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ARCHAEOLOGICAL CONSULTANCY REPORT ON A PROGRAMME OF GEOPHSYICS

PROPOSED SAND AND GRAVEL QUARRY, BLACK CAT ISLAND, ROXTON BEDFORDSHIRE TL 1625 5515/D1

In connection with extraction proposal

AC 3133/D3

On behalf of:

Lafarge Aggregates Ltd
The Horse Shoe
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by

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Black Cat Island, Roxton, Bedfordshire Report on Archaeogeophysical Survey 2006 by A.D.H. Bartlett

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1.0 BACKGROUND

1.1 Introduction

- 1.1.1 Archaeologica Ltd is a limited company providing archaeological consulting services. It is committed to ensuring that the client receives an effective service while maintaining the highest professional standards.
- 1.1.2 All projects are managed in accordance with and in the light of English Heritage's MAP2 Guidelines (1991), the recommendations of PPG16 and the Institute of Field Archaeologists' guidelines (1999).

1.2 Reasons for and circumstances of the project

1.2.1 It is proposed to extract mineral from the Application Site. This development would necessarily negatively affect potentially buried archaeology.

1.3 Policy background

PPG16

- 1.3.1 Planning Policy Guidance note No 16 (DoE 1990) 'Archaeology and Planning' gives Local Planning Authorities guidance on the management of the archaeology within the planning process. It states that local authority development plans should include policies for the protection, enhancement and preservation of archaeological sites and their settings.
- 1.3.2 The main thrust of the guidance in PPG16 is that where development is proposed important archaeological sites should be protected and wherever possible preserved *in situ*. Where this is not possible, preservation by record through excavation should be effected.

CBI Code of Practice for Minerals Operators

1.3.3 The guidelines within PPG16 are repeated in the CBI's Code of Practice for Mineral Operators.

EIA

1.3.4 The nature and the size of the Proposed Development falls within the remit of projects requiring an Environmental Impact Assessment. Archaeology and heritage must be considered within the impact of the proposed development.

Bedfordshire County Council Minerals and Waste Plan 2002

- 1.3.5 Section Vii of the Bedfordshire County Council Minerals and Waste Plan 2002 para 2.13 outlines the County Council policy on Mineral Planning, refers to PPG16 and follows its guidance.
- 1.3.6 It states that when considering proposals for minerals development in Bedfordshire, the County Council will seek to protect Scheduled Ancient Monuments and other important sites and their setting by:

- Ensuring developers provide sufficient information with which to evaluate the importance of the sites and to assess the potential impact of development on the archaeology;
- Resisting or seeking modification of development likely to have a negative effect upon the sites and their settings;
- Ensuring that provision is made to an adequate level of investigations and recording in advance of removal of archaeological remains that do not warrant preservation *in situ*;
- Requiring a long-term management plan from the developers where appropriate for sites of archaeological importance which are preserved *in situ*.

1.4 The commission

1.4.1 Mr Tim Deal of Lafarge Aggregates Ltd appointed Archaeologica Ltd to project manage the archaeology of this Site.

1.5 In connection with the commission

1.5.1 A desk-based archaeological study of the area (of which this report is a revision) was prepared by Bedfordshire County Archaeology Service in 1998 (BCAS 1998). It was considered necessary to revise the original work in light of recent archaeological findings from the surrounds of the Site, namely the Great Barford bypass work, and significant changes to the extent of Application Site. The revised desktop was undertaken by R J Ivens and I Lisboa in 2005.

2.0 THE SITE

- 2.1.1 The Application Area is located to the North East of the village of Roxton and sits to the East of the junction between the A421 and the A1, the Black Cat roundabout. It is delimited in to the West by the A1, the Great North Road, and to the East by the river Great Ouse. It is centred at TL 164552 (Fig 1) and covers 32 ha in extent.
- 2.1.2 The eastern edge of the Black Cat Island is in the Great Ouse valley, the river itself providing the eastern border of the Site.

2.2 Geology and soils

- 2.2.1 The Application Site is set in the River Great Ouse corridor characterised by shallow, gently undulating valley sides, intensive generally arable farming and flood plain pasture. Mature hedgerow and riverside trees feature strongly as do occasional roadside plantings and other small woodland groups.
- 2.2.2 Sheet 204 (Geological Sheet Drift) issued by the Geological Survey, shows the Application Site to consist of a drift geology of alluvium along the eastern side adjacent to the River Great Ouse and 1st and 2nd Terrace gravel over the western part of the site.

- 2.2.3 Most of the Application Site, the higher ground in the west, centre and south of the Application Site, has shallow and moderately deep soils developed over gravels. A second type of soil developed in a deeper covering of drift (Soil Type B) and overlie parts of the palaeochannels. On the lower land adjacent to the River Great Ouse, in the east of the Application Site, the soils are non-calcareous (Soil Type D) and consist of imperfectly and poorly drained clayey soils in alluvium.
- 2.2.4 Borehole survey information provided by Lafarge Redland Aggregates Ltd indicates the presence and absence of gravel deposits, as well as the depth of overburden. A detailed soil survey was undertaken by Dr McRae (1998). It identifies three types of soil within the Application Site: Soil A consists of shallow, well drained soil with topsoil, and subsoil totalling 0.5m depth over gravel. Soil B consists of deep well drained chalky loam soil with topsoil, clay loam (0.7m thick) and gravel. Alluvium is encountered in soil types C and D. Soil type D showed alluvial subsoil of at least 0.65m. soil. D shows 0.6m if top and subsoil over a lower subsoil of less clayey alluvium. This soil type is mapped in the BSG sheet as alluvium.
- 2.2.5 The overburden is likely to be a combination of topsoil, alluvium and possibly archaeological deposits. The subsoil consists of S1/S2 except for the eastern edge. In the same area of Soils D (see paragraph above) the subsoils consist of loamy upper subsoil (S1) and stoney and/or sandy lower subsoils (S2). These subsoils are 0.3m depth in general except where they underlie soil B, where they are 0.6m deep. The eastern edge of the site, the subsoils underlying D consist of clayey plastic lower subsoil/ alluvial material with a thickness over 0.8m. The Lafarge Aggregates boreholes show depths ranging from 0.45m to 3.6m. It is likely that the greater depths, mainly located adjacent to the modem river course, reflect increased depths of alluvial deposits. These may represent deposition within a river floodplain, although the greater depths may suggest former river channels. The shallower depths of overburden may reflect the locations of gravel islands situated within a meandering river in a floodplain.
- 2.2.6 The division between the clayey/alluvial subsoils S4/S5 and overlying imperfectly drained clayey soils D (East), and the better drains topsoils (S1/S2) and subsoil A to the West -the deeper soils B referring to parts of the 'palaeochannel', linear silty clay deposits- coincides with a field boundary in the present field, the field to the east, the wetter field, having remained fallow for a number of years. This boundary first appears in the Estate map of 1818 and seems to separate the two different geological formations.

2.3 Topography and landform

- 2.3.1 The Application Site is located adjacent to and in the floodplain of the River Great Ouse. Two streams cross the area, one, Rockham Ditch, forming the southern boundary of the Site, while the other, South Brook, lies to the north of the Application Site. The land is generally fairly flat sloping gently down from c. 20.5m AOD in the west to 15.5m in the east. Within this general gently sloping topography minor slight variations may be detected, probably the result of past changes in the course of the Great Ouse (palaeochannels) and consequent intervening islands.
- 2.3.2 The easternmost field of the Site sits on the actual floodplain as shown by the deep, clayey substrate.

2.4 Current land-use

2.4.1 The entire Application Site was under an agricultural regime and is partly set aside. The field in the East has been set aside for a number of years resulting in impassable vegetation growth which could not be cut.

2.5 Recent ground disturbance

- 2.5.1 There are two main areas of modern/recent disturbance: the area in the NW boundary of the site adjacent to the Black Cat roundabout where recent road improvements have taken place.
- 2.5.2 The Ordnance Survey map of 1890 shows a quarry in the northern area of the Application Site.

2.5 Known Archaeology Of The Site

- 3.3.3 The Aerial Assessment carried out by Bedfordshire County Archaeology Service covered the present Application Site and additional areas immediately to the north and south (this larger area is referred to as the Aerial Photograph Study Area). Their findings may be summarised as follows:
 - River Channels: A number of dark linear cropmarks curving north-east to south-west probably represent former river channels. On some of the gravel 'islands' in between these channels, cropmarks indicative of patterned ground and solifluction hollows are visible e.g. HSL UK 76 25, 25 June 1976, 6/1821-2, in the area marked BCAS (Luke 1998). Towards the north-east of the Aerial Photograph Study Area a dark linear cropmark orientated east to west may be a previous channel of the South Brook.
 - Archaeology: Cropmarks suggestive of ditches are visible in the north-west part of the Aerial Photograph Study Area. This cropmark was plotted by BCC HER 2664 and was added in the course of the work for the second desktop (Ivens and Lisboa 2005). The cropmarks are overlaid in the geophysical survey as light blue lines. I seems to consist of a rectangular enclosure, a droveway running approximately N-S and internal curing ditches, consistent with know late Iron Age/Romano-British settlements known in other parts of the Ouse valley.

3.0 METHODOLOGY

3.1 Introduction

- 3.1.1 A geophysical survey consisting of detailed magnetometry and magnetic susceptibility for the whole of the Site was undertaken by Bartlett-Clark Consultancy. The detailed and fully illustrated report is attached (**Part 2** of this report). The area surveyed is shown in **Fig 2**. The vegetation conditions in the Eastern field which had been set aside for a few years could not be cut mechanically and made reliable surveying impossible.
- 3.1.2 The geophysical survey consisted of two techniques: magnetic susceptibility and magnetometry. Magnetic susceptibility survey is a reconnaissance survey technique.

- It is particularly useful for detecting settlements and industrial areas which show up as high readings on the plots.
- 3.1.3 Magnetometry responds to cut features such as ditches and pits when they are silted with topsoil, which usually has a higher magnetic susceptibility than the underlying natural subsoil. It also detects the thermoremanent magnetism of fired materials, notably baked clay structures such as kilns or hearths, and so responds preferentially to the presence of ancient settlement or industrial remains.
- 3.1.4 The form, size and nature of the features producing the anomalies fall within the realm detailed magnetometer survey. This technique records cut features where the fill is magnetic, allowing the contrast between the natural background of the gravel and the more magnetic silt/sand to be recorded by the instrumentation. It records pits, hollows and ditches whether of natural or anthropogenic origin. It also records the magnetism of the different stones which became incorporated into the gravel by the movement of the ice. The interpretation of the nature of the features, whether archaeological or natural depends on (i) their size and shape, (ii) whether it falls into a pattern and (iii) the comparison of those patterns with known archaeological sites.
- 3.1.5 The observation of the irregularity of these anomalies was afforded by the use of the total detailed magnetometry throughout the Site of Proposed Development
- 3.1.6 The results of the magnetometry survey are shown in Figs 3-5 and the larger scale and raw plots are illustrated in the specialist report at the back of the present report: the large scale plots are in Fig 3-6.
- 3.1.7 In parallel with the magnetometry survey a magnetic susceptibility survey was undertaken. This is shown on Fig 7 of the Specialist report and is reproduced at the back of the report where it is overlaid with the detailed magnetometry results as **Fig** 5b.

4.0 RESULTS AND DISCUSSION

4.1 Results (Figs 3, 4)

4.1.1 Conditions of the Site appear to be favourable for the magnetic detection of archaeological features as shown by the high topsoil magnetic susceptibility values which means that there is a strong contrast between the high values of the soil filled features in relation to the background magnetic readings. The greyscale plot is shown in Fig 3 while the interpretative results are shown in Fig 4. The full set of illustrations including the larger scale plans are included as Fig 3-7 in the Specialist report which forms the second part of the present report.

Palaeochannels

4.1.2 Though numerous clusters of anomalies were identified by the survey, and some of the magnetic features within these clusters could, individually and in a suitable context, be interpreted as archaeologically significant, their overall plan and distribution strongly suggest they are of natural origin. That is clearly the case with the more substantial, inverted 'Y' shaped palaeochannel with one arm running SE-N (R,S) and joining one running SW-N to form a single channel running N-S (Q). This palaeochannel also sows in the topographic survey. These palaeochannels also show

- clearly as cropmarks and even as earthwork in aerial photographs. In the interpreted magnetometry survey (Fig 4) they are shown as *orange* sinuous lines.
- 4.1.3 Cropmarks plotted by Luke (1998) (Fig 5a) show a second palaeochannel running from the South and then dividing into two channels, towards the North-West of the Site. It does not show at all as a natural magnetic feature in the magnetometry survey but can be seen as an area of lower susceptibility readings Fig 5 (b). Shallow, linear board bands of silty clay are known to occur in the gravels of the Ouse valley. The area of this western 'palaeochannel' sits in the area of the archaeological remains of site HER 2664.

Modern disturbance

4.1.4 The magnetometer and magnetic susceptibility surveys have identified three major areas of modern disturbance which is shown by *orange hatching*: the Northwester corner of the Site by the newly rebuilt Black Cat roundabout; the southwest corner also next to the road die to roadwork disturbance. A smaller area **D** and the orange area immediately to the West sit in the area which is shown as a quarry in the 1890's first edition Ordnance survey map. The high magnetic susceptibility readings in the North-East of the Site are due to the effects of a pipeline to the East.

Archaeological features

- 4.1.5 There are anomalies of recognisable archaeological origin: they present a combination of clusters of magnetometry which forms a regular pattern which falls within recognised typology (Fig 4). This is the case of the enclosure ditches and droveways which characterised settlement sites from the Middle Iron Age onwards in this part of the Ouse valley. The enclosure ditches form the most positive of indication of settlements, while associated pits, internal and external, are less clearly recognisable as being of archaeological origin in view of the abundance of pit-like anomalies, most of which are likely to be of natural origin, which characterise the magnetic responses in this type of geology.
- 4.1.6 At the Black Cat Island, the strongest evidence for settlement, where magnetic activity is most concentrated, is located in the southern part of the Site. Here, the presence of possible enclosure ditch, enclosures, parallel ditches L, M (droveway?) seem to be represented by the cluster of anomalies F, E, and K with a further enclosure at J are suggested by the survey. A possible roundhouse seems to sit to the west of F.
- 4.1.7 The area of E, F, K, L, M coincide with raised magnetic susceptibility readings adding further weight to the interpretation of these anomalies as archaeological in origin (Fig 5b).
- 4.1.8 A second possible settlement is suggested by the cropmark site BCC HER 2664 (Fig 4, light blue lines). It sits in the northwest of the Site. The presence of this cropmark complex was not confirmed by the survey, although features which may be associated with it were detected at N, two parallel ditches and a linear feature P which roughly coincide with the cropmark features. The corresponding magnetic anomalies are slightly dislocated in relation to the cropmark equivalent features but this is often the case of cropmarks in this part of the Ouse valley. Much of the cropmark complex is located in a relatively unresponsive area of the survey possibly related to the palaochannels/ linear spread of silty soil which may not provide as much of a contrast with the soil filled features themselves, but the features are more easily visible in the greyscale plot (Fig 3)

- magnetic clusters of possible non archaeological origin
- 4.1.9 The significance of these and other clusters of magnetic anomalies (e.g., **A-D**) remains uncertain on the basis of the survey evidence alone. **D** sits in the area of the late 19th quarry.
- 4.1.10 The group of features at **H** lies close to, and may be associated with, an area of strong magnetic disturbances in the north west corner of the survey, which must be of recent origin.

4.2 Discussion

- 4.2.1 The soils and subsoils at Black Cat Island are of the same type, S1 and S2 as those found in the central band running E-W across the Dairy Farm site (Lisboa 2005), also on the Ouse valley and c 4 Km to the west of the Site. Both the central band of Dairy Farm and all the surveyed part of Back Island consist of loamy upper subsoils (S1) and stoney and/or sandy lower subsoils (S2).
- 4.2.2 At Dairy Farm the Eastern part of the Site was trenched (Beardsmore 2005) enabling comparisons and inferences to be drawn. The archaeological trenching showed that the area of that site characterised by the geology described above (S1 and S2) produced the best concordance between the geophysical anomalies thought to be of archaeological origin (ring ditch and two field boundaries, one of which turned out to be a palaeochannel on trenching). On these types of subsoil magnetometry performed better than the boulder clay to the North and the well drained clayey subsoil in the SE corner.
- 4.2.3 Both sites, Black Cat and Dairy Farm, produced a large number of dense, amorphous clusters which were thought to be of geological anomalies (Barltett 2005). At Dairy Farm the three clusters investigated through trenching showed this was the case (Beardsmore 2005). These anomalies were caused by the magnetic properties of stones incorporated within the subsoil and the gravel element. Isolated lighter clusters of magnetic anomalies, pit-like anomalies, also abound in both sites.
- 4.2.4 In examining the results of the geophysical survey at Black Cat there are three factors to take into account:
- The presence of palaeochannels/ areas of deposits of silty clay which in one case seems to obscure the magnetic response
- The presence of subsoil type S1 and S2 which at Dairy Farm seems to have allowed the geophysical survey to show a good degree of confidence.
- These types of soils also contain stones with a strong magnetic response which show up in the magnetometry survey as clusters of pit-like anomalies often easy to identify if their pattern is amorphous but this is not always the case.
- 4.2.5 In spite of these factors, at Dairy Farm it was possible to discern archaeological features on the basis of the magnetometry survey on the basis of the shape and regularity of the anomalies. Trenching confirmed the anomalies judged to be of natural origin to be so. It was possible to identify successfully the anomalies of archaeological origin as opposed to those of natural origin in soils S1/S2, narrow palaeochannels could not be distinguished from ditches. On the basis of what was learnt at Dairy Farm, the probability is that there are two settlement sites in the

- Application Site, the northern site being less certain. While other clusters of anomalies need testing (A-C, G) as while not enclosed some of the pits could be of archaeological origin.
- 4.2.6 At Dairy farm the geopmorphological study showed that the tributaries of the Ouse have been dry though much of the Holocene. However they clearly cut various course across the gravel terraces leaving filled-in channels. The Black Cat Island Site seems to conform to this pattern, as suggested by the substantial inverted 'Y' shaped palaeochannel towards the East of the Site. It is expected that there is an alluvial cover which will have blanketed the gravel and masked the original relief of the gravel surface.
- 4.2.7 The geomorphological investigations at Diary Farm showed that the landscape has been filled by the deposition of alluvium as well as colluvium. The slope at Black Cat Island is much less pronounced than at Diary Farm, with a 4 metre difference between the North-Western edge and the eastern edge of the Site, so it is less likely that there is colluvium.
- 4.2.8 The eastern area of the Site at Black Island, as the case of the southern edge of Diary Farm fall within the floodplain of the river Great Ouse. Neither area was surveyed through geophysical survey. In Dairy Farm the riverside area was criss-crossed with palaeochannels. At Black Cat Island at least one such paleochannel is known to exist and it is probable that further palaeochannels run across the unsurveyed area.

4.3 Mitigation

- 4.3.1 The results of the geophysical survey here reported will be used to inform and place trenches to test whether the magnetic anomalies are of archaeological, modern of natural origin. The archaeophysical survey has also shown areas of modern disturbance.
- 4.3.2 Evaluative trenching is to test the groups of magnetic anomalies of varied dimensions, and which are comparable with magnetic disturbances which may be associated with ancient settlement sites, marked on **Figure 8** by red cross-hatching superimposed on the anomaly outlines (A-G). The demarcation of these groups of features is rather arbitrary, and in general they lack any coherence of plan which would confirm their archaeological significance, but it may be unsafe to exclude them from consideration without further investigation.
- 4.3.3 In addition it will also aim to test whether the more probable anomalies of archaeological origin, possible enclosures and droveways are indeed of archaeological origin, and N in the North, F, J, L and M in the South.

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