



**C8016 Rev A
SEPTEMBER 2018**

GEOENVIRONMENTAL APPRAISAL REPORT

**for land off
MINERS ROAD, WREXHAM**

**prepared for
SIRIUS RENEWABLE ENERGY LIMITED**

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SITE NAME: Miners Road, Wrexham

PREPARED FOR: Sirius Renewable
 Energy Limited

PREPARED BY: Sirius Geotechnical Ltd Tel: 0113 264 9960
 4245 Park Approach
 Thorpe Park
 Leeds
 LS15 8GB

WRITTEN BY: Richard Caine
 Engineer


07/09/2018

REVIEWED BY Adrian Grant
 Principal Engineer


07/09/2018

APPROVED BY: Chris Rudd
 Associate

pp. 
07/09/2018

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GEOENVIRONMENTAL APPRAISAL

of land off

Miners Road, Wrexham

Prepared for

SIRIUS RENEWABLE ENERGY LTD.

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Drawing No.	Title	Scale
C8016/01	Site Location Plan	1:50,000 @ A4
C8016/02	Site Features Plan	1:1,000 @ A3
C8016/03	Preliminary Conceptual Site Model	NTS
C8016/04	Exploratory Hole Location Plan	1:500 @ A3
C8016/05	Revised Conceptual Site Model	NTS
SRE1065/17/03 Rev. 3 (Sirius Planning)	Indicative Site Layout	1:500 @ A3
SRE1082/17/03 (Sirius Planning)	Indicative Site Layout	1:500 @ A3

NTS: Not to Scale

APPENDIX B ENVIROCHECK REPORT & HISTORICAL MAPS

APPENDIX C COAL AUTHORITY MINING REPORT

APPENDIX D EXPLORATORY HOLE LOGS

APPENDIX E SIRIUS QUALITATIVE RISK ASSESSMENT METHODOLOGY

APPENDIX F LABORATORY TEST RESULTS

APPENDIX G SIRIUS GENERIC ASSESSMENT CRITERIA

EXECUTIVE SUMMARY

Introduction	Sirius Geotechnical Ltd was commissioned by Sirius Renewable Energy Ltd to undertake a geoenvironmental appraisal of a plot of land off Miners Road, Wrexham. It is understood that the site is proposed to be developed as a reserve power plant (RPP) facility, which will comprise the construction of gas generators, battery storage units, along with transformers, gas governor, substations and a meter room.
Site Description	The site comprises a roughly rectangular plot of land off Miners Road, Wrexham. A number of shipping containers and sheds are present in the southeast of the site, with a stockpile of rubble in the southwest of the site, with heavy vegetation beyond; stockpiles of hardcore were present in the northwest and southwest of the site. The remainder of the site has a surface covering of gravel, with areas of scrub vegetation. A row of trees and hedges run along the northern and north western site boundary.
Site History	Review of historical Ordnance Survey maps indicates that the site comprised undeveloped agricultural land up until approximately 1954, when a number of railway lines are shown to cross the site, leading to a colliery to the east. By 1975, the railway lines are no longer shown and the site is shown to form a vacant plot of land within the Llay Industrial Estate.
Fieldwork	Fieldwork was undertaken by Sirius on 22 nd August 2018, comprising the excavation of seven machine dug trial pits, to depths of up to 3.0m bgl.
Laboratory Testing	Selected samples of the made ground, natural soils were tested for a range of commonly occurring contaminants.
Ground Conditions	Made ground was encountered across the site from ground level to depths of between 0.9m and 2.4m bgl, underlain by stiff clay (glacial till) to the base of the excavations.
Mining and Quarrying	The stability of the site is unlikely to be affected by historical mining and quarrying.
Sulphate Class	Design Sulphate Class DS-1 and ACEC Class AC-1 should be used for buried concrete structures in contact with the made ground.
Soakaways	Based on the proven ground conditions (i.e. moderately deep made ground, underlain by natural clay soils), soakaway drainage is unlikely to be viable.
Contamination	Chrysotile asbestos fibres were recorded within the made ground in one trial pit, at a depth of 1.0m bgl. If disturbed, this could pose a potential risk to the health of construction workers and site end users. It is considered that the provision of imported hardcore access tracks and areas of gravel between the generators and other plant will minimise the dust generation from the made ground, which will break the source-pathway-receptor linkage for asbestos. Should any excavations be undertaken within the made ground during the redevelopment of the site or post re-development, especially in the area of TP01, then the presence of asbestos should be considered as part of the risk assessment. Mitigation measures would include the use of personal protective equipment during any below-ground works within the affected area.
Invasive Species	None were noted during the site walkover or the site investigation. An ecological survey should be carried to confirm the absence of any invasive plant species.

The executive summary is an overview of the key findings and conclusions of the report. There may be other information contained in the body of the report which puts into context the findings of the executive summary. No reliance should be placed on the executive summary in isolation, particularly when deriving design detail / abnormal costs.

1. INTRODUCTION

Sirius Geotechnical Ltd (Sirius) were commissioned by Sirius Renewable Energy Ltd (SRE) to undertake a geoenvironmental appraisal for a plot of land off Miners Road, Wrexham.

It is understood that the site is proposed to be developed as a reserve power plant (RPP) facility, which will comprise the construction of gas generators, battery storage units, along with transformers, gas governor, substations and a meter room, as shown on Sirius Planning Drawing Ref. SRE1065/17/03 Rev. 3, included in Appendix A. A subsequent extension was permitted as shown on Sirius Planning Drawing Ref. SRE1082/17/03 (also included in Appendix A) and this report is to satisfy conditions 7 and 5 of planning permissions LLAP/2017/0937 and LLAP/2018/0517.

Due to the anticipated low loadings, it is understood that the new plant will be placed upon concrete rafts, which are to be formed above a layer of compacted hardcore.

The objectives of this appraisal were to:

- Summarise the historical development and the environmental setting of the site and surrounding area;
- Investigate and confirm the near-surface soil conditions across the site;
- Determine the potential risks posed by any ground contamination and provide recommendations on remedial measures to manage such risks.

Fieldwork was undertaken on the 22nd August 2018, comprising the mechanical excavation of seven trial pits.

This report, which was designed to meet the requirements of relevant current guidance, presents the factual information available during this appraisal, an interpretation of the data obtained and recommendations relevant to the defined objectives.

It has been assumed in the production of this report that the site is to be developed for a RPP facility, as described above. In addition, it is assumed that ground levels will not change significantly from those described in this report. It is also assumed that the parts of the site to be developed will be securely fenced, covered in hardcore and that any new buildings will be relocatable, with no permanent below-ground structures. There will be pipes and cables below

ground. As such, these buildings will not be in contact with existing soils. If this is not the case, then amendments to the recommendations made in this report may be required.

Where the report refers to the potential presence of invasive plants (such as Japanese Knotweed) or asbestos-containing materials (ACMs), such observations are for information only and should be verified by a suitably qualified expert.

The comments and opinions presented in this report are based on the ground conditions encountered during intrusive investigation works performed by Sirius and the results of tests carried out within one or more laboratories.

There may be other conditions prevailing on the site which have not been revealed by this investigation and which have not been taken into account by this report. Responsibility cannot be accepted for any conditions not revealed by this investigation. Any diagram or opinion on the possible configuration of strata, contamination or other spatially variable features between or beyond investigation positions is conjectural and given for guidance only. Confirmation of ground conditions between exploratory holes should be undertaken if deemed necessary.

Evaluation of groundwater is based on observations made at the time of the investigation. It should be noted that groundwater levels and quality may vary due to seasonal and other effects.

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2. SITE DETAILS AND DESCRIPTION

Table 2.1 Current Site Overview

Location	The site is located to the south of Miners Road, on the Llay Industrial Estate, approximately 6.5km north of Wrexham Town Centre. A site location plan is included as Drawing No. C8016/01 within Appendix A.
National Grid Reference	332490, 356380.
Topography and Features	Please refer to the Site Features Plan in Appendix A (Drawing No. C8016/02). The site comprises a roughly rectangular shaped plot of land. Reference to the topographical survey plan, Sirius Environmental Drawing No. SRE1065/2/001, dated 27/01/2017 (held by the client) indicates that the site lies at approximately 93m above Ordnance Datum (AOD) and slopes gently to the north, with an overall gradient of c. 1 in 100. Access to the site is from Miners Road, through a gate in the northeast of the site. The site has a surface covering of crushed aggregate, with evidence of localised minor hydrocarbon spillages in the central eastern site area. A site office, a number of shipping containers and two low loader trailers are present in the centre, southeast and east of the site, with bags of bricks running along the eastern site boundary up to the north eastern corner of the site. Stockpiles of rubble and hardcore are present in the southwestern area of the site, with a further stockpile of hardcore in the north western area of the site. A row of trees and hedges run along the northern and north western site boundary.
Approximate Site Area	0.5 hectares.
Site Boundaries	The site is bounded by a steel fence, with trees and low vegetation present along the southern, western and northern boundaries of the site.
Current Land Use	General storage and machinery dismantling.
Adjacent Land	A scrap yard is present to the immediate west of the site, a historical coal

Uses	mine spoil heap present to the south of the site. Commercial units are present to the east and north of the site.
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3. ENVIRONMENTAL SETTING

3.1. Introduction

Published environmental, geological and historical data relating to the site has been reviewed. A summary of relevant information is provided below, and a copy of the Envirocheck Report and associated historical maps are enclosed in Appendix B.

3.2. Site History

Table 3.1 presents a summary of the site history from 1872 to 2018. It is not the intention of this report to describe in detail all of the changes that have occurred on or adjacent to the site, only those pertinent to the proposed development.

Table 3.1 Site History

Map Dates	On-site Features	Off-site Features (only features within 500m that may affect the site are listed)
1872 – 1879	The site is shown as undeveloped agricultural land and is split into two fields.	The surrounding area is shown as undeveloped agricultural land. There is a smithy c. 300m south of the site. A small pond is shown c. 130m to the north of the site.
1899 – 1914	No significant changes.	No significant changes visible.
1938	No significant changes.	Llay Main Colliery is shown from 220m to 400m to the east of the site.
1954 – 1968	Several railway tracks / sidings are shown running west to east through the site to the Llay Main Colliery.	Additional railway lines are present to the immediate south of the site, with a mine spoil heap beyond. A water body is shown to the immediate north of the site, with two additional water bodies shown around 50m to the east. An area of osiers is present around 80m north of the site.
1975 – 1992	Railway tracks / sidings are no longer shown within the site. A track is shown running north to south through the site.	The colliery, associated railway lines and water bodies are no longer shown. The mine spoil heap to the south of the site is labelled as a tip (disused). Miners Road is shown running east to west, to the immediate north of the site. The site is shown to be part of the Llay Industrial Estate. Two disused shafts are shown around 195 and 271m to the northeast of the site. The industrial estate has been partially developed, including a textiles factory, food production factory and an engineering works. The area of osiers, the pond and water bodies are no longer shown.
1992 – 2018	No significant changes noted on-site.	The majority of the surrounding land to the west, north and east of the site has been developed with industrial

Map Dates	On-site Features	Off-site Features (only features within 500m that may affect the site are listed)
		type buildings. The disused shafts are no longer shown.

3.3. Published Geological Information

A summary of available published geological information is provided in Table 3.2.

Table 3.2 Geological Summary

Sources of Information	BGS 1:10,000 scale geological map (Sheet no. SJ35NW). BGS 1:50,000 scale geological map (Flint, Sheet 108). BGS Geology of Britain Viewer (on-line service). BGS Lexicon of Named Rock Units (on-line service). BGS borehole records (on-line service). Coal Authority (CA) Interactive Map Viewer (on-line service). CA Non-Residential Mining Report, Ref: 177493550_2, dated 21st August 2018 (see copy in Appendix C). Envirocheck Report, Ref: 177493550_1_1, dated 21st August 2018.
Made Ground	None recorded on the published maps, but given the presence of the spoil heap to the south of the site and historical railway lines running across the site, it is anticipated that Made Ground could be present across the site area.
Superficial Deposits	The site is shown to be underlain by Glacial Till, which generally comprises clay with variable sand and gravel content.
Solid Geology	The site is shown to be underlain by the Salop Formation (Carboniferous age), which comprises mudstone, sandstone and conglomerate. No faults are shown to affect the site itself. An inferred north to south trending fault is shown around 100m east of the site.
Mining and Quarrying	Coal Seams: No coal seams are shown to outcrop on or close to the site. The generalised vertical section for the local area shows that the Middle Coal Measures Formation is present at depth, dipping to the east / southeast. Coal Mining: The Coal Authority Mining report indicates that the site

	could be affected by six seams of coal at depths of between 570m and 810m below the site, last worked in 1966. The site is not in an area where current or future underground mining is anticipated to be undertaken, though it is noted that reserves of coal exist in the local area which could be worked at some point in the future. The site is not reported to be in an area where previous, current or future open cast mining is anticipated to be undertaken. Mine Entries: The CA do not record any mine entries within 20m of the site. The online CA interactive viewer indicates two mine entries, 195m and 271m northeast of the site. Quarries: The historical OS maps do not show any quarries within the vicinity of the site.
BGS Recorded Mineral Sites	The spoil heap to the south of the site is classified as a dormant site for common clay and shale. Additionally, the Llay Main Colliery shafts, located 195m and 271m to the northeast of the site are recorded as ceased sites for deep coal mining.
BGS Borehole Records	A series of historical boreholes (dated between 1977 and 1988) available for review online are located approximately 150m to 180m to the north and west of the site. They generally record ground conditions comprising firm to stiff brown sandy and gravelly clay to depths of between 4.6m and 8.0m bgl, overlying brown, medium dense sands and gravels.

3.4. Hydrology and Hydrogeology

A summary of available information pertaining to hydrology and hydrogeology is presented in Table 3.3 to Table 3.5, inclusive.

Table 3.3 Surface Water Features

	Presence/location	Comments
Classified Watercourses (within 500m)	NR	
Unclassified Watercourses (within 500m)	A drain is shown to run east to west along the site's southern boundary, with another drain running south to north immediately north of the site and Miners Road.	
Licensed Surface Water Abstractions (within 1000m)	NR	
Other Surface Water Features (Canals, Ponds, Lakes, etc.) (within 250m)	NR	N/A
Flood Risk Status	The Envirocheck report indicates the site to be located within a flood zone 1, with a low probability of flooding.	The Envirocheck report indicates that the majority of the site is located within an area with potential for groundwater flooding of property situated below ground level.

NR – None recorded.

Table 3.4 Groundwater Occurrence and Abstraction

	Presence/location	Comments
Licensed Abstractions (within 1000m)	NR	N/A
Private Wells	NR	N/A
Source Protection Zones (within 500m)	NR	N/A
Springs	NR	N/A

NR - none recorded.

Table 3.5 Groundwater Vulnerability Status

	Environment Agency Classification
Groundwater Classification	The Envirocheck Report notes that the superficial deposits beneath the site are classified as Unproductive Strata. The solid strata beneath the site is classified as a Secondary A Aquifer, which are defined as <i>“having permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers....”</i>.

3.5. Landfilling and Waste Management

Information on waste management and related activities that could impact upon the site is summarised in Table 3.6.

Table 3.6 Waste Management Activities

	Presence / Location	Comments
Historical Landfills (within 1000m)	One historical landfill is recorded within 1km of the site.	The historical landfill called Astbury Quarry, is recorded 428m to the northeast of the site, on Dark Lane, Llay. Deposited waste included inert, industrial, commercial, household and special waste. The last input date was 31 st December 1987.
Registered Landfills (within 1000m)	There are three entries relating to the above Astbury Landfill, located 755m and 896m northeast of the site.	The most recent status is given as Operational as far as is known / Operational (as of 25 th April 1999). Authorised wastes include alkalis, construction / demolition / excavation waste, contaminated rubbish, household waste, toxic and non-toxic metal compounds, organic acids, animal carcasses, asbestos and paper pulp.
Other Licensed Waste Management Facilities (within 500m)	Eight Licenced Waste Management Facilities are recorded within 500m of the site.	The closest two entries relate to a metal recycling plant, located immediately west of the site. The permit was issued 20 th July 1995 and is noted to still be active.
Evidence of Fly-Tipping on-site?	NR	N/A
Other Evidence of Waste Disposal on or within 250m of Site	Three stockpiles are present on-site. There is a large colliery spoil heap in proximity to the south of the southern	Three stockpiles are present on-site, two in the west and northwest of the site comprise limestone hardcore. The remaining stockpile in the southwest of the site comprises coarse mixed

	Presence / Location	Comments
	site boundary.	demolition material.
Ground Gas Risk Assessment Required?	No.	The proposed development does not comprise any occupied buildings or structures. Any structure which people are required to enter are understood to be well ventilated.

NR - none recorded

3.6. Radon Risk

The Envirocheck report states that no radon protection measures are required for the site.

3.7. Ecological Receptors

No designated ecological receptors are recorded to be located within 500m of the site.

3.8. Other

Other potentially contaminative activities or environmental constraints are listed below. The entries relate to activities within approximately 250m of the site, with the exception of Control of Major Accident Hazards Sites (COMAH) where the assessment is extended to a distance of approximately 1km from the site.

- The site is recorded as an inactive road haulage yard.
- Active trade directory entries are located 18m to the west of the site, relating to the scrap yard mentioned above, 39m northeast of the site, relating to a plastic product manufacturer and 64m northwest of the site, relating to a waste disposal service.

4. PREVIOUS INVESTIGATION FINDINGS

No previous desk study or site investigation reports relating to this site have been made available to Sirius.

5. PRELIMINARY CONCEPTUAL SITE MODEL

Based on the desk study information, a preliminary conceptual site model (CSM) has been developed for the proposed future land use (peak power generating plant). This summarises the understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors to assess potential contaminant linkages.

A qualitative risk assessment has also been made of each contaminant linkage operating following the methodology described in Appendix E. The preliminary CSM is presented in schematic form in Drawing No. C8016/03 in Appendix A.

In summary, the following potential contaminant linkages have been assessed as posing a potentially unacceptable level of risk (defined as being greater than “low” risk) in the proposed end-use:

- Inhalation and ingestion of, and dermal contact with, localised made ground or shallow natural soils in which asbestos-containing materials (ACMs, inhalation only) or elevated concentrations of metals, metalloids or organic contaminants (including hydrocarbons and PAHs) are present. These linkages are assessed as posing a **moderate** risk to construction workers and a **low to moderate** risk to future site users and adjacent land users;
- Leaching of metals and metalloids, other inorganics and / or organic contaminants from made ground and / or shallow natural soils posing a **low to moderate** risk to controlled waters (including underlying Secondary A Aquifer and surface water drain at southern site boundary);
- Attack of construction materials (concrete and plastic) by sulphates and organic contaminants; this linkage is considered to pose a **low to moderate** risk to the built environment.

6. FIELDWORK

6.1. Scope of Investigation

The information contained in this report is limited to areas of land accessible during the investigation, as indicated on the site feature plan presented in Appendix A as Drawing No. C8016/02.

The investigation, which was supervised by a Sirius Geoenvironmental Engineer, took place on 22nd August 2018 and comprised excavation of seven of machine-excavated trial pits (TP01 to TP07) to a maximum depth of 3.0m bgl.

6.2. Exploratory Hole Locations

The exploratory hole locations were selected using the findings of the preliminary conceptual site model in order to achieve general site coverage. The principles given in BS 10175:2011+A1:2013 and BS EN 1997:2007 were followed when determining exploratory hole locations.

Exploratory hole locations are shown on Drawing No. C8016/04 in Appendix A of this report.

6.3. Strata Description

Strata descriptions were logged in accordance with Eurocode 7. Detailed descriptions of strata and groundwater observations made during investigation works, together with samples recovered and the results of all in situ field testing, are presented on the Engineer's records in Appendix D. The depths of strata on the record sheets are recorded from current ground levels at each location, unless indicated otherwise.

6.4. Chemical Testing

Selected samples of the made ground were tested for a range of potential contaminants under subcontract with Chemtest Ltd., a UKAS accredited laboratory.

The potential contaminants of concern identified by the preliminary conceptual site model were selected as the analytes for the samples recovered from the site. The results of soil analysis, as received from the laboratory, are presented in Appendix F of this report.

7. GROUND CONDITIONS AND MATERIAL PROPERTIES

7.1. Strata Profile

A summary of the strata profile encountered is provided in Table 7.1. For detailed descriptions, see the exploratory hole logs in Appendix D.

Table 7.1 Strata Profile

Strata	Depth Range (Thickness Range)	Description and Comments
Made Ground	Ground Level (0.9 to 2.4m)	Identified within all exploratory holes across the site, comprising granular and locally cohesive materials. The made ground was found to be thicker within the central and eastern part of the site. A surface covering of a grey, sandy gravel with variable cobble content was present across the site, to depths between 0.3m and 0.5m bgl. The gravel and cobble fractions generally comprised limestone. Below the surface covering, the made ground comprised either a dark grey to black sandy gravel with ash or a soft to stiff, slightly gravelly clay. The gravel fractions comprised mudstone, sandstone, coal, brick and limestone. Low to medium cobble content and low boulder content were occasionally recorded, comprising mudstone, sandstone, limestone and coal. The cohesive made ground was generally present in the southeast and northwest of the site, while the granular made ground was generally present in the southwest and northeast of the site. A 0.4m to 0.5m thick layer of cohesive made ground was present above the granular made ground in the northeast of the site. A stockpile in the northwest of the site was described as a grey, sandy gravel and one in the southwest of the site was described as creamy and grey cobbles with much sandy

Strata	Depth Range (Thickness Range)	Description and Comments
		gravel and low boulder content.
Glacial Till	0.9m to 2.4m (full thickness not proven)	The made ground soils were underlain by a predominantly stiff, reddish brown, mottled grey, slightly gravelly slightly sandy clay. The gravel fraction generally comprised sandstone and mudstone. In the central, northern and north eastern areas of the site, a firm to stiff orangish brown, mottled grey, occasionally slightly gravelly clay was present directly above the reddish-brown glacial till. In TP07, this unit was encountered to the base of the trial pit, with the reddish brown glacial till not being encountered. Within TP05, an asbestos cement pipe was identified at 2.9m bgl; accordingly, the overlying glacial till material has been recorded as being re-worked on the trial pit log.

7.2. Material Properties

Made Ground

Water soluble sulphate (SO_4^{2-}) analyses undertaken on six samples of the made ground (including one sample from the stockpile in the southwest of the site) recorded concentrations of between 29mg/l and 380mg/l, together with pH values ranging from 7.6 to 10.7. These results indicate a design sulphate class of DS-1 and an ACEC class of AC-1, in accordance with BRE Special Digest 1 (2005) for the design of buried concrete, based on brownfield site designation and mobile groundwater conditions.

7.3. Obstructions

No significant obstructions were encountered within trial pits during the site investigation works.

A section of asbestos concrete pipe was encountered in TP05, at a depth of approximately 2.9m bgl.

7.4. Groundwater

Groundwater was not encountered in any trial pits excavated during this site investigation.

7.5. Visual / Olfactory Evidence of Contamination

Besides the section of asbestos cement pipe encountered in TP05, no visual or olfactory evidence of contamination was encountered as part of this investigation. During the site walkover, some minor hydrocarbon staining of the surface covering of aggregate was noted in the central-eastern site area.

8. RESULTS OF CHEMICAL TESTING

The results of chemical analysis are provided in full within Appendix F.

8.1. Assessment Methodology

The laboratory test data for the relevant soil strata were reviewed for completeness and consistency. Those determinands that represent potential contaminants of concern were subject to further evaluation.

For each potential contaminant of concern, analytical data for soil samples were evaluated against the relevant Generic Assessment Criterion (GAC), taking account of the Soil Organic Matter (SOM) content. For this site, measured values were compared to GACs derived for a commercial end-use in the first instance. Source data for all GACs are provided in Appendix G.

Given the targeted nature of the chemical testing conducted as part of this site investigation, the heterogeneous nature of the made ground soils, and the general low contaminant concentrations identified, detailed statistical assessment of data has not been conducted, and instead individual contaminant concentrations have been compared to their relevant assessment criteria.

8.2. Soil Analysis

Made Ground and Stockpile

Table 8.1 presents a summary of the analytical results obtained and their evaluation against the applicable GACs.

Table 8.1 Summary of Total Soil Concentrations – Made Ground and Stockpile

Determinand	No. of Samples Tested	Range of Results (mg/kg unless specified)	GAC (5% SOM)	No. of Samples >GAC	Samples Exceeding GAC
Metals					
Arsenic (Inorganic)	5	8.7 - 27	630	0	
Cadmium	5	0.13 - 0.4	190	0	
Chromium (III)	5	6.7 - 25	8600	0	
Copper	5	21 - 94	68000	0	
Lead	5	25 - 45	2300	0	
Mercury (Inorganic)	5	0.1 - 0.45	1100	0	
Nickel	5	13 - 40	980	0	
Selenium	5	0.2 - 2.5	12000	0	
Zinc^	5	54 - 69	750000	0	
Inorganics					
pH	5	7.6 - 10.7	5-9	0	TP02 @ 0.3m
Water Soluble Sulphate	6	29 – 380	500	0	
Speciated PAHs					
Acenaphthene	5	<0.1 - <0.1	100000	0	
Acenaphthylene	5	<0.1 - <0.1	100000	0	
Anthracene	5	<0.1 - <0.1	540000	0	
Benzo(a)anthracene*	5	<0.1 - <0.1	B(a)P	0	
Benzo(a)pyrene	5	<0.1 - <0.1	27	0	
Benzo(b)fluoranthene*	5	<0.1 - <0.1	B(a)P	0	
Benzo(g,h,i)perylene*	5	<0.1 - <0.1	B(a)P	0	
Benzo(k)fluoranthene*	5	<0.1 - <0.1	B(a)P	0	
Chrysene*	5	<0.1 - <0.1	B(a)P	0	
Dibenzo(a,h)anthracene*	5	<0.1 - <0.1	B(a)P	0	
Fluoranthene	5	<0.1 - 0.86	23000	0	
Fluorene	5	<0.1 - <0.1	70000	0	
Indeno(1,2,3-cd)pyrene*	5	<0.1 - <0.1	B(a)P	0	
Naphthalene	5	<0.1 - <0.1	510	0	
Phenanthrene	5	<0.1 - <0.1	23000	0	
Pyrene	5	<0.1 - 1.3	54000	0	
Organics					
Aliphatic EC 5-6	2	<1 - <1	6900	0	
Aliphatic EC >6-8	2	<1 - <1	21000	0	
Aliphatic EC >8-10	2	<1 - <1	6000	0	
Aliphatic EC >10-12	2	<1 - <1	28000	0	
Aliphatic EC >12-16	2	<1 - <1	85000	0	
Aliphatic EC >16-35	2	<1 - <1	>1E6	0	
Aromatic EC 5-7	2	<1 - <1	48000	0	
Aromatic EC >7-8	2	<1 - <1	110000	0	
Aromatic EC >8-10	2	<1 - <1	9800	0	

Aromatic EC >10-12	2	<1 - <1	30000	0	
Aromatic EC >12-16	2	<1 - <1	37000	0	
Aromatic EC >16-21	2	<1 - 2.5	28000	0	
Aromatic EC >21-35	2	<1 - <1	28000	0	
Benzene	2	<1 - <1	49	0	
Toluene	2	<1 - <1	110000	0	
Ethylbenzene	2	<1 - <1	14000	0	
Xylenes (total)	2	<1 - <1	15000	0	
MTBE	2	<1 - <1	19000	0	
Other					
Phenol	5	<0.3 - <0.3	440	0	
TOC	5	0.51 - 35	3	4	TP01 @ 1.0m TP04 @ 0.3m TP06 @ 1.3m TP07 @ 0.8m
Asbestos (presence / absence)	5	NAD - Chrysotile	NAD	1	TP01 @ 1.0m
Asbestos (quantitative analysis)		0.087% Chrysotile			

* Assessed using benzo(a)pyrene as a surrogate marker, except where stated in text.
NAD - No Asbestos Detected.

Metals and Metalloids

No metals and metalloids tested recorded concentrations above the relevant GAC.

Inorganic Analytes

Concentrations of pH were recorded outside of the GAC range of pH 5 to 9 in one sample, which relates to the stockpile of material in the southwest of the site. The maximum value was 10.7, which may have the potential to cause skin irritation. Exposure of construction workers during enabling works can be mitigated through the use of appropriate personal protective equipment (PPE) and good hygiene practices.

Asbestos

Microscopic fibres of chrysotile were encountered in TP01 at a depth of 1.0m bgl. Gravimetric assessment of this material recorded an asbestos concentration of 0.087%.

Organics

No organic contaminants recorded concentrations above the relevant GAC.

Other

Total organic carbon (TOC) was recorded at concentrations exceeding the relevant GAC within four of the five samples of made ground analysed, the majority of which were noted to contain coal and / or coal ash. The GAC for TOC is based on Hazardous Waste (England and Wales) Regulations 2005. TOC content in itself does not represent a potential risk to human health. This GAC is provided for indicative assessment of disposal options, in the case that the off-site landfill of soil is undertaken. This GAC is specified at the 'inert' waste threshold and should therefore be considered for information purposes.

9. REVISED CONCEPTUAL SITE MODEL

The preliminary combined conceptual site model, developed from the desk study information and presented in Section 5, has been revised in light of the ground investigation and the chemical analysis results presented as part of the Sirius intrusive investigations.

The revised conceptual model has been developed for the proposed future land use (peak power generating plant). This summarises the understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors.

The revised conceptual model is presented in schematic form in Appendix A, Drawing No. C8016/05.

9.1. Summary of Residual Contaminant Linkages

The qualitative risk assessment of identified contaminant linkages has also been revised, following the methodology described in Appendix E. In summary, the revised CSM has identified the following residual contaminant linkages (defined as being greater than “low” risk) that could result in an unacceptable risk in the proposed end-use:

- Inhalation of localised asbestos-impacted made ground (in the area of TP01). These linkages are assessed as posing a **moderate risk** to construction workers and a **low to moderate risk** to future site users and adjacent land users.

Risks from the above potential contaminant linkages can be effectively managed by adopting standard mitigation measures, as outlined in Section 10.5.

10. CONCLUSIONS AND RECOMMENDATIONS

10.1. General

This geoenvironmental appraisal has been performed for a plot of land off Miners Road, Wrexham.

It is understood that the site is proposed to be developed as a reserve power plant (RPP) facility, which will comprise the construction of gas generators, battery storage units, along with transformers, gas governor, substations and a meter room, as shown on Sirius Planning Drawing Ref. SRE1065/17/03 Rev. 3, included in Appendix A. A subsequent extension was permitted as shown on Sirius Planning Drawing Ref. SRE1082/17/03 (also included in Appendix A) and this report is to satisfy conditions 7 and 5 of planning permissions LLAP/2017/0937 and LLAP/2018/0517.

Due to the anticipated low loadings, it is understood that the new plant will be placed upon concrete rafts, which are to be formed above a layer of compacted hardcore.

It has been assumed that ground levels will not change significantly from those described in this report. If this is not the case, then amendments to the interpretation and conclusions in this report may be required.

10.2. Flood Risk

The Envirocheck report indicates the site to be located within a flood zone 1, with a low probability of flooding.

10.3. Geotechnical

Mining and Quarrying

Based on the findings of this investigation the risk to surface stability from coal mining or quarrying is considered to be negligible.

Concrete in Aggressive Ground

Based on the samples tested from the Sirius investigation, a Design Sulphate Class of DS-1 and an ACEC Class of AC-1 should be used for buried concrete structures in contact with the made ground.

10.4. Asbestos

Asbestos was recorded within one sample of made ground of five tested (TP01, at a depth of 1.0m bgl) during this investigation, comprising microscopic fibres of chrysotile, at a concentration of 0.087% by weight. There are no current published assessment criteria for asbestos in soils; however, the Sirius GAC for asbestos is 'fibres present'. The presence of localised microscopic asbestos fibres within soils is common place and not a cause for concern.

The possibility of additional asbestos-containing materials being encountered within made ground soils cannot be discounted. If encountered, advice should be sought from an appropriately qualified asbestos specialist.

10.5. Soil and Groundwater Contamination

Risk Evaluation for the Proposed Land Use

The revised conceptual site model indicates that potentially unacceptable contaminant linkages exist for site end-users. Contaminant linkages assessed as a Low or Negligible risk are not considered significant or requiring remedial action and are not discussed further.

Human Health Receptors

Microscopic asbestos fibres detected within the made ground in the vicinity of TP01 (1.0m bgl) at very low concentrations is considered to pose a localised potential risk to human health through inhalation pathways should this material be disturbed, e.g., by excavation.

Whilst construction workers could be exposed to asbestos fibres in the ground, the use of appropriate PPE and good working practices would mitigate these risks.

If left undisturbed and in situ, the risk to human health from identified asbestos soil contamination at the site is considered low.

Construction and Maintenance Workers

Contamination may pose a short-term (acute) or long-term (chronic) risk to workers during construction and maintenance. The potential risks must be specifically assessed as part of the health and safety evaluation for the works to be performed in accordance with prevailing legislation. Site practices must conform to the specific legislative requirements and follow appropriate guidance (e.g. HSE, 1991; CIRIA, 1996).

On the basis of the results obtained, the principal potential exposure risks to construction workers may arise from localised asbestos in made ground soils. Whilst construction workers could be exposed to asbestos fibres in the ground, the use of appropriate PPE and good working practices would mitigate these risks.

Outline Remediation Requirements

Based on the findings of this investigation, no specific remedial works are considered necessary for the proposed development.

It is considered that the installation of the hardcore access tracks and areas of gravel between the units will minimise the dust generation from the made ground, which will break the source-pathway-receptor linkage for asbestos.

Should any excavations be undertaken within the made ground during the redevelopment of the site or post re-development, especially in the area of TP01, then the presence of asbestos fibres / clumps within made ground should be considered as part of the risk assessment.

It is possible that areas of more significant contamination, not identified to date, may be encountered on-site during excavation and construction works. If any areas of noxious, odorous, brightly coloured, fibrous, liquid etc. are encountered, further advice should be sought from a suitably qualified consultant.

10.6. Disposal of Soils

The classification of soils for disposal are determined by the receiving landfill facility. It is therefore recommended that the laboratory test results are forwarded to the appropriate landfill facility in order to confirm the waste classification of any material to be removed from site.

Any materials removed from site should be undertaken in accordance with current Duty of Care requirements and the Environment Agency Technical Guidance Document WM3, dated 2015. The waste may also be subject to Waste Acceptance Criteria (WAC) testing. Depending upon the foundation solution to be adopted and in light of the regulations it is recommended that discussion with landfill operators takes place at an early stage.

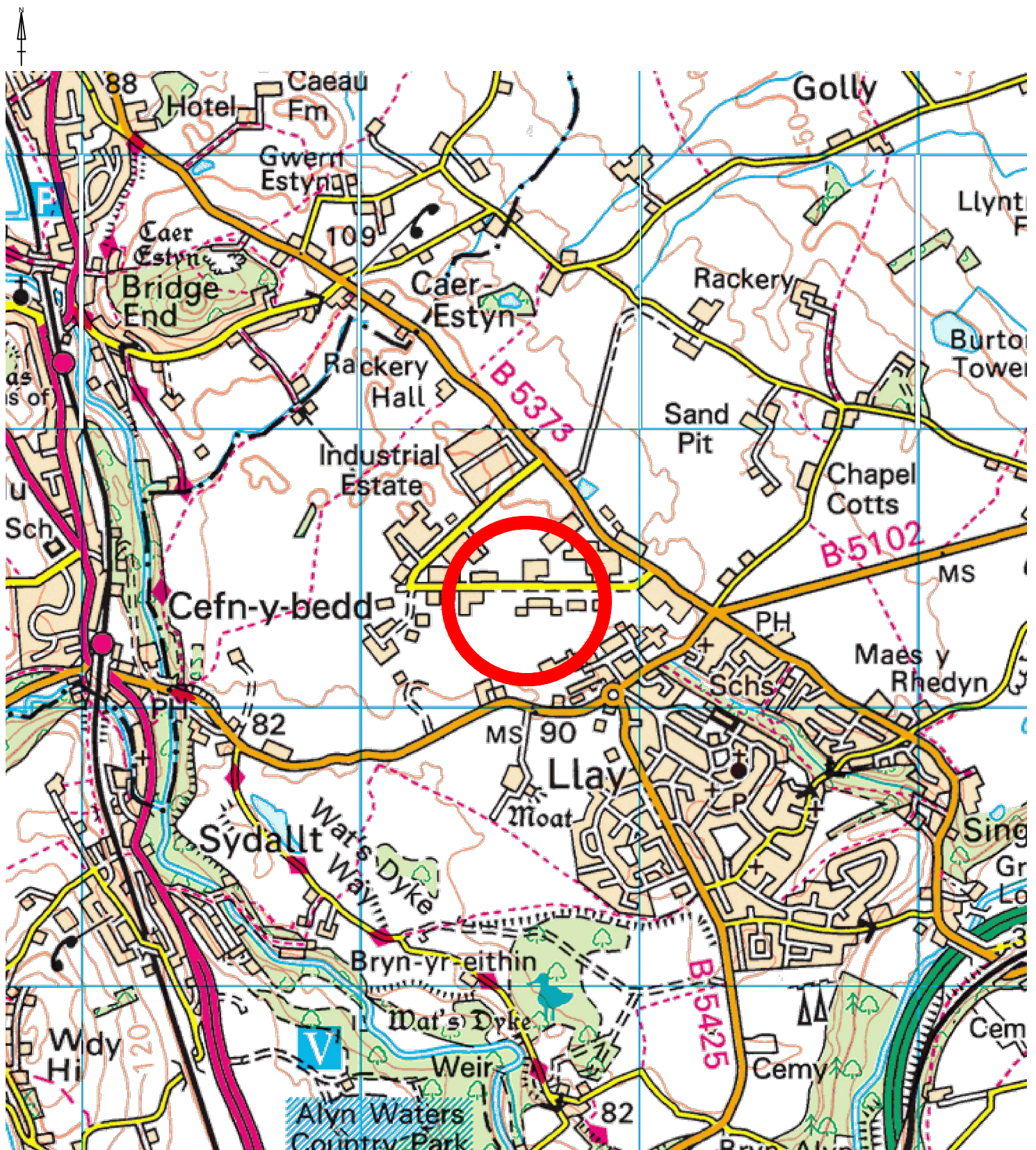
11. REGULATORY APPROVALS

The conclusions and recommendations presented above are considered reasonable based on the findings of the site investigation. However, these cannot be guaranteed to gain regulatory approval and, therefore, the report should be passed to the appropriate regulatory authorities and / or other relevant organisations for their comment and approval prior to undertaking any works on-site.



APPENDIX A

DRAWINGS



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NOTES



Site Location

REVISION

0	For information
A	>>
B	>>
C	>>
D	>>

SIRIUS
GEOTECHNICAL LTD
4245 Park Approach
Thorpe Park
Leeds
LS15 8GB
www.thesiriusgroup.com
TEL: 0113 264 9960
FAX: 0113 264 9962



CLIENT

Sirius Renewable
Energy Ltd

SITE

Miners Road, Wrexham

DRAWING TITLE

Site Location Plan

DRAWING NO.

C8016/01

DRAWN BY

RC

DATE

September
2018

REVISION NO.

0

APPROVED BY

AMG

SCALE

1:25,000

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