prior to drilling.
2. Groundwater was not observed.
3. Upon completion exploratory hole was backfilled with arisings.

Window Sampler Runs

Groundwater

From	To	Diameter	Recovery	Remarks	Struck	Rising to	Time	Remarks
0.00m	1.20m	200mm	100%					
1.20m	2.00m	87mm	100%					
2.00m	3.00m	77mm	100%					
3.00m	4.00m	67mm	100%					
4.00m	5.00m	57mm	100%					



Appendix D – Groundwater Monitoring Data

**GROUNDWATER MONITORING & SAMPLING RECORD SHEET**

Client Galliford Try Building North West
Project Wrexham Custody Facility
Job Number A098075

Visit No. 1 **Date** 31/08/2016 **Start** 8.30 **End** 11.00 **By** NS **Cool Box** Y **Weather** Fine, dry
Instruments used - Oil/Water Interface Meter, Dedicated Disposable Bailer

Installation	DTW (mbgl)	DTB (mbgl)	Calculated 1 well volume (l)	Volume Purged (l)	Free Product present? (Y(mm)/N)	pH	Redox (mV)	Conductivity (µs)	TDS (ppm)	Salinity as NaCl (%)	DO (ppm)	DO (%)	Samples Collected (Y/N)	Remarks
WS101	0.68	1.43	1.5	4.5	N	8.08	127	1195	597	2.1	6.70	73.3	Y	NVO
WS102	0.67	1.72	2.1	6.3	N	8.21	72	1388	694	2.5	6.38	67.3	Y	Strong sulphurous odour
WS103	0.68	2.28	3.2	9.6	N	8.06	62	1339	669	2.7	12.59	102.7	Y	NVO

Notes:

If free product is identified, sample the free product using a disposable bailer before purging.

Remarks should include well recovery (fast/moderate/slow, if went dry), water colour, odour, turbidity and sediment content e.t.c.

Wells should be sampled in order of anticipated contamination, with the cleanest well sample first.

Dedicated sampling equipment (bailer or tubing) should be used where possible. If not, then sampling water should be rinsed with Decon90 and deionised water between each monitoring well.

NVO - No Visual or Olfactory Evidence of Concern

Purging:

LPH Guidance Document v2.5 (May 2000) states that it is "best practice" to remove at least three standpipe volumes of water prior to groundwater sampling.

Wells screened in low permeability strata (i.e. clays) may go dry before 3 well volumes are removed. If this occurs the well should be left for a period of time, then the recharge sampled.

An alternative procedure is to take regular field measurements of pH, Temperature, Conductivity and Dissolved Oxygen until successive consistent field readings (i.e. within 10% of previous readings) are recorded prior to sampling.

Approximate well volume calculations for use in field:

For a 35mm well, 1 well volume (l) = 1 x (DTB - DTW)

For a 50mm well, 1 well volume (l) = 2 x (DTB - DTW)

For a 100mm well, 1 well volume (l) = 8 x (DTB - DTW)



Appendix E – Chemical Test Certificates



Jones Environmental Laboratory

Registered Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Deeside, CH5 2UA. UK

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

WYG
Quay West at MediaCityUK
Trafford Wharf Road
Trafford Park
Manchester
M17 1HH

Tel: +44 (0) 1244 833780

Fax: +44 (0) 1244 833781



Attention : Sara Hegewald
Date : 14th September, 2016
Your reference : A098075
Our reference : Test Report 16/13541 Batch 1
Location : Wrexham Custody
Date samples received : 26th August, 2016
Status : Final report
Issue : 2

Forty one samples were received for analysis on 26th August, 2016 of which eleven were scheduled for analysis. 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:

Bruce Leslie
Project Co-ordinator

Jones Environmental Laboratory

Client Name: WYG
Reference: A098075
Location: Wrexham Custody
Contact: Sara Hegewald
JE Job No.: 16/13541

Report : Solid

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

J E Sample No.	13-14	15-16	17-18	19-20	29-30	35-36	45-46	49-50	61-62	67-68	Please see attached notes for all abbreviations and acronyms		
Sample ID	HDP106	HDP104	HDP102	HDP103	HDP105	WS103	WS103	HDP101	WS101	WS102			
Depth	0.2	0.3	0.3	0.9	0.4	1.0	0.4	0.3	0.4	0.4			
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J	V J	V J	V J	V J			
Sample Date	25/08/2016	25/08/2016	25/08/2016	25/08/2016	25/08/2016	25/08/2016	25/08/2016	25/08/2016	25/08/2016	25/08/2016			
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	26/08/2016	26/08/2016	26/08/2016	26/08/2016	26/08/2016	26/08/2016	26/08/2016	26/08/2016	26/08/2016	26/08/2016	LOD/LOR	Units	Method No.
TPH CWG													
Aliphatics													
>C5-C6 ^{#M}	-	-	-	-	-	<0.1	<0.1	-	-	<0.1	<0.1	mg/kg	TM36/PM12
>C6-C8 ^{#M}	-	-	-	-	-	<0.1	<0.1	-	-	<0.1	<0.1	mg/kg	TM36/PM12
>C8-C10	-	-	-	-	-	<0.1	0.8	-	-	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C12 ^{#M}	-	-	-	-	-	<0.2	<0.2	-	-	<0.2	<0.2	mg/kg	TM5/PM16
>C12-C16 ^{#M}	-	-	-	-	-	<4	<4	-	-	<4	<4	mg/kg	TM5/PM16
>C16-C21 ^{#M}	-	-	-	-	-	<7	<7	-	-	<7	<7	mg/kg	TM5/PM16
>C21-C35 ^{#M}	-	-	-	-	-	<7	<7	-	-	<7	<7	mg/kg	TM5/PM16
Total aliphatics C5-35	-	-	-	-	-	<19	<19	-	-	<19	<19	mg/kg	TM5/PM16/PM15
Aromatics													
>C5-EC7	-	-	-	-	-	<0.1	<0.1	-	-	<0.1	<0.1	mg/kg	TM36/PM12
>EC7-EC8	-	-	-	-	-	<0.1	<0.1	-	-	<0.1	<0.1	mg/kg	TM36/PM12
>EC8-EC10 ^{#M}	-	-	-	-	-	<0.1	<0.1	-	-	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC12	-	-	-	-	-	<0.2	<0.2	-	-	<0.2	<0.2	mg/kg	TM5/PM16
>EC12-EC16	-	-	-	-	-	<4	<4	-	-	<4	<4	mg/kg	TM5/PM16
>EC16-EC21	-	-	-	-	-	<7	<7	-	-	<7	<7	mg/kg	TM5/PM16
>EC21-EC35	-	-	-	-	-	<7	<7	-	-	<7	<7	mg/kg	TM5/PM16
Total aromatics C5-35	-	-	-	-	-	<19	<19	-	-	<19	<19	mg/kg	TM5/PM16/PM12/PM15
Total aliphatics and aromatics(C5-35)	-	-	-	-	-	<38	<38	-	-	<38	<38	mg/kg	TM5/PM16/PM12/PM15
MTBE [#]	-	-	-	-	-	<5	<5	-	-	<5	<5	ug/kg	TM31/PM12
Benzene [#]	-	-	-	-	-	<5	<5	-	-	<5	<5	ug/kg	TM31/PM12
Toluene [#]	-	-	-	-	-	<5	<5	-	-	<5	<5	ug/kg	TM31/PM12
Ethylbenzene [#]	-	-	-	-	-	<5	8	-	-	<5	<5	ug/kg	TM31/PM12
m/p-Xylene [#]	-	-	-	-	-	<5	<5	-	-	<5	<5	ug/kg	TM31/PM12
o-Xylene [#]	-	-	-	-	-	<5	5	-	-	<5	<5	ug/kg	TM31/PM12
PCB 77	<5	<5	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM16/PM8
PCB 81	<5	<5	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM16/PM8
PCB 105	<5	<5	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM16/PM8
PCB 114	<5	<5	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM16/PM8
PCB 118	<5	<5	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM16/PM8
PCB 123	<5	<5	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM16/PM8
PCB 126	<5	<5	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM16/PM8
PCB 156	<5	<5	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM16/PM8
PCB 157	<5	<5	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM16/PM8
PCB 167	<5	<5	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM16/PM8
PCB 169	<5	<5	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM16/PM8
PCB 189	<5	<5	<5	<5	<5	-	-	<5	<5	-	<5	ug/kg	TM16/PM8
Total 12 PCBs	<60	<60	<60	<60	<60	-	-	<60	<60	-	<60	ug/kg	TM16/PM8
Total Phenols HPLC	<0.15	-	-	-	-	-	-	-	-	-	<0.15	mg/kg	TM26/PM21

Client Name: WYG
Reference: A098075
Location: Wrexham Custody
Contact: Sara Hegewald
JE Job No.: 16/13541

Report : Solid

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

J E Sample No.	69-70										Please see attached notes for all abbreviations and acronyms		
Sample ID	WS102												
Depth	0.9												
COC No / misc													
Containers	V J												
Sample Date	25/08/2016												
Sample Type	Soil												
Batch Number	1												
Date of Receipt	26/08/2016										LOD/LOR	Units	Method No.
Arsenic ^{#M}	-										<0.5	mg/kg	TM30/PM15
Cadmium ^{#M}	-										<0.1	mg/kg	TM30/PM15
Chromium ^{#M}	-										<0.5	mg/kg	TM30/PM15
Copper ^{#M}	-										<1	mg/kg	TM30/PM15
Lead ^{#M}	-										<5	mg/kg	TM30/PM15
Mercury ^{#M}	-										<0.1	mg/kg	TM30/PM15
Nickel ^{#M}	-										<0.7	mg/kg	TM30/PM15
Selenium ^{#M}	-										<1	mg/kg	TM30/PM15
Water Soluble Boron ^{#M}	-										<0.1	mg/kg	TM74/PM32
Zinc ^{#M}	-										<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene ^{#M}	-										<0.04	mg/kg	TM4/PM8
Acenaphthylene	-										<0.03	mg/kg	TM4/PM8
Acenaphthene ^{#M}	-										<0.05	mg/kg	TM4/PM8
Fluorene ^{#M}	-										<0.04	mg/kg	TM4/PM8
Phenanthrene ^{#M}	-										<0.03	mg/kg	TM4/PM8
Anthracene #	-										<0.04	mg/kg	TM4/PM8
Fluoranthene ^{#M}	-										<0.03	mg/kg	TM4/PM8
Pyrene #	-										<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	-										<0.06	mg/kg	TM4/PM8
Chrysene ^{#M}	-										<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene ^{#M}	-										<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	-										<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene ^{#M}	-										<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	-										<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	-										<0.04	mg/kg	TM4/PM8
PAH 16 Total	-										<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	-										<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	-										<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	-										<0	%	TM4/PM8
EPH >C8-C10 ^{#M}	-										<5	mg/kg	TM5/PM8
EPH >C10-C12 ^{#M}	-										<10	mg/kg	TM5/PM8
EPH >C12-C16 ^{#M}	-										<10	mg/kg	TM5/PM8
EPH >C16-C21 ^{#M}	-										<10	mg/kg	TM5/PM8
EPH >C21-C40	-										<10	mg/kg	TM5/PM8
EPH >C8-C40	-										<30	mg/kg	TM5/PM8

Client Name: WYG
Reference: A098075
Location: Wrexham Custody
Contact: Sara Hegewald
JE Job No.: 16/13541

Report : Solid

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

J E Sample No.	69-70										Please see attached notes for all abbreviations and acronyms		
Sample ID	WS102												
Depth	0.9												
COC No / misc													
Containers	V J												
Sample Date	25/08/2016												
Sample Type	Soil												
Batch Number	1												
Date of Receipt	26/08/2016										LOD/LOR	Units	Method No.
TPH CWG													
Aliphatics													
>C5-C6 ^{#M}	<0.1										<0.1	mg/kg	TM36/PM12
>C6-C8 ^{#M}	<0.1										<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1										<0.1	mg/kg	TM36/PM12
>C10-C12 ^{#M}	<0.2										<0.2	mg/kg	TM5/PM16
>C12-C16 ^{#M}	<4										<4	mg/kg	TM5/PM16
>C16-C21 ^{#M}	<7										<7	mg/kg	TM5/PM16
>C21-C35 ^{#M}	<7										<7	mg/kg	TM5/PM16
Total aliphatics C5-35	<19										<19	mg/kg	TM5/TM36/PM12/PM16
Aromatics													
>C5-EC7	<0.1										<0.1	mg/kg	TM36/PM12
>EC7-EC8	<0.1										<0.1	mg/kg	TM36/PM12
>EC8-EC10 ^{#M}	<0.1										<0.1	mg/kg	TM36/PM12
>EC10-EC12	<0.2										<0.2	mg/kg	TM5/PM16
>EC12-EC16	<4										<4	mg/kg	TM5/PM16
>EC16-EC21	<7										<7	mg/kg	TM5/PM16
>EC21-EC35	<7										<7	mg/kg	TM5/PM16
Total aromatics C5-35	<19										<19	mg/kg	TM5/TM36/PM12/PM16
Total aliphatics and aromatics(C5-35)	<38										<38	mg/kg	TM5/TM36/PM12/PM16
MTBE #	<5										<5	ug/kg	TM31/PM12
Benzene #	<5										<5	ug/kg	TM31/PM12
Toluene #	<5										<5	ug/kg	TM31/PM12
Ethylbenzene #	<5										<5	ug/kg	TM31/PM12
m/p-Xylene #	<5										<5	ug/kg	TM31/PM12
o-Xylene #	<5										<5	ug/kg	TM31/PM12
PCB 77	-										<5	ug/kg	TM16/PM8
PCB 81	-										<5	ug/kg	TM16/PM8
PCB 105	-										<5	ug/kg	TM16/PM8
PCB 114	-										<5	ug/kg	TM16/PM8
PCB 118	-										<5	ug/kg	TM16/PM8
PCB 123	-										<5	ug/kg	TM16/PM8
PCB 126	-										<5	ug/kg	TM16/PM8
PCB 156	-										<5	ug/kg	TM16/PM8
PCB 157	-										<5	ug/kg	TM16/PM8
PCB 167	-										<5	ug/kg	TM16/PM8
PCB 169	-										<5	ug/kg	TM16/PM8
PCB 189	-										<5	ug/kg	TM16/PM8
Total 12 PCBs	-										<60	ug/kg	TM16/PM8
Total Phenols HPLC	-										<0.15	mg/kg	TM26/PM21

Client Name: WYG
Reference: A098075
Location: Wrexham Custody
Contact: Sara Hegewald
JE Job No.: 16/13541

SVOC Report : Solid

J E Sample No.	13-14	15-16	17-18	19-20	29-30	49-50	61-62				Please see attached notes for all abbreviations and acronyms		
Sample ID	HDP106	HDP104	HDP102	HDP103	HDP105	HDP101	WS101						
Depth	0.2	0.3	0.3	0.9	0.4	0.3	0.4						
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J	V J						
Sample Date	25/08/2016	25/08/2016	25/08/2016	25/08/2016	25/08/2016	25/08/2016	25/08/2016						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1						
Date of Receipt	26/08/2016	26/08/2016	26/08/2016	26/08/2016	26/08/2016	26/08/2016	26/08/2016				LOD/LOR	Units	Method No.
SVOC MS													
Phenols													
2-Chlorophenol ^{#M}	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
2-Methylphenol	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
2-Nitrophenol	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
2,4-Dichlorophenol ^{#M}	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
2,4-Dimethylphenol	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
2,4,5-Trichlorophenol	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
2,4,6-Trichlorophenol	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
4-Chloro-3-methylphenol	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
4-Methylphenol	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
4-Nitrophenol	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Pentachlorophenol	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Phenol ^{#M}	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
PAHs													
2-Chloronaphthalene ^{#M}	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
2-Methylnaphthalene ^{#M}	<10	<10	<10	<10	<10	56	<10				<10	ug/kg	TM16/PM8
Naphthalene	<10	<10	<10	<10	<10	44	<10				<10	ug/kg	TM16/PM8
Acenaphthylene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Acenaphthene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Fluorene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Phenanthrene ^{#M}	<10	<10	<10	<10	<10	91	<10				<10	ug/kg	TM16/PM8
Anthracene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Fluoranthene ^{#M}	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Pyrene ^{#M}	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Benzo(a)anthracene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Chrysene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Benzo(b)fluoranthene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Benzo(a)pyrene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Indeno(123cd)pyrene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Dibenzo(ah)anthracene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Benzo(ghi)perylene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Benzo(b)fluoranthene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Benzo(k)fluoranthene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Phthalates													
Bis(2-ethylhexyl) phthalate	<100	<100	<100	<100	<100	<100	<100				<100	ug/kg	TM16/PM8
Butylbenzyl phthalate	<100	<100	<100	<100	<100	<100	<100				<100	ug/kg	TM16/PM8
Di-n-butyl phthalate	<100	<100	<100	<100	<100	<100	<100				<100	ug/kg	TM16/PM8
Di-n-Octyl phthalate	<100	<100	<100	<100	<100	<100	<100				<100	ug/kg	TM16/PM8
Diethyl phthalate	<100	<100	<100	<100	<100	<100	<100				<100	ug/kg	TM16/PM8
Dimethyl phthalate ^{#M}	<100	<100	<100	<100	<100	<100	<100				<100	ug/kg	TM16/PM8

Client Name: WYG
Reference: A098075
Location: Wrexham Custody
Contact: Sara Hegewald
JE Job No.: 16/13541

SVOC Report : Solid

J E Sample No.	13-14	15-16	17-18	19-20	29-30	49-50	61-62				Please see attached notes for all abbreviations and acronyms		
Sample ID	HDP106	HDP104	HDP102	HDP103	HDP105	HDP101	WS101						
Depth	0.2	0.3	0.3	0.9	0.4	0.3	0.4						
COC No / misc													
Containers	V J	V J	V J	V J	V J	V J	V J						
Sample Date	25/08/2016	25/08/2016	25/08/2016	25/08/2016	25/08/2016	25/08/2016	25/08/2016						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1						
Date of Receipt	26/08/2016	26/08/2016	26/08/2016	26/08/2016	26/08/2016	26/08/2016	26/08/2016				LOD/LOR	Units	Method No.
SVOC MS													
Other SVOCs													
1,2-Dichlorobenzene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
1,2,4-Trichlorobenzene ^{#M}	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
1,3-Dichlorobenzene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
1,4-Dichlorobenzene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
2-Nitroaniline	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
2,4-Dinitrotoluene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
2,6-Dinitrotoluene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
3-Nitroaniline	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
4-Bromophenylphenylether ^{#M}	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
4-Chloroaniline	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
4-Chlorophenylphenylether	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
4-Nitroaniline	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Azobenzene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Bis(2-chloroethoxy)methane	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Bis(2-chloroethyl)ether	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Carbazole	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Dibenzofuran ^{#M}	<10	<10	<10	<10	<10	54	<10				<10	ug/kg	TM16/PM8
Hexachlorobenzene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Hexachlorobutadiene ^{#M}	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Hexachlorocyclopentadiene	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Hexachloroethane	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Isophorone ^{#M}	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
N-nitrosodi-n-propylamine ^{#M}	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Nitrobenzene ^{#M}	<10	<10	<10	<10	<10	<10	<10				<10	ug/kg	TM16/PM8
Surrogate Recovery 2-Fluorobiphenyl	92	109	108	106	93	123	90				<0	%	TM16/PM8
Surrogate Recovery p-Terphenyl-d14	112	124	135	129	116	134	118				<0	%	TM16/PM8

Client Name: WYG
Reference: A098075
Location: Wrexham Custody
Contact: Sara Hegewald
JE Job No.: 16/13541

VOC Report : Solid

J E Sample No.	13-14	15-16	17-18	19-20	29-30	49-50	61-62				Please see attached notes for all abbreviations and acronyms		
Sample ID	HDP106	HDP104	HDP102	HDP103	HDP105	HDP101	WS101						
Depth	0.2	0.3	0.3	0.9	0.4	0.3	0.4						
COC No / misc Containers	V J	V J	V J	V J	V J	V J	V J						
Sample Date	25/08/2016	25/08/2016	25/08/2016	25/08/2016	25/08/2016	25/08/2016	25/08/2016						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1						
Date of Receipt	26/08/2016	26/08/2016	26/08/2016	26/08/2016	26/08/2016	26/08/2016	26/08/2016						
											LOD/LOR	Units	Method No.
VOC MS													
Dichlorodifluoromethane	<2	<2	<2	<2	<2	<2	<2				<2	ug/kg	TM15/PM10
Methyl Tertiary Butyl Ether ^{#M}	<6	<6	<6	<6	<6	<6	<6				<6	ug/kg	TM15/PM10
Chloromethane [#]	<3	<3	<3	<3	<3	<3	<3				<3	ug/kg	TM15/PM10
Vinyl Chloride	<2	<2	<2	<2	<2	<2	<2				<2	ug/kg	TM15/PM10
Bromomethane	<1	<1	<1	<1	<1	<1	<1				<1	ug/kg	TM15/PM10
Chloroethane ^{#M}	<6	<6	<6	<6	<6	<6	<6				<6	ug/kg	TM15/PM10
Trichlorofluoromethane ^{#M}	<3	<3	<3	<3	<3	<3	<3				<3	ug/kg	TM15/PM10
1,1-Dichloroethene (1,1 DCE) ^{#M}	<6	<6	<6	<6	<6	<6	<6				<6	ug/kg	TM15/PM10
Dichloromethane (DCM) [#]	<7	<7	<7	<7	<7	<7	<7				<7	ug/kg	TM15/PM10
trans-1,2-Dichloroethene [#]	<3	<3	<3	<3	<3	<3	<3				<3	ug/kg	TM15/PM10
1,1-Dichloroethane ^{#M}	<6	<6	<6	<6	<6	<6	<6				<6	ug/kg	TM15/PM10
cis-1,2-Dichloroethene ^{#M}	<7	<7	<7	<7	<7	<7	<7				<7	ug/kg	TM15/PM10
2,2-Dichloropropane	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
Bromochloromethane ^{#M}	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
Chloroform ^{#M}	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM15/PM10
1,1,1-Trichloroethane ^{#M}	<5	<5	<5	16	<5	12	<5				<5	ug/kg	TM15/PM10
1,1-Dichloropropene [#]	<3	<3	<3	<3	<3	<3	<3				<3	ug/kg	TM15/PM10
Carbon tetrachloride ^{#M}	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
1,2-Dichloroethane ^{#M}	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM15/PM10
Benzene ^{#M}	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM15/PM10
Trichloroethene (TCE) ^{#M}	<5	<5	<5	<5	<5	21	<5				<5	ug/kg	TM15/PM10
1,2-Dichloropropane ^{#M}	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
Dibromomethane ^{#M}	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
Bromodichloromethane ^{#M}	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
cis-1,3-Dichloropropene	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
Toluene ^{#M}	<3	<3	<3	<3	<3	<3	5				<3	ug/kg	TM15/PM10
trans-1,3-Dichloropropene	<3	<3	<3	<3	<3	<3	<3				<3	ug/kg	TM15/PM10
1,1,2-Trichloroethane ^{#M}	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
Tetrachloroethene (PCE) [#]	<3	<3	<3	<3	<3	<3	<3				<3	ug/kg	TM15/PM10
1,3-Dichloropropane ^{#M}	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
Dibromochloromethane ^{#M}	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM15/PM10
1,2-Dibromoethane [#]	<3	<3	<3	<3	<3	<3	<3				<3	ug/kg	TM15/PM10
Chlorobenzene ^{#M}	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
1,1,1,2-Tetrachloroethane ^{#M}	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM15/PM10
Ethylbenzene ^{#M}	<3	<3	<3	<3	<3	<3	<3				<3	ug/kg	TM15/PM10
p/m-Xylene ^{#M}	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
o-Xylene ^{#M}	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
Styrene	<3	<3	<3	<3	<3	<3	<3				<3	ug/kg	TM15/PM10
Bromoform	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
Isopropylbenzene [#]	<3	<3	<3	<3	<3	<3	<3				<3	ug/kg	TM15/PM10
1,1,2,2-Tetrachloroethane ^{#M}	<3	<3	<3	<3	<3	<3	<3				<3	ug/kg	TM15/PM10
Bromobenzene	<2	<2	<2	<2	<2	<2	<2				<2	ug/kg	TM15/PM10
1,2,3-Trichloropropane ^{#M}	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
Propylbenzene [#]	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
2-Chlorotoluene	<3	<3	<3	<3	<3	<3	<3				<3	ug/kg	TM15/PM10
1,3,5-Trimethylbenzene [#]	<3	<3	<3	<3	<3	<3	<3				<3	ug/kg	TM15/PM10
4-Chlorotoluene	<3	<3	<3	<3	<3	<3	<3				<3	ug/kg	TM15/PM10
tert-Butylbenzene [#]	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM15/PM10
1,2,4-Trimethylbenzene [#]	<6	<6	<6	<6	<6	<6	<6				<6	ug/kg	TM15/PM10
sec-Butylbenzene [#]	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
4-Isopropyltoluene [#]	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
1,3-Dichlorobenzene ^{#M}	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
1,4-Dichlorobenzene [#]	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
n-Butylbenzene [#]	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
1,2-Dichlorobenzene ^{#M}	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
1,2-Dibromo-3-chloropropane [#]	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
1,2,4-Trichlorobenzene [#]	<7	<7	<7	<7	<7	<7	<7				<7	ug/kg	TM15/PM10
Hexachlorobutadiene	<4	<4	<4	<4	<4	<4	<4				<4	ug/kg	TM15/PM10
Naphthalene	<27	<27	<27	<27	<27	<27	<27				<27	ug/kg	TM15/PM10
1,2,3-Trichlorobenzene [#]	<7	<7	<7	<7	<7	<7	<7				<7	ug/kg	TM15/PM10
Surrogate Recovery Toluene D8	104	97	103	103	102	102	98				<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	110	86	108	105	109	102	94				<0	%	TM15/PM10

Please include all sections of this report if it is reproduced

Matrix : Solid

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 16/13541

SOILS

Please note we are only MCERTS accredited (UK soils only) 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 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.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 (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.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised 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.

Please include all sections of this report if it is reproduced

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS) accredited - UK.
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.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 16/13541

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.				
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes	Yes	AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes	Yes	AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes	Yes	AR	Yes
TM5/TM36	TM005: Modified USEPA 8015B. Determination of solvent Extractable Petroleum Hydrocarbons (EPH) including column fractionation in the carbon range of C10-35 into aliphatic and aromatic fractions by GC-FID. TM036: Modified USEPA 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C5-10 by headspace GC-FID. Including determination of	PM12/PM16	CWG GC-FID			AR	Yes
PM13	A visual examination of the solid sample is carried out to ascertain sample make up, colour and any other inclusions. This is not a geotechnical description.	PM0	No preparation is required.			AR	

JE Job No: 16/13541

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes	Yes	AR	Yes
TM16	Modified USEPA 8270. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM16	Modified USEPA 8270. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes	Yes	AR	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21	As received solid or water samples are extracted in Methanol: Sodium Hydroxide (0.1M NaOH) (60:40) by orbital shaker.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7 and 6010B	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes	Yes	AD	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes

JE Job No: 16/13541

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes	Yes	AR	Yes
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM20	Extraction of dried and ground samples with deionised water in a 2:1 water to solid ratio for anions. Extraction of as received samples with deionised water in a 2:1 water to solid ratio for ammoniacal nitrogen and hydrazine. Samples are extracted using an orbital shaker.	Yes	Yes	AD	Yes
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM20	Extraction of dried and ground samples with deionised water in a 2:1 water to solid ratio for anions. Extraction of as received samples with deionised water in a 2:1 water to solid ratio for ammoniacal nitrogen and hydrazine. Samples are extracted using an orbital shaker.	Yes		AR	Yes
TM73	Modified US EPA methods 150.1 and 9045D. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes	Yes	AR	No
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes	Yes	AD	Yes
TM89	Modified USEPA method OIA-1667. Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide and Thiocyanate analysis.			AR	Yes



Jones Environmental Laboratory

Registered Address : Unit 3 Deeside Point, Zone 3, Deeside Industrial Park, Deeside, CH5 2UA. UK

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

WYG
Quay West at MediaCityUK
Trafford Wharf Road
Trafford Park
Manchester
M17 1HH

Tel: +44 (0) 1244 833780
Fax: +44 (0) 1244 833781

Attention :	Sara Hegewald
Date :	6th September, 2016
Your reference :	A098075
Our reference :	Test Report 16/13541 Batch 2
Location :	Wrexham Custody
Date samples received :	1st September, 2016
Status :	Final report
Issue :	1

Three samples were received for analysis on 1st September, 2016 of which three were scheduled for analysis. 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:

A handwritten signature in black ink, appearing to read 'Phil'.

Phil Sommerton BSc
Project Manager

Client Name: WYG
Reference: A098075
Location: Wrexham Custody
Contact: Sara Hegewald
JE Job No.: 16/13541

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H₂SO₄, Z=ZnAc, N=NaOH, HN=HNO₃

J E Sample No.	83-85	86-88	89-91								Please see attached notes for all abbreviations and acronyms		
Sample ID	WS101	WS102	WS103										
Depth													
COC No / misc													
Containers	V G	V G	V G										
Sample Date	31/08/2016	31/08/2016	31/08/2016										
Sample Type	Liquid	Liquid	Liquid										
Batch Number	2	2	2										
Date of Receipt	01/09/2016	01/09/2016	01/09/2016								LOD/LOR	Units	Method No.
PAH MS													
Naphthalene	<0.1	<0.1	<0.1								<0.1	ug/l	TM4/PM30
Acenaphthylene	<0.013	<0.013	<0.013								<0.013	ug/l	TM4/PM30
Acenaphthene	<0.013	<0.013	<0.013								<0.013	ug/l	TM4/PM30
Fluorene	<0.014	<0.014	<0.014								<0.014	ug/l	TM4/PM30
Phenanthrene	0.020	0.030	0.030								<0.011	ug/l	TM4/PM30
Anthracene	<0.013	<0.013	<0.013								<0.013	ug/l	TM4/PM30
Fluoranthene	<0.012	0.020	<0.012								<0.012	ug/l	TM4/PM30
Pyrene	0.020	0.020	<0.013								<0.013	ug/l	TM4/PM30
Benzo(a)anthracene	<0.015	<0.015	<0.015								<0.015	ug/l	TM4/PM30
Chrysene	<0.011	<0.011	<0.011								<0.011	ug/l	TM4/PM30
Benzo(bk)fluoranthene	<0.018	<0.018	<0.018								<0.018	ug/l	TM4/PM30
Benzo(a)pyrene	<0.016	<0.016	<0.016								<0.016	ug/l	TM4/PM30
Indeno(123cd)pyrene	<0.011	<0.011	<0.011								<0.011	ug/l	TM4/PM30
Dibenzo(ah)anthracene	<0.01	<0.01	<0.01								<0.01	ug/l	TM4/PM30
Benzo(ghi)perylene	<0.011	<0.011	<0.011								<0.011	ug/l	TM4/PM30
PAH 16 Total	<0.195	<0.195	<0.195								<0.195	ug/l	TM4/PM30
Benzo(b)fluoranthene	<0.01	<0.01	<0.01								<0.01	ug/l	TM4/PM30
Benzo(k)fluoranthene	<0.01	<0.01	<0.01								<0.01	ug/l	TM4/PM30
PAH Surrogate % Recovery	72	71	71								<0	%	TM4/PM30
Methyl Tertiary Butyl Ether	<0.1	<0.1	<0.1								<0.1	ug/l	TM15/PM10
Benzene	<0.5	<0.5	<0.5								<0.5	ug/l	TM15/PM10
Toluene	<5	<5	<5								<5	ug/l	TM15/PM10
Ethylbenzene	<0.5	<0.5	<0.5								<0.5	ug/l	TM15/PM10
p/m-Xylene	<1	<1	<1								<1	ug/l	TM15/PM10
o-Xylene	<0.5	<0.5	<0.5								<0.5	ug/l	TM15/PM10
Surrogate Recovery Toluene D8	99	99	100								<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	102	102	104								<0	%	TM15/PM10
TPH CWG													
Aliphatics													
>C5-C6	<5	<5	<5								<5	ug/l	TM36/PM12
>C6-C8	<5	<5	<5								<5	ug/l	TM36/PM12
>C8-C10	<5	<5	15								<5	ug/l	TM36/PM12
>C10-C12	<5	109	30								<5	ug/l	TM5/PM30
>C12-C16	<10	530	80								<10	ug/l	TM5/PM30
>C16-C21	<10	420	<10								<10	ug/l	TM5/PM30
>C21-C35	<10	12270	1060								<10	ug/l	TM5/PM30
Total aliphatics C5-35	<10	13329	1185								<10	ug/l	TM5/TM36/PM30

Please see attached notes for all abbreviations and acronyms

Client Name: WYG
Reference: A098075
Location: Wrexham Custody
Contact: Sara Hegewald
JE Job No.: 16/13541

VOC Report : Liquid

J E Sample No.	83-85	86-88	89-91							Please see attached notes for all abbreviations and acronyms		
Sample ID	WS101	WS102	WS103									
Depth												
COC No / misc												
Containers	V G	V G	V G									
Sample Date	31/08/2016	31/08/2016	31/08/2016									
Sample Type	Liquid	Liquid	Liquid							LOD/LOR	Units	Method No.
Batch Number	2	2	2									
Date of Receipt	01/09/2016	01/09/2016	01/09/2016									
VOC MS												
Dichlorodifluoromethane	<2	<2	<2							<2	ug/l	TM15/PM10
Methyl Tertiary Butyl Ether	<0.1	<0.1	<0.1							<0.1	ug/l	TM15/PM10
Chloromethane	<3	<3	<3							<3	ug/l	TM15/PM10
Vinyl Chloride	<0.1	<0.1	<0.1							<0.1	ug/l	TM15/PM10
Bromomethane	<1	<1	<1							<1	ug/l	TM15/PM10
Chloroethane	<3	<3	<3							<3	ug/l	TM15/PM10
Trichlorofluoromethane	<3	<3	<3							<3	ug/l	TM15/PM10
1,1-Dichloroethene (1,1 DCE)	<3	<3	<3							<3	ug/l	TM15/PM10
Dichloromethane (DCM)	<3	<3	<3							<3	ug/l	TM15/PM10
trans-1-2-Dichloroethene	<3	<3	<3							<3	ug/l	TM15/PM10
1,1-Dichloroethane	<3	<3	<3							<3	ug/l	TM15/PM10
cis-1-2-Dichloroethene	<3	<3	<3							<3	ug/l	TM15/PM10
2,2-Dichloropropane	<1	<1	<1							<1	ug/l	TM15/PM10
Bromochloromethane	<2	<2	<2							<2	ug/l	TM15/PM10
Chloroform	<2	<2	<2							<2	ug/l	TM15/PM10
1,1,1-Trichloroethane	<2	<2	<2							<2	ug/l	TM15/PM10
1,1-Dichloropropene	<3	<3	<3							<3	ug/l	TM15/PM10
Carbon tetrachloride	<2	<2	<2							<2	ug/l	TM15/PM10
1,2-Dichloroethane	<2	<2	<2							<2	ug/l	TM15/PM10
Benzene	<0.5	<0.5	<0.5							<0.5	ug/l	TM15/PM10
Trichloroethene (TCE)	<3	<3	<3							<3	ug/l	TM15/PM10
1,2-Dichloropropane	<2	<2	<2							<2	ug/l	TM15/PM10
Dibromomethane	<3	<3	<3							<3	ug/l	TM15/PM10
Bromodichloromethane	<2	<2	<2							<2	ug/l	TM15/PM10
cis-1-3-Dichloropropene	<2	<2	<2							<2	ug/l	TM15/PM10
Toluene	<5	<5	<5							<5	ug/l	TM15/PM10
trans-1-3-Dichloropropene	<2	<2	<2							<2	ug/l	TM15/PM10
1,1,2-Trichloroethane	<2	<2	<2							<2	ug/l	TM15/PM10
Tetrachloroethene (PCE)	<3	<3	<3							<3	ug/l	TM15/PM10
1,3-Dichloropropane	<2	<2	<2							<2	ug/l	TM15/PM10
Dibromochloromethane	<2	<2	<2							<2	ug/l	TM15/PM10
1,2-Dibromoethane	<2	<2	<2							<2	ug/l	TM15/PM10
Chlorobenzene	<2	<2	<2							<2	ug/l	TM15/PM10
1,1,1,2-Tetrachloroethane	<2	<2	<2							<2	ug/l	TM15/PM10
Ethylbenzene	<0.5	<0.5	<0.5							<0.5	ug/l	TM15/PM10
p/m-Xylene	<1	<1	<1							<1	ug/l	TM15/PM10
o-Xylene	<0.5	<0.5	<0.5							<0.5	ug/l	TM15/PM10
Styrene	<2	<2	<2							<2	ug/l	TM15/PM10
Bromoform	<2	<2	<2							<2	ug/l	TM15/PM10
Isopropylbenzene	<3	<3	<3							<3	ug/l	TM15/PM10
1,1,2,2-Tetrachloroethane	<4	<4	<4							<4	ug/l	TM15/PM10
Bromobenzene	<2	<2	<2							<2	ug/l	TM15/PM10
1,2,3-Trichloropropane	<3	<3	<3							<3	ug/l	TM15/PM10
Propylbenzene	<3	<3	<3							<3	ug/l	TM15/PM10
2-Chlorotoluene	<3	<3	<3							<3	ug/l	TM15/PM10
1,3,5-Trimethylbenzene	<3	<3	<3							<3	ug/l	TM15/PM10
4-Chlorotoluene	<3	<3	<3							<3	ug/l	TM15/PM10
tert-Butylbenzene	<3	<3	<3							<3	ug/l	TM15/PM10
1,2,4-Trimethylbenzene	<3	<3	<3							<3	ug/l	TM15/PM10
sec-Butylbenzene	<3	<3	<3							<3	ug/l	TM15/PM10
4-Isopropyltoluene	<3	<3	<3							<3	ug/l	TM15/PM10
1,3-Dichlorobenzene	<3	<3	<3							<3	ug/l	TM15/PM10
1,4-Dichlorobenzene	<3	<3	<3							<3	ug/l	TM15/PM10
n-Butylbenzene	<3	<3	<3							<3	ug/l	TM15/PM10
1,2-Dichlorobenzene	<3	<3	<3							<3	ug/l	TM15/PM10
1,2-Dibromo-3-chloropropane	<2	<2	<2							<2	ug/l	TM15/PM10
1,2,4-Trichlorobenzene	<3	<3	<3							<3	ug/l	TM15/PM10
Hexachlorobutadiene	<3	<3	<3							<3	ug/l	TM15/PM10
Naphthalene	<2	<2	<2							<2	ug/l	TM15/PM10
1,2,3-Trichlorobenzene	<3	<3	<3							<3	ug/l	TM15/PM10
Surrogate Recovery Toluene D8	99	99	100							<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	102	102	104							<0	%	TM15/PM10

Please include all sections of this report if it is reproduced

Client Name: WYG
Reference: A098075
Location: Wrexham Custody
Contact: Sara Hegewald

[illegible]

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 16/13541

SOILS

Please note we are only MCERTS accredited (UK soils only) 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 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.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 (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.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised 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.

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ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS) accredited - UK.
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.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

JE Job No: 16/13541

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM5/TM36	TM005: Modified USEPA 8015B. Determination of solvent Extractable Petroleum Hydrocarbons (EPH) including column fractionation in the carbon range of C10-35 into aliphatic and aromatic fractions by GC-FID. TM036: Modified USEPA 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C5-10 by headspace GC-FID. Including determination of	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM15	Modified USEPA 8260. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.				
TM16	Modified USEPA 8270. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.				



Appendix F – Tier 1 Screening Assessment



		Sample ID													
		WS101		WS102		WS103		WS103		HDP101		HDP102		HDP103	
		WS104		WS105		HDP104		HDP105		HDP106					
		Depth		TSV		Depth		TSV		Depth		TSV		Depth	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1.0		0.3		0.3		0.9	
		0.4		0.4		0.4		1							

A098075 Wrexham Custody Facility
Groundwater Screening Data

			Sample ID	WS101	WS102	WS103
Test	Units	LOD	Screening Value			
PAH MS						
Acenaphthene ^{#M}	µg/l	<0.013	-	<0.013	<0.013	<0.013
Acenaphthylene	µg/l	<0.013	-	<0.013	<0.013	<0.013
Anthracene [#]	µg/l	<0.013	0.1	<0.013	<0.013	<0.013
Benzo(a)anthracene [#]	µg/l	<0.015	-	<0.015	<0.015	<0.015
Benzo(a)pyrene [#]	µg/l	<0.016	0.01	<0.016	<0.016	<0.016
Benzo(b)fluoranthene	µg/l	<0.01	0.017	<0.01	<0.01	<0.01
Benzo(ghi)perylene [#]	µg/l	<0.011	0.0082	<0.011	<0.011	<0.011
Benzo(k)fluoranthene	µg/l	<0.01	0.017	<0.01	<0.01	<0.01
Chrysene ^{#M}	µg/l	<0.011	-	<0.011	<0.011	<0.011
Dibenzo(ah)anthracene [#]	µg/l	<0.01	-	<0.01	<0.01	<0.01
Fluoranthene ^{#M}	µg/l	<0.012	0.12	<0.012	0.02	<0.012
Fluorene ^{#M}	µg/l	<0.014	-	<0.014	<0.014	<0.014
Indeno(123cd)pyrene ^{#M}	µg/l	<0.011	-	<0.011	<0.011	<0.011
Naphthalene ^{#M}	µg/l	<0.1	2	<0.1	<0.1	<0.1
Phenanthrene ^{#M}	µg/l	<0.011	-	0.02	0.03	0.03
Pyrene [#]	µg/l	<0.013	-	0.02	0.02	<0.013
TPH CWG						
Aliphatics						
>C5-C6	µg/l	<5	10	<5	<5	<5
>C6-C8	µg/l	<5	10	<5	<5	<5
>C8-C10	µg/l	<5	10	<5	<5	15
>C10-C12	µg/l	<5	10	<5	109	30
>C12-C16	µg/l	<10	10	<10	530	80
>C16-C21	µg/l	<10	10	<10	420	<10
>C21-C35	µg/l	<10	10	<10	12270	1060
Total Aliphatics C5-C35	µg/l	<10	-	<10	13329	1185
Aromatics						
>C5-EC7	µg/l	<5	1	<5	<5	<5
>EC7-EC8	µg/l	<5	10	<5	<5	<5
>EC8-EC10	µg/l	<5	10	<5	<5	<5
>EC10-EC12	µg/l	<5	2	<5	<5	<5
>EC12-EC16	µg/l	<10	10	<10	<10	<10
>EC16-EC21	µg/l	<10	0.00017	<10	30	<10
>EC21-EC35	µg/l	<10	0.0082	<10	3430	350
Total Aromatics C5-35	µg/l	<10	-	<10	3460	350
BTEX						
MTBE	µg/l	<5	15	<0.1	<0.1	<0.1
Benzene	µg/l	<5	1	<0.5	<0.5	<0.5
Toluene	µg/l	<5	74	<5	<5	<5
Ethylbenzene	µg/l	<5	20	<0.5	<0.5	<0.5
p/m Xylene	µg/l	<5	30	<1	<1	<1
o Xylene	µg/l	<5	30	<0.5	<0.5	<0.5
VOC MS						
Dichlorodifluoromethane	µg/l	<2		<2	<2	<2
Methyl Tertiary Butyl Ether	µg/l	<0.1		<0.1	<0.1	<0.1
Chloromethane	µg/l	<3		<3	<3	<3
Vinyl Chloride	µg/l	<0.1		<0.1	<0.1	<0.1
Bromomethane	µg/l	<1		<1	<1	<1
Chloroethane	µg/l	<3		<3	<3	<3
Trichlorofluoromethane	µg/l	<3		<3	<3	<3
1,1-Dichloroethene (1,1 DCE)	µg/l	<3		<3	<3	<3
Dichloromethane (DCM)	µg/l	<3		<3	<3	<3
trans-1-2-Dichloroethene	µg/l	<3		<3	<3	<3
1,1-Dichloroethane	µg/l	<3		<3	<3	<3
cis-1-2-Dichloroethene	µg/l	<3		<3	<3	<3
2,2-Dichloropropane	µg/l	<1		<1	<1	<1
Bromochloromethane	µg/l	<2		<2	<2	<2
Chloroform	µg/l	<2		<2	<2	<2
1,1,1-Trichloroethane	µg/l	<2		<2	<2	<2
1,1-Dichloropropene	µg/l	<3		<3	<3	<3
Carbon tetrachloride	µg/l	<2		<2	<2	<2
1,2-Dichloroethane	µg/l	<2		<2	<2	<2
Benzene	µg/l	<0.5		<0.5	<0.5	<0.5
Trichloroethene (TCE)	µg/l	<3		<3	<3	<3
1,2-Dichloropropane	µg/l	<2		<2	<2	<2
Dibromomethane	µg/l	<3		<3	<3	<3
Bromodichloromethane	µg/l	<2		<2	<2	<2
cis-1-3-Dichloropropene	µg/l	<2		<2	<2	<2
Toluene	µg/l	<5		<5	<5	<5
trans-1-3-Dichloropropene	µg/l	<2		<2	<2	<2
1,1,2-Trichloroethane	µg/l	<2		<2	<2	<2
Tetrachloroethene (PCE)	µg/l	<3		<3	<3	<3
1,3-Dichloropropane	µg/l	<2		<2	<2	<2
Dibromochloromethane	µg/l	<2		<2	<2	<2
1,2-Dibromoethane	µg/l	<2		<2	<2	<2
Chlorobenzene	µg/l	<2		<2	<2	<2
1,1,1,2-Tetrachloroethane	µg/l	<2		<2	<2	<2

A098075 Wrexham Custody Facility
Groundwater Screening Data

Ethylbenzene	µg/l	<0.5		<0.5	<0.5	<0.5
p/m-Xylene	µg/l	<1		<1	<1	<1
o-Xylene	µg/l	<0.5		<0.5	<0.5	<0.5
Styrene	µg/l	<2		<2	<2	<2
Bromoform	µg/l	<2		<2	<2	<2
Isopropylbenzene	µg/l	<3		<3	<3	<3
1,1,2,2-Tetrachloroethane	µg/l	<4		<4	<4	<4
Bromobenzene	µg/l	<2		<2	<2	<2
1,2,3-Trichloropropane	µg/l	<3		<3	<3	<3
Propylbenzene	µg/l	<3		<3	<3	<3
2-Chlorotoluene	µg/l	<3		<3	<3	<3
1,3,5-Trimethylbenzene	µg/l	<3		<3	<3	<3
4-Chlorotoluene	µg/l	<3		<3	<3	<3
tert-Butylbenzene	µg/l	<3		<3	<3	<3
1,2,4-Trimethylbenzene	µg/l	<3		<3	<3	<3
sec-Butylbenzene	µg/l	<3		<3	<3	<3
4-Isopropyltoluene	µg/l	<3		<3	<3	<3
1,3-Dichlorobenzene	µg/l	<3		<3	<3	<3
1,4-Dichlorobenzene	µg/l	<3		<3	<3	<3
n-Butylbenzene	µg/l	<3		<3	<3	<3
1,2-Dichlorobenzene	µg/l	<3		<3	<3	<3
1,2-Dibromo-3-chloropropane	µg/l	<2		<2	<2	<2
1,2,4-Trichlorobenzene	µg/l	<3		<3	<3	<3
Hexachlorobutadiene	µg/l	<3		<3	<3	<3
Naphthalene	µg/l	<2		<2	<2	<2
1,2,3-Trichlorobenzene	µg/l	<3		<3	<3	<3
SVOC MS	µg/l					
2-Chlorophenol	µg/l	<1		<1	<1	<1
2-Methylphenol	µg/l	<0.5		<0.5	<0.5	<0.5
2-Nitrophenol	µg/l	<0.5		<0.5	<0.5	<0.5
2,4-Dichlorophenol	µg/l	<0.5		<0.5	<0.5	<0.5
2,4-Dimethylphenol	µg/l	<1		<1	<1	<1
2,4,5-Trichlorophenol	µg/l	<0.5		<0.5	<0.5	<0.5
2,4,6-Trichlorophenol	µg/l	<1		<1	<1	<1
4-Chloro-3-methylphenol	µg/l	<0.5		<0.5	<0.5	<0.5
4-Methylphenol	µg/l	<1		<1	<1	<1
4-Nitrophenol	µg/l	<10		<10	<10	<10
Pentachlorophenol	µg/l	<1		<1	<1	<1
Phenol	µg/l	<1		<1	<1	<1
2-Chloronaphthalene	µg/l	<1		<1	<1	<1
2-Methylnaphthalene	µg/l	<1		<1	<1	<1
Bis(2-ethylhexyl) phthalate	µg/l	<5		<5	7	<5
Butylbenzyl phthalate	µg/l	<1		<1	<1	<1
Di-n-butyl phthalate	µg/l	<1.5		<1.5	1.9	2.4
Di-n-Octyl phthalate	µg/l	<1		<1	<1	<1
Diethyl phthalate	µg/l	<1		10	<1	<1
Dimethyl phthalate	µg/l	<1		9	<1	<1
Other SVOCs						
1,2-Dichlorobenzene	µg/l	<1		<1	<1	<1
1,2,4-Trichlorobenzene	µg/l	<1		<1	<1	<1
1,3-Dichlorobenzene	µg/l	<1		<1	<1	<1
1,4-Dichlorobenzene	µg/l	<1		<1	<1	<1
2-Nitroaniline	µg/l	<1		<1	<1	<1
2,4-Dinitrotoluene	µg/l	<0.5		<0.5	<0.5	<0.5
2,6-Dinitrotoluene	µg/l	<1		<1	<1	<1
3-Nitroaniline	µg/l	<1		<1	<1	<1
4-Bromophenylphenylether	µg/l	<1		<1	<1	<1
4-Chloroaniline	µg/l	<1		<1	<1	<1
4-Chlorophenylphenylether	µg/l	<1		<1	<1	<1
4-Nitroaniline	µg/l	<0.5		<0.5	<0.5	<0.5
Azobenzene	µg/l	<0.5		<0.5	<0.5	<0.5
Bis(2-chloroethoxy)methane	µg/l	<0.5		<0.5	<0.5	<0.5
Bis(2-chloroethyl)ether	µg/l	<1		<1	<1	<1
Carbazole	µg/l	<0.5		<0.5	<0.5	<0.5
Dibenzofuran	µg/l	<0.5		<0.5	<0.5	<0.5
Hexachlorobenzene	µg/l	<1		<1	<1	<1
Hexachlorobutadiene	µg/l	<1		<1	<1	<1
Hexachlorocyclopentadiene	µg/l	<1		<1	<1	<1
Hexachloroethane	µg/l	<1		<1	<1	<1
Isophorone	µg/l	<0.5		<0.5	<0.5	<0.5
N-nitrosodi-n-propylamine	µg/l	<0.5		<0.5	<0.5	<0.5
Nitrobenzene	µg/l	<1		<1	<1	<1

Key:

	Concentration exceeds TSV (Tier 1 Screening value)
	Drinking Water Standard (DWS)
	Environmental Quality Standard (EQS) for River Water
<10	Laboratory limit of detection greater than screening value



Appendix G – Gas Mitigation Design Measures

SPILMAN ASSOCIATES

Geotechnical and Environmental Engineers

Spilman Associates Limited

38 South Avenue

Stourbridge

West Midlands DY8 3XY

Tel: 01384 820578

Email: harry@spilmanassociates.co.uk

ACS Lining Limited

EASTERN COMMAND CENTRE
WREXHAM

Gas Protection Measures

November 2016

Report No J16111/01 Rev A

Issued By: Harry Spilman

Date Issued: 08 November 2016

EASTERN COMMAND CENTRE, WREXHAM

GAS PROTECTION MEASURES
DESIGN METHODOLOGY

1.0 SITE CLASSIFICATION

The gas protection measures are intended to provide protection to satisfy the requirements of Characteristic Situation 4 in accordance with CIRIA C665 (2007) Assessing Risks Posed by Hazardous Gases to Buildings.

In accordance with BS 8485 (2015) Characteristic Situation 4 would require 4.5 points of protection in accordance with Table 4 for a Type C building. These would be achieved by the following:-

<u>Item</u>	<u>Score</u>
1. Ground bearing slab	0.5*
2. Active sub-floor ventilation	2.5
3. Gas resistant membrane	2.0
Total	5.0

* in areas of raft slab score would increase to 1 or 1.5 points

2.0 GAS PROTECTION PROPOSALS

In order to satisfy the requirements of CIRIA C665 (2007) and BS8485 (2015) the following gas protection measures are proposed:-

1. Active sub-floor venting to comprise a full cover of geocomposite voidformer connected to 100mm diameter HDPE gas collection manifold pipes leading to gas extraction fans (4 no) on one elevation and ground level vent boxes on opposite elevation (OPTION 2).
2. Clean air is introduced into the venting system via a series of ground level vent boxes. Sufficient clean air is drawn through the venting system to dilute ground gases to harmless concentrations.
3. The active sub-floor ventilation is designed to meet the requirements of Very Good Performance in accordance with Table 6 of BS8485 (2015).
4. The extraction fans are designed to be continuous running with fan fail indicators. In the event of fan or power failure the system will operate in passive mode relying on the differential pressure between the windward and leeward sides of the building.
5. The proprietary gas resistant membrane is laid in line with current good practice under independent validation.
6. A conventional cast insitu ground bearing slab will be employed as a minimum (parts of the building will use a raft foundation).

EASTERN COMMAND CENTRE, WREXHAM SPECIFICATION FOR GAS PROTECTION MEASURES
--

Membrane

1. Gas resistant membrane to be high performance loose lay membrane containing encapsulated aluminium core (**ACS Gas Resistant Membrane**).
2. Installation and protection in accordance with manufacturer's recommendations. Membrane to be laid on concrete blinding throughout.
3. Individual membrane sheets to be lapped minimum 100mm and sealed with 30mm wide proprietary butyl tape (**ACS Butyl Sealant Tape**).
4. All services and other penetrations to be sealed with self-adhesive gas resistant membrane (**ACS Adhesive Gas Membrane**).

Geocomposite Gas Venting Layer

5. Geocomposite to comprise single sided 25mm thick cusped high density polyethylene core with high permeability geotextile fabric bonded to core dimples (**ACS Gasflow 25**).
6. Core to have a minimum 13mm clear void and a minimum crushing strength of 100kN/m².
7. Full cover of geocomposite gas venting layer (**ACS Gasflow 25**) to whole building footprint with connections on opposite sides of the building to 100mm diameter gas collection manifold pipe.

Perimeter Ventilation & Extract Fans

10. Gas collection manifold connected to ground level vent boxes (VB) to Gridline 1. Exact positions to be agreed on site to suit door openings and Architects requirements. On opposing elevation (Gridline 10 & 8) manifold pipe connected to permanent running extract fans (4 no.) mounted within external venting pipework. Power supply (3 phase) by main contractor. All fans to be certified flame proof. External venting pipework from fan to be fitted with static venting cowl.



1

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Geotechnical and Environmental Engineers

38 South Avenue
Stourbridge
West Midlands DY8 3XY

Tel: 01384 820578
Fax: 01384 823251

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Project:

Eastern Command Centre, Wrexham

Subject:

Gas Protection Measures

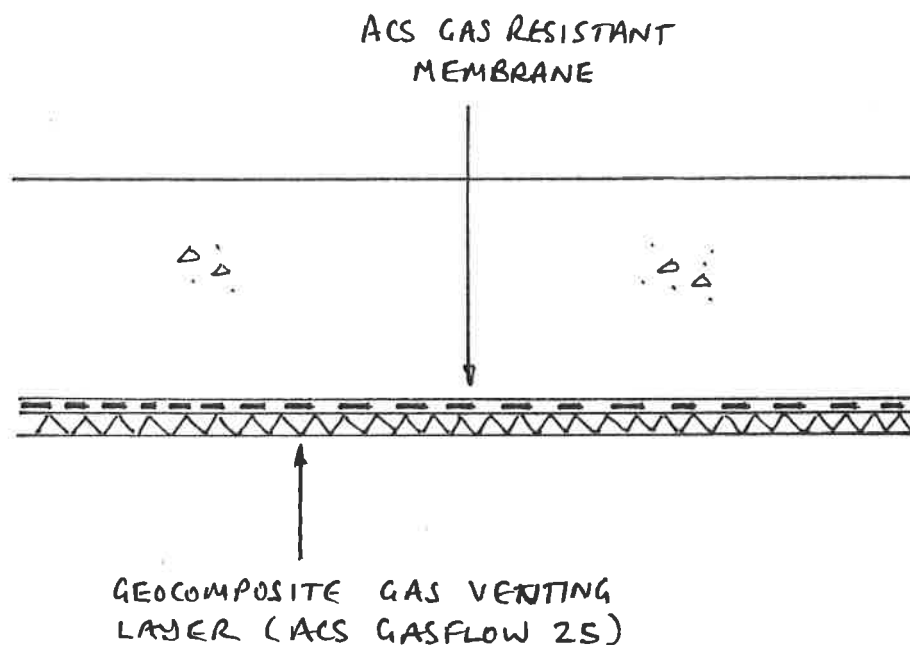
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DETAIL A

TYPICAL SLAB SECTION
(FULL COVER OF GEOCOMPOSITE)

SCALE 1:10

NOTE: IF FULL COVER OF GEOCOMPOSITE IS
ADOPTED THERE WOULD BE NO REQUIREMENT
FOR BINDING, GEOTEXTILE LAYER OR
CLEAN STONE LAYER

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38 South Avenue
Stourbridge
West Midlands DY8 3XY

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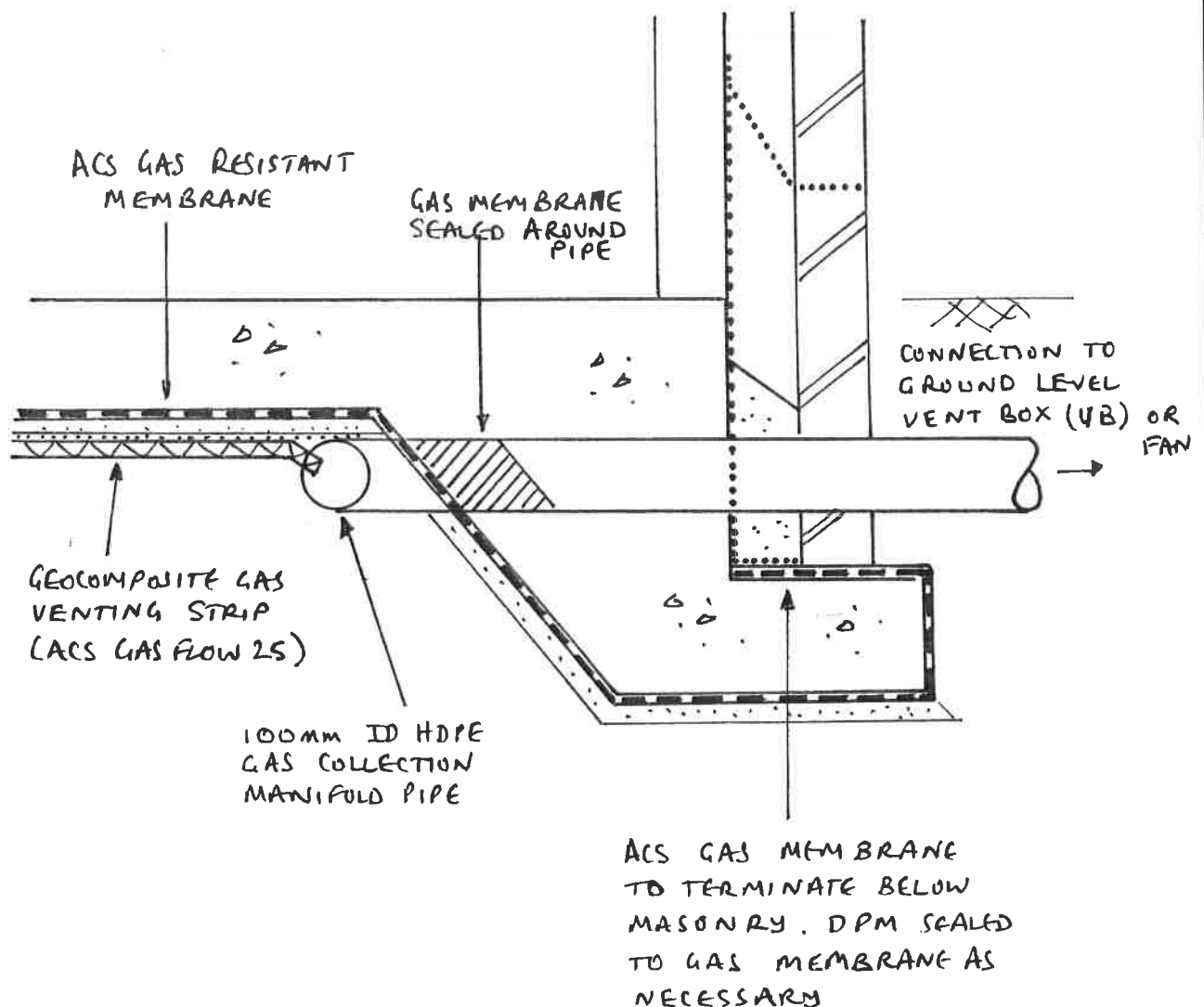
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NOTE: DPC, CAVITY TRAY
& DPM TO ARCHITECT'S
DETAILS



DETAIL B

TYPICAL PERIMETER SECTION

SCALE 1:10

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Stourbridge
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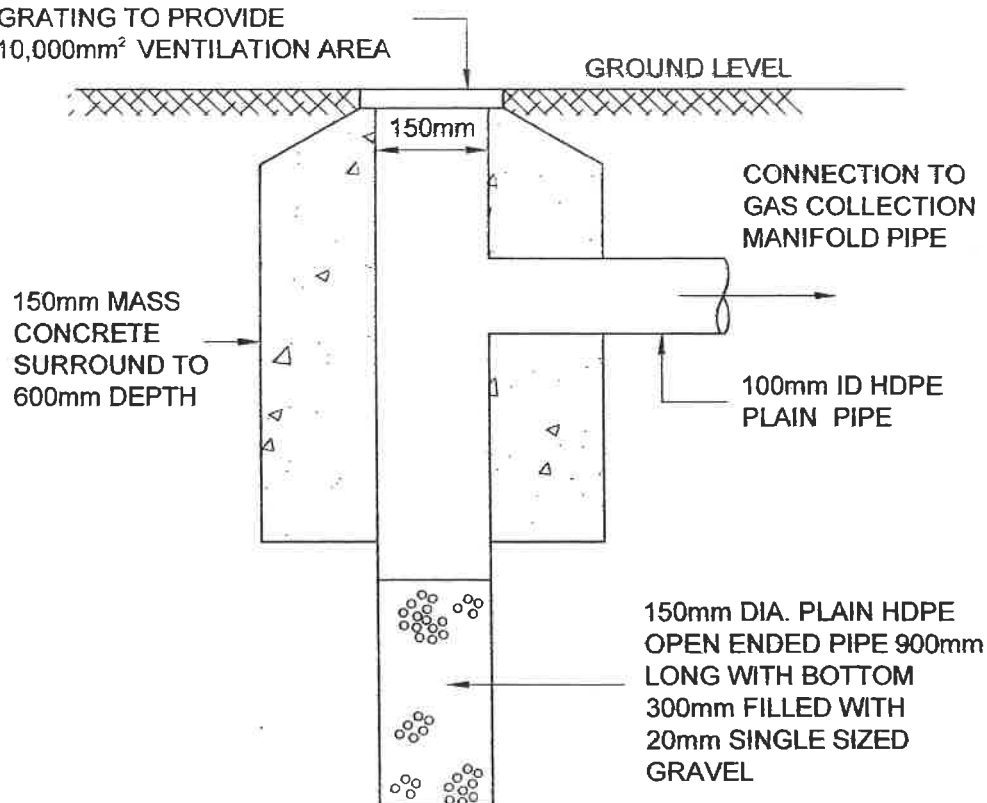
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REMOVABLE CIRCULAR ALLOY
GRATING TO PROVIDE
10,000mm² VENTILATION AREA



DETAIL C
GROUND LEVEL VENT BOX (VB)
SCALE 1:10

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West Midlands DY8 3XY

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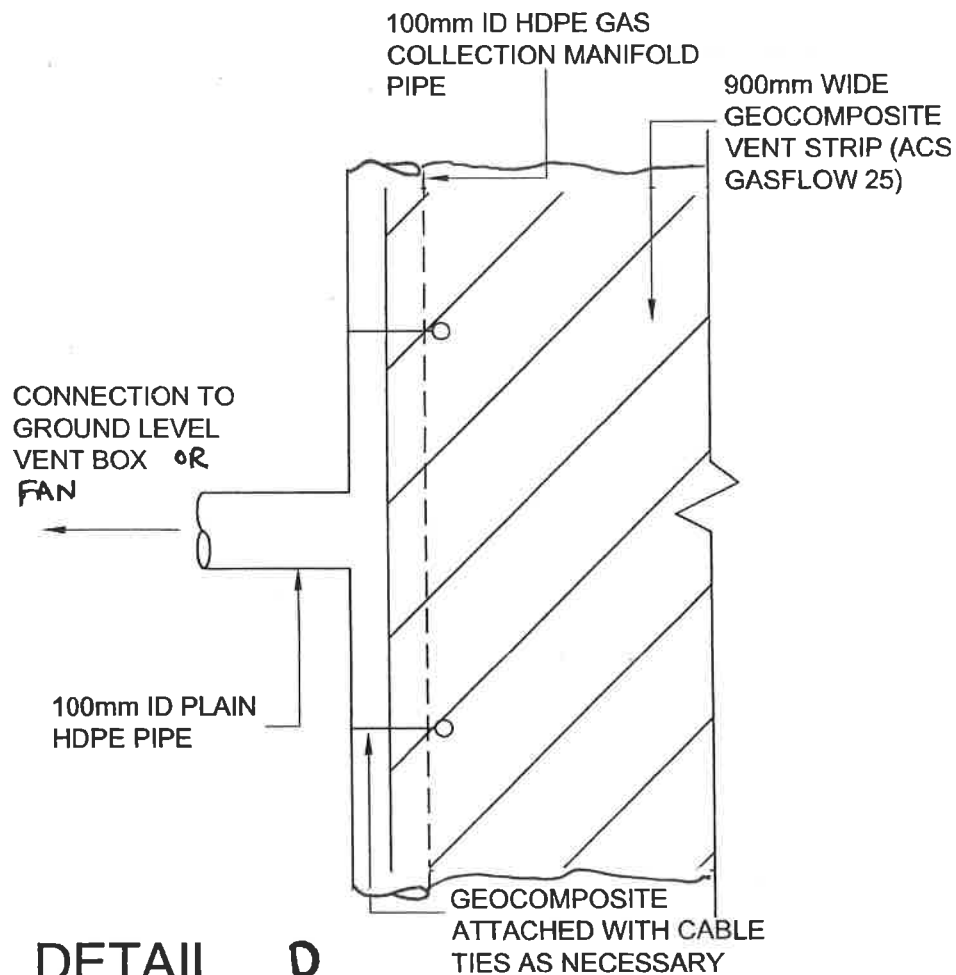
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DETAIL D
GEOCOMPOSITE CONNECTION TO
MANIFOLD PIPE
SCALE - 1:10

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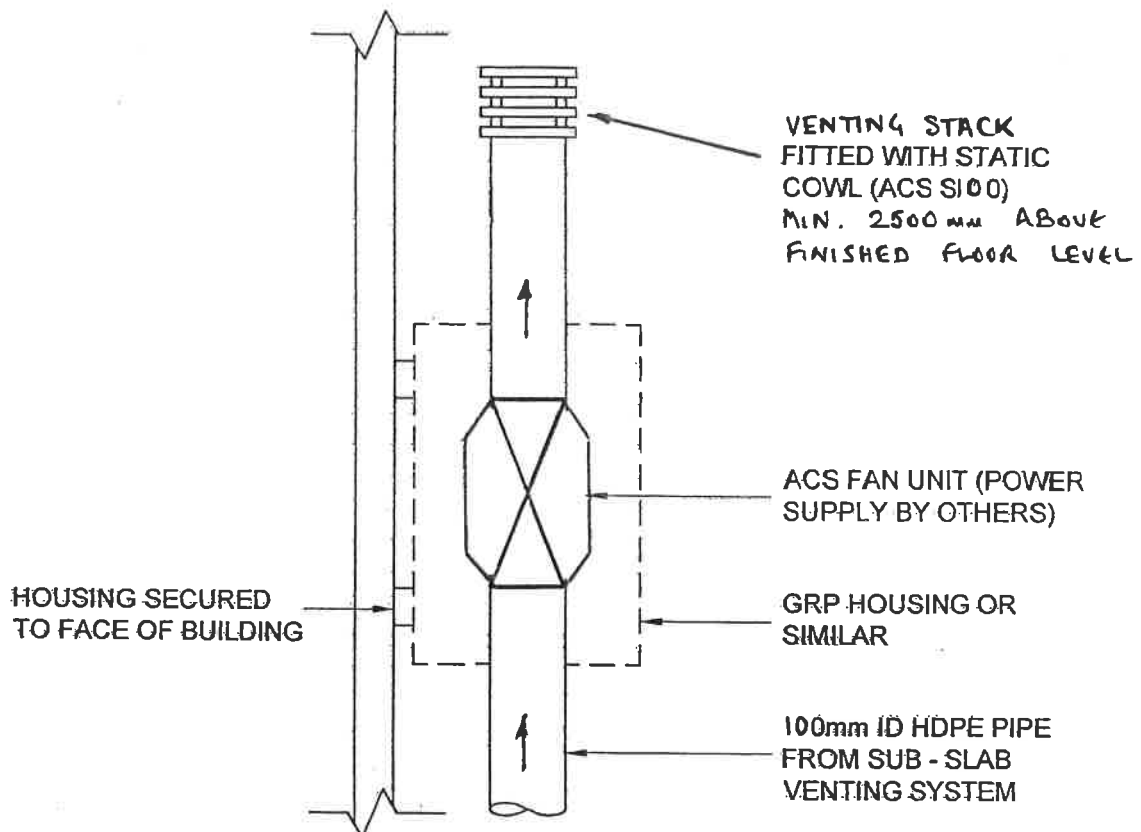
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DETAIL E
TYPICAL FAN SECTION
NOT TO SCALE

NOTE : 1. 3 PHASE POWER SUPPLY BY OTHERS.

2. FLAME PROOF VENTING FAN - MIN FLOW RATE $0.1 \text{ m}^3/\text{s}$
AT 100 PASCALS

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Geotechnical and Environmental Engineers

38 South Avenue
Stourbridge
West Midlands DY8 3XY

Tel: 01384 820578
Fax: 01384 823251

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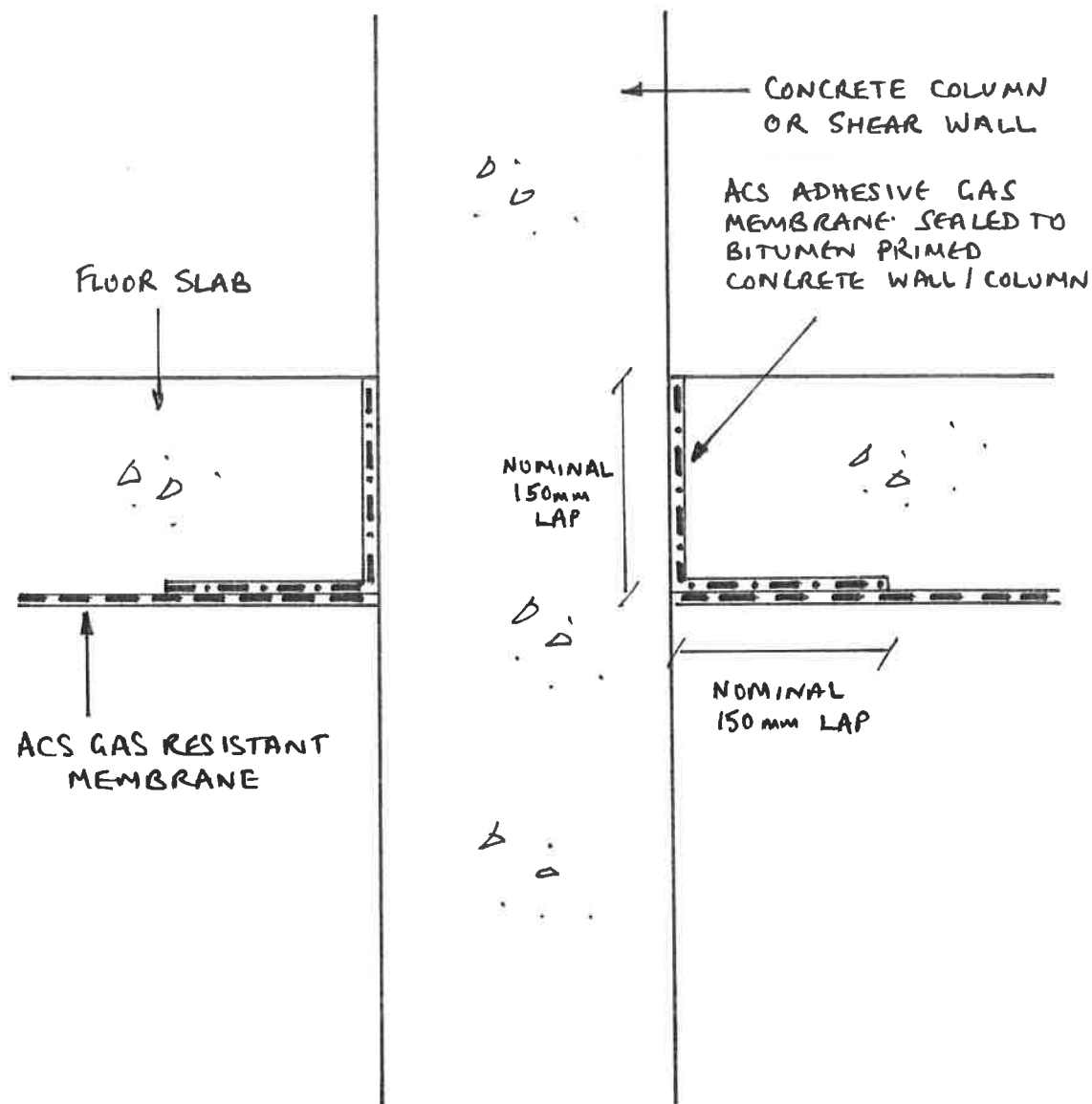
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DETAIL F

MEMBRANE SEAL TO COLUMN
OR SHEAR WALL

SCALE 1:5

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Geotechnical and Environmental Engineers

38 South Avenue
Stourbridge
West Midlands DY8 3XY

Tel: 01384 820578

Fax: 01384 823251

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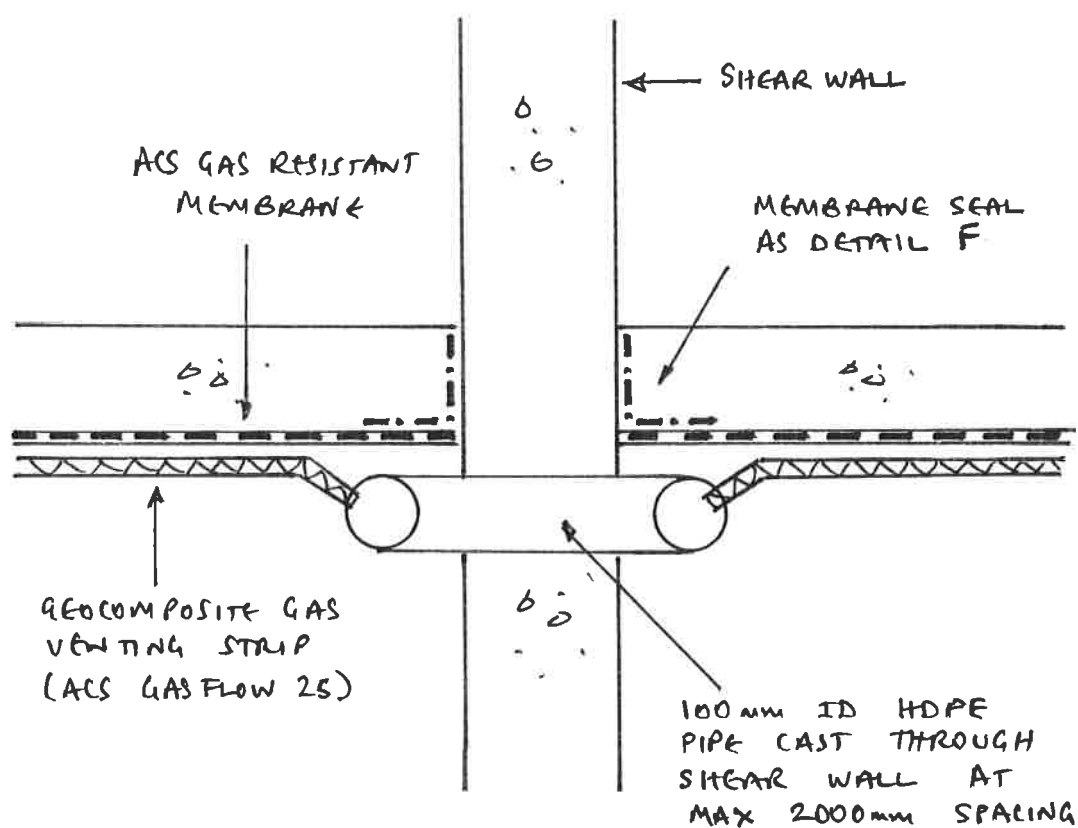
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DETAIL 9

GEOCOMPOSITE THROUGH SHEAR WALL
(SECTION)

SCALE 1:10

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38 South Avenue
Stourbridge
West Midlands DY8 3XY

Tel: 01384 820578

Fax: 01384 823251

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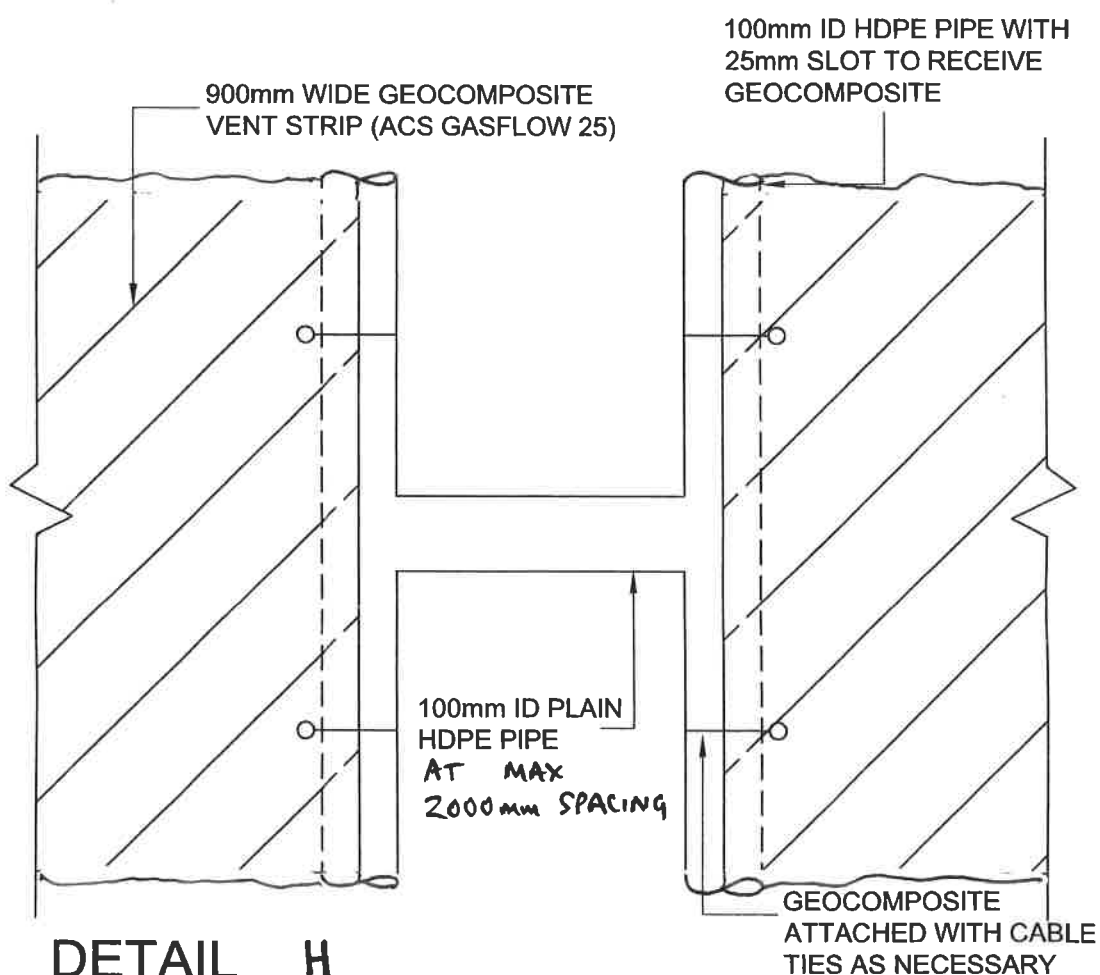
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DETAIL H
VENT STRIP THROUGH INTERNAL WALL
(PLAN)
SCALE - 1:10

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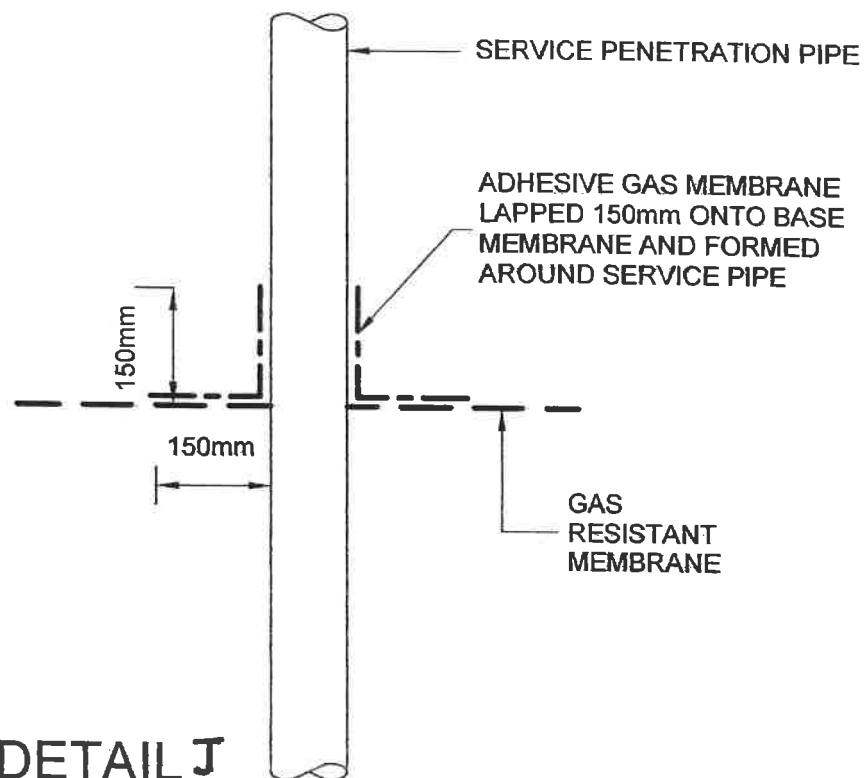
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DETAIL J
SEAL TO PIPE PENETRATION
NOT TO SCALE

ACS GAS RESISTANT MEMBRANE

Technical Data

CE CE Mark to EN 13967

Gas Membrane	
Technical Data	
Thickness	350mu
Width(m)	1.6metres - 0 + 2.5%
Length(m)	100 metres -0+2.5%
Roll Weight	40 Kg
Aluminium Core	20 micron
Properties	6 Layers Polywoven Reinforcement
Colour	Blue/White
Gas Transmission	
Complies with the requirements of BS 8485 2015 Test Method BS ISO 15105-1 manometric method	
Hydrocarbon Vapours	
Petrol	g/m ² /hr 0.001
Diesel	g/m ² /hr 0.001
PCB'S	g/m ² /hr 0.001
Technical Performance	
Water Vapour Trans. Rate g/m ² /day	0.000
Tear Resistance	154.9m ²
Tensile Strength	15.26Kn/m ²

ACS BUTYL SEALANT TAPE

ACS Lining Limited's Butyl Sealant Tape, is manufactured in double sided roll form, for easy on site application to bond and seal various materials. The butyl tape has an elastomeric backbone which is particularly beneficial when different thermal movements are experienced, thereby ensuring a sealed joint, even under pressure.

Colour	Black
Roll size	1.5mm x 30mm x 30m
Product Specification	Polybutene, inert fillers and oil with an elastomeric backbone, formed into a homogenous tape carried on a release paper
Joint Movement	20%
Service Temperature	-40°C to +90°C
Chemical Resistance:	Dilute acids and alkali – Good Detergents – Good Organic solvents – Poor
UV Resistance:	Very good
Toxicity	Contains no known toxic ingredients Solvent free
Shelf life	One year in ambient condition
Application Temperature	>4°C

ACS Butyl Sealant Tape

ACS ADHESIVE GAS MEMBRANE

ACS Adhesive Gas Membrane is a high-performance gas-resistant membrane doubly reinforced with a 100 micron polyethylene core and a 50 micron aluminium foil gas barrier. Both sides are coated with a self-adhesive modified bitumen compound. The upper surface is finished with a polyethylene film and the underside with a silicone coated release paper for easy installation.

Dimensions and weight

Nominal thickness (mm)	2.0
Nominal weight (kg/m ²)	2.1
Roll length (m)	15
Roll width (m)	1.01

Physical properties

Test Method

Methane gas transmission rate (ml/m ² /24hrs)	BRE gas chromatography ¹	<0.14
Tensile strength at break (N/50mm)	BS 2782 (320A)	(L) 200 (T) 200
Elongation at break (N)	BS 2782 (320A)	(L) 360 (T) 750
Low temperature flexibility (°C)	MOAT No 27 Test 5.4.2	Does not break at -15°C
Water vapour resistance (MN/s/g)	BS 3177	1,740

Notes

¹Tested to BS 903 : Part 17

ACS GASFLOW 25

GEOCOMPOSITE VOID FORMER

ACS GASFLOW 25 consists of a geotextile filter, thermally bonded on one side of a specially formulated cusped HDPE (High Density Polyethylene) core, suitable for both active and passive venting systems.

GEOTEXTILE

Type		Non woven continuous filament needle punched and heat treated	
Material		Polypropylene	
Mass/unit area	(g/m ²)	140	BSEN 965:1995
Thickness at 2kPa	(mm)	1.2	BSEN 964-1:1995
U.V. resistance		Excellent and 100% stabilised	
Tensile strength long/cross	(kN/m)	7/9	BSEN ISO 10319:1996
Elongation at break long/cross	(%)	80/35	BSEN ISO 10319:1996
Pore size O ₉₀	(micron)	100-150	BS 6906 (2)
Gas Flow at 100mm	(l/m ² /s)	15,000	GAS TEST
Puncture resistance	(N)	1400	BSEN ISO 12236:1996
Tear resistance	(N)	200	ASTM D4533-85
Bacteria/chemical resistance		Superior and highly resistant to all common chemicals	

CORE

Type		Single Cusped (Dimpled)	
Material		Gas resistant HDPE (High Density Polyethylene)	
Mass/unit area	(g/m ²)	1250	BSEN 965:1995
Impact resistance		Excellent (even at low temperatures)	
Bacteria/chemical resistance		Superior and highly resistant to all common chemicals	

COMPOSITE

Flow capacity ⁽⁶⁾	(m ³ /hr)	2.0	DoE
Intrinsic permeability	(m ²)	1.03 x 10 ⁻⁵	DoE
Forcheimer term	(s/m)	18.0	DoE
Porosity		0.82	DoE
Equivalent clear void	(mm)	13	DoE
Thickness at 2kPa	(mm)	25	BSEN 964-1:1995
Compressive strength	(kPa)	240	ASTM D1621(MOD)
Creep resistance		Less than 6% in 100,000 hours	
Tensile strength long/cross	(kN/m)	13/15	BSEN ISO 10319:1996
Elongation long/cross	(%)	60/30	BSEN ISO 10319:1996
CBR puncture resistance	(N)	3,500	BSEN ISO 10319:1996
Life expectancy	(yrs)	120	
Working temperature	°C	-20 to 80	
Chemical resistance		Superior and excellent resistance to all common chemicals	
Bacteria/fungi		Does not support growth	
Compatibility with gas membranes		Fully compatible. The composite has a flat side in contact with the gas membrane to keep long term contact stresses to an absolute minimum	
Health, safety, environment		INERT. No known health hazard. No precautions necessary	

NOTE

- (1) The geotextile is bonded to the core to prevent intrusion into and blockage of the gas passageways under the action of pressure of backfill material.
- (2) The values given are indicative and correspond to nominal results obtained in our laboratories and testing institutes. The right is reserved to make changes without notice at any time.
- (3) Gasflow 25 has approx 6x the flow performance of 20mm gravel ballast.
- (4) Allowable tolerances are +/- 10% of the typical value.
- (5) Refer to separate sheets for fixing instructions, full range of fittings and packing dimensions.
- (6) 30m foundation, 2m air brick spacing, 1m/s wind speed, 0.6 Pa pressure difference

SPILMAN ASSOCIATES Geotechnical and Environmental Engineers 38 South Avenue Stourbridge West Midlands DY8 3XY Tel: 01384 820578 Fax: 01384 823251	Sheet No:	1 of 4		
	Job No:	J16111		
	Project:	Eastern Command Centre, Wrexham		
	Subject:	Gas Venting Design		
	Made By:	HDS	Date:	September 2016

1.0 DESIGN PHILOSOPHY

Provide 2 principle elements of gas protection:

- Actively vented sub-slab layer comprising a geocomposite venting strips
- High Quality "foil encapsulated" gas resistant membrane

Voidformer to be ventilated via ground level vent boxes on one elevation and extraction fans on the opposing elevation

The venting calculations are conservative for the following reasons:

- Worst case gas concentration parameters have been assumed.
- The Pecksen assumption has been used to assess borehole gas flow rates (ie each borehole is assumed to "drain" 10m² only).

Passive venting will provide nominal venting in the event of fan failure relying on wind effects resulting in a positive pressure on the windward side and negative pressure on the leeward side of the building.

SPILMAN ASSOCIATES

Geotechnical and Environmental Engineers

38 South Avenue
Stourbridge
West Midlands DY8 3XY

Tel: 01384 820578
Fax: 01384 823251

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Project: Eastern Command Centre, Wrexham

Subject: Gas Venting Design

Made By: HDS Date: September 2016

2.0 SELECTION OF DESIGN PARAMETERS

Worst case gas design parameters from the Ian Farmer Associates Ground Investigation Report dated February 2016 indicate a methane concentration of 85.9% and a borehole flow rate of 10.1l/hr.

Conservative design parameters have been utilised as detailed below:

METHANE GAS CONCENTRATION	85.9%
DESIGN GAS FLOW RATE (10.1l/hr)	$2.806 \times 10^{-6} \text{ m}^3/\text{s}$
MAXIMUM ACCEPTABLE SUB-FLOOR METHANE CONCENTRATION	1.0%

3.0 SURFACE CH₄ EMISSION RATE

CH₄ Emission (q) = $\frac{\text{Flow from BH}}{\text{Area Drained by BH}^*}$ x CH₄ Concentration

$$q = \frac{2.806 \times 10^{-6}}{10} \times 0.859$$

$$q = 2.410 \times 10^{-7} \text{ m}^3/\text{m}^2/\text{s}$$

(*taken as 10m² after Pecksen)

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38 South Avenue
 Stourbridge
 West Midlands DY8 3XY

Tel: 01384 820578
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Subject: Gas Venting Design

Made By: HDS

Date:

September 2016

4.0 CLEAN AIR DILUTION

Calculate the volume of "clean air" required to dilute the methane gas to an equilibrium concentration of 1% CH₄.

From BS 5925 (1991)

Rate of air flow (Q) required to give equilibrium concentration C_E is:

$$Q = \frac{q(1 - C_E)}{C_E} \quad \text{where } C_E = 1.0\% \text{ (or } 0.01)$$

$$Q = 2.410 \times 10^{-7} \times \frac{(1 - 0.01)}{0.01}$$

$$Q = 2.386 \times 10^{-5} \text{ m}^3/\text{m}^2/\text{s}$$

$$\text{Area of building (A)} = 83 \times 69 = 5727 \text{ m}^2$$

$$Q_T = Q \times A$$

$$Q_T = 2.386 \times 10^{-5} \times 5727 = 0.1366 \text{ m}^3/\text{s}$$

The design fan extraction rate at 100 Pascals is 0.1m³/s. There are four fans thereby giving an overall flow rate of 0.4m³/s. This exceeds the clean air required to achieve dilution.

The nominal factor of safety is Q_{FANS}/Q_T = 0.4/0.1366 = 2.9

THEREFORE DESIGN ACCEPTED

SPILMAN ASSOCIATES

Geotechnical and Environmental Engineers

38 South Avenue
Stourbridge
West Midlands DY8 3XY

Tel: 01384 820578
Fax: 01384 823251

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Project:	Eastern Command Centre, Wrexham		
Subject:	Gas Venting Design		
Made By:	HDS	Date:	September 2016

5.0 REFERENCES

1. Pecksen GN (1985) London Environmental Supplement No 113. Methane and the Development of Derelict Land. GLC.
2. BS 5925 (1991) Code of Practice for Ventilation Principles and Designing for Natural Ventilation.

Operation and maintenance of ACS sub slab ventilation fan unit

ACS Lining Ltd
ACS Business Park
2-4 Middleton Road
Heywood
Rochdale
OL10 2 HT

Telephone 01706 628524
Fax 01706 628318

1 Description and operation

The sub slab ventilation fan unit comprises a 150 mm diameter axial flow bifurcated fan in galvanised body housed within a GRP (glass reinforced polyester enclosure).

The unit is design for continuous operation and is supplied from a 400 V 3 Phase supply.

The double insulated enclosure is UL and CE marked and does not present any electric shock risk.

2 Maintenance

A rotary switch located within the GRP housing is for isolating and padlocking off the supply whilst maintenance is undertaken to the fan.



Rotary isolator switch

Important

The unit requires annual dismantling to access the fan and to clean the blades.

A competent person must undertake this work, there is a serious risk of amputatation from the rotating fan blades if the supply is not isolated and padlocked off.

1. Commence by isolating the supply and fitting a suitable padlock to the rotary isolator switch
2. Allow the fan blades to stop rotating for a period of 5 minutes.
3. Using 10mm spanners unbolt the 16 screws retaining the fan between the flanges.
4. Remove the fan assembly, being careful not to pull on the flexible lead.
5. The fan unit is located in the lower section of the unit, lay the unit on its side and clean the fan blades using a soft cloth and soapy water, do not use solvent based cleaners as this will cause permanent damage to the plastic fan blades
6. Allow the fan blades to dry and polish off.
7. The fan motor bearings are sealed for life and do not require lubrication.
8. Relocate the fan assembly between the flanges making sure the direction of flow is correct, the fan blades are at the bottom of the unit.
9. Refit the 16 screws retaining the fan between the flanges.
10. Unlock the padlock and turn on the supply, the annual maintenance is complete

Service history

[illegible]



Appendix H – P20 Assessment



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	Wrexham		
Site Address:	Llay Industrial Estate, LL12 0PB		
Completed by:	SH	Version:	1
Date:	15-Sep-16		
Contaminant	TPH C10-12 Aliphatic		
Target Concentration (C _T)	0.01	mg/l	Origin of C _T : DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	TPH C10-12 Aliphatic	from Level 1
Target Concentration	C _T 1.00E-02	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
-------------	------------------------------

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to pollutants in all phases (e.g. field derived vs

Initial contaminant concentration in groundwater at plume core	C ₀	1.09E-01	mg/l	Lab data WST02
Half life for degradation of contaminant in water	t _{1/2}	3.60E+02	days	EA PS-079/TR1 (pg 46)
Calculated decay rate	λ	1.93E-03	days ⁻¹	
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+00	m	Site data/lab results
Plume thickness at source	Sy	1.00E+00	m	Head of ground water
Saturated aquifer thickness	da	1.50E+00	m	Depth of water table
Bulk density of aquifer materials	p	2.00E+00	g/cm ³	Consim database- mean
Effective porosity of aquifer	n	5.00E-01	fraction	Mean from Consim
Hydraulic gradient	I	1.00E-02	fraction	Estimate
Hydraulic conductivity of aquifer	K	1.73E-01	m/d	Consim database- max
Distance to compliance point	x	1.10E+02	m	Distance to SW receptor
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+41	days	time variant options only

Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	see options
Longitudinal dispersivity	ax	4.65E+00	m	see options
Transverse dispersivity	az	4.65E-01	m	see options
Vertical dispersivity	ay	4.65E-02	m	see options

Calculated Parameters

Groundwater flow velocity	v	3.46E-03	m/d	
Retardation factor	Rf	2.00E+03	fraction	
Decay rate used	λ	1.93E-03	d ⁻¹	
Rate of contaminant flow due to retardation	u	1.73E-06	m/d	
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	0.00E+00	mg/l	
Attenuation factor (one way vertical dispersion, CO/CED)	AF	breakthrough at compliance point		

Remedial Targets

Remedial Target	No impact	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	110	m	
Concentration of contaminant at compliance point	C _{ED} /C ₀	0.00E+00	mg/l Ogata Banks
after		1.0E+41	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

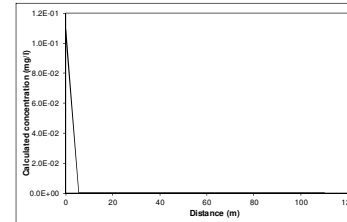
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)		
Soil water partition coefficient	Kd	l/kg
Entry for non-polar organic chemicals (option)		
Fraction of organic carbon in aquifer	foc	2.00E-02 fraction
Organic carbon partition coefficient	Koc	2.50E+04 l/kg
Entry for ionic organic chemicals (option)		
Sorption coefficient for related species	K _{oc,n}	l/kg
Sorption coefficient for ionised species	K _{oc,i}	l/kg
pH value	pH	
acid dissociation constant	pKa	
Fraction of organic carbon in aquifer	foc	fraction
Soil water partition coefficient	Kd	5.00E+02 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

Longitudinal dispersivity	ax	Enter value	Calc value Xu & Eckstein	m
Transverse dispersivity	az	0.00E+00	1.10E+03	4.65E-01 m
Vertical dispersivity	ay	0.00E+00	1.10E-01	4.65E-02 m
Note values of dispersivity must be > 0				
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x				
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ X) ^{0.411} ; az = ax/10, ay = ax/100 are assumed				



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action. Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc then an alternative solution should be used.

Site being assessed:	Wrexham
Completed by:	SH
Date:	#####
Version:	1



Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	Wrexham		
Site Address:	Llay Industrial Estate, LL12 0PB		
Completed by:	SH		
Date:	15-Sep-16	Version:	1
Contaminant	TPH C21-35 Aliphatic		
Target Concentration (C _T)	0.01	mg/l	Origin of C _T : DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	TPH C16-35 Aliphatic	from Level 1
Target Concentration	C _T 1.00E-02	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
-------------	------------------------------

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to pollutants in all phases (e.g. field derived vs

Initial contaminant concentration in groundwater at plume core	C ₀	1.23E+01	mg/l	Lab data WST02
Half life for degradation of contaminant in water	t _{1/2}	1.25E+03	days	EA PS-079/TR1 (pg 46)
Calculated decay rate	λ	5.55E-04	days ⁻¹	
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+00	m	Site data/lab results
Plume thickness at source	Sy	1.00E+00	m	Head of ground water
Saturated aquifer thickness	da	1.50E+00	m	Depth of water table
Bulk density of aquifer materials	p	2.00E+00	g/cm ³	Consim database- mean
Effective porosity of aquifer	n	5.00E-01	fraction	Mean from Consim
Hydraulic gradient	I	1.00E-02	fraction	Estimate
Hydraulic conductivity of aquifer	K	1.73E-01	m/d	Consim database- max
Distance to compliance point	x	1.10E+02	m	Distance to SW receptor
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+41	days	time variant options only

Parameters values determined from options				
Partition coefficient	Kd	5.00E+02	l/kg	see options
Longitudinal dispersivity	ax	4.65E+00	m	see options
Transverse dispersivity	az	4.65E-01	m	see options
Vertical dispersivity	ay	4.65E-02	m	see options

Calculated Parameters

Groundwater flow velocity	v	3.46E-03	m/d	
Retardation factor	Rf	2.00E+03	fraction	
Decay rate used	λ	5.55E-04	d ⁻¹	
Rate of contaminant flow due to retardation	u	1.73E-06	m/d	
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	0.00E+00	mg/l	
Attenuation factor (one way vertical dispersion, CO/CED)	AF	breakthrough at compliance point		

Remedial Targets

Remedial Target	No impact	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	110	m	
Concentration of contaminant at compliance point	C _{ED} /C ₀	0.00E+00	mg/l
after	1.0E+41	days	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

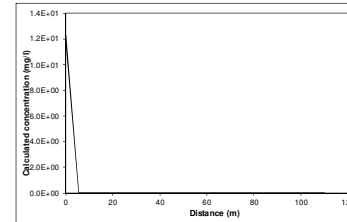
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)		
Soil water partition coefficient	Kd	l/kg
Entry for non-polar organic chemicals (option)		
Fraction of organic carbon in aquifer	foc	2.00E-02 fraction
Organic carbon partition coefficient	Koc	2.50E+04 l/kg
Entry for ionic organic chemicals (option)		
Sorption coefficient for related species	K _{oc,n}	l/kg
Sorption coefficient for ionised species	K _{ow,i}	l/kg
pH value	pH	
acid dissociation constant	pKa	
Fraction of organic carbon in aquifer	foc	fraction
Soil water partition coefficient	Kd	5.00E+02 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

		Enter value	Calc value Xu & Eckstein	m
Longitudinal dispersivity	ax	0.00E+00	1.10E+03	4.65E+00
Transverse dispersivity	az	0.00E+00	1.10E+00	4.65E-01
Vertical dispersivity	ay	0.00E+00	1.10E-01	4.65E-02
Note values of dispersivity must be > 0				
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x				
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ^{0.411} ; az = ax/10, ay = ax/100 are assumed				



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Calculated concentrations for distance-concentration graph

Ogata Banks	Distance	Concentration
From calculation sheet		
	0	1.2E+01
	5.5	1.30E-19
	11.0	3.00E-39
	16.5	5.46E-59
	22.0	1.08E-78
	27.5	2.23E-98
	33.0	4.78E-118
	38.5	1.05E-137
	44.0	2.33E-157
	49.5	5.27E-177
	55.0	1.20E-196
	60.5	2.78E-216
	66.0	6.45E-236
	71.5	1.51E-255
	77.0	3.55E-275
	82.5	8.38E-295
	88.0	0.00E+00
	93.5	0.00E+00
	99.0	0.00E+00
	104.5	0.00E+00
	110.0	0.00E+00

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action. Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Site being assessed:	Wrexham
Completed by:	SH
Date:	#####
Version:	1



Sensitivity Analysis – Aliphatic C10-C12 (SSTL – no impact)

Parameter	Utilised in DQRA Assessment	Range in Analysis		Resulting SSTL (ug/l)	
		Min	Max	Min	Max
Fraction Organic Carbon	0.02	0.000001	0.1	4.63E+05	No impact
Hydraulic conductivity	0.173 m/d	0.05m/d	1m/d	4.97E+169	No impact
Width of plume in aquifer in source	5m	1m	50m	No impact	
Hydraulic gradient	0.01	0.001	0.1	9.08E+129	No impact
Bulk density of aquifer	2.0 g/cm ³	1 g/cm ³	5 g/cm ³	1.19E+292	No impact
Distance to compliance point	110m	50m		No impact	
Half life for degradation in water	360 days	9.9E+99 days		2.09E-01	

The SSTL is particularly sensitive to the half life, distance to compliance point, hydraulic data and FOC in the aquifer materials.

Sensitivity Analysis – Aliphatic C21-C35 (SSTL – no impact)

Parameter	Utilised in DQRA Assessment	Range in Analysis		Resulting SSTL (mg/l)	
		Min	Max	Min	Max
Fraction Organic Carbon	0.02	0.000001	0.1	No impact	
Hydraulic conductivity	0.173 m/d	0.05m/d	1m/d	No impact	
Width of plume in aquifer in source*	5m	1m	50m	4.13E-02	No impact
Hydraulic gradient	0.01	0.001	0.1	No impact	
Bulk density of aquifer	2.0 g/cm ³	1 g/cm ³		No impact	
Distance to compliance point	110m	50m		2.90E+220	
Half life for degradation in water	1250 days	9.9E+99 days		2.09E-01	

*This has been calculated when degradation has been set at 9.9E+99

The SSTL is primarily driven by degradation rate; however it is also sensitive to the width of plume in aquifer and distance to compliance point.



Appendix I – Acceptance Criteria Site Won and Imported Materials

Appendix I.1 Validation Chemical Testing of Imported Soils (In accordance with Welsh Land Contamination Working Group Guidance, May 2013).

The determinands listed below are based on the imported soils being used in areas of soft standing.

Imported soils will be to the following testing at an MCERTS/UKAS accredited laboratory as follows:

- Fraction Organic Carbon;
- Arsenic;
- Cadmium;
- Total Chromium;
- Hexavalent Chromium;
- Lead;
- Mercury;
- Selenium;
- Total Petroleum Hydrocarbons – Criteria Working Group (TPH-CWG) with aromatic and aliphatic splits;
- Monohydric phenols;
- Speciated 16 Polycyclic Aromatic Hydrocarbons (PAHs); and,
- Screening for the presence of asbestos.

If soils are used beneath areas of hardstanding, only TPH-CWG, phenol and asbestos should be analysed.

A visual inspection of all materials to ensure that there is no visible evidence of contamination (e.g. free phase hydrocarbons, asbestos containing materials, putrescible / organic wastes, notable discolourations) or odours present.

All Materials

Analysis	Units	Criteria	Source of Criteria
General, Metals and Others			
pH	pH units	<5 >9	
Asbestos (Screen)	None	Presence	
Free Cyanide	mg/kg	40	Acute effects infant 1 dose 3g soil
Total Cyanide	mg/kg	40	Acute effects infant 1 dose 3g soil
Arsenic	mg/kg	640	C4SLs
Water soluble boron	mg/kg	240000	CIEH/LQM S4ULs
Cadmium	mg/kg	410	C4SLs
Hexavalent chromium	mg/kg	49	C4SLs
Copper	mg/kg	68000	CIEH/LQM S4ULs
Lead	mg/kg	2300	C4SLs
Mercury	mg/kg	1100	CIEH/LQM S4ULs
Nickel	mg/kg	980	CIEH/LQM S4ULs
Selenium	mg/kg	12000	CIEH/LQM S4ULs
Zinc	mg/kg	730000	CIEH/LQM S4ULs
Phenols (monohydric)	mg/kg	440	CIEH/LQM S4ULs
TPH-CWG Speciated Hydrocarbons (based on 1% SOM)			
TPH Aliphatic >C5-6	mg/kg	3200	CIEH/LQM S4ULs
TPH Aliphatic >C6-8	mg/kg	7800	CIEH/LQM S4ULs

TPH Aliphatic >C8-10	mg/kg	2000	CIEH/LQM S4ULs
TPH Aliphatic >C10-12	mg/kg	9700	CIEH/LQM S4ULs
TPH Aliphatic >C12-16	mg/kg	59000	CIEH/LQM S4ULs
TPH Aliphatic >C16-35	mg/kg	1000000	CIEH/LQM S4ULs
TPH Aromatic >EC5-7 (benzene)	mg/kg	27	C4SLs
TPH Aromatic >EC7-8	mg/kg	56000	CIEH/LQM S4ULs
TPH Aromatic >EC8-10	mg/kg	3500	CIEH/LQM S4ULs
TPH Aromatic >EC10-12	mg/kg	16000	CIEH/LQM S4ULs
TPH Aromatic >EC12-16	mg/kg	36000	CIEH/LQM S4ULs
TPH Aromatic >EC16-21	mg/kg	28000	CIEH/LQM S4ULs
TPH Aromatic >EC21-35	mg/kg	28000	CIEH/LQM S4ULs
PolyAromatic Hydrocarbons (PAHs)			
Naphthalene (1% SOM)	mg/kg	190	CIEH/LQM S4ULs
Benzo(a)pyrene	mg/kg	77	C4SLs

*In order to use benzo(a)pyrene as a surrogate marker of PAH the profile of the genotoxic PAHs relative to BaP must be tested as described above.

Criteria based on publically available commercial end use.

Appendix I.2 Validation Chemical Testing – Reuse of Site Soils Beneath Hardstanding

Site won soils to be used below hardstanding will be subject to the following testing at an MCERTS/UKAS accredited laboratory as follows:

- Total Petroleum Hydrocarbons – Criteria Working Group (TPH-CWG) with aromatic and aliphatic splits;
- Volatile Organic Carbons (VOCs)
- Phenol
- Asbestos presence

A visual inspection of all materials to ensure that there is no visible evidence of contamination (e.g. free phase hydrocarbons, asbestos containing materials, putrescible / organic wastes, notable discolourations) or odours present.

All Materials

Analysis	Units	Criteria	Source of Criteria
Misc			
Phenol	mg/kg	440	CIEH/LQM S4ULs
Asbestos	%	Presence	-
TPH-CWG Speciated Hydrocarbons (based on 1% SOM)			
TPH Aliphatic >C5-6	mg/kg	3200	CIEH/LQM S4ULs
TPH Aliphatic >C6-8	mg/kg	7800	CIEH/LQM S4ULs
TPH Aliphatic >C8-10	mg/kg	2000	CIEH/LQM S4ULs
TPH Aliphatic >C10-12	mg/kg	9700	CIEH/LQM S4ULs
TPH Aliphatic >C12-16	mg/kg	59000	CIEH/LQM S4ULs
TPH Aliphatic >C16-35	mg/kg	1000000	CIEH/LQM S4ULs
TPH Aromatic >EC5-7 (benzene)	mg/kg	27	C4SLs
TPH Aromatic >EC7-8	mg/kg	56000	CIEH/LQM S4ULs
TPH Aromatic >EC8-10	mg/kg	3500	CIEH/LQM S4ULs
TPH Aromatic >EC10-12	mg/kg	16000	CIEH/LQM S4ULs
TPH Aromatic >EC12-16	mg/kg	36000	CIEH/LQM S4ULs
TPH Aromatic >EC16-21	mg/kg	28000	CIEH/LQM S4ULs
TPH Aromatic >EC21-35	mg/kg	28000	CIEH/LQM S4ULs
Volatile Organic Carbons (VOCs)			
Trichloroethene (TCE)	ug/kg	1200	CIEH/LQM S4ULs

Criteria based on publically available commercial end use.

Appendix I.3 Validation Chemical Testing – Reuse of Site Soils in Areas of Soft Standing

Site won soils to be used near surface sampled will be subject to the following testing at an

MCERTS/UKAS accredited laboratory as follows:

- Fraction Organic Carbon;
- Arsenic;
- Water Soluble Boron;
- Cadmium;
- Total Chromium;
- Hexavalent Chromium;
- Copper;
- Free / total cyanide;
- Lead;
- Mercury;
- Nickel;
- Selenium;
- Zinc;
- pH;
- Total Petroleum Hydrocarbons – Criteria Working Group (TPH-CWG) with aromatic and aliphatic splits;
- Monohydric phenols;
- Speciated 16 Polycyclic Aromatic Hydrocarbons (PAHs);
- Volatile Organic Carbons (VOCs) and,
- Screening for the presence of asbestos.

A visual inspection of all materials to ensure that there is no visible evidence of contamination (e.g. free phase hydrocarbons, asbestos containing materials, putrescible / organic wastes, notable discolourations) or odours present.

All Materials

Analysis	Units	Criteria	Source of Criteria
General, Metals and Others			
pH	pH units	<5 >9	
Asbestos (Screen)	None	Presence	
Free Cyanide	mg/kg	40	Acute effects infant 1 dose 3g soil
Total Cyanide	mg/kg	40	Acute effects infant 1 dose 3g soil
Arsenic	mg/kg	640	C4SLs
Water soluble boron	mg/kg	240000	CIEH/LQM S4ULs
Cadmium	mg/kg	410	C4SLs
Hexavalent chromium	mg/kg	49	C4SLs
Copper	mg/kg	68000	CIEH/LQM S4ULs
Lead	mg/kg	2300	C4SLs
Mercury	mg/kg	1100	CIEH/LQM S4ULs
Nickel	mg/kg	980	CIEH/LQM S4ULs
Selenium	mg/kg	12000	CIEH/LQM S4ULs
Zinc	mg/kg	730000	CIEH/LQM S4ULs
Phenols (monohydric)	mg/kg	440	CIEH/LQM S4ULs

TPH-CWG Speciated Hydrocarbons (based on 1% SOM)			
TPH Aliphatic >C5-6	mg/kg	3200	CIEH/LQM S4ULs
TPH Aliphatic >C6-8	mg/kg	7800	CIEH/LQM S4ULs
TPH Aliphatic >C8-10	mg/kg	2000	CIEH/LQM S4ULs
TPH Aliphatic >C10-12	mg/kg	9700	CIEH/LQM S4ULs
TPH Aliphatic >C12-16	mg/kg	59000	CIEH/LQM S4ULs
TPH Aliphatic >C16-35	mg/kg	1000000	CIEH/LQM S4ULs
TPH Aromatic >EC5-7 (benzene)	mg/kg	27	C4SLs
TPH Aromatic >EC7-8	mg/kg	56000	CIEH/LQM S4ULs
TPH Aromatic >EC8-10	mg/kg	3500	CIEH/LQM S4ULs
TPH Aromatic >EC10-12	mg/kg	16000	CIEH/LQM S4ULs
TPH Aromatic >EC12-16	mg/kg	36000	CIEH/LQM S4ULs
TPH Aromatic >EC16-21	mg/kg	28000	CIEH/LQM S4ULs
TPH Aromatic >EC21-35	mg/kg	28000	CIEH/LQM S4ULs
PolyAromatic Hydrocarbons (PAHs)			
Naphthalene (1% SOM)	mg/kg	190	CIEH/LQM S4ULs
Benzo(a)pyrene	mg/kg	77	C4SLs
Volatile Organic Carbons (VOCs)			
Trichloroethene (TCE)	ug/kg	1200	CIEH/LQM S4ULs

*In order to use benzo(a)pyrene as a surrogate marker of PAH the profile of the genotoxic PAHs relative to BaP must be tested as described above.

Criteria based on publically available commercial end use.