

Tillbridge Solar

Stage 1 – Tier 1: Preliminary Risk Assessment

Tillbridge Solar Ltd

September 2022

Quality information

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The methodology adopted and the sources of information used by AECOM in providing its services are outlined in this Report. The work described in this Report was undertaken between **July and August 2022** and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances. AECOM 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 AECOM’s attention after the date of the Report.

The site reconnaissance consisted of a general external inspection of the site aimed at identifying any obvious signs of geotechnical hazards and potential sources of ground contamination affecting the site. An environmental compliance audit and/or detailed structural inspection of existing buildings were outside the project brief. Similarly, the site visit excluded detailed consideration of the ecological or archaeological aspects of the site, and if such are believed to be of potential significance then it is recommended that specialist advice is sought.

Any risks identified in this Report are perceived risks, based on the information reviewed during the desk study and therefore partially based on conjecture from available information. The study is limited by the non-intrusive nature of the work and actual risks can only be assessed following a physical investigation of the site.

The opinions expressed in this report and the comments and recommendations given are based on a desk assessment of readily available information and an initial site reconnaissance by an AECOM Engineer. At this stage intrusive investigations have yet to be undertaken at site to establish actual ground and groundwater conditions and to provide data for an assessment of the geo-environmental status of the site.

Where assessments of works or costs identified in this Report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

Reference to historical Ordnance Survey (OS) maps and/or data provides invaluable information regarding the land use history of a site. However, it should be noted that historical evidence will be incomplete for the period pre-dating the first edition and between the release of successive maps and/or data.

Certain statements made in the Report that are not historical facts may constitute estimates, projections or other forward-looking statements and even though they are based on reasonable assumptions as of the date of the Report, such forward-looking statements by their nature involve risks and uncertainties that could cause actual results to differ materially from the results predicted. AECOM specifically does not guarantee or warrant any estimate or projections contained in this Report.

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1. Executive Summary

A Tier 1 Preliminary Risk Assessment (PRA) of the proposed Tillbridge Solar scheme (hereafter referred to as 'the Scheme') has been undertaken by AECOM Limited (AECOM) to support an application for development consent.

The Scheme will comprise the construction, operation and maintenance, and decommissioning of solar photovoltaic (PV) generating panels and on-site energy storage facilities with a total capacity exceeding 50 megawatts (MW). The purpose of this report is to determine whether potentially contaminative land uses have taken place within, or in close proximity to the Scheme, which could have led to the contamination of underlying soils or groundwater. The assessment considers the Principal Site (i.e. where solar PVs will be installed) and does not consider the Cable Route Corridor (i.e. the connection from the Principal Site to the national grid at Cottam power station) as this area is expected to be refined as the Scheme design progresses.

The Principal Site comprises agricultural fields, with a tributary of the River Till flowing across the south-western part of the Principal Site, the River Eau at the north-eastern edge of the Principal Site and Fillingham Beck across the southern part.

The anticipated geology includes quaternary deposits over sedimentary bedrock of mudstone, limestone and sandstone formations. The superficial deposits and the bedrock are classified as Secondary Aquifers, except for Lincolnshire Limestone Formation, bordering the Principal Site to the east, which is classified as a Principal Aquifer.

The indicative floodplain map for the area, published by the Environment Agency (the EA), shows that the risk of surface water flooding at the Principal Site is generally very low (annual chance of flooding of less than 0.1%); with isolated patches of low (chance of flooding of between 0.1% and 1%), medium (chance of flooding of between 1% and 3%) and high risk (chance of flooding of greater than 3.3%) generally associated with the rivers located on the Principal Site.

Based on a review of historical maps, the Principal Site was undeveloped land/agricultural fields since the earliest available historical maps (late 1800s). Areas formerly associated with Sturgate Airfield (currently located 600m south-west of the Principal Site) extend across the south-western part of the Principal Site. Areas formerly associated with airfield also adjoin the Principal Site to the west, north of Common Lane.

Potential contaminative sources identified on-site include the historical use of the south-western part of the Principal Site as an airfield and an area characterised by a vegetated mound of unknown material, tyres and an abandoned vehicle (south-eastern part of the Principal Site). Small areas of potentially infilled land may be present on the Principal Site associated with pits and former ponds, which may have been filled with a variety of (potentially unlicensed) waste materials. A Pre-desk Study Assessment from Zetica indicates that a British bomber aircraft crashed on the Principal Site.

Off-site sources may include farmland, with farm buildings and yards where fuel and agricultural materials were/are stored, shown at various locations adjacent to the Principal Site; an active IGas Energy Plc. oil well, located adjacent south-east of the Principal Site; a former brick yard (adjacent north of the eastern part of the Principal Site); and a former metal recycling site/vehicle dismantler, adjacent west of the

Principal Site, south-east of Sturgate and north of Common Lane. The former metal recycling site is located within areas formerly associated with the Sturgate Airfield.

The potential risks identified have been assessed by the preliminary risk assessment as being very low to low. Limited intrusive Site Investigation and Risk Assessment is recommended in the areas of potential contamination to confirm the results of this PRA. Discarded materials and any hazardous materials potentially associated with the vegetated mound (and any associated contaminated soils) are required to be removed from the site to an appropriate facility, prior to construction.

A high-pressure gas main has been identified on the Principal Site during the site reconnaissance.

The information collected as part of this PRA suggests that there are no significant constraints with regards to contamination of soil and groundwater that would limit the development of the site as a solar farm.

The regional unexploded bomb (UXB) mapping published by Zetica shows that the Principal Site lies within a zone that experiences a low risk of UXB. However, part of the Principal Site extends across areas formerly occupied by a currently operative airfield, which is considered a wartime site of interest. A Pre-desk Study Assessment from Zetica recommends that a detailed Unexploded Ordnance (UXO) Assessment is commissioned to assess, and potentially zone, the UXO hazard level at the Principal Site, prior to the commencement of any intrusive works.

2. Introduction

2.1 Terms of Appointment

On the instructions of Tillbridge Solar Ltd (the Client), AECOM Limited (AECOM) has undertaken a Tier 1 Preliminary Risk Assessment (PRA) of the Tillbridge Solar scheme (hereafter referred to as ‘the Scheme’).

The Scheme will comprise the construction, operation and maintenance, and decommissioning of solar photovoltaic (PV) generating panels and on-site energy storage facilities with export connection to the National Grid. The Scheme will require a Development Consent Order (DCO).

A site location map for the Principal Site is included in Appendix A as Figure 1. Figure 1 shows the maximum area of land potentially required for the construction, operation and maintenance of the Principal Site and includes land required for permanent and temporary purposes. Note that this assessment considers only the Principal Site (i.e. where solar PVs will be installed) and does not consider the Cable Route Corridor (i.e. the connection from the Principal Site to the national grid at Cottam power station) as this area is expected to be refined as the Scheme design progresses.

The Principal Site consists of an approximately 1,400 ha area and comprises the following elements of the Scheme:

- Solar PV Array Works Area.
- Battery Energy Storage System.
- Associated Infrastructure.
- Non-Developable Area/Areas to be Considered for Mitigation.

The operational areas of the Site will be fenced and protected via security measures such as CCTV. Internal access tracks, habitat management and drainage will also be provided within the fenced areas on the Site.

Refer to *Chapter 3: Description of the Scheme* in the EIA Scoping Report for further details about the Scheme.

2.2 Report Objectives

The primary objective of this report is to determine whether potentially contaminative uses have taken place within, or in close proximity to the Principal Site which could have led to the contamination of underlying soils or groundwater. This report aims to identify and evaluate potential land quality risks and development constraints associated with the Scheme and to construct an initial conceptual site model that can be used to inform future decision making and design future ground investigation (if needed).

This report is prepared to support an eventual DCO application under the requirements of Planning Act 2008 (as amended) (Ref 1), the National Planning Policy Framework (2012) (Ref 2), and considers the potential implications of Part 2A of the Environmental Protection Act 1990 (Part 2A) (Ref 3) and the associated Contaminated Land (England) Regulations 2006 (as amended) (Ref 4). Relevant legislation is described in *Chapter 1: Introduction* of the EIA Scoping Report.

The planning policies from relevant National Policy Statements (NPS) that have been considered in this assessment include:

- Overarching NPS for Energy (NPS EN-1) (Ref 5), with particular reference to sections 5.3 Biodiversity and Geological Conservation and 5.15 Water Quality and Resources; and
- NPS for Electricity Networks Infrastructure (NPS EN-5), (Ref 6), with particular reference to impact of electricity networks on soils and geological conservation.

This report has been prepared in general accordance with the technical guidance and procedures described in the UK Government guidance Land Contamination: Risk Management (2019) (Ref 7); British Standard (BS) 5930:2015+A1:2020 Code of Practice for Ground Investigations (BSI) (Ref 8) and BS 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites – Code of Practice (BSI) (Ref 9) to:

- Describe the geology, hydrogeology and shallow mining potential;
- Describe the environmental setting/sensitivity and current/historical land use of the Principal Site and surrounding area;
- Describe the findings of a reconnaissance visit to the Principal Site;
- Summarise the findings of any historical ground investigation work (if available);
- Provide an initial Conceptual Site Model (CSM) for the prevailing ground conditions; and
- Using the source-pathway-receptor model present a preliminary qualitative risk assessment of potential land contamination risks to human (chronic), environmental, and controlled water receptors from contamination sources on or in the vicinity of the Principal Site.

2.3 Sources of Information

This report has been prepared using a combination of published records (e.g. British Geological Survey (BGS), the EA and Department for Environment, Food & Rural Affairs (Defra)). These include statutory records and historical mapping supplied within a Envirocheck report (in WebGIS format) (July 2022) (Ref 10), published geological and hydrogeological mapping, historical borehole records, and observations made during the site reconnaissance visit completed on 21 July 2022. The site reconnaissance visit included a visual walkover (non-intrusive survey) of the Principal Site to identify the range of activities undertaken on-site and any obvious potential sources of ground contamination at the time of writing. The Public Register for Determined Contaminated Land Sites (Ref 40) and List of Landfill Sites (Ref 41) available from the West Lindsey District Council have been also reviewed for any contaminated land within the Principal Site and surrounding areas. A Pre-Desk Study Assessment that looks at readily available records for military activity has also been commissioned from Zetica and included as Appendix E.

Specific information sources are referenced throughout the document and a bibliography is included in Section 13 of this report.

3. Site Setting

3.1 Location

The Principal Site is located directly south of the A631, between the town of Gainsborough and village of Glentworth, in the county of Lincolnshire. The Principal Site is within the administrative area of West Lindsey District Council.

3.2 Description and Setting

The Principal Site comprises an area of approximately 1,400ha. The Principal Site is defined by the red line boundary shown in Figure 1 in Appendix A (hereafter referred to as ‘the Principal Site Boundary’). The Principal Site Boundary shows the expected area of land required for the construction, operation and maintenance, and decommissioning of the Principal Site, but not including the Cable Route Corridor. It includes land required for temporary and permanent works. It is important to note that this may be subject to change as the design and EIA progress and comments from stakeholders and the public during the informal and statutory consultation are taken into account.

The Principal Site consists of agricultural fields mainly under arable production, with parcels of pasture, interspersed with individual trees, hedgerows, some small-scattered areas of woodland and farm access tracks. Where there are hedgerows, these generally form the boundaries of fields as they adjoin roads. Several small ponds are scattered across the Principal Site. The fields are separated by a few minor roads and tracks. There are also some agricultural buildings and dwellings dispersed within the main Principal Site area, but which are excluded from the Principal Site Boundary (see Figure 1 (Appendix A)). A vegetated mound of unknown material, discarded tyres and an abandoned car have been identified in an area in the south-eastern part of the Principal Site (refer to Section 7 and Figure 2 in Appendix A).

The topography of the area is relatively flat, with existing ground levels generally between 20m and 30m Above Ordnance Datum (AOD) according to online Ordnance Survey (OS) (Ref 11). B1398 Middle Street, which borders the Principal Site to the east, is defined in landscape terms by its ridge known as Lincolnshire Edge (and Lincoln Cliff). This area is relatively elevated (up to 60m AOD) compared to the general character of the area which is characterised by its flat rural landscape.

Relevant features immediately surrounding the Principal Site are summarised in Table 3-1.

Table 3-1. Features Surrounding the Principal Site

Direction	Summary
North	<ul style="list-style-type: none"> The Principal Site is bound by A631 Harpswell Lane, with agricultural land beyond. At the eastern extent, the residential settlement of Harpswell Hill Park adjoins the Principal Site to the north, north of A631 Harpswell Lane. The village of Hemswell is from approximately 500m north of the Principal Site. Isolated residential dwellings (Hemswell Grange and Moorlands Magin Moor) are also located on the A631 Harpswell Lane, adjacent north of the Principal Site. A substation is located along the northern boundary of the site (eastern extent of the Principal Site), on the A631 Harpswell Lane, west of Harpswell. Figure 1 in Appendix A shows the substation to be within the current redline, however, it is likely to be excluded from the Principal Site Boundary in due course.
South	<ul style="list-style-type: none"> To the south, the Principal Site is bound by agricultural land. Farm buildings and associated dwellings are adjacent south of the Principal Site, on Common Lane and Kexby Road.

Direction	Summary
East	<ul style="list-style-type: none">• The north-eastern part of the Principal Site is bound by B1398 Middle Street (proposed for roadside screen planting), with agricultural land beyond.• An active oil well, Glentworth Oilfield Well 1, is adjacent to the Principal Site. The oil well and associated infrastructure is operated by IGas Energy Plc, and is off Northlands Road (directly adjacent to the south-eastern part of the Principal Site) (refer to Section 7 and Figure 2 in Appendix A).• A reservoir (divided into three sections) is adjacent east of the Principal Site, between Northlands Road and Kexby Road.• The residential property of Northlands Cottages is located adjacent east the Principal Site, north-west of Glentworth.• An oil well is located 1.2km east of the southern part of the Principal Site (refer to Section 7).
West	<ul style="list-style-type: none">• Farm buildings and associated dwelling of Church Farm are adjacent west of Principal Site, in School Lane.• Sturgate Airfield is approximately 600m south-west of the Principal Site.• Adjacent to the western boundary of the central part of the Principal Site, is a company that provides large outdoor festival tents. This area was formerly part of the larger Sturgate Airfield. This area also hosted a revoked licensed waste management facility, associated with a metal recycling site/vehicle dismantler (refer Figure 2 in Appendix A).

4. Geological and Environmental Setting

4.1 Introduction

The environmental setting including the topography, geology, hydrogeology and hydrology are the key factors that influence the way in which contaminants in the soil or groundwater can be transported on-site or off-site, and also the way in which contamination can affect applicable receptors including controlled waters and users of the Principal Site and surrounding areas.

The environmental setting of the Principal Site has been assessed by making reference to the information sources detailed in Section 2.3.

4.2 Geology and Soils

4.2.1 Published Geology & Exploratory Hole Records

AECOM has reviewed publicly available information. The published 1:50,000 scale geological map of the area produced by the BGS (Sheet 102, Market Rasen, 1999) (Ref 12) and the BGS Geindex Onshore online geological mapping (Ref 13) (accessed July 2022) indicates that the Principal Site is underlain by the geological succession summarised in Table 4-1.

Table 4-1. Geological Succession from Published Mapping

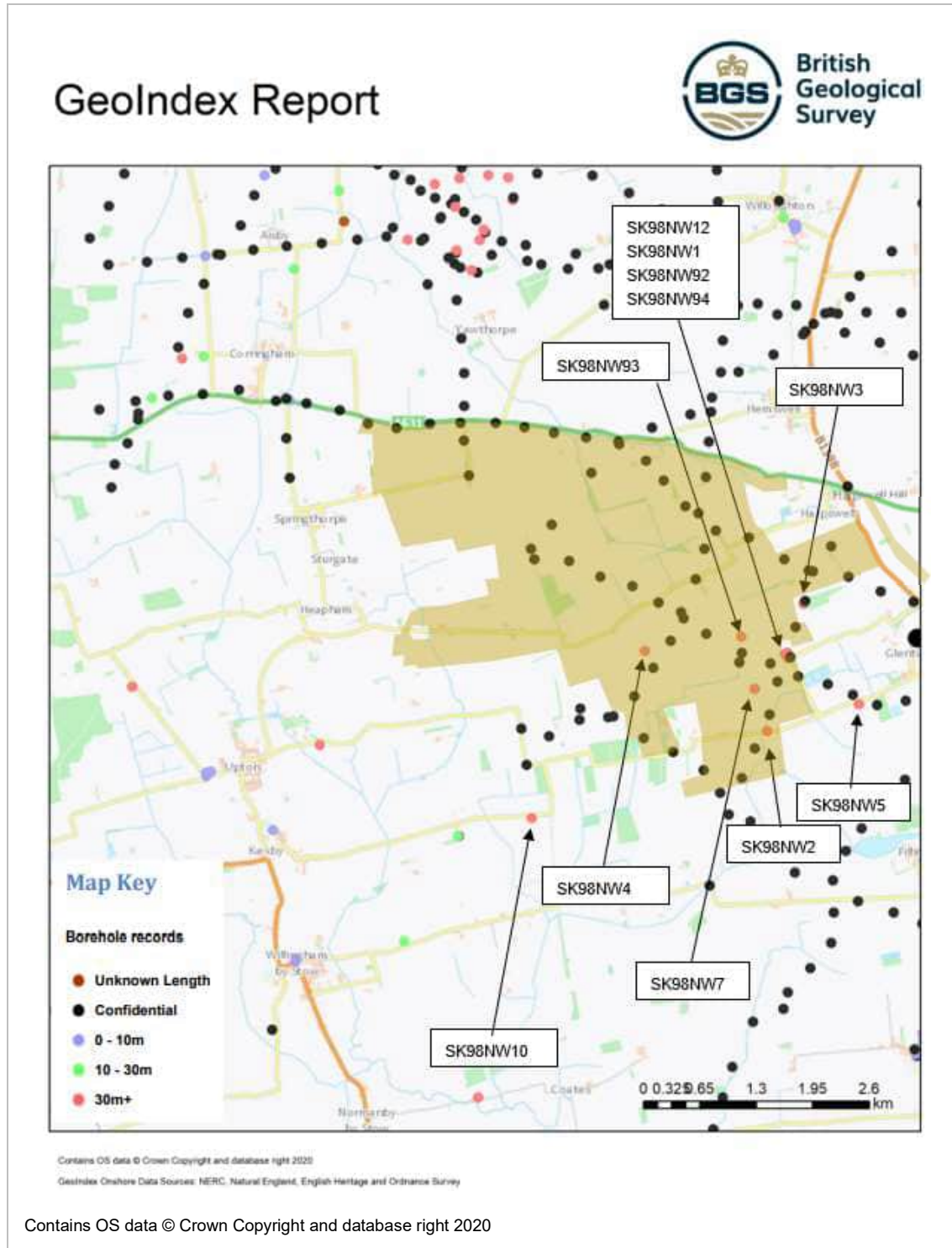
Age	Group or Parent	Geological Stratum	Description	Anticipated Thickness (m) (approximate)	Location
Superficial deposits					
Up to 0.0118 million years ago (Quaternary Period)	Fluvial deposits	Alluvium	Clay, silt, sand and gravel.	Variable	Limited to elongated areas along the River Eau and tributary (north-eastern part of the Principal Site) and Fillingham Beck and tributary (south-eastern part of the Principal Site)
0.116 to 0.86 million years ago (Mid Pleistocene)	NA	Till	Diamicton	Variable	Across most of the Principal Site
0.116 to 0.86 million years ago (Mid Pleistocene)	NA	Glaciofluvial deposits	Sand and gravel	Variable	Small areas across the eastern extent of the Principal Site, west and north of Glentworth.
Bedrock (from east to west)					
170.3 to 168.3 million years ago	Inferior Oolite Group	Lincolnshire Limestone Formation	Limestone	Up to 30m or more.	Along B1398 Middle Street and extending east.
174.1 to 170.3 million years ago	Inferior Oolite Group	Grantham Formation	Sandstone, siltstone and mudstone	Typically, about 2m to 5m.	Adjacent west of B1398 Middle Street.
182.7 to 174.1 million years ago	Lias Group	Whitby Mudstone Formation	Mudstone	120m	Between Harpswell and Glentworth
190.8 to 174.1 million years ago	Lias Group	Marlstone Rock Formation	Ferruginous limestone and ferruginous sandstone	10m	Between Harpswell and Glentworth, to the west of Whitby Mudstone Formation.
199.3 to 182.7 million years ago	Lias Group	Charmouth Mudstone	Mudstone	335m	Across most of the eastern part of Principal Site, from west of Glentworth to Glentworth Road.

Age	Group or Parent	Geological Stratum	Description	Anticipated Thickness (m) (approximate)	Location
		Formation (mudstone)			
190.8 to 209.5 million years ago	Lias Group	Scunthorpe Mudstone Formation	Mudstone and limestone; interbedded.	128m	Across the western part of the Principal Site.

Source: *Geological Map BGS Sheet 102, Market Rasen, 1999. BGS Geoindex Onshore online geological mapping (accessed July 2022).*

The BGS maintains an archive of historical exploratory borehole records throughout the UK. AECOM has searched the database and those which are considered to provide useful information on the ground profile at the Principal Site are highlighted as part of the extract shown in Figure 4-1 below. Eleven boreholes have been referenced in producing this report. Copies of these exploratory hole records are included as Appendix C and relevant information from the records is considered as part of the Preliminary Ground Model in Section 8.

Figure 4-1 Screenshot of relevant exploratory hole locations from BGS GeoIndex Viewer (Principal Site Boundary is shown in beige and is approximate)



4.2.2 Soils and Soil Chemistry

Natural England reports the Agricultural Land Classification on the Principal Site to be Grade 3 (good to moderate) (Ref 14). However, Natural England maps represent a generalised pattern of land classification grades and are not sufficiently accurate for use in the assessment of individual fields. The maps do not show the subdivisions of Grade 3, which are normally mapped by a more detailed survey.

An Agricultural Land Classification survey is being undertaken at the Principal Site at the time of writing.

The UK Soil Observatory (UKSO) (Ref 16) provide indicative information on regional concentrations of five potentially harmful elements (PHEs): arsenic (As), cadmium (Cd), chromium (Cr), nickel (Ni) and lead (Pb) in soil. Elevated concentrations of these PHEs can exist because of natural geological conditions or possible anthropogenic contamination. The following estimated soil chemistry levels are attributed to the Principal Site based on the geometric mean concentrations of available data (presented in Table 4-2).

Table 4-2. Estimated Soil Chemistry

Potentially Harmful Element	Estimated geometric mean concentration (mg/kg)
Arsenic	<15
Cadmium	<1.8
Chromium	40 – 60; <100
Lead	<100
Nickel	<15; 15 – 30

Source: UKSO website

4.2.3 Ground Stability Records

Table 4-3 shows the variable risk of ground stability hazards across the Principal Site, taken from the Envirocheck® report (Ref 10).

Table 4-3. Ground Stability Records

Hazard Type	Hazard Potential
Collapsible Hazard	Very low
Compressible Hazard	No hazard
Ground Dissolution Hazard	No hazard
Landslide Hazard	Very low
Running Sand Hazard	No hazard to low
Shrinking or Swelling Clay Hazard	Low to very low

Source: Envirocheck® Report.

4.2.4 Mining and Mineral Extraction

4.2.4.1 Aggregate/Mineral Quarrying, Mining and Mineral Sites

One BGS recorded mineral site, Glentworth Oilfield Well 1, listed as active, is indicated in Northlands Road, directly adjacent to the east of the Principal Site. This site relates to liquid or gas extraction from carboniferous strata (sandstone), and it is operated by IGas Energy Limited (Ref 10) (refer to Figure 2 in Appendix A).

Table 4-4 presents the available information on mining and quarrying operations, past or present that are known to have taken place on-site and within 250m of the Principal Site Boundary (refer to Figure 2 in Appendix A).

Table 4-4. Quarrying (<250m of Principal Site)

National Reference	Grid	Distance and Direction	Name	Operator	Status/ Material Quarried
492944, 390227		Adjacent north of the north-eastern part of the Principal Site	Harpwell (opencast)	Brick Yard NA	Ceased/Common clay and shale

Source: Envirocheck® Report.

4.2.4.2 Coal Mining

The Coal Authority's online mining checker (Ref 17) and the Envirocheck® report (Ref 10) identify the Principal Site as not being located on a coal field or an area that has been affected by coal mining. This is supported by the Coal Authority's Interactive Map Viewer (Ref 18), which also states that no evidence of historical or current mining is present.

4.2.5 Radon

The Public Health England (PHE) interactive map for radon (UKRadon.org) (Ref 20) indicates that most of the Principal Site is within a low probability radon area (less than 1% of homes are estimated to be above the Action Level). The PHE interactive map indicates that areas between Harpswell and Glentworth (eastern part of the Principal Site) are characterised by 1-3 % of homes estimated to be above the Action Level. Areas along B1398 Middle Street and adjacent to the west are characterised by over 30% of homes estimated to be above the Action Level. These areas coincide with areas where various bedrock formations are present directly beneath the Principal Site, due to the absence of superficial deposits.

4.2.6 Aquifer Classification

The Environment Agency's Groundwater Protection Policy adopts aquifer designations that are consistent with the Water Framework Directive. Definitions of the various aquifer types can be found on the Environment Agency section of the gov.uk website (Ref 19). According to this system, the superficial deposits underlying the Principal Site are classified as Secondary A Aquifers (Glaciofluvial deposits and Alluvium) and Secondary Undifferentiated Aquifers (Till). The solid geology of the Lincolnshire Limestone Formation is classified as a Principal aquifer; Marlstone Rock Formation as a Secondary AAquifer; Scunthorpe Mudstone Formation as a Secondary B Aquifer; and Grantham Formation and Charmouth Mudstone Formation as Secondary Undifferentiated Aquifers. Whitby Mudstone Formation is classified as Unproductive Strata.

4.2.7 Groundwater Vulnerability

The Environment Agency's Simplified Groundwater Vulnerability Map in Magic (Ref 15) shows that the Principal Site is located in an area where the groundwater vulnerability to pollution is medium (in the central extent of the Principal Site; areas characterised by the presence of superficial deposits) and medium-high to high (in the eastern part of the Principal Site; areas where the bedrock directly underlies the Principal Site). Significant soluble rocks are likely to be present across the eastern part of the Principal Site, between Glenworth and Hemswell.

All associated terminology/definitions can be found on the Environment Agency section of the gov.uk website (Ref 19).

4.2.7.1 Source Protection Zones and Drinking Water Safeguarding Zones for Groundwater

In terms of identifying the risk of contamination from potentially polluting activities in a given area to groundwater sources (wells, boreholes and springs) used for supplying public drinking water, the Environment Agency identifies Source Protection Zones (SPZ). These show the extent of a groundwater source catchment and are divided into three zones, which can be found on the Environment Agency section of the gov.uk website.

The Principal Site does not lie within a SPZ (Ref 15). There is an area of Zone II (Outer Protection Zone) adjacent east of the Principal Site, east of the B1398 Middle Street. This zone is defined by the 400-day travel time from a point below the water table. Note that this SPZ is over 500m from the indicative areas of solar panels and associated infrastructure (developable areas). There are no other SPZ within 1km of the Principal Site.

The Principal Site does not lie within any Drinking Water Safeguard Zones for groundwater) (Ref 15).

4.2.8 Licensed Groundwater Abstractions

No licensed groundwater abstractions have been identified on-site and within 250m of the Principal Site.

Consultation regarding records of private abstractions held by West Lindsey District Council will be provided within the water chapter of the ES.

4.2.9 Risk of Flooding from Groundwater

The Envirocheck® report (Ref 10) indicates that there is a risk of groundwater flooding occurring at the Principal Site, both at the surface and of property situated below ground level. Refer to *Chapter 11: Flood Risk, Drainage and Surface Water* in the EIA Scoping Report for further details.

4.2.10 Surface Water Courses and Drainage

The Principal Site sits across three Water Framework Directive (WFD) surface waterbodies. The Eau from Source to Northorpe Beck covering the northern and central part of the Principal Site; the Till covering the western part of the Principal Site; and Fillingham Beck which covers the southern part of the Principal Site.

The northern extent of the Principal Site falls within the catchment of the WFD designated Eau Water Body (WFD ID: GB104028057970). The Eau borders the northern extent of the Principal Site, south of A631 (Ref 21). The latest available water quality classification (2019) shows the River Eau to be classified as having a Moderate Ecological Status and Fail Chemical Status. The Environment Agency indicates that River Eau is not achieving a 'Good' Chemical Status, due to sewage discharge and poor nutrient management. The surface water network within the Eau water body is comprised of agricultural ditches that drain to the Yawthorpe Beck, a tributary of the River Eau.

The western extent of the Principal Site falls within the catchment of the WFD designated Till (Witham) Water Body (WFD ID: GB105030062500) (Ref 21). A tributary of the River Till crosses the south-western part of the Principal Site. The latest available water quality classification (2019) shows the River Till to be classified as having a Moderate Ecological Status and Fail Chemical Status. The Environment

Agency indicates that River Till is not achieving a 'Good' Chemical Status, due to sewage discharge, poor nutrient management and trade/industry discharge.

The southern extent of the Principal Site falls within the catchment of the WFD designated Fillingham Beck Water Body (WFD ID: GB105030062490). Fillingham Beck, which becomes designated approximately 1.7km south of the Principal Site, is indicated across the southern part of the Principal Site. The Catchment Data Explorer website (Ref 21) indicates that the WFD Fillingham Beck Water Body is at 'Moderate' Ecological Status and 'Fail' for Chemical Status (in 2019). The Environment Agency indicates that Fillingham Beck is not achieving a 'Good' Chemical Status, due to sewage discharge, poor nutrient management and poor soil management and land drainage. The surface water network within the Fillingham Beck water body comprises a network of small, straightened Ordinary Watercourses that are probably artificial drainage ditches, or natural watercourses that have been deepened and modified to facilitate land drainage and agriculture.

In addition to the above watercourses, there are also numerous ponds located across the Principal Site. A reservoir is adjacent to the east of the Principal Site, east of Northland Road.

The Principal Site is not within a Drinking Water Safeguard Zone for surface water or Drinking Water Protected Areas for surface water. A Drinking Water Safeguard Zone for surface water is indicated adjacent east of the Principal Site (designation SWSGZ1000) (Ref 15), east of B1398 Middle Street, although noting that this Drinking Water Safeguard Zone is over 500m from the indicative areas of solar panels and associated infrastructure (developable areas). Drinking Water Safeguard Zones are established around public water supplies where additional pollution control measures are needed. The Drinking Water Safeguard Zone adjacent east of the Principal Site has been designated as water supplies are at risk from pesticides (carbetamide, clopyralid, metaldehyde, propyzamide and quinmerac) (Ref 15).

4.2.11 Licensed Surface Water Abstractions

No Licensed Surface Abstractions have been identified on-site and within 250m of the Principal Site.

Consultation regarding records of private abstractions held by West Lindsey District Council will be provided in the Flood Risk, Drainage and Surface Water chapter of the Environmental Statement.

4.2.12 Risk of Flooding from Surface Water

The indicative floodplain map (Ref 22) for the area, published by the Environment Agency, shows that the risk of surface water flooding at the Principal Site is generally very low (annual chance of flooding of less than 0.1%) with isolated patches of low (chance of flooding of between 0.1% and 1%), medium (chance of flooding of between 1% and 3%) and high risk (chance of flooding of greater than 3.3%) generally associated with the Eau River (northern part of the Principal Site, at Hemswell Grange), with the River Till's tributary (south-western part of the Principal Site) and with Fillingham Beck (southern part of the Principal Site). It is the intention that areas at higher risk of flooding will not be developed with solar panels/associated infrastructure, but will be used for landscape/ecology enhancement and mitigation only.

5. Historical & Planned Development

5.1 Historical Ordnance Survey Mapping & Aerial Photographs

Historical Ordnance Survey (OS) maps of the Principal Site and the wider environs were provided in the Envirocheck® Report (scales 1:2,500, 1:10,560 and 1:10,000) and from Google Earth Pro and these are reviewed in this section. Relevant features are presented in Figure 2 in Appendix A.

The historical Ordnance Survey (OS) maps obtained with the Envirocheck® Report date between mid-1880s and mid-1990s.

Table 5-1 presents a summary of the main features present on and within approximately 250m radius of the Principal Site. It should be noted that only indicative map scales are provided. Where dates are stated, these refer to the dates of maps on which the features are present, have changed use or are no longer annotated, and do not necessarily refer to the exact dates of existence of a particular feature. Development that may have occurred between map editions is recorded as occurring on the later published map, hence there are some limitations to the accuracy of the date of development unless supplementary evidence is available.

Table 5-1. Summary of Historical Mapping

Date/s	Key Features on-site	Key Features off-site
pre-1900	<p>The Principal Site consists of agricultural fields, with limited woodland and farm access tracks. Several small ponds are scattered across the Principal Site.</p> <p>A small pit is indicated on-site, south of Harpswell Lane, in the eastern part of the Principal Site (historical map dated 1885; 1:10,560). This is likely associated with the Harpswell Brick Yard, which is shown off-site to the north.</p> <p>A small copse called Brick Kiln Holt is shown on the eastern boundary (historical map dated 1885; 1:10,560).</p>	<p>The Principal Site is surrounded by agricultural fields, with a few farm buildings adjacent to the Principal Site or 'within' the Principal Site area (but excluded from the Principal Site Boundary). The village of Harpswell is located adjacent north-east of the Principal Site.</p> <p>A brick yard and quarry or pit (Harpswell Brick Yard) is indicated adjacent to the north of the north-eastern part of the Principal Site (historical map dated 1885; 1:10,560).</p>
1900-1910	<p>A few parcels of land across the eastern part of the Principal Site are identified as allotments.</p> <p>A 'Windpump' is identified in the south-eastern part of the Principal Site adjacent to Glentworth Grange.</p>	<p>A smithy is indicated 50m east of the northern part of the Principal Site (historical map dated 1907; 1:10,560).</p> <p>A disused windmill is indicated 160m west of the northern part of the Principal Site (historical map dated 1907; 1:10,560).</p>
1940-1950	No significant change since previous map.	No significant change since previous map.
1950-1960	<p>The south-western part of the Principal Site, south of Common Lane, is shown as occupied by part of an airfield (later indicated as Sturgate airfield), which also extends further to the west. As a potential military target, the precise extent of the airfield is not shown on this map. However, the airfield seems to also occupy the areas to the north of Common Lane, adjacent to the west of the Principal Site (historical map dated 1956; 1:10,000).</p>	<p>A pit is indicated 80m east of the north-eastern part of the Principal Site, west of Harpswell.</p> <p>Military land is identified directly east of the Principal Site alongside the B1398 (historical map dated 1956; 1:10,000).</p>
1970 - 1980	<p>Unspecified tanks are indicated at Hermitage Low Farm House (central part of the Principal Site) (historical map dated 1974; 1:2,500).</p> <p>Unspecified tanks are indicated at Harpswell Low Farm (northern part of the Principal Site) (historical map dated 1978; 1:2,500).</p>	<p>Unspecified tanks are indicated at the western edge of Northlands Road (eastern part of the Principal Site – at the location of the current oil well).</p> <p>An unspecified tank is indicated adjacent to the north (eastern) border of the Principal Site associated with the electricity substation (which is assumed to be excluded from the Principal Site Boundary) (historical map dated 1978; 1:2,500).</p> <p>An unspecified tank is indicated 100m north of the central part of the Principal Site, at Hemswell Grange (historical map dated 1978; 1:2,500).</p> <p>An unspecified tank is indicated 250m east of the north-eastern part of the Principal Site, at Harpswell (historical map dated 1978; 1:2,500).</p>

Date/s	Key Features on-site	Key Features off-site
1980-1990	Sturgate airfield is clearly marked on the map as partially on-site, and is shown to extend across the south-western part of the Principal Site, south of Common Lane and bordering the Principal Site to the west, north of Common Lane.	Unknown Filled Ground is indicated along the northern boundary of the Principal Site (in the north-eastern corner) associated with the former Harpswell Brick Yard. An electricity substation is indicated adjacent to the north (eastern) border of the Principal Site, at Harpswell Lane (north-eastern part of the Principal Site) (historical map dated 1983; 1:2,500). A substation is still present at this location as confirmed by the site reconnaissance (refer to Section 7).
1990 – 2000	No significant change since previous map.	No significant change since previous map.
2000 – 2010	No significant change since previous map.	The aerial photographs (Google Earth) dated between 2003 and 2008 show vehicles parked at the location of the current company that provides large outdoor festival tents (adjacent west of the Principal Site). This area is shown as cleared in the 2011 photograph. The planning application 133771, dated 2015 (refer to Table 5-2), indicates the change of use at this location from the storage of damaged motor vehicles and vehicle spares to the storage of marquees.
2010 - 2020	The aerial photograph (Google Earth) dated 2018 shows a squared feature under construction (NGR: 491444, 38984), south of Harpswell Grange, in the northern part of the Principal Site (shown as completed in 2019 aerial photograph). This is related to a lagoon for the storage of anaerobic digestate (refer to planning application 137647 in Table 5-2).	No significant change since previous map.

5.2 Planning Authority Records

A search of planning application records for the Principal Site and within 250m of the Principal Site using the search facility on the website of West Lindsey District Council (Ref 23) has been undertaken. Table 5-2 summarises the most relevant applications found during the search where potential for impact to the ground or controlled waters may have occurred. The search dated back to 2010 and included Harpswell, Glentworth, Heapham, Corringham and Springthorpe.

Table 5-2. Planning Authority Record

Decision date	Application Status	Location	Reference	Description
18 April 2018	No observation / objections	In the north (sited within the Principal Site area but expected to be excluded from the Principal Site Boundary). Harpswell Grange, Harpswell Lane, Harpswell, DN21 5UW	137647	County matters application to discharge conditions 3,4 and 5 of PL 013417- lagoon for the storage of anaerobic digestate.
31 August 2017	Granted with conditions	In the north (sited within the Principal Site area but expected to be excluded from the Principal Site Boundary). Harpswell Grange, Harpswell Lane, Harpswell, DN21 5UW	136725	Planning application for demolition of existing dwelling and erection of replacement dwelling - resubmission of 135018.
18 October 2010	Granted time limit +conditions	Off-site, adjacent north. Church Farm, Church Lane, Harpswell, Lincs, Lincolnshire, DN21 5UY	126560	Planning Application for new agricultural storage buildings, to allow relocation of existing farmstead - to replace extant planning permission M06-P-0960 granted 22 February 2008.
13 August 2022	Granted time limit +conditions	Off-site, adjacent south. Manor Farm, Common Lane, Heapham, Gainsborough, DN21 5XB	141506	Planning application to erect a covered manure store.

Decision date	Application Status	Location	Reference	Description
07 February 2019	Granted time limit +conditions	Off-site, adjacent south. Land off Common Lane, Heapham, Gainsborough, DN21 5XD	139019	Planning application for change of use for agricultural machinery storage building into log processing and forestry/tree surgery machinery and products.
26 November 2015	Granted time limit +conditions	Off-site, adjacent west. Mobile Structures Management Ltd, Storage Site, Common Lane, Heapham, Gainsborough, DN21 5XD	133771	Planning application for the change of use from the storage of damaged motor vehicles and vehicle spares to the storage of marquees. It is noted that the applicant purchased the site in 2015 and the site was already being used for the purposes for which permission is being sought. It is a retrospective application. Environmental Protection note appended to the application states: “verbally agreed no comments to make regarding contamination due to the change of use nature of the proposals” (Ref 24).

5.3 Other Relevant Site History

5.3.1 Oil Field

IGas Energy Plc. is an on-shore hydrocarbon producer, delivering natural gas and crude oil to the British energy market. The Site is part of the Gainsborough area, which is made up of 10 fields and a processing facility. As indicated in Section 4.2.4.1, Glentworth Oilfield Well 1, listed as active, is located at Northlands Road (adjacent to the east of the Principal Site). This site relates to liquid or gas extraction from carboniferous strata (sandstone). IGas Energy Plc. 2019 Annual Report available from the website (Ref 25) states that:

“IGas operates an ISO 14001 certified Environmental Management System and by doing so demonstrates, via external assurance, that the systems and processes which we apply to our business in the management and determination of environmental risk are robust....the protection of the environment is a core business objective for IGas. We are committed to working with regulators to ensure that any activity is undertaken safely and with as little impact to the environment as possible. Throughout our operations and the lifecycle of our wells, robust safety measures are in place to protect the environment. IGas operates an ISO 14001 certified Environmental Management System and by doing so demonstrates, via external assurance, that the systems and processes which we apply to our business in the management and determination of environmental risk are robust. We work with the EA and the MPA to ensure that we adhere to high standards through a series of formal and informal audits, review and general discussion with the MPAs and other key regulators. ... Throughout the project lifecycle we continually identify, evaluate and mitigate risk and have publicly committed to stringent evaluation prior to determining whether to conduct operations in areas of natural or cultural sensitivity. In England & Wales, onshore oil and gas exploratory activities require environmental permits issued under the Environmental Permitting Regulations (EPR 2010) and other permissions from the environmental regulator, depending on the methods used and the geology of the site. Amongst other things, these activities shall not be carried out within: (a) 10 metres of any watercourse; (b) a groundwater source protection zone 1 or 2, or where a source protection zone has not been defined then within 250 metres of any well, spring or borehole used for the supply of water for human consumption or food production purposes. This must include private water supplies; (c) a specified Air Quality Management Area (AQMA); (d) 200

metres of a European Site or a Site of Special Scientific Interest; (e) 200 metres of the nearest sensitive receptor; and (f) a flood zone 3”.

5.3.2 Sturgate Airfield

Sturgate Airfield is currently operational and located approximately 600m south-west of the Principal Site. On-line sources (Bomber County Aviation Resource website (Ref 27)) and historical maps (refer to Table 5-1) indicate that the south-western part of the Principal Site extends into areas historically occupied by the airfield. The website indicates that the construction of the airfield started in early 1943 and the airfield opened in March 1944. Post-war, the airfield was used by US Air Force until 1959, when it was transferred back to the RAF. Currently, most areas have returned to the original use as farmland, with only a small part of the airfield in use by civilian aircrafts.

On-line sources (Ref 28) also indicate that a bomb store associated with the airfield was located to the north-east of the airfield, and accessed from Common Lane. No detailed information is available; however, this feature may have been located in the area adjacent to the west of the Principal Site, latterly used as metal recycling site/vehicle dismantler, and currently occupied by the company that provides large outdoor festival tents.

5.4 Unexploded Ordnance Risk

5.4.1 Wartime Land-use

Based on a review of historical maps, the Principal Site was open land during wartime Britain and was undeveloped, meaning it was possible for bomb strikes to go unobserved. Part of the Principal Site is located across areas formerly occupied by the Sturgate Airfield, which is considered a wartime site of interest.

The Pre-desk Study Assessment from Zetica (Appendix E) identified one British bomber aircraft crashed on the Principal Site. The Pre-desk Study Assessment also indicates that *“during World War (WW) II the [Principal] Site was located in the Rural District of Gainsborough, which officially recorded 102 No. High Explosive bombs with a bombing density of 1.3 bombs per 405 hectares. No readily available records have been found to indicate that the [Principal] Site was bombed”.*

5.4.2 Post War Development

An analysis of the post war historical map does not show visible changes on the land uses of the Principal Site which could indicate potential aerial bombing. However, due to its rural nature, the risk of unexploded Ordnance (UXO) going unnoticed does exist. An on-line search has been undertaken for any mention of recent ordnance discovery reported at or around the Principal Site. The search did not identify any records of ordnance in the study area.

5.4.3 Unexploded Ordnance Mapping

The regional unexploded bomb (UXB) mapping published by Zetica (Ref 30 and Appendix D) show that the Principal Site lies within a zone that experiences a low risk of UXB. It is estimated that the bombing density of the area is 15 bombs or less within 1000 acres.

However, a Pre-desk Study Assessment from Zetica (Appendix E) identified strategic targets in the vicinity of the Principal Site and recommends that a detailed UXO Assessment is commissioned to assess, and potentially zone, the UXO hazard level at the Principal Site, prior to the commencement of any intrusive works.

Historical and Planned Development Key Findings:

The maps show that areas formerly associated with Sturgate Airfield, constructed in the early 1940's, extended across the south-western part of the Principal Site, and border the Principal Site to the west. The remaining areas of the Principal Site were undeveloped land/agricultural fields since the earliest available historical maps (late 1800's), with contamination sources limited to potential application of pesticides and fertilisers for agricultural purposes. Potential contaminative sources identified locally on-site may be associated with small areas of infilled land (associated with former pits/small ponds) which may have been filled with a variety of (potentially unlicensed) waste materials. Farmland, including farm buildings and yards where fuel and agricultural materials were/are stored, are shown at various locations adjacent to the Principal Site. Several historical tanks (contents unknown) are shown in various locations on and adjacent to the Principal Site. An electrical substation exists adjacent the north of the eastern part of the Principal Site since early 1980s. The Pre-desk Study Assessment from Zetica (Appendix E) indicates that one British bomber aircraft crashed on the Principal Site. This may have potentially caused (local) contamination of the ground.

The planning records indicate the presence of various commercial activities and features (agricultural buildings for livestock, storage of damaged motor vehicles and vehicle spares) in the proximity of the Principal Site.

The Pre-desk Study Assessment from Zetica (Appendix E) indicates that *“during WWII the Site was located in the Rural District of Gainsborough, which officially recorded 102No. High Explosive bombs with a bombing density of 1.3 bombs per 405 hectares. No readily available records have been found to indicate that the Site was bombed”*.

6. Regulated Activities and Statutory Consultation

6.1 Introduction

The key relevant features that characterise the Principal Site and surrounding area are summarised in this section, along with an indication of the risk to the land quality of the Principal Site.

Generally, any regulated activities within 250m of the Principal Site could, depending upon their nature, represent potential off-site sources of contamination. This section indicates the activities present within 250m. The extent of this study area has been developed using professional judgement on the basis that contamination migration beyond this distance is likely to be minimal. This principle has been applied in assessing similar sites.

6.2 Regulated Processes

Table 6-1 summarises information on regulated processes contained in the Envirocheck[®] sensitivity data (Ref 10). The Envirocheck[®] collates data from a variety of sources including the Environment Agency and the BGS.

There were no instances of the following data identified within the information sources reviewed:

- Contaminated Land Register Entries and Notices;
- Prosecutions Relating to Controlled Waters;
- Enforcement and Prohibition Notices;
- Integrated Pollution Controls;
- Local Authority Integrated Pollution Prevention and Control;
- Local Authority Pollution Prevention and Control Enforcements;
- Registered Radioactive Substances;
- Water Industry Act Referrals and Hazardous Substances (Control of Major Accident Hazards Sites (COMAH));
- Explosive Sites;
- Notification of Installations Handling Hazardous Substances (NIHHS);
- Planning Hazardous Substance Consents; and
- Planning Hazardous Substance Enforcements.

The Contaminated Land Register (Ref 40) accessed from the West Lindsey District Council website indicates that there are currently no entries within the West Lindsey District area for:

- Remediation notices;
- Appeals against remediation notices;
- Remediation declarations;
- Remediation statements;
- Appeals against charging notices;

- Designation of special sites;
- Notification of claimed remediation;
- Convictions for offences under Section 78M of the Act;
- Guidance issued under Section 78V(1) of the Act; and
- Other matters prescribed by Regulations.

Table 6-1. Summary of Regulatory Information

Subject	Number present		Details
	On site	0-250m	
Agency & Hydrological			
Discharge Consents	6	1	<p>Five discharge consents are listed on-site and relate to sewage discharges, detailed as follows.</p> <ul style="list-style-type: none"> • One discharge consent is listed at Springthorpe Grange (northern part of the Principal Site) and relates to sewage discharges into groundwater. Operator Miss N J Watson. • One discharge consent is listed at Harpswell Grange (northern part of the Principal Site) and relates to sewage discharges into groundwater. Operator Messrs F Pickering and Sons. • Two discharge consents are listed at Harpswell Hill Park (northern part of the Principal Site) and relate to sewage discharges – pumping station, and sewage emergency discharges into stream/river (River Eau Catchment). Operator Severn Trent Water Ltd. • One discharge consent is listed at Northlands Road (eastern part of the Principal Site), is operated by Glentworth Scottish Farms Ltd. Destination of the sewage discharge not provided. Note that a vegetated mound of unknown material, discarded tyres and an abandoned vehicle have also been observed at this location (refer to Section 7 and Figure 2 in Appendix A). • One discharge consent is listed at Glentworth Grange in Kexby Road (within the southern part of the Principal Site, but in an area excluded from the boundary), is operated by Glentworth Scottish Farms Ltd. Destination of the sewage discharge not provided.
Integrated Pollution Prevention and Control (IPPC)	NA	8	<p>One effective IPPC, related to Igas Energy Production Limited, and associated with the oil well, is indicated adjacent to the east of the Principal Site, approximately 1km west of Glentworth. Another seven IPPC are listed as superseded by variation, at the same location.</p>
Pollution Incidents to Controlled Waters	5	NA	<p>Five pollution incidents to controlled waters are listed on-site, detailed as follows:</p> <ul style="list-style-type: none"> • Two incidents occurred at Church Farm, in School Lane (western part of the Principal Site) and related to release of unknown miscellaneous pollutants to Somerby Beck, a tributary of River Till, in March and June 1993. Both these incidents are Category 2 (Significant Incident). • The incident indicated south-west of Glentworth Grange occurred in April 1994 and relates to release of chlorinated water, due to poor operational practice, in an unnamed watercourse. The incident is Category 1 (Major Incident). • The incident indicated west of Glentworth occurred in December 1995 and relates to release of oil/diesel, due to poor operational practice, in Fillingham Beck. The incident is Category 3 (Minor Incident). • The incident indicated west of Harpswell occurred in January 1995 and relates to release of oil/diesel, likely to be in a tributary of River Eau (considering the location of the incident). The cause of this incident was vandalism. The incident is Category 3 (Minor Incident).

Source: Envirocheck Report

6.3 Licensed Waste Management Facilities

There are no recorded landfill sites (operative or historical) located on-site and within 1km of the Principal Site (Ref 31 and Ref 41). There are no licensed waste management facilities on the Principal Site.

A licensed waste management facility, for a mining waste operation, held and operated by IGas Energy Production Limited, is located adjacent to the east of the Principal Site, at the location of the oil well site approximately 1km west of Glentworth.

A revoked licensed waste management facility, consisting of a metal recycling site (vehicle dismantler), operated by W J Furber Ltd, is located adjacent west of the Principal Site, east of Field View, approximately 1km east of Heapham.

A summary of the licensed waste management facilities on-site and within 250m of the Principal Site is given in Table 6-2.

Table 6-2. Licensed Waste Management Facilities (<250km of Principal Site)

National Grid Reference	Distance and Direction	Name	Operator	Status / Dates
489301, 388901	Adjacent west of the Principal Site	Metal recycling site (vehicle dismantler)	W J Furber Ltd	Revoked 26/05/2015
493099, 388088	Adjacent east the Principal Site	Mining Waste Operations	IGas Energy Production Limited	Active

Source: Envirocheck Report

6.4 Industrial Land Use

There are no active or inactive contemporary trade directory entries on the Principal Site. There are one active and three inactive entries within 250m of the Principal Site Boundary, as summarised in Table 6-3. Any significant inactive listings thought not to be covered by the historical development review in Section 5.1 are also noted if present and/or identified. With regards to contemporary trade directory entries, unless otherwise stated, the entry relates to an active listing. No fuel station entries have been identified on-site and within 250m of the Principal Site Boundary.

Table 6-3. Potentially Contaminative Industrial Land Use on and Within 250 m of the Principal Site

Subject	Location	Details
Contemporary Trade Directory Entries	Off-Site	Rinaldi Furniture - Workshops and Repair Centres: adjacent to the east of the northern extent of the Principal Site.
		G F Tatam & Son - Workshops and Repair Centres (inactive): adjacent to the east of the northern extent of the Principal Site.
		W J Furber Ltd - car breakers & dismantlers (inactive): adjacent to the west of the Principal Site, north of Common Lane.
		Abel Chatsworth - damp & dry rot control (inactive): southern part of the Principal Site (excluded from the Principal Site Boundary), on Kexby Road.
Gas Pipelines	On Site	Not provided in the Envirocheck data. Note that demarcating of no dig areas due to high pressure gas mains were observed in the central part of the Principal Site during the site reconnaissance (refer to Section 7).

6.5 Sensitive Land Uses

The Principal Site does not lie within any land-based designations, such as Sites of Special Scientific Interest (SSSI), Environmentally Sensitive Areas, Areas of Outstanding Natural Beauty, Nature Reserves, National Parks, Special Areas of Conservation and Special Protection Areas (Ref 15). The Principal Site is within a nitrate vulnerable zone (Ref 15).

There is no record of Local Geological Sites (LGS) or geological sites of interest on the Principal Site from on-line resources (Ref 15). West Lindsey District Council has been engaged to obtain records of any LGS or geological sites of interest on the Principal Site.

6.6 Regulatory Consultation

Liaison will be undertaken with West Lindsey District Council to obtain records of private and / or unlicensed groundwater and surface water abstractions within the study area as part of the Flood Risk, Drainage and Surface Water Environmental Statement Chapter.

West Lindsey District Council has been contacted to request records of any LGS or geological sites of interest, located within the study area. The response is awaited at time of writing.

7. Site Reconnaissance

An external inspection of the Principal Site was completed by a suitably qualified and experienced AECOM Geo-Environmental Engineer on 21st of July 2022. The aim of the visit was to identify the range of activities carried out on the Principal Site and any obvious potential sources of ground contamination.

A photographic record of the visit is included as Appendix B.

The Principal Site consists of agricultural fields used for crops or grazing. There are a number of lanes and farm buildings dotted throughout the Principal Site area, some of which are excluded from the Principal Site Boundary. Due to the size of the Principal Site, the site walkover took place at several locations spread evenly throughout the Principal Site. Access to some parts of the Principal Site was restricted due to landowner restrictions, hedgerows, foliage and fencing.

Photos 1 - 4 (in Appendix B) show the north-west of the Principal Site. Photo 5 is taken from the south of these western fields and shows a field containing crops. Photos 6 - 9 show crop fields and are taken from the western Principal Site Boundary, with a manure heap visible in Photo 8. The heap covered an area of approximately 10m x 20m.

Photo 10 shows the entrance to a private land parcel (off-site). The AECOM Geo-Environmental Engineer was informed by a local landowner that this gated compound is used by a company providing large outdoor festival tents and that this area had formerly been a part of the larger airfield (Sturgate Airfield). Photo 11 shows the area directly south (on-site), which is used to store agricultural materials. This was also stated to have previously been part of the airfield.

Photo 12 is taken looking north along a gravel track towards a line of Poplar trees from Common Lane (between Grange Farm and Manor Farm). The AECOM Geo-Environmental Engineer was informed by a local landowner that the area to the north of this was due to contain a large bunded chicken waste storage area to store material from a nearby chicken farm. It was stated that this would have a concrete base and was currently under construction.

Photos 13 and 14 are taken further to the east along Common Lane where the road bends to the south and show field access points. Through the gate to the north (Photo 13), lies a gravel track that runs adjacent to a woodland area (Harpswell Wood and Peter's Wood, excluded from Principal Site Boundary). Access to the eastern field is restricted by large boulders. The fields are shown in Photos 15 and 16. A large building which houses free-range chickens is located 300m north of Common Lane (Photo 18), the building is excluded from Principal Site Boundary. Within Harpswell Wood and Peter's Wood (excluded from Principal Site Boundary) which are to the east of the chicken house, a disused pheasant pen was identified with numerous feeders. Empty oil drums were noted in two locations with no visible or olfactory signs of contamination (see Photos 17 and 19).

To the north of Peter's Wood are further agricultural fields (photos 20 and 21 show the views to the west and east respectively). Posts were observed here, and in the distance, demarcating no dig areas due to high pressure gas mains. The route of this gas main could not be determined during the visit using these markers. To the south of the woodland area further along Common Lane (photos 22 and 23 show open agricultural fields on both sides of the road with open access). Further no dig posts were observed showing the gas main running underneath Common Lane. Billyards

Farm is located further north-east along Common Lane, surrounded by agricultural fields. Photo 24 shows the entrance to a track to the east of Billyards Farm, which gives access to the southern fields shown in Photos 25 and 26. Track access is currently restricted by a telegraph pole lying along the floor.

Photo 27 shows the agricultural fields to the north of Common Lane, and a no dig marker demarcating the high-pressure gas main was observed between Billyards Farm and Hermitage Low House Farm (Photo 28). Common Lane continues to the north-east towards Harpswell, with agricultural fields on either side and no hedgerows, Photos 29 and 30.

There is an oil well located to the south-east of the Principal Site (excluded from Principal Site Boundary). This facility comprises a track leading to a gated and fenced compound which contains four 'nodding donkey' pumps of varying sizes, a substation building, tanks for storing crude oil, and a small site office. Three of the smaller size pumps were operating at the time of the visit with the largest stationary (Photo 31). Two boreholes were observed in the corners of the compound (Photo 32).

What appeared to be a recently harvested field is to the south of the oil well compound (Photo 33) and is separated from the compound by an overgrown ditch (Photo 34). The ditch which was dry at the time of the site visit, continued to the north-east, cutting across another field to the east of the oil well compound (Photo 35). Photo 36 shows the agricultural fields are to the north of the compound.

Approximately 200m north of the oil well compound is a wooded area, adjacent to the east of which is a farm waste / storage area. A mound in the western section consists of overgrown loose sand or soil with fragments of concrete visible. The mound was noted to have a distinct smell similar to landfill and is approximately 30m x 20m in area. An abandoned car was present to the south with numerous parts and registration plate missing (Photos 37 and 38). A large amount of manure was stored on unbunded concrete hardstanding, and was approximately 30m x 20m in area (Photo 39). Directly north of the manure heap is a large pile of tyres approximately 10m x 5m in area shown in Photo 40. Photo 41 shows the agricultural fields further to the east.

An area of fly tipping consisting of sand and concrete building materials was found approximately 300m to the east of the Principal Site, shown in Photo 42.

Approximately 280m south of the oil well compound are a number of raised (approximately 5m high) reservoirs (Photo 43). The reservoirs are off-site but directly adjacent to the western site boundary. Waterfowl were observed, and no visual or olfactory evidence of contamination was noted.

Approximately 1.3 km south-east of the Principal Site is another oil well compound (Photo 44). This compound contains two smaller 'nodding donkeys', oil storage tanks, and a small site office. One 'nodding donkey' pump was currently being worked on by a drilling rig and tanker.

The north-eastern section of the Principal Site consists of agricultural fields with a number of farms located throughout and was accessed from A631 Harpswell Lane (Photos 45 – 48). An electricity substation is shown in Photo 46, which is assumed to be excluded from the Principal Site Boundary.

8. Preliminary Ground Model

Based on the review of published geological and hydrogeological information and a selection of historical borehole records, the ground conditions within the Principal Site are considered to comprise the following sequence presented in Table 8-1.

Table 8-1. Preliminary Ground Model

Geology	Description	Thickness	Groundwater
Alluvium	Clay, silt, sand and gravel. Normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel.	Variable	Secondary A (Groundwater level not provided)
Till	Diamicton	Variable – 4.5m (refer to BGS borehole SK98NW7 – southern part of the Principal Site)	Secondary (undifferentiated) (Groundwater level not provided)
Glaciofluvial deposits	Sand and gravel	Variable	Secondary A (Groundwater level not provided)
Lincolnshire Limestone Formation	Limestone. Commonly includes sandy limestone in basal part and may contain substantial units of mudstone particularly from the Lincoln area northwards.	Up to 30m or more	Principal (Groundwater level not provided)
Grantham Formation	Sandstone, siltstone and mudstone. Mudstones, sandy mudstones and argillaceous siltstone-sandstone, which is commonly ferruginous, and containing generally abundant plant debris.	Typically 2m to 5m	Secondary (undifferentiated) (Groundwater level not provided)
Whitby Mudstone Formation	Mudstone. Medium and dark grey fossiliferous mudstone and siltstone, with thin siltstone or silty mudstone beds and rare fine-grained calcareous sandstone beds.	120 m	Unproductive (Groundwater level not provided)
Marlstone Rock Formation	Ferruginous Limestone and ferruginous sandstone. Sandy, shell-fragmental and ooidal ferruginous limestone interbedded with ferruginous calcareous sandstone, and	10 m	Secondary A (Groundwater level not provided)

Geology	Description	Thickness	Groundwater
	generally subordinate ferruginous mudstone beds.		
Charmouth Mudstone Formation	Mudstone. Dark grey laminated shales, and dark, pale and bluish grey mudstones.	131 m (refer to BGS borehole SK98NW12 – south-eastern part of the Principal Site)	Secondary (undifferentiated) (Groundwater level not provided)
Scunthorpe Mudstone Formation	Mudstone and limestone; interbedded. Grey, variably calcareous and silty, blocky or fissile mudstone with thin beds of argillaceous limestone (bioclastic or micritic) and calcareous siltstone.	108 m (refer to BGS borehole SK98NW10 – off-site)	Secondary B (Groundwater level not provided)

8.1 Preliminary Gas Risk Assessment

Significant thickness of Made Ground, natural organic deposits and degrading contaminant hotspots have the potential to generate hazardous gases (i.e. methane and carbon dioxide).

The principal source of potential ground gases at the Principal Site is considered to be the alluvial deposits underlying part of the eastern extent of the Principal Site, identified along the River Eau, Fillingham Beck and their tributaries (refer to Table 4-1). Ground gas may be also associated with decomposition of any putrescible materials in Made Ground, likely present in the proximity of farm buildings (many of which are excluded from the Principal Site Boundary); manure heaps and the vegetated mound of unknown material (on-site, refer to Section 7).

Former ponds and pits including the quarry at the former Harpswell Brick Yard to the north-east of the Principal Site could be a source of ground-gas, if infilled with unlicensed material, depending on their organic matter content. However, given the small sizes of these features, the presence of degrading contaminant hotspots that have the potential to generate hazardous gases (i.e. methane and carbon dioxide) is considered unlikely.

No historical landfills are located on-site or within 250m of the Principal Site.

An anaerobic lagoon is located at the Principal Site, south of Harpswell Grange (northern extent of the Principal Site). Typically, anaerobic lagoons are designed to hold and treat wastewater, via anaerobic bacteria degrading pollutants in the absence of oxygen. Potential emission from anaerobic lagoon includes nitrogen oxides, carbon monoxide, methane and sulphur oxides (Ref 26). Lagoons must be covered with a fixed cover and an appropriately designed air abatement and gas capture system. Provided that the requirements of relevant legislation relating to this feature have been integrated within the design, the risk from gases deriving from this feature are considered low. As such, the anaerobic lagoon will not be considered further in the assessment.

Due to the limited ground gases sources identified, and the current use of the Principal Site as agricultural land and the proposed land use as a solar farm, with no

permanently occupied buildings/structures, an intrusive investigation for ground gas is not considered to be necessary.

9. Initial Conceptual Site Model

9.1 Introduction

This section is aimed at identifying possible risks, if any, arising from substances used or deposited on-site, or from other sources of land contamination. Both past and current potentially contaminative land uses have been considered. It is based on the description of the Scheme as identified in *Chapter 3: Description of the Scheme* in the EIA Scoping Report. The aim of the initial conceptual site model (CSM) is to inform future decision making and the design of any future ground investigation (if needed).

9.2 Assessment Framework

The Principal Site, in terms of potential land contamination, will be regulated by the Local Planning Authorities (West Lindsey District Council) (Ref 1), taking account of the NPPF 2019 (Ref 2), with the Environment Agency, Natural England and Historic England acting as potential statutory consultees.

Environmental liabilities can arise through provisions contained within statutory legislation including Part 2A of the Environmental Protection Act 1990 (Ref 3), the Environmental Damage (Prevention and Remediation) (England) Regulations 2015 (Ref 33), the Water Resources Act 1991 (Ref 34), the Environmental Permitting (England and Wales) Regulations 2016 and the Water Act 2003 (Ref 36).

Current industry good practice recommends that the determination of health hazards due to contaminated land is based on the principle of risk assessment, as outlined in the Statutory Guidance to Part 2A (2012) and Land Contamination Risk Management (LCRM) (Ref 7).

The “suitable for use” approach is adopted for the assessment of contaminated land where remedial measures are undertaken where unacceptable risks to human health or the environment are realised taking into account the use (or proposed use) of the land in question and the environmental setting. The proposed end-use for the Principal Site is the installation of PV Panels and on-site energy storage facilities.

The risk assessment process for environmental contaminants is based on a source-pathway-receptor analysis. These terms can be defined as follows:

- **Source:** hazardous substance that has the potential to cause adverse impacts; and
- **Pathway:** route whereby a hazardous substance may come into contact with the receptor: examples include ingestion of contaminated soil and leaching of contaminants from soil into watercourses; and
- **Receptor:** target that may be affected by contamination: examples include human occupants/ users of site, water resources (surface waters or groundwater), or structures.

For a risk to be present, there must be a relevant/viable contaminant linkage; i.e. a mechanism whereby a source impacts on a sensitive receptor via a pathway.

The following sections detail the CSM which has been developed for the Principal Site with a view to assessing the potential risks/liabilities and constraints associated with the Principal Site in its current condition prior to any development. Risks associated with the proposed development have also been assessed based on a future land use scenario as a solar farm, including any potential sources of contamination, potential

receptors and potential contaminant pathways identified during this desk-based assessment.

9.3 Sources of Potential Contamination

9.3.1 On Site

The potential for a contaminant hotspot has been identified on the Principal Site. This includes the areas historically occupied by the airfield (south-western extent of the Principal Site) and the ground potentially impacted by the vegetated mound of unknown material, discarded tyres, abandoned vehicle and manure heap (south-eastern part of the Principal Site) (refer to Figure 2 in Appendix A). A manure heap was also present in the north-west of the Principal Site.

A small pit (northern part of the Principal Site), which may have been filled with a variety of (potentially unlicensed) waste materials, could be a potential source of local contamination. The presence of other small, infilled pits/historical ponds across the Principal Site cannot be excluded. One British bomber aircraft was reported to have been crashed on the Principal Site; however, the precise location is unknown. This could have caused local contamination of the ground.

Potential contaminants associated with the above sources include metals, semi-metals, asbestos, organic and inorganic compounds. In addition, there is the potential for landfill gases such as methane or carbon dioxide and leachate.

The Principal Site is occupied by agricultural land comprising arable fields. It is considered that although chemicals such as pesticides, herbicides and insecticides may have been used on-site and in its proximity, these chemicals typically have a low residency time in soils and they degrade rapidly in compliance with the requirements for crops and grazing prior to products being used for human consumption. Therefore, agricultural uses are not considered a potential significant source of contamination.

Pollution Incidents to Controlled Waters of Category 3 (Minor Accident) and Category 2 (Significant Accident) identified on the Principal Site occurred almost 30 years ago and are therefore not considered of concern. The Category 1 (Major Accident) occurred in 1994 is also of little significance, given the time passed, and the location at the southern edge of the Principal Site, downgradient from the rest of the Principal Site.

A few drums were identified during the site walkover in the central part of the Principal Site, by Peter's Wood and Harpswell Wood (refer to Photos 17 and 19 in Appendix B). Given that these were empty, and no sign of ground contamination was reported at these locations, the drums have not been included as a potential source of contamination in Table 9-1.

9.3.2 Off Site

The following potential sources of off-site contamination have been identified as requiring consideration:

- Farm buildings and yards where fuel, and agricultural materials were/are stored, (some of which historically had unidentified tanks) at various locations across the Principal Site (but excluded from the Principal Site Boundary) and adjacent to the Principal Site.
- The active IGas Energy Plc. oil well and associated Licenced Waste Management Facility (Mining Waste Operations) (adjacent east of the Principal Site).

- Areas formerly occupied by the Sturgate Airfield (adjacent west of the Principal Site).
- Revoked licenced waste management facility (metal recycling site/vehicle dismantler) (adjacent west of the Principal Site – across the area formerly occupied by the airfield).
- Former Harpswell Brick Yard with quarry (adjacent north of the north-eastern part of the Principal Site).
- Current electricity substation (adjacent north-east of the Principal Site).
- Active and former workshops and repair centres (adjacent east of the northern extent of the Principal Site).
- Former damp & dry rot control (adjacent south of the Principal Site).
- Former smithy (50m east of the northern extent of the Principal Site).

Most of the above sources, including the former brick yard and quarry, former smithy, and the commercial activities, are small scale, hence not considered to be a pertinent off-site source. Potential pathways from contaminants migration to the Principal Site from these locations are also restricted by the low permeability Till deposits, which underlie the majority of the Principal Site.

It is therefore considered that the relevant off-site sources are farm buildings and yards where fuel and agricultural materials were/are stored; the current electricity substation; the metal recycling site/vehicle dismantler and areas formerly occupied by the Sturgate Airfield.

The active IGas Energy Plc. oil well and associated Licenced Waste Management Facility (Mining Waste Operations) (adjacent east of the Principal Site) may also be considered a potential source of contamination due to potential leakages during operation. Tanks and an electricity substation have been also identified at this location. However, this site has an associated IPPC. This means that for this site the regulators have set permit conditions so as to achieve a high level of protection for the environment, including land and water.

9.4 Summary of potential sources

Table 9-1 indicates the potential contaminants that may be associated with the current land use.

Table 9-1. Potential Sources of Contamination

Source Reference	Location	Potential Sources	Associated Contaminants of Potential Concern (CoPC)
S1	On-Site	<p>Made Ground (former quarry/pits)</p> <p>Material associated with the British bomber aircraft crashed on the Principal Site, and potentially dispersed across the Principal Site.</p>	<p>Heavy metals and inorganics (including sulphate, nitrate, phosphate, ammoniacal nitrogen, acidic/alkaline pH), total petroleum hydrocarbon (TPH), polyaromatic hydrocarbons (PAH), semi-volatile organic compound (SVOCs), Volatile Organic Compound (VOCs), asbestos and asbestos containing materials (ACMs).</p> <p>Ground gases (such as methane or carbon dioxide) and leachate.</p>

Source Reference	Location	Potential Sources	Associated Contaminants of Potential Concern (CoPC)
S2	On-Site	Potentially hazardous materials at the location of the vegetated mound (with landfill odour), manure heap, tyres and the abandoned vehicle. This area is associated with a sewage discharge (refer to Table 6-3) Manure heap in the north west of the Principal Site.	Heavy metals and inorganics (including sulphate, nitrate, phosphate, ammoniacal nitrogen, acidic/alkaline pH), TPH, SVOCs, VOCs, asbestos, ACMs, pesticides and fertilisers.
S3	On-Site	Areas formerly occupied by the Sturgate Airfield	Heavy metals and inorganics (including acidic/alkaline pH, cyanide complex), oil/fuel hydrocarbons, aromatic hydrocarbons, chlorinated aliphatic hydrocarbons, PCBs, PFAS.
S4	Off-Site	Licensed Waste Management Facility (Mining Waste Operations) - Active IGas Energy Plc. oil well	Oil Polychlorinated biphenyls (PCBs) associated with electrical substation
S5	Off-Site	Revoked licensed waste management facility (metal recycling site/vehicle dismantler) (this area was also formerly occupied by the Sturgate Airfield)	Heavy metals and inorganics (including sulphate, nitrate, phosphate, ammoniacal nitrogen, acidic/alkaline pH), TPH, SVOCs, VOCs, asbestos, ACMs.
S6	Off-Site	Farm buildings and yards where fuel and agricultural materials were/are stored, including the chicken shed (Photo 18)	Heavy metals and inorganics (including sulphate, nitrate, phosphate, ammoniacal nitrogen, acidic/alkaline pH), TPH, SVOCs, VOCs, asbestos, ACMs, pesticides and fertilisers.
S7	Off-Site	Electrical substation	PCBs

9.5 Potential Receptors

9.5.1 On-Site Receptors

The principal human receptors on-site are considered to be: current site users, including farmers, site visitors and general public using PRow; construction and maintenance workers; and future site users, including maintenance workers, and general public using PRow, as these will remain following development.

The controlled water receptors include groundwater (Secondary Aquifers and Principal Aquifer), and surface water (River Eau, Fillingham Beck, tributaries of these watercourses, River Till's tributary, drains, ponds and reservoirs).

Property receptors include crops, livestock, existing buildings and future PV mounting structure and cables.

There are no sensitive ecological receptors associated with the Principal Site.

9.5.2 Off-Site Receptors

The principal human receptors off-site are considered to be neighbours in residential/commercial properties adjacent to the Principal Site and the general public in the areas adjacent the Principal Site. Residents/workers in the farm buildings and associated dwellings located across the Principal Site (but excluded from the Principal Site Boundary) have been considered as off-site receptors.

Property receptors include crops and livestock.

9.5.3 Summary of Potential Receptors

Potential receptors associated with the potential development are shown on Table 9-2.

Table 9-2. Potential Receptors

Receptor Reference	Receptor	Description
R1	Human Health: Acute ¹	Construction and maintenance workers
R2	Human Health: Acute	Current Site Users: farmers/site visitors/general public on the Site using the PRoW
R3	Human Health	Future Site Users: farmers/site visitors/trespassers/general public using the PRoW
R4	Human Health: Acute	Adjacent site users during earthworks, (neighbours in residential/commercial properties adjacent to the Principal Site and general public in the areas adjacent the Principal Site)
R5	Water Environment: Aquifers	Secondary A Aquifers (superficial deposits of the Alluvium and glaciofluvial deposits; and bedrock of the Marlstone Rock Formation) Secondary B Aquifer (bedrock of Scunthorpe Mudstone Formation) Secondary Undifferentiated (superficial deposits of the Till; and bedrock of Grantham Formation and Charmouth Mudstone Formation) Principal Aquifer (bedrock of Lincolnshire Limestone Formation)
R6	Water Environment: Surface waters	River Eau River Till's tributary Fillingham Beck Drains, ponds and reservoirs
R7	Property	Livestock and Crops
R8	Buildings & Infrastructure: Concrete	Future proposed infrastructures (PV Mounting Structure and cables)
R9	Buildings & Infrastructure: Structures	Proposed structures
R10	Buildings & Infrastructure: Services	Potable water supply pipes and other services (off-site).

¹ Refer to a considerable exposure to contaminated land in a short period of time (for example during construction activities).

9.6 Potential Pathways

9.6.1 On-Site Pathways

The human health exposure pathways that are considered viable based on UK guidance (Environment Agency, Contaminated Land Exposure Model “CLEA UK”) (Ref 29) are listed below:

- Direct contact, dermal absorption or ingestion of soil.
- Ingestion of fruit and vegetables and/or waters.
- Inhalation of soil particulates derived from soils.
- Migration of hazardous gases/vapours via permeable strata into confined spaces (asphyxiation/ explosion).

The evaluation of exposure pathways for controlled waters receptors requires an understanding of geological and hydrogeological pathways beneath the Principal Site. The controlled waters pathways considered viable with respect to the Principal Site are as follows:

- Spillage/loss/run off from surface direct to receiving water.
- Leaching of chemicals and vertical migration via permeable unsaturated strata to shallow groundwater.
- Lateral migration in groundwater and baseflow into surface waters.

The property receptor (crops and livestock) pathways considered viable with respect to the Principal Site are as follows:

- Direct contact, dermal absorption or ingestion of soil / ingestion of fruit and vegetables and/ or waters/inhalation of soil particulates derived from soils.

The buildings and infrastructure pathways considered viable with respect to the Principal Site are as follows:

- Direct contact of buried concrete (proposed PV Mounting Structure and cables) with contaminated soils (i.e. hydrocarbons) and aggressive ground conditions (pH and sulphate).
- Migration of hazardous gases/vapours via permeable strata into enclosed spaces and service/utility trenches.

9.6.2 Summary of Potential Pathways

Potential pathways associated with the Scheme are shown in Table 9-3.

Table 9-3. Potential Pathways

Pathway Reference	Receptor	Description
P1	Human Health / Property: People (Human Health) and animals (Property)	Direct Pathway: direct contact, dermal absorption or ingestion of soil.
P2	Human Health / Property: People (Human Health) and animals (Property)	Indirect Pathway: inhalation of soil particulates or vapour derived from soils.
P3	Human Health: People (Human Health)	Indirect Pathway: migration of hazardous gases/vapours via permeable strata into confined spaces (asphyxiation/explosion)
P4	Water Environment: Surface water	Direct Pathway: spillage/loss/run off from surface direct to receiving water
P5	Water Environment: Groundwater	Indirect Pathway: leaching of chemicals and vertical migration via permeable unsaturated strata to shallow groundwater

Pathway Reference	Receptor	Description
P6	Water Environment: Surface water / Groundwater	Indirect Pathway: lateral migration in groundwater and baseflow into surface waters
P7	Property: Crops and livestock	Indirect Pathway: uptake via root system and ingestion
P8	Buildings and Infrastructure: Concrete	Direct Pathway: direct contact of buried concrete with contaminated soils (i.e. hydrocarbons) and aggressive ground conditions (pH and sulphate).
P9	Buildings and Infrastructure: Supply pipes	Direct Pathway: direct contact of services and supply pipes with contaminated soils.
P10	Buildings & Infrastructure: Structures	Indirect Pathway: Migration of hazardous gases/vapours via permeable strata into enclosed spaces and service/utility trenches

10. Environmental Risk Assessment

10.1 Risk Assessment Principles

Current industry good practice recommends that the determination of hazards due to contaminated land is based on the principle of risk assessment, as outlined in the Environment Agency guidance on Land Contamination: Risk Management (LCRM) (Ref 7).

For a risk to be present, there must be a viable contaminant linkage (at the current site condition and/or during construction and/or when the Scheme is complete and operational); i.e. a mechanism whereby a source impacts on a sensitive receptor via a pathway.

Assessments of risks associated with each of these contaminant linkages are discussed in the following sections. The methodology adopted within this Preliminary Risk Assessment does not intend to reflect the EIA Methodology, as described in *Chapter 6: Environmental Impact Assessment Methodology* in the EIA Scoping Report.

Using criteria broadly based on those presented in Section 6.3 of the CIRIA Report “Contaminated Land Risk Assessment: A Guide to Good Practice” (CIRIA Report C552) (Ref 32), the magnitude of the risk associated with potential contamination at the DCO Principal Site has been assessed. To do this an estimate is made of:

- The magnitude of the potential consequence (i.e. severity); and
- The magnitude of probability (i.e. likelihood).

The severity of the risk is classified according to the criteria in Table 10-1.

10.2 Risk Assessment Framework

Table 10-1. Description of Severity of Risk

Term	Description
Severe	<ul style="list-style-type: none"> – Highly elevated concentrations likely to result in significant harm to human health. – Catastrophic damage to crops, buildings or property (e.g. by explosion). – Equivalent to EA Category 1 pollution incident including persistent and/or extensive effects of water quality. – Major damage to aquatic or other ecosystems.
Medium	<ul style="list-style-type: none"> – Elevated concentrations which could result in significant harm to human health. – Significant damage to crops, buildings or property (e.g. damage to building rendering it unsafe). – Equivalent to EA Category 2 pollution incident including significant effect on water quality. – Significant damage to aquatic or other ecosystems.

Term	Description
Mild	<ul style="list-style-type: none"> – Exposure to human health unlikely to lead to significant harm. – Minor damage to crops, buildings or property (e.g. surface spalling to concrete). – Equivalent to EA Category 3 pollution incident including minimal or short-lived effect on water quality. – Minor or short-lived damage to aquatic or other ecosystems.
Minor	<ul style="list-style-type: none"> – No measurable effect on humans. – Repairable effects of damage to buildings, structures and services. – Equivalent to insubstantial pollution incident with no observed effect on water quality of ecosystems.

The probability of the risk occurring is classified according to the criteria in Table 10-2.

Table 10-2. Likelihood of Risk Occurrence

Likelihood	Explanation
High	Contaminant linkage may be present that appears very likely in the short-term and risk is almost certain to occur in the long term, or there is evidence of harm to the receptor.
Likely	Contaminant linkage may be present, and it is probable that the risk will occur over the long term.
Low	Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Unlikely	Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.

An overall evaluation of the level of risk is gained from a comparison of the severity and probability, as shown in Table 10-3.

Table 10-3. Risk based on Comparison of Likelihood and Severity

		Severity			
		SEVERE	MEDIUM	MILD	MINOR
Likelihood	HIGH	Very High	High	Moderate	Low
	LIKELY	High	Moderate	Moderate/Low	Low
	LOW	Moderate	Moderate/Low	Low	Very Low
	UNLIKELY	Moderate/Low	Low	Very Low	Very Low

10.3 Preliminary Risk Assessment

A CSM illustrating plausible contaminant linkages has been formulated for the Principal Site. The qualitative preliminary risk assessment of the possible linkages of the above sources (S1 to S7), transport pathways (P1 to P11) and receptors (R1 to R11) is provided in the Table 10-4.

The level of risk is determined based on the current condition of the Principal Site (i.e. the effects of mitigation measures are not included).

The preliminary risk assessment undertaken within this section does not consider acute² linkages for construction and maintenance workers. It is anticipated that these acute linkages will be managed by appropriate health and safety measures. As construction workers are protected under existing health and safety legislation, any potential effects are considered to be temporary and will be avoided, prevented and reduced through the implementation of standard mitigation measures to be incorporated into a CEMP. Work will be undertaken in accordance with relevant Construction Design Management (CDM) Regulations 2015 (Ref 37).

² Refers to a considerable exposure to contaminated land in a short period of time (for example during construction activities).

Table 10-4. Potential Sources, Pathways and Receptors

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk	Justification
<p>S1: Made Ground (Infilled pits/quarry)</p> <p>Material associated with the British bomber aircraft crashed on the Principal Site, and potentially dispersed across the Principal Site.</p> <p><i>Heavy metals and inorganics (including sulphate, nitrate, phosphate, ammoniacal nitrogen, acidic/alkaline pH), TPH, PAH, SVOCs, VOCs, asbestos and ACMs. Gases such as methane or carbon dioxide and leachate</i></p>	P1: Direct contact, dermal absorption or ingestion of soil.	R2: Current Site Users	Mild	Unlikely	Very Low	The British bomber aircraft crashed at the Principal Site may have resulted in localised ground contamination. Made ground of unknown quality may be associated with infilling of the pits/former ponds on site. The volume of the infill is relatively small and unlikely to represent a significant widespread issue. Current users are farmers and general public who might be exposed to soils. Future users include site visitors/trespassers/general public on the Principal Site using the PRoW who might be exposed to soils.
	P1: Direct contact, dermal absorption or ingestion of soil.	R3: Future Site Users	Mild	Unlikely	Very Low	Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable, given the current use of the site as agricultural fields and the proposed use of the site as a Solar farm.
	P1: Direct contact, dermal absorption or ingestion of soil.	R7: Property (livestock/crops)	Minor	Unlikely	Very Low	Livestock may be present on-site; and small grazing animals such as sheep may be present on-site after construction. The risk of harm to livestock and small grazing animals is considered to be very low, since limited potential for ground contamination has been identified at the Principal Site. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.
	P2: Inhalation of soil particulates and vapour derived from soils.	R2: Current Site Users	Mild	Unlikely	Very Low	Limited potential for ground contamination has been identified at the Principal Site. Limited potential for soil vapour exists at the Principal Site, given the age of the potentially infilled pits/former ponds and quarry. Therefore, risk of inhalation of soil particulates is considered to be very low.
		R3: Future Site Users	Mild	Unlikely	Very Low	Livestock may be present on-site; and small grazing animals such as sheep may be present on-site after construction.
		R7: Property (livestock)	Mild	Unlikely	Very Low	Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.
	P3: Migration of hazardous gases/vapours via permeable strata into confined spaces (asphyxiation/explosion)	R3: Future Site Users	Medium	Unlikely	Low	Ground gas accumulation and potential explosion risk is generally unlikely at the Principal Site, given that limited potential sources of hazardous gases/vapours have been identified. The proposed development will include on-site structures such as inverters, transformers, battery storage and sub-stations. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk	Justification
	P5: Leaching of chemicals and vertical migration via permeable unsaturated strata to shallow groundwater	R5: Aquifers	Minor to Medium	Unlikely	Very Low to Low	Complete pathways may be present but current information suggests a gross source is unlikely. The risk of harm to groundwater from leaching of contaminants is considered between low (for Secondary A Aquifers – Alluvium, glaciofluvial deposits and Marlstone Rock Formation); and very low (for both Secondary B Aquifer - Scunthorpe Mudstone Formation; and Secondary (undifferentiated) Aquifers - Till, Grantham Formation and Charmouth Mudstone Formation). The risk is considered to be Low for Principal Aquifer - Lincolnshire Limestone Formation, as this aquifer only borders the Principal Site to the east.
	P6: Lateral migration in groundwater and baseflow into surface waters	R6: Surface waters	Minor	Unlikely	Very Low	Complete pathways may be present but current information suggests a gross source is unlikely. The risk of harm to surface waters from lateral migration in groundwater and baseflow into surface waters is very low.
	P7: Uptake via root system	R7: Property (crops)	Minor	Unlikely	Very Low	Complete pathways may be present but current information suggests a gross source is unlikely. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable. Potential risk from direct contact with contaminated soils for crops is considered very low.
	P8: Direct contact of buried concrete with contaminated soils (i.e. hydrocarbons) and aggressive ground conditions (pH and sulphate).	R9: Buildings and Infrastructure: Concrete (PV Mounting Structure and cables)	Minor	Unlikely	Very Low	Complete pathways may be present but current information suggests a gross source is unlikely. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable. Potential risk from direct contact with contaminated soils for buried concrete and infrastructure (PV Mounting Structure and cables) is considered very low.
	P9: Direct contact of services and supply pipes with contaminated soils.	R10: Buildings and Infrastructure: Supply pipes	Minor	Unlikely	Very Low	Complete pathways may be present for water supply pipes at properties located on-site and off-site from on-site sources, but current information suggests a gross source is unlikely. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk	Justification
	P10: Migration of hazardous gases/vapours via permeable strata into enclosed spaces and service/utility trenches	R9: Buildings and Infrastructure: Structures	Mild	Unlikely	Very Low	Ground gas accumulation and potential explosion risk is generally unlikely at the Principal Site, given that limited potential sources of hazardous gases/vapours have been identified. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.
	P1: Direct contact, dermal absorption or ingestion of soil.	R2: Current Site Users	Mild	Low	Low	Potentially hazardous materials may be associate with the vegetated mound; manure heaps, tyres and the abandoned vehicle. The volume of materials is relatively small and unlikely to represent a significant widespread issue. Current users are farmers and general public. Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
S2: Potentially hazardous materials at the location of the vegetated mound (with landfill odour), manure heap, tyres and the abandoned vehicle. Manure heap in the north west of the Principal Site	P1: Direct contact, dermal absorption or ingestion of soil.	R3: Future Site Users	Mild	Unlikely	Very Low	The mound, manure heaps, tyres and the abandoned vehicle (and any associated contaminated soils) will be removed from the Principal Site during the construction of Scheme. Potential residual contamination is unlikely to persist at this location. Future users include site visitors/trespassers/general public on the Principal Site using the PRoW who might be exposed to soils in this area. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable, given the proposed use of the Principal Site.
Heavy metals and inorganics (including sulphate, nitrate, phosphate, ammoniacal nitrogen, acidic/alkaline pH), TPH, SVOCs, VOCs, asbestos, ACMs, pesticides and fertilisers.	P1: Direct contact, dermal absorption or ingestion of soil.	R7: Property (livestock/ crops)	Minor	Low	Very Low	Livestock may be currently present on-site; and small grazing animals such as sheep may be present on-site after construction. The risk of harm to livestock and small grazing animals is considered to be very low, considering the limited scale of these potentially contaminated areas. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.
	P2: Inhalation of soil particulates and vapour derived from soils.	R2: Current Site Users	Minor	Low	Very Low	A distinct smell similar to landfill was observed at this location during the site reconnaissance. Therefore, risk of inhalation of vapours and soils particulates, albeit very low, exists. Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
	P2: Inhalation of soil particulates and	R3: Future Site Users	Minor	Unlikely	Very Low	The mound, manure, tyres and the abandoned vehicle (and any associated contaminated soils) is expected to be removed from the Site prior to construction of Scheme. Potential residual contamination is unlikely to persist at this location.

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk	Justification
	vapour derived from soils.					Therefore, risk of inhalation of soil particulates from this location is considered to be very low. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.
	P3: Migration of hazardous gases/vapours via permeable strata into confined spaces (asphyxiation/explosion)	R3: Future Site Users	Medium	Unlikely	Low	This contaminated source will be removed prior construction. Ground gas accumulation and potential explosion risk deriving from this source once the Scheme is complete is therefore highly unlikely. The Scheme will include switch housing/control room in terms of structures. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.
	P5: Leaching of chemicals and vertical migration via permeable unsaturated strata to shallow groundwater	R5: Secondary Aquifers	Minor	Likely	Low	Complete pathways may be present but current information suggests a gross source is unlikely. This area is underlain by Secondary (undifferentiated) Aquifers (Till over Charmouth Mudstone Formation). The risk of harm to groundwater from leaching of contaminants is considered low (for Secondary (undifferentiated) Aquifers - Till and Charmouth Mudstone Formation).
	P6: Lateral migration in groundwater and baseflow into surface waters	R6: Surface waters	Minor	Unlikely	Very Low	Complete pathways may be present but current information suggests a gross source is unlikely. The risk of harm to surface waters from lateral migration in groundwater and baseflow into surface waters is very low.
	P7: Uptake via root system	R7: Property (livestock/crops)	Minor	Unlikely	Very Low	Complete pathways may be present but current information suggests a gross source is unlikely. Potential risk from direct contact with contaminated soils for crops is considered very low. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.
	P8: Direct contact of buried concrete with contaminated soils (i.e. hydrocarbons) and aggressive ground conditions (pH and sulphate).	R8: Buildings and Infrastructure: Concrete (PV Mounting Structure and cables)	Minor	Unlikely	Very Low	Complete pathways may be present but current information suggests a gross source is unlikely. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable. Potential risk from direct contact with contaminated soils for buried concrete and infrastructure (PV Mounting Structure and cables) is considered very low.

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk	Justification
	P10: Migration of hazardous gases/vapours via permeable strata into enclosed spaces and service/utility trenches	R9: Buildings and Infrastructure: Structures	Mild	Low	Low	Ground gas accumulation and potential explosion risk is generally unlikely at the Principal Site, given that limited potential sources of hazardous gases/vapours have been identified. Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
	P1: Direct contact, dermal absorption or ingestion of soil.	R2: Current Site Users	Mild	Low	Low	Potential localised contaminant hotspots may be associated with the area formerly occupied by the Sturgate Airfield. Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
S3: Areas formerly occupied by the Sturgate Airfield. Heavy metals and inorganics (including acidic/alkaline pH, cyanide complex), oil/fuel hydrocarbons, aromatic hydrocarbons, chlorinated aliphatic hydrocarbons, PCBs, PFAS.	P1: Direct contact, dermal absorption or ingestion of soil.	R3: Future Site Users	Mild	Unlikely	Very Low	Potential localised contaminant hotspots may be associated with the area formerly occupied by the Sturgate Airfield. This area will not be developed with the solar farm infrastructures but will be used for mitigation. Should any potentially contaminated ground, including isolated 'hotspots' of contamination and/or potential deposits of asbestos containing materials (ACM), be encountered, the contractor would be required to investigate the areas and assess the need for containment or disposal of the material. In the event that contamination is identified, appropriate remediation measures would be taken to protect construction workers, future site users, water resources, structures and services (refer to Table 10-5). Given the above, residual contamination is unlikely. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable, given the proposed use of the site.
	P1: Direct contact, dermal absorption or ingestion of soil.	R7: Property (livestock/crops)	Minor	Low	Very Low	Livestock may be currently present on-site; and small grazing animals such as sheep may be present on-site after construction. The risk of harm to livestock and small grazing animals is considered to be very low, since limited potential for ground contamination has been identified at the Principal Site. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk	Justification
	P2: Inhalation of soil particulates and vapour derived from soils.	R2: Current Site Users	Minor	Low	Very Low	Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
		R7: Property (livestock/crops)	Minor	Low	Very Low	
	P2: Inhalation of soil particulates and vapour derived from soils.	R3: Future Site Users	Mild	Unlikely	Very Low	Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.
	P2: Inhalation of soil particulates and vapour derived from soils.	R7: Property (livestock/crops)	Minor	Unlikely	Very Low	
	P5: Leaching of chemicals and vertical migration via permeable unsaturated strata to shallow groundwater	R5: Secondary Aquifers	Minor to Medium	Unlikely	Very Low to Low	Complete pathways may be present but given that area is unpaved, any potential contamination is likely already dispersed. The risk of harm to groundwater from leaching of contaminants is considered between low (for Secondary A Aquifers – glaciofluvial deposits) and very low (for Secondary B Aquifer - Scunthorpe Mudstone Formation).
	P6: Lateral migration in groundwater and baseflow into surface waters	R6: Surface waters	Minor	Unlikely	Very Low	Complete pathways may be present but current information suggests a gross source is unlikely. The risk of harm to surface waters from lateral migration in groundwater and baseflow into surface waters is very low.

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk	Justification
	P7: Uptake via root system	R7: Property (livestock/crops)	Minor	Unlikely	Very Low	Complete pathways may be present but current information suggests a gross source is unlikely. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable. Potential risk from direct contact with contaminated soils for crops is considered very low.
	P9: Direct contact of services and supply pipes with contaminated soils.	R10: Buildings and Infrastructure: Services	Minor	Unlikely	Very Low	Complete pathways may be present for water supply pipes at properties located on-site and off-site from on-site sources, but current information suggests a gross source is unlikely. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.
	P10: Migration of hazardous gases/vapours via permeable strata into enclosed spaces and service/utility trenches	R10: Buildings and Infrastructure: Structures	Mild	Low	Low	Ground gas accumulation and potential explosion risk is generally unlikely at the Principal Site, given that limited potential sources of hazardous gases/vapours have been identified. Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
S4: Off-site Licenced Waste Management Facility (Mining Waste Operations) - Active IGas Energy Plc. oil well	P5: Leaching of chemicals and vertical migration via permeable unsaturated strata to shallow groundwater	R5: Secondary Aquifers	Minor	Unlikely	Very Low	This site is associated with an IPPC. This means that for this site the regulators have set permit conditions so as to achieve a high level of protection for the environment, including land and water. IGas Energy Plc. operate an ISO 14001 certified Environmental Management System that ensures robust safety measures are in place to protect the environment at this location (refer to 5.3). Leakage from the electrical substation and oils spill during operation cannot be excluded at this location. There is no record of historical incidents at this location.
	Oil PCB associated with electrical substation	P6: Lateral migration in groundwater and baseflow into surface waters	R6: Surface waters	Minor	Unlikely	Very Low

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk	Justification
S5: Off-site revoked licenced waste management facility (metal recycling site/vehicle dismantler)	P2: Inhalation of particulates derived from soils	R2: Current Site Users	Mild	Low	Low	Potential localised contaminant hotspots may be associated with the area formerly occupied by metal recycling site/vehicle dismantler and the Sturgate Airfield, located adjacent to the Principal Site to the west.
		R3: Future Site Users	Mild	Low	Low	Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Heavy metals and inorganics (including sulphate, nitrate, phosphate, ammoniacal nitrogen, acidic/alkaline pH), TPH, SVOCs, VOCs, asbestos, ACMs.	P2: Inhalation of particulates derived from soils	R7: Property (livestock/crops)	Minor	Low	Very Low	Complete pathways may be present but current information suggests a gross source is unlikely. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable. The risk of harm to livestock/small grazing animals is considered to be very low.
This area was also formerly occupied by the Sturgate Airfield	P5: Leaching of chemicals and vertical migration via permeable unsaturated strata to shallow groundwater	R5: Superficial Secondary Aquifers	Minor	Low	Very Low	Complete pathways may be present but current information suggests a gross source is unlikely, considering the time passed since these areas were developed. The absence of hardstanding across these areas is likely to have allowed the continual infiltration of rain and as such the leaching of potential contaminants into shallow perched / groundwater allowing dispersion and dilution of contaminants over time. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.
	P6: Lateral migration in groundwater and baseflow into surface waters	R6: Surface waters	Minor	Unlikely	Very Low	Potential water receptors underlying these areas are Secondary B Aquifer - Scunthorpe Mudstone Formation and Secondary (undifferentiated) Aquifers – Till. The risk of harm to groundwater from leaching of contaminants and lateral migration to the Principal Site is considered very low.
S6: Off-site farm buildings and yards where fuel and agricultural materials were/are stored, including the chicken shed.	P2: Inhalation of particulates derived from soils	R2: Current Site Users	Mild	Unlikely	Very Low	Potential localised contaminant hotspots may be associated with the farm buildings located across the Principal Site (but excluded from the Principal Site Boundary) and adjacent to the Principal Site at various locations;
		R3: Future Site Users	Mild	Unlikely	Very Low	Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.
Metals, semi-metals, asbestos, organic and inorganic compounds, pesticides and fertilizers.	P2: Inhalation of particulates derived from soils	R7: Property (livestock/crops)	Minor	Unlikely	Very Low	Complete pathways may be present but current information suggests a gross source is unlikely. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable. The risk of harm to livestock/small grazing animals is considered to be very low.

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk	Justification
	P4: Spillage/loss/run off from surface direct to receiving water	R6: Surface waters	Minor to Medium	Unlikely	Very Low to Low	Complete pathways may be present but current information suggests a gross source is unlikely. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable. The risk of harm to surface waters from run off from off-site contaminated soil is considered between very low (for drains and ponds located on-site) to low (River Eau, River Till's tributary, Fillingham Beck and tributaries).
	P5: Leaching of chemicals and vertical migration via permeable unsaturated strata to shallow groundwater	R5: Superficial Secondary and Principal Aquifers	Minor to Medium	Unlikely	Very Low to Low	Complete pathways may be present but current information suggests a gross source is unlikely. Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable. The risk of harm to groundwater from leaching of contaminants and lateral migration to the Principal Site is considered between low (for Principal Aquifer - Lincolnshire Limestone Formation and for Secondary A Aquifers – Alluvium, glaciofluvial deposits and Marlstone Rock Formation) and very low (for Secondary B Aquifer - Scunthorpe Mudstone Formation and for Secondary (undifferentiated) Aquifers - Till, Grantham Formation and Charmouth Mudstone Formation)
	P6: Lateral migration in groundwater and baseflow into surface waters	R6: Surface waters	Minor	Unlikely	Very Low	
S7: Off-site electrical substation (PCB).	P5: Leaching of chemicals and vertical migration via permeable unsaturated strata to shallow groundwater	R5: Superficial Secondary Aquifer	Minor	Unlikely	Very Low	An electrical substation is present adjacent north-east of the Principal Site since at least 1983. This area is paved and well maintained, but it may not have been in the same condition in the past. PCB may be present in soil, associated with oil in the electrical sub-station. Complete pathways may be present but current information suggests a gross source is unlikely.
	P6: Lateral migration in groundwater and baseflow into surface waters	R6: Surface waters	Minor	Unlikely	Very Low	Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable. The risk of harm to groundwater from leaching of contaminants and lateral migration to the Principal Site is considered very low for the aquifers underlain this location, i.e. Secondary (undifferentiated) Aquifers – Till and Charmouth Mudstone Formation.

10.4 Environmental Design and Management

A number of environmental mitigation measures are expected to be employed as standard to minimise impacts to both human health and controlled waters from the Scheme. The mitigation measures are anticipated to be implemented in order to avoid, prevent, reduce or offset the following potential impacts:

- Human exposure through direct contact / inhalation / dermal uptake of contaminants;
- Creation of preferential pathways and mobilisation of contamination;
- Contamination of natural soils, driving of contamination into an aquifer during piling, contamination of groundwater with concrete, paste or grout;
- Pollution and degradation of water quality of any underlying aquifer;
- Infiltration and / or run off into the local drainage / sewerage network – pollution of drainage and sewerage network and any adjacent surface water features;
- Run-off and infiltration of contaminants from material stockpiles;
- Contamination of drainage and sewerage network and / or groundwater; and
- Spread of nuisance dusts and soils to the wider environment and local roads.

A Framework Construction Environmental Management Plan (CEMP) will be developed, taking into account comments from the Local Planning Authority (LPA), as part of the DCO application for the Scheme. A detailed CEMP will be produced for the Scheme following the appointment of the Principal Contractor in accordance with a Requirement of the DCO, prior to commencing construction.

Table 10-5 lists the standard or tertiary mitigation measures which will be included in the Framework CEMP. These mitigation measures, defined by IEMA (Ref 38) are considered to be standard measures that form part of the general environmental management of the Scheme.

The assessment of potential effects set out in the preceding sections takes into account that these measures will be implemented.

Table 10-5. Construction Standard or Tertiary Environmental Mitigation Measures

Potential Impact	Mitigation / Enhancement Measure
<p>Potential for risks to human health associated with waste generation, land contamination, airborne contamination and groundwater contamination.</p> <p>The discovery of ground contamination during groundworks.</p> <p>Levelling of the Principal Site including the possible introduction of new fill materials.</p>	<p>Ground investigation works (if required) will be undertaken prior to commencing construction. Results would be reviewed by the appointed contractor, including any additional investigation or mitigation measures beyond the impact avoidance measures stated here.</p> <p>Best practice avoidance and mitigation measures proposed include:</p> <ul style="list-style-type: none"> • All workers would be required to wear Personal Protective Equipment (PPE) such as dust masks as applicable; • Containment measures would be implemented, including drip trays, bunding or double-skinned tanks of fuels and oils; all chemicals would be stored in accordance with their COSHH guidelines, whilst spill kits would be provided in areas of fuel/oil storage; • All plant and machinery would be kept away from surface water bodies wherever possible, checked regularly and, where necessary, the use of drip trays would be employed. Refuelling and delivery areas would be located away from surface water drains; • An emergency spillage action plan will be produced, which staff would have read and understood, and provisions made to contain any leak/spill; • Should any potentially contaminated ground, including isolated 'hotspots' of contamination and/or potential deposits of asbestos containing materials (ACM), be encountered, the contractor would be required to investigate the areas and assess the need for

Potential Impact	Mitigation / Enhancement Measure
	<p>containment or disposal of the material. The contractor would also be required to assess whether any additional health and safety measures are required;</p> <ul style="list-style-type: none"> • To further minimise the risks of contaminants being transferred and contaminating other soils or water, construction workers would be briefed as to the possibility of the presence of such materials; • In the event that contamination is identified, appropriate remediation measures would be taken to protect construction workers, future site users, water resources, structures and services; • The contractor would be required to place arisings and temporary stockpiles away from watercourses and drainage systems, whilst surface water would be directed away from stockpiles to prevent erosion; • The risk to surface water and groundwater from run-off from any contaminated stockpiles during construction works would be reduced by implementing suitable measures to minimise rainwater infiltration and/or capture runoff and leachates, through use of bunding and/or temporary drainage systems. These mitigation measures would be designed in line with current good practice, follow appropriate guidelines and all relevant licences/permits; • The contractor would ensure that all material is suitable for its proposed use and would not result in an increase in contamination-related risks on identified receptors, including any landscaped areas and underlying groundwater; • Any waters removed from excavations by dewatering would be discharged appropriately, subject to the relevant permits being obtained from the Environment Agency; • The contractor will implement a dust suppression/management system in order to control the potential risk from airborne contamination migrating off-site to adjacent sites; and • Piling design and construction works will be completed following the preparation of a piling risk assessment

10.5 Discussion of Acute Risk to Future Construction Workers & Off-Site Receptors.

The proposed works will be undertaken in compliance with Construction Design and Management (CDM) 2015 Regulations (Ref 37).

Prior to work commencing, a health and safety risk assessment should be undertaken by the appointed Principal Contractor and developed in accordance with current health and safety regulations. This assessment should cover potential risks to construction staff, permanent site staff and the local population. Based on the findings of this risk assessment, appropriate mitigation measures should be implemented during the construction period. These mitigation measures, defined by IEMA (Ref 38) are considered to be standard measures that form part of the general environmental management of the Scheme, and are integrated within the CEMP (refer to Table 10-5).

The greatest potential for generation of dust will be during the construction phase. Dust generation should be kept to a minimum in accordance with general industry good practice, as outlined in, for example, 'Environmental Good Practice on Site Guide', CIRIA Publication C741 (Ref 32) (refer to Table 10-5).

The risk to construction workers during the site preparation and construction phases in terms of potential exposure to high concentrations of contaminants is considered to be low given the historic and current land uses identified at the Principal Site. Should gross contamination be identified during the construction phase, then this may pose a potential acute risk to construction works. It is likely that the risks to construction workers can be effectively managed through good health and safety practices and protocols. Adoption of appropriate dust suppression techniques would also mitigate

the degree of potential particulate migration off-site; these will be included within the CEMP for the Scheme.

10.6 Decommissioning (2067)

Potential impacts from the decommissioning of the Principal Site are similar in nature to those during construction, as some groundwork would be required to remove infrastructure installed. A Decommissioning Environmental Management Plan will be prepared prior to construction to identify required measures to prevent pollution.

As a result, it is considered the decommissioning impacts and effects would mirror those of the construction phase. Standard mitigation measures (refer to Table 10-5) are expected to be applied during decommissioning.

11. Conclusions

The potential risks that have been identified from contaminated land have been assessed by the preliminary risk assessment as being very low to low.

A number of environmental design and management measures will be employed as standard best practice to minimise impacts to both human health and controlled waters during the construction and decommissioning phases of the Scheme. These will be incorporated into the Framework CEMP which will be provided alongside the Environmental Statement as part of the DCO application.

The information collected as part of this PRA suggests that there are no significant constraints with regards to contamination of soil and groundwater that would limit the development of the Principal Site for solar PV panels and associated infrastructure.

12. Recommendations

As indicated in the Pre-desk Study Assessment from Zetica, a detailed UXO assessment is recommended prior to the commencement of any intrusive works. While it is acknowledged that the Pre-desk Study Assessment by Zetica shows that no readily available records have been found to indicate that the Principal Site was bombed, the Principal Site includes areas formerly occupied by the Sturgate airfield which is considered a wartime site of interest.

Limited intrusive Site Investigation and Generic Quantitative Risk Assessment (GQRA) is recommended in the areas of potential contamination. Where features are off-site, the investigation locations will be on-site but adjacent/around the feature. Areas recommended to be included within the site investigation are:

- Areas formerly occupied by the Sturgate Airfield;
- Area covering the vegetated mound of unknown material, discarded tyres, abandoned vehicle and manure heap;
- Area around the manure heap near the western boundary;
- Area of the small pit south of Harpswell Lane;
- Areas of any historical tanks, small infilled pits or ponds identified;
- Around the chicken farm shed;
- Around the farm buildings and yards, especially where tanks had historically been identified;
- Around the active IGas Energy Plc. oil well and associated Licenced Waste Management Facility;
- Around the waste management facility (metal recycling site/vehicle dismantler) (the area formerly occupied by the airfield);
- Near the former Harpswell Brick Yard with quarry; and
- Near the current electricity substation on the northern boundary.

The results of the investigation can be used to refine the findings of this PRA, allow for any recommendations for further works, and allow for appropriate treatment and disposal of the materials in the vegetated mound (and any associated contaminated soils) to an appropriate facility, prior to construction.

A high-pressure gas main has been identified during the site reconnaissance. Full plans to map out the exact route of the pipe and information on appropriate clearances should be obtained prior to any intrusive works.

13. References

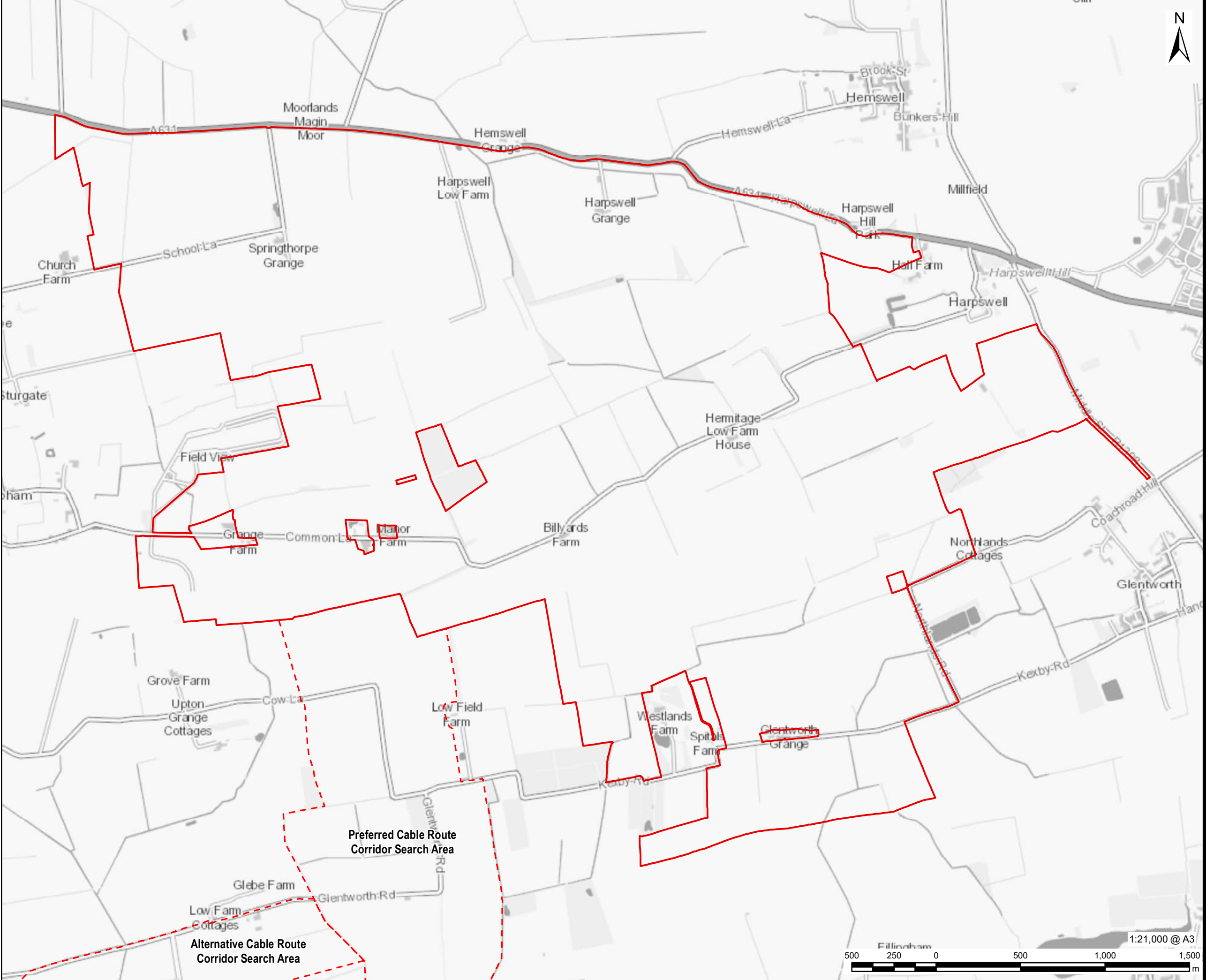
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- Ref 32 CIRIA Report C552 'Contaminated Land Risk Assessment: A Guide to Good Practice'.
- Ref 33 HMSO, (2015); Environmental Damage (Prevention and Remediation) Regulations 2015.
- Ref 34 HMSO, (1991); The Water Resources Act 1991.
- Ref 35 HMSO, (2009); The Groundwater (England and Wales) Regulations 2009.
- Ref 36 HMSO, (2003); The Water Act 2003.
- Ref 37 HMSO, (2015); The Construction (Design and Management) Regulations.
- Ref 38 IEMA, (2016). Environmental Impact Assessment Guide to Delivering Quality Development.
- Ref 39 CIRIA, (2015). PUB C741 Environmental good practice on site guide. 4th edition
- Ref 40 West Lindsley District Council. Public Register for Determined Contaminated Land Sites. Available at <https://www.west-lindsey.gov.uk/environment-climate/environment/contaminated-land/public-register-determined-contaminated-land-sites>. Accessed July 2022.
- Ref 41 West Lindsley District Council. Landfill. Available at <https://www.west-lindsey.gov.uk/sites/default/files/2022-02/List%20of%20landfill%20sites.pdf>. Accessed July 2022

Appendix A – Figures

Revision: 0 Drawn: LL Checked: VM Approved: ST Date: 2022-09-22
Filename: i:\na.aecomnet.com\fs\EMEA\London-UK\LO\06\Legacy\UK\LO\06\PPFS\W001\1\1\DP\Library\GIS_DATA\Projects\Greta III\Layout\Tillbridge Solar\Ground Conditions\220801_TillbridgeSolar_Figure1_Sitelocation.mxd



AECOM

PROJECT
Tillbridge Solar

CLIENT
Tillbridge Solar Limited

CONSULTANT
Aldgate Tower
2, Leman Street
London, E1 8FA
United Kingdom
T +44-0207-645-2000

LEGEND
Principal Site
Cable Route Corridor Options

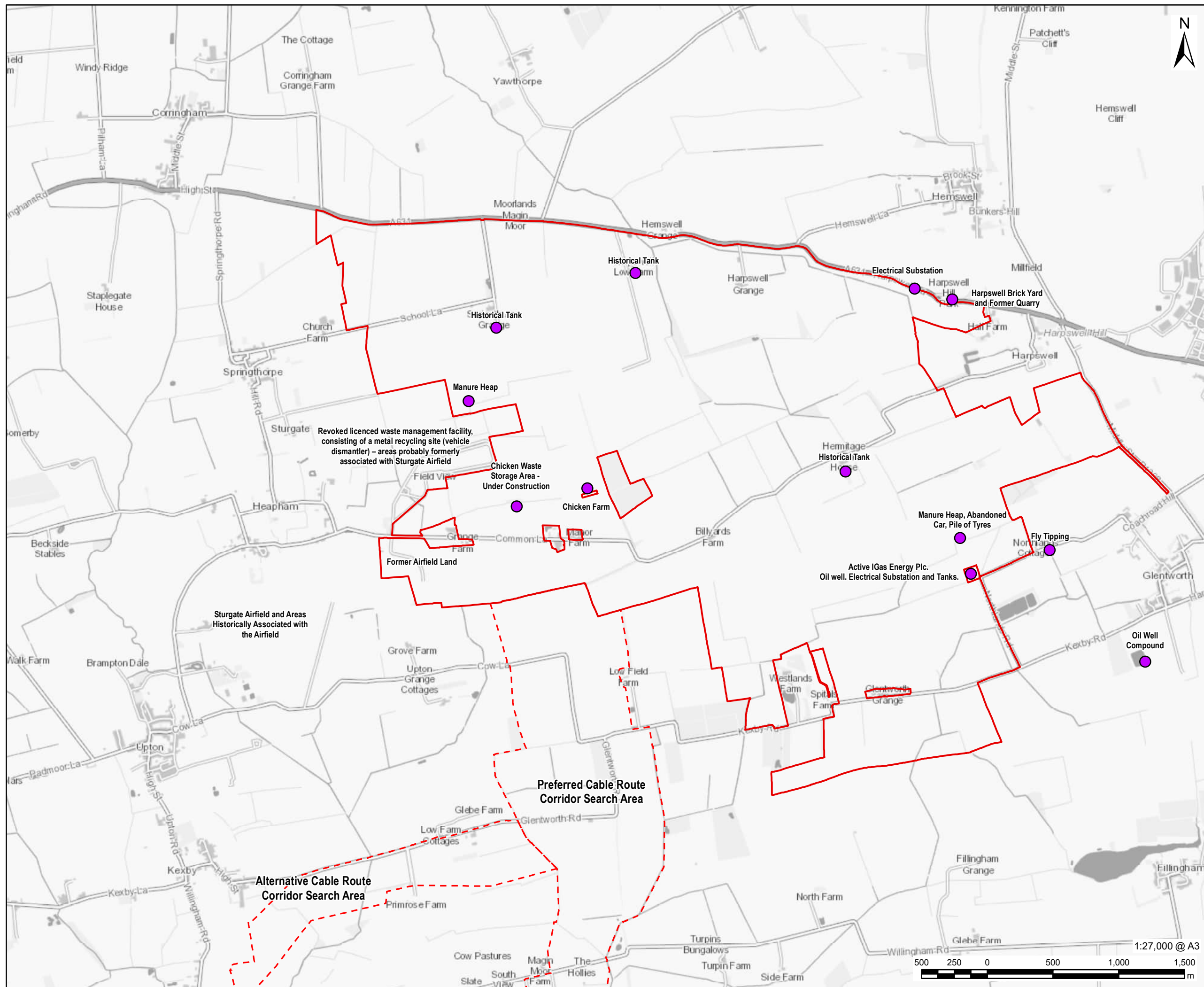
NOTES
Contains Ordnance Survey Data © Crown
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ISSUE PURPOSE
EIA Scoping Report
PROJECT NUMBER
60677969

FIGURE TITLE
Site Location Figure

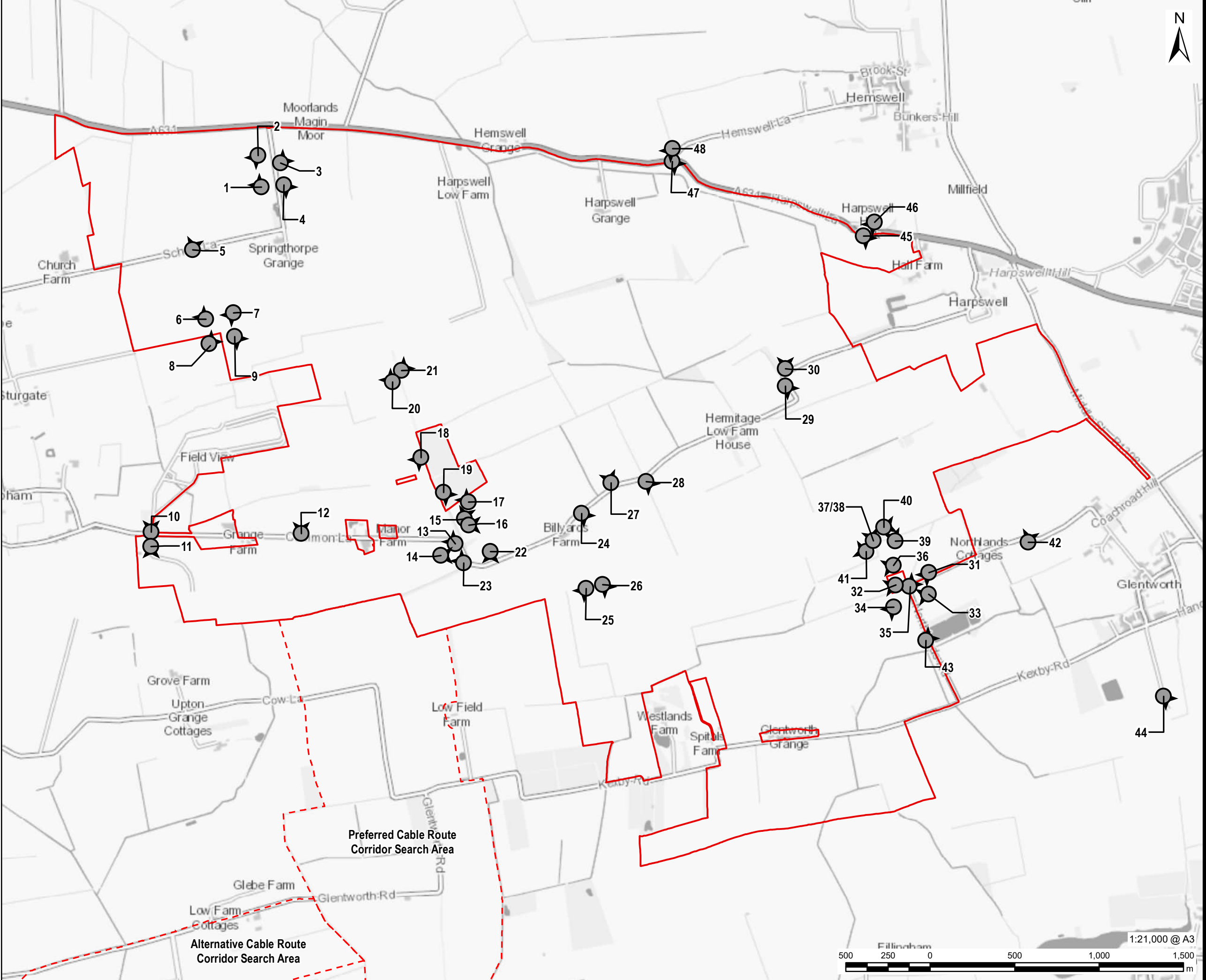
FIGURE NUMBER
Figure 1

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Revision: 0 Drawn: LL Checked: VM Approved: ST Date: 2022-09-22
Filename: i:\na.aecomnet.com\fs\EMEA\London-UK\LO\06\Legacy\UK\LO\06\PPFS\W001\1\1\DP\Library\GIS_DATA\Projects\Greta III\Layout\Tillbridge Solar\Ground Conditions\220801_TillbridgeSolar_Figure3_PhotoLocations.mxd



AECOM

PROJECT
Tillbridge Solar

CLIENT
Tillbridge Solar Limited

CONSULTANT
Aldgate Tower
2, Leman Street
London, E1 8FA
United Kingdom
T +44-0207-645-2000

LEGEND

- Principal Site
- Cable Route Corridor Options
- Photo Location

NOTES
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ISSUE PURPOSE
EIA Scoping Report

PROJECT NUMBER
60677969

FIGURE TITLE
Photo Locations

FIGURE NUMBER
Figure 3

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Appendix B – Photographic Record

Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.

Date:

1

21/07/2022

Direction Photo Taken:

North West

Description

Agricultural field.



Photo No.

Date:

2

21/07/2022

Direction Photo Taken:

South West

Description

Agricultural field.



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.

Date:

3

21/07/2022

Direction Photo Taken:

North East

Description

Agricultural field.



Photo No.

Date:

4

21/07/2022

Direction Photo Taken:

South East

Description

Agricultural field.



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.
5

Date:
21/07/2022

Direction Photo Taken:
North East

Description
Agricultural field.



Photo No.
6

Date:
21/07/2022

Direction Photo Taken:
North West

Description
Agricultural field.



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.

Date:

7

21/07/2022

Direction Photo Taken:

South West

Description

Agricultural field.



Photo No.

Date:

8

21/07/2022

Direction Photo Taken:

North East

Description

Agricultural field with access granted to horse riders. A large pile of manure approximately 20m x 5m is visible in the background.



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.

Date:

9

21/07/2022

Direction Photo Taken:

South East

Description

Agricultural field.



Photo No.

Date:

10

21/07/2022

Direction Photo Taken:

North

Description

Former part of airfield, now used by a company that provides large tents to festival companies.



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.
11

Date:
21/07/2022

Direction Photo Taken:
South

Description

Directly South of photo 10. Informed this was formerly part of the airfield and now used for agricultural storage.



Photo No.
12

Date:
21/07/2022

Direction Photo Taken:
North

Description

Hardcore access road leading to agricultural fields. Informed by local landowner that large banded chicken waste storage area will be located at far end of road.





PHOTOGRAPHIC LOG

Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.
13

Date:
21/07/2022

Direction Photo Taken:
North West

Description
Gates with path adjacent to wooded area.



Photo No.
14

Date:
21/07/2022

Direction Photo Taken:
East

Description
Two large boulders preventing access to field.



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.

Date:

15

21/07/2022

Direction Photo Taken:

North East

Description

Agricultural field.



Photo No.

Date:

16

21/07/2022

Direction Photo Taken:

East

Description

Agricultural field.
Green space/wooded mound area in background.



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.
17

Date:
21/07/2022

Direction Photo Taken:
North West

Description
Wooded area (off-site) containing a disused pheasant pen. Oil drum, empty and with no visual signs of contamination around.



Photo No.
18

Date:
21/07/2022

Direction Photo Taken:
South West

Description
Large free-range chicken shed (off-site), currently housing 30,000 chickens, adjacent land is for roaming.




Client Name: Tillbridge Solar Ltd		Site Location: Tillbridge Solar Farm	Project No. 60677969
Photo No. 19	Date: 21/07/2022		
Direction Photo Taken: South East			
Description Oil drums noted adjacent to path leading north. Drums were empty and showed no visible signs of contamination around.			

Photo No. 20	Date: 21/07/2022		
Direction Photo Taken: North West			
Description Agricultural field. Number of posts designating "no dig" due to high pressure gas main in various locations			

Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.
21

Date:
21/07/2022

Direction Photo Taken:
North East

Description
Agricultural field.



Photo No.
22

Date:
21/07/2022

Direction Photo Taken:
South

Description
Posts designating "no dig" due to high pressure gas main, this runs underneath the road.



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.
23

Date:
21/07/2022

Direction Photo Taken:
North West

Description
Agricultural field.



Photo No.
24

Date:
21/07/2022

Direction Photo Taken:
South East

Description
Partially paved access road, turns to grassed path access currently restricted by telegraph pole.



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.
25

Date:
21/07/2022

Direction Photo Taken:
South West

Description
Agricultural field.



Photo No.
26

Date:
21/07/2022

Direction Photo Taken:
South East

Description
Agricultural field.



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.
27

Date:
21/07/2022

Direction Photo Taken:
North

Description
Agricultural field.



Photo No.
28

Date:
21/07/2022

Direction Photo Taken:
South East

Description
Agricultural field.
Another pole adjacent to the road demarcating the high pressure gas main.



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.
29

Date:
21/07/2022

Direction Photo Taken:
South East

Description
Agricultural field.



Photo No.
30

Date:
21/07/2022

Direction Photo Taken:
North

Description
Agricultural field with large concrete block restricting access.



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.
31

Date:
21/07/2022

Direction Photo Taken:
South West

Description
Oil well (off-site), 4 nodding donkeys, substation and crude oil storage tanks.



Photo No.
32

Date:
21/07/2022

Direction Photo Taken:
West

Description
A number of boreholes along the perimeter of the fenced enclosure (far corner of the photo).



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.

Date:

33

21/07/2022

Direction Photo Taken:

West

Description

Agricultural field.



Photo No.

Date:

34

21/07/2022

Direction Photo Taken:

South West

Description

South of the oil well enclosure within 5m is a dry ditch, likely to carry water in wetter seasons.



Client Name: Tillbridge Solar Ltd		Site Location: Tillbridge Solar Farm	Project No. 60677969
Photo No. 35	Date: 21/07/2022		
Direction Photo Taken: North East			
Description Agricultural field. Centre of field contains dry ditch, likely to carry water during wetter seasons.			

Photo No. 36	Date: 21/07/2022		
Direction Photo Taken: West			
Description Agricultural field north of oil well enclosure. Borehole is located immediately adjacent to fence.			

Client Name: Tillbridge Solar Ltd		Site Location: Tillbridge Solar Farm	Project No. 60677969
Photo No. 37	Date: 21/07/2022		
Direction Photo Taken: North			
Description Area of suspected waste material with odour reminiscent of landfill. Vehicle missing various parts, wheels unattached and no registration plate.			

Photo No. 38	Date: 21/07/2022	
Direction Photo Taken: North		
Description Material within western mound. Well vegetated loose sand like material with large fragments of what seems to be concrete.		

Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.

Date:

39

21/07/2022

Direction Photo Taken:

North

Description

Manure heap on concrete hardstanding.



Photo No.

Date:

40

21/07/2022

Direction Photo Taken:

East

Description

To the rear of the manure heap lies a large pile of tyres. Approximately 10m x 5m.



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.

Date:

41

21/07/2022

Direction Photo Taken:

North West

Description

Agricultural field.



Photo No.

Date:

42

21/07/2022

Direction Photo Taken:

North

Description

Off-site to the east evidence of fly tipping (mentioned anecdotally). Consists of building material, concrete and sand.



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.

Date:

43

21/07/2022

Direction Photo Taken:

East

Description

Pond off-site. No evidence of sheen was observed, water is clear with abundant waterfowl on pond.



Photo No.

Date:

44

21/07/2022

Direction Photo Taken:

South East

Description

Oil well compound to south of the Site (off-site). Two nodding donkeys and oil storage tanks. Lorry on site with drilling equipment.



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.
45

Date:
21/07/2022

Direction Photo Taken:
South East

Description
Agricultural field.



Photo No.
46

Date:
21/07/2022

Direction Photo Taken:
South West

Description
Agricultural field.
Pipe (likely for irrigation) runs over the surface.
Electricity substation can be seen in the distance.



Client Name: Tillbridge Solar Ltd

Site Location: Tillbridge Solar Farm

Project No.
60677969

Photo No.

Date:

47

21/07/2022

Direction Photo Taken:

South East

Description

Agricultural field.



Photo No.

Date:

48

21/07/2022

Direction Photo Taken:

South West

Description

Agricultural field.



Appendix C – Exploratory Boreholes Records

AREA: GLENTWORTH

Well No 1

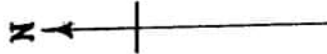
B26d

approx 1 acre

US SHEETERS: LINCS. AL151319

76

Northland's Farm



SK 98 NW/1

95

98

166

164

Owner: - The Church Commissioners
5% Messrs. Smiths Gore & Co
4, Duncan Place
York.

Occupier: Glentworth Scottish Farms, Ltd.
c/o J. Proudfoot Esq
Hillside House
Glentworth
Lincs.

Post a wire fence around three sides of site

Do not obstruct this roadway

Two 10' Field gates. With section of post-wire to complete enclosure.

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

105 D 10 T
6490
5714 N
2/19/60.

B P EXPLORATION Co. Ltd.

SP 550

Scale 1/2500
Date: 19.7.60
J.B.L.

REPRODUCED FROM THE ORDINANCE SURVEY
MAP WITH THE SANCTION OF THE CONTROLLER
OF H.M. STATIONERY OFFICE
1960
CROWN COPYRIGHT RESERVED

RECORD OF SHAFT OR BORE FOR MINERALS

6-inch Map Registered No.

Lines 44 Sw

Name of Shaft or Bore given by Geological Survey:

6 LENTWORTH No. 1 Oil Well

Name and Number given by owner:

As above B.P. Exploration Co. Ltd.

For whom made 6 LENTWORTH County Lines

Exact site 350 yards S.E. of Northlands Farm (Attach a tracing from a map, or a sketch-map, if possible.)

and 4,800 Yds W. of St. Michael's Church, Sharnford

Purpose for which made Oil

Ground Level at shaft relative to O.D. ———

If not ground level give O.D. of beginning of shaft R 12 + 24.7 bore

Made by B.P. Big National 50

Date of sinking 23-2-61 to 28-5-61

Information from

Date received 10-11-61

Examined by Colin E. Seddon

British Geological Survey

SPECIMEN NUMBERS AND ADDITIONAL NOTES

British Geological Survey

This hole was an excellent production test, the producing sandstone being in the coal measures about 800 feet above the Clay Cross. This horizon may be approximately to that of the 2-foot Marine Band.

The first core was drilled below the producing sandstone, below this core were taken 3 thin strata above the Clay Cross, of a horizon in the "millstone bed", and of the Carb. Limestone at the bottom of the well.

Total 8' + 10 1/2' + 40' + 3' 158 1/2 YPF 6764-6772 SN 6490
 D/S. station see cov. 3 7193-7698

(For Survey use only)
 GEOLOGICAL CLASSIFICATION

DESCRIPTION OF STRATA

THICKNESS

DEPTH

British Geological Survey

British Geological Survey

British Geological Survey

Open hole: Clay samples down to 490, Rhatic to 535. Keyes to 1395. Brants to 2320. Permian upper tri. 2492. Limestone with knots (only 70'). 3070. Base Permian 3091. Strata mainly Sandstone & shaly to 3580. Production to 3613

Mudstone grey silty with plant debris at top and masses of brownish ironstone, passing down into shaly fine with increasing members of bedded fractures & surfaces below. About Mudstone brown rusty, soft and debatable, with thick surfaces. End of core about

Open hole, including several seams one 36-4034

Sandstone, brown fine grained, thick bedded to massive with even and strongly false bedding and micaceous partings. Thin gray spots at 4326, frequent from 4340. Bands of very thin to shaly bedding 4330-4335 and 4360.

Later with early stages and much carbonaceous debris on partings. Bed of abundant mudstone to 4360. 4360-4365. 4365-4370. 4370-4375. 4375-4380.

British Geological Survey

British Geological Survey

British Geological Survey

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS		DEPTH	
		FT	IN.	FT	IN.
	<p>Thin bedded, congl. with wavy wraps of bedding, spots of clay material, fine mica and scattered carbonaceous fragments. The base is grey, with soft partings presenting shaly of course in some sections. The upper part of this rock has good oil-sand properties but DST's at 4294 - 4363 and 4326 - 4414 both gave no production.</p> <p>Mudstone grey silty, varying to mid grey in the middle, with light grey siltstone bands and laminae. Mosaic of ironstone present above 4363. Some at level direct the bedding & are therefore original. Bedding of most of the silts is flat or gently curved, but some are disturbed. The base is very silty. No fossils noted.</p> <p>Sandstone greyish white with brownish lenses; bedding rather thin; constant bedding noted. Thin bedded siltstone at 4378 & 4403. Dark wraps of bedding from 4386 to 4400 carbonaceous debris fragments. Buried at 4385, where some oil sand properties (but did not produce, see above). Base only approximate, due to core losses.</p> <p>Mudstone grey silty with siltstone bands, rather softer & darker 4399 - 4401 and 4403 - 4403'9 (ironstone or flat nodules 4400.4, 4401.8, 4403, also present in small nodules and masses. Bedding of siltstone comes from fine lentils and wraps to considerable disturbance and overturning.</p> <p>Mudstone hard grey, rather shaly, with creamy brown spots on bedding at some horizons (very scattered). No fossils except very scattered stem fragments. Or has laminae of pale siltstone 4408'6 to base.</p> <p>Mudstone grey shaly with abundant siltstone laminae. Minute carbonaceous debris.</p> <p>Mudstone hard grey, rather shaly, with silty laminae at top. 1" ironstone band (brown siderite with white spot) with base at 4409'8.</p> <p>Below laminae pure siltstone, softer below. Mudstone rather hard, grey, with a few muscels at top, mostly hard to silty, colored laminated. Rather sandy MAC. Sharp muscels not certainly det.</p> <p>Mudstone grey, softer, rather shaly, with siltstone. No fossils. Sp. at top. Mottling on bedding. No other fossils seen. MAC sharp then. Mottling is consistent with ironstone laminae.</p>	42	3	4366	3
		6	8	4372	11
		24	9	4397	8
		9	10	4407	6
		1	3	4408	9
		6	6	4409	3
		6 1/2	6 1/2	4409	9 1/2
		1	1 1/2	4410	11

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS		DEPTH	
		Ft	in.	Ft	in.
	Brought forward			4411	9
	Mudstone grey with thin dark beds; one band with distinctive appearance, pale in colour, at 4412. Mottled bedding - structures like "worm tubes"				
	Mudstone mid grey, rather dark down, broken at base. Pyritic, micaceous fragments from 4412. Cherty above about	6	4412	3	
	Mudstone dark grey rather silty, with abundant small <i>Lingula</i>	9	4413	-	
	Note: - This band lithologically more resembles the 2 feet than the Clay Coos of Miller's banding; the fauna is much more limited than is often the case in the Clay Coos. On the other hand it is not unlike the Heavy Marine Band of Dickinson at the Clay Coos Hanson 1120 considered to be the Clay Coos for the following reasons -	1	4414	1	
	(1) The Micrites at 4411				
	(2) This interpretation involves less intense condensation in the sequence down to the low Esthonia-band and 'Milkstone Grit'				
	COAL, 2" recovered, supposed to be about 16' (thickness estimate by geophysicists)				
	1.6 to 1.8 fine hard grey, greenish down, silty, booby, with irregular nodules. Some roots present.				
	Siltstone grey with roots and cross-lamination at top, the bedding mostly obscure, but where seen, falls and uneven. Several shallow angled "steps" in the bedding. These are not now fractured & are presumably pre-re-				
	centen-posture features. Mottled fabric bedding at 26'-23'6". Plane of cleavage (Calamites sp. etc.) at one horizon.				
	Very impure at some horizons in the lower part, ironstone nodules frequent. 4420-4425 Grey light grey colored banding does not indicate any variation in hardness.				
	Loss of core	14	4431	7	
	Open hole: includes rather thin ironstone local masses with two thick seams near top, and sandy masses correlated with the upper part of the Milkstone Grit	1	4433	-	
	Mudstone mid grey, silty (with abundant thin	839	5272	-	

GEOLOGICAL CLASSIFICATION	DESCRIPTION	THICKNESS	DEPTH
British Geological Survey	<p>Brought forward.</p> <p>Mudstone mid grey, silty, silty and micaceous, not pyritic at top, but pyrite increases down, especially from 5274. It is laminated, the parting is at base.</p> <p>Alternating beds, mainly white or whitish sandstones in thin beds, extremely variable in grain size, rapidly changing from fine to coarse (with at least one 1" pebble bed). Bedding parting up to 1/2" LD. at 5280 and back again. Subvertical to l.e. are dark silty mudstones with some pyrite and shales bedded sandstone with carbonaceous micaceous partings - laminae. Often pyritic at several horizons. Where seen, the bedding exhibits 'tabular' cross bedding. Not proved below about 5282, but probably extends to at least a loss of core. BP suggests silty beds sandstone with coarse grains, mostly clay added with thin bedded bands. Felsparitic texture not open whitish matrix. Slight false bedding.</p> <p>Mudstone mid grey to dark grey, slightly micaceous, with frequent thin ortho-stone bands. These are mainly flat lying with uneven surfaces; the thickest about 1/2" thick.</p> <p>Pebbly occurs from 5296's, scattered at top, but abundant 5300-5305, often in masses up to 1' across, but mostly in small nodules. From 5306 silty beds are less prominent. The rock remains very micaceous, it is dark and rather more shaly. Plant debris at 5305, 5307, further silty stone bands occur in the roof 5309-5311. The lowest part is softer, but still the only fossils seen were plants.</p>	<p>5273</p> <p>2</p> <p>10 1/2</p> <p>8</p> <p>5</p> <p>5</p> <p>5</p> <p>16</p> <p>1076</p>	<p>5273</p> <p>5276</p> <p>5285</p> <p>5290</p> <p>5295</p> <p>5312</p> <p>6388</p> <p>6391</p> <p>6500</p>
British Geological Survey	<p>Open hole: dominantly sandstone to 5690, then nearly all shaly to 6385. Below this, limestone bands.</p> <p>Chert or cherty limestone, hard, dark grey to black, splintery with hydrous carbon or carbon on joints. Bedding rather thick; fossils not abundant but a few seen: extra chert cliff with chert forms dark nodules in limestone bedded chert to 6385.</p> <p>Recovery 61%: represents core to 100% (chert beds being: Portland, Enniskillen).</p> <p>Open hole: all limestone, to end of well at</p>	<p>1076</p> <p>3</p> <p>109</p>	<p>6388</p> <p>6391</p> <p>6500</p>

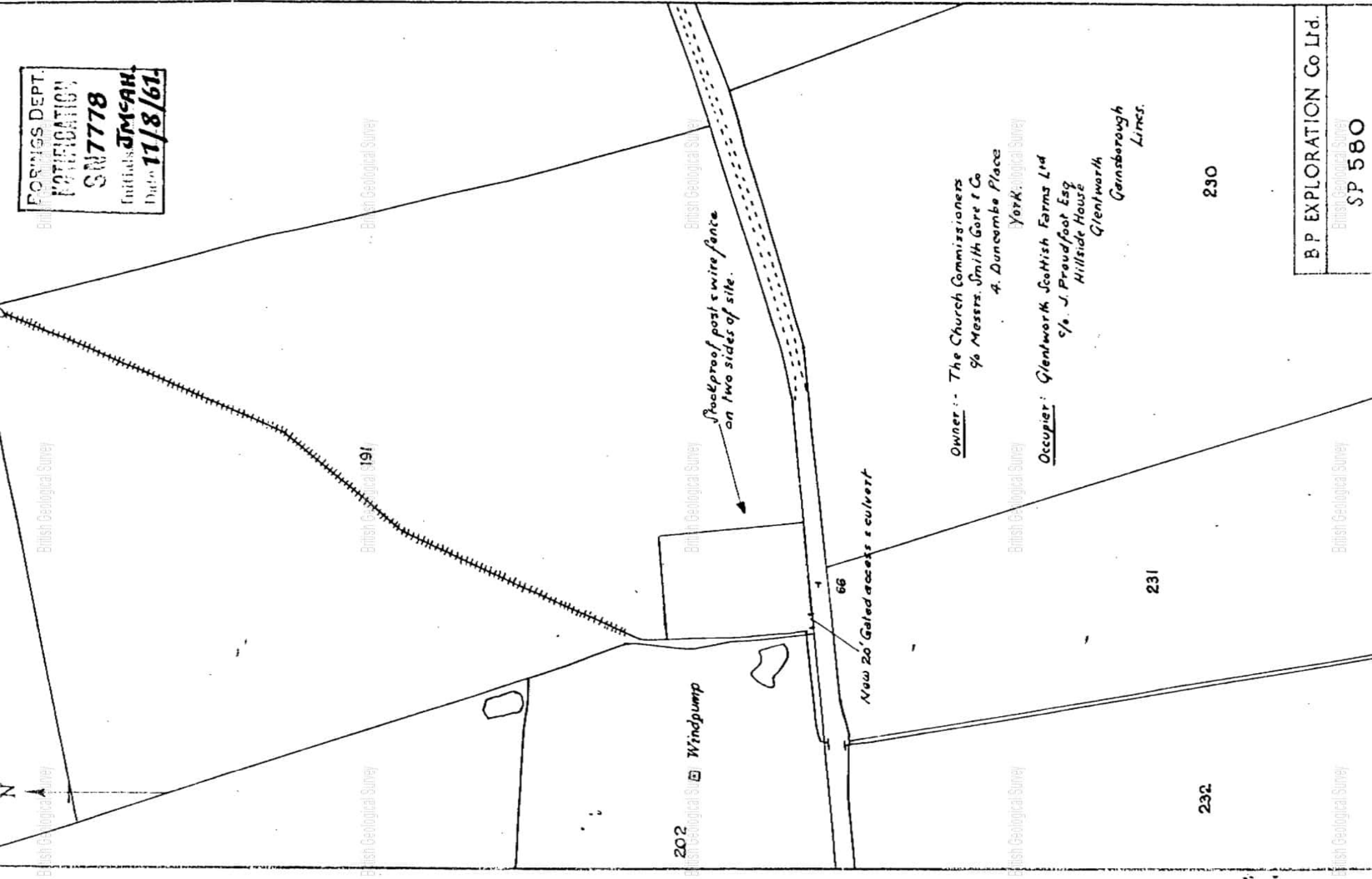
British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

FORMING DEPT.
NOTIFICATION
SN 7778
 Initials: **JMCAH**
 Date: **11/8/61.**



Owner :- The Church Commissioners
 % Messrs. Smith Gore & Co
 4, Duncombe Place
 York.

Occupier: Glentworth Scottish Farms Ltd
 s/o. J. Proudfoot Esq
 Hillside House
 Glentworth
 Gainsborough
 Lincs.

B P EXPLORATION Co Ltd.
 SP 580

RECORD OF SHAFT OR BORE FOR MINERALS

6-inch Map Registered No.

SK 98NW/2

Name of Shaft or Bore given by Geological Survey:

Name and Number given by owner:

GLENTWORTH No 2

For whom made

British Petroleum

Town or Village

County

Exact site

Attach a tracing from a map, or a sketch-map, if possible.

Purpose for which made. To prove oil bearing strata

Ground Level at bore

shaft relative to O.D. If not ground level give O.D. of beginning of bore

Made by

B.P.

Date of sinking

1962

Information from

Core examination

Date received

Examined by

Ronald V. Hoar

SPECIMEN NUMBERS AND ADDITIONAL NOTES

(For Survey use only)

GEOLOGICAL
CLASSIFICATION

DESCRIPTION OF STRATA

THICKNESS

Ft

in.

DEPTH

Ft

in.

See official B.P. log. for con-
cored strata

Coring commenced at

Mud, red, with grey-green
streaks and patchesMudstone, grey silt, with
plant-fragments; coaly
trace 2553 ft 3 inMudstone, grey, silt, with
pyrite cubes and ironstone
nodules. Sporadic greenish
lensesMudstone, grey-brown, footy,
with lenticular facets,
(beat east)Mudstone, grey, with lentic
outcrops; sporadic laminae
of silt; mudstone.

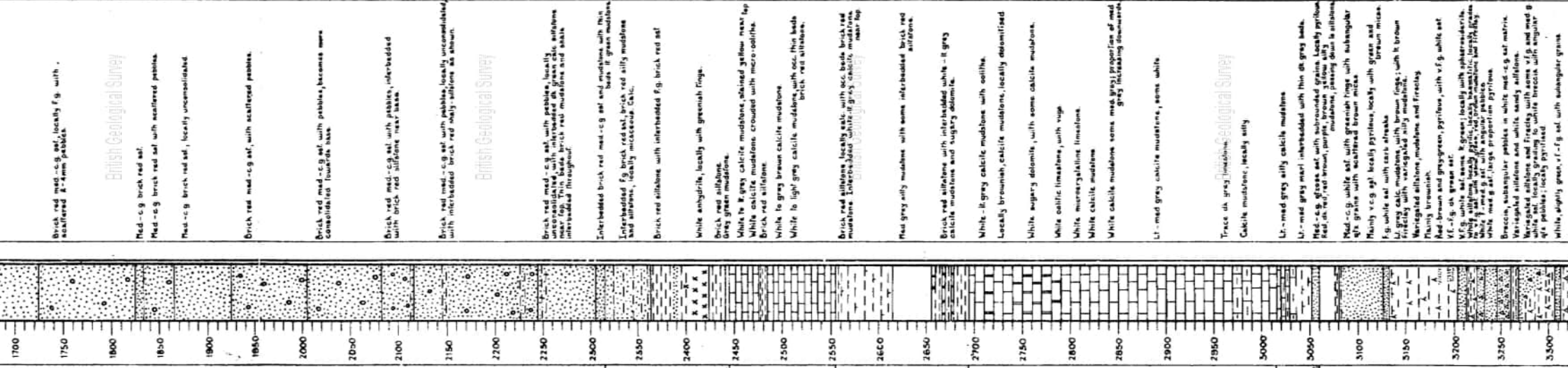
Mudstone, grey silt, with

Mudstone, laminae and silt.

Gentworth No 2.

SK 98 NW/2

GEOLOGICAL CLASSIFICATION	DESCRIPTION OF STRATA	THICKNESS		DEPTH	
		Ft	in.	Ft	in.
	<u>covered find</u>			35	60 10
	Mudstone, dark grey with coaly traces	0	2	35	61 0
	partly soft, passing down to brown, rooky, with bituminous surfaces				
	limestone light grey with fossiliferous, shaly, accumulations and plant fragments.	5	4	35	66 4
	<u>Core missing</u>	3	8	35	70 0
	<u>Coreing complete</u>			35	70 0



Brick red med -c.g. sst. locally f.g. with scattered 2-4mm pebbles

Med -c.g. brick red sst.

Med -c.g. brick red sst with scattered pebbles

Med -c.g. brick red sst, locally unconsolidated

Brick red med -c.g. sst. with scattered pebbles

Brick red med -c.g. sst. with pebbles, becomes more consolidated towards base

Brick red med -c.g. sst. with pebbles, interbedded with brick red siltstone near base

Brick red med -c.g. sst. with pebbles, locally unconsolidated with interbedded brick red shaly siltstone at about

Brick red med -c.g. sst. with pebbles, locally unconsolidated, with interbedded dk green calc. siltstone near top. Base brick red mudstone and shaly interbedded throughout

Interbedded brick red med-cg sst and mudstone with thin beds of green mudstone

Interbedded f.g. brick red sst, brick red silty mudstone and siltstone, locally micaceous Calc.

Brick red siltstone with interbedded f.g. brick red sst

White argillite, locally with greenish fringe.

Brick red siltstone

Grey green mudstone

White to f. grey calcite mudstone, stained yellow near top

White calcite mudstone crowded with micro-ooliths

Brick red siltstone

White to grey brown calcite mudstone

White to light grey calcite mudstone with occ. thin beds brick red siltstone

Brick red siltstone, locally calc. with occ. beds brick red mudstone. Interbedded with grey siltstone near top

Med grey silty mudstone with some interbedded brick red siltstone

Brick red siltstone with interbedded white -lt grey calcite mudstone and sugary dolomite

White -lt grey calcite mudstone with oolite

Locally brownish calcite mudstone, locally dolomitized

White sugary dolomite, with some calcite mudstone

White calcite limestone, with vugs

White micaceous limestone

White calcite mudstone

White calcite mudstone some med grey proportion of med grey increasing downwards

Lt - med grey white mudstone, some white

Trace dk grey mudstone

Calcite mudstone, locally silty

Lt - med grey silty calcite mudstone

Lt - med grey med interbedded with thin dk grey beds

Med -c.g. green sst with subrounded grains. Locally pyritous bed of red brown, purple mudstone, passing down to siltstone

Med -c.g. white sst with greenish fringe with subangular dk grains with scattered brown mica

F.g. white sst locally pyritous, locally with green and brown mica

Lt grey calc. mudstone with brown fringes with lt brown micaceous siltstone

Variegated siltstone, mudstone, and Fracting

Finely brownish

Red-brown and grey-green pyritous, with v.f.g. white sst

V.f.g. white sst some lt green, locally with sphero-ooliths

Med grey calc. mudstone with brown fringes, locally with white fringes

White med g. sst with angular pebbles

White med g. sst, large proportion pyritous

Breccia, subangular pebbles in white med -c.g. sst matrix

Variegated siltstone and Fracting with some v.f.g. and med g. sst

White med g. sst with white breccia with angular dk pebbles, locally pyritous

White, slightly green, v.f.g. sst with subangular grains

8' floor

Top of cement plug 2287ft

Top of Permian 2282 ft (Schlumberger)

Deviation 1"

Hole size reduced to 8 1/2 in.

Anhydrite 2250ft - 2270ft (Schlumberger)

Top of Upper Magnesian Limestone 2254 ft (Schlumberger)

Top of Middle Marls 2253 ft (Schlumberger)

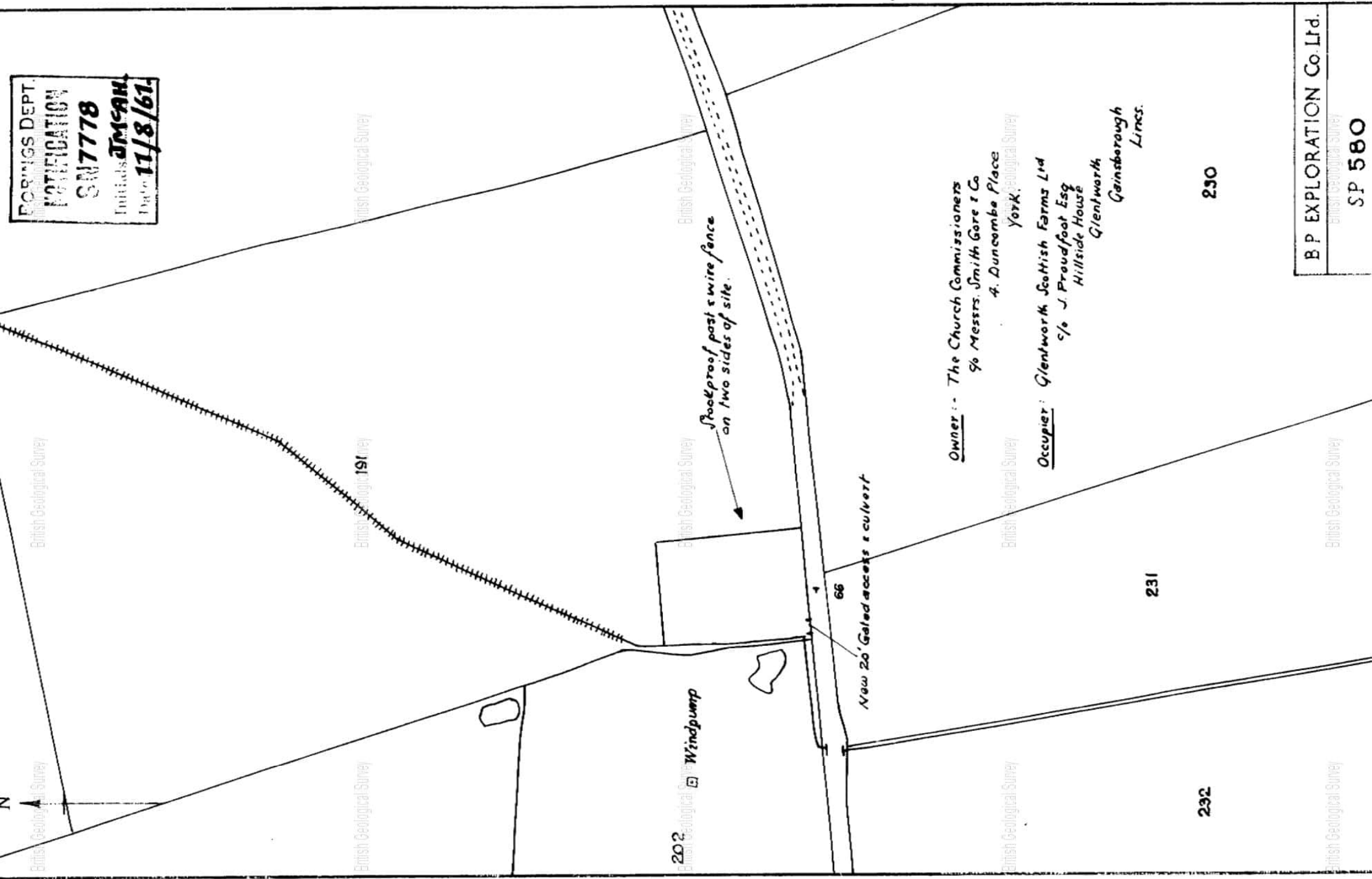
Deviation 1"

Top of Lower Magnesian Limestone 2544 ft (Schlumberger)

Deviation 1"

Top of Coal Measures 3000ft (Schlumberger)

BORINGS DEPT.
 IDENTIFICATION
 SM7778
 Initials JMC:AM
 Date 11/8/61.



Owner :- The Church Commissioners
 % Messrs. Smith Gore & Co
 4, Duncombe Place
 York.

Occupier : Glentworth Scottish Farms Ltd
 % J. Proudfoot Esq
 Hillside House
 Glentworth
 Gainsborough
 Lincs.

230

231

232

B P EXPLORATION Co. Ltd.

British Geological Survey

SP 580



47

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61

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New 20' access & culvert.
Install two 10' field gates.

New 12' access road to site

British Geological Survey

British Geological Survey

British Geological Survey

64

7862

JMCAH

16/2/62

Notified 13/10/61.

Install culvert.

70

Owners: Messrs GRW and JA Gagg,
Lower Debdhill Farm,
Misterton,
Doncaster,
Yorks.

Occupier: G. F. Gagg and Sons Ltd,
Lower Debdhill Farm,
Misterton,
Doncaster,
Yorks.

Two 10' field gates
Stuck proof post &
wire fence.

2

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British Geological Survey

British Geological Survey

66

3

B P EXPLORATION Co. Ltd.

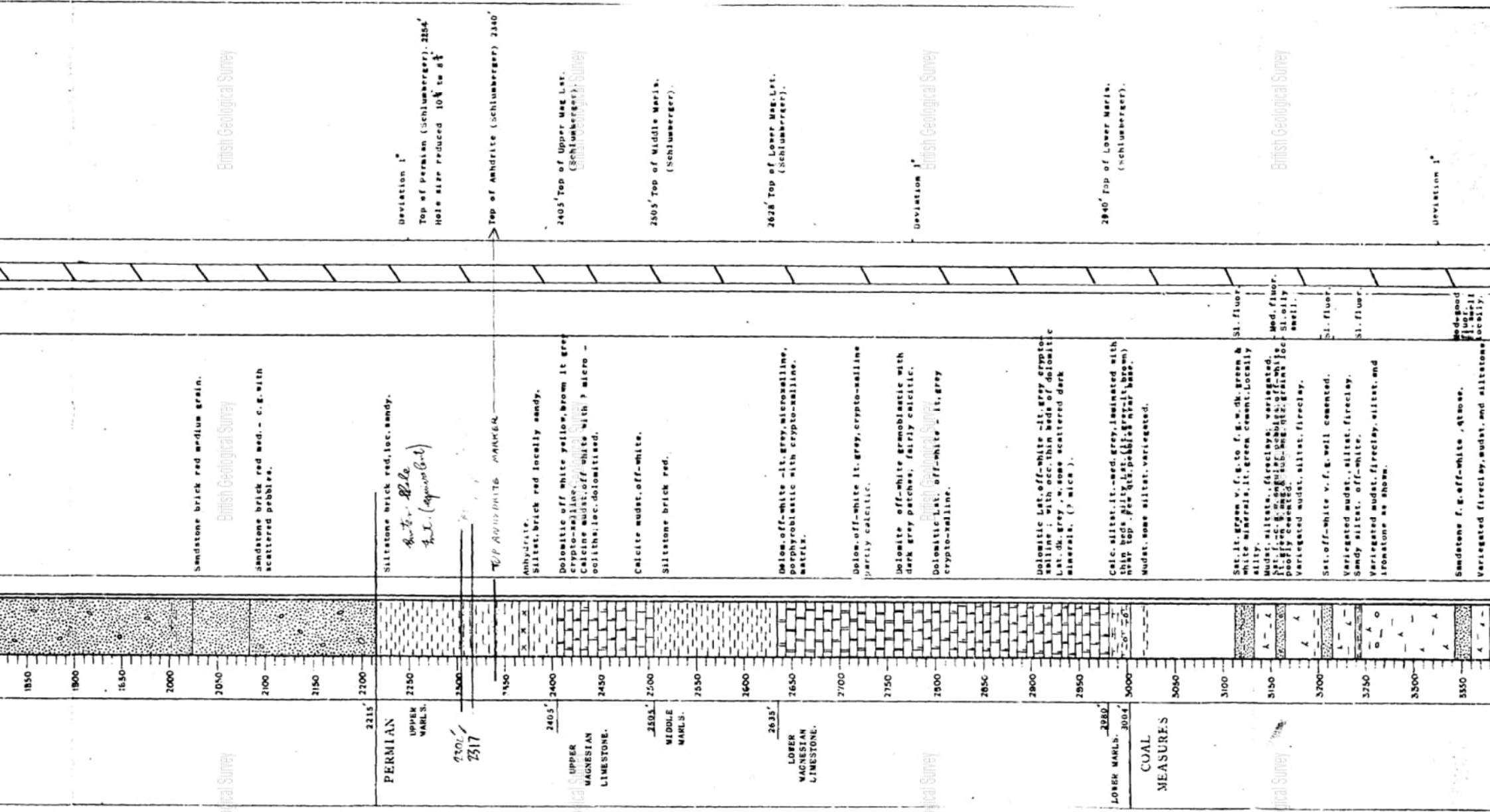
SP. 589

Scale 1/2500

3416

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Deviation 1"
 Top of Permian (Schlumberger), 2854'
 Hole size reduced 10% to 8"

Top of Anhydrite (Schlumberger) 2340'

2405' Top of Upper Mag. Lst.
 (Schlumberger)

2505' Top of Middle Marls.
 (Schlumberger).

2626' Top of Lower Mag. Lst.
 (Schlumberger).

Deviation 1"
 British Geological Survey

2840' Top of Lower Marls.
 (Schlumberger).

Deviation 1"

Sandstone brick red medium grain.

Sandstone brick red med. - c.g. with scattered pebbles.

Siltstone brick red, loc. sandy.

*See T. R. L. p. 2
 Anhydrite (Goul.)*

TOP ANHYDRITE MARKER

Anhydrite.

Siltst. brick red locally sandy.

Dolomite off white yellow, brown lt grey crypto-xalline.

Calcare mudst. off white with ? micro - ooliths, loc. dolomitised.

Calcite mudst. off-white.

Siltstone brick red.

Dol. off-white - lt. grey, micro-xalline, porphyroblastic with crypto-xalline matrix.

Dol. off-white lt. grey, crypto-xalline purely calcitic.

Dolomite off-white granoblastic with dark grey patches, fairly calcitic.

Dolomitic Lst. off-white - lt. grey crypto-xalline.

Dolomitic Lst. off-white - lt. grey crypto-xalline; with occ. thin beds of dolomitic Lst. dk. grey + w. some scattered dark minerals. (? mica).

Calc. siltst. lt. med. grey, laminated with thin beds silty Lst. (lt. grey - lt. brown) near top. Few quartz pebbles near base. Mudst. some siltst. variegated.

Sst. lt. green v. f. g. to f. g. w. dk. green & white minerals. lt. green cement. Locally silty.

Sst. off-white, fireclay; variegated. It. green & mag. sub. mag. silty. Silty poorly cemented.

Variegated mudst. siltst. fireclay.

Sst. off-white v. f. g. well cemented.

Variegated mudst. siltst. fireclay.

Sandy siltst. off-white.

Variegated mudst. fireclay. siltst. and ironstone as shown.

Sandstone f. g. off-white, qtzose.

Variegated fireclay, mudst. and siltstone locally. Med. fluor. Silty locally.

PERMIAN

UPPER MARLS.

2300'
 2317'

UPPER MAGNESIAN LIMESTONE.

MIDDLE MARLS.

LOWER MAGNESIAN LIMESTONE.

LOWER MARLS.

COAL MEASURES

7/12/104

File

BP EXPLORATION COMPANY LIMITED

Name changed from D'Arcy Exploration Co. Ltd.

Telephone Nos.
BILSTHORPE 201, 202 & 203

Telegraphic
BEPEE-KNEESALL



British Geological Survey

EAKRING

Postal Address:
British P.O. Box 1
Southwell, Notts.

Our Reference: **GLE/A.1/1511**

13th October, 1961.

The Director,
Geological Survey and Museum,
Exhibition Road,
South Kensington,
London, S.W.7.

Dear Sir,



Glentworth No. 4 Proposed Trial Borehole
Licence Area B.26e

British Geological Survey

British Geological Survey

British Geological Survey

We enclose herewith, in duplicate, Site Plan No. 589, showing the approximate position of the above trial borehole which it is our intention to drill.

A 14 $\frac{3}{4}$ " hole will be drilled to 1425 feet and 11 $\frac{3}{4}$ " casing set from surface to that depth. From 1425 feet a 10 $\frac{5}{8}$ " hole will be drilled to 2500 feet and thence an 8 $\frac{3}{8}$ " hole to final depth of approximately 5200 feet. If oil production is proved, 6 $\frac{5}{8}$ " casing will be set from surface to below the oil-producing sand.

We regret that we are at present unable to forecast a start date for drilling operations at this location, but will inform you of the exact date in due course.

Yours faithfully,

For BP EXPLORATION COMPANY LIMITED

British Geological Survey

British Geological Survey

J. B. Acres.
J. B. Acres

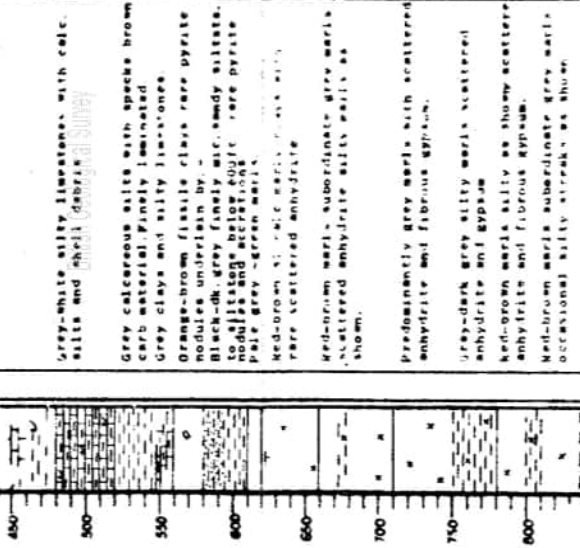
Enclosures

FC/FEK

British Geological Survey

British Geological Survey

British Geological Survey



550
RHARTIC.
610
NEUPER.

1400
BUNTER.

Top of Rhestr. 560 ft. (Schlumberger).
Top of Kuper 610 ft. (Schlumberger).

Top of Bunter 1455 ft. (Schlumberger).

Red-brown medium-coarse grained quartz sandstone with in part white-yellow calcareous clay matrix.

7/21/64 *W. Ransford* File

BP EXPLORATION COMPANY LIMITED

Name changed from D'Arcy Exploration Co. Ltd.

Telephone Nos.
BILSTHORPE 201, 202 & 203

Telegraphic
BEPEE-KNEESALL



EAKRING

Postal Address:
P.O. Box 1
Southwell, Notts.

Our Reference: **GLE/A.1/1509**

13th October, 1961.

SK 98NW/S.

1961 100 9 1 0100

The Director,
Geological Survey and Museum,
Exhibition Road,
South Kensington,
London, S.W.7.

ADVISORY BOARD

Dear Sir,

Glentworth No. 5 Proposed Trial Borehole
License Area B.26e

British Geological Survey

We enclose herewith, in duplicate, Site Plan No. 591, showing the approximate position of the above trial borehole which it is our intention to drill. *plans*

A 14 $\frac{3}{4}$ " hole will be drilled to 1425 feet and 11 $\frac{3}{4}$ " casing set from surface to that depth. From 1425 feet a 10 $\frac{5}{8}$ " hole will be drilled to 2500 feet and thence an 8 $\frac{5}{8}$ " hole to final depth of approximately 5200 feet. If oil production is proved, 6 $\frac{5}{8}$ " casing will be set from surface to below the oil-producing sand.

We regret that we are at present unable to forecast a start date for drilling operations at this location, but will inform you of the exact date in due course.

Yours faithfully,

RECORDINGS DEPT
OCT 18 1961
SN 7861
J.B.A.
17/10/61

For BP EXPLORATION COMPANY LIMITED

British Geological Survey

J. B. Acres.

J. B. Acres

Enclosures

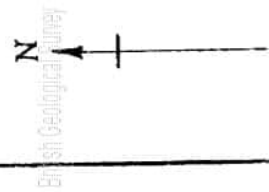
FC/FBK

16/10/61
J.B.A.

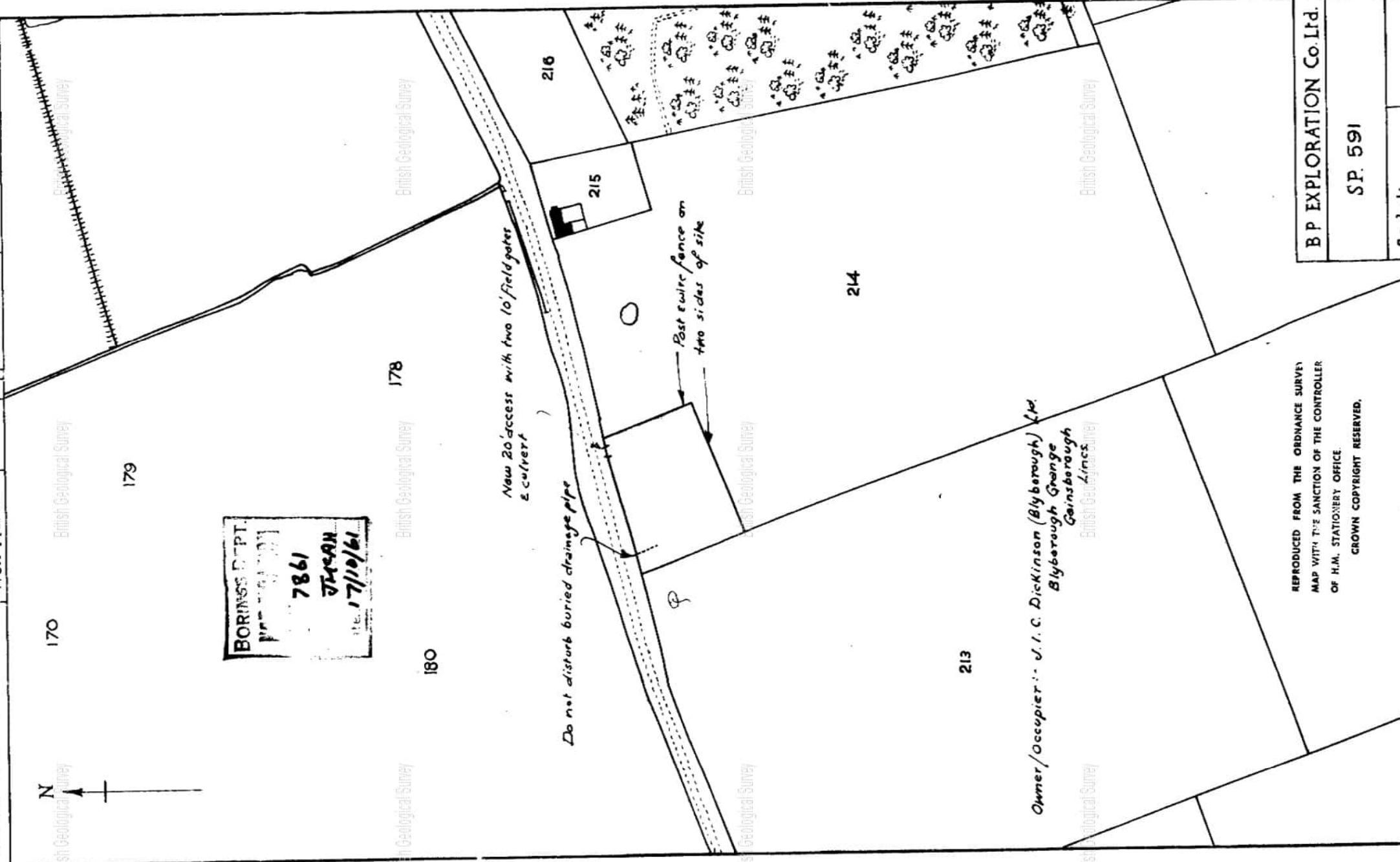
British Geological Survey

British Geological Survey

British Geological Survey



BORINGS DEPT.
 7861
 7145AH
 17/10/61



Do not disturb buried drainage pipe

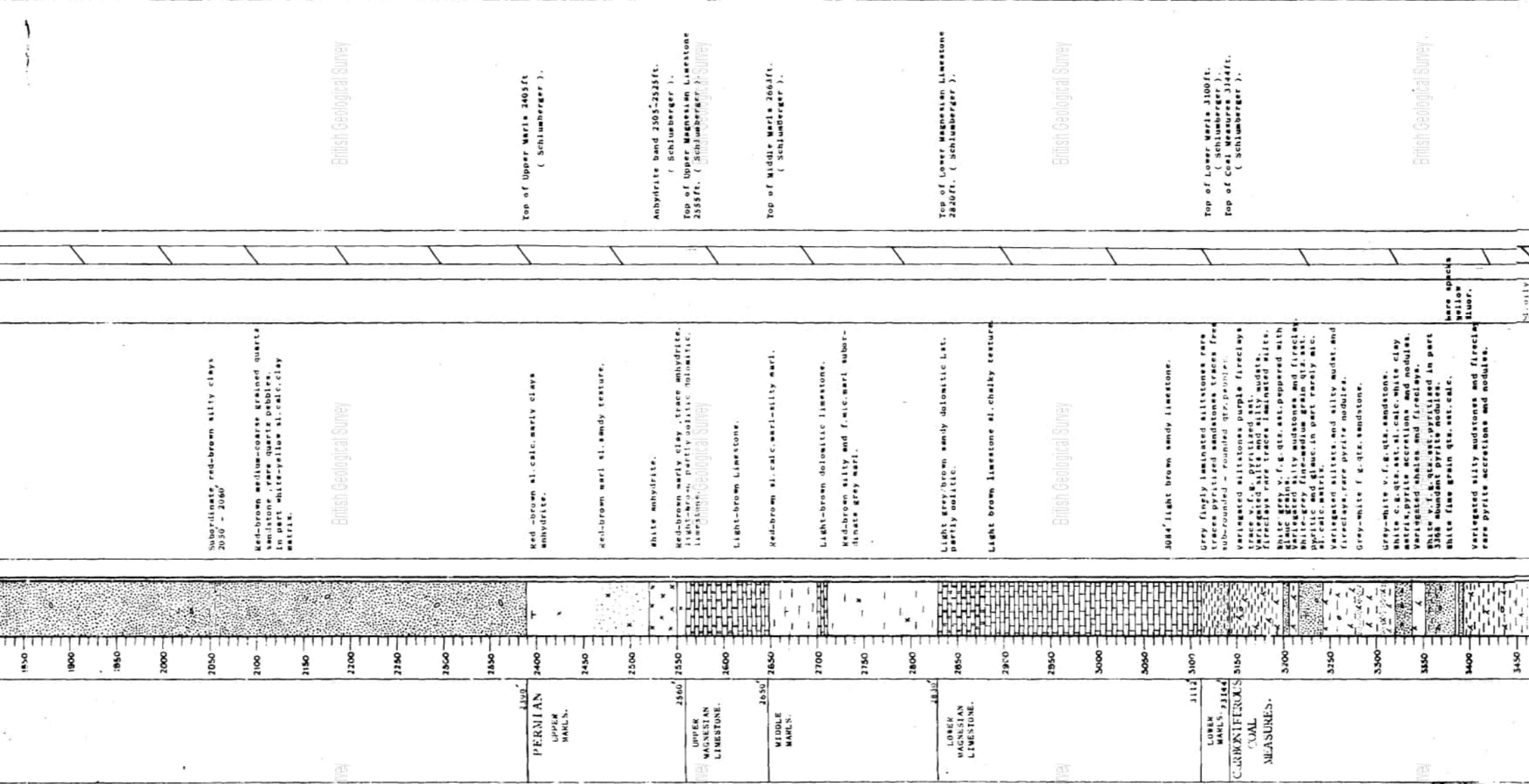
New 20' access with two 10' field gates & culvert

Post wire fence on two sides of site

*Owner/Occupier :- J. I. C. Dickinson (Blyborough) Ltd.
 Blyborough Grange
 Gainsborough
 Lincs*

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B P EXPLORATION Co. Ltd.
 S.P. 591
 Scale 1/1000



Subordinate, red-brown silty clays
2030 - 2060

Med-brown medium-coarse grained quartz
sandstone, rare quartz pebbles,
in part white-yellow sl. calc. clay
matrix.

Top of Upper Marl 2405 ft.
(Schlumberger).

Red-brown sl. calc. marl-silty clays
anhydrite.

Red-brown marl sl. sandy texture.

White anhydrite.

Red-brown marly clay, trace anhydrite,
limestone, metallic nodules.

Anhydrite band 2505-2525 ft.
(Schlumberger).
Top of Upper Magnesian Limestone
2555 ft. (Schlumberger).

Light-brown Limestone.

Red-brown sl. calc. marl-silty marl.

Top of Middle Marl 2661 ft.
(Schlumberger).

Light-brown dolomitic limestone.

Red-brown silty and f. sl. marl sub-
ordinate grey marl.

Light grey-brown sandy dolomitic ls.,
partly oolitic.

Top of Lower Magnesian Limestone
2820 ft. (Schlumberger).

Light brown limestone sl. chalky texture.

3084' light brown sandy limestone.

Grey finely laminated siltstones rare
traces pyritized sandstones traces free
sub-rounded - rounded qtz. pebbles.

Top of Lower Marl 3100 ft.
(Schlumberger).
Top of Coal Measures 3144 ft.
(Schlumberger).

Variagated siltstones purple fireclays
trace v. f. g. pyritized slt.

Variagated silts and silty mudst.

Fireclays rare traces, laminated silts,
white grey v. f. g. qtz. slt. peppered with
black grey.

Variagated silty sandstones and fireclay
white-grey fine-medium grain qtz. slt.
pyritic and glauc. in part rarely slc.
sl. calc. matrix.

Variagated siltst. and silty mudst. and
fireclays, rare pyrite nodules.

Grey-white f. g. qtz. sandstone.

White c. g. qtz. slt. sandstone.

Matrix, pyrite accretions and nodules.

Variagated shales and fireclays.

White v. f. g. qtz. slt. pyritized in part
3368 abundant pyrite nodules.

White fine grain qtz. slt. calc.

Variagated silty sandstones and fireclay
rare pyrite accretions and nodules.

Here specks
yellow
fluor.

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Lt. grey mudst. & brick red, slightly calc. mic. soft mudst., little gypsum at bottom.

Brick red & grey-green mudst., silty in part.

Brick red and grey-green mudst. trace gypsum. Silty and evenly bedded.

As above, more silty.

Brick red and grey-green mudstone.

As above with v. f. g. grey-green sst. s.l.c. bands.

Brick red and grey-green mudst. tr. gypsum.

Trick mudst. w. purple & grey mic. grey-green mudstone.

Grey silty mudst. & siltst. becoming

silty to sandy.

Brick siltst. thin bedded purple and

grey mudst. thin bedded purple and

Red-brown mudstone.

Red-brown s. c. sandstone, with some coarser bands.

Thin chocolate mudstone bands.

Red-brown m-c. g. sst. with occ. bands of red-brown and grey silty mudstones.

As above with some quartz pebbles and coarser sst.

Sst. as above with a fine g. band and mic silty red-brown mudst. band at 1810.

Red-brown sst. with occ. quartz pebbles and red-brown silty mudst. band.

Red-brown m. g. sst. bands of red-brown mudst. and little white fm. g. sst.

Red-brown siltst. and silty mudst., slightly calc. and calc.

Red-brown siltst. and f. g. sst. and red-brown mudst.

Red-brown f. g. sst. and silty mudst.

White anhydrite. A little brown mudst.

and siltstone.

Brown mudst. interbedded with anhydrite.

Cream-yellow mottled calcilutite and

brown mudst.

White slightly oolitic l.t. dolomitic,

compact lower part.

pale grey l.t. oolitic in places and

vuggy in places trace of white marl.

v. finely granular pale grey liasstone.

Dk. brick red clay of non-calc. marl.

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BUNTER

1380

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UPPER
MARNES IN
LEWISSTONE

2180

PROVIA

UPPER
MARNES

2305

2272' Deviation 14

Name of Hunter 2206 (Schlumberger).

2335' Hole size reduced to 8"

2360' Tight hole.

Anhydrite Marker bed from 2407 - 2423' (Schlumberger).

Name of Permian Upper Gelfu 2451' (Schlumberger).

2512' Tight hole.

Name of Upper Gelfu Lat. 2551'

AREA: GLENTWORTH

Well No. 7

B26e

approx 1 acre.

OS Sheet. Lincs. XLIV.13



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British Geological Survey

162

Two 10' Fieldgates.

Stockproof post & wire fence
on three sides of site.

New 12' access road

8256
JMSAH
3/2/62

163

B.P.

Owner - The Church Commissioners
% Messrs. Smiths, Gyles & Co.
4 Duncombe Place
York.

Occupier - Glentworth Scottish Farms, Ltd
% J. Proudfoot Esq.,
Hillside House
Glentworth
Gainsborough
Lincs.

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164

No 1 Well

New 20' access & culvert

190

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B.P. EXPLORATION Co. Ltd.

SP. 612

Scale 1/25,000

9104

SK 98 NW/8 12.

49

AREA: GLENTWORTH

SITE PLAN. WELL N°8

B 26e

SITE AREA 1 Acre

OS SHEETS. Lincs XLIII.16 & XLIV.13

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British Geological Survey



BOINGS DEPT
8257
J.H.A.M.
2/3/42

CAUTION :- 3" Asbestos water main on Northern verge of Farm road, upto and beyond N°8 site.

Strengthen & maintain farm road

Post & wire fence on three sides of site

Two 10' Field gates

Strengthen existing culvert

Owner:- The Church Commissioners
% Messrs. Smiths, Gore & Co
4, Duncombe Place
York.

Occupier:- Glentworth Scottish Farms Ltd.
% J. Proudfoot Esq
Hillside House
Glentworth

Gainsborough
Lincs.

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MAP WITH THE SANCTION OF THE CONTROLLER
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BRITISH SCIENTIFIC RESEARCH

BP EXPLORATION CO LTD

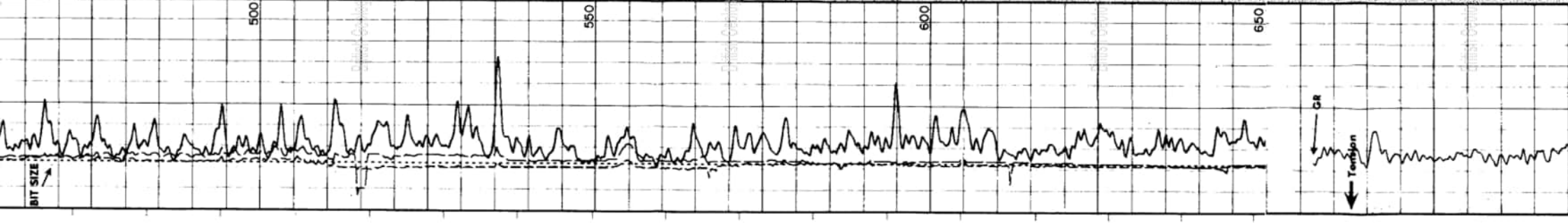
SP613

Scale: 1/2500
Date: 23-2-62

J.S.A.

56

SANDSTONE GROUP

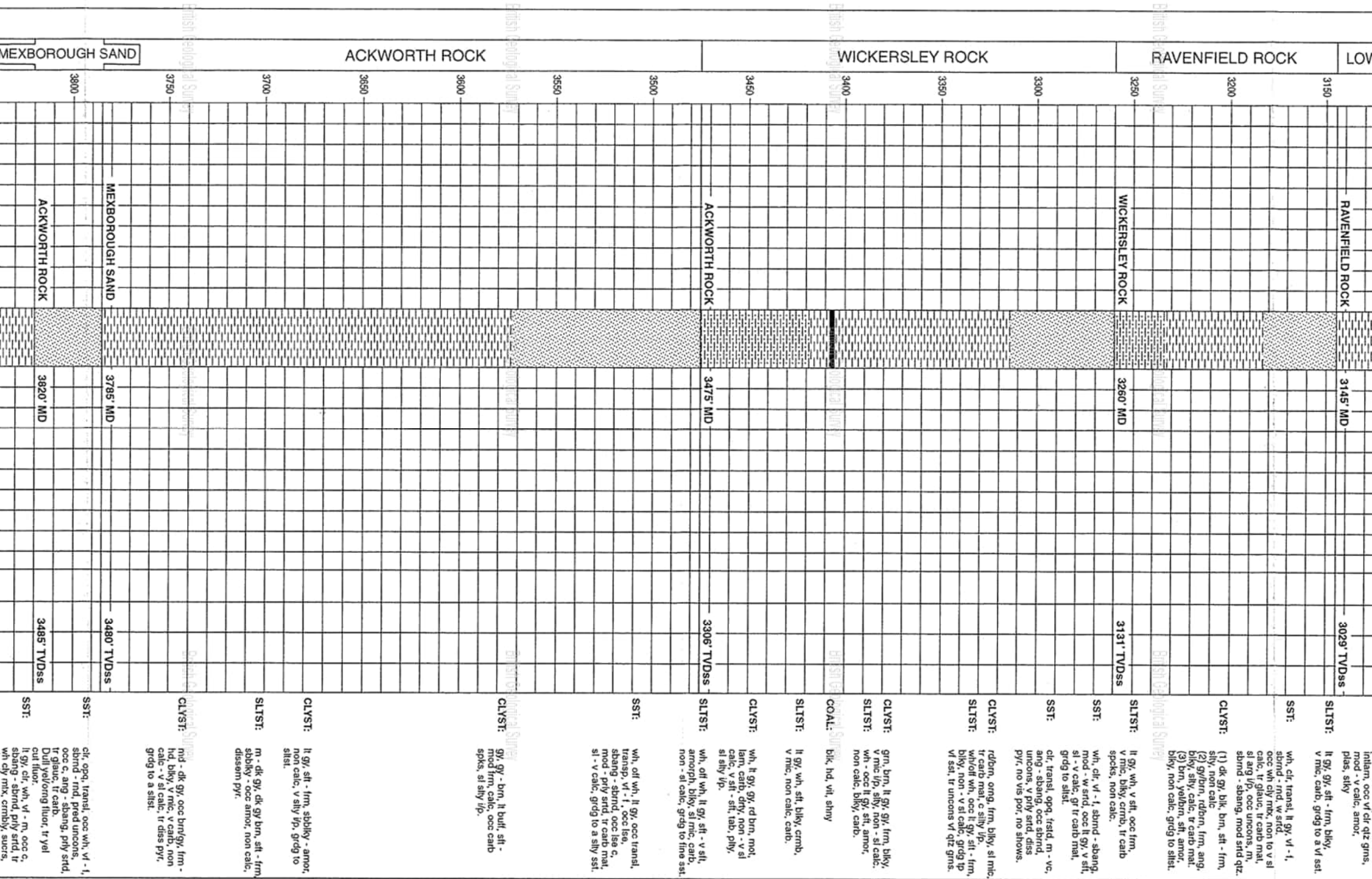


MUDESTONE: light brown-red, occasionally light green, firm, blocky, angular, occasionally subfissile, non fatigaceous.

SANDSTONE: quartzose, red-light brown-translucent, fine to medium, moderately sorted, moderately spherical, loose, occasional siliceous cement, trace of ferrous staining, occasionally argillaceous, no fluorescence.

Δt

Tension



LOW

RAVENFIELD ROCK

3145' MD

3029' TVDss

SLTST: Inham, occ vt clz qtz gms, mod - v calc, amor, plss, silty

SST:

wh, clr, transl, ll gy, vt - l, sbnd - rnd, w srd, occ wh clay mx, non to v sl calc, tr glauc, tr carb mat, sl arg lp, occ uncons, m, sbnd - sbang, mod srd qtz (1) dk gy, blk, brn, silt - frm, silty, non calc (2) gy/brn, rdbrn, frm, ang, blkly, silty, calc, tr carb mat, (3) brn, yelbrn, silt, amor, blkly, non calc, grdg to silst.

RAVENFIELD ROCK

3200

WICKERSLEY ROCK

3260' MD

3131' TVDss

SLTST: ll gy, wh, v silt, occ frm, v mic, blkly, crmb, tr carb specks, non calc.

SST:

wh, clr, vt - l, sbnd - sbang, mod - w srd, occ ll gy, v silt, sl - v calc, gr tr carb mat, grdg to silst

WICKERSLEY ROCK

3300

WICKERSLEY ROCK

3260' MD

3131' TVDss

SST: clr, transl, ood, frisd, m - vc, ang - sbang, occ sbnd, uncons, v pry srd, flss pyr, no vis por, no shows.

WICKERSLEY ROCK

3350

WICKERSLEY ROCK

3260' MD

3131' TVDss

CLVST: rdbrn, ong, frm, blkly, sl mic, tr carb mat, c silty lp, wh/clf wh, occ ll gy, silt - frm, blkly, non - v sl calc, grdg to vt sst, tr uncons vt qtz gms.

SLTST:

CLVST: grn, brn, ll gy, gy, frm, blkly, v mic lp, silty, non - sl calc, wh - occ ll gy, silt, amor, non calc, blkly, carb.

SLTST:

COAL: blk, hd, vt, shny

WICKERSLEY ROCK

3400

WICKERSLEY ROCK

3475' MD

3306' TVDss

SLTST: ll gy, wh, silt, blkly, crmb, v mic, non calc, carb.

WICKERSLEY ROCK

3450

WICKERSLEY ROCK

3475' MD

3306' TVDss

CLVST: wh, ll gy, gy, rd brn, mod, lam, carb, dry, non - v sl calc, v silt - silt, tab, pily, sl silty lp.

SLTST:

wh, off wh, ll gy, silt - v silt, amorph, blkly, sl mic, carb, non - sl calc, grdg to fine sst.

WICKERSLEY ROCK

3500

WICKERSLEY ROCK

3475' MD

3306' TVDss

SST:

wh, off wh, ll gy, occ transl, transp, vt - l, occ lsa, sbang - sbnd, occ lsa c, mod - pry srd, tr carb mat, sl - v calc, grdg to a silty sst.

ACKWORTH ROCK

3550

ACKWORTH ROCK

3475' MD

3306' TVDss

CLVST:

gy, gy - brn, ll buff, silt - mod frm, calc, occ carb spls, sl silty lp.

ACKWORTH ROCK

3600

ACKWORTH ROCK

3475' MD

3306' TVDss

CLVST:

ll gy, silt - frm, sbbily - amor, non calc, v silty lp, grdg to silst.

ACKWORTH ROCK

3650

ACKWORTH ROCK

3475' MD

3306' TVDss

SLTST:

m - dk gy, dk gy brn, silt - frm, sbbily - occ amor, non calc, dissemin pyr.

ACKWORTH ROCK

3700

ACKWORTH ROCK

3475' MD

3306' TVDss

CLVST:

rnd - dk gy, occ brn/gy, frm - hd, blkly, v mic, v carb, non calc - v sl calc, tr diss pyr, grdg to a silst.

MEXBOROUGH SAND

3750

MEXBOROUGH SAND

3785' MD

3480' TVDss

SST:

clr, opa, transl, occ wh, vt - l, sbnd - rnd, pred uncons, occ c, ang - sbang, pry srd, tr glauc, tr carb, Dull yellow illuor, tr yel cut fluor, ll gy, clr, wh, vt - m, occ c, sbang - sbnd, pry srd, tr wh clay mx, crmbly, suocr,

MEXBOROUGH SAND

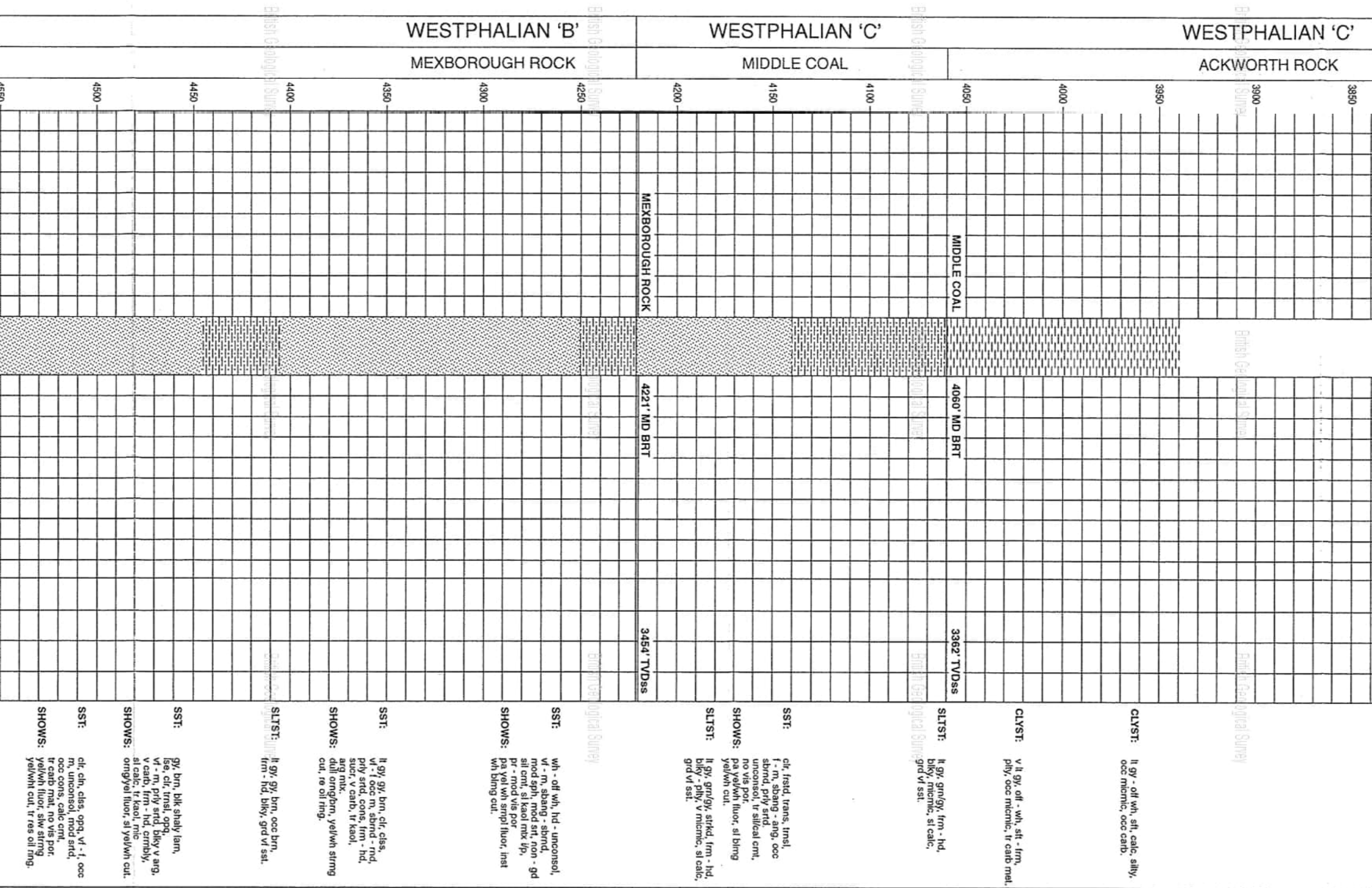
3800

MEXBOROUGH SAND

3820' MD

3485' TVDss

SST:



TRIPHALIAN 'C'

ZECHSTEIN

CARBONIFEROUS

LOWER MAGNESIAN LIMESTONE AND LOWER MARL

MIDDLE MARL

UPPER MAGNESIUM LIMESTONE

2500-	2550-	2600-	2650-	2700-	2750-	2800-	2850-	2900-	2950-	3000-	3050-	3100-	3150-	3200-
<p>LST: mlky wh - lt gy, hd - v hd, br/crma brk, l gy, calc emt lp, chky - wh lp, maxcn.</p>	<p>LST: lt gy - mlky wh, hd - v hd, occ amorph, maxcn.</p>	<p>CLST: rd - brn & lt gy, sl calc, slt, amorph, maxcnca.</p>	<p>MARL: lt brn - brn, sft, amorph, calc, swell.</p> <p>CLYST: rd - brn, sft - frm, non - calc, hydrophyllite, sbblky.</p> <p>CLST: rd - brn, sft - frm, slgt calc, amorph, occ lt - gy.</p>	<p>CLST: rd - brn & lt gy, sl calc, slt, amorph, maxcnca.</p>	<p>LST: wh - crng, sft, lgnrd, chky, dk - gy, hd - v hd.</p>	<p>CLST: rd - brn, frm, blkly brk.</p>	<p>LST: gy - wh, frm - hd, occ sft, blkly brk, micro xin, lgnrd, interbeds of dolomite.</p>	<p>LST: gy - wh, frm - hd, blkly brk, microxin, lgnrd, occ dk gy/wh microlam.</p> <p>CLYST: rd - brn, frm, blkly brk, non calc.</p>	<p>CLYST: rd - brn, hd, blkly brk, stly lp.</p>	<p>LST: lt gy, sft - frm, lgnrd, lv/dk gy microlam, occ dk gy.</p>	<p>LST: lt gy, sft, lgnrd, microxin.</p>	<p>LST: lt gy, sft - frm, lgnrd, microlam, occ dk gy.</p> <p>HD - v hd, crptan.</p>	<p>LST: lt gy, sft - frm, lgnrd, microlam, occ dk gy.</p> <p>HD - v hd, crptan.</p>	<p>LST: lt gy, sft - frm, lgnrd, microlam, occ dk gy.</p> <p>HD - v hd, crptan.</p>
<p>3210' MD</p>	<p>2697' MD</p>	<p>2637' TVDss</p>	<p>2734' MD</p>	<p>2697' MD</p>	<p>3113' MD</p>	<p>2992' TVDss</p>	<p>3075.6' TVDss</p>	<p>3113' MD</p>	<p>2992' TVDss</p>	<p>3113' MD</p>	<p>2992' TVDss</p>	<p>3113' MD</p>	<p>2992' TVDss</p>	<p>3113' MD</p>
<p>CLYST: gn - gy, sft, amorph, non calc, non swell.</p> <p>CLYST: lt gy, sft, amorph, non calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>COAL: slt calc, bk, brtl, ang, vit lsir.</p>	<p>CLYST: gn - gy, sft, amorph, non calc, non swell.</p> <p>CLYST: lt gy, sft, amorph, non calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>COAL: slt calc, bk, brtl, ang, vit lsir.</p>	<p>CLYST: gn - gy, sft, amorph, non calc, non swell.</p> <p>CLYST: lt gy, sft, amorph, non calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>COAL: slt calc, bk, brtl, ang, vit lsir.</p>	<p>CLYST: gn - gy, sft, amorph, non calc, non swell.</p> <p>CLYST: lt gy, sft, amorph, non calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>COAL: slt calc, bk, brtl, ang, vit lsir.</p>	<p>CLYST: gn - gy, sft, amorph, non calc, non swell.</p> <p>CLYST: lt gy, sft, amorph, non calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>COAL: slt calc, bk, brtl, ang, vit lsir.</p>	<p>CLYST: gn - gy, sft, amorph, non calc, non swell.</p> <p>CLYST: lt gy, sft, amorph, non calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>COAL: slt calc, bk, brtl, ang, vit lsir.</p>	<p>CLYST: gn - gy, sft, amorph, non calc, non swell.</p> <p>CLYST: lt gy, sft, amorph, non calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>COAL: slt calc, bk, brtl, ang, vit lsir.</p>	<p>CLYST: gn - gy, sft, amorph, non calc, non swell.</p> <p>CLYST: lt gy, sft, amorph, non calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>COAL: slt calc, bk, brtl, ang, vit lsir.</p>	<p>CLYST: gn - gy, sft, amorph, non calc, non swell.</p> <p>CLYST: lt gy, sft, amorph, non calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>COAL: slt calc, bk, brtl, ang, vit lsir.</p>	<p>CLYST: gn - gy, sft, amorph, non calc, non swell.</p> <p>CLYST: lt gy, sft, amorph, non calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>COAL: slt calc, bk, brtl, ang, vit lsir.</p>	<p>CLYST: gn - gy, sft, amorph, non calc, non swell.</p> <p>CLYST: lt gy, sft, amorph, non calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>COAL: slt calc, bk, brtl, ang, vit lsir.</p>	<p>CLYST: gn - gy, sft, amorph, non calc, non swell.</p> <p>CLYST: lt gy, sft, amorph, non calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>COAL: slt calc, bk, brtl, ang, vit lsir.</p>	<p>CLYST: gn - gy, sft, amorph, non calc, non swell.</p> <p>CLYST: lt gy, sft, amorph, non calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>COAL: slt calc, bk, brtl, ang, vit lsir.</p>	<p>CLYST: gn - gy, sft, amorph, non calc, non swell.</p> <p>CLYST: lt gy, sft, amorph, non calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>SLTST: trnscl - lt gy, sft, amorph, slt calc.</p> <p>COAL: slt calc, bk, brtl, ang, vit lsir.</p>	

Appendix D – Zetica UXO Map

UNEXPLODED BOMB RISK MAP



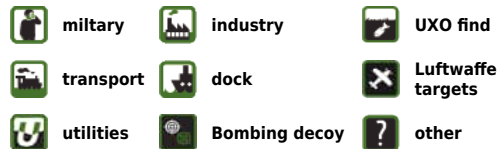
SITE LOCATION

Location: DN21 5UY,
Map Centre: 493610,389886



LEGEND

- High:** Areas indicated as having a bombing density of 50 bombs per 1000acre or higher.
- Moderate:** Areas indicated as having a bombing density of 15 to 49 bombs per 1000acre.
- Low:** Areas indicated as having 15 bombs per 1000acre or less.



How to use your Unexploded Bomb (UXB) risk map?

The map indicates the potential for Unexploded Bombs (UXB) to be present as a result of World War Two (WWII) bombing.

You can incorporate the map into your preliminary risk assessment* for potential Unexploded Ordnance (UXO) for a site. Using this map, you can make an informed decision as to whether more in-depth detailed risk assessment* is necessary.

What do I do if my site is in a moderate or high risk area?

Generally, we recommend that a detailed UXO desk study and risk assessment is undertaken for sites in a moderate or high UXB risk area.

Similarly, if your site is near to a designated Luftwaffe target or bombing decoy then additional detailed research is recommended.

More often than not, this further detailed research will conclude that the potential for a significant UXO hazard to be present on your site is actually low.

Never plan site work or undertake a risk assessment using these maps alone. More detail is required, particularly where there may be a source of UXO from other military operations which are not reflected on these maps.

If my site is in a low risk area, do I need to do anything?

If both the map and other research confirms that there is a low potential for UXO to be present on your site then, subject to your own comfort and risk tolerance, works can proceed with no special precautions.

A low risk really means that there is no greater probability of encountering UXO than anywhere else in the UK.

If you are unsure whether other sources of UXO may be present, you can ask for one of our **pre-desk study assessments (PDSA)**

If I have any questions, who do I contact?

tel: **+44 (0) 1993 886682**

email: **uxo@zetica.com**

web: **www.zeticauxo.com**

The information in this UXB risk map is derived from a number of sources and should be used in conjunction with the accompanying notes on our website: (<https://zeticauxo.com/downloads-and-resources/risk-maps/>)

Zetica cannot guarantee the accuracy or completeness of the information or data used and cannot accept any liability for any use of the maps. These maps can be used as part of a technical report or similar publication, subject to acknowledgment. The copyright remains with Zetica Ltd.

It is important to note that this map is not a UXO risk assessment and should not be reported as such when reproduced.

*Preliminary and detailed UXO risk assessments are advocated as good practice by industry guidance such as CIRIA C681 'Unexploded Ordnance (UXO), a guide for the construction industry'.

Appendix E – Pre-Desk Study Assessment from Zetica

Pre-Desk Study Assessment

Site:	Tillbridge Solar Farm, Hemswell, Lincolnshire
Client:	AECOM
Contact:	Maria Vigano
Date:	4 th August 2022
Pre-WWI Military Activity on or Affecting the Site	None identified.
WWI Military Activity on or Affecting the Site	Harpwell Airfield opened in 1916, on land adjacent to the Site, as a Home Defence Landing Group (HDLG). By the end of WWI, the airfield expanded and became a night flying training ground for the Royal Air Force (RAF).
WWI Strategic Targets (within 5km of Site)	The following strategic targets were located in the vicinity of the Site: <ul style="list-style-type: none"> ■ Transport infrastructure and public utilities. ■ Royal Flying Corps (RFC) Harpswell. ■ Military barracks, camps, and training areas.
WWI Bombing	None identified on the Site.
Interwar Military Activity on or Affecting the Site	RAF Harpswell closed in 1919. The airfield was reopened in January 1937 as RAF Hemswell and was used as a bomber airfield.
WWII Military Activity on or Affecting the Site	No. 61 and No. 144 bomber squadrons were the first units stationed at the airfield flying Hadley Page Hampden medium bombers. No. 300 and No. 300 were the next units stationed at the airfield flying Vickers Wellington bomber aircraft from July 1941. Readily available records have been found indicating that 1No. British bomber aircraft crashed on the Site.
WWII Strategic Targets (within 5km of Site)	The following strategic targets were located in the vicinity of the Site: <ul style="list-style-type: none"> ■ Transport infrastructure and public utilities. ■ RAF Hemswell. ■ Military barracks, camps, and training areas. ■ Anti-Aircraft (AA) and anti-invasion defences.
WWII Bombing Decoys (within 5km of Site)	None.
WWII Bombing	During WWII the Site was located in the Rural District (RD) of Gainsborough, which officially recorded 102No. High Explosive (HE) bombs with a bombing density of 1.3 bombs per 405 hectares (ha). No readily available records have been found to indicate that the Site was bombed.
Post-WWII Military Activity on or Affecting the Site	Post-WWII, RAF Hemswell continued to be a bomber airfield until the late 1950s. In 1958, RAF Hemswell gained the responsibility as one of the main headquarters in Britain for the Douglas Thor nuclear missile. RAF Hemswell closed in 1967 and was passed the Care and Maintenance. The Military Gliding School continued until 1974 when the RAF officially left the airfield.

Recommendation	It is recommended that a detailed desk study is commissioned to assess, and potentially zone, the Unexploded Ordnance (UXO) hazard level on the Site.
Further information	<p>For information about Zetica’s detailed UXO desk studies and other UXO services, please visit our website: www.zeticauxo.com.</p> <p>Details and downloadable resources covering the most common sources of UXO hazard affecting sites in the UK can be found here.</p> <p>If you have any further queries, please don’t hesitate to get in contact with us at uxo@zetica.com or 01993 886 682.</p>
<p>This summary is based on a cursory review of readily available records. Caution is advised if you plan to action work based on this summary.</p>	
<p>It should be noted that where a potentially significant source of UXO hazard has been identified on the Site, the requirement for a detailed desk study and risk assessment has been confirmed and no further research will be undertaken at this stage. It is possible that further in-depth research as part of a detailed UXO desk study and risk assessment may identify other potential sources of UXO hazard on the Site.</p>	

