



Archaeological Services
University of Durham

Bradley Surface Mining Scheme, Leadgate, County Durham

geophysical surveys

on behalf of

UK Coal Mining Ltd

Report 1855

April 2008

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1. Summary

The project

- 1.1 This report presents the results of geophysical surveys conducted in advance of a proposed surface mining scheme at Bradley, near Leadgate in County Durham. The works comprised geomagnetic survey of approximately 50% (32ha) of the area to be subject to ground disturbance.
- 1.2 The works were commissioned by UK Coal Mining Ltd and conducted by Archaeological Services Durham University.

Results

- 1.3 Traces of ridge and furrow cultivation and former field boundaries have been detected across much of the area, some of which may be medieval.
- 1.4 Occasional magnetic anomalies throughout the study area could reflect the remains of ditch features of unknown date, though a number of these correspond to paths and tracks evident on aerial photographs.
- 1.5 Remains of early surface mining, generally in the form of clusters of bell-pits, have been detected across the central and southern parts of the site.
- 1.6 The surveys have not identified any geomagnetic evidence for the 'Western Way' waggonway.

2. Project background

Location (Figure 1)

- 2.1 The study area for the proposed Bradley Surface Mining Scheme comprised approximately 65ha of land at West Billingside, between Leadgate and Pontop, in County Durham (NGR centre: NZ 13515 52796). The site is bounded to the north and west by woodland (Billingside Wood and Billingside Plantation respectively) and to the south and east by the A692 Gateshead to Consett road. Twenty-three surveys totalling approximately 32.5ha (50% of the land to be disturbed), were undertaken in 18 land parcels.

Development proposal

- 2.2 Planning permission is currently being sought for the establishment of a surface coal mining facility and associated infrastructure.

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 advance of development.

Methods statement

- 2.4 The surveys have been undertaken in accordance with a brief provided by UK Coal and a Written Scheme of Investigation (WSI) prepared by Archaeological Services and approved by the Assistant County Archaeologist at Durham County Council.

Dates

- 2.5 Fieldwork was undertaken between 17th and 25th March 2008. This report was prepared between 26th March and 16th April 2008.

Personnel

- 2.6 Fieldwork was conducted by Graeme Attwood (Supervisor), Andrew Blair, Matt Claydon, Edward Davies, Natalie Swann and Richie Willis. This report was prepared by Duncan Hale and Graeme Attwood with illustrations by Edward Davies and Janine Wilson. The Project Manager was Duncan Hale.

Archive/OASIS

- 2.7 The site code is **BSM08**, for **Bradley Surface Mining 2008**. The survey archive will be deposited with the Bowes Museum. Archaeological Services is registered with the **Online AccesS to the Index of archaeological investigationS** project (OASIS). The OASIS ID number for this project is **archaeol3-40674**.

3. Archaeological and historical background

- 3.1 An archaeological desk-based assessment (DBA) of the study area was conducted by Tyne & Wear Museums Archaeology (TWM Archaeology 2006). Additional information has since been collated by the Pont Valley Network and supplied to the County Archaeologist for consideration (Pont Valley Network 2007). Information from both these sources is summarised here.
- 3.2 There are no known prehistoric sites within the immediate area though some cropmarks on aerial photographs could relate to prehistoric features.
- 3.3 There is no known evidence for Romano-British features within or adjacent to the site. Dere Street Roman Road runs approximately 500m to the west of the site and Roman forts are located at Ebchester and Lanchester.
- 3.4 There are no known early medieval features within or in the immediate vicinity of the site, though place-name evidence suggests an Anglo-Saxon origin for some nearby settlements including Iveston, Medomsley, Bradley and Billingside.
- 3.5 References to the above villages were first documented in the 12th and 13th centuries. Medieval cultivation remains in the form of broad ridge and furrow are evident on aerial photographs of the site. Bradley Hall, which lies about 500m north of the site, was originally a medieval moated hall, though it was rebuilt in both the 17th and 19th centuries.
- 3.6 From the post-medieval period up to the 20th century coal-mining has played a significant role in the history and landscape of this general area and, to some extent, the study site. Collieries were present all around the present site at Medomsley, Eden, Pont Head and Pontop, which were served by the Pont Valley Waggonway and later waggonways (including the Western Way) and tramways. Areas of early surface mining and bell-pitting are evident on aerial photographs of the study area. Post-medieval farmsteads were located at West and East Billingside and narrow ridge and furrow remains (presumed to be post-medieval) have also been identified on aerial photographs of the site.

4. Landuse, topography and geology

- 4.1 At the time of survey the proposed development area comprised 65ha, the majority of which was pasture, divided by tracks and hedgerows. Only Areas 19 and 22/23 have been ploughed recently. Survey was conducted over 50% of each of 18 fields throughout the site. Parts of the study area had been precluded from the survey brief because they were either ponds/marshy areas, wooded, former opencast mining areas or areas to be left undisturbed by the proposed development. The only parcel not sampled by geophysical survey was the small and overgrown site of the former West Billingside farmstead in the central part of the study area.

- 4.2 The study area occupies parts of the north and north-west facing slopes of Pontop Fell, ranging in elevation from 270m OD in the south-west, by the A692 road, down to 165m OD in the north near the Pont Burn.
- 4.3 The underlying solid geology of the area comprises Carboniferous (Westphalian) Pennine Middle Coal Measures, which are here overlain by Devensian Till.

5. Geophysical survey

Standards

- 5.1 The surveys and reporting were conducted in accordance with English Heritage Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation, 2nd edition* (David forthcoming); the Institute of Field Archaeologists Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2001).

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 variety of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar and electromagnetic survey. Some techniques are more suitable than others in particular situations, depending on a variety of 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 existing evidence, it was known that cut features such as furrows, ditches and pits would be present on the site, and that traces of other types of feature such as waggonways, tracks, wall foundations and fired structures (for example kilns and hearths) might also survive.
- 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 Survey was conducted in 18 land parcels, with the survey area in each parcel covering 50% of the area of that parcel. The geophysical surveys were located to avoid partial grids, field boundaries, former opencast mining areas, ponds or marshes and areas that would be left undisturbed by the proposed development, as identified in the tender documentation. The survey locations

were agreed with the Assistant County Archaeologist at Durham County Council prior to the commencement of survey.

- 5.6 A 30m grid was established across each survey area and tied-in to known, mapped Ordnance Survey points using a Trimble Pathfinder Pro XRS global positioning system (GPS) with real-time correction providing sub-metre accuracy.
- 5.7 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 set to 0.1nT, the sample interval to 0.25m and the traverse interval to 1.0m, thus providing 3600 sample measurements per 30m grid unit.
- 5.8 Data were downloaded on site into laptop computers for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

- 5.9 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 (unfiltered) data. The greyscale images and interpretations are presented in Figures 2-4; the trace plots are provided in Figure 5. In the greyscale images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. Palette bars relates the greyscale intensities to anomaly values in nanoTesla.

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

<i>clip</i>	clips, or limits data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic.
<i>zero mean traverse</i>	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.
<i>destagger</i>	corrects for displacement of anomalies caused by alternate zig-zag traverses.
<i>despike</i>	locates and suppresses iron spikes in gradiometer data.
<i>interpolate</i>	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

- 5.11 Colour-coded geophysical interpretation plans are provided in Figure 3. Three types of geomagnetic anomaly have been distinguished in the data:

<i>positive magnetic</i>	regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic
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	susceptibility soil-filled structures such as pits and ditches.
<i>negative magnetic</i>	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.
<i>dipolar magnetic</i>	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

- 5.12 Many of the anomalies detected in these surveys correspond to cropmark features identified in the DBA report (TWM Archaeology 2006), however, a number of these are interpreted differently in this survey report.
- 5.13 Colour-coded archaeological interpretation plans are provided in Figure 4.
- 5.14 Except where stated otherwise in the text below, positive magnetic anomalies are taken to reflect relatively high magnetic susceptibility materials, typically sediments in cut features (such as furrows, ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning, though they can also indicate features such as fired clay drains, for example.
- 5.15 Series of parallel, alternate positive and negative magnetic anomalies have been detected much of the study area. These anomalies almost certainly reflect former ridge and furrow cultivation. The broader riggs are presumed to be medieval in date whereas the narrower riggs are presumed to be post-medieval.
- 5.16 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.

Area 1

- 5.17 Well-defined, straight and narrow, parallel positive magnetic anomalies were detected across this survey area at approximately 9m intervals, aligned north-east/south-west. These anomalies almost certainly reflect land drains rather than ridge and furrow remains, though it is possible that the drains were laid along former furrows.
- 5.18 Large positive and negative magnetic anomalies along the southern limit of this survey indicate the proximity of a steel gas main. This pipe appears to be aligned more towards the north-eastern corner of the field than is shown on the

supplied site drawing. A linear cropmark which extends across the northern part of the site for almost 1km corresponds to the course of this pipeline.

- 5.19 A few extremely weak linear magnetic anomalies aligned north-west/south-east here, and more prominently in adjacent areas, could reflect a former plough direction.
- 5.20 Additional weak positive magnetic anomalies here could reflect soil-filled features.

Area 2

- 5.21 Straight and narrow, parallel positive magnetic anomalies were also detected across this area, again at approximately 9m intervals, here aligned north-west/south-east. These anomalies again almost certainly reflect land drains rather than ridge and furrow remains, though it is possible that the drains were laid along former furrows.
- 5.22 Chains of large dipolar magnetic anomalies were detected across the southern part of the survey and along the south-western limit of this survey, indicating the presence and proximity of ferrous pipes there.
- 5.23 Additional, very weak, linear positive magnetic anomalies here could reflect soil-filled features, two of which continue north into Area 3.

Area 3

- 5.24 A series of straight and narrow, well-defined parallel positive magnetic anomalies in this area is almost certainly a continuation of the drainage system detected in Area 2, which may follow earlier plough furrows.
- 5.25 Other weak linear positive magnetic anomalies here could reflect soil-filled features, two of which appear to continue from Area 2.

Area 4

- 5.26 Parallel positive and negative magnetic anomalies were detected in the north-western part of this area. These anomalies are slightly arcuate, are more diffuse than those described above and are considered likely to reflect traces of ridge and furrow cultivation. The traces are oriented perpendicular to those shown in the DBA.
- 5.27 The surveys have not detected evidence of bell-pitting in this area, as indicated in the DBA, although it is possible that some of the small dipolar magnetic anomalies could reflect ferrous items in the backfill of such features. However, bell-pits elsewhere in the study area have been clearly represented in the geophysical data.
- 5.28 Two weak and discontinuous positive magnetic anomalies in the eastern part of the survey area correspond to a former field boundary and track shown on the first edition Ordnance Survey (OS) of 1862-64.

- 5.29 Three additional linear positive magnetic anomalies here could reflect soil-filled ditches or drains.
- 5.30 The gas main appears to lie just to the north of its shown location on the supplied site plan. It is evident in the eastern corner of the survey area as a large intense dipolar magnetic anomaly.

Area 5

- 5.31 Possible former ridge and furrow cultivation has been detected across this area, aligned north-west/south-east, parallel to the field boundaries. The anomalies are evenly spaced at *c.*6.5m intervals. This is contrary to the aerial photographic evidence in the DBA which reports broad rigg on a different alignment. An additional linear anomaly could reflect ditch remains.
- 5.32 A concentration of intense dipolar magnetic anomalies at the north-eastern limit of this survey corresponds to an old coal level shown on the first OS revision of 1898-99.

Area 6

- 5.33 Possible former ridge and furrow cultivation has been detected across this area, again aligned north-west/south-east, parallel to the field boundaries and the traces detected in Area 5 to the immediate north. This is on a different alignment to that shown in the DBA.
- 5.34 A curvilinear magnetic anomaly aligned broadly east-west corresponds to the location of a grassed trackway across the field.

Area 7

- 5.35 A circular hollow in this survey area corresponds to the location of a former well, shown on the first edition OS of 1862-64.
- 5.36 A former field boundary and probable traces of ridge and furrow cultivation were detected as parallel positive and negative magnetic anomalies in the western part of the survey.
- 5.37 An extremely weak positive magnetic anomaly aligned broadly east-west corresponds to the location of a grassed trackway.

Area 8

- 5.38 Probable traces of former ridge and furrow cultivation have been detected throughout this survey, aligned north-west/south-east. These traces are overlain by large, intense positive and negative magnetic anomalies which are almost certainly associated with former surface mining activities; these more evident in Areas 9 and 10 to the south.
- 5.39 An extremely weak positive magnetic anomaly aligned broadly east-west may reflect a grassed path or track, or a trench for the water supply to troughs around the site.

Area 9

- 5.40 Probable traces of former ridge and furrow cultivation have also been detected throughout this survey area aligned north-west/south-east. These traces are again overlain by large, intense positive and negative magnetic anomalies, the majority of which are almost certainly backfilled bell-pits and other surface mining features, located on the steeper part of the field.

Area 10

- 5.41 A broad band of bell-pits and other mining features have been detected across the central, steeper, part of this field. The bell-pits typically appear to measure 3-4m across. A broad positive magnetic anomaly detected beneath the steeper ground may reflect the remains of a soil-filled ditch or earthen bank, which, if contemporary, would form a western boundary to the mining activity. Two short lengths of probable ditch which were detected to the west of this possible boundary could represent part of a double-ditched trackway, or ditches associated with a waggonway.
- 5.42 Faint traces of possible former ridge and furrow cultivation have been detected in this survey area aligned north-west/south-east.
- 5.43 A number of other linear anomalies were detected in this area. Several straight, narrow and inter-connecting anomalies almost certainly reflect land drains, which appear to post-date the mining activity and possible boundary feature. Two broader positive magnetic anomalies probably reflect soil-filled ditches, possibly former field boundaries, though as with the other possible boundary feature above, none is shown on early OS editions.
- 5.44 A linear anomaly parallel to the track along the south-eastern boundary of the field could also reflect the remains of a ditch and, given its location, it could be associated with the former 'Western Way' waggonway, whose course is believed to underlie the track here (Pont Valley Network 2007).

Area 11

- 5.45 Remains of narrow-gauge ridge and furrow cultivation have been detected throughout this area, and were evident on the ground during survey.
- 5.46 A number of intense magnetic anomalies at the northern end of the survey area correspond to bell-pits, also noted on the ground during survey. Two large intense dipolar magnetic anomalies to the south of here correspond to existing pylons, and between them is another area of bell-pitting.
- 5.47 Three curvilinear positive magnetic anomalies were detected here. Two of these may reflect partial ditch remains and could correspond to features on aerial photographs, while the third may reflect a former ditch or gully defining the southern edge of a group of bell-pits.

Area 12

- 5.48 Traces of narrow-gauge ridge and furrow cultivation have been detected throughout this small survey area.

- 5.49 Some large, intense dipolar magnetic anomalies here almost certainly indicate the presence of large ferrous items.

Area 13

- 5.50 The only anomalies detected here reflect near-surface ferrous/fired litter.

Area 14

- 5.51 Remains of narrow-gauge ridge and furrow cultivation have been detected throughout this area, and were evident on the ground during survey.
- 5.52 A broad band of small dipolar magnetic anomalies crossing the survey east-west almost certainly reflects brick rubble or clinker hardcore used for the former trackway between East Billingside and West Billingside farmsteads, as shown on all early OS editions. The location of the anomaly also broadly corresponds to the course of a private water main and footpath, as shown on the supplied site plan.
- 5.53 A large dipolar magnetic anomaly detected near the centre of the field almost certainly reflects a large ferrous object.

Area 15

- 5.54 A large dipolar magnetic anomaly detected near the centre of this survey area represents a pylon.
- 5.55 Traces of ridge and furrow cultivation have been detected throughout this survey area.
- 5.56 No trace of the former 'Western Way' waggonway, as described by the Pont Valley Network (2007), has been detected in the southern part of the survey.

Area 16

- 5.57 The survey area lay immediately north of an embankment associated with a former, late 19th-century railway, the South Medomsley Branch of the North Eastern Railway (NER).
- 5.58 Traces of ridge and furrow cultivation aligned north-west/south-east have been detected throughout this survey area.
- 5.59 Brick and metal fragments were noted on the ground surface here. These will have contributed to the relatively high concentration of ferrous/fired litter detected by the survey.
- 5.60 A few possible ditch remains have been detected, but no evidence for the Western Way waggonway crossing the field north-east/south-west, as described by the Pont Valley Network (2007).

Area 17

- 5.61 This survey was undertaken immediately south-west of the former East Billingside farmstead. A chain of small dipolar magnetic anomalies crossing

the survey east-west almost certainly reflects brick rubble or clinker hardcore used for the former trackway between East Billingside and West Billingside farmsteads, as shown on all early OS editions. The location of the anomaly also broadly corresponds to the course of a private water main and footpath, as shown on the supplied site plan.

- 5.62 Traces of ridge and furrow earthworks aligned north-west/south-east were noted and have been detected geophysically in part of this area, however, the survey is dominated by intense dipolar magnetic anomalies reflecting ferrous/fired litter. This concentration of anomalies corresponds to an area of bell-pitting, which post-dates the ridge and furrow.

Area 18

- 5.63 The probable remains of backfilled bell-pits have been detected in two areas here: along the south side of the former South Medomsley Branch of the NER and in the western part of the field. Some of the large dipolar magnetic anomalies along the side of the railway could reflect ferrous litter associated with the railway. An old quarry is marked on the first edition OS between these two areas.
- 5.64 Intense positive and negative magnetic linear anomalies were detected just south of the former railway in the western part of the field. These anomalies are associated with very high magnetic susceptibility materials and could reflect features associated with the railway, possibly part of a siding for example.
- 5.65 Traces of narrow ridge and furrow earthworks aligned north-west/south-east were observed on the ground and have been detected in the survey. These are most evident at the eastern end of the field, which had previously been a separate field.
- 5.66 Occasional other anomalies across this area could reflect the remains of soil-filled ditches or grassed tracks, as evident on aerial photographs.

Area 19

- 5.67 The most prominent, intense anomaly detected here reflects a disused gas main, which was also detected across Areas 21-23. The course of the pipe deviates slightly from that shown on the supplied site plan, and gives rise to the long linear cropmark noted on aerial photographs.
- 5.68 Weak traces of probable ridge and furrow cultivation were detected throughout this survey area aligned north-west/south-east. Slightly arcuate anomalies on broadly the same alignment could reflect an earlier phase of ploughing. Both of these sets of anomalies run perpendicular to recent ploughing. A former field boundary is evident as a stronger linear anomaly, also aligned north-west/south-east.
- 5.69 A number of other positive magnetic lineations across this area could reflect ditch remains.

Area 20

- 5.70 This survey is characterized by intense parallel positive and negative anomalies aligned north-west/south-east. These correspond to narrow ridge and furrow remains evident on the ground during survey.
- 5.71 Occasional other anomalies across this area could reflect the remains of soil-filled ditches or grassed tracks, as evident on aerial photographs.

Area 21

- 5.72 The remains of narrow ridge and furrow have been detected across the majority of this area, and were evident on the ground, aligned north-east/south-west.
- 5.73 Many former bell-pits were also evident on the ground here, particularly in the western and central parts of the field. These have been detected geophysically. Occasional large intense magnetic anomalies in the eastern part of this field are also likely to reflect bell-pits or ferrous materials. An old coal level is shown to the north of this survey area on the first edition OS.
- 5.74 The disused gas main continues across this area.

Areas 22 and 23

- 5.75 These surveys were both undertaken within the same field and show a high concentration of backfilled bell-pits and ferrous/fired litter. Old coal levels and shafts are shown to the north of this survey area on the first edition OS.
- 5.76 A modern plough direction was recorded aligned north-east/south-west in this field, traces of which have been detected by the survey.
- 5.77 The disused gas main continues across this field.

6. Conclusions

- 6.1 Approximately 32ha of geomagnetic survey has been conducted on land for the proposed Bradley Surface Mining Scheme near Leadgate in County Durham.
- 6.2 Traces of ridge and furrow cultivation and former field boundaries have been detected across much of the area, some of which may be medieval.
- 6.3 Occasional magnetic anomalies throughout the study area could reflect the remains of ditch features of unknown date, though a number of these correspond to paths and tracks evident on aerial photographs.
- 6.4 Remains of early surface mining, generally in the form of clusters of bell-pits, have been detected across the central and southern parts of the site.
- 6.5 Services and land drains were detected in a number of areas.

- 6.6 The surveys have not detected magnetic anomalies which might have been associated with the 'Western Way' waggonway, along its route parallel and north of the later NER branch line as indicated by the Pont Valley Network.
- 6.7 It is understood that a programme of trial trench evaluation will follow this geophysical investigation.

7. Sources

David, A, forthcoming *Geophysical survey in archaeological field evaluation*, 2nd edition, Research and Professional Services Guideline 1, English Heritage

Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*, Technical Paper 6, Institute of Field Archaeologists

Pont Valley Network 2007 *A brief study of the history in and around Billingside*, unpublished report, and additional material collated by the Pont Valley Network and supplied to the Durham County Archaeologist

Schmidt, A, 2001 *Geophysical Data in Archaeology: A Guide to Good Practice*, Archaeology Data Service, Arts and Humanities Data Service

TWM Archaeology 2006 *Bradley County Durham Archaeological Desk-based Assessment*, unpublished report 88 for UK Coal, Tyne & Wear Museums Archaeology

Appendix: Project brief

UK COAL MINING LTD

CONSULTANTS BRIEF

**WRITTEN SCHEME OF INVESTIGATIONS FOR ARCHAEOLOGICAL
EVALUATION (INCLUDING GEOPHYSICS) ON LAND AT WEST BILLINGSIDE
(BRADLEY OPEN CAST COAL SITE), LEADGATE, COUNTY DURHAM.**

1. Introduction

- 1.1 This project design represents a methods statement for undertaking an archaeological evaluation, including a geophysical survey, in advance of a proposed opencast coal mine, associated spoil heaps, buildings and access at Bradley, County Durham.
- 1.2 The site is located in a wider archaeological landscape containing medieval and post-medieval agricultural remains, including extensive ridge and furrow, whilst aerial photographs of the site show possible prehistoric features. A detailed summary of the potential of the site is provided by a recent archaeological desk-based assessment undertaken by Tyne and Wear Museums (Scott, 2006). This is available for consultation at the Durham SMR.
- 1.3 In view of both the scale of the site and the cropmarks identified, there is a potential for remains of prehistoric and medieval date to be present on the site.
- 1.4 The proposed development area is in the county of Durham. Durham County Council (DCC) Archaeology Section has advised that the archaeological potential of the site should be further investigated to support a planning application. It has been agreed that this will take the form of an initial geophysical survey followed by a programme of trial trenching.

2. Site Location

- 2.1 The site lies within the county of Durham. The site is centred on NGR NZ 13515 52796 and consists of 64.96ha of land between the villages of Leadgate and Pontop. Currently the site to be evaluated consists of open fields and woodland.

3. Archaeological and Historical Background

3.1 Prehistoric Period

- 3.1.1 There are no known prehistoric sites within the immediate area although there are several cropmark features on aerial photographs which may date to this period.

3.2 Romano-British Period

- 3.2.1 There is no known evidence of features of this date within or in the immediate vicinity of the site. Dere Street Roman Road runs approximately 500m to the west of the site and Roman forts are located at Ebchester and Lanchester.

3.3 Early Medieval Period

- 3.3.1 There is no specific archaeological evidence of features of this date within or in the immediate vicinity of the site. However place name studies suggest an Anglo-Saxon origin for the settlements including Iveston, Medomsley, Lanchester, Bradley and Billingside.

3.4 Medieval Period

- 3.4.1 References to the villages named above were first documented in the twelfth and thirteenth centuries. Agricultural remains in the form of medieval broad ridge and furrow from are clearly visible on aerial photographs with a wave length of 10-15m. There is also the possibility that a settlement was present within enclosure 29 (see Scott, 2006, Appendix 3).
- 3.4.2 Approximately 500m north of the site is the site of Old Bradley Hall which was built as a moated hall during the medieval period but then rebuilt in 1690 and replaced with the late nineteenth century farmhouse which is now present in this location..

3.5 Post-Medieval Period

- 3.5.1 Coal mining activity was rife within the area during this period with collieries at Medomsley, Pont Head and Pontop. The collieries were served by the Pont Valley Waggonway and later by a network of waggonways and tramways.
- 3.5.2 Aerial photographs of the site show agricultural remains in the form of post-medieval narrow ridge and furrow with a wave length of 3-5m.

3.6 Victorian and Modern Periods.

- 3.6.1 Much of the landscape around the site has been affected by the mining industry since the early nineteenth century.

4. Recommended Course of Action

- 4.1 The whole of the area within the site boundary is to be subject to mining activity and will therefore be subject to the geophysical survey, totalling 64.96ha
- 4.2 The evaluation work proposed here is intended to ascertain whether there are any archaeological constraints that may affect the planned development. The purpose of geophysical survey and trial excavation is to establish the presence or absence of archaeological remains, their nature, quality, depth and preservation.
- 4.3 The geophysical survey will be used help to establish the presence/absence and nature of any anomalies within the site and to define the extent of such anomalies and to characterise them if possible.

- 4.4 Once the geophysical survey has been completed, a trial trenching exercise will then be carried out within areas of highest impact by the proposed development as well as potential archaeological anomalies. A minimum of 3% of the site will be subject to this trial trenching, with a contingency for up to a further 2% of the site. The final amount of trenching will be determined by the results of the geophysical survey.
- 4.5 Fieldwalking has not been recommended for this site as it is situated on pasture fields where the grass is too long for fieldwalking to be feasible.

Geophysical Survey

- 4.5 The geophysical survey will be carried out using a fluxgate gradiometer and will cover a total of 50% (32.48ha) of the area of the site to be subject to disturbance, including beneath proposed soil mounds.
- 4.6 The survey will be undertaken using a parallel or zig-zag traverse scheme and data logged in 30m grid units. These grids will be located taking care to avoid partial grids, existing services and field boundaries and will be accurately tied into local topographic features and overlaid onto an OS base map. The location of these grids will be agreed with the DCC Archaeology Section prior to the commencement of the survey.
- 4.7 The results, including archaeological interpretation of the data will be set out in a report format with maps and must be available to aid the placement of subsequent evaluation trenches.
- 4.8 A contingency for a geophysical survey of a further 25% (16.24ha) of the site is required to enable further work if necessary. This contingency will only be used after discussion with the DCC Assistant Archaeology Officer, the client and the archaeological contractor.

Evaluation

- 4.9 Archaeological evaluation trenches are required on the site. Areas of highest impact by the proposed development must be targeted as well as potential archaeological features.
- 4.10 The trenching requirement comprises a minimum of 3% of the site area which is to be subject to disturbance with a contingency for a further 2%. **The final amount of trenching will be contingent upon the results of the geophysical survey which will be used to target trenches accordingly.** The archaeological contractor must be aware that if a fixed price quotation is given that this may need to be revised after the geophysical survey results have been discussed with the DCC Assistant Archaeology Officer.
- 4.11 The final trench layout plan will be agreed with the DCC Archaeology Section before evaluation commences.

- 4.12 In order to retain a degree of flexibility, trenches may be moved from their intended positions particularly where safety or logistical issues require. This will only be done with the prior consent of the DCC Assistant Archaeological Officer.
- 4.13 The 2% contingency is to be used to answer any questions of an unexpected nature which may be raised by the evaluation. It is more suitable in the long term to be able to answer these questions whilst the archaeological team is still in the field. The contingency budget should only be used after a consultation meeting between the developer, contractor and the DCC Archaeology Section.
- 4.14 The overall aim of the trial trenching will be:
- To establish the presence/absence, nature, depth and character of any possible archaeological features identified in the geophysical survey,
 - To make suggestions, where possible, about further mitigation which may be necessary to preserve archaeological features *in situ*, or
 - To make suggestions to preserve archaeological features by record, where necessary
 - To determine if further archaeological interventions are required

The Trenching element will not form part of this Contract. UK Coal only require a price for the Geophysical Element.

5. General Standards

- 5.1 All work will be carried out in compliance with the codes of practice of the Institute of Field Archaeologists (IFA) and will follow the IFA Standard and Guidance for Archaeological Field Evaluation.

6. Fieldwork

- 6.1 Topsoil and unstratified modern material will be removed mechanically by a machine using a wide toothless ditching blade. This machine stripping will be carried out under continuous supervision by a monitoring archaeologist. Each machine will have a dedicated monitoring archaeologist.
- 6.2 The topsoil or recent overburden will be removed by machine in successive level spits down to the first significant archaeological horizon or the natural subsoil, whichever is encountered first. All cleaning and excavation of archaeological layers or features will be by hand.
- 6.3 A sufficient sample of exposed archaeological features and deposits will be excavated in an archaeologically controlled and stratigraphic manner to fulfil the aims of the project. The complete excavation of all features is not necessary, especially where these continue into sections or below the maximum depth of excavation.
- 6.4 Within the constraints of the site, the excavations will be maintained in a manner that allows quick and easy inspection without any requirement for additional cleaning.

- 6.5 Deposits will be assessed for their potential for providing environmental or dating evidence. The archaeological contractor will make contact with and ensure that any proposed sampling strategy includes the input of Jacqui Huntley, English Heritage Science Advisor for the North-East, University of Durham, Archaeology Department, Biological Sciences Laboratory, South Road, Durham, DH1 3LE. The contractor must inform the DCC Archaeology Section of their choice of environmental specialist in advance of fieldwork commencing on the site.
- 6.5 In the event of human burials being discovered, they will be left *in situ*, covered and protected and the Coroner's Office will be informed. If removal is essential, work will comply with relevant Home Office regulations.
- 6.7 Appropriate procedures under the relevant legislation will be followed in the event of the discovery of artefacts covered by the provisions of the Treasure Act 1996.
- 6.9 The drawn record from the site will include all sections from the excavations that clearly allow the nature and depth and any significant changes in the deposits recorded to be demonstrated. Evaluation trenches found to be devoid of archaeological features will be planned in outline and a sample section drawn. If there is any uncertainty, advice will be sought from the County Archaeology Officer as to which sections may be appropriate for inclusion within the site record.
- 6.10 During and after the excavation, all recovered artefacts will be stored in the appropriate materials and storage conditions to ensure minimal deterioration and loss of information (this will include controlled storage, correct packaging, regular monitoring of conditions, immediate selection for conservation of vulnerable material).
- 6.11 The relevant museum will be contacted to discuss archiving, prior to work commencing.
- 6.12 All staff will familiarise themselves with the archaeological background of the site, and the results of any previous work in the area, prior to the start of work on site. All staff will be briefed in the work required under the specification and the project aims and methodologies.

7. Archaeological Recording

- 7.1 Each evaluation trench will be accurately related to the National Grid and located on a map of the area at an appropriate scale.
- 7.2 A full and proper record (written, graphic and photographic as appropriate) will be made for all work, using pro forma record sheets and text descriptions appropriate to the work. Accurate scale plans and section drawings will be drawn at 1:50, 1:20 and 1:10 scales as appropriate.
- 7.3 The stratigraphy of all trenches will be recorded even where no archaeological deposits have been identified

- 7.4 All archaeological deposits and features, the current ground level and base of each trench will be recorded with an above ordnance datum (AOD) level.
- 7.5 A photographic record of contexts, as appropriate, will be taken in colour transparency and black and white print and will include a clearly visible, graduated metric scale. A register of all photographs will be kept. Digital photographs will be taken for inclusion in the report.

8. Post excavation work, archive, and report preparation

8.1 Finds

- 8.1.1 Pottery and animal bone will be collected as bulk samples by context. Significant small finds will be three dimensionally located prior to collection. All finds will be processed to MAP2 standards and subject to specialist assessment.
- 8.1.2 The deposition and disposal of artefacts will be agreed with the legal owner and recipient museum prior to the work taking place. Where the landowner decides to retain artefacts, adequate provision will be made for recording them. Details of land ownership will be provided by the developer.
- 8.1.3 All retained artefacts will be cleaned and packaged in accordance with the requirements of the recipient museum.

8.2 Site Archive

- 8.2.1 The archive and the finds will be deposited in the appropriate local museum, within 6 months of completion of the post-excavation work and report.
- 8.2.2 Before the commencement of fieldwork, contact will be made with the landowners and with the appropriate local museum to make the relevant arrangements. Details of land ownership will be provided by the developer.
- 8.2.3 NCC Conservation Team require confirmation that the archive has been submitted in a satisfactory form to the relevant museum.

8.3 Reporting

- 8.3.1 The evaluation is the second stage in a potential multi-staged programme of archaeological work and has been requested prior to the determination of planning permission.
- 8.3.2 Due to the strict deadlines laid out in the planning system, the archaeological consultant will submit copies of the report to DCC Archaeology Section and their client within 50 working days of being commissioned to undertake the evaluation report unless agreed in advance with all relevant parties.

8.3.3 The following copies of the report are required:

- Two paper copies of the report for the client
- One paper copy for the SMR
- One digital copy with images to enhance the online SMR website *Keys to the Past* in .pdf or .jpg format.

8.3.4 The report will include the following as a minimum:

- Each page and paragraph will be numbered within the report and illustrations cross-referenced within the text.
- Planning application numbers, Northumberland County Council Conservation Team reference, OASIS reference numbers and a 10 figure grid reference
- Contractors details including date work carried out
- An executive summary
- A location plan of the site at an appropriate scale of at least 1:10 000
- Description of the site location and geology
- Geophysical technical and processing information
- Geophysical results
- Geophysical discussion and interpretation
- A plot of the raw geophysical data (to an appropriate scale)
- Geophysical plots must show the location of modern intrusions (i.e. services)
- Geophysical X-Y trace and greyscale and/or dot density plots (to an appropriate scale)
- Geophysical interpretative feature map (to an appropriate scale)
- A location plan showing trench locations within the site. This will be at a recognisable planning scale, and located with reference to the national grid, to allow the results to be accurately plotted on the Sites and Monuments Record
- Plans and sections of main trench axes and excavated features located at a recognisable planning scale (1:10, 1:20, 1:50 or 1:100, as appropriate)
- A discussion of the results of the fieldwork
- A table summarising the deposits, features, classes and numbers of artefacts encountered and spot dating of significant finds
- Recommendations regarding the need for, and scope of, any archaeological work, including publication
- Bibliography

8.3.5 The report must be presented in an ordered state and contained within a protective cover/sleeve or bound in some fashion (loose leaf presentation is unacceptable). The report must contain a title page listing site/development name, district and county together with general NGR, the name of the archaeological contractor and the developer or commissioning agent.

8.3.6 The report must seek to identify any deposits remaining on or associating with the site that will remain following the completion of the evaluation.

8.3.7 Any variation to the above requirements will be approved by the planning authority prior to work being submitted

9 OASIS

- 9.1 DCC Archaeology Section and support the Online Access to Index of Archaeological Investigations (OASIS) Project. The overall aim of the OASIS project is to provide an online index to the mass of archaeological grey literature that has been produced as a result of the advent of large scale developer funded fieldwork.
- 9.2 The archaeological contractor will therefore complete the online OASIS form at <http://ads.ahds.ac.uk/project/oasis/>. If the contractors are unfamiliar with OASIS, they are advised to contact Durham SMR prior to completing the form. Once a report has become a public document by submission to or incorporation into the SMR, Durham SMR will then validate the OASIS form thus placing the information into the public domain on the OASIS website. The archaeological contractor will conform to this procedure.

10 Publication

- 10.1 Editors of regional journals, either the *Durham Archaeological Journal* or *Archaeologi Aeliana* must be contacted for information on outline publication costs, fuller figures may be worked out on completion of the evaluation. As the final outcome is largely unpredictable in advance, a contingency sum must be set aside at the outset of the work in the tender.
- 10.2 DCC Archaeology Section produces an annual publication every March which highlights the archaeological work conducted in the county over the previous twelve months. To this end, it is required that a short account of the evaluation be submitted to the DCC Archaeology Section by the beginning of December of the same year in which the work was conducted. This précis will be no more than 500 words and also include .jpg or .tiff images of a minimum of 300dpi.

11. Monitoring

- 11.1 The DCC Assistant Archaeology Officer will be informed on the start date and timetable for the evaluation in writing, two weeks in advance of work commencing.
- 11.2 Reasonable access to the site will be afforded to the Assistant Archaeology Officer or his/her nominee at all times, for the purposes of monitoring the archaeological evaluation
- 11.3 Regular communication between the archaeological contractor, the Assistant Archaeology Officer and other interested parties will be maintained to ensure the project aims and objectives are achieved.
- 11.4 The Regional Scientific Advisor will be afforded access to monitor the evaluation and give advice on environmental / dating issues.

12 Tenders

12.1 Tenders must include the following:

- Brief details of the organisation and the number of staff who are proposing to carry out the work including any relevant specialisms or experience
- The earliest date at which the work can be commenced and the amount of notice required to initiate the fieldwork
- Details concerning proposed methods of recording
- Statement agreeing to complete the OASIS forms on completion of fieldwork
- An estimate of how long the work will take broken down in terms of data collection and report production (the anticipated extent of the work must be confirmed with the client in advance) on a *per diem* basis where possible (this is particularly in reference to the specialists' costs). The tender must include a breakdown of costs attributable to:
 - Travelling and subsistence
 - Geophysical survey
 - Trenching fieldwork
 - Finds assessment
 - Report production
 - Archiving and publication
 - Administration
 - Other
- Contingency sums must be clearly allocated for the following:
 - Additional 25% geophysical survey
 - Additional 2% trenching
 - Conservation of finds
 - Scientific dating
 - Environmental sampling
 - Other

13 Bibliography

Institute of Field Archaeologists, 2000, Code of Conduct

Scott, J. 2006. Bradley, County Durham: Archaeological Desk-based Assessment

14 Contact Details

Lee White
Archaeology Section
Adult and Community Services
Culture and Leisure
Durham County Council
Rivergreen Centre
Aykley Heads
Durham
DH1 5TS

Steve Speak

Senior Keeper of Field Archaeology
Tyne and Wear Museums Archaeology
Jesmond
East Lodge
Old Jesmond Cemetery
Newcastle Upon Tyne
NE2 1NL

Tel: 0191 281 6251

Fax: 0191 281 6545

E-mail: steve.speak@twmuseums.org.uk

15. Staff

15.1 The Consultant will identify the main staff that will be employed on this work. The names of the overall Project Manager and the principle in each of the subject areas are required.

16. Access

16.1 Access to the site shall be arranged with David Miller on 01302 755149

17. Pricing

17.1 The work is to be tendered on a Fixed Lump Sum basis.

17.2 You are requested to provide additional rates for the following:-

i. Additional Geophysical Survey price per Ha.

17.3 Following appointment, the Consultant will identify the limitations of the above specified work and, where necessary, make recommendations for further works identifying the benefits that would be achieved. No additional works are to be undertaken without the express agreement of the Company.

18. Invite

18.1 You are invited to submit a proposal for this work. Should you choose to bid for this work, you should set out the methodology and standards you would apply in your impact assessment of the site, together with your Lump Sum Fixed Price at Form of Tender Part II.

19 Insurance

19.1 The Consultant shall be required to provide evidence of Public Liability, Employers and Professional Indemnity Insurance.

20. Confidentiality & Intellectual Property

- 20.1 The successful consultant shall exercise discretion and confidentiality at all times whilst representing the Authority.
- 20.2 The Consultant hereby undertakes with the Authority, that he will not at any time hereafter use, divulge or communicate to any other person, nor allow to be used, divulged or communicated, save with the consent of the Authority, any information concerning any aspect of this Contract, or the contents of any drawings, reports, specification, bills of quantities, calculations or other similar documents relating to the Works, or any other dealings, transactions or affairs of the Authority, which may come to his knowledge or into his possession and that he shall use his best endeavours to prevent the publication or disclosure of any such items of information.
- 20.3 The Consultant shall not act in any manner which could conflict with the interests of the Authority.

21. Information to be supplied to the Consultant

- 21.1 The Authority shall supply to the Consultant without charge and within a reasonable time, all necessary and relevant data and information in the possession of the Authority and shall give such assistance as shall reasonably be required by the Consultant in the performance of his services under this Contract. None of the said data or information shall be used by the Consultant for any purpose other than in connection with this Contract without the prior written approval of the Authority.
- 21.2 The Authority shall give its decision on all sketches, drawings, reports, recommendations, and other matters properly referred to him for decision by the Consultant in such reasonable time as to avoid undue delay or disruption to the performance of the Consultant in carrying out the Works.

22 Authority's Representative

The Authority has appointed as his Representative for the Consultancy:-

Mr R Cory
Senior Geologist
UK Coal Mining Ltd,
Harworth Park
Blyth Road
Harworth
Doncaster
DN11 8DB

Tel No:01302 755159
or any duly authorised nominee.

23 Payment

- 23.1 Invoices shall be sent upon satisfactory completion of the works as directed by the S.O. and in accordance with contractual time scales and prices quoted in Form of Tender Part II - Schedule of Prices.
- 23.2 Invoices should be addressed to:-
Accounts Dept
UK Coal Mining Ltd
Harworth Park,
Blyth Road,
Harworth,
Doncaster,
DN11 8DB.
- 23.3 All invoices should be clearly addressed for the attention of the Accounts Dept quoting the contract reference number (MB/BRADL/2479-1), all descriptions to be in accordance with the Form of Tender Part II, payments shall be made by the Authority in accordance with Form of Tender Part IV.
- 23.4 In addition to his fees the Consultant shall be entitled to claim from the Authority the amount of V.A.T. properly chargeable on the goods and services supplied by him in the performance of the Consultancy.

24. Variations

- 24.1 The Supervising Officer may require to vary the Services to be provided under this Contract. The value of any variation order shall be added to or deducted from the price payable under the Contract, and shall be calculated in accordance with the Schedule of Prices at Form of Tender Part II. No variation shall invalidate the Contract nor shall it entitle the Consultant to any compensation for loss of profit in respect of work which may no longer be required nor to any other payment except as provided for in the variation order.

25. Conditions of Engagement

- 25.1 The Conditions of Engagement shall be UK Coal Mining Ltd General Conditions of Contract Consultancy 2007.
- 25.2 In the case of conflict, terms and conditions stated herein shall take precedence.

26. Limits of Site

- 26.1 The Consultant shall ensure that his employees and agents and the employees and agents of his sub-contractors keep within the limits of:-
- (i) The site occupied by the Works;

- (ii) Any other area or premises made available to him in connection with the Contracted Works.



Archaeological Services
University of Durham

**Bradley Surface Mining Scheme, Leadgate,
County Durham**
geophysical surveys

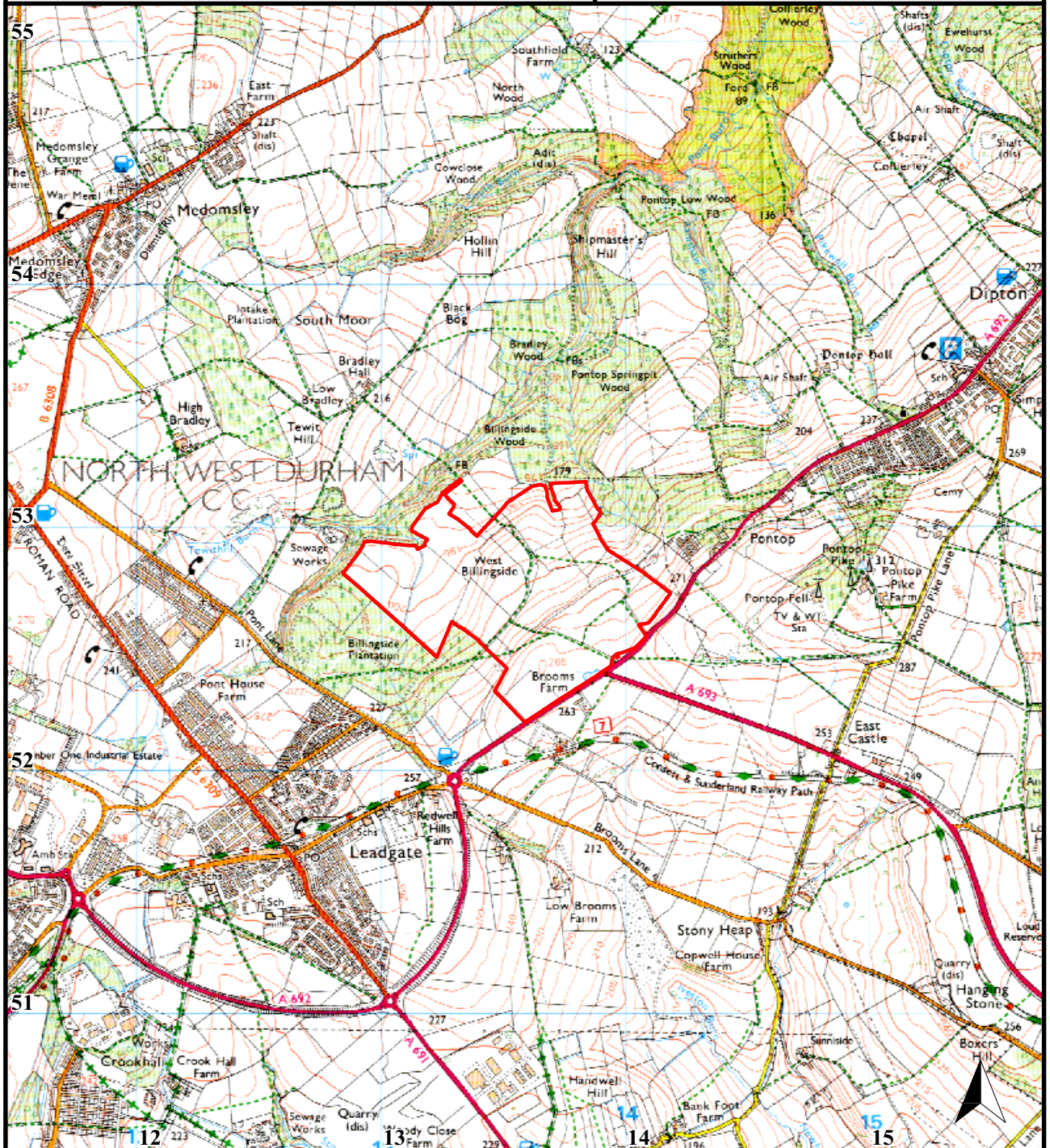
Report 1855

Figure 1

Proposed development area

on behalf of
UK Coal

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 site boundary

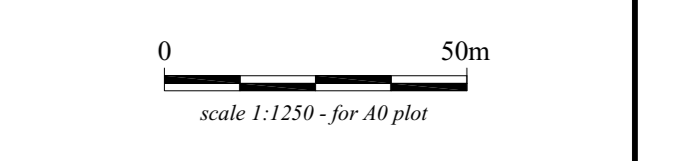
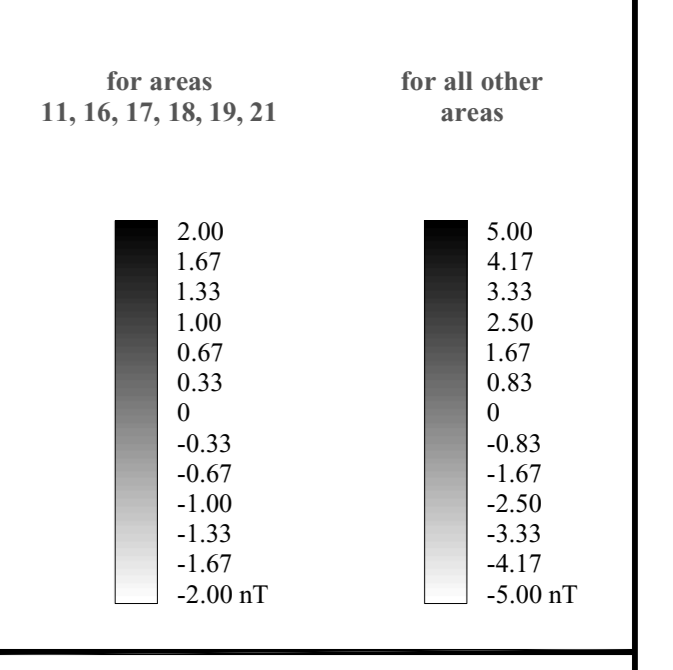


scale 1:25 000 - for A4 plot

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- site boundary
- outline of survey area
- to be left undisturbed by development
- previous opencast mining area
- marshy area



on behalf of
UK Coal

Archaeological Services
University of Durham

Bradley Surface Mining Scheme,
Leadgate, County Durham

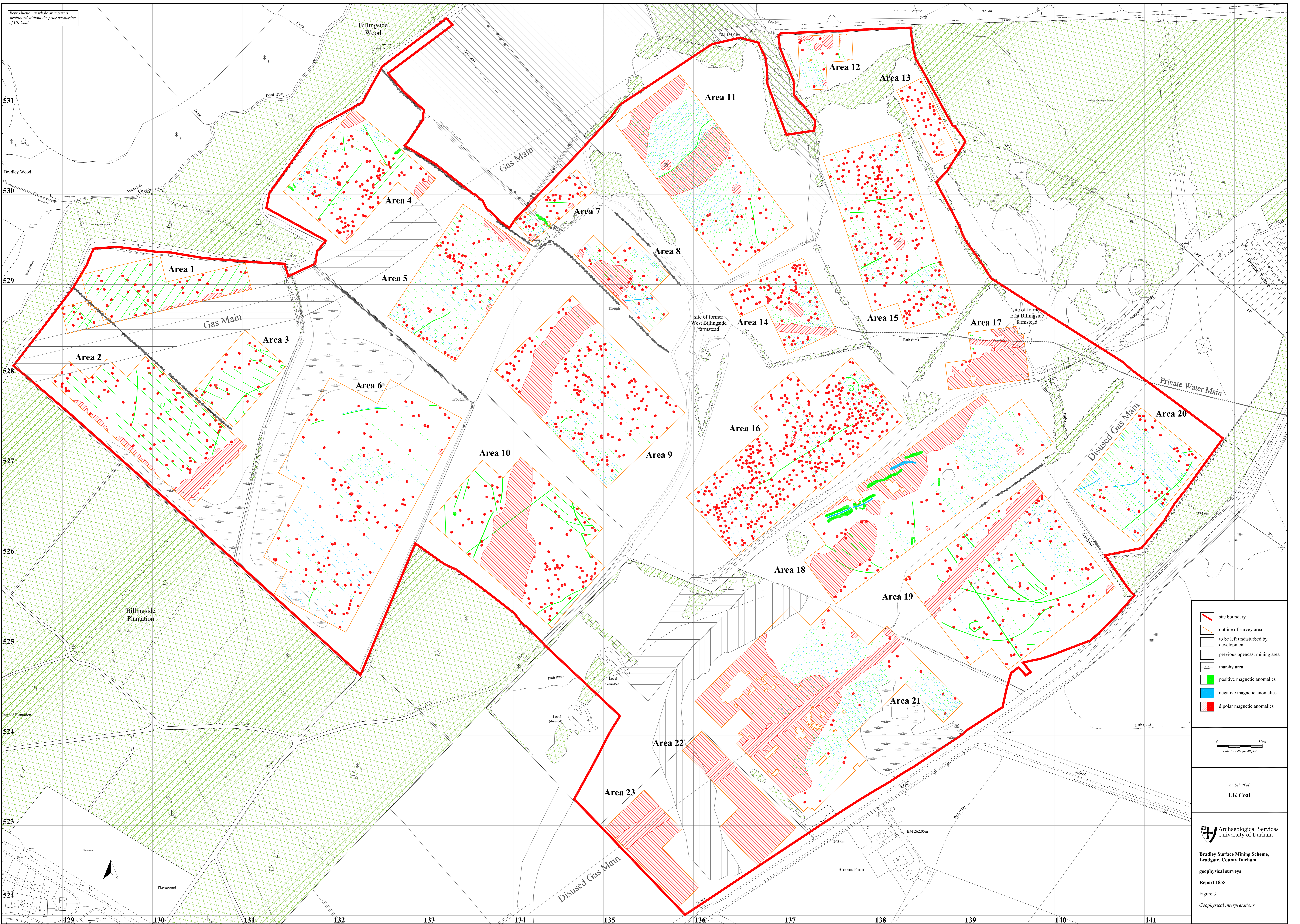
geophysical surveys

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Figure 2

Geophysical surveys

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- site boundary
- outline of survey area to be left undisturbed by development
- previous opencast mining area
- marshy area
- positive magnetic anomalies
- negative magnetic anomalies
- dipolar magnetic anomalies

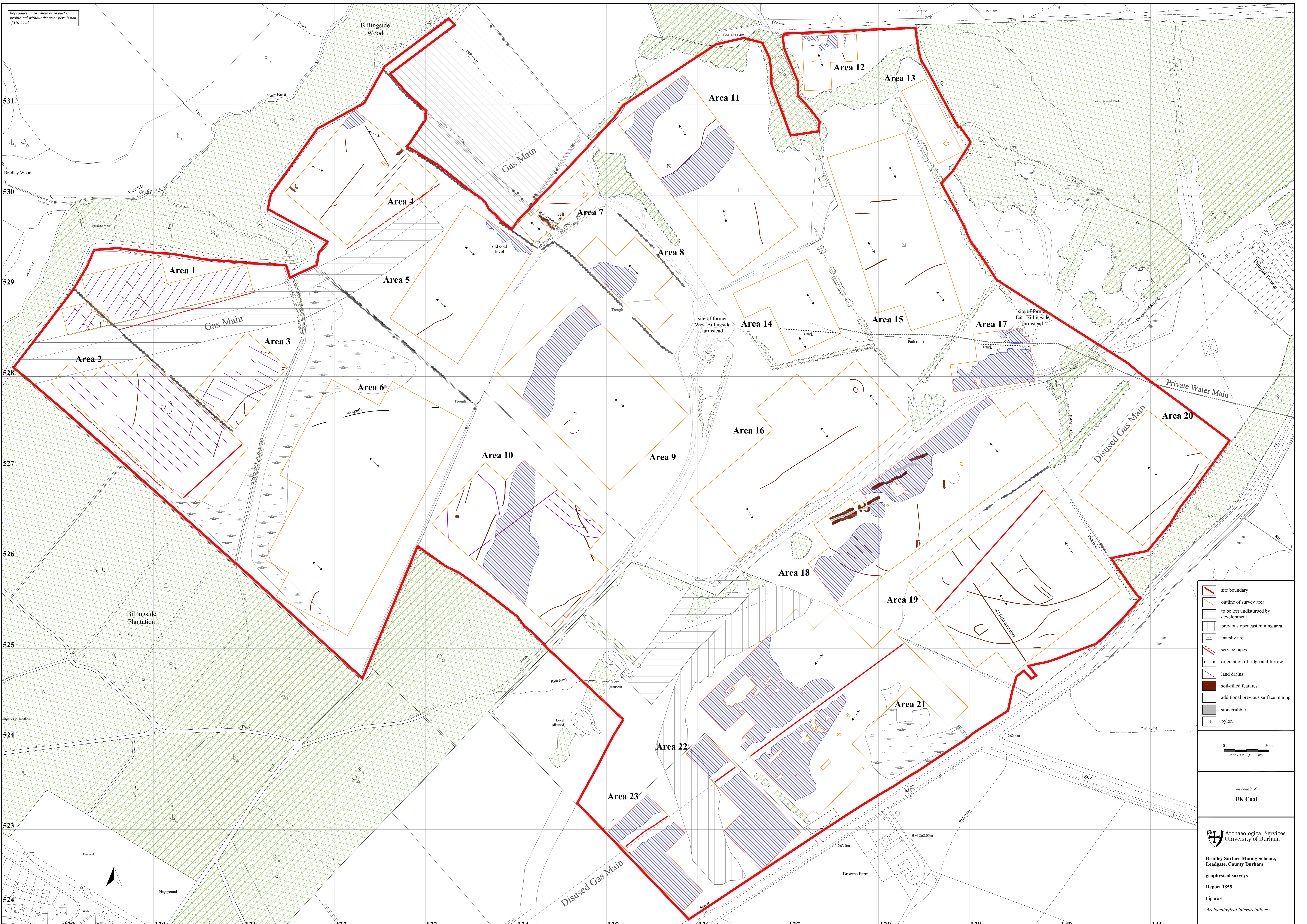
0 50m
scale 1:1250 for 50m plot

on behalf of
UK Coal



**Bradley Surface Mining Scheme,
Leadgate, County Durham**
geophysical surveys
Report 1855
Figure 3
Geophysical interpretations

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- site boundary
- outline of survey area to be left undisturbed by development
- previous opencast mining area
- marshy area
- service pipes
- orientation of ridge and furrow
- land drains
- soil-filled features
- additional previous surface mining
- stone/rubble
- pylon

0 50m
scale 1:1250 for 40 plots

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Figure 4
Archaeological interpretations

Figure 5: Trace plots of geophysical data

