ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
Bellway Homes Ltd (North East)

Cadger Bank
Lanchester
County Durham

geophysical survey

report 3141
April 2013

Durham University

Contents

Figures

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1. Summary

The project

1.1 This report presents the results of a geophysical survey conducted in advance of proposed development at Cadger Bank, Lanchester, County Durham. The works comprised geomagnetic survey or *c*. 3ha of pasture.

1.2 The works were commissioned by Bellway Homes Ltd (North East) and conducted by Archaeological Services Durham University.

Results

1.3 Probable soil-filled ditch and pit features relating to the Roman *vicus* at *Longovicium* were identified in Areas 1 and 2, with possible evidence of industrial activity.

1.4 A probable Roman road running east from the *vicus* has been identified in Area 2.

1.5 A former field boundary, as recorded by historic Ordnance Survey editions, has been identified in Area 2.

1.6 Former agricultural regimes have been detected across Areas 1 and 2.

1.7 A ferrous water main has been identified in Areas 1 and 2. The strong magnetic response of this has hindered the geomagnetic detection of potential archaeological features within its vicinity.

2. Project background

Location (Figure 1)

2.1 The survey areas were located on land to the north of Cadger Bank, to the south-west of Lanchester, County Durham (NGR centre: NZ 1604 4723). Four surveys totalling *c*. 3ha were conducted in four land parcels. To the east and north was a housing estate, to the south and west was the Scheduled Ancient Monument of *Longovicium* Roman fort and *vicus*. Cadger Bank, the B 6296 road, bordered proposed development area to the immediate south. Alderdene Beck flows through the north of the proposed development area.

Development proposal

2.2 The development proposal is for housing.

Objective

2.3 The principal aim of the surveys was to assess the nature and extent of any sub-surface features of potential archaeological significance within the proposed development area, so that an informed decision may be made regarding the nature and scope of any further scheme of archaeological works that may be required in relation to the development.

Methods statement

2.4 The surveys have been undertaken in accordance with national standards and guidance (see para. 5.1 below).

Dates

2.5 Fieldwork was undertaken on 10th April 2013. This report was prepared for April 2013.

Personnel

2.6 Fieldwork was conducted by Jamie Armstrong, Matt Claydon and Patricia Edwards. The geophysical data were processed by Richie Villis. This report was prepared by Richie Villis with illustrations by Janine Watson and edited by Duncan Hale, the Project Manager.

Archive/OASIS

2.7 The site code is **CBL13**, for **C**adger **B**ank **L**anchester 20**13**. The survey archive will be supplied on CD to the client for deposition with the project archive in due course. Archaeological Services Durham University is registered with the **O**nline **A**cces**S** to the **I**ndex of archaeological investigation**S** project (**OASIS**). The OASIS ID number for this project is **archaeol3-148583**.

3. Historical and archaeological background

3.1 The Roman fort of *Longovicium*, which was located *c*. 140 m to the south-west of the proposed development area, was built at around AD150 and covers an area of about 2.3ha. It was rebuilt around AD230 and again in the early 4th century. The fort was a later addition to a chain of defensive forts along the Roman road of Dere Street.

3.2 Previous archaeological work has shown that the interior of the fort could have held up to 1000 soldiers and included barracks, granaries and a *praetorium* or

commandant's house, and that there was an aqueduct and a cemetery to the south-west of the fort (for example, Casey *et al*. 1992; Turner 1990).

3.3 Outside the fort several phases of geophysical survey have shown that there was an extensive *vicus* to the north, south and east, along the line of Dere Street (Archaeological Services 2008a, 2008b, 2009; Cousins 1990; Noel 1991; Payne 1991).

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised four fields of pasture.

4.2 Area 1 occupied a north-east facing slope, with elevations of between *c.* 163m and 153m OD. Area 2 also occupied a north-east facing slope, with elevations between *c*. 160m and 138m OD. Area 3 occupied a narrow, fairly flat area of land between a steep bank to the south and Alderdene Burn to the north, with a mean elevation of *c*. 135m OD. Area 4 occupied a small west-facing slope to the north of a steep slope down to Alderdene Burn and just west of Broadoak Drive, with elevations between *c*. 130-132m OD.

4.3 The underlying solid geology of the area comprises Westphalian mudstone, siltstone and sandstone strata of the Pennine Middle Coal Measures Formation, which are overlain by, in the main, Devensian till.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Institute for Archaeologists (IfA) *Standard and Guidance for archaeological geophysical survey* (2011); the IfA Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Guide to Good Practice: Geophysical Data in Archaeology* (Schmidt & Ernenwein 2011).

Technique selection

5.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a suite of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar, electromagnetic survey and topsoil magnetic susceptibility survey. Some techniques are more suitable than others in particular situations, depending on site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.

5.3 In this instance, based on previous work, it was considered likely that cut features such as ditches and pits would be present on the site, and that other types of feature such as trackways, wall foundations and fired structures (for example kilns and hearths) might also be present.

5.4 Given the anticipated shallowness of targets and the non-igneous geological environment of the study area a geomagnetic technique, fluxgate gradiometry, was considered appropriate for detecting the types of feature mentioned above. This technique involves the use of hand-held magnetometers to detect and record anomalies in the vertical component of the Earth's magnetic field caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect archaeological features.

Field methods

5.5 A 30m grid was established across each survey area and related to the Ordnance Survey National Grid using a Leica GS15 global navigation satellite system (GNSS) with real-time kinematic (RTK) corrections typically providing 10mm accuracy.

5.6 Measurements of vertical geomagnetic field gradient were determined using Bartington Grad601-2 dual fluxgate gradiometers. A zig-zag traverse scheme was employed and data were logged in 30m grid units. The instrument sensitivity was nominally 0.03nT, the sample interval was 0.25m and the traverse interval was 1m, thus providing 3,600 sample measurements per 30m grid unit.

5.7 Data were downloaded on site into a laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

5.8 Geoplot v.3 software was used to process the geophysical data and to produce both continuous tone greyscale images and trace plots of the raw (minimally processed) data. The greyscale images and interpretations are presented in Figures 2-5; the trace plots for Areas 1 and 2 are provided in Figure 6. In the greyscale images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. A palette bar relates the greyscale intensities to anomaly values in nanoTesla.

5.9 The following basic processing functions have been applied to each dataset:

clip	clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic
zero mean traverse	sets the background mean of each traverse within a grid to zero; for removing striping effects in the traverse direction and removing grid edge discontinuities
destagger	corrects for displacement of geomagnetic anomalies caused by alternate zig-zag traverses
interpolate	increases the number of data points in a survey to match sample and traverse intervals; in this instance the data have been interpolated to 0.25m x 0.25m intervals

Interpretation: anomaly types

5.10 Colour-coded geophysical interpretation plans are provided. Three types of geomagnetic anomaly have been distinguished in the data:

positive magnetic	regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic susceptibility soil-filled structures such as pits and ditches
negative magnetic	regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility such as wall footings and other concentrations of sedimentary rock or voids
dipolar magnetic	paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials (including fences and service pipes) and/or fired structures such as kilns or hearths

Interpretation: features

General comments

5.11 Colour-coded archaeological interpretation plans are provided.

5.12 Except where stated otherwise in the text below, positive magnetic anomalies are taken to reflect relatively high magnetic susceptibility materials, typically sediments in cut archaeological features (such as ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning.

5.13 Series of parallel, weak, positive and negative magnetic anomalies, which almost certainly reflect former agricultural regimes, have been detected across Areas 1 and 2.

5.14 Small, discrete dipolar magnetic anomalies have been detected in all of the survey areas. These almost certainly reflect items of near-surface ferrous and/or fired debris, such as horseshoes and brick fragments, and in most cases have little or no archaeological significance. A sample of these is shown on the geophysical interpretation plans, however, they have been omitted from the archaeological interpretation plans and the following discussion. Dipolar magnetic anomalies detected around the edges of survey areas reflect the proximity of metal field boundaries.

Area 1

5.15 Several linear positive magnetic anomalies have been detected in this area. These anomalies reflect relative increases in high magnetic susceptibility materials and almost certainly represent the remains of soil-filled ditches. These are almost certainly associated with enclosures which are likely to form part of the Roman *vicus* of *Longovicium*. Some of these anomalies in the south and west of the area were identified by previous surveys (Payne 1991).

5.16 A north-west/south-east aligned large and strong dipolar magnetic anomaly has been detected in the west of the area. This reflects a ferrous water main, as detected in previous surveys (Payne 1991), which continues to the north-west through Area 2 and previous surveys (Archaeological Services 2009). The strong

magnetic response of this feature, extending beyond the physical impact of the service, has hindered the detection of weaker features, such as extensions of the probable enclosure ditches.

Area 2

5.17 A large number of linear and rectilinear positive magnetic anomalies have also been detected in this area. As in Area 1 these almost certainly reflect the remains of soil-filled features, and are likely to be associated with Roman *vicus* enclosures.

5.18 A negative magnetic anomaly flanked by two positive magnetic anomalies has been detected aligned broadly east/west near the centre of the area. The negative magnetic anomaly may reflect a metalled surface. The two flanking anomalies are likely to reflect former ditches, such as drainage ditches along a roadside. These anomalies are likely to reflect a Roman road, which often have metalled surfaces close to settlements, such as the extensive *vicus* to the west, before giving way to earthen tracks. The earth part of the track has not been detected and may be ploughed out.

5.19 A number of discrete positive magnetic anomalies have also been detected in this area. These almost certainly reflect soil-filled pit features.

5.20 Linear negative magnetic anomalies may reflect areas of stone work, such as walls or stone drains. Two parallel anomalies with an associated positive magnetic anomaly aligned broadly north-east/south-west, have been detected near the centre of the survey area. These correspond to a former field boundary as recorded by historic OS editions.

5.21 Some of the larger dipolar magnetic anomalies detected amongst the enclosure ditches may reflect the remains of industrial activity.

5.22 The large and strong dipolar magnetic anomaly detected at the west of the area reflects a continuation of the ferrous water main detected in Area 1. As in Area 1 the strong magnetic response of this service has hindered detection of weaker magnetic anomalies.

Area 3

5.23 No features of archaeological significance have been identified in this area.

Area 4

5.24 No features of archaeological significance have been identified in this area.

6. Conclusions

6.1 Approximately 3ha of geomagnetic survey was undertaken at Cadger Bank, Lanchester prior to proposed housing development.

6.2 Probable soil-filled ditch and pit features relating to the Roman *vicus* of *Longovicium* were identified in Areas 1 and 2, with possible evidence of industrial activity.

6.3 A probable Roman road running east from the *vicus* has been identified in Area 2.

6.4 A former field boundary, as recorded by historic OS editions, has been identified in Area 2.

6.5 Former agricultural regimes have been detected across Areas 1 and 2.

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7. Sources

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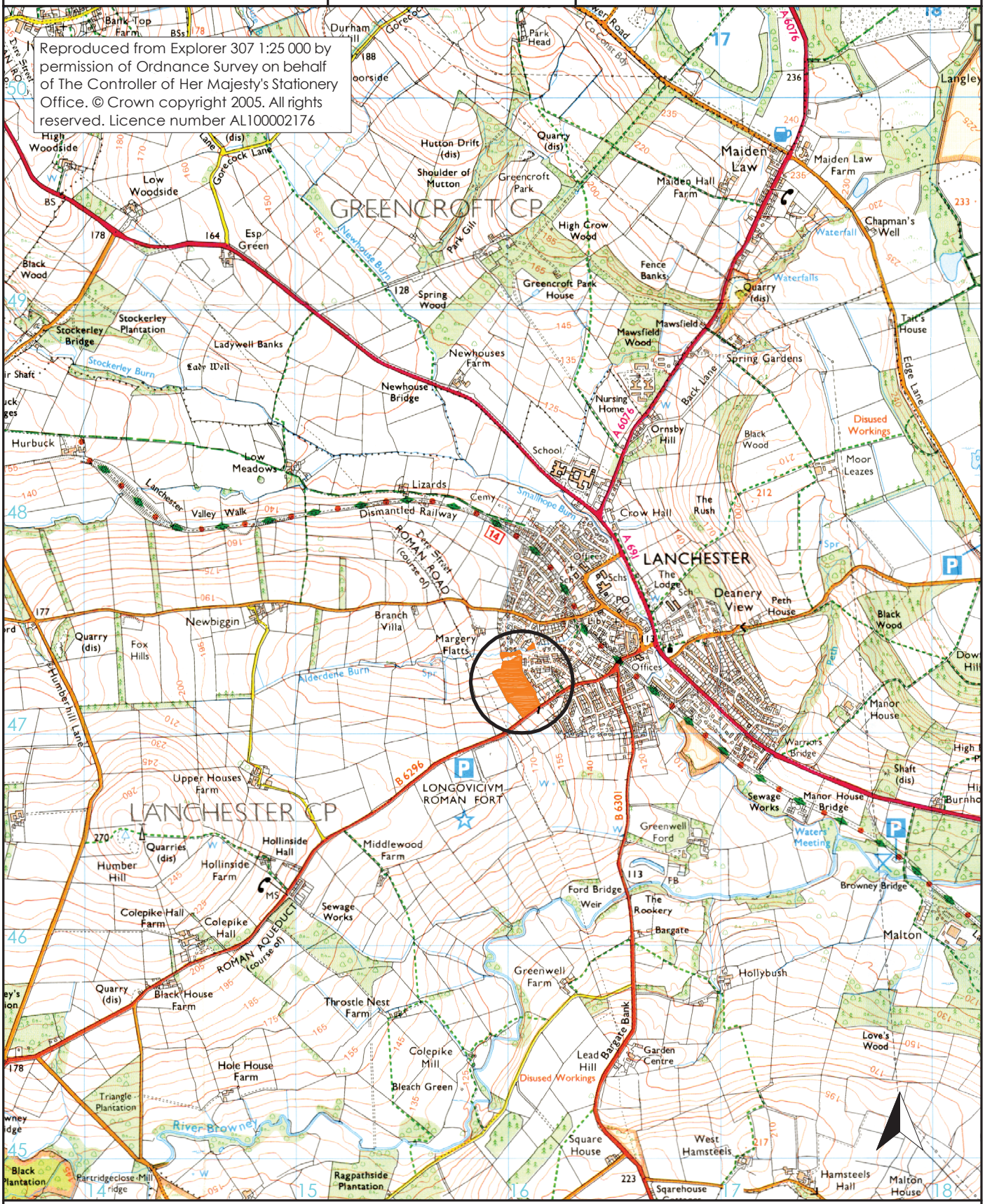
Figure 1: Site location



magnetic survey

previous survey

scheduled ancient monument

-5 nT 5

Area 4

Area 3

Area 2

Area 1

474

473

472

471

159

160

161

B6296 CADGER BANK

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0 50m
scale 1:1250 for A3 plot

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Figure 2: Geophysical survey overview

Area 4

Area 3

Area 2

Area 1

474

473

472

471

159

160

161

B6296 CADGER BANK

magnetic survey

previous survey

scheduled ancient monument

-5 nT 5

0 50m

scale 1:1000 for A2 plot

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Figure 3: Geophysical survey

Area 4

Area 3

Area 2

Area 1

474

473

472

471

159

160

161

B6296 CADGER BANK

magnetic survey

previous survey

scheduled ancient monument

dipolar magnetic anomaly

positive magnetic anomaly

negative magnetic anomaly

0 50m

scale 1:1000 for A2 plot

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Figure 4: Geophysical interpretation

Area 4

Area 3

Area 2

Area 1

474

473

472

471

159

160

161

B6296 CADGER BANK

magnetic survey

previous survey

scheduled ancient monument

soil-filled feature

possible stone feature

service

ridge and furrow

former field boundary

road surface

0 50m

scale 1:1000 for A2 plot

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Figure 5: Archaeological interpretation

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0 50m
scale 1:1000 for A3 plot

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Figure 6: Trace plots of Areas 1 and 2