East Pye Solar Project

Environmental Impact Assessment (EIA) Scoping Report

Volume III - Part 1 Appendix 5.1

Date: January 2025

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Contents

APPENDIX 5.1
PRELIMINARY MINERALS RESOURCE ASSESSMENT

East Pye Solar Project

Mineral Resource Assessment Desk Study

On behalf of Island Green Power

Project Ref: 333101211 / 3501 | Version: 01 | Date: January 2025

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This report has been prepared by Stantec UK Limited ('Stantec') on behalf of its client to whom this report is addressed ('Client') in connection with the project described in this report and takes into account the Client's particular instructions and requirements. This report was prepared in accordance with the professional services appointment under which Stantec was appointed by its Client.

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1 Introduction

1.1 Brief

1.1.1 Stantec UK Ltd (Stantec) has been commissioned by Island Green Power (the Client) to prepare a Qualitative Minerals Resource Assessment (desktop study) for a proposed solar farm, Battery Energy Storage System (BESS) and associated cable routes (the Scheme) approximately 10km to the south of Norwich.

1.2 Scheme Location

1.2.1 The land currently being considered for the Scheme consists of multiple land parcels totalling approximately 1,100 hectares (2,718 acres) in area (the Site). The solar array sites are concentrated east of Long Stratton, with an additional cluster located south of Great Moulton, approximately 6.5km to the south-west of the Solar PV Array sites around Long Stratton, as shown on **Figure 1**.

1.2.2 As shown on **Figure 1** the Site has been divided into the following areas based on the proposed land use:

- The National Grid Substation and Point of Connection (POC).
- The BESS Site.
- Ten Sites (Sites 1 to 10), each of which will contain solar photovoltaic arrays. Each Site is comprised of one or more Sub-Sites, each given a letter designation, e.g., 1A, 1B etc.
- Fourteen Cable Route Corridors (CRCs) (numbered CRC1 to CRC14).

1.3 Background

1.3.1 The Site lies within the area covered by the Norfolk Joint Minerals & Waste Development Framework (MWDF)[1]. The MWDF was informed by a British Geological Survey (BGS) report for the area[2], which includes the Mineral Resource Map for Norfolk.

1.3.2 Section 17 of the National Planning Policy Framework (NPPF)[3] includes the UK Government policy for sustainable use of minerals.

[1] Norfolk Minerals and Waste Development Framework - Core Strategy and Minerals and Waste Development Management Policies Development Plan Document 2010-2026 – September 2011. Norfolk County Council.

[2] Harrison, DJ, and 8 others. 2004. Mineral Resource Information in Support of National, Reginal and Local Planning: Norfolk. British Geological Survey Commissioned Report CR/03/174N.

[3] https://www.gov.uk/government/publications/national-planning-policy-framework--2

1.3.3 The BGS mineral resource map shows that there are a number of mineral resources in Norfolk, including; Sand and Gravel from various geological strata, Silica Sand from the Leziate Member, Crushed Rock from the Carstone Formation, Peat, and Chalk.

1.3.4 With regard to safeguarding of minerals the MWDF (in Section 6.82) states that 'Chalk, clay and peat are either so extensive in Norfolk or demand for them is so low (relatively) that safeguarding such deposits is not considered necessary. Therefore, only sand and gravel, silica sand and carstone resources are safeguarded.'

1.3.5 The Leziate Member and the Carstone Formation occur only in the west of Norfolk, far from the Site, and are therefore not considered further in this assessment.

1.3.6 The Mineral Safeguarding Areas on the Policies Map[4] that accompanies the MWDF cover only cover the outcrops of the geological formations that contain sand and gravels.

1.4 Minerals Assessment Desk Study

1.4.1 This report comprises a first stage (qualitative) desktop study. The study area for this report is the red-line boundary presented on **Figure 1**. The report describes the geology of the Site and presents an initial assessment of the potential mineral resources and resultant potential sterilisation from Scheme based on a review of the BGS and MWDF documents described above and the following reports and information:

- Geological data from the British Geological Survey, including; published mapping5 6 7 8; historical borehole records and other publications/ data sets in the public domain9;
- Review (undertaken in September 2024) of public domain aerial imagery of the Site and surrounding land via the Google Earth and Bing Maps;
- A Phase 1 Ground Conditions Assessment report10 (Phase 1 GCA); and

[4] Norfolk Minerals and Waste Development Framework Revised Policies Map, Dec 2017. Norfolk County Council.

[5] 1:50,000 scale geological map of England and Wales Sheet 161, Norwich (Solid and Drift), 1975. BGS.

[6] 1:50,000 scale geological map of England and Wales Sheet 162, Great Yarmouth (Quaternary and Pre-Quaternary Geology), 1991. BGS.

[7] 1:50,000 scale geological map of England and Wales Sheet 175, Diss (Solid and Drift), 1989. BGS.

[8] 1:50,000 scale geological map of England and Wales Sheet 176, Lowestoft (Solid and Drift), 1996. BGS.

[9] Including online access to the National Geoscience Data Centre collection of scanned borehole, well and shaft records (through the BGS OpenGeoscience website https://www.bgs.ac.uk/data/boreholescans/home.html).

[10] East Pye Solar Project Phase 1 Ground Conditions Assessment Doc Ref: 333101211 - 3501 (GCA Phase 1) - Version 01. September 2024.

- Groundsure Enviro+Geo Insight Reports11 12 (appended to the Phase 1 GCA report).

1.4.2 This report represents the first stage in the assessment of the potential mineral resource. Where the initial desktop study suggests that there are significant mineral resources of potential value that are likely to be sterilised by the Scheme, a site-specific investigation would need to be implemented as a second stage of works to inform a quantitative assessment of the mineral reserves.

[11] Enviro+Geo Insight Report. Ref. GSIP-2024-16319-20839_A. 23/08/24. Groundsure.

[12] Enviro+Geo Insight Report. Ref. GSIP-2024-16319-20839_B. 23/08/24. Groundsure.

2 Site Setting

2.1 Site History

2.1.1 The Site lies in a largely rural area and the desk study report refers to historical Ordnance Survey (OS) map evidence which indicates that the Site has remained as fields, occasionally crossed by watercourses and minor roads since the late 1800's. For further details refer to the Phase 1 Ground Conditions Assessment report (Scoping Report Appendix 5.2).

2.2 Published Geology

2.2.1 The Geological mapping indicates that the Site and surrounding area is underlain by bedrock strata of either undifferentiated chalk strata (over the western parts of the Site) or Norwich Crag Formation (over the central and eastern parts of the Site).

2.2.1 The bedrock strata present at the Site as recorded by the BGS are described in the table below.

Table 2.1 Bedrock Geology Present on the Site, as Recorded by the BGS

Stratum	Description
Norwich Crag Formation (NCF)	NCF is a localised member of the Crag Group and is described by the BGS as: "A widespread sheet of well sorted, fine- to medium-grained micaceous, glauconitic, locally shelly sands".
Undifferentiated chalk deposits of the Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation	Formations are part of the White Chalk Subgroup which is described by the BGS as: "Chalk with flints. With discrete marl seams, nodular chalk, sponge-rich and flint seams throughout".

2.2.2 The bedrock strata are overlain over the entire Site and surrounding area by superficial strata (see **Figure 2**). The superficial deposits mapped as present at the Site are described in the table below and their disposition relative to the National Grid Substation, POC, Solar PV Array sites, Sub-Sites and BESS are shown on **Figure 2**. Generally, the majority of the Site is underlain by Lowestoft Formation - Diamicton with the valleys of the various small watercourses that cross the Site containing deposits of alluvium, glaciofluvial deposits, river terrace deposits, peat and head.

Table 2.2 Superficial Deposits Present On-Site, as Recorded by the BGS

Stratum	Description
Lowestoft Formation - Diamicton	Cohesive material of pebbly chalky clay. In its unweathered state the cohesive material comprises typically bluish grey, variably sandy and silty clay, with abundant flint and chalk gravel. At surface the material may be decalcified, weathering to yellowish brown or brownish grey with a noticeable absence of chalk. Bands of sand and gravel may be found within or above the general sequence and can often be water bearing.
Lowestoft Formation – Sand and Gravel	The BGS describe this stratum as “Granular deposits commonly associated with the Diamicton but they can be found separately as a result of deposition by glacial meltwater. Consequently the sand and gravel may vary in grading according to the previous depositional setting. The materials derived from glacial deposits may have travelled long distances and therefore contain exotic material, however, the bulk has been found to comprise predominantly flint”.
Leet Hill Sand and Gravel Member	The BGS describe this stratum as “stratified and channelled proximal glaciofluvial outwash deposits. Lithologically, the gravels are rich in flint and quartzose clasts, and contain erratics of northern provenance including Old Red Sandstone, basaltic porphyry, dolerite and Carboniferous limestone”.
Head	The BGS describe this stratum as “gravel, sand and clay depending on upslope source and distance from source. Locally with lenses of silt, clay or peat and organic material”.
Alluvium	The BGS describe this stratum as “normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel”.
Peat	The BGS describe this stratum as “a partially decomposed mass of semi-carbonized vegetation which has grown under waterlogged, anaerobic conditions, usually in bogs or swamps”.
River Terrace Deposits	The BGS describe this stratum as “sand and gravel, locally with lenses of silt, clay or peat”.

Stratum	Description
Happisburch Glacigenic Formation and Lowestoft Formation (Undifferentiated)	The BGS describe this stratum as “clay, sand and silty clay with subsidiary diamicton, gravel and silt”.

2.2.3 Available BGS borehole records (see locations on **Figure 2**) appear to have been sunk either in the Diamicton or the Leet Hill Sand and Gravel Member (LEHI). A summary of the information in the borehole records of the LEHI is summaries below, with additional detail in Section 3.1 and Table 3.2:

- Thickness from 4.8m to 12.35m.
- The deposit is variable and is regularly described as:
- fine to coarse sand with some gravel,
- slightly sandy fine to coarse gravel, and
- sandy or slightly sandy fine to coarse gravel with chalk nodules.
- Locally the deposits contain clay or silt layers occasionally as overburden to the mineral or more commonly as waste within the mineral that range in thickness from 0.6m to 2.95m.
- Locally the sands and gravels are described as ‘chalky’, having ‘chalk traces’ or containing ‘chalk nodules’.

2.3 Hydrological Setting

2.3.1 The Site is crossed by four separate surface water body catchments associated with; the Broome Beck (eastern end of the Site), the Hempnall Beck (central parts of the Site), the Tas Brook (western edge of the Site) and Sarston Brook (south-western end of the Site). Various ditches and smaller watercourse discharge into these watercourses at numerous locations on the Site. Further detail on the hydrological setting can be obtained from the Water Environment section of Chapter 5 of the Scoping Report..

2.4 Hydrogeological Setting

2.4.1 With regard to hydrogeology the strata underlying the Site are classified as follows:

- **Norwich Crag Formation and Chalk - Principal Aquifers.** Defined by the Environment Agency (EA) as strata which 'provide significant quantities of drinking water, and water for business needs. They may also support rivers, lakes and wetlands'.

- **Alluvium, River Terrace Deposits, Lowestoft Formation (sand and gravel), Leet Hill Sand and Gravel Member - Secondary A Aquifers**. Defined by the EA as 'Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'.

- **Lowestoft Formation (Diamicton), Head – Secondary Undifferentiated Aquifers**. Defined by the EA as 'These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow'.

- **Happisburgh Glacigenic Formation and Lowestoft Formation (Undifferentiated – Clay and Silt), Peat - Unproductive Strata (non-aquifers)**. Defined by the EA as 'largely unable to provide usable water supplies and are unlikely to have surface water and wetland ecosystems dependent on them.'

2.4.2 The majority of the Site is within a groundwater Source Protection Zone 3 (Total Catchment). This is the area around a supply source within which all the groundwater ends up at the abstraction point (the point from where the water is taken). This could extend some distance from the source point.

3 Mineral Assessment

3.1 Sand and Gravel Resources

3.1.1 The current Norfolk Mineral Resources Map[13] identifies that the Site is underlain by potential sand and gravel resources associated with the following superficial strata:

- Alluvium;
- River Terrace Deposits;
- Leet Hill Sand and Gravel Member; and
- Lowestoft Formation - Sand and Gravel.

3.1.2 A brief summary of the sand and gravel mineral resource deposits and their mapped locations on the Site (see **Figure 2**) is given below:

Table 3.1 On-Site Superficial Deposits Potentially Containing Sand and Gravel Mineral Resources

Stratum	**Resource Type and BGS Mineral Description[12]**	**Sub-Site and CRC reference**
Lowestoft Formation - Sand and Gravel	Comprising variable thickness of glaciofluvial sand and chalk-bearing flint gravel.	Northern end of 4A
Leet Hill Sand and Gravel Member	Glaciofluvial Sand and Gravel with great variability generally in terms of thickness, particle size and composition. In the vicinity of the Site they comprise variable thickness of glaciofluvial sand and chalk-bearing flint gravel.	NE edge of 4A, N end of 4B, NW corner of 5A, SW corner of 7A, All of 7B, S end of 7C, NW part of CRC6, Most of CRC7, SW end of CRC8
Alluvium	Sub-alluvial Gravels - Occurring beneath the silty alluvium. Comprise fine to coarse, predominantly flint gravels with subordinate sand. Because of their	S end of 7A, SW edge of 8A,

[13] Harrison, DJ, and 8 others. 2004. Mineral Resource Information in Support of National, Reginal and Local Planning: Norfolk. British Geological Survey Commissioned Report CR/03/174N.

Stratum	Resource Type and BGS Mineral Description[12]	Sub-Site and CRC reference
	location the Sub-alluvial Gravels are always saturated and require wet working.	W part of CRC6, N edge of CRC7
River Terrace Deposits	Formed on terraces on the sides of valleys. Generally comprise sequences of sands and gravels, commonly 3-8m in thickness with a sheet-like geometry. The lowest terraces are often saturated.	CRC6

3.1.3 The Mineral Resources Map indicates that the Leet Hill Sand and Gravel has historically been extracted in the vicinity of the Site. **Figure 2** shows the locations of these now closed quarries. Online historical Google Earth satellite imagery shows that these quarries to be inactive and either flooded to form lakes or restored to agricultural or other uses before the earliest image date of 1999.

3.1.4 The BGS GeoRecords Database[14] includes several historical records from boreholes sunk in the vicinity of the Site that recorded geological strata that are considered to be sand and gravel mineral bearing. All of the boreholes were sunk in the Leet Hill Sand and Gravel Member (LEHI) (see **Figure 2**). Table 3.2 below provides details of the composition of these where the record provides details.

Table 3.2 - Summary of Sand and Gravel Strata Recorded by BGS Borehole Records

Borehole	Formation	Depth / Thickness	Description
TM29SW2	LEHI	10.1m	Gravel and stone.
TM29SW21	LEHI	0.6 to 11.3mbgl / 10.7m	1.8m of clay, over 9.5m of sand and shingle.
TM29SW22	LEHI	0.3 - 12.5m bgl / 12.3m	1.2m of fine to coarse sand with some gravel, over 1m of clay, over 1.75m of clayey silt with clay laminations, over 0.35m of fine to coarse sand and gravel, over 3m of medium and coarse sand and gravel, over 4.9m of layers of medium and coarse sand and gravel.
TP29SW23	LEHI	0 - 10.7m bgl / 10.7m	0.5m of medium sand with occasional gravel, over 7.2m of fine to coarse sand and gravel, over 3m of fine to medium sand.

[14] https://mapapps2.bgs.ac.uk/geoindex/home.html

Borehole	Formation	Depth / Thickness	Description
TP29SW24	LEHI	0 - 4.8m bgl / 4.8m	0.8m of clay, over 2.5m of slightly sandy fine to coarse gravel, over 1.5m of fine to coarse sand.
TM29SW25	LEHI	0 - 4.85m bgl / 4.85m	1.1m of fine to coarse gravel with medium to coarse sand and occasional chalk nodules, over 0.5m of fine to medium sand with some gravel, over 3.35m of sandy medium gravel.
TM29SW27	LEHI	0.15 - 10.7mbgl / 10.55m	1.4m of silt, or sand and silt with clay layers, over 10.15m of sandy or slightly sandy fine to coarse gravel with chalk nodules.
TM29SW26	LEHI	0 - 7.05m bgl / 7.05m	2.15m of fine to medium sand with occasional gravel, over 4.9m of fine and medium sand.
TM29SW29	LEHI	1 - 10m bgl / 9m	0.8m chalky sand and gravel, over 1.2m of clay, over 2.8m of gravelly coarse and medium sand with chalk traces, over 1.2m of sand and gravel with chalk traces, over 4m of gravelly coarse and medium sand.
TP29SW30	LEHI	0 - 8.8m bgl / 8.8m	4.2m of laminated sand and gravel, over 0.6m of clay, over 4m of slightly gravelly medium sand.

3.1.5 The Policies Maps of the MWDF[15] show the following:

- The Mineral Safeguarding Areas for sand and gravel on the Site and the surrounding area coincide exactly with the mapped geological strata identified in Table 3.1 above.
- There are no Safeguarded Existing Mineral Extraction or Existing Mineral Infrastructure sites, or consultation areas for these on or within 250m of the Site.
- There are no Mineral Site Allocations or consultation areas or Areas of Search for these on or within 250m of the Site.
- There are no Regionally Important Geological Sites on or within 250m of the Site.

[15] Norfolk Minerals and Waste Development Framework Revised Policies Maps, Dec 2017. Norfolk County Council.

3.2 Viability of Mineral Resources for Extraction

3.2.1 Superficial deposits are mapped as present in seven of the Sub-Sites and three CRCs. The area of each has been calculated based on the geological mapping and is presented in Table 3.3 below. In total the area of mapped potential mineral resources is approximately 8.1% of the total area of the Site.

Table 3.3 Area of On-Site Superficial Deposits Potentially Containing Sand and Gravel Mineral Resources

Sub-Site Reference	Area (m^2)
4a	39,113.6
4b	116,442.4
5a	6,553.3
5b	12,613.8
7a	24,284.9
7b	93,667.1
7c	135,810.5
CRC6	268,536.6
CRC7	124,126.6
CRC8	75,595.2

3.2.2 The viability of the four formations of potential sand and gravel mineral deposits (Lowestoft Sand and Gravel, Leet Hill Sand and Gravel, Sub-alluvial Gravels and River Terrace Deposits) present on or near the Site are discussed in the subsections below.

3.2.3 **River Terrace Deposits** - These are mapped as present over a very small portion of CRC6 and as such are considered to be not economically viable to extract.

3.2.4 **Sub-alluvial Gravels** - The Alluvium is mapped as being present only in narrow strips in valley bottoms associated with watercourses in CRC6 and CRC7 only. The gravels present at the base of the Alluvium are not considered to be economically viable or practical to extract because:

- Mineral extraction from the Alluvium would be constrained by the presence of the watercourses which would either need costly diversion (for which permission would be very unlikely to obtain) or buffers around them.

- There is unlikely to be sufficient mineral present given the small surface area of Alluvium present.
- The likely presence of clay and silt overburden over the mineral.
- Working the mineral would have to be done in the wet which is unfavourable.

3.2.5 **Lowestoft Sand and Gravel** - The deposit is mapped as present at the north-western end of Land Parcel 4A only and extraction of the mineral would be constrained by the presence of the road that borders the Site for which a typically 50m buffer would be needed. This deposit is therefore considered unlikely to be economically viable or practical to extract.

3.2.6 **Leet Hill Sand and Gravel** - This deposit is present more widely on the Site than the others but it is considered unlikely to be economically viable or practical to extract. This is because it is present over small areas of individual parcels and extraction would be constrained over each of the land parcels where it is present by the presence of roads and land boundaries, for which a 50m buffer would typically be needed, and residential properties for which typically a 100m buffer would be needed.

3.3 Sterilisation of Mineral Resources

3.3.1 On small areas of the Site the construction and operation of the Scheme, including the Solar PV Arrays and CRC, will potentially sterilise (i.e., make an area of underground mineral deposits inaccessible for extraction) the underlying sand and gravel mineral resources until the Scheme is fully decommissioned. The operational lifespan of the Scheme is anticipated to be up to 60 years which means that the sterilisation of mineral would only be temporary because at the end of operation the Site could be cleared, leaving the mineral in place and potentially available for extraction.

3.3.2 The BESS and the National Grid Substation and POC are not mapped as on or near any mineral resource.

3.3.3 The remaining elements of the Scheme comprise Solar PV Arrays and associated underground cables. These elements of the scheme are considered to be of low sensitivity to activities associated with mineral extraction, e.g. traffic, noise and dust (unlike, a proposed residential development for example) and therefore the presence of the Scheme (once constructed) is unlikely to present a constraint to any new mineral extraction in areas adjacent to / near the Site.

4 Conclusions

4.1.1 The Site is mapped as being underlain by non-mineral bearing bedrock strata which are overlain by Superficial deposits which over the majority of the Site are classified as non-mineral bearing.

4.1.2 Locally (present in ten Sub-Sites), small parts of the Site (less than 10% of the total area) are underlain by superficial strata of Alluvium, Leet Hill Sand and Gravel Member, Lowestoft Formation - Sand and Gravel and River Terrace Deposits, which are classified as sand and gravel mineral resources and are safeguarded under the current Norfolk Joint MWDF.

4.1.3 There are no allocated or safeguarded existing or proposed mineral sites nor consultations for these within 250m of any part of the Site in the current MWDF.

4.1.4 The National Grid Substation, POC and BESS locations do not lie within mineral safeguarded areas.

4.1.5 The presence of the Solar PV arrays and Cable Route Corridors will sterilise minerals on parts of the Site, noting that the sterilisation is temporary in nature during the anticipated 60-year operational lifespan of the Scheme and following decommissioning any economically and commercially viable mineral will once again be accessible. However, these on-site minerals are not considered to be economically viable or practical to extract due to a combination of the mineral resource being limited in area or constrained by the presence of nearby roads, watercourses and residential properties.

4.1.6 The Scheme is not considered to sterilise off-site minerals in the land surrounding the Site. This is because the proposed Solar PV Arrays and Cable Route Corridors are considered to be of low sensitivity to activities associated with mineral extraction, e.g. traffic, noise and dust (unlike, a proposed residential development for example) and therefore the presence of the Scheme (once constructed) is unlikely to present a constraint to any new mineral extraction in areas adjacent to / near the Site.

Figure 1: Site Location Plan

Sites
Proposed BESS
Proposed National Grid Substation and Point of Connection
Cable Route Corridor
1A Land Parcel Number
CRC1 Cable Route Corridor Number

N

East Pye SOLAR	Client: Island GREEN POWER	**EAST PYE SOLAR** Site Location Plan	0 1 2 km © Crown copyright and database rights [year of supply or date of publication] Ordnance Survey AC0000808122

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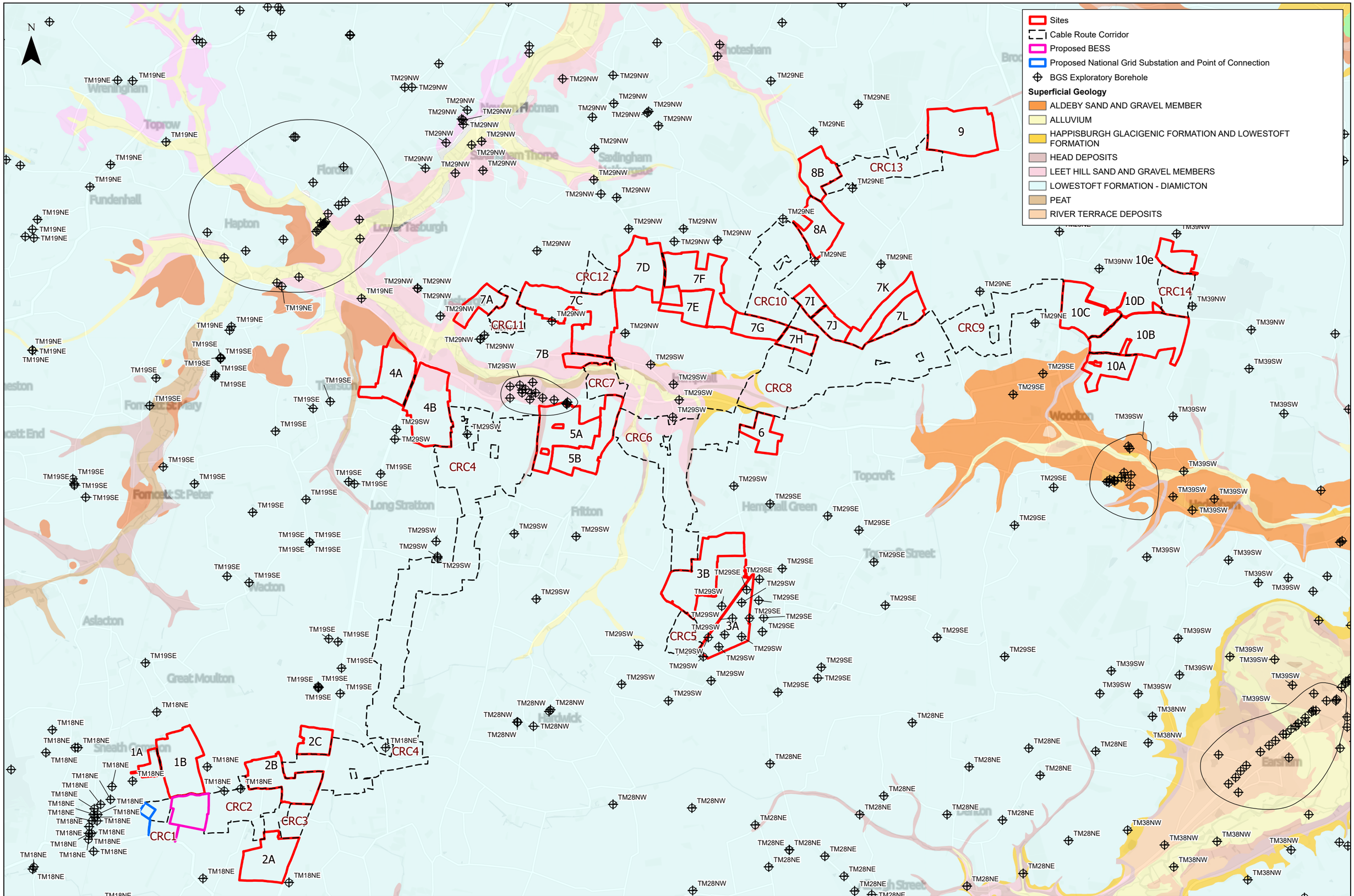
Figure 2: Superficial Strata



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Superficial Geology

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