



Client:
Patrick Berry

Architect/Consultant
Trevor Mennell
The Gables, Kendricks Bank
Bayston Hill
Shrewsbury
Shropshire
SY3 0EH

Phase II Contaminated Land Risk Assessment

Land at Stryt y Bydden, New Broughton, Wrexham

Feb 2024

Site Ref: 6144/VBW-CLRA v1.00

Unit 4
Sheffield Street
Heaton Norris
Stockport
Cheshire
SK4 1RU
Telephone : 0161 480 8885
e-mail : info@geoassist.co.uk

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Architect/Consultant
Trevor Mennell
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1. Introduction	4
2. Description of the Site	5
2.1 Present.....	5
2.2 Proposed	5
3. Review Of Previous Reports	5
4. Preliminary Conceptual Model	6
5. Intrusive Investigation	7
5.1 Intrusive Investigation objectives	7
5.2 Intrusive Investigation Strategy	7
5.3 Methods Used for Forming Exploratory Holes	7
5.4 Exploratory Hole Programme	7
5.5 Field Sampling and Testing	8
6. Laboratory Investigation	9
6.1 Contamination Testing.....	9
7. Subsurface Stratigraphy	10
8. Groundwater	10
9. Ground Gas	10
10. Part IIA Legislation	11
10.1 Assessment Methodology	11
10.2 Soils	12
10.4 Subsoil Deposits.....	13
11. Discussion	14
12. Remediation.....	14
13. Conceptual Model.....	15
14. Conclusions	16
14.1 Supplementary Recommendations	16

Appendices

- A1. Site Plan with Exploratory Hole Locations
- A2. Proposed Site Plan
- B1. Exploratory Hole Logs
- C1. i2 Chemical Test Results - Soils
- C2. Analysis of Results with Assessment Criteria - Soils

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Phase II Contaminated Land Risk Assessment

1. Introduction

This report is an account of a Phase II Contaminated Land Risk Assessment carried out by GeoAssist Limited at the request of the Client, Patrick Berry, for the proposed development of a traveller site on former railway land on Stryt y Bydden, Wrexham.

The work was commissioned following the receipt of instruction to proceed issued by the Client on the 17th January 2024.

The purpose of this Phase II investigation is to provide information in order to ensure that the site:

- Is assessed in accordance with the UK government methodology outlined online in Land Contamination Risk Management (LCRM) and as cited in Development of Land Affected by Contamination Developers Guide Version 4 September 2023 issued by the Welsh Local Government Association and Natural Resources Wales.
- Is suitable for the intended proposed land use. In this case, as a managed residential development.

The approximate grid reference for the centre of the site is 331258, 351024 and the total area of the site is approximately 1,800m². The area of the site scheduled for investigation is outlined with a solid red line on the site plan in Appendix A1. The positions of exploratory holes are also indicated on the plan. The proposed development plan is shown in appendix A2.

2. Description of the Site

2.1 Present

The site is located on Strytybydden, Wrexham. The site forms a rectangular shape and the topography of the site is relatively level. The agricultural land along the north eastern boundary is approximately 0.50m lower than the site level. There are no permanent structures on site and the ground cover is made up of a compacted gravel surface across the entire site. The content of the gravel appears to be made up from locally derived inert sandy gravel and cobbles with occasional bricks and cinders and there are no obvious signs of any other contaminants. The site boundary is formed by; Strytybydden and agricultural land to the west, Agricultural land to the east. A storage yard to the south and residential property to the north. At the time of the fieldwork there was no obvious visual or olfactory observations of contaminants noted.

2.2 Proposed

It is understood that the proposed development incorporates:

- The change of use of the lane to a traveller site with 4 pitches. The proposed development plan for the Site forms appendix A2 to this report.

3. Review Of Previous Reports

There is no indication that previous subsurface ground investigations have been undertaken on this site.

The issues to be covered in the present investigation are to provide information in respect of any potentially unacceptable geo-environmental risks arising from previous land uses both on site and in the immediate area, and the potential for any sources of contamination to impact both present and future receptors, including:

- Human
- Controlled waters via established pathways
- Property
- Adjoining land

4. Preliminary Conceptual Model

An outline conceptual model has been developed based on knowledge of the former use of the site as a railway track bed. Readily available online historical mapping does not indicate any other previous uses. The site and immediate surrounds have remained fairly unchanged throughout the past 150 years.

Potential Source /Hazard	Nature of Hazard (Risk Level to site given a Residential end use)	Contaminants Associated with Source	Potential Pathway	Potential Receptor
<i>Previous & Present ON SITE Land uses:</i>				
1. Railway Land (track Bed Only) Possible Made Ground in embankment along route	Ground contamination Low to Moderate Risk	Heavy Metals PAH	Dermal Contact Ingestion Inhalation	Site Users Construction workers Controlled Waters
	Gas from in-filled ground Low to Moderate Risk	Low CO2	Vertical and Lateral Migration	Site Users Future Buildings & Services
<i>Previous OFF SITE land uses within 250m as indicated by Historical Plans Including:</i>				
2. Railway Land	Ground contamination Low Risk	See DoE Profiles	Dermal Contact Ingestion Inhalation	Site Users Construction workers Controlled Waters
	Gas from in-filled ground Low Risk	None	Vertical and Lateral Migration	Site Users Future Buildings & Services
3. Coal Workings & Mineral Extraction	Geotechnical Hazard Low Risk	None	Ground Collapse Subsidence	Humans (site users) Future Buildings & Services
	Ground contamination Low Risk	None	None	Site Users Services
	Mine Gas Low Risk	None	None	Humans (site users) Future Buildings & Services

5. Intrusive Investigation

5.1 Intrusive Investigation objectives

The objectives of the site investigation are to collect data to confirm whether or not the soils beneath the site in their current state pose a risk by reason of substances within or under the land that;

- Significant harm is being caused or there is significant possibility of such harm being caused; or
- Pollution of controlled waters is being, or is likely to be, caused.

Data to describe the following parameters has been collected at a suitable spatial resolution in accordance with BS10175, 2015:

- Soil Characteristics including type of material
- Chemical profile of the soil.
- Hydrological regime beneath the site

The data will be used to refine the conceptual site model and confirm the existence of any established contaminant/pollutant linkage in accordance with the UK government methodology outlined online in Land Contamination Risk Management (LCRM) as well as The Environment Agency Requirements for Land Contamination Reports, 2005 where appropriate.

5.2 Intrusive Investigation Strategy

The ground investigation was carried out in accordance with British Standard 5930: 2015 Code of Practice for Site Investigations and BS BS10175: 2015 Investigation of potentially contaminated sites where relevant.

All fieldwork was supervised by suitably qualified GeoAssist Limited Environmental Engineers.

The analytical testing was carried out in an independent UKAS accredited Laboratory.

5.3 Methods Used for Forming Exploratory Holes

The exploratory holes drilled across the Site as part of this investigation were established using:

- § Windowless sampling percussive drilling methods with casing advancement

Information provided by the Client regarding the position of proposed structures areas was used to inform a decision on the actual exploratory hole locations.

In general, the windowless dynamic sampling holes were used to determine the shallow soils profile and obtain analytical samples for contamination testing. The location of any above and below ground services was also considered during the positioning of the exploratory holes. A plan showing the locations of the exploratory holes established as part of the investigation forms Appendix A1 to this report.

5.4 Exploratory Hole Programme

In total 8 exploratory holes were established across the Site by GeoAssist utilising the exploration techniques as outlined below:

- § 8 exploratory holes WS1 to WS8 were undertaken across the Site using windowless sampling

The details of the strata in the exploratory holes were recorded by a suitably qualified Professional Engineer. Upon completion the WS series exploratory holes were backfilled with inert clean soil of a similar type to that removed in accordance with the specification to prevent the creation of any preferential pathways.

All intrusive work was carried out in accordance with:

§ British Standard 5930: 2015 Code of Practice for Site Investigations

§ British Standard 10175: 2011 where applicable

The fieldwork for all exploratory holes was commenced and completed on 13/02/2024 in cold, dry weather conditions. The location of the exploratory holes are shown on the site plan in Appendix A1.

5.5 Field Sampling and Testing

A non-targeted borehole layout was selected as the most appropriate strategy for this site given the visible uniform nature of the surface materials on the site and knowledge of the past use of the site. Representative samples were taken of all the strata encountered in the exploratory holes. Once exposed samples to be subjected to chemical analysis were immediately placed into a suitable container and stored in a cool dark sample box prior to submission to the laboratory in order to prevent alteration of the composition of the samples. In all cases 500ml wide necked amber glass jars were used with a Teflon faced foamed polyethylene cap liner that offers excellent chemical resistance with the compressibility and sealing properties of polyethylene foam. These containers were filled with sample, sealed and delivered to the laboratory for testing. Samples for volatile compounds were placed into appropriate containers with a screw cap and pierceable septum as supplied by the testing laboratory specifically appropriate to the determinand. These containers were filled with sample sealed and delivered to the laboratory for testing. Observations of groundwater conditions were recorded throughout the fieldwork operations where encountered.

All other samples were stored in airtight containers and returned to the laboratory for examination and geotechnical testing where necessary.

A photo ionisation detector (PID) with a 10.6eV lamp was used as a screening tool to indicate the likelihood of the presence of volatile organic compounds throughout the profile of the shallow soils in the laboratory. The PID results are all given as isobutylene equivalents and are included within the Exploratory Hole Logs only where elevated readings were noted (10ppm). None were recorded.

6. Laboratory Investigation

6.1 Contamination Testing

In total 11 soil samples were collected and subjected to elements of the suite of chemical testing as outlined below. All tests were conducted by i2 Analytical under UKAS Testing No 4041. The results of all the chemical analysis tests are given in appendix C1.

Soils	
Arsenic	Acenaphthene
Boron (water-soluble)	Acenaphthylene
Cadmium	Anthracene
Chromium	Benzo(a)Anthracene
Chromium VI	Benzo(a)Pyrene
Copper	Benzo(b/k)Fluoranthene
Cyanide(Total)	Benzo(ghi)Perylene
Cyanide(free)	Chrysene
Lead	Dibenzo(ah)Anthracene
Mercury	Fluoranthene
Nickel	Fluorene
pH	Indeno(123-cd)Pyrene
Phenols(Mono)	Naphthalene
Selenium	Phenanthrene
SO4(Total)	Pyrene
Sulphide	BTEX & MTBE (where PID Screening indicates a requirement)
Sulphur(Free)	Speciated TPH (where PID Screening indicates a requirement)
Thiocyanate	VOCs (where PID Screening indicates a requirement)
Zinc	Asbestos ID (screen)

7. Subsurface Stratigraphy

The subsoil profile obtained from the exploratory holes WS1 to WS8 follows a sequence of granular made ground consisting of sandy gravel with cinders and sandstone cobbles over natural granular mixed sandy gravel, with sandstone fragments and cobbles.

The WS holes all extended into and terminated in the natural underlying granular drift deposits

Table 7.0 Subsoil Profile Summary

Strata	Depth of Strata (m) below ground level	
	Top	Base
Sandy gravel with cinders and sandstone cobbles – MADE GROUND	Ground Level	0.30 to 1.00
Sand / Sandy Gravel with sandstone fragments and cobbles	0.30 to 1.00	>3.00

Further details of the subsurface stratigraphy can be found in the exploratory hole log sheets which form Appendix B1 to this report.

8. Groundwater

Seepage groundwater was not encountered during the course of the fieldwork. The groundwater conditions entered on the exploratory hole logs are those observed at the time of the investigation and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken.

Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.

9. Ground Gas

The inert granular nature and the very limited depth of the Made Ground encountered at this site and the absence of any other potential gas sources identified from historical mapping indicates a low probability for the presence of ground gas at the site. Consequently the site has been categorised as Low Risk for ground gas and no further action is required.

10. Part IIA Legislation

Part IIA of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) provides a new regime for the control of specific threats to health or the environment from existing land contamination. In accordance with the Act and the statutory guidance document on The Contaminated Land (England) Regulations 2000, the definition of contaminated land is intended to embody the concept of risk assessment. Within the meaning of the Act, land is only “contaminated land” where it appears to the regulatory authority, by reason of substances within or under the land that

- § Significant harm is being caused or there is significant possibility of such harm being caused; or
- § Pollution of controlled waters is being, or is likely to be, caused.

The guidance defines “risk” as the combination of

- § The probability, or frequency, of occurrence of a defined hazard (for example, exposure of a property to a substance with the potential to cause harm); and
- § The magnitude (including the seriousness) of the consequences.

For a risk of pollution or environmental harm to occur as a result of ground contamination, all of the following elements must be present:

- § A source, i.e. a substance that is capable of causing pollution or harm;
- § A receptor (or target). i.e. something which could be adversely affected by the contaminant; and
- § A pathway, i.e. a route by which the contaminant can reach the receptor.

If one of these elements is missing there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

10.1 Assessment Methodology

In order to assess the environmental risk posed by potential contaminants within the near surface soils considering the final levels of the scheme, GeoAssist Limited undertook an initial screen of the laboratory results using GeoAssist Limited Generic Assessment Criteria (GACs) and where applicable Category 4 Screening Levels as given as part of Appendix C2.

The GeoAssist Limited GACs and Category 4 Screening levels (C4SLs herein) are generated in consideration of the proposed end use of the Site, in this case as residential land. Contaminant concentrations below the GACs and or C4SLs levels are considered not to warrant further risk assessment. Concentrations of potential contaminants above the GACs and C4SLs levels require further consideration of the potential pollutant linkages. It should be noted that exceedance of the GACs and or C4SLs levels does not necessarily mean that the Site requires remediation, although this is dependent on the nature, type and depth of the contaminant and further justification may be required.

10.2 Soils

For assessment of the soil analysis results with regard to potential human health risks, GeoAssist Limited GACs are selected from the following sources which represent minimal risk to site users:

CLEA Soil Guideline Values (SGVs). These values have been developed by the Department of the Environment, Food and Rural Affairs (DEFRA) and the Environment Agency (EA) using the Contaminated Land Exposure Assessment (CLEA) Model, and are considered to be protective of human health (considered to be a potential receptor on site). To date, SGVs have been published for only a limited suite of contaminants, with SGVs derived for each contaminant for three different land use scenarios namely:

- § residential
- § allotments
- § commercial and industrial.

The proposed assessment of this site is as residential land as this is considered to be the most appropriate land use scenario for the proposed situation on site.

Chartered Institute of Environmental Health Generic Assessment Criteria (LQM CIEH GAC) have been used where available and where CLEA SGVs have not yet been published.

Where CLEA or LQIM CIEH GAC values are not available, Atkins at Risk GAC values have been selected as appropriate all of which represent a minimal risk to receptors.

C4SLs and where appropriate the surrogate marker approach for PAH compounds have been used in preference to LQM S4UL and these represent a Low Level of Toxicological Concern (LLTC herein). LLTC represent an intake of low concern that remains suitably protective of health, and definitely does not approach an intake level that could be defined as Significant Possibility of Significant Harm.

The CLEA guidelines state that for each contaminant, apart from lead, the upper 95th percentile of the mean measured concentration should be calculated where appropriate and this value should be compared to the applicable screening value (defined here as the GeoAssist Limited GACs).

For Lead impacts the geometric mean should be calculated and compared to the GAC or C4SL.

The CLEA model states that, 'the contamination is assumed to be at or within 1 m of the surface (CLR10 page 10 now withdrawn). It is considered that at depths greater than 1m, the probability of human exposure via the direct contact pathways are significantly reduced, leaving inhalation of volatile compounds as the dominant pathway. Typically, volatile compounds only significantly affect the indoor inhalation pathway.

10.4 Subsoil Deposits

The soils contaminants that were identified above the GeoAssist Limited GACs, SGVs and C4SLs for a residential with gardens end use from the GeoAssist Limited investigations are summarized below.

Table 10.4 Tier one summary of identified soils impacts.

Determinand	GAC (mg/kg) Residential	Total tests	No. of / No. of tests in impacted strata (Made Ground)	No. of samples exceeding SGV/GAC/ C4SL	Max Value (mg/kg)	Treat as Hotspot	US95 Value	Further action required
None Identified								

sm Surrogate marker approach

The analytical laboratory test results and analysis are presented in appendix C1 & C2 and have not identified any risks to end users of the Site from elevated levels of anthropogenic contamination within the near surface or deeper natural superficial deposits on the Site. Results have confirmed that no samples were found to exceed the applicable assessment criteria and the site may be considered not to present a significant possibility of significant harm to human health in the context of Part IIA. Consequently, the upper shallow made ground across the site does not require remedial action.

Asbestos fibres were not detected to be present within any of the samples where tests were conducted. Good practice has been used to ensure that the soil samples submitted to the laboratory are likely to be representative of those found across the site. and experience dictates that the likely age and the make up of the made ground encountered across the site does not give rise to any particular concerns regarding the likely presence of ACM. The results of all the chemical laboratory analytical tests form appendix C1 to this report and the analysis of the results forms appendix C2 to this report.

11. Discussion

The assessment of the chemical laboratory analytical tests has identified that the soils on this site pose little risk to present site end users or proposed development site end users when assessed in accordance with the current UK methodology. Consequently, the risk to end users from ground contamination is classified as low given a residential with plant uptake end use scenario of the site.

The soft landscaped areas of the Site will have a minimum suitable growth medium depth of 100mm. Any imported non first generation soil or aggregate materials will need to be tested at a rate of not less than 1 test per 20m³ of imported material or where imported volumes are less than 60m³ a minimum of 3 tests per source will be required.

Analysis of drift materials and overlying made ground indicate that the underlying principal aquifer beneath the Site and any close by controlled waters are highly unlikely to be at significant risk from the soils on this site as a function of the low levels and immobility of the determinants identified in the made ground and drift materials. Waste Acceptance Criteria testing (WAC herein) has not been undertaken. The results of the solid soils analysis indicate that soils arising from excavations on site are likely to be classified as inert for disposal purposes. However, It is recommended that the advice of a specialist waste haulage contractor be sought prior to disposal. It should be noted that disposal at landfill is not the only option for materials leaving the Site and off site recycling of all arisings through a recognised EA hub site using the voluntary code of practice (COP) could present opportunities for significant savings over traditional landfilling. It is the duty of the developer to maintain adequate lines of evidence, such as waste transfer notes, that waste movements conform with the current UK regulations.

The results of asbestos fibre screening indicate that Asbestos fibres were not detected in the samples of made ground submitted for analysis.

The risk to construction workers from on site generated dusts as part of the site preparatory works is assessed to be low as a function of the age class of the receptor and the anticipated limited exposure durations of this group. Nonetheless, it is recommended that standard PPE & RPE including correctly fitted particulate masks and disposable coveralls and gloves should be worn by operatives as a matter of course during removal of made ground.

The risk to building services from chemical attack is likely to be low given the low risk status of the site and standard HDPE pipe is acceptable for use on site.

12. Remediation

Given the soils on site present a low risk to both, site end user receptors and the wider environment, the production of a remediation scheme is not deemed to be a requirement on this site. GeoAssist do not consider the importation of topsoil/growth medium as a remediation activity and this does not require a remediation strategy. However validation sampling of imported materials may be a requirement of the LPA. It is the duty of the developer to maintain adequate lines of evidence that imported soils are suitable and failure to provide the

necessary evidential information such as waste transfer notes, photographs, delivery notes for imported soils could lead to planning delays and cost increases in the final completion stages of the development for which the developer will be responsible.

13. Conceptual Model

The updated conceptual model based on the information and test results presented in this report including contamination sources, pathways and receptors is presented below.

Table 13 Amended Conceptual Site Model based on information as presented within this report.

Potential Source /Hazard	Nature of Hazard (Risk Level to site given a Residential end use)	Contaminants Associated with Source	Potential Pathway	Potential Receptor
<i>Previous & Present ON SITE Land uses:</i>				
1. Railway Land (track Bed Only) Possible Made Ground in embankment along route	Ground contamination Low Risk	None	None	Site Users Construction workers Controlled Waters
	Gas from in-filled ground Low Risk	None	None	Site Users Future Buildings & Services
<i>Previous OFF SITE land uses within 250m as indicated by Historical Plans Including:</i>				
2. Railway Land	Ground contamination Low Risk	None	None	Site Users Construction workers Controlled Waters
	Gas from in-filled ground Low Risk	None	None	Site Users Future Buildings & Services
3. Coal Workings & Mineral Extraction	Geotechnical Hazard Low Risk	None	Ground Collapse Subsidence	Humans (site users) Future Buildings & Services
	Ground contamination Low Risk	None	None	Site Users Services
	Mine Gas Low Risk	None	None	Humans (site users) Future Buildings & Services

Only sources that have not been present on site in the past or currently are considered within the off site category. Unless the information is deemed to be pertinent to the analysis.

14. Conclusions

Evidence presented elsewhere within this report indicates that there is:

- A Low Risk to end user receptors from soil contamination at the site in its present condition
- The site presents a Low Risk to controlled waters and the wider environment in its present condition
- The proposed development presents a Low Risk to end user receptors from soil contamination.
- The proposed development presents a Low Risk to controlled waters and the wider environment.

14.1 Supplementary Recommendations

Any evidence of contamination encountered during site development and not previously identified within the ground investigation will be brought to the attention of the LPA as soon as is practicably possible along with an appropriate action plan for remediation.



Matthew Benson MSc. GMICE
Geotechnical/Environmental Engineer



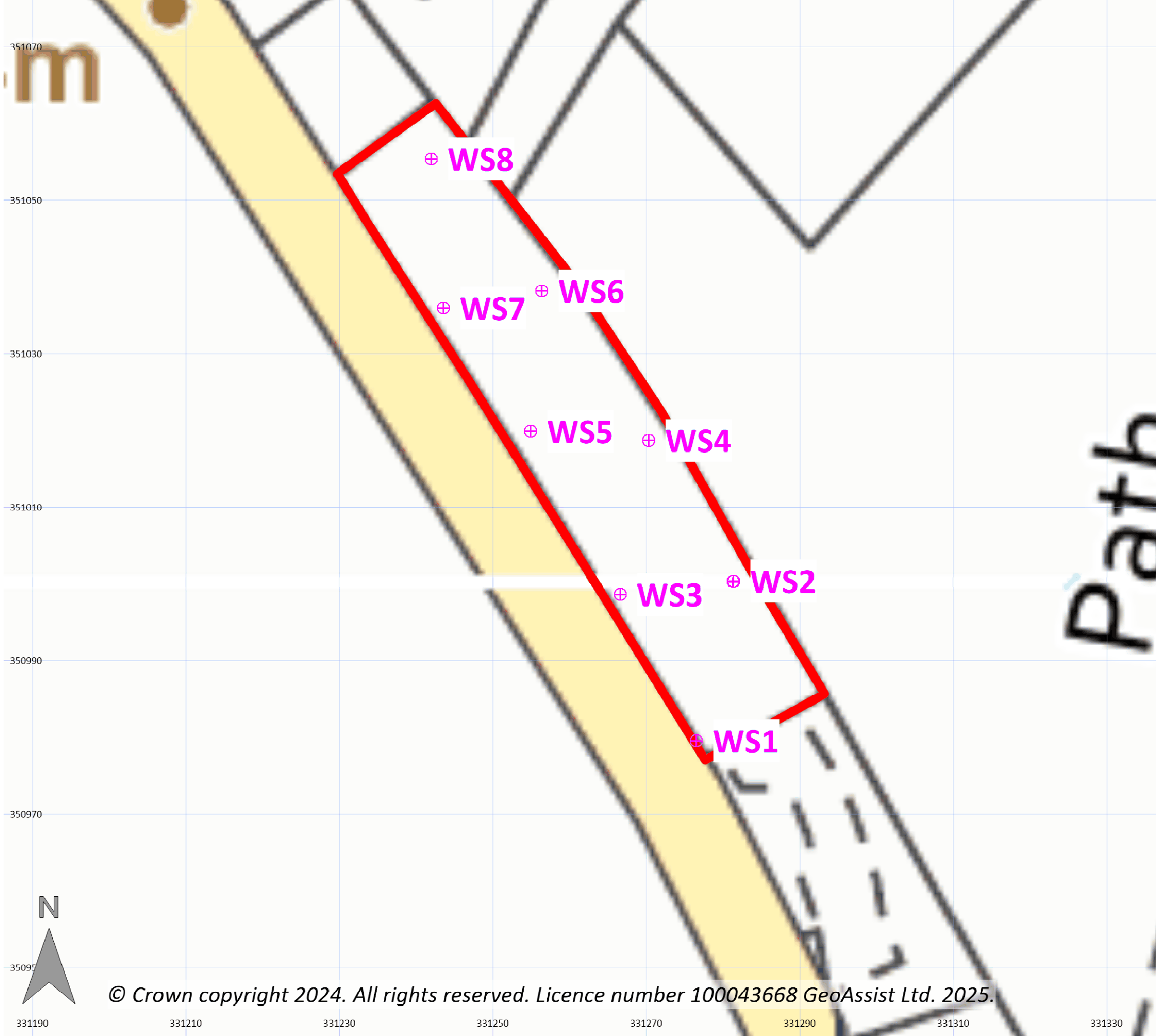
Mark Richardson MSc CEng MICE
Technical Director

Field investigations have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions are, and can be, variable and have only been tested at isolated locations across the site. Therefore, the potential exists for ground conditions to be encountered which are different to those considered in this report. Chemical analysis was conducted for a number of parameters based on an expert understanding of the historical and operational data available at the time and it should not be inferred or otherwise, that other chemical species are not present.

This report has been prepared by GeoAssist Limited with all reasonable professional skill, care and diligence within the terms of the contract with Patrick Berry. The report is confidential to Patrick Berry, their /the named persons, advisors and bankers, and GeoAssist Limited accepts no responsibility of whatever nature to third parties to whom this report may be divulged. GeoAssist Limited owns the copyright in this report. All rights are reserved and unauthorised use is prohibited. Patrick Berry may use the report for their/her/his own purposes.

Appendix A

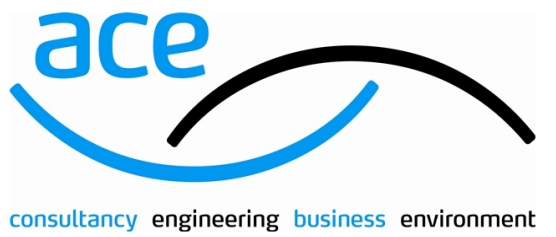
- A1 Site Plan & Exploratory Hole Locations
- A2 Proposed Site Plan



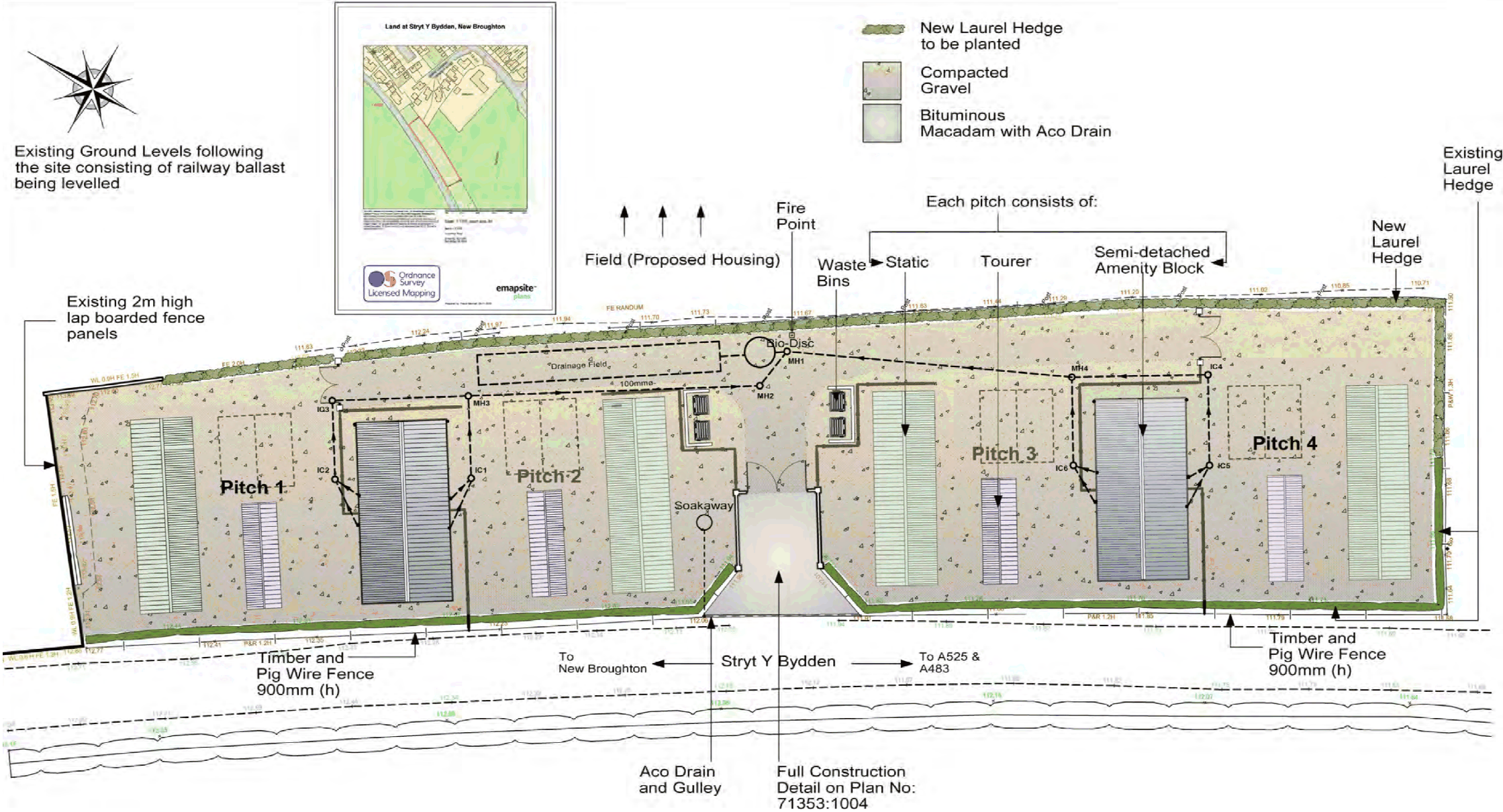
A1 Site Plan

Site Name	Land at Stryt y Bydden, New Broughton
Location	Wrexham
GeoAssist Ref	6144VBW
Client	Patrick Berry
Planning Consultant	Trevor Mennell
NGR (centre of site)	331258,351024
Production Date	Feb 2024
Survey Method	
Surveyor	Others
Status	Final v1.00
Base Survey	OSGB36

Do Not Scale



6144GALv1.00



A2 Site Development Plan

Site Name	Land at Stryt y Bydden, New Broughton
Location	Wrexham
GeoAssist Ref	6144VBW
Client	Patrick Berry
Planning Consultant	Trevor Mennell
NGR (centre of site)	331258,351024
Production Date	Feb 2024
Survey Method	
Surveyor	Others
Status	Final v1.00
Base Survey	OSGB36

Do Not Scale

Appendix B

B1 Exploratory Hole Logs

GeoAssist Limited		Exploratory Hole Record Sheet					Ref: WS1		
Consultant: Trevor Mennell		Project: Land at Stryt y Bydden, New Broughton Location: Wrexham					Sheet: 1		
Client: Patrick Berry		Equipment: Archway Dart Rig					Ground Level: 111.69 m.AOD Co-ordinates: Easting: 331276.5(m) Northing: 350979.6(m) Dates: 13/02/2024 to 13/02/2024		
Drilling Foreman: M Walton Engineer/Geologist: M Benson		STRATUM DESCRIPTION		Depth (Thick) (m)	Reduced Level (mAOD)	Strata Legend/ Standpipe Backfill	Samples/Tests		Field Records
						Depth (m) from to	Sample Type/No	Blow Count N/(U)	
0 Dark brown gravelly sand - MADE GROUND		(0.50) 0.50	111.19			0.20 0.30	C1		13/02/2024: On completion of exploratory hole at 3.00m. Casing at 1.00m. Standing water level Nil with casing. On withdrawal of casing exploratory hole backfilled and reinstated
Red/brown silty sand with sandstone fragments - MADE GROUND		0.70	110.99						
Brown sandy GRAVEL with occasional cobbles		1.00	110.69						
1 Brown/dark brown/grey sandy GRAVEL with sandstone fragments and cobbles						1.10 1.20	C2		
2		(2.00)							
3		3.00	108.69						
Exploratory Hole complete at 3.00m									
4									
5									
6									
7									
8									
9									
10									

Remarks:		Logged: M Benson
The groundwater conditions entered on the exploratory hole logs are those observed at the time of the drilling operations and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken.		Date: 14/02/2024
Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.		Checked: M Richardson
		Date: 14/02/2024
		Site Ref: 6144/VBW
		Scale 1:50

GeoAssist Limited		Exploratory Hole Record Sheet					Ref: WS2			
Consultant: Trevor Mennell		Project: Land at Stryt y Bydden, New Broughton Location: Wrexham					Sheet: 1			
Client: Patrick Berry		Equipment: Archway Dart Rig					Ground Level: 111.87 m.AOD Co-ordinates: Easting: 331281.3(m) Northing: 351000.4(m) Dates: 13/02/2024 to 13/02/2024			
Drilling Foreman: M Walton STRATUM DESCRIPTION Engineer/Geologist: M Benson		Depth (Thick) (m)	Reduced Level (mAOD)	Strata Legend/ Standpipe Backfill	Samples/Tests Depth (m) from to			Sample Type/No	Blow Count N/(U)	Field Records
0 Dark brown/dark grey clayey sand and gravel with cinders and sandstone cobbles - MADE GROUND		(1.00)			0.20	0.30	C1			13/02/2024: On completion of exploratory hole at 3.00m. Casing at 1.00m. Standing water level Nil with casing. On withdrawal of casing exploratory hole backfilled and reinstated
1 Brown/dark brown/grey sandy GRAVEL with sandstone fragments and cobbles		1.00	110.87							
2		(2.00)								
3 Exploratory Hole complete at 3.00m		3.00	108.87							
4										
5										
6										
7										
8										
9										
10										
Remarks: The groundwater conditions entered on the exploratory hole logs are those observed at the time of the drilling operations and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken. Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.								Logged: M Benson Date: 14/02/2024 Checked: M Richardson Date: 14/02/2024 Site Ref: 6144/VBW Scale 1:50		

GeoAssist Limited		Exploratory Hole Record Sheet					Ref: WS3			
Consultant: Trevor Mennell		Project: Land at Stryt y Bydden, New Broughton Location: Wrexham					Sheet: 1			
Client: Patrick Berry		Equipment: Archway Dart Rig					Ground Level: 111.71 m.AOD Co-ordinates: Easting: 331266.6(m) Northing: 350998.6(m) Dates: 13/02/2024 to 13/02/2024			
Drilling Foreman: M Walton STRATUM DESCRIPTION Engineer/Geologist: M Benson		Depth (Thick) (m)	Reduced Level (mAOD)	Strata Legend/ Standpipe Backfill	Samples/Tests Depth (m) from to			Sample Type/No	Blow Count N/(U)	Field Records
0 Dark brown/dark grey sandy gravel with cinders - MADE GROUND		(0.60) 0.60	111.11		0.20	0.30	C1			13/02/2024: On completion of exploratory hole at 2.40m. Casing at 1.00m. Standing water level Nil with casing. On withdrawal of casing exploratory hole backfilled and reinstated
Dark brown/brown gravelly silty SAND with sandstone cobbles		(0.40) 1.00	110.71							
1 Brown/grey sandy GRAVEL with sandstone cobbles		(1.40)								
2 Exploratory Hole complete at 2.40m		2.40	109.31							
3										
4										
5										
6										
7										
8										
9										
10										
Remarks: The groundwater conditions entered on the exploratory hole logs are those observed at the time of the drilling operations and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken. Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.								Logged: M Benson Date: 14/02/2024 Checked: M Richardson Date: 14/02/2024 Site Ref: 6144/VBW Scale 1:50		

GeoAssist Limited		Exploratory Hole Record Sheet					Ref: WS4	
Consultant: Trevor Mennell		Project: Land at Stryt y Bydden, New Broughton Location: Wrexham					Sheet: 1	
Client: Patrick Berry		Equipment: Archway Dart Rig					Ground Level: 112.15 m.AOD Co-ordinates: Easting: 331270.3(m) Northing: 351018.7(m) Dates: 13/02/2024 to 13/02/2024	
Drilling Foreman: M Walton STRATUM DESCRIPTION Engineer/Geologist: M Benson		Depth (Thick) (m)	Reduced Level (mAOD)	Strata Legend/ Standpipe Backfill	Samples/Tests			Field Records
					Depth (m) from to	Sample Type/No	Blow Count N/(U)	
0 Dark brown/brown clayey silty sand with sandstone fragments and cobbles - MADE GROUND		(0.70)			0.20	0.30	C1	13/02/2024: On completion of exploratory hole at 3.00m. Casing at 1.00m. Standing water level Nil with casing. On withdrawal of casing exploratory hole backfilled and reinstated
Brown silty SAND with sandstone fragments		0.70	111.45					
1 Brown SAND and GRAVEL with sandstone cobbles and clayey in parts		1.00	111.15		1.00	1.10	C2	
2		(2.00)						
3 Exploratory Hole complete at 3.00m		3.00	109.15					
4								
5								
6								
7								
8								
9								
10								
Remarks: The groundwater conditions entered on the exploratory hole logs are those observed at the time of the drilling operations and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken. Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.							Logged: M Benson Date: 14/02/2024 Checked: M Richardson Date: 14/02/2024 Site Ref: 6144/VBW Scale 1:50	

GeoAssist Limited		Exploratory Hole Record Sheet					Ref: WS5	
Consultant: Trevor Mennell		Project: Land at Stryt y Bydden, New Broughton Location: Wrexham					Sheet: 1	
Client: Patrick Berry		Equipment: Archway Dart Rig					Ground Level: 112.07 m.AOD Co-ordinates: Easting: 331255(m) Northing: 351019.9(m) Dates: 13/02/2024 to 13/02/2024	
Drilling Foreman: M Walton STRATUM DESCRIPTION Engineer/Geologist: M Benson		Depth (Thick) (m)	Reduced Level (mAOD)	Strata Legend/ Standpipe Backfill	Samples/Tests			Field Records
					Depth (m) from to	Sample Type/No	Blow Count N/(U)	
0 Dark brown/grey sandy gravel with cinders - MADE GROUND		0.30	111.77		0.20	0.30	C1	13/02/2024: On completion of exploratory hole at 2.60m. Casing at 1.00m. Standing water level Nil with casing. On withdrawal of casing exploratory hole backfilled and reinstated
Brown/dark brown sandy GRAVEL with sandstone fragments								
1		(1.70)						
2		2.00	110.07					
Brown/grey sandy GRAVEL with sandstone fragments and cobbles		(0.60)						
2.60		109.47						
Exploratory Hole complete at 2.60m								
3								
4								
5								
6								
7								
8								
9								
10								

Remarks:		Logged: M Benson
The groundwater conditions entered on the exploratory hole logs are those observed at the time of the drilling operations and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken.		Date: 14/02/2024
Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.		Checked: M Richardson
		Date: 14/02/2024
		Site Ref: 6144/VBW
		Scale 1:50

GeoAssist Limited		Exploratory Hole Record Sheet					Ref: WS6			
Consultant: Trevor Mennell		Project: Land at Stryt y Bydden, New Broughton Location: Wrexham					Sheet: 1			
Client: Patrick Berry		Equipment: Archway Dart Rig					Ground Level: 112.51 m.AOD Co-ordinates: Easting: 331256.4(m) Northing: 351038.2(m) Dates: 13/02/2024 to 13/02/2024			
Drilling Foreman: M Walton STRATUM DESCRIPTION Engineer/Geologist: M Benson		Depth (Thick) (m)	Reduced Level (mAOD)	Strata Legend/ Standpipe Backfill	Samples/Tests Depth (m) from to			Sample Type/No	Blow Count N/(U)	Field Records
0 Dark grey sandy gravel - MADE GROUND		0.20	112.31		0.20	0.30	C1			13/02/2024: On completion of exploratory hole at 3.00m. Casing at 1.00m. Standing water level Nil with casing. On withdrawal of casing exploratory hole backfilled and reinstated
Brown/dark brown/grey clayey gravelly silty sand with cinders - MADE GROUND		(0.60) 0.80	111.71							
Brown gravelly fine to medium SAND with rootlets		1.00	111.51							
1 Brown/grey SAND and GRAVEL with sandstone fragments and cobbles and clayey in parts										
2		(2.00)								
3 Exploratory Hole complete at 3.00m		3.00	109.51							
4										
5										
6										
7										
8										
9										
10										
Remarks: The groundwater conditions entered on the exploratory hole logs are those observed at the time of the drilling operations and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken. Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.								Logged: M Benson Date: 14/02/2024 Checked: M Richardson Date: 14/02/2024 Site Ref: 6144/VBW Scale 1:50		

GeoAssist Limited		Exploratory Hole Record Sheet					Ref: WS7			
Consultant: Trevor Mennell		Project: Land at Stryt y Bydden, New Broughton Location: Wrexham					Sheet: 1			
Client: Patrick Berry		Equipment: Archway Dart Rig					Ground Level: 112.45 m.AOD Co-ordinates: Easting: 331244(m) Northing: 351036(m) Dates: 13/02/2024 to 13/02/2024			
Drilling Foreman: M Walton STRATUM DESCRIPTION Engineer/Geologist: M Benson		Depth (Thick) (m)	Reduced Level (mAOD)	Strata Legend/ Standpipe Backfill	Samples/Tests Depth (m) from to			Sample Type/No	Blow Count N/(U)	Field Records
0 Dark brown/grey sand and gravel with cinders - MADE GROUND		(0.40) 0.40	112.05		0.20	0.30	C1		13/02/2024: On completion of exploratory hole at 3.00m. Casing at 1.00m. Standing water level Nil with casing. On withdrawal of casing exploratory hole backfilled and reinstated	
Brown silty SAND with sandstone fragments		(0.60) 1.00	111.45							
1 Brown/grey SAND and GRAVEL with sandstone fragments and cobbles					1.00	1.10	C2			
2		(2.00)								
3		3.00	109.45							
Exploratory Hole complete at 3.00m										
4										
5										
6										
7										
8										
9										
10										

Remarks:		Logged: M Benson
The groundwater conditions entered on the exploratory hole logs are those observed at the time of the drilling operations and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken.		Date: 14/02/2024
Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.		Checked: M Richardson
		Date: 14/02/2024
		Site Ref: 6144/VBW
		Scale 1:50

GeoAssist Limited		Exploratory Hole Record Sheet					Ref: WS8			
Consultant: Trevor Mennell		Project: Land at Stryt y Bydden, New Broughtton Location: Wrexham					Sheet: 1			
Client: Patrick Berry		Equipment: Archway Dart Rig					Ground Level: 112.71 m.AOD Co-ordinates: Easting: 331241.9(m) Northing: 351055.4(m) Dates: 13/02/2024 to 13/02/2024			
Drilling Foreman: M Walton STRATUM DESCRIPTION Engineer/Geologist: M Benson		Depth (Thick) (m)	Reduced Level (mAOD)	Strata Legend/ Standpipe Backfill	Samples/Tests Depth (m) from to			Sample Type/No	Blow Count N/(U)	Field Records
0 Dark brown/grey sand and gravel with cinders - MADE GROUND		(0.80)			0.20	0.30	C1			13/02/2024: On completion of exploratory hole at 3.00m. Casing at 1.00m. Standing water level Nil with casing. On withdrawal of casing exploratory hole backfilled and reinstated
1 Brown clayey gravelly silty fine to medium SAND		(0.40) 1.20	111.91 111.51							
Brown/grey clayey silty SAND and GRAVEL with sandstone fragments		(0.80) 2.00	110.71							
2 Brown/grey sandy GRAVEL with sandstone fragments and cobbles		(1.00) 3.00	109.71							
3 Exploratory Hole complete at 3.00m										
4										
5										
6										
7										
8										
9										
10										
Remarks: The groundwater conditions entered on the exploratory hole logs are those observed at the time of the drilling operations and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken. Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.								Logged: M Benson Date: 14/02/2024 Checked: M Richardson Date: 14/02/2024 Site Ref: 6144/VBW Scale 1:50		

Appendix C

- C1 i2 Analytical Laboratory Test Results Soils
- C2 Analysis of Soils Results with Assessment Criteria



GeoAssist Ltd
Unit 4, Sheffield Street
Heaton Norris
Stockport
Cheshire
SK4 1RU

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

e: info@geoassist.co.uk

Analytical Report Number : 24-003533

Project / Site name:	Land at Stryt y Bydden, Wrexham	Samples received on:	15/02/2024
Your job number:	6144 VBW	Samples instructed on/ Analysis started on:	15/02/2024
Your order number:	2240213	Analysis completed by:	22/02/2024
Report Issue Number:	1	Report issued on:	23/02/2024
Samples Analysed:	11 soil samples		

Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 24-003533
Project / Site name: Land at Stryt y Bydden, Wrexham
Your Order No: 2240213

Lab Sample Number				119494	119495	119496	119497	119498
Sample Reference				WS1	WS1	WS2	WS3	WS4
Sample Number				C1	C2	C1	C1	C1
Depth (m)				0.20	1.10	0.20	0.20	0.20
Date Sampled				14/02/2024	14/02/2024	14/02/2024	14/02/2024	14/02/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	15	10	16	15	17
Total mass of sample received	kg	0.1	NONE	0.5	0.6	0.7	0.5	0.6

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	-	-	Not-detected	Not-detected	-
Asbestos Analyst ID	N/A	N/A	N/A	-	-	DSO	DSO	-

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	8.1	7.9	7	9	7.9
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO4	%	0.005	MCERTS	0.054	0.019	0.102	0.116	0.052
Sulphide	mg/kg	1	MCERTS	1	< 1.0	8.3	59	1.8
Total Sulphur	mg/kg	50	MCERTS	320	110	840	1800	320
Total Sulphur	%	0.005	MCERTS	0.032	0.011	0.084	0.179	0.031
Organic Matter (automated)	%	0.1	MCERTS	-	-	6.2	-	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.28	0.61	0.12
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.15	0.06
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.12	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.34	< 0.05	0.55	1.4	0.35
Anthracene	mg/kg	0.05	MCERTS	0.07	< 0.05	0.13	0.32	0.08
Fluoranthene	mg/kg	0.05	MCERTS	1.3	< 0.05	0.58	2.9	0.91
Pyrene	mg/kg	0.05	MCERTS	1.2	< 0.05	0.48	2.5	0.77
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.69	< 0.05	0.4	1.5	0.54
Chrysene	mg/kg	0.05	MCERTS	0.81	< 0.05	0.37	1.6	0.6
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	1.2	< 0.05	0.42	1.9	0.79
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.44	< 0.05	0.18	0.89	0.28
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.95	< 0.05	0.34	1.6	0.58
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.41	< 0.05	0.12	0.61	0.24
Dibenzo(a,h)anthracene	mg/kg	0.05	MCERTS	0.11	< 0.05	< 0.05	0.19	0.09
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.47	< 0.05	0.15	0.7	0.25

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	8	< 0.80	4	16.9	5.66
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Analytical Report Number: 24-003533
 Project / Site name: Land at Stryt y Bydden, Wrexham
 Your Order No: 2240213

Lab Sample Number				119494	119495	119496	119497	119498
Sample Reference				WS1	WS1	WS2	WS3	WS4
Sample Number				C1	C2	C1	C1	C1
Depth (m)				0.20	1.10	0.20	0.20	0.20
Date Sampled				14/02/2024	14/02/2024	14/02/2024	14/02/2024	14/02/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	9.6	9.3	20	15	12
Barium (aqua regia extractable)	mg/kg	1	MCERTS	81	110	190	540	250
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.6	0.75	1.6	2.6	0.88
Boron (water soluble)	mg/kg	0.2	MCERTS	0.4	< 0.2	0.2	0.3	1
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.6	0.4	< 0.2	0.6	0.5
Chromium (hexavalent) Low Level	mg/kg	1.2	NONE	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	26	20	21	30	17
Copper (aqua regia extractable)	mg/kg	1	MCERTS	22	18	87	64	45
Lead (aqua regia extractable)	mg/kg	1	MCERTS	79	40	88	72	170
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	1.7
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	12	25	33	34	20
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	41	23	35	59	26
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	160	41	110	140	140

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 24-003533
Project / Site name: Land at Stryt y Bydden, Wrexham
Your Order No: 2240213

Lab Sample Number				119499	119500	119501	119502	119503
Sample Reference				WS4	WS5	WS6	WS7	WS7
Sample Number				C2	C1	C1	C1	C2
Depth (m)				1.00	0.20	0.20	0.20	1.00
Date Sampled				14/02/2024	14/02/2024	14/02/2024	14/02/2024	14/02/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Stone Content	%	0.1	NONE	13	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	10	16	12	16	13
Total mass of sample received	kg	0.1	NONE	0.5	0.6	0.5	0.5	0.6

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	-	Not-detected	-	Not-detected	-
Asbestos Analyst ID	N/A	N/A	N/A	-	DSO	-	DSO	-

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	8.2	8.3	8	7.6	8
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO4	%	0.005	MCERTS	0.017	0.094	0.046	0.23	0.011
Sulphide	mg/kg	1	MCERTS	2.3	55	2.7	13	1.3
Total Sulphur	mg/kg	50	MCERTS	77	860	310	1300	58
Total Sulphur	%	0.005	MCERTS	0.008	0.086	0.031	0.126	0.006
Organic Matter (automated)	%	0.1	MCERTS	-	4.5	-	-	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	0.22	0.23	0.24	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.41	0.22	0.53	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.1	0.05	0.1	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.69	0.19	1.1	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	0.64	0.16	0.97	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.44	0.13	0.6	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.44	0.16	0.68	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.71	0.15	0.81	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.26	0.07	0.43	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.56	0.13	0.74	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.22	0.06	0.3	< 0.05
Dibenzo(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.08	< 0.05	0.08	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	0.31	0.06	0.36	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	5.08	1.61	6.91	< 0.80
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Analytical Report Number: 24-003533
 Project / Site name: Land at Stryt y Bydden, Wrexham
 Your Order No: 2240213

Lab Sample Number				119499	119500	119501	119502	119503
Sample Reference				WS4	WS5	WS6	WS7	WS7
Sample Number				C2	C1	C1	C1	C2
Depth (m)				1.00	0.20	0.20	0.20	1.00
Date Sampled				14/02/2024	14/02/2024	14/02/2024	14/02/2024	14/02/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8.2	13	7.2	14	13
Barium (aqua regia extractable)	mg/kg	1	MCERTS	100	260	110	240	49
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.46	1.7	1.1	1.4	0.62
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2	0.5	0.5	0.9	0.2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	0.7	< 0.2
Chromium (hexavalent) Low Level	mg/kg	1.2	NONE	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	15	25	24	23	19
Copper (aqua regia extractable)	mg/kg	1	MCERTS	11	56	32	53	15
Lead (aqua regia extractable)	mg/kg	1	MCERTS	43	92	30	110	21
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	0.5	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	17	34	37	34	18
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	18	36	26	34	23
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	40	120	90	160	49

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 24-003533
Project / Site name: Land at Stryt y Bydden, Wrexham
Your Order No: 2240213

Lab Sample Number				119504
Sample Reference				WS8
Sample Number				C1
Depth (m)				0.20
Date Sampled				14/02/2024
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	

Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	17
Total mass of sample received	kg	0.1	NONE	0.4

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	DSO

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	8.3
Total Cyanide	mg/kg	1	MCERTS	< 1.0
Free Cyanide	mg/kg	1	MCERTS	< 1.0
Total Sulphate as SO ₄	%	0.005	MCERTS	0.068
Sulphide	mg/kg	1	MCERTS	18
Total Sulphur	mg/kg	50	MCERTS	870
Total Sulphur	%	0.005	MCERTS	0.087
Organic Matter (automated)	%	0.1	MCERTS	7.9

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.86
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.74
Anthracene	mg/kg	0.05	MCERTS	0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.13
Pyrene	mg/kg	0.05	MCERTS	0.13
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.14
Chrysene	mg/kg	0.05	MCERTS	0.14
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.11
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.09
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05
Dibenzo(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.09

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	2.48
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Analytical Report Number: 24-003533

Project / Site name: Land at Stryt y Bydden, Wrexham

Your Order No: 2240213

Lab Sample Number				119504
Sample Reference				WS8
Sample Number				C1
Depth (m)				0.20
Date Sampled				14/02/2024
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	11
Barium (aqua regia extractable)	mg/kg	1	MCERTS	410
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.9
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2
Chromium (hexavalent) Low Level	mg/kg	1.2	NONE	< 1.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	13
Copper (aqua regia extractable)	mg/kg	1	MCERTS	72
Lead (aqua regia extractable)	mg/kg	1	MCERTS	70
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	29
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	38
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	49

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 24-003533

Project / Site name: Land at Stryt y Bydden, Wrexham

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
119494	WS1	C1	0.2	Brown loam with gravel
119495	WS1	C2	1.1	Brown loam and clay with gravel
119496	WS2	C1	0.2	Brown loam and clay with gravel and vegetation
119497	WS3	C1	0.2	Brown loam and clay with gravel and vegetation
119498	WS4	C1	0.2	Brown loam and clay with gravel and vegetation
119499	WS4	C2	1	Brown sand with stones
119500	WS5	C1	0.2	Brown loam and clay with gravel and vegetation
119501	WS6	C1	0.2	Brown loam and clay with gravel and vegetation
119502	WS7	C1	0.2	Brown loam and clay with gravel
119503	WS7	C2	1	Brown sandy clay
119504	WS8	C1	0.2	Brown gravely loam with clinker

Analytical Report Number : 24-003533
Project / Site name: Land at Stryt y Bydden, Wrexham

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode	In-house method	L010	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES	In-house method based on Second Site Properties version 3	L038B	D	MCERTS
Total sulphate (as SO ₄ in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES	In-house method	L038B	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES	In-house method	L038B	D	MCERTS
Speciated EPA-16 PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
Hexavalent chromium in soil (low level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080	W	NONE
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	MCERTS
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	MCERTS

Analytical Report Number : 24-003533
Project / Site name: Land at Stryt y Bydden, Wrexham

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099	D	MCERTS

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
 For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
 For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
 Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
 Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Soils Risk Assessment

Site Reference:6144VBW

Project Site:Land at Stryt y Bydden, New Broughton

Project Location:Wrexham

Client:Patrick Berry

i2 Reference	Resi HGP	WS1	WS1	WS2	WS3	WS4	WS4	WS5	WS6	WS7	WS7	WS8
Customer Sample Ref:	C4SL / S4UL	0.20	1.10	0.20	0.20	0.20	1.00	0.20	0.20	0.20	1.00	0.20
	SOM 2.5% GAC	14/02/2024	14/02/2024	14/02/2024	14/02/2024	14/02/2024	14/02/2024	14/02/2024	14/02/2024	14/02/2024	14/02/2024	14/02/2024
Determinand												
Arsenic	37	9.6	9.3	20	15	12	8.2	13	7.2	14	13	11
Boron (water-soluble)	290	0.4	0.2	0.2	0.3	1	0.2	0.5	0.5	0.9	0.2	0.2
Cadmium	9	0.6	0.4	0.2	0.6	0.5	0.2	0.2	0.2	0.7	0.2	0.2
Chromium*	910	26	20	21	30	17	15	25	24	23	19	13
Chromium VI	21	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Copper	2400	22	18	87	64	45	11	56	32	53	15	72
Cyanide(Total)	-	1	1	1	1	1	1	1	1	1	1	1
Cyanide(free)**	34	1	1	1	1	1	1	1	1	1	1	1
Lead	200	79	40	88	72	170	43	92	30	110	21	70
Mercury ¹	199	0.3	0.3	0.3	0.3	1.7	0.3	0.3	0.3	0.5	0.3	0.3
Nickel	130	12	25	33	34	20	17	34	37	34	18	29
pH	-	8.1	7.9	7	9	7.9	8.2	8.3	8	7.6	8	8.3
Phenols(Mono)	550	1	1	1	1	1	1	1	1	1	1	1
Selenium	434	1	1	1	1	1	1	1	1	1	1	1
SO4(Total)	-	0.054	0.019	0.102	0.116	0.052	0.017	0.094	0.046	0.23	0.011	0.068
Sulphide	-	1	1	8.3	59	1.8	2.3	55	2.7	13	1.3	18
Sulphur(Free)	-	320	110	840	1800	320	77	860	310	1300	58	870
Thiocyanate	-	0	0	0	0	0	0	0	0	0	0	0
Zinc	3700	160	41	110	140	140	40	120	90	160	49	49
Acenaphthene	510	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Acenaphthylene	420	0.05	0.05	0.05	0.15	0.06	0.05	0.05	0.05	0.05	0.05	0.05
Anthracene	5400	0.07	0.05	0.13	0.32	0.08	0.05	0.1	0.05	0.1	0.05	0.05
Benzo(a)Anthracene	-	0.69	0.05	0.4	1.5	0.54	0.05	0.44	0.13	0.6	0.05	0.14
Benzo(a)Pyrene SM	5	0.95	0.05	0.34	1.6	0.58	0.05	0.56	0.13	0.74	0.05	0.09
Benzo(b)Fluoranthene	-	1.2	0.05	0.42	1.9	0.79	0.05	0.71	0.15	0.81	0.05	0.11
Benzo(ghi)Perylene	-	0.47	0.05	0.15	0.7	0.25	0.05	0.31	0.06	0.36	0.05	0.09
Benzo(k)Fluoranthene	-	0.44	0.05	0.18	0.89	0.28	0.05	0.26	0.07	0.43	0.05	0.05
Chrysene	-	0.81	0.05	0.37	1.6	0.6	0.05	0.44	0.16	0.68	0.05	0.14
Dibenzo(ah)Anthracene	-	0.11	0.05	0.05	0.19	0.09	0.05	0.08	0.05	0.08	0.05	0.05
Fluoranthene	560	1.3	0.05	0.58	2.9	0.91	0.05	0.69	0.19	1.1	0.05	0.13
Fluorene	400	0.05	0.05	0.05	0.12	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Indeno(123-cd)Pyrene	-	0.41	0.05	0.12	0.61	0.24	0.05	0.22	0.06	0.3	0.05	0.05
Naphthalene	5.6	0.05	0.05	0.28	0.61	0.12	0.05	0.22	0.23	0.24	0.05	0.86
Phenanthrene	220	0.34	0.05	0.55	1.4	0.35	0.05	0.41	0.22	0.53	0.05	0.74
Pyrene	1200	1.2	0.05	0.48	2.5	0.77	0.05	0.64	0.16	0.97	0.05	0.13
PAH(total)	500	160	41	110	140	140	40	120	90	160	49	49
Asbestos	Not-detected	-	-	Not-detected	Not-detected	-	-	Not-detected	-	Not-detectec	-	Not-detected
SOM [#]	-	-	-	6	-	-	-	5	-	-	-	8

All Units mg/kg unless otherwise stated

Indicates Exceedance of Applicable Level

Where no SOM is reported 1% SOM Criteria are used. For individual samples SOM value is used to adjust the assessment crieteria accordingly that that sample.

*Criteria Assumes Chromium IIISM = Surrogate Marker Approach Culp et al/

**Criteria is derrived considering acute effects on 1-2yo Female Receptor ingesting a single dose of 3g of soil

***Criteria is derrived considering Total TPH (C10 to C35) is formed entirley of a 50:50 Aliphatic and Aromatic Split C8-C10 range

¹ GAC for inorganic mercury can normally be compared with chemical analysis for total mercury content because the equilibrium concentrations of elemental and methylmercury are likely to be very low

[#] Criteria reported to zero decimal places

Basis of Assessment Criteria:	CLEA v1.071	EA 2005 WAC (Human Health Value)	C4SL
		LQM S4UL	Atrisk 06