Proposed Solar PV Development

Byers Gill Solar
EN010139

6.4.2.1 Environmental Statement Appendix 2.1 Phase I Geoenvironmental and Geotechnical Desk Study

Planning Act 2008

APFP Regulation 5(2)(q)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

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ENERGY AND CLIMATE CHANGE
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ARUP

BYERS GILL SOLAR

PHASE I GEOENVIRONMENTAL AND GEOTECHNICAL DESK STUDY

NOVEMBER 2023

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DRAWINGS

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EXECUTIVE SUMMARY

Client	ARUP on behalf of JBM Solar
Site	Byers Gill Solar (the Proposed Development)
Current Land Use	The planning boundary for Proposed Development (the 'Order Limits') currently comprises agricultural land and a power station within the eastern corner consisting of buildings, hardstanding, and electricity infrastructure.
Past Site Use	Historical Land Use is limited to agricultural land; however, the east of the Order Limits has been occupied by Norton Sub-Station since 1938.
Proposals	The Proposed Development consists of a solar farm capable of generating over 50MW Alternating Current (AC) of electricity with co-located Battery Energy Storage Systems (BESS), located between Darlington and Stockton-on-Tees in north-east England.
Geology	The Groundsure records do not identify Made Ground within the Order Limits; however, Made Ground is expected within the east of the site. Groundsure records indicate the presence of Devensian Till underlying most of the Order Limits. Superficial Deposits in the form of Alluvial Deposits, Head Deposits, Glaciofluvial Deposits and Lacustrine Deposits are also underlying the Order Limits. The bedrock stratum underlying most of the Order Limits is shown to comprise dolomitised limestone and dolomite of the Ford Limestone Formation. The east of the Order Limits is underlain by mudstone, siltstone, and sandstone, along with limestone with subordinate and argillaceous rocks of the Yoredale Group. The far eastern end of the Order Limits is underlain by the Sherwood Sandstone Group interbedded sandstones and conglomerates.
Hydrogeology and Hydrology	Groundsure records identify a Secondary Undifferentiated and Secondary A aquifer within the superficial deposits. The bedrock beneath the Order Limits is classified as a Principal, Secondary A and Secondary B aquifer. Records indicate the presence of 53no. surface water features within the Order Limits.
Mining and Quarrying	There are no records of coal mining, or underground workings within the Order Limits. A limited amount of historical surface ground working features is recorded within the Order Limits. These are mainly within the east of the Order Limits and pertain to cuttings, gravel pits, sewage beds and unspecified heaps/pits.
Ecology and Heritage	There are no Local Nature Reserve, Designated Ancient Woodland, Ramsar sites, Special Areas of Conservation, Special Protection Areas, or Site of Special Scientific Interest within the Order Limits.
Geoenvironmental Risk	Preliminary assessment has not identified any potentially complete pollutant linkages comprising of organic and inorganic contaminants. A review of the Groundsure data has identified the risk at the Proposed Development to be **Very Low to Low**.

Geotechnical Constraints	A review of the Groundsure data has identified a potential risk of compressible ground, ground dissolution features and running sand across the Proposed Development.
Other Risks	Data obtained from UXO specialise risk maps has classed the Proposed Development to be of low bomb risk.
Recommendations for Further Works	An intrusive ground investigation should be undertaken to further assess the prevailing ground conditions, reduce the current uncertainty and fill gaps in existing information/knowledge. The ground investigation would facilitate the collection of data to support a detailed geotechnical and contaminated land assessment and any subsequent remediation design.
Overall Environmental Risk for Site	**Very Low to Low.**

1. INTRODUCTION

1.1. Instruction

1.1.1. The ‘Standard Terms’ and ‘Limitations’ to this Report are presented in Appendix A.

1.2. Site Location

1.2.1. Byers Gill Solar (the Proposed Development) spans approximately 490 hectares of land between Darlington and Stockton-on-Tees. The centre of the Proposed Development is located at National Grid Reference 434748E, 521637N. The planning boundary (the ‘Order Limits') for Proposed Development is shown on Drawing no. BGS-ES01-00001, ES Figure 1.1 (Document Reference 6.3.1.1).

1.2.2. Most of the Order Limits is composed of agricultural land including fields and crops. Within the Eastern corner of the Order Limits, there is a power station consisting of buildings, hardstanding, and electricity infrastructure. Surrounding land use mostly includes agricultural land to the north and south of the Order Limits, along with sporadic farm buildings and houses. The central eastern part of the Order Limits also traverses through the village of Bishopton. There are several villages in the vicinity of the Proposed Development including Brafferton, Newton Ketton, Great Stainton, Bishopton and Old Stillington to the north.

1.2.3. Topographically, the highest elevation is located in the north of the Order Limits at 107m AOD, and lowest elevation in the east at 48m AOD. Generally, the Order Limits slopes towards the south and east.

1.2.4. An aerial image of the Order Limits is illustrated in Figure 1.

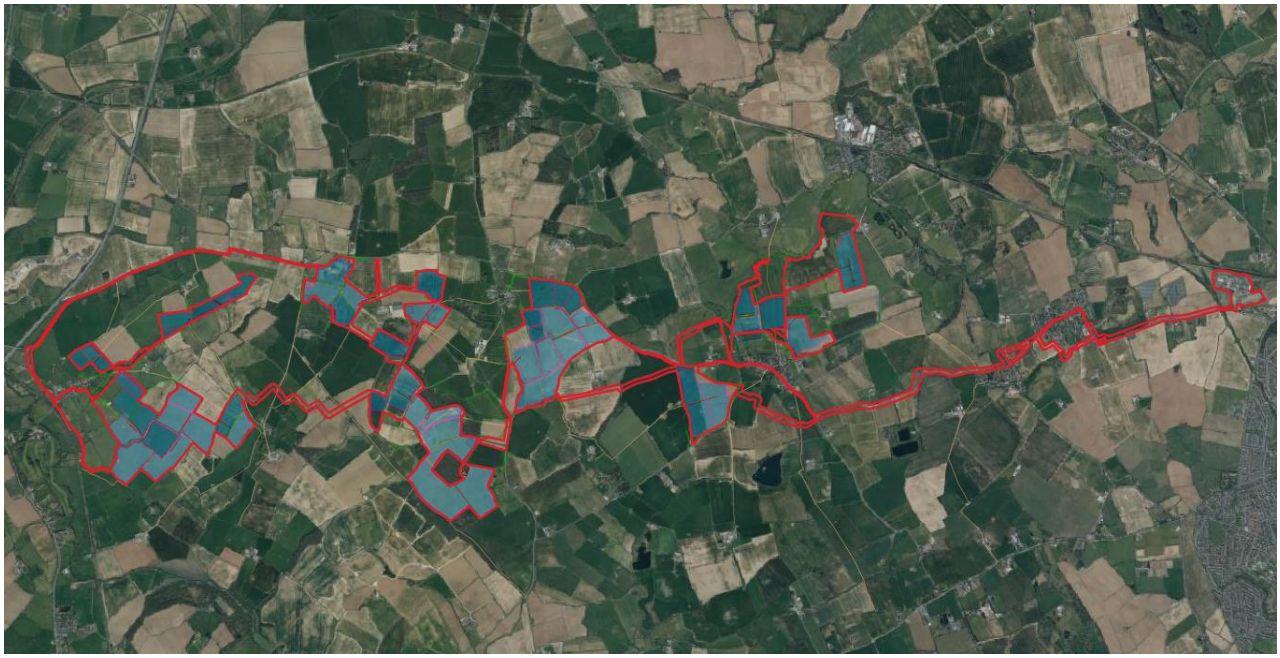


Figure 1: Aerial Image Showing the Approximate Order Limits (not to scale)

Image provided by Bing Satellite (24/04/2023)

1.3. Purpose and Basis of Report

1.3.1. The purpose of this report is to identify and examine in broad terms readily available information for the feasibility of the development of a Solar farm on-site. Information examined as part of this report will relate to the:

- past and current uses of the Order Limits and surrounding area;
- the nature of any hazards and physical constraints;
- environmental setting including geology, mining, hydrogeology, and hydrology;
- current and likely future receptors, potential sources of contamination and likely pathways;
- information for the preliminary risk assessment;
- likely ground conditions beneath the Order Limits including soil/rock types, groundwater and potential geohazards; and
- potential contamination constraints and liabilities that may arise in connection with the present use or proposed use of the Order Limits.

1.3.2. The report has been produced in general accordance with Environment Agency's Land Contamination Risk Management (LCRM) (version 3 - published October 2020).

1.4. Proposed Use

1.4.1. The Proposed Development consists of a solar farm capable of generating over 50MW Alternating Current (AC) of electricity with co-located Battery Energy Storage Systems (BESS), located between Darlington and Stockton-on-Tees in north-east England. The Order Limits is approximately 490ha and comprises six solar photovoltaic (PV) panel areas (Panel Areas A-F). The Panel Areas are as follows:

- Panel Area A: Brafferton (114.37ha), Darlington Borough Council;
- Panel Area B: Hauxley Farm (52.24ha), Darlington Borough Council;
- Panel Area C: Byers Gill Wood (77.16ha), Darlington Borough Council;
- Panel Area D: Great Stainton (75.86ha), Darlington Borough Council;
- Panel Area E: West of Bishopton (26.63ha), Darlington Borough Council; and
- Panel Area F: North of Bishopton (71.9ha), Darlington Brough Council.

1.4.2. The solar PV panels would be mounted on a metal frame in groups. The solar PV panels will be fixed in rows of solar PV modules aligned in East-West rows with solar PV modules facing South. The exact number and arrangement of modules depends on a range of factors including the size of the system, its location, and the direction in which the panels are installed. As technology and equipment is evolving, some flexibility in design will be required to accommodate technological advances. An on-site substation compound (approximately 70m by 70m with a 30m by 70m parking and turning area) would be located within Panel Area C.

1.4.3. A range of supporting infrastructure is required for the Proposed Development, comprising BESS; transformers and inverters for managing the electricity produced; storage containers to hold this equipment; and security measures such as fencing, CCTV and lighting. The Proposed Development includes environmental mitigation and enhancement measures to avoid or reduce adverse impacts on the surrounding environment and nearby communities.

1.4.4. The Proposed Development includes up to 32.5km of 33kilovolt (kV) underground cabling to connect the inverters and switchgears, and the switchgears to the on-site substation. The cable routes are currently under discussion with relevant landowners and will be confirmed following negotiations with landowners. Further information regarding the proposed cable routes can be found in ES Chapter 2 The Proposed Development (Document Reference 6.2.2).

1.4.5. Additionally, approximately 10km of 132kV underground cable (Eastern Grid Connection Area) to connect the Proposed Development to the grid connection at the existing Norton substation (located to the north-west of Stockton-on-Tees). The cable routes are currently under discussion with relevant landowners and will be confirmed following negotiations with landowners. Further information regarding the proposed cable routes can be found in ES Chapter 2 The Proposed Development (Document Reference 6.2.2).The majority of the Proposed Development, including the solar PV modules, on-site substation, Norton Substation and BESS are located within the administrative boundary of Darlington Borough Council. The eastern part of the cable routes crosses into the administrative boundary of Stockton-on-Tees Council. The northern extent of the Order Limits borders Durham County Council's administrative area.

1.5. Limitations of Report

1.5.1. The report does not constitute or contain a valuation, nor is it a full rigorous environmental audit or assessment of potential abnormal costs.

1.5.2. In this instance, this report is prepared as a preliminary desktop feasibility study for the potential redevelopment with regards to geo-environmental and geotechnical conditions across the Order Limits. This study has been requested to inform decision making and the process of risk management with regards to the Proposed Development constraints and to support an Environmental Statement (ES) as part of a Development Consent Order (DCO).

1.5.3. The opinions and findings of this report are given without the benefit of any physical ground investigation, sampling, or testing. A site walkover visit has been carried out.

2. DATA SOURCES

2.1. Data Sources

2.1.1. Our desk study research has been carried out in general accordance with current recognised guidance and with the procedures set out in the following documents:

- Environment Agency's LCRM entitled "How to assess and manage the risks from land contamination" dated October 2020;
- British Standard BS EN ISO 21365:2020 Soil quality - Conceptual site models for potentially contaminated sites; and
- British Standard BS 5930:2015+A1:2020 - Code of practice for ground investigations.

2.1.2. The Desk Study report has been prepared following the examination of the following key information:

- Groundsure GIS data dated 15th March 2023 prepared by Groundsure Limited. The data covers a study area comprising the Order Limits and a 250m radius, and contains the following information:
  - Hydrological and hydrogeological conditions;
  - Ground Vulnerability Mapping;
  - Details of sensitive land use;
  - Published Ordnance Survey (OS) map;
  - Registered Landfill, waste transfer and waste treatment or disposal sites;
  - Pollution incidents relating to the air and controlled waters;
  - Discharge consents;
  - Licensed groundwater abstractions;
  - British Geological Survey (BGS) recorded mineral sites;
  - Mining instability/hazards, including natural and mining cavities;
  - Ground instability hazard; and
  - Radon affected areas.
- Zetica UXO;
- BGS mapping and borehole records;
- Coal Authority Interactive Map Viewer;
- Durham County Council Information; and
- Site walkover details.

2.1.3. A copy of the Groundsure GIS data can be available upon request.

3. SITE HISTORY AND PRESENT LAND USE

3.1. Site History

3.1.1. Historical maps (1:10,560 and 1:2,500 scale) have been assessed to identify previous land uses, including any significant potentially contaminative uses, within the Order Limits. Where other features that may influence the Proposed Development have been identified, they are also described. The historical maps are presented within the Groundsure Report.

3.1.2. **Table 3.1** summarises the history of the Order Limits over the period between 1856 to 2023.

TABLE 3.1
SUMMARY OF HISTORICAL ON-SITE LAND USE

Date	Site Land Use	Additional Comments
1856-2023	The Order Limits is entirely utilised as agricultural land.	From 1938, the eastern area of the Order Limits a is utilised for electricity works including associated infrastructure, tanks, and pump house. A sand pit is present within the north-east corner of the Order Limits from 1938. The pit is not shown on historical maps by 1970.

3.1.3. **Table 3.2** summarises the history of the immediate vicinity (within 250m) over the period 1856 to 2023.

TABLE 3.2
SUMMARY OF HISTORICAL OFF-SITE LAND USE

Surrounding Site Use/Features	Dates	Location
Sand pit	1856 – (labelled as old sand pits from 1893) 1966	171m north of Panel Area B Grid Reference: 432393E, 522494N 465m east of Panel Area A. Grid reference: 431570.2 E, 521051.5 N
London & North Eastern Railway	1856-2023	35m southwest of Panel Area A. Grid reference: 429107.83 E,520968.63 N.
Railway Lines	1893 -2023	Eastern Grid Connection Area to Norton Substation, four separate lines immediately north and west of the Order Limits which join to form two larger lines at Carlton East Junction and Carlton South Junction. Grid reference: 441178.5 E, 522254.9 N (Carlton North), and 440985.5 E, 521871.2 N (Carlton South).

TABLE 3.2 SUMMARY OF HISTORICAL OFF-SITE LAND USE		
Surrounding Site Use/Features	**Dates**	**Location**
Well	1856 - 1916	95m east of Panel Area C. Grid reference: 433916.91 E, 520029.47 N.
Brick and Tile Works	1856 - 1966	Immediately adjacent eastern boundary of Panel Area C. Grid reference: 433680.60 E, 520217.21 N.
Gravel Pits	1856 – 1957	On-site in Panel Area F and 175m to 315m south of Panel Area F Grid reference: 437095E, 522775N 436281.10 E, 521440.04 N, 436389.82 E, 521368.78 N and 436770.8 E, 520616.8 N.
Infilled Ponds	1964-1966	8m west of Panel Area E. Grid reference: 435537.08 E, 520919.08N.
Clay Pit (as part of the brick works)	1893 - 1984	8m east of Panel Area C. Grid reference: 433640.9 E, 520117.7 N.
Refuse Tips	1964-1980	150m south of the Eastern Grid Connection Area to Norton Substation. Grid reference: 437109.22 E, 520623.57 N.
Sewage Works including tanks	1964-2023	Immediately adjacent of eastern boundary of the Panel Area F. Grid reference: 436085.08 E, 521460.76 N.
Garage including tank from 1984	1946- 2023	Immediately adjacent to 90m north of the Eastern Grid Connection Area. Grid reference: 439298.22 E, 521810.79 N
Sand and Gravel Pits	1966-1980	40 to 400m north of Panel Area F, and 125m south of Panel Area E. Grid reference: 436642.7 E, 522563.1 N 437243.5 E, 522960.1 N
Unspecified Works including tanks	1973 -2023	175m north & south of Eastern Grid Connection Area. Grid reference: 439548.22 E, 521684.45 N.
Electricity Substation	1973-2023	Eastern Grid Connection Area and Norton Substation. Grid reference: 439247.44 E, 521774.20 N 439147.615 E, 521737.65 N 439608.21 E, 521890.80 N 438827.72 E, 521173.02 N 12m west of Panel Area D. Grid reference: 433757.0 E, 521579.9 N
Pump Station	1973-1994	140m south of the Eastern Grid Connection Area.

TABLE 3.2 SUMMARY OF HISTORICAL OFF-SITE LAND USE		
Surrounding Site Use/Features	**Dates**	**Location**
		Grid reference: 439453.22 E, 521663.90 N
Silo	1973-1994	91m south of the Eastern Grid Connection Area Grid reference: 438586.36 E, 521142.65 N

3.2. Present Order Limits

3.2.1. A site walkover survey over was carried out on 28th and 29th March 2023. The key findings of the site walkover are summarised below and are presented in full within **Appendix B**, along with a collation of photographs presented within **Appendix C**. All photos can be made available on request.

3.2.2. The walkover survey was only carried out on Panel Areas A, D and E, with limited surveying in Panel Areas C and F. The remainder of the Order Limits is yet to be surveyed due to access restrictions. The location of Panel Areas can be found within **Drawing BGS-ES02-00001.**

3.2.3. The entire Order Limits is comprised of agricultural land including livestock, farming equipment and barn buildings. The land is vegetated by crops and grassland.

3.2.4. The Order Limits is bounded by hedges, trees, and fences.

3.2.5. A number of surface water features are located on-site, mostly consisting of streams and one artificial pond.

4. GEOLOGICAL AND HYDROGEOLOGICAL SETTING

4.1. Geology

4.1.1. The assessment of the Order Limits geology is based on BGS GeoIndex online mapping, Groundsure data, and geological information obtained as part of the site walkover. A summary of significant geological information is provided below in **Table 4.1.**

TABLE 4.1
SUMMARY OF GEOLOGICAL INFORMATION

Strata	Description
Made Ground	Made Ground has not been recorded on-site; however, it is expected within the east of the Order Limits with relation to Norton Sub-Station.
Natural Superficial	Most of the Order Limits is underlain by Devensian Glacial Till. The following lithologies are present across the Order Limits: • Peat Deposits, small area present approximately 125m north of the eastern extent of the cable routes, • Head Deposits in the form of clay, silt, sand, and gravel (limited across the Order Limits with larger areas present along north-western boundary of Panel Area F and the northern area of Panel Area A); • Alluvial Deposits in the form of clay, silt, sand, and gravel (limited area across the Order Limits with larger occurrences present along the north-western boundary of Panel Area F associated with the Bishopton Beck and the western boundary of Panel Area A associated with the River Skerne); • Lacustrine Deposits in the form of clay and silt (mainly across the centre of the Order Limits in Panel Area C, Panel Area D and east of the Order Limits in Panel Area F and cable routes); • Glacial Till in the form of unsorted, unconsolidated mixture of clay, sand, gravel, and boulders present the majority of the Order Limits, and • Glaciofluvial Deposits in the form of sand and gravel (mainly within the east of the Order Limits in Panel Area F, however limited areas within the centre and west).

TABLE 4.1 SUMMARY OF GEOLOGICAL INFORMATION	
Strata	**Description**
Bedrock Strata	The bedrock geology underlying the Order Limits comprise the following: • Sherwood Sandstone Group predominantly comprising sandstone with some conglomerates. Present at the eastern extent of the Order Limits. • Roxby Formation comprising mudstones and siltstones with subordinate sandstone. Present across the eastern area of the Order Limits, Panel Area F, and the eastern Grid Connection Area to Norton Substation. • Seaham Formation comprising thinly bedded limestone within some dolomitic limestone. Present across the central area of the Order Limits, Panel Areas A, C, D, E and F. • Edlington Formation comprising mudstones, with subordinate siltstones and sandstones. Present as a band across the western and central areas of the Order Limits, Panel Area A to E. • Ford Formation comprises dolomitic limestone. Present across the western areas of the Order Limits, Panel Area A to D. • Yoredale Group comprises marine limestone, marine shale, thin sandstone commonly topped with seatearth and an overlying coal. Present as small area across the central and eastern areas of the Order Limits, Panel Area B, F, and eastern Grid Connection Area to Norton Substation.
Linear Features	The BGS mapping indicates there is a fault, known as the Little Stainton Fault, shown at surface traversing east-west across southern areas of the Panel Areas A, C, and E, as well as the eastern cable routes. The BGS map sheet indicates that the fault is downthrown to the north.
Borehole Records	There are 19no. boreholes located across the Order Limits. Generally, the ground conditions have been recorded as slightly sandy, gravelly clay to 5m below ground level (bgl), underlain by silty sandy clay to 10m bgl.

4.2. Hydrogeology

4.2.1. The hydrogeology of the Order Limits is summarised in **Table 4.2** below.

TABLE 4.2 HYDROGEOLOGY OF THE ORDER LIMITS	
Aquifer Designation	**Location on-site**
Superficial Deposits Aquifer	
Secondary A Aquifer – Superficial Aquifer. 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. These	Underlying sporadic areas across the Order Limits, and especially within the north-east of the site. Associated with the Glaciofluvial

TABLE 4.2 HYDROGEOLOGY OF THE ORDER LIMITS	
Aquifer Designation	**Location on-site**
are generally aquifers formerly classified as minor aquifers	Superficial Deposits, and to a lesser extent some Alluvium Deposits.
Secondary Undifferentiated Aquifer -Superficial Deposits. Secondary Undifferentiated layer is assigned where it is not possible to attribute as either Category A or B. In general, these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.	The predominant superficial deposit aquifer underlying the Order Limits. Associated with the Glacial Till and Head Deposits.
Unproductive Aquifer – Superficial Deposits These are superficial deposits with low permeability that have negligible significance for water supply or river base flow	Present across the Order Limits as discrete areas, predominantly related to the Lacustrine Superficial Deposits, and to a lesser extent some Alluvium Deposits.
Bedrock Geology Aquifer	
Principal Aquifer -Bedrock Aquifer Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers	Underlying most of the western and central areas of the Order Limits, as well as the far eastern extent. Associated with the Ford and Seaham Formations across the western and central areas, and the Sherwood Sandstone Group at the eastern extent of the Order Limits.
Secondary A – Bedrock Aquifer 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.	Discrete areas across the central and-eastern areas of the Order Limits. Associated with the Yoredale Group.
Secondary B – Bedrock Aquifer Predominantly lower permeability layers which may store/yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons, and weathering. These are generally the water-bearing parts of the former non-aquifers	Predominantly present across the eastern area of the Order Limits Panel Area E and F and eastern Grid Connection Area to Norton Substation as well as a thin band across the west and centre of the Order Limits. Associated with the Edlington and Roxby Formations.

4.2.2. The Groundsure data indicates that the groundwater beneath the majority of the Order Limits is considered by the BGS to be of medium vulnerability, with small discrete areas associated with either Alluvium, Head, Lacustrine and Peat Deposits are considered to of low vulnerability.

4.2.3. The Groundsure data indicates the Order Limits is partially covered by Source Protection Zones (SPZ). The SPZs are summarised as follows:

- Source Protection Zone 1 (Inner Catchment), 1ha area present across the western boundary of Panel Area D. A BGS borehole record located towards the centre of this SPZ1 area, is named "Northumbrian River Authority C1" and marked as confidential. It should be noted that this area is outside of any planned development;
- Source Protection Zone 2 (Outer Catchment), 690ha area present across Panel Areas B, C, and D, and surrounding 250m area;
- Source Protection Zone 3 (Total Catchment), 517ha area present across the western area of the Order Limits in Panel Area A and the surrounding 250m area; and
- The remainder of the Order Limits is not included within a SPZ.

4.2.4. The 'Skerne Magnesian Limestone', covering the vast majority of the Order Limits and 'Tees Sherwood Sandstone' (far-eastern extent) have been recorded as the Water Framework Directive (WFD) groundwater body designations on-site. The two waterbodies are summarised as follows:

- Skerne Magnesian Limestone (ID. GB40301G704000). WFD 2019 ratings: overall poor; biological poor; and chemical poor, and
- Tees Sherwood Sandstone (ID. GB40301G702000). WFD rating: overall good, biological good and chemical good. **Hydrology**

Surface Water Features

4.3.1. According to OS Mastermap Water Network records, provided by Groundsure, there are 160no. surface water features (e.g., river, stream, pond, lake, and canals) across and within 250m of the Order Limits, of which approximately 53no. are located on-site.

4.3.2. The Bishopton Beck River traverses the Order Limits in a north to south direction along the north-western boundary of Panel Area F and to the east of Panel Area E.

4.3.3. The Billingham Beck runs along the northern boundary of Panel Area F and joins the Bishopton Beck.

4.3.4. The River Skerne is located approximately 115m southwest of Panel Area A and runs northeast-southwest direction.

4.3.5. According to the Groundsure data, there are 7no. surface water catchment areas managed under the Water Framework Directive (WFD) across or within 250m of the Order Limits. The 7no. water body catchment areas are associated with the Billingham Beck, Lustrum Beck and the River Skerne and are detailed as follows:

- Skerne from Demons Beck to Tess, GB103025072596. (Panel Area A and Panel Area B);
- Skerne from Woodham Burns to Demons Beck, GB103025072391. (Panel Area A and Panel Area B);
- Billingham Beck from Source to Bishopton Beck, GB103025072410. (Panel Area B);
- Bishopton Beck from Source to Billingham Beck, GB103025072280. (Panel Areas B, C, D, E and F);
- Billingham Beck from Bishopton Beck to Brierley Beck, GB103025072360.(Panel Area F and Eastern Grid Connection Area to Norton Substation);
- Billingham Beck from Brierley Beck to Tees Estuary, GB103025076010. (Eastern Grid Connection Area to Norton Substation); and
- Lustrum Beck Catchment (tributary of Tees), GB103025072550. (Eastern Grid Connection Area to Norton Substation).

4.4. Flooding

4.4.1. The EA maintains national flood maps based on ground levels, predicted flood levels, information on flood defences and local knowledge. The flood maps show the predicted likelihood of flooding in an area in the context of current and also the proposed land use (considered in development planning).

4.4.2. For further information on flooding, please refer to ES Chapter 10 Hydrology and Flood Risk (Document Reference 6.2.10), and the Flood Risk Assessment (FRA)and Drainage Strategy provided in ES Appendix 10.1 (Document Reference 6.4.10.1).

Rivers and Coastal (Fluvial) Flooding

4.4.3. According to the EA data provided by Groundsure, the majority of the Order Limits and surrounding 250m are not at risk of flooding from rivers and sea (RoFRaS). There

is a low to high risk of RoFRaS across Panel Areas D & F and an area to the southwest of Panel Area A, relating to the Bishopton Beck and the Skerne, respectively. There is a limited area which is shown to be of low to high risk of RoFRas across the Eastern Grid Connection Area to Norton Substation relating to the Letch Beck.

4.4.4. There are three areas located across Panel Area D; E & F, and the Eastern Grid Connection Area of the Order Limits which are situated within Flood Zone 2. These areas relate to the Little Stainton Beck present at the southern extent of Panel Area D; Bishopton Beck running approximately north-south through Panel Areas E and F; and Letch Beck that runs northeast-southwest across the Eastern Grid Connection Area to Norton Substation. The EA flood maps indicate that the majority of the Order Limits are predominantly situated within Flood Zone 1

Surface Water Flooding

4.4.5. Surface water flooding data provided by the EA indicates that area of medium to high risk of surface water flooding extent across and within 250m of the Order Limits. These areas of flooding are primarily related to the Bishopton Beck present across Panel Areas C, E & F, the River Skerne located to southwest of Panel Area A, and the Letch Beck located across the Eastern Grid Connection Area to Norton Substation. It should be noted that the implication of surface water flooding on the majority of Order Limits is low risk.

Flood Defences

4.4.6. The Groundsure data did not identify any flood defences across or within 250m of Order Limits and no area within 250m of the boundary has been identified as benefiting from flood defences.

5. MINING AND QUARRYING

5.1. General

5.1.1. Research of the mining setting at the Order Limits is based on examination of published topographical and geological information, and records provided within the Groundsure Report.

5.2. Coal Authority Information

5.2.1. Information available on the Coal Authority website (Interactive Map Viewer) indicates that the Order Limits does not lie within a Coal Mine Reporting Area nor does the Order Limits lie within a Development High Risk Area (DHRA).

5.3. Surface Workings

5.3.1. Review of the Groundsure Report has identified a limited amount of historical surface ground working features are present on-site. These are mainly within the east of the Order Limits and pertain to cuttings, gravel pits, sewage beds and unspecified heaps/pits.

5.3.2. Historical surface workings located within 250m of the Order Limits are shown within **Table 5.1**.

TABLE 5.1
SUMMARY OF HISTORICAL WORKING LOCATED WITHIN 250M OF THE ORDER LIMITS

Historical Working	Location
Cuttings (related to roadworks and railway lines)	• On-site to immediately east of Panel Area E • Immediately north to 200m south of the Eastern Grid Connection Area to Noron Substation. • 50m southwest to 250m northwest of Panel Area A
Unspecified pit	• immediately east of Panel Area C • 30m south of Panel Area F
Pond	• 10m west of Panel Area E • 70-116m north of Panel Area F • 50-175m south of eastern cable routes
Water body	• 45m north-east of Panel Area E
Sewage works/beds	• Immediately east of the north-eastern area; and • Immediately north and south of the eastern area
Gravel pit/ old gravel pit	• On-site at the northern extent of Panel Area F; • On-site along the eastern cable routes; • Immediately adjacent eastern cable routes; • 40-106m northeast of Panel Area F; and

TABLE 5.1 SUMMARY OF HISTORICAL WORKING LOCATED WITHIN 250M OF THE ORDER LIMITS	
	• 122m south of eastern cable routes.
Old Sand pit/ sand pit	• On-site at northern extent of Panel Area F; and • 140m north of Panel Area B
Refuse heap	• Immediately south of the cable routes.
Unspecified ground workings	• Immediately north of eastern cable routes.

5.4. Underground Workings, Non-Coal Mining and Brit Pits

5.4.1. There are no records of localised small scale underground workings of non-coal mining on-site or within 250m of the Order Limits.

5.4.2. There is one Brit Pit located within the north-east of the Order Limits and pertains to a surface working mineral at Stanklings Gravel Pit. The pit has been classed as ceased. Within 250m, there are a further 4no. Brit Pit entries pertaining to sand and gravel surface working minerals.

6. ENVIRONMENTAL DATA AND CONSULTATIONS

6.1. Introduction

6.1.1. The potentially contaminative historical industrial land uses are briefly reviewed within Section 3 of this report. Based on a review of the Groundsure Report, the following environmental information and consultations have been noted.

6.2. Contaminated Land Register Entries and Notices

6.2.1. There are no Control of Major Accident Hazards (COMAH) sites, regulated explosive sites or historical licensed industrial activities (Integrated Pollution Control), or hazardous substance storage/usage within 250m of the Order Limits.

6.2.2. There are no historical licensed industrial activities located on-site or within 250m of the Order Limits.

6.2.3. There are 8no. records of pollution incidents located within 250m of the Order Limits of which 1no. is located on-site. The record located to the east of Panel Area E, along the eastern cable routes(437568 E, 520930 N) has been classed as a Category 3 (minor) to air and water, and Category 4 (no impact) to land. The pollution type has been categorised as general biodegradable materials and wastes. The remaining records within 250m of the Order Limits have been mainly classified as Category 4 (no impact) and Category 3 (minor impact) to water, air, and land. However, one record pertaining to a pollution incident on the 21st July 2005, located on the River Skerne approximately 75m west of Panel Area A, relating to surfactants and detergents has been classified as Category 1 (major) to water.

6.2.4. There is one record of a List 2 Dangerous Substances permit within 250m of the Order Limits located approximately 60m southeast of Panel Area F. The permit pertains to the Bishopton Sewage Treatment Works.

6.2.5. There is one record of licensed industrial activities (Part 1-A1) within 250m of the Order Limits located approximately 100m off-site in Panel Area B. The record pertains to the Hauxley Poultry Farm (permit ID. EPR/NP3234YT) allowing activities relating to “intensive farm; >40,000 poultry”. Additionally, there are 3no. Pollution Inventory Substance records related to Hauxley Poultry Farm.

6.2.6. There are 3no. records of Radioactive Substance Authorisation Permits present on-site approximately 50m south of Norton Substation. The 3no. records relate to a revoked/cancelled permit (ID. AO4828) for the disposal of radioactive waste, held by Cleveland Medical Laboratories between 1994 and 1997.

6.2.7. There are 37no. records of historical tanks and unspecified tanks within 250m of the Order Limits. A total of 2no. tanks and 5no. unspecified tanks are located within the east of the Order Limits, associated with Norton Sub-Station.

6.2.8. There are 24no. records of historical energy features within 250m of the Order Limits, of which 6 no. are located on-site and related to Norton Sub-Station within the east. The on-site records have been recorded as electricity substation, electricity transformer station, and electricity works. The remaining records all pertain to electricity substations located within the surrounding area.

6.3. Waste Management

6.3.1. There is one record of active or recent landfill sites within 250m of the Order Limits according to the Environment Agency (EA). The record pertains to Aycliffe Quarry Landfill located approximately 100m northwest of the northern cable routes in Panel Area A (429262 E, 522104 N). The quarry permit is classified as effective status, allow "*>10 t/d with capacity >25,000t excluding inert waste*". The permit (ID. DP3039AU) is held by Stonegrave Aggregates Limited.

6.3.2. There are 2no. records of historic landfill sites within 250m of the Order Limits according to the EA records provided as part of the Groundsure data. The historic landfill records are as follows:

- Cobby Castle Lane. Located approximately 30m south of Panel Area F, Bishopton, Darlington, County Durham. Site ref. DL011. No information pertaining to license. As shown in the Figure 6.1, the extent of the historical landfill is clearly unknown, but it can be assumed that it is related to surface ground workings (brown polygons) believed to be an Old Sand Pit; and
- Stillington Refuse Tip. Located approximately 35m north of Panel Area F, Stillington, Durham, County Durham. License held by Redland Purle (Northern) Limited, with first waste input 12/06/1967, no indication of closure date. The landfill accepted industrial and liquid sludge wastes. There is also a BGS record pertaining to the Stillington Refuse Tip (ID. 1910).

6.3.3. There are no records of licensed waste sites or historical waste sites, according to the Environment Agency and local authority mapping respectively.

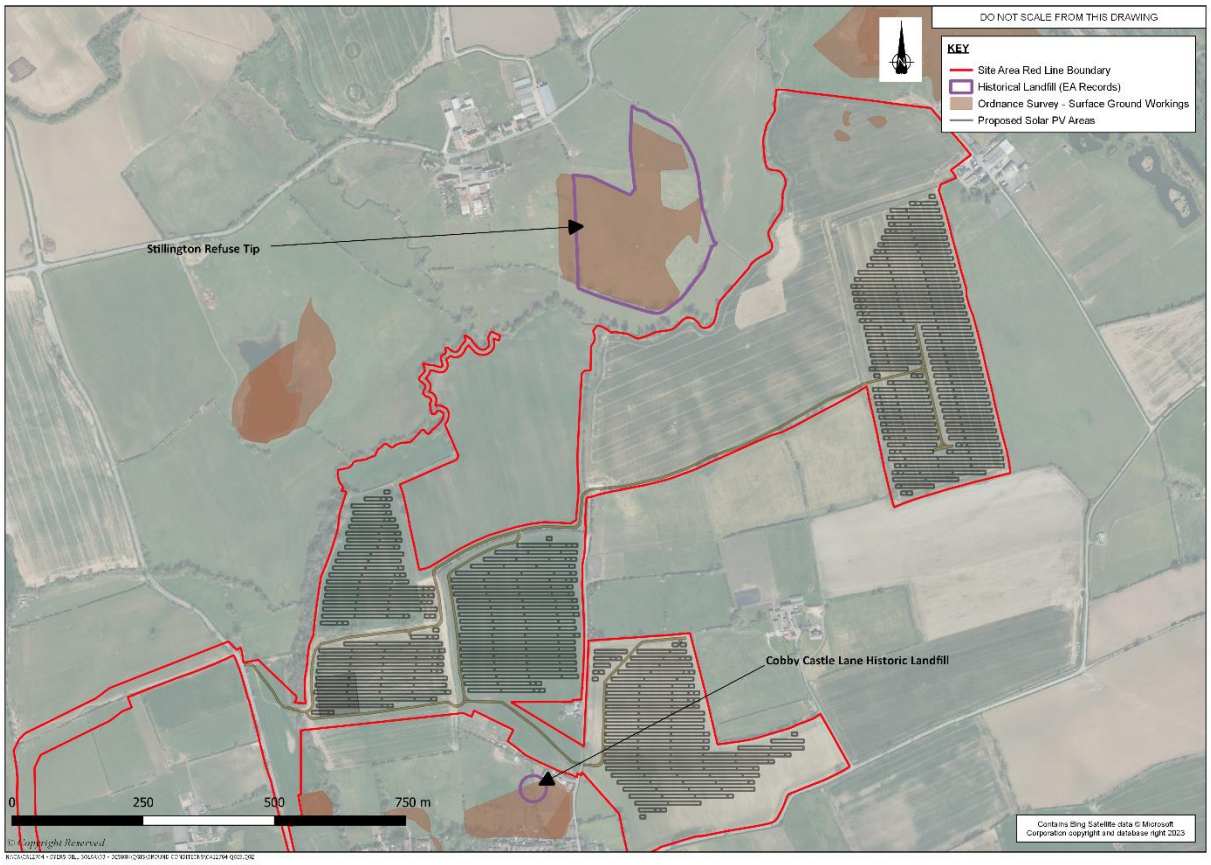


Figure 6.1: Aerial Image Showing the Approximate Locations of Historic Landfills near Panel Area F.

6.4. Radon

6.4.1. The BRE 'Guidance on Protective Measures for New Dwellings' (BR 211) has been consulted to review the geological radon potential of the Order Limits as outlined by the BGS.

6.4.2. The relevant radon data collated within the Groundsure Report estimates the percentage of dwellings exceeding the Radon Action Level as less than 1% for most of the Order Limits. There are areas within the Panel Areas A, B and F which estimated the percentage as 1% to 3%, and a limited area within the south-east and north-east which estimates the percentage as between 10% and 30%.

6.5. Discharge Consents

6.5.1. There are 40no. records of licensed discharges to controlled waters on-site and within 250m of the Order Limits. There are 4no. records of licensed discharged on-site and are located within the centre and east of the Order Limits. The records pertain to the release of sewage in the form of final treated effluent and unspecified

material. The remaining licensed discharges within 250m of the boundary pertain to sewer discharges in the form of sewer storm overflow and final treated effluent. **Table 6.1** summarises the records of licensed discharges that have been recorded on-site.

Table 6.1: Summary of the licensed discharges recorded within the Order Limits

Description	Location
Permit number 254/D/0176 Issued from 22/02/1968 and revoked on 03/01/2009. The receiving water has been recorded as Trib Little Stainton Beck and effluent type has been described as sewage discharges of final/treated effluent.	Panel Area D: 433902 E, 521498 N
Permit number 254/0069 Issued from 01/07/1985 and revoked on 05/01/2009. The receiving water has been recorded as Byers Gill Beck and effluent type has been described as sewage discharges of final/treated effluent.	Panel Area D: 433844 E, 521422 N.
Permit number 254/E/0019 Issued from 14/11/1952 and revoked on 05/03/1990. The receiving water has been recorded as Letch Beck and effluent type has been described as sewage discharges of final/treated effluent.	Panel Area D: 434202 E, 521101 N.
Permit number 254/1518 Issued from 26/08/1997 and revoked on 16/06/2011. The receiving water has been recorded as Land and effluent type has been described as sewage and trade combined – unspecified.	Norton Sub-Station: 441201 E, 522199 N.

6.5.2. There are no records reported for pollutant release to surface waters (Red List), pollutant release to public sewer or List 1 Dangerous Substances within 250m of the Order Limits.

6.6. Local Authority Pollution Prevention Controls

6.6.1. There are no licensed industrial activities (Part A (1)) or licensed pollutant releases (Part A (2)/B) on or within 250m of the Order Limits.

6.7. Dangerous or Hazardous Sites

6.7.1. There are no records of hazardous sites on or within 250m of the Order Limits. The classification of hazardous sites in this regard specifically relates to consents granted for a site to hold certain quantities of hazardous substances at or above defined limits in accordance with the Planning (Hazardous Substances) Regulations 2015.

6.7.2. There are no records of dangerous substances on-site, however there is one record of a List 2 dangerous substance located approximately 60m south-east of Panel Area F. The record has been listed as not active.

6.8. Designated Environmentally Sensitive Sites

6.8.1. No Local Nature Reserve (LNR), Designated Ancient Woodland, Ramsar sites, Special Areas of Conservation (SAC) or Special Protection Areas (SPA) have been noted on site or within 250m of the Order Limits.

6.8.2. A Site of Special Scientific Interest (SSSI), recorded as Newton Ketton Meadow, has been identified approximately 130m south of the centre of the Order Limits.

6.9. Asbestos

6.9.1. The Health and Safety at Work Act requires that Employers provide safe places of work for their employees. The Control of Asbestos Regulations place very heavy specific duties on those who commission and carry out work on asbestos containing materials.

6.9.2. Construction work that is likely to involve exposure of workers to hazards associated with asbestos in existing buildings will be subject to the Construction (Design and Management) Regulations which impose duties upon Clients, Designers and the Contractors carrying out the work.

6.9.3. Due to the previous usage of the area, the likelihood of encountering asbestos containing materials at the Order Limits is low but should not be discounted until deemed otherwise.

6.10. Unexploded Ordnance (UXO)

6.10.1. Data obtained from UXO specialise risk maps has classed the Order Limits to be of low bomb risk.

7. CONCEPTUAL SITE MODEL

7.1. Methodology

7.1.1. On 8th October 2020, the EA republished (LCRM) which replaced Model procedures for the management of land contamination (CLR11).

7.1.2. The LCRM approach includes the production of a Conceptual Site Model (CSM) depicting the environmental processes that occur on and in the vicinity of the Order Limits and identifying the potential contaminant linkages. The assessment of the significance of these contaminant linkages can then be carried out through the risk assessment process.

7.1.3. The production of a CSM and the assessment of the associated risk is based upon the identification of the possible sources of contamination ("the sources"), the identification of who or what may be affected by the contaminants ("the receptors") and the possible pathways by which contaminants may migrate to one or more of the receptors ("the pathways").

7.1.4. The results of the desk study and site walkover have been used to identify the potential sources, pathways and receptors that exist within the Order Limits.

7.2. Potential Sources of Contamination

7.2.1. The potential sources of contamination are summarised below and within Table 7.1:

On-site

- Source 1 -Agricultural land;
- Source 2 -Electricity works including tanks (Norton Sub-Station); and
- Source 3 - Infilled gravel and sand pits (Panel Area F).

Off-site

- Source 1 - Infilled sand pits (50-125m north of Panel Area F, 20-120m south of the Panel Area F &Eastern Grid Connection Area);
- Source 2 - Railway lines (72m west of the Panel Area A and immediately north of the Eastern Grid Connection Area);
- Source 3 - Brick and Tile Works, clay pit (Immediately adjacent eastern boundary of Panel Area C);
- Source 4 - Gravel pits (immediately north and south of the Eastern Grid Connection Area);

- Source 5 - Infilled ponds (immediately adjacent western boundary of Panel Area E);
- Source 6 - Refuse tips (Immediately south and 145m south of the Eastern Grid Connection Area);
- Source 7 - Sewage works including tanks (immediately adjacent southern boundary of Panel Area F);
- Source 8 - Garage (immediately north and south of the Eastern Grid Connection Area);
- Source 9 – Historical Unspecified works including tanks (immediately north and south of the Eastern Grid Connection Area);
- Source 10 - Electricity substations (12m west of Panel Area D, 36-60m north and 75-85m south of Eastern Grid Connection Area); and
- Source 11 – Historic Landfills (30m north and 35m south of Panel Area F).

Table 7.1: Source of contamination and potential contaminants.		
On-site Sources	**Activities/ contaminant source**	**Potential Contaminants**
On-site Source 1 – Agricultural land	Leaks and spillages from vehicles, fertilisation.	Total petroleum hydrocarbons (TPH), polyaromatic hydrocarbons (PAHs), oils and solvents, pesticides, herbicides, nitrates.
On-site Source 2 – Electricity works including tanks (Norton Sub-Station).	Contamination associated with activities undertaken within a electricity works, spillages from tanks and equipment.	Heavy metals, PAH, TPH, inorganics.
On-site Source 3 – Infilled sand pit	Potentially contaminated infilled material.	Heavy metals, PAH, TPH, inorganics, asbestos.
Off-site Sources	**Activities/ contaminant source**	**Potential Contaminants**
Off-site Source 1 – Infilled sand pit.	Potentially contaminated infilled material.	Heavy metals, PAH, TPH, inorganics, asbestos.
Off-site Source 2 – Railway sidings	Potential leaks from train vehicles.	PAH, TPH, PCBs.
Off-site Source 3 – Brick and Tile works, clay pit	Contamination associated with activities undertaken within a brick and tile works, potentially contaminated infilled material.	Heavy metals, PAH, TPH, inorganics, asbestos.
Off-site Source 4 – Gravel pits	Contamination associated with machinery and excavation activities, potentially contaminated infilled material.	Heavy metals, PAH, TPH, inorganics, asbestos.
Off-site Source 5 – Infilled ponds.	Potentially contaminated infilled material.	Heavy metals, PAH, TPH, inorganics, asbestos.
Off-site Source 6 – Refuse tips	Potentially contaminated refuse material.	Heavy metals, PAH, TPH, inorganics, asbestos.
Off-site Source 7 – Sewage works including tanks	Contamination associated with sewage works, tank spillages.	Heavy metals, PAH, TPH, inorganics, asbestos, polychlorinated biphenyls (PCBs), pesticides.
Off-site Source 8 – Garage	Contamination associated with garage works, tank spillages.	Heavy metals, PAH, TPH, inorganics.
Office Source 9 – Unspecified works and tanks.	Contamination associated with works, tank spillages.	Heavy metals, PAH, TPH, inorganics.
Off-site Source 10 – Electricity substation	Leaks from substation	Heavy metals, PAH, TPH, inorganics.

Off-site Source 11 – Historic Landfills	Historically landfilled materials.	Ground gas generation.

7.3. Potential Receptors

7.3.1. Based on the desk study researches, the following potential receptors for contamination have been identified:

- Humans – Current and future users of the Proposed Development (maintenance staff);
- Humans – Construction workers;
- Controlled Waters – Surface Waters (53no. surface water features located within the Order Limits);
- Controlled Waters – Groundwater (Secondary A superficial and Principal bedrock aquifer);
- Built Environment - buried concrete structures and utilities; and
- Flora and Fauna.

7.4. Identification of Pathways

Pathways to Humans

7.4.1. There are various routes by which any contaminant present within the soils or groundwater beneath the Order Limits may pose a direct risk to humans, either during construction work or following redevelopment. These pathways include:

- Direct ingestion of soils;
- Dermal contact with soil;
- Dermal contact with groundwater in excavations;
- Inhalation or ingestion of dust;
- Contact through the eye;
- Ingestion of water; and
- Inhalation of vapours and/or gases.

Pathways to Built Environment

7.4.2. There is a potential for topsoil and groundwater containing substances aggressive to concrete to come into direct contact with service pipes / conduits, buried concrete and associated infrastructure.

7.4.3. Ground gas generation on-site and from nearby historical landfills, and infilled land is a possibility, and these ground gases have the potential to migrate directly from and through permeable Superficial Deposits. However, as there are no buildings proposed within the development layout, the risk of ground gas accumulation will not be included within the conceptual site model. If buildings where gas can accumulate are later added to the proposed development layout, the level of ground gas risk will need to be assessed.

Pathways to Controlled Waters (Surface Waters)

7.4.4. There are 53no. surface water bodies located on-site, and further rivers located within 250m of the Order Limits. Contaminants may be transported as leachate or as dissolved phase by lateral migration within shallow groundwater in hydraulic continuity with surface water features or via surface water run-off.

Pathways to Controlled Waters (Groundwater)

7.4.5. Mobile or leached contaminants, including spillages and leakages to ground from plant/machinery, could potentially migrate laterally or vertically from ground surface into the superficial and bedrock aquifers.

Pathways to Local Flora and Fauna

7.4.6. Consideration of risks posed to any flora (from phytotoxic compounds), or fauna (direct contact including ingestion of flora) may be required if observed in future.

8. QUALITATIVE ENVIRONMENTAL RISK ASSESSMENT

8.1. Introduction

8.1.1. In line with EA guidance - LCRM, plausible source, pathway and receptor linkages have been identified through the Conceptual Site Model (CSM). The information gathered in the CSM can now be used to carry out a Qualitative Risk Assessment (QRA).

8.1.2. LCRM outlines that for each tier of Risk Assessment the following steps must be taken:

i) Identify the hazard - establish contaminant sources;

ii) Assess the hazard - use a source-pathway-receptor (S-P-R) contaminant linkage approach to find out if there is the potential for unacceptable risk;

iii) Estimate the risk - predict what degree of harm or pollution might result and how likely it is to occur by using the tiered approach to risk assessment; and

iv) Evaluate the risk – decide whether a risk is unacceptable.

8.1.3. LCRM states that the assessment must be based on the potential severity that the risk poses to the receptors against the likelihood of it happening. Subsequently, it is necessary to employ a risk assessment matrix, the CIRIA document Contaminated Land Risk Assessment – a guide to good practice C552, 2001 provides a good example of a suitable risk assessment matrices.

8.1.4. The CIRIA document defines Consequence of Risk, Probability of Risk Being Realised and Risk Classification Definitions. These definitions are provided in **Appendix D**.

8.1.5. From the combination of the information collated within this report thus far, a qualitative assessment of the potential geo-environmental risk is provided in **Table 8.1**. Where indicated, these risks may need to be considered for any future redevelopment of the land.

8.1.6. In order to place the on-site assessment of contamination into full context, the contaminative impact of the present site use is assessed. This assessment is in relation to potential contaminant migration and the general environmental setting of the surrounding area.

TABLE 8.1 PRELIMINARY CONCEPTUAL SITE MODEL						
Source	**Contaminants**	**Pathway**	**Receptor**	**Risk (before mitigation)**	**Justification/Mitigation**	**Post mitigation hazard**
Human Health Receptors						
On-site source 1: Agricultural land (spillages from farm machinery, fertilisers).	Total petroleum hydrocarbons (TPH), polyaromatic hydrocarbons (PAHs), oils and solvents, pesticides, herbicides, nitrates.	• Ingestion of contaminated dust, soils and/or groundwater. • Dermal contact with contaminated dust, soils and/or groundwater. • Inhalation of dust	**Human Health** – Future site users (High receptor sensitivity)	Consequence: Mild Probability: Low Likelihood **Risk: Low**	There is a potential for contaminants associated with the current land use to be present on-site. However, a significant source of contamination is not expected. Soil sample collection and testing as part of a proposed ground investigation works is recommended to identify any hotspots of contamination prior to site construction and development.	Consequence: Mild Probability: Unlikely **Risk: Very Low**
			Human Health – construction workers (low receptor sensitivity)	Consequence: Mild Probability: Likely **Risk: Moderate/Low**	There is a potential for construction workers to encounter contamination through excavations. However, a limited source of contamination is expected within the Order Limits. Construction workers will be provided with Personal Protective Equipment (PPE) and therefore the risk of	Consequence: Mild Probability: Low Likelihood **Risk: Low**

TABLE 8.1
PRELIMINARY CONCEPTUAL SITE MODEL

Source	Contaminants	Pathway	Receptor	Risk (before mitigation)	Justification/Mitigation	Post mitigation hazard
					encountering contamination can be reduced to low. Soil sample collection and testing as part of a proposed ground investigation works is recommended to identify any hotspots of contamination prior to site construction and development.	
On-site source 2: Electricity Works including tanks (Norton Sub-Station).	PAH, TPH, heavy metals, inorganics.	• Direct ingestion of contaminated dust, soil and/or groundwater. • Dermal contact with contaminated dust, soil and/or groundwater. • Inhalation of dust	**Human Health** – Future site users (High receptor sensitivity)	Consequence: Mild Probability: Low Likelihood **Risk: Low**	There is a potential for contaminants associated with the current land use to be present on-site. However, a significant source of contamination is not expected, and no excavation works are to be undertaken at this location. Should any significant future works be proposed at this location, sample collection and testing as part of a ground investigation is recommended to identify any contamination associated with the current/historical land use	Consequence: Mild Probability: Unlikely **Risk: Very Low**

TABLE 8.1
PRELIMINARY CONCEPTUAL SITE MODEL

Source	Contaminants	Pathway	Receptor	Risk (before mitigation)	Justification/Mitigation	Post mitigation hazard
					prior to construction and development.	
			Human Health – construction workers (low receptor sensitivity)	Consequence: Mild Probability: Likely **Risk: Moderate/Low**	There is a potential for construction workers to encounter contamination through excavations. However, a limited source of contamination is expected within the Order Limits. Construction workers will be provided with Personal Protective Equipment (PPE) and therefore the risk of encountering contamination can be reduced to low. Soil sample collection and testing as part of a proposed ground investigation works is recommended to identify any hotspots of contamination prior to site construction and development.	Consequence: Mild Probability: Low Likelihood **Risk: Low**

TABLE 8.1
PRELIMINARY CONCEPTUAL SITE MODEL

Source	Contaminants	Pathway	Receptor	Risk (before mitigation)	Justification/Mitigation	Post mitigation hazard
On-site source 3: Infilled sand pit	Heavy metals, PAH, TPH, inorganics, asbestos.	• Direct ingestion of contaminated dust, soil and/or groundwater. • Dermal contact with contaminated dust, soil and/or groundwater. • Inhalation of dust	**Human Health** – Future site users (High receptor sensitivity)	Consequence: Mild Probability: Low Likelihood **Risk: Low**	There is a potential for contaminants associated with the current land use to be present on-site. However, a significant source of contamination is not expected, and solar PV modules are not proposed within this area. Should any significant future works be proposed at this location, sample collection and testing as part of a ground investigation is recommended to identify any contamination associated with the current/historical land use prior to construction and development.	Consequence: Mild Probability: Unlikely **Risk: Very Low**

			Human Health – construction workers (low receptor sensitivity)	Consequence: Mild Probability: Likely **Risk: Moderate/Low**	There is a potential for construction workers to encounter contamination through excavations. However, a limited source of contamination is expected within the Order Limits. Construction workers will be provided with Personal Protective Equipment (PPE) and therefore the risk of encountering contamination can be reduced to low. Soil sample collection and testing as part of the proposed ground investigation works will identify any hotspots of contamination prior to site construction and development.	Consequence: Mild Probability: Low Likelihood **Risk: Low**

TABLE 8.1
PRELIMINARY CONCEPTUAL SITE MODEL

Source	Contaminants	Pathway	Receptor	Risk (before mitigation)	Justification/Mitigation	Post mitigation hazard
Off-site Sources – • Infilled sand pit • Railway sidings • Brick and tile works, clay pit. • Gravel pit • Infilled ponds • Refuse tips. • Sewage works including tanks. • Garage • Unspecified works and tanks • Electricity substation • Historic Landfills	PAH, TPH, heavy metals, inorganics, PCBs, and asbestos	• Ingestion of contaminated dust, soils, and/or groundwater • Dermal contact with contaminated dust, soils and/or groundwater. • Inhalation of dust. • Inhalation of vapours and/or gases.	**Human Health** – construction workers (low receptor sensitivity)	Consequence: Mild Probability: Likely **Risk: Moderate/Low**	The off-site sources of contamination are located beyond the site boundary where excavation is not anticipated. Therefore, physical exposure to contaminants and direct exposure is considered to be low. Off-site contamination migration onto the Order Limits may possibly occur through the permeable soils in contact with contamination. Soil sample collection and testing as part of a proposed ground investigation works will identify any hotspots of contamination prior to site construction and development	Consequence: Mild Probability: Low Likelihood **Risk: Low**
			Human Health – Future site users (High receptor sensitivity)	Consequence: Medium Probability: Low Likelihood **Risk: Moderate/Low**		Consequence: Medium Probability: Unlikely **Risk: Low**

TABLE 8.1
PRELIMINARY CONCEPTUAL SITE MODEL

Source	Contaminants	Pathway	Receptor	Risk (before mitigation)	Justification/Mitigation	Post mitigation hazard
Flora and Fauna Receptors						
On-site • Agricultural land • Electricity works including tanks. • Infilled sand pit. Off-site • Infilled sand pit • Railway sidings • Brick and tile works, clay pit. • Gravel pit • Infilled ponds • Refuse tips. • Sewage works including tanks. • Garage • Unspecified works and tanks • Electricity substation • Historic Landfills	PAH, TPH, heavy metals, inorganics, nitrates, pesticides, and PCBs.	<u>On-site</u> • Direct uptake from soil. • Plant uptake. <u>Off-site</u> • Direct uptake from soil. Including airborne transmission then uptake • Plant uptake. Including airborne transmission then uptake	**Flora and Fauna** (on-site) (Low receptor sensitivity)	Consequence: Minor Probability: Low Likelihood **Risk: Very Low** Consequence: Mild Probability: Low Likelihood **Risk: Very Low**	Contaminants of concern associated with current and historical land use and where possible, the potential impact to flora and fauna should be considered during future site investigation. Therefore, the probability of flora and fauna encountering contamination will be reduced further.	Consequence: Minor Probability: Unlikely **Risk: Very Low** Consequence: Mild Probability: Unlikely **Risk: Very Low**
Controlled Waters - Surface Water						
On-site • Agricultural land • Electricity works including tanks. • Infilled sand pit.	PAH, TPH, heavy metals, inorganics, and PCBs.	• Off-site migration of contaminated Surface run-off • Migration of contaminants within	**Controlled Waters – Surface Waters** (53no. surface water features located on-site).	Consequence: Mild Probability: Unlikely **Risk: Very Low**	There is potential for on-site surface water contamination associated with historical land use on-site, however	Consequence: Mild Probability: Unlikely **Risk: Very Low**

TABLE 8.1
PRELIMINARY CONCEPTUAL SITE MODEL

Source	Contaminants	Pathway	Receptor	Risk (before mitigation)	Justification/Mitigation	Post mitigation hazard
		shallow groundwater flow in continuity with surface water features.			this is considered to be a very limited occurrence. Whilst likely to be limited, contaminated surface water migrate off-site could migrate vertically or laterally as groundwater. Prior to development, a ground investigation will be carried out to assess any contamination within the Order Limits. Any contamination which poses a risk to surface water should be remediated and therefore the risk to groundwater will be reduced.	
On-site • Agricultural land • Electricity works including tanks. • Infilled sand pit.	PAH, TPH, heavy metals, inorganics, and PCBs.	• Vertical migration of leachate into the underlying superficial deposits and bedrock strata within shallow groundwater flow in continuity with	**Controlled Waters – Groundwater** (Secondary A superficial and Principal bedrock aquifers).	Consequence: Medium Probability: Low Likelihood **Risk: Moderate/Low**	There is a potential for contaminants associated with historical land use to be present onsite. However, a significant source of contamination is not expected. Furthermore, the BGS borehole records and	Consequence: Medium Probability: Unlikely **Risk: Low**

TABLE 8.1 PRELIMINARY CONCEPTUAL SITE MODEL						
Source	**Contaminants**	**Pathway**	**Receptor**	**Risk (before mitigation)**	**Justification/Mitigation**	**Post mitigation hazard**
		surface water features.			mapping indicate that the vast majority of the Order Limits is covered by Glacial Till deposits with up to 10m of clay dominant horizons present. These clay horizons are expected to significantly reduce the likelihood of leachate and dissolved contaminant migration into the principal bedrock aquifer. Whilst likely to be limited, surface water infiltration and subsequent leachate generate could allow for the vertical migration of contaminants into the sands, gravels, and silts (Secondary A superficial aquifer). Prior to development, a ground investigation will be carried out to assess any contamination across the Order Limits. Any contamination which poses a risk to groundwater should be remediated and therefore the risk to	

TABLE 8.1 PRELIMINARY CONCEPTUAL SITE MODEL						
Source	**Contaminants**	**Pathway**	**Receptor**	**Risk (before mitigation)**	**Justification/Mitigation**	**Post mitigation hazard**
					groundwater will be reduced.	
Built Environment						
On-site • Infilled sand pit. Off-site • Infilled sand pit • Railway sidings • Brick and tile works, clay pit. • Gravel pit • Infilled ponds • Refuse tips • Historic Landfills	Ground gas generation through potential contaminated backfill and historically disposed waste	• Migration and accumulation of ground gas onto site through permeable strata and into enclosed spaces and/or basement structures (Explosive Risk).	**Built Environment** (Structures).	Consequence: Medium Probability: Low Likelihood **Risk: Moderate/Low**	There is potential for the ground gas generation from the potentially backfilled ground workings and historic landfills to migrate through permeable superficial deposits onto site. The historical landfill sites have been identified within 250m of the Order Limits. However, they are both located over 100m from any proposed solar PV modules and over 3km from the proposed substation. Therefore, the migration and accumulation of landfill gases within the built environment is considered unlikely. Ground investigation works including the installation and monitoring of ground gas monitoring wells across the site would allow for the	Consequence: Medium Probability: Unlikely **Risk: Low**

TABLE 8.1 PRELIMINARY CONCEPTUAL SITE MODEL						
Source	**Contaminants**	**Pathway**	**Receptor**	**Risk (before mitigation)**	**Justification/Mitigation**	**Post mitigation hazard**
					characterisation of the ground gas regime beneath the site and the recommendation of appropriate levels of ground gas protection measures.	

9. GEOTECHNICAL PRELIMINARY CONSIDERATION

9.1. Geotechnical Hazards

9.1.1. In addition to the environmental hazards, geotechnical hazards associated with the stability of the ground and mining issues should be assessed. A brief summary of the geotechnical hazards found within the Groundsure data for the site is provided in **Table 9.1** below.

9.1.2. It should be noted that the BGS Ground Stability Hazard assessment data is derived from the BGS digital 1:50,00 geological mapping. The data is used to assess potential ground stability issues related to natural geological conditions only, and does not cover any man-made hazards, such as waste disposal, contaminated land, or mining. The only exception to this is Compressible Ground hazard layer, which does consider Made Ground deposits e.g., landfill.

TABLE 9.1
SUMMARY OF GEOTECHNICAL HAZARDS

Hazard	Hazard rating
Collapsible Ground Stability Hazard **(Negligible to Very Low Risk)**	Most of the Order Limits has been classed as at Very Low risk where 'Deposits with potential to collapse when loaded and saturated are unlikely to be present.' Areas indicated as underlain by Alluvium deposits across the Order Limits are classified as Negligible risk with "*Deposits with potential to collapse when loaded and saturated are believed not to be present*".
Compressible Ground Stability Hazard **(Negligible to High Risk)**	Most of the Order Limits is classified as Negligible risk where "Compressible strata are not thought to occur". These areas are associated with the Glacial Till and Glaciofluvial Deposits. Discreet areas located by Panel Areas E and F have been classed as at Very Low risk where "*Compressibility and uneven settlement problems are not likely to be significant on the site for most land uses*". These areas are associated with Glaciofluvial Deposits. Small areas present across the Order Limits are classified as Moderate risk with "*Compressibility and uneven settlement hazards are probably present. Land use should consider specifically the compressibility and variability of the site*". These areas are associated with the Alluvium, Head, and Lacustrine Deposits. A small area present to the north of the eastern cable routes has been classified as High Risk where "*Highly compressible strata present. Significant constraint on land use depending on thickness*". This area is associated with the Peat Deposits as mapped by the BGS.

Potential for Ground Dissolution Stability Hazards **(Negligible to Moderate Risk)**	Most of the Order Limits is classified as Negligible risk where "Soluble rocks are either not thought to be present within the ground, or not prone to dissolution. Dissolution features are unlikely to be present". An area across the northern extent of Panel Area F is classified as Very Low risk where "*Soluble rocks are present within the ground. Few dissolution features are likely to be present. Potential for difficult ground conditions or localised subsidence are at a level where they need not be considered*". An east-west band across the south of the Order Limits traversing Panel Area A, C and E is classified as Low Risk where "*Soluble rocks are present within the ground. Some dissolution features may be present. Potential for difficult ground conditions are at a level where they may be considered, localised subsidence need not be considered except in exceptional circumstances*". A small area located immediately south of Panel Area C is classified as Moderate risk where "*Soluble rocks are present within the ground. Many dissolution features may be present. Potential for difficult ground conditions are at a level where they should be considered. Potential for subsidence is at a level where it may need to be considered*".
Potential for Landslide Ground Stability Hazards **(Low to Moderate Risk)**	Most of the Order Limits is classed as Very Low risk where 'Slope instability problems are not likely to occur but consideration to potential problems of adjacent areas impacting on the site should always be considered.' There are small discrete areas across Panel Areas A, C, D and F which have been classed as low risk where "Slope instability problems may be present or anticipated. Site investigation should consider specifically the slope stability of the site". A small area to the northwest of Panel Area A is indicated as Moderate Risk where "*Slope instability problems are probably present or have occurred in the past. Land use should consider specifically the stability of the site*".
Potential for Running Sand Ground Stability Hazards **(Very Low to Low Risk)**	Most of the Order Limits has been classed as Very Low risk where "running sand conditions are unlikely. No identified constraints on land use due to running conditions unless water table rises rapidly". There are sporadic areas across the entire Order Limits which have been classified as Low Risk where "running sand conditions may be present. Constraints may apply to land uses involving excavation or the addition or removal of water".
Potential for Shrinking or Swelling Clay Ground Stability Hazards **(Negligible to Low Risk)**	There are sporadic areas across the entire Order Limits which have been classified as Negligible Risk where "ground conditions are predominantly non-plastic". Most of the Order Limits has been classed as at Very Low risk where "ground conditions predominantly low plasticity". The east of the site, as well as some areas in the centre and west have been classed as Low Risk where "ground conditions are predominantly medium plasticity".

9.2. Near Surface Soils and Foundations

9.2.1. A detailed intrusive ground investigation is recommended to delineate the risks associated with near surface soils to confirm the suitability of the founding soils where solar PV modules and associated infrastructure is proposed, especially in areas where ground dissolution features and running sand may be present.

9.3. Mining

9.3.1. The Order Limits does not lie within a coal mining area. The Groundsure Report has identified a Brit Pit pertaining to Stanklings Gravel Pit within the north-east of the Order Limits. There are no solar PV modules proposed within this location, however if future changes to the layout include solar PV modules within this location a site investigation to confirm the presence of unstable ground associated with the pit is recommended.

9.3.2. Topography and Regrading

9.3.3. Topographically, the Order Limits generally is generally slopes towards the south and east.

9.4. Excavations and Groundwater

9.4.1. Due to the unknown strength of subsurface material, excavations may be difficult within the solid bedrock beneath the Order Limits .

9.4.2. An intrusive ground investigation would assist with verifying the presence of shallow groundwater and, if present, this may need to be considered further as part of a pre-construction phase.

9.5. Services and Subsurface Structures

9.5.1. Utility and services should be located prior to any future ground investigation or redevelopment.

10. CONCLUSIONS AND RECOMMENDATIONS

10.1. Current Land Area

10.1.1. The Proposed Development spans approximately 490 hectares of land between Darlington and Stockton-on-Tees. The centre of the Order Limits is located at National Grid Reference 434748E, 521637N.

10.1.2. Most of the Order Limits is composed of agricultural land. Within the eastern corner of the Order Limits, there is a power station consisting of buildings, hardstanding, and electricity infrastructure. Surrounding land area mostly includes agricultural land to the north and south of the Order Limits, along with sporadic farm buildings and houses. The central eastern part of the Order Limits also traverses through the village of Bishopton.

10.2. Environmental Sensitivity

10.2.1. The Superficial Deposits underlying the Order Limits have been classified as Secondary Undifferentiated and Secondary A aquifer. Bedrock underlying the Order Limits is classed as a Principal, Secondary A and Secondary B aquifer.

10.3. Contamination Potential

10.3.1. A review of the Groundsure data has identified the risk at the Order Limits to be Very low to Moderate/Low to sensitive receptors, with the recommended mitigation measures the risk can be reduced to Very Low to Low.

10.3.2. An intrusive ground investigation is recommended with the associated environmental analysis to assist in reducing existing uncertainties.

10.4. Geotechnical Constraints

10.4.1. A review of the desk study has identified a potential risk of compressible ground, ground dissolution features and running sands hazards across the Order Limits.

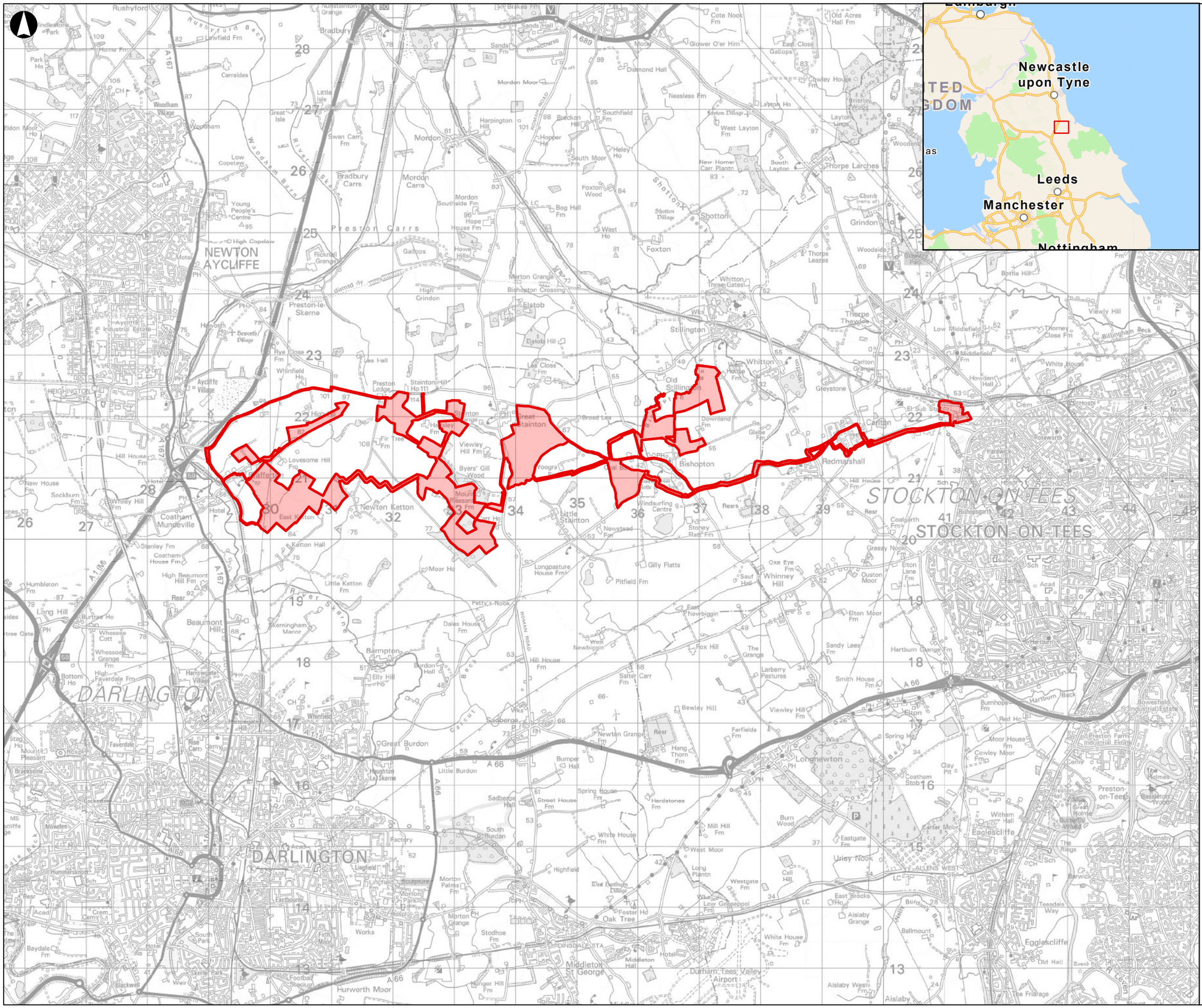
10.4.2. It is recommended that a ground investigation is carried out to confirm the shallow ground conditions at the Order Limits to confirm the suitability of the founding soils where solar PV modules and associated infrastructure is proposed.

10.5. Preliminary Ground Investigation

10.5.1. Due to the limited contaminative risk associated historic and current activities across the Order Limits and surrounding land, together with the potential geotechnical hazards related with identified ground conditions beneath the Order Limits, an

intrusive ground investigation is recommended. The ground investigation requirements could be considered at the detailed design phase. This approach will ensure the scope of any proposed investigation is commensurate with the future land use/masterplan.

Drawing
BGS-ES01-00001 Site Location Plan



Legend

Order Limits

A3

11/2/2023 4:35 PM

Coordinate System: British National Grid

Metres

0 500 1,000 2,000

Rev	Date	By	Chkd	Appd	Authd
P01.04	02/11/2023	JE	--	--	--

Client

JBM SOLAR

Project Name

Byers Gill Solar

Drawing Title

Figure 1.1
Location Plan

Scale at A3

1:60,000

Role

Initial Status or WiP

Suitability

Environmental Statement

Project Number

286386-00

Rev

P01.04

Drawing Number

BGS-ES01-00001

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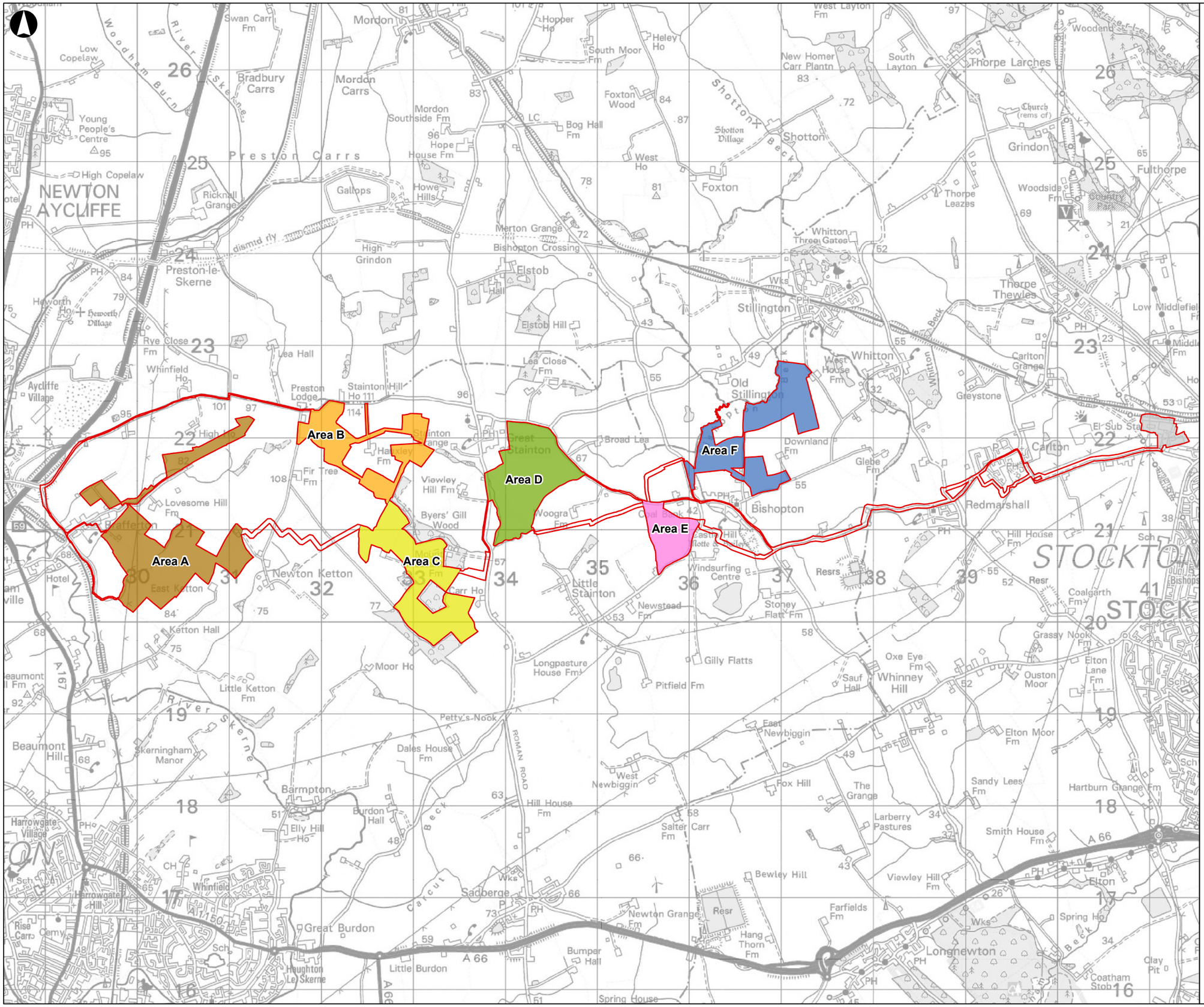
Drawing
BGS-ES02-00001 Panel Areas Plan



Rev	Date	By	Chkd	Appd	Authd
P01.04	03/11/2023	JE	--	--	--

Client

RWE

Project Name

Byers Gill Solar

Drawing Title

Figure 2.1
Panel Areas

Scale at A3

1:40,000

Role

Initial Status or WiP

Suitability

Environmental Statement

Project Number

286386-00

Rev

P01.04

Drawing Number

BGS-ES02-00001

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Appendix A

Standard Terms and Conditions and Limitation to Report

STANDARD TERMS AND CONDITIONS AND LIMITATIONS TO REPORTS

This Report is provided for the stated purpose and for the sole use of the Client in accordance with the Terms and Conditions of Appointment under which the services were performed. The Report is confidential to the Client and no other warranty, expressed or implied, is made as to the professional advice included in the Report or any other services provided by Wardell Armstrong LLP. This Report may not be disclosed by the Client nor relied upon by any other party without the prior and express written agreement of Wardell Armstrong LLP.

The conclusions and recommendations contained in this Report are based upon information provided by others including details supplied by the Client and/or professional advisors on the assumption that all relevant information from whom it has been requested and/or supplied is accurate. Information so provided and/or supplied has not been verified independently by Wardell Armstrong LLP, unless otherwise stated in the Report.

The methodology adopted and the sources of information used by Wardell Armstrong LLP in providing the services are outlined in this Report. The work described in this Report is based on the conditions and information as stated at the date the Report was completed. The scope of this Report and the services are accordingly limited by these circumstances. The findings outlined in the Report together with any opinions expressed and recommendations made are considered to be valid and appropriate at the time of preparation and for the specific purpose or purposes intended. Whilst a walk over site visit was carried out as part of the work this has been limited to observations only and no other physical investigations, sampling and testing work has been carried out as part of this work. The walkover survey does not constitute an asbestos survey and not all areas of the site may have been visited or made available for inspection.

Wardell Armstrong LLP disclaim any undertaking or obligation to advise any person of any change in any matter affecting the Report which may come or be brought to Wardell Armstrong LLP's attention after the date of the Report. Unless otherwise stated in this Report, the assessments made assume that the sites and facilities will continue to be used for their current purpose without significant changes.

Where any site observations have been carried out, these have been restricted to a level of detail required to meet the stated objectives of the services. The results from any site observations made may vary and further confirmatory work should be made after the issuance of this Report. Wardell Armstrong LLP does not guarantee or warrant any estimates or projections contained in this Report.

The opinions given in this report have been based on finite data and are relevant only to the purpose for which the report was commissioned.

It should be noted that any risks identified in a Phase 1 report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

The executive summary forms part of the overall report and should not be considered in isolation.

Appendix B

Site Walkover Notes

SITE VISIT RECORD	
Date of visit	28/03/2023 & 29/03/2023
Weather	28/03/2023: Cold (sub 5°C) and raining. 29/03/2023:
Client	ARUP
Enquiry/Job No.	CA12764
Site name	Byers Gill
Drawings / photographs attached?	See plans for walkover point locations.
Visited by	28/03/2023: Liam Brown & Andy Rutter 29/03/2023: Liam Brown & Esther Bowdler
Site contact details	
Access details	
Site area (Ha)	635

Observations	**Comments**	**Further action required?**
General Site Details		
Relevant Identification *(names of buildings, roads etc)*	N/A	
Present Land Use	Land is currently used as agricultural land. 16. Beehives present. 24. Livestock (sheep) present. 27. Livestock (sheep) present. 40. Farming equipment and a barn present. 45. Stack of hay. 93. Pheasant coup.	
Adjacent Land Use	75. Sewage works to the south. 89. Road to the E and barn and house to the S. 90. School to the SW boundary. 90. Area to the south hosts an equestrian school.	

Observations	Comments	Further action required?
Adjacent public highways, roads leading to /crossing/servicing the site	N/A	
Site Access (*main access points, dimensions, by rig/excavator etc, footpaths)*	1. Access gate and PROW stile located here. 7. Access gate located here. 9. Access gate here and directly south of this point. 11. Access gate located here. 12. Access gate here. 13. Bridleway 14. Access gate on bridleway. 38. Stone bridge as access. 44. Access gate along the western boundary. 45. Concrete bridge used as access point. 50. Access gate via road to the NE. 55. Access via metal fence. 65. Access gate in the N. 72. Access gate to the East leading to road. 75. Access gate along the western boundary via the road, leads to the fields. 77. Brick bridge over watercourse leading to next field. 82. Access gate. 92. No visible access here.	
Site Boundary *(walls, hedges and fences open etc)*	All site are constrained to hedges, trees and fences (wooden & barbed).	
Topography *(general site setting, land gradients, slopes etc)*	N/A	
Evidence of land use		
Archaeology *(old buildings, monuments, mounds, ditches, artefacts in soil, pottery/glass)*	N/A	
Site Relics *(evidence of past land use, building remains, roads, humps, bumps, hollows etc)*	1. Relic farming equipment left. 6. Potentially an old boundary with position of trees and lay of the land.	

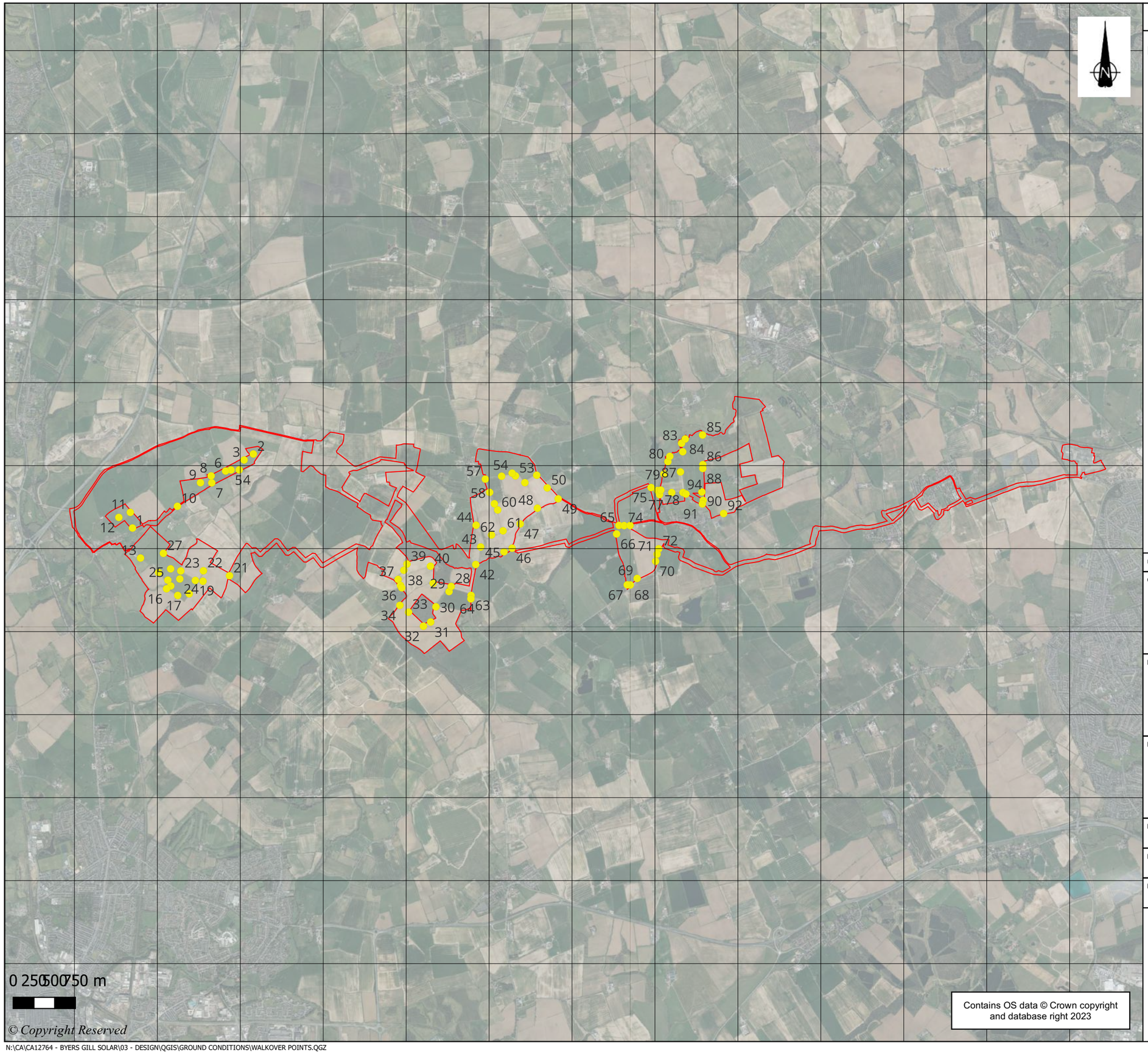
Observations	Comments	Further action required?
Buildings *(general condition/construction; eg brick/ steel framed, asbestos, pits/basement, use)*	14. In use barn housing cows and hay directly to the N. 68. Old barn made of brick and wood to the E.	
Storage Facilities *(eg: tanks/drums/chemicals/capacity /condition/bunding/containment)*	5. Water trough 21. Water trough 61. Stockpile of fertilizer. 80. Water trough	
Activities/processes on site *(past and present)*	5. Metal top over a hole in the ground. Unable to visualise depth of hole. 13. Sheep cutting pen situated here.	
Observable Environment *(noise/dust/odours/emissions)*	13 to 20 & 22 to 27. Noise from the train line to the west can be heard.	
Waste Management *(fly tipping/ waste disposal/fires)*	76. Mound of unknown waste.	
Underground Services *(evidence of manholes, grates, culverts, water supply, telephone)*	2. Underground electrical cable striking SE/NW. Identified by white poles indicating presence of cable. 63. Manhole with unknown use to the E of the red line boundary. 64. Open manhole showing drainage pipe trending W/SW into site area. 74. Underground electrical cable with unknown strike to the north of the field.	
Overhead Services *(overhead cables/pipes)*	9. TV pylon runs through the centre of this field. Trending SE. 10. Pylon trending SE. 15. Pylon trending NW. 16. Electricity lines follow the western boundary. 22. Pylon running along northern boundary of the field. Trending SE. 23. Pylon trending SE. 24. Pylons trending SE. 26. Multiple pylons running through this field SE. 36. Electrical pylons feeding into small electrical substation. 40. Multiple pylons striking NE. 48. Pylons trending NW. 57. Overhead powerlines running along field. 65. Multiple pylons running through site.	

Observations	Comments	Further action required?
	69. Telephone mast running along southern boundary. 74. Electricity pylons running E/W. 84. Multiple pylons here.	
Evidence of ground conditions		
Vegetation *(description and condition, tree, frequency and age, bare patches, saplings, new growth)*	N/A	
Ecology *(woodland, trees, hedges, ponds, running water, water loving plants, wildflowers, wildlife)*	1. Small woodland area to the SE boundary. 30. Square wood to the north but out of red line boundary. 46. A couple of trees to the centre of the field. 78. Unkept woodland along the western boundary. Follows direction of Bishopton Beck.	
Soil Cover *(vegetated, unvegetated, soil/made ground/hardstanding/ condition/cracks/staining)*	All points show vegetated areas with some fields having crops and some fields having grassy areas.	
Evidence of Geological Setting *(made ground, natural superficials and underlying rock)*	N/A	
Groundwater and Drainage *(ponding, streams, springs, wells, marshes, tides, rivers etc)*	1. Stream striking NE/SW along southern boundary. 4. Marshy 5. Sporadic areas of marsh land. 5. Waterlogged area with water flowing underground in the direction of the hole in the ground – potentially linked. 7. Marshy 8. Pond with surrounding marshy vegetation. This area has been separated from the main field with barbed wire fencing. 10. Very boggy walking along this path – is the PROW. 24. Stream running along the northern boundary. 25. Stream running along the southern boundary.	

Observations	Comments	Further action required?
	28. Stream running SE along red line boundary. 32. Boggy in places. 33. Boggy with areas of standing water. 34. Watercourse to the NW boundary. 35. Watercourse to the SE boundary. 38. Stream separates the two fields here, striking NE/SW. 42. Stream running along southern boundary. 43. Stream running south, feeding into stream at point 42. 43. Artificial pond found here too. 46. Marshy. 48. Pooled surface water. 54. Watercourse running along the south and east boundaries. 62. Very waterlogged area and marshy. 72. Watercourse runs along the eastern boundary. 76. Watercourse to the E with drainage pipes filtering into the stream. Pipes running west.	
Subsidence *(fissures, abrupt changes in slope, collapse, tilting tree/posts, property damage)*	N/A	
Evidence of Mining *(surface features, shafts, trenches, tunnels, caves, wells, boreholes, gas etc)*	N/A	
Hazards identified		
(e.g. contamination, mine entries, ground fissures, sharps etc)	N/A	
Anecdotal information		
Local knowledge	N/A	
Interview with residents/staff	N/A	
Further observations	N/A	
Additional remarks		

Observations	Comments	Further action required?

Originator: Liam Brown **Date: 31/03/2023**



DO NOT SCALE FROM THIS DRAWING

KEY

- Walkover Points
- Red Line Boundary

REVISION	DETAILS	DATE	DR'N	CH'K'D	APP'D

CLIENT

ARUP

PROJECT

BYERS GILL SOLAR

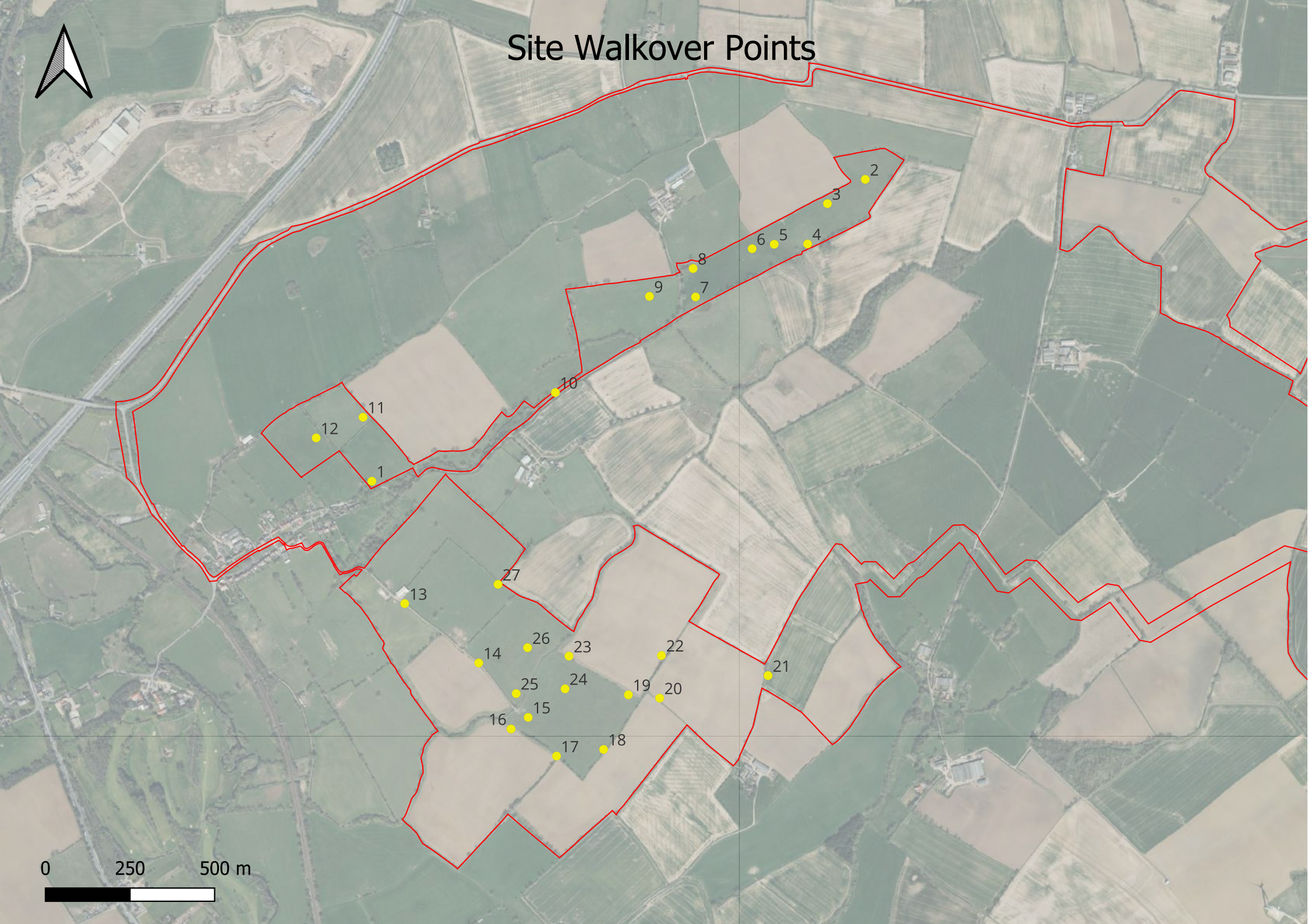
DRAWING TITLE

WALKOVER POINTS PLAN

DRG No.		REV
002		-
DRG SIZE A3	SCALE 1:45,000	DATE April 2023
DRAWN BY BT	CHECKED BY .	APPROVED BY .

wardell armstrong

N:\CA\CA12764 - BYERS GILL SOLAR\03 - DESIGN\QGIS\GROUND CONDITIONS\WALKOVER POINTS.QGZ


Site Walkover Points
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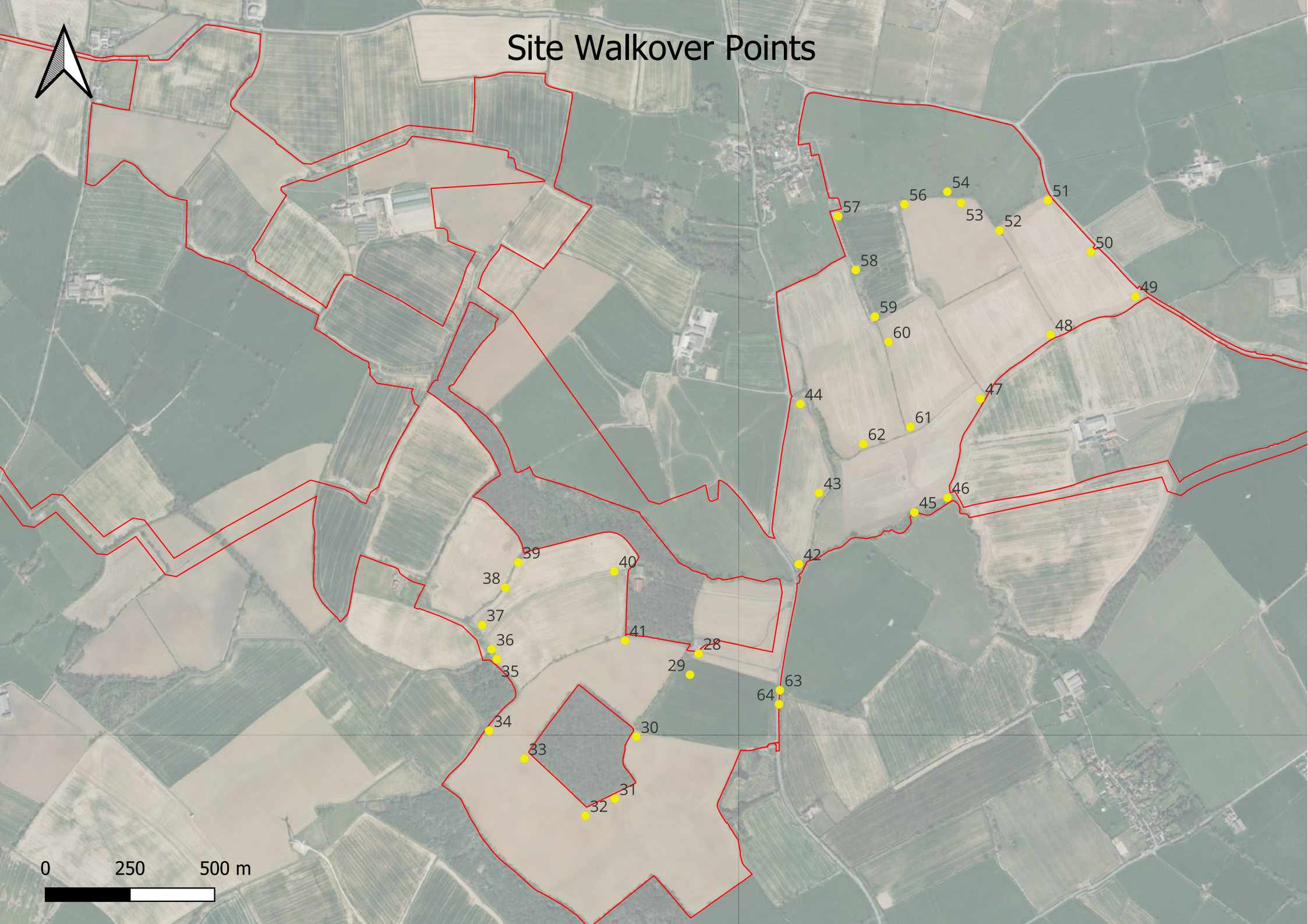
Site Walkover Points
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Site Walkover Points
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Appendix C

Site Walkover Photographic Record

Picture Taken: 28/03/2023		(Point 1) Public right of way, farming equipment to right of picture as well as stile.

Picture Taken: 28/03/2023	(Point 1) Image of the farmland
wardell armstrong	Client: ARUP
	Project: Byers Gill Solar
	Contract Number: CA12764

Picture Taken: 28/03/2023		(Point 1) Access gate with pool of standing water

Picture Taken: 28/03/2023	(Point 1) Farming equipment including a gate, fence and a trough for animals.
wardell armstrong	Client: ARUP
	Project: Byers Gill Solar
	Contract Number: CA12764

Picture Taken: 28/03/2023		(Point 1) Stream and woodland area.

Picture Taken: 28/03/2023	(Point 3) Looking down field at points 3 and 2

wardell armstrong

Client: ARUP

Project: Byers Gill Solar

Contract Number: CA12764

Picture Taken: 28/03/2023	(Point 4) Pole highlighting presence of electrical underground cable

Picture Taken: 28/03/2023	(Point 5) Trough, fencing and gate.
wardell armstrong	Client: ARUP
	Project: Byers Gill Solar
	Contract Number: CA12764

Picture Taken: 28/03/2023	(Point 5) Access gate

Picture Taken: 28/03/2023	(Point 5) Fencing
wardell armstrong	Client: ARUP
	Project: Byers Gill Solar
	Contract Number: CA12764

Picture Taken: 28/03/2023	(Point 5) Area of marsh land

Picture Taken: 28/03/2023	(Point 5) Metal covering hole in ground.

wardell armstrong

Client: ARUP

Project: Byers Gill Solar

Contract Number: CA12764

Picture Taken: 28/03/2023		(Point 7) Access gate.

Picture Taken: 28/03/2023	(Point 8) Pond.

wardell armstrong

Client: ARUP

Project: Byers Gill Solar

Contract Number: CA12764

Picture Taken: 28/03/2023	(Point 10) Telephone pylon.

Picture Taken: 28/03/2023	(Point 13) Sheep cutting area with barn in background.

wardell armstrong

Client: ARUP

Project: Byers Gill Solar

Contract Number: CA12764

Picture Taken: 28/03/2023	(Point 14) Barn

Picture Taken: 28/03/2023	(Point 15) Access gate with pool of standing water

wardell armstrong

Client: ARUP

Project: Byers Gill Solar

Contract Number: CA12764

Picture Taken: 28/03/2023	(Point 18) Area of cropped farmland.

Picture Taken: 28/03/2023	(Point 19) On bridleway with pylons in distance.

wardell armstrong

Client: ARUP

Project: Byers Gill Solar

Contract Number: CA12764

Picture Taken: 28/03/2023	(Point 28) Stream separating gravel car park and field.

Picture Taken: 28/03/2023	(Point 30) Large pool of standing water forming on cropped fields.

wardell armstrong

Client: ARUP

Project: Byers Gill Solar

Contract Number: CA12764

Picture Taken: 28/03/2023	(Point 36) Small electrical sub station with power line.

Picture Taken: 28/03/2023	(Point 40) Farming equipment on gravel road.

wardell armstrong

Client: ARUP

Project: Byers Gill Solar

Contract Number: CA12764

Picture Taken: 29/03/2023	(Point 42) Stream to the southern boundary.

Picture Taken: 29/03/2023	(Point 43) Artificial Pond.

wardell armstrong

Client: ARUP

Project: Byers Gill Solar

Contract Number: CA12764

Picture Taken: 29/03/2023	(Point 44) Gated access from road.

Picture Taken: 29/03/2023	(Point 45) Gated access and into fields via concrete bridge.

wardell armstrong

Client: ARUP

Project: Byers Gill Solar

Contract Number: CA12764

Picture Taken: 29/03/2023	(Point 49) Poor drainage along SE boundary.

Picture Taken: 29/03/2023	(Point 57) Cropped field.

wardell armstrong

Client: ARUP

Project: Byers Gill Solar

Contract Number: CA12764

Picture Taken: 29/03/2023	(Point 61) Fertilizer stockpile.

Picture Taken: 29/03/2023	(Point 62) Waterlogged and marshy area.

wardell armstrong

Client: ARUP

Project: Byers Gill Solar

Contract Number: CA12764

Picture Taken: 29/03/2023	(Point 64) Open manhole showing drainage pipe striking W.

Picture Taken: 29/03/2023	(Point 65) Access gate and pylon overhead.

wardell armstrong

Client: ARUP

Project: Byers Gill Solar

Contract Number: CA12764

Picture Taken: 29/03/2023	(Point 67) Brick and wood barn.

Picture Taken: 29/03/2023	(Point 72) Access gate leading from road to field.

wardell armstrong

Client: ARUP

Project: Byers Gill Solar

Contract Number: CA12764

Picture Taken: 29/03/2023	(Point 74) Indication of electrical underground cables.

Picture Taken: 29/03/2023	(Point 75) Access gate to field via road blocked by tree.

wardell armstrong

Client: ARUP

Project: Byers Gill Solar

Contract Number: CA12764

Picture Taken: 29/03/2023	(Point 76) Mound of unknown waste material.

Picture Taken: 29/03/2023	(Point 76) Bishopton Beck.
wardell armstrong	Client: ARUP
	Project: Byers Gill Solar
	Contract Number: CA12764

Picture Taken: 29/03/2023	(Point 77) Concrete bridge over Bishopton Beck.

Picture Taken: 29/03/2023	(Point 79) Unkept woodland to the western boundary.

wardell armstrong

Client: ARUP

Project: Byers Gill Solar

Contract Number: CA12764

Picture Taken: 29/03/2023	(Point 79) Grassy land sloping up to the East.

Picture Taken: 29/03/2023	(Point 84) Cropped field with pylons overhead.
wardell armstrong	Client: ARUP
	Project: Byers Gill Solar
	Contract Number: CA12764

Picture Taken: 29/03/2023	(Point 89) Barn yard to the south.

Picture Taken: 29/03/2023	(Point 93) Pheasant coup.
wardell armstrong	Client: ARUP
	Project: Byers Gill Solar
	Contract Number: CA12764

Appendix D

Risk Assessment Matrix

Guidance on Contaminated Land Risk Assessment

In the UK, contaminated land is regulated by the planning and development control system and the contaminated land regime set out in Part 2A of the Environmental Protection Act (EPA) 1990.

When considering an application for development, the potential for the land to be contaminated is a material consideration, and the local planning authority should satisfy itself that any contamination is properly assessed and adequately remediated, based on a suitable for use approach. This is to ensure that the land is made suitable for its proposed new use.

Guidance on the investigation of contamination is contained in British Standard 10175: 2011 (+A2-2017) "Investigation of potentially contaminated sites - Code of Practice". It involves an identification of risks due to the presence of contaminants, and an assessment of those risks based on the:

- possible sources of contamination;
- identification of who or what may be affected by the contaminants (the receptors);
- possible pathways by which contaminants may migrate to one or more of the receptors.

A conceptual site model is a representation of the environmental processes that occur on and in the vicinity of the site and its purpose is to identify the potential contamination linkages that exist on the site. The assessment of the significance of these contamination linkages can then be carried out through the risk assessment process.

Since the conceptual site model underpins each stage of contaminated land management, BS10175: 2011 (+A2-2017) suggests that such a model should be developed for every site. Accordingly, the results of the desk study research on the site have been used to identify the source- pathway-receptor relationships that exist on the site before and during redevelopment works.

A conceptual site model is a representation of the environmental processes that occur on and in the vicinity of the site and its purpose is to identify the potential contamination linkages that exist on the site. The assessment of the significance of these contamination linkages can then be carried out through the risk assessment process.

Environmental Risk Assessment Methodology

In line with EA guidance LCRM, plausible source, pathway and receptor linkages have been identified through the Conceptual Site Model (CSM). The information gathered in the CSM can now be used to carry out a Qualitative Risk Assessment (QRA).

The LCRM outlines that for each tier of Risk Assessment the following steps must be taken:

1. Identify the hazard - establish contaminant sources.
2. Assess the hazard - use a source-pathway-receptor (S-P-R) linkage approach to find out if there is the potential for unacceptable risk.
3. Estimate the risk - predict what degree of harm or pollution might result and how likely it is to occur by using the tiered approach to risk assessment.
4. Evaluate the risk - decide whether a risk is unacceptable.

The LCRM states that the assessment must be based on the potential severity that the risk poses to the receptors against the likelihood of it happening. Subsequently, it is necessary to employ a risk assessment matrix, the CIRIA document Contaminated Land Risk Assessment – a guide to good practice C552, 2001 provides a good example of a suitable risk assessment matrices.

In the CIRIA methodology, the sensitivity assessment considers the contaminant-pathway-receptor in conjunction with the contamination linkage concept (described below). This information is then used to classify consequences and the probability of a contamination linkage occurring, affording the level of sensitivity of a given receptor to be established.

Contamination Linkage Concept

In forming a risk assessment for land contamination, there are three essential elements to be given consideration collectively known as a ‘contaminant linkage’:

- A contaminant/source – A substance that is in, on or under the land and has potential to cause harm or to cause pollution of controlled waters.

- A receptor – in general terms, something that could be adversely affected by a contaminant, these can include people, an ecological system, property or a water body; and

- A pathway – a route or means by which a receptor can be exposed to or affected by a contaminant.

Each of these elements can exist independently, but they create a risk where they are linked together, so that a particular contaminant affects a particular receptor through a particular pathway. This kind of linked combination of contaminant-pathway-receptor is described as a contaminant linkage.

Sensitivity Assessment Criteria

By considering the contaminant, pathways and receptors, an assessment of the environmental risk is made with reference to the degree of sensitivity of the receptor to a contaminant.

The qualitative sensitivity assessment is conducted by determining the severity of the potential consequences, taking into account the probability of risk and by considering the sensitivity of the receptor based on the categories below. It follows CIRIA documents C552 terminology and methodology as summarised:

Potential Consequences	x	Probability of Risk	=	Sensitivity
(Table 1)	x	(Table 2)	=	(Table 3)

Table 1 presents the consequences to the receptor of the contaminant linkage being realised. It has four categories, with severe being the most serious and minor being the least serious consequences:

Table 1 – Consequence of Risk Being Realised			
Classification	**Category**	**Definition**	**Examples (Not necessarily specific to this site)**
Severe short-term (acute) risks only	Humans	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part 2A.	High concentrations of cyanide on the surface of an informal recreation area.
	Controlled Waters	Short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource.	Major spillage of contaminants from site into controlled water.
	Property	Catastrophic damage to buildings/property.	Explosion causing building collapse (can also equate to a short-term human health risk if buildings are occupied.
	Ecological System	A short-term risk to a particular ecosystem, or organism forming part of such ecosystem.	
Medium chronic (long term) risks; "significant harm"	Humans	Chronic damage to Human Health ("significant harm" as defined in Defra 2006).	Concentrations of a contaminant from site exceed the generic, or site-specific assessment criteria
	Controlled Waters	Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution).	Leaching of contaminants from a site into a major or minor aquifer.
	Ecological System	A significant change in a particular ecosystem	Death of a species within a designated nature reserve.
Mild chronic (long term) risks; fewer sensitive receptors	Controlled Waters	Pollution of non-sensitive water resources.	Pollution of non-classified groundwater
	Property	Significant damage to buildings, structures and services ("significant harm" as defined in Circular on Contaminated Land, Defra, 2006). Damage to sensitive buildings/structures/services	Damage to building rendering it unsafe to occupy (e.g., foundation damage resulting in instability)
	Ecological System	Significant damage to crops. Damage to the environment.	
Minor chronic (long term) risks; mild	Financial / project	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve.	
	Humans	Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc).	The presence of contaminants at such concentrations that protective equipment is required during site works.
	Property	Easily repairable effects of damage to buildings, structures and services	The loss of plants in a landscaping scheme. Discolouration of concrete.

The likelihood of the pollution linkage being realised must take into account the presence of the source and position of the receptor as well as the pathway that connects them. Table 2 overleaf defines the likelihood of the pollution linkage occurring.

TABLE 2: Probability of Risk Being Realised	
Classification	**Definition**
High Likelihood	There is a contaminant linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a contaminant linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a contaminant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place and is less likely in the shorter term.
Unlikely	There is a contaminant linkage, but circumstances are such that it is improbable that an event would occur even in the very long term.

The potential consequences and the probability of the risk occurring are combined to form the classification of sensitivity matrix, as presented in Table 3a below. It provides a sensitivity category for potential receptors if a pollution linkage exists, allowing the level of sensitivity of a receptor in a particular circumstance can be determined.

TABLE 3a: Risk Classification Matrix					
		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High Likelihood**	Very High	High	Moderate	Moderate/Low
	Likely	High	Moderate	Moderate/Low	Low
	Low Likelihood	Moderate	Moderate/Low	Low	Very Low
	Unlikely	Moderate/Low	Low	Very Low	Very Low

TABLE 3b: Risk Classification Definitions	
Very High	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Moderate / Low	A notable balance between moderate and low categorisation. The moderate/low interface.
Low	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very Low	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

Under each of the contaminant linkage categories, the identified environmental risks have been assessed with regard to a wide range of topics including (where appropriate):

- the 'source-pathway-receptor' concept;
- the behaviour of potential contaminants within the environment;
- environmental processes;
- industrial operations and best practice;
- current environmental legislation;
- the views and practices of the environmental regulators;
- the likelihood of environmental notices, orders or other enforcement action;
- any requirements to remove waste, contaminated or hazardous materials;
- the health and safety of occupiers or neighbours;
- any redevelopment plans for the site; and
- effects on the fabric of buildings caused by contamination.