

HIGH SPEED RAIL (LONDON - WEST MIDLANDS)

Supplementary Environmental Statement and
Additional Provision 2 Environmental Statement

Volume 5 | Technical appendices
CFA17 | Offchurch and Cubbington

July 2015

SES and AP2 ES 3.5.1.4

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This table shows the topics covered by the technical appendices in this volume, and the reference codes for them.

CFA name and number	Topic	Code
CFA17, Offchurch and Cubbington	Cultural heritage	CH-002-017
		CH-003-017
		CH-004-017

Environmental topic:	Cultural heritage	CH
Appendix name:	Gazetteer of heritage assets	002
Community forum area:	Offchurch and Cubbington	017

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1 Introduction

- 1.1.1 This appendix provides an update to Appendix CH-002-017 Cultural heritage gazetteer of heritage assets to the main Environmental Statement (ES) as a result of changes assessed as part of the Supplementary Environmental Statement (SES) and the Additional Provision 2 Environmental Statement (AP2 ES). This update should be read in conjunction with Appendix CH-002-017 Cultural heritage gazetteer of heritage assets from the main ES.

2 Gazetteer

Table 1 – Gazetteer of heritage assets for CFA17

Unique ID	Map reference	Asset type	Name	Description	Period	Designation	Grade	Significance/ value	NHL reference	HER reference
OFC057		Potential Ancient Woodland	Burnt Firs	Shown on 1834 1 st edition Ordnance Survey (OS) mapping as irregular parcel of woodland surrounding Burnt Firs Farm. Titled 'Burnt Furze' on 1845 map suggesting management as wood pasture.	Medieval/ Post-medieval	Potential Ancient Woodland	n/a	High	n/a	n/a
OFC058		Archaeology	Land off Fosse Way, near Offchurch	Geophysical survey has revealed presence of ditches, pits and ridge and furrow of archaeological origin.	Undated	None	n/a	Low	n/a	n/a
OFC059		Archaeology	Site between Fields Farm and River Leam	Geophysical survey results have revealed significant areas of archaeology; including ditches, enclosures, pits and ridge and furrow associated with possible settlement.	Romano-British	None	n/a	Moderate	n/a	n/a

Environmental topic:	Cultural heritage	CH
Appendix name:	Impact assessment table	003
Community forum area:	Offchurch and Cubbington	017

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1 Introduction

- 1.1.1 This appendix provides an update to Appendix CH-003-017 Cultural heritage impact assessment to the main Environmental Statement (ES) as a result of changes assessed as part of the Supplementary Environmental Statement (SES) and the Additional Provision 2 Environmental Statement (AP2 ES). This update should be read in conjunction with Appendix CH-003-017 Cultural heritage impact assessment from the main ES.

2 Impact assessment

Table 1 – Impact assessment for CFA17

Unique identification	Name	Designation(s)	Value	Construction impact			Operation impact			New or different environmental effect from that reported in the main ES or the Additional Provision (AP ₁) ES
				Nature of impact including mitigation	Scale of impact	Effect	Nature of impact including mitigation	Scale of impact	Effect	
OFCo57	Burnt Firs	Potential Ancient Woodland	High	The route will cut through a portion of the woodland and the underlying topography remodeled. There would be a noticeable change to the setting of the woodland. Landscape mitigation planting is proposed.	High adverse	Major adverse	The woodland would experience an increase in noise and trains would be visible from the woods. This will effect the rural character and setting of the woodlands.	Low adverse	Moderate adverse	The impact of the HS2 scheme on Burnt Firs is a new significant effect, not previously identified in the main ES or the AP ₁ ES
OFCo58	Land off Fosse Way	None	Low	The construction of the mainline, excavation of cuttings and landscaping would result in the removal of archaeological remains. This would be mitigated through a scheme of archaeological works.	High adverse	Moderate adverse	The operation of the HS2 scheme would not impact the significance of the asset	No change	Neutral	The impact of the HS2 scheme on the archaeological site identified by geophysical surveys on land off the Fosse Way constitutes a new significant effect not previously identified in the main ES or the AP ₁ ES

SES and AP2 ES Appendix CH-003-017

Unique identification	Name	Designation(s)	Value	Construction impact			Operation impact			New or different environmental effect from that reported in the main ES or the Additional Provision (AP1) ES
				Nature of impact including mitigation	Scale of impact	Effect	Nature of impact including mitigation	Scale of impact	Effect	
OFC059	Site between Fields Farm and River Leam	None	Moderate	The construction of the mainline, excavation of cuttings and landscaping would result in the removal of archaeological remains. This would be mitigated through a scheme of archaeological works.	High adverse	Major adverse	The operation of the HS2 scheme would not impact the significance of the asset	No change	Neutral	The impact of the HS2 scheme on the archaeological site identified by geophysical surveys on land between Fields Farm and the River Leam constitutes a new significant effect not previously identified in the main ES or AP1 ES

Environmental topic:	Cultural heritage	CH
Appendix name:	Survey reports	004
Community forum area:	Offchurch and Cubbington	017

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1 Introduction

- 1.1.1 This appendix provides an update to Appendix CH-004-017 Cultural heritage survey reports from the main Environmental Statement (ES) as a result of changes assessed as part of the Supplementary Environmental Statement (SES) and the Additional Provision 2 Environmental Statement (AP2 ES). This update should be read in conjunction with Appendix CH-004-017 Cultural heritage survey reports from the main ES.

2 Geophysical surveys

2.1 CNoo8 Land off Fosse Way

Introduction

- 2.1.1 Survey parcel CNoo8 was not reported in the main ES due to access being unavailable at the time.

Project background

- 2.1.2 Wessex Archaeology was commissioned on the behalf of HS2 Ltd, to undertake a geophysical survey of area CNoo8 off Fosse Way, near Offchurch, Warwickshire (Figure 1), hereafter “the site” (centred on NGR 437293, 265347). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

- 2.1.3 The geophysical survey undertaken here has been preceded by desk-based research (HS2 Environmental Statement, 2013) and a remote sensing survey comprising LiDAR and hyperspectral survey and analysis (Volume 5 CH-004-017, ES 3.5.2.17.7). Geophysical survey areas have been identified based on the archaeological potential and conclusions identified in these reports.

- 2.1.4 This site, CNoo8, was selected for geophysical survey as it is considered to be an area at high risk with potential for Roman remains and it will be an area of major construction works (risk model score: 2).

Site details

- 2.1.5 The site comprises a single arable field located approximately 1.5km, east of Offchurch, Warwickshire. It is bounded to the north by Leamington Road, to the west by Fosse Way (B4455) to the south by Welsh Road and to the east by farm buildings, a small wood and a lake. The gradiometer survey covered 9.3ha out of a proposed 9.8ha with only a small area lost due to field boundaries.
- 2.1.6 The site lies on an area of gently sloping land that falls away towards the south. The northern region of the survey area lies at a height of 104m aOD (above Ordnance Datum) and falls from this height to less than 88m aOD at the south of the site.
- 2.1.7 The solid geology is recorded as Mercia Mudstone Formation (Early Triassic) (Ordnance Survey (OS) 1957). There are superficial deposits recorded on site, these include areas of Dunsmore Gravel to the north, with banding of Thrussington Member and Wolston sand and gravel throughout the site. (Ordnance Survey (OS), 1977).

- 2.1.8 The soils underlying the site are likely to comprise the typical brownearths of the 541r (Wick 1) association with clayey soils of 572f (Whimble 3) association to the south (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological background

- 2.1.9 Detailed assessment of the known archaeology of the site and surrounding area is contained within Vol 5 appendix CH-001-017, ES 3.5.2.17.4. A summary of relevant sites within approximately 1km of the survey area are summarised in paragraphs 2.1.10 to 2.1.14 and have been included to provide context and inform the geophysical interpretation. Sites referred to can be found either within volume 5 appendix CH-002-017, ES 3.5.2.17.5 in the Environmental Statement (OFC numbers) in the supplementary survey works (WA numbers) or in the Warwickshire scope and methodology report (SMR) (MWA/HWA numbers).
- 2.1.10 The current landscape is characterised as very large irregular fields with curvilinear boundaries (HWA8171). Remote sensing identified the route of the Fosse Way which borders the southeast of the site (WA17.9) and a larger irregular shaped reservoir to the south-east of the site (WA17.8) (Wessex Archaeology, 2013).
- 2.1.11 Approximately 150m to the east of the site and to the southeast of Burnt Heath Farm is an undated cropmark enclosure discovered from aerial photographs, it is an incomplete circular enclosure containing a small rectangular enclosure (OFC 009). There are two undated cropmark enclosures approximately 0.8km to the south-west of the site boundary (OFC014). They are all undated but due to their form and layout have been interpreted as prehistoric in origin.
- 2.1.12 The Roman road of the Fosse Way borders the north-western boundary of the site (OFC012). Although the Roman road no longer survives as a surface feature there is considered to be increased archaeological potential for Roman remains in its vicinity immediately to the northwest and southeast of the modern Fosse Way road.
- 2.1.13 No sites or findspots are recorded within the survey area but in the immediate surroundings find spots dated to the Neolithic, Roman and post-medieval periods have been recorded. A Neolithic axe (MWA9276) was found 150m south-east of the site, whilst Roman and post-medieval pottery has been found in a number of places within the 1km survey area (MWA2243, MWA2230, MW4545).
- 2.1.14 The site lies within the parish of Offchurch which is characterised by medieval enclosed field systems, with the village of Offchurch itself located to the west of the site. Earthworks surrounding the village display evidence for settlement shrinkage. Ridge-and-furrow is still evident with five plots located in the survey area (OFC 027; 036; 044; 047; 048). Other medieval earthworks and deposits associated with extant built heritage are likely to survive in the village cores and particularly near the medieval churches with earthworks forming an enclosure (OFC 023).

Survey objectives

2.1.15 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology 2014). The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site;
- to determine the general nature of the remains present; and
- to combine the results of the geophysical surveys with data from other archaeological assessments carried out as part of the project in order to analyse the archaeological potential of the survey locations

2.1.16 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

Methods

Survey dates

2.1.17 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between the 10 -12 February 2015.

Grid location

2.1.18 The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds Historic England's recommendations (Historic England, 2008).

2.1.19 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments used and survey method

2.1.20 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with Historic England's guidelines (Historic England, 2008).

2.1.21 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data processing

2.1.22 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function ($\pm 5nT$ thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in

traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.

2.1.23 Further details of the geophysical and survey equipment, methods and processing are described in Annex 1.

Data presentation

2.1.24 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then passed to Atkins' graphics team who produced the final figures in GIS (ESRI ArcMap 10).

2.1.25 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and $\pm 25nT$ at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.

Results

2.1.26 The gradiometer survey has been successful in identifying anomalies of possible archaeological interest, along with numerous trends. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (Figures 2 to 4).

2.1.27 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 4). Full definitions of the interpretation terms used in this report are provided in Appendix 2.

2.1.28 A very large number of ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: archaeology

2.1.29 Anomalies of archaeological potential are concentrated in the northern part of the site and in the south-west in proximity to the route of the Fosse Way.

2.1.30 A series of oval and elongated oval shaped anomalies around 4000 to 4003 are discernible as positive anomalies against the highly ferrous background and have been interpreted as Archaeology. It cannot be identified what their associations are to each other but they are typical of cut features such as sections of ditch or pits. Between 4000 and 4001 the anomalies are oriented north-west to south-east and suggest a ditch but the anomalies around 4002 and 4003 are not as regular and are not as easily distinguishable as either pits or ditches.

2.1.31 A second series of elongated positive anomalies are evident at 4004, 4005 and 4006 and have been interpreted as Archaeology (weak) with a weaker and more intermittent line of positive anomalies at 4007 interpreted as Possible Archaeology. Overall they appear as three ditches oriented approximately north-south and are intermittent and weak against the high number of ferrous anomalies across the site.

2.1.32 A number of smaller oval shaped positive anomalies are grouped around 4008 with slightly larger semi-circular positive anomalies at 4009. They are typical responses of cut features

- such as pits or sections of ditch and are smaller discrete anomalies compared to the long linear ditch-type anomalies at 4004 to 4007.
- 2.1.33 A second area that shows a concentration of several oval and elongated positive anomalies is located at 4010 and overall the area of anomalies extends in an east-west direction from the current field boundary.
- 2.1.34 There are a few isolated pit-type responses, such as at 4011 to the south of the site; no further anomalies of archaeological or possible archaeological interest have been identified around these except for some short curvilinear trends.
- 2.1.35 Against the background of a large number of ferrous anomalies are identified several regularly spaced, positive linear trends approximately 10-12m apart in some areas and they have been interpreted as ridge and furrow. The linear anomalies are oriented approximately north-east to south-west and there is a greater concentration around 4012 which tapers out towards 4013.
- 2.1.36 Some ploughing trends are visible in the western half of the site, such as those south west of 4010 and those at 4025, these are oriented north-west to south-east and also south-west to north-east.
- 2.1.37 A number of linear and curvilinear trends are identified across the site with no particular concentration or arrangement. Examples can be seen at 4017 and 4026 which could possibly be archaeological in origin but cannot be characterised further due to their weak positive ephemeral form.
- 2.1.38 The site has a large number of modern services running through it and also a large number of ferrous anomalies indicating a spread of debris containing ferrous and ceramic material and assumed to be modern in origin. One area of note against the highly ferrous background is around 4027 because it is relatively ferrous free compared to the rest of the site.

Interpretation: modern services

- 2.1.39 There are at least seven modern services identified across the survey area. These are identified at 4013 to 4016 and 4018 to 4024.
- 2.1.40 It is not clear from the geophysical data whether the services identified are in active use or not. Also gradiometer data will not be able to locate and identify all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny radiodetection tools) should be used to confirm the location of buried services before any trenches are opened on site.

Conclusions

- 2.1.41 The detailed gradiometer survey has been successful in detecting anomalies of likely and possible archaeological interest within the site along with ploughing trends, trends of uncertain origin, a large number of ferrous anomalies and several modern services.

Discussion

- 2.1.42 The data shows a concentration of archaeological and possible archaeological anomalies to the north of the site and to the south-west.

- 2.1.43 Possible ditches are evident at 4000 to 4001 with a second perpendicular set of anomalies around 4003 to 4004; their association with each other cannot be established though.
- 2.1.44 Still in the same area but on a different alignment of north-south are three parallel features at 4004 to 4007 made up of intermittent positive anomalies that are typical responses of ditches. They are assumed to be associated with each other due to their similar orientation and response.
- 2.1.45 A smaller area of more discrete oval and curvilinear shaped anomalies at 4008 and 4009 are more typical of pits with the larger curvilinear anomaly possibly a section of ditch.
- 2.1.46 The east-west series of positive anomalies around 4010 is in the same orientation as a former field boundary visible on available OS mapping so would suggest this function but it cannot be ascertained if it is in the same location as the one recorded (Ordnance Survey (OS), 1887).
- 2.1.47 Ridge and furrow is visible around 4012 and 4013 interpreted primarily from the regular but wider spacing of the weak linear trends and at a different orientation to the current field boundaries and ploughing trends on site.
- 2.1.48 The relative dimensions of the modern services identified by the gradiometer survey are indicative of the strength of their magnetic response, which is dependent upon the materials used in their construction and the backfill of the service trenches. The physical dimensions of the services indicated may therefore differ from their magnetic extents in plan; it is assumed that the centreline of services is coincident with the centreline of their anomalies. It is difficult to estimate the depth of burial of the services through
- 2.1.49 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are and the large number of ferrous anomalies across the site it seems very likely that more features may be present than were detected during the survey.

References

- Historic England, (2008), Geophysical Survey in Archaeological Field Evaluation. Research and Professional Service Guideline No. 1, 2nd Edition
- HS2 Environmental Statement, (2013), London-West Midlands Environmental Statement, Volume 5: Technical Appendices: CFA17: Offchurch to Cubbington Baseline Report: Cultural Heritage. Report Reference: CH-001-017
- Ordnance Survey, OS (1887), OS County Series: Warwickshire, 1:2500
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- Ordnance Survey, OS (1977), Quaternary Map of the United Kingdom: South. Ordnance Survey: Southampton
- Soil Survey of England and Wales, (1983), Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.
- Wessex Archaeology, (2013), LiDAR and Hyperspectral Analysis Report Reference 86252.01

Wessex Archaeology, (2014), HS2: Geophysical Survey Written Scheme of Investigation: Warwickshire
Report Reference: 86257.01.

HER records consulted

- HWA 8171 - Historic Landscape Characterisation: Very large irregular fields with curvilinear boundaries
- OFCo09 - Burnt Heath Farm cropmark
- OFCo12 - Fosse Way Roman road
- OFCo14 - Fosseway Cottage cropmarks
- OFCo23 - Offchurch earthwork enclosures
- OFCo27 - Valley Fields ridge and furrow
- OFCo36 - Lower Grange ridge and furrow
- OFCo44 - Mill Lane ridge and furrow
- OFCo47 - Rugby Road ridge and furrow
- OFCo48 - Coventry Road ridge and furrow
- MWA 2230 - Find spot - Imperial pottery
- MWA 2243 - Find spot - Roman pottery sherd
- MWA 4545 - Roman to modern tiles
- MWA 9276 - Neolithic axe found in Offchurch

Figure 1 - CN008 Site location

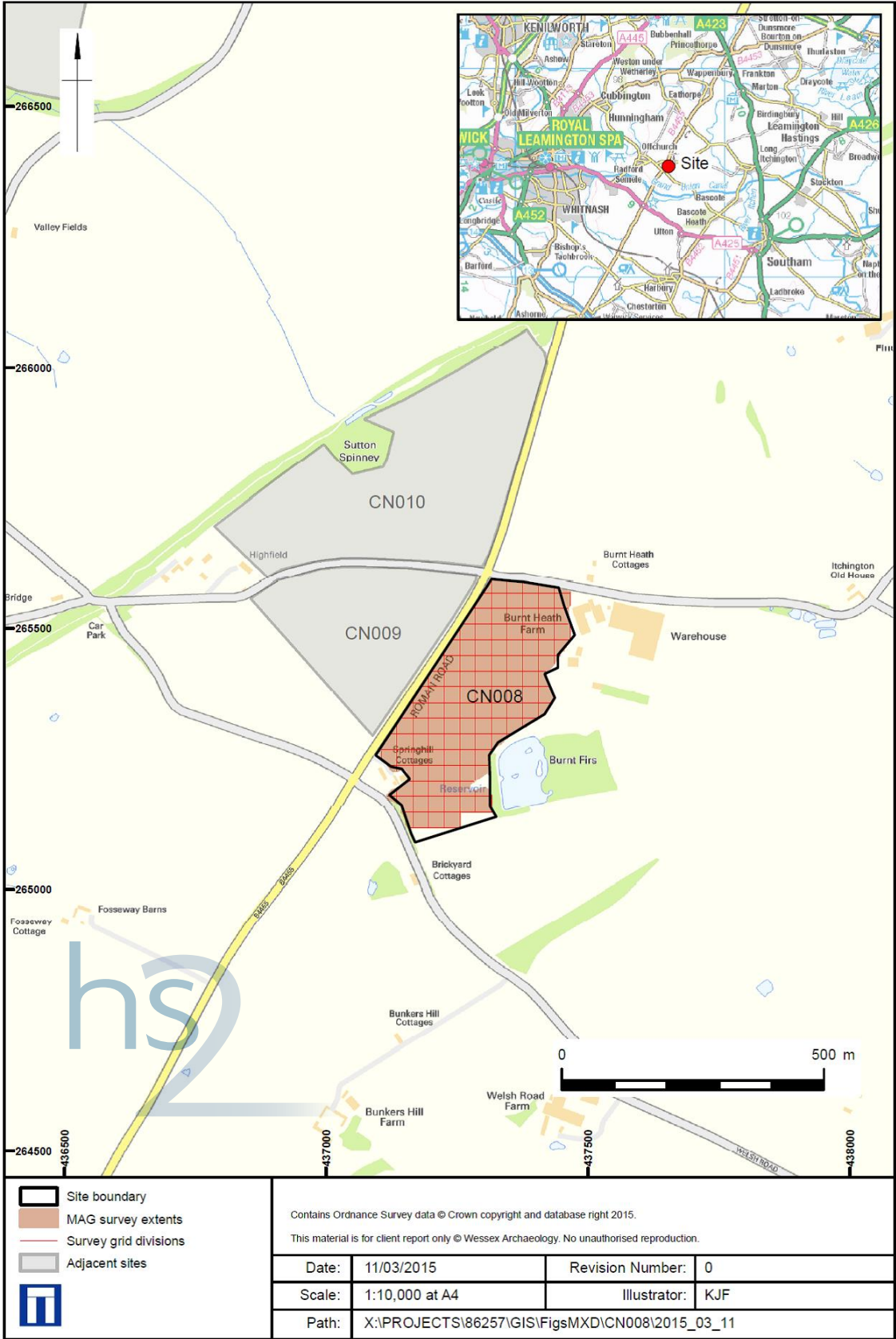


Figure 2 - CN008 greyscale

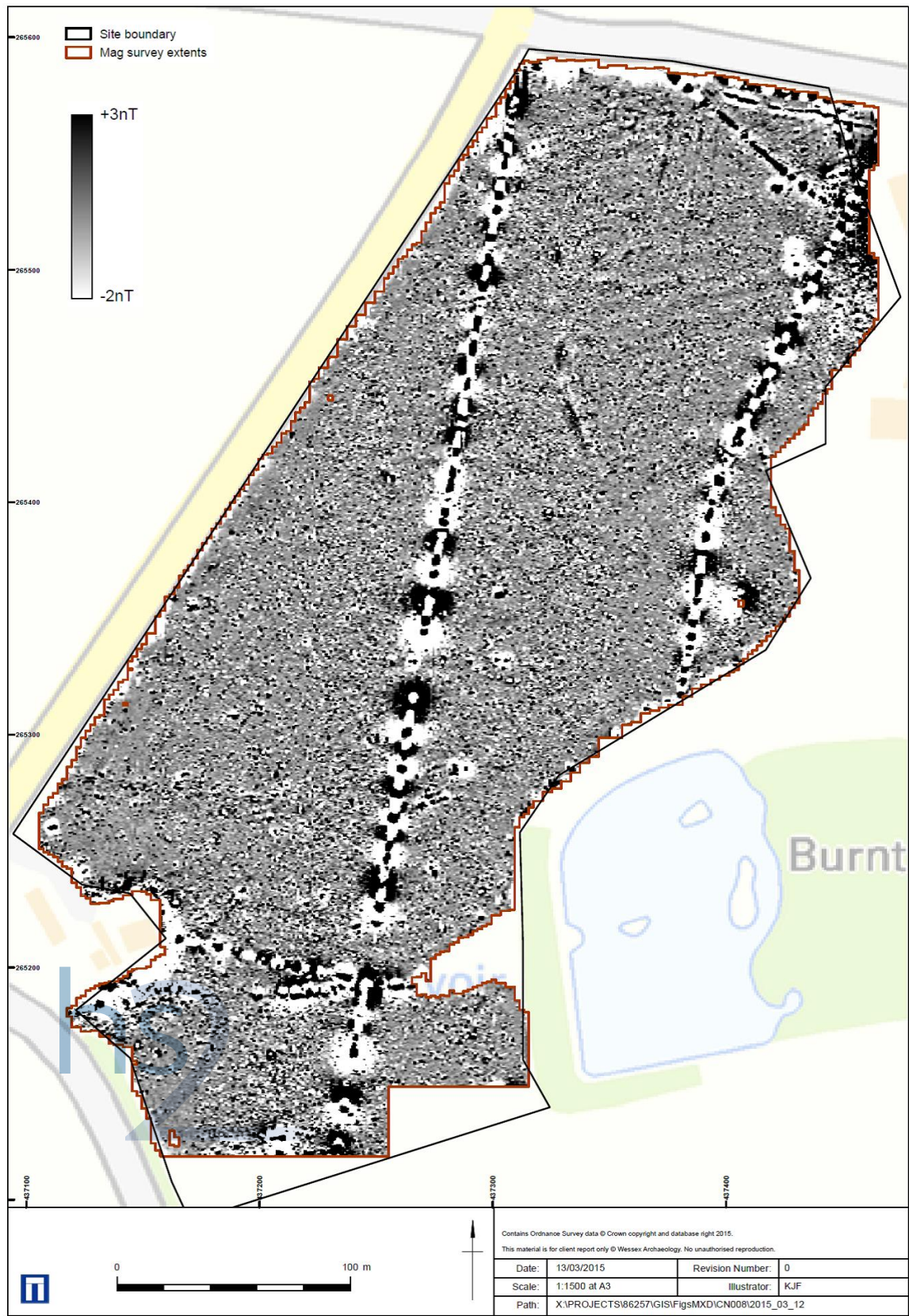


Figure 3 - CN008 XY trace

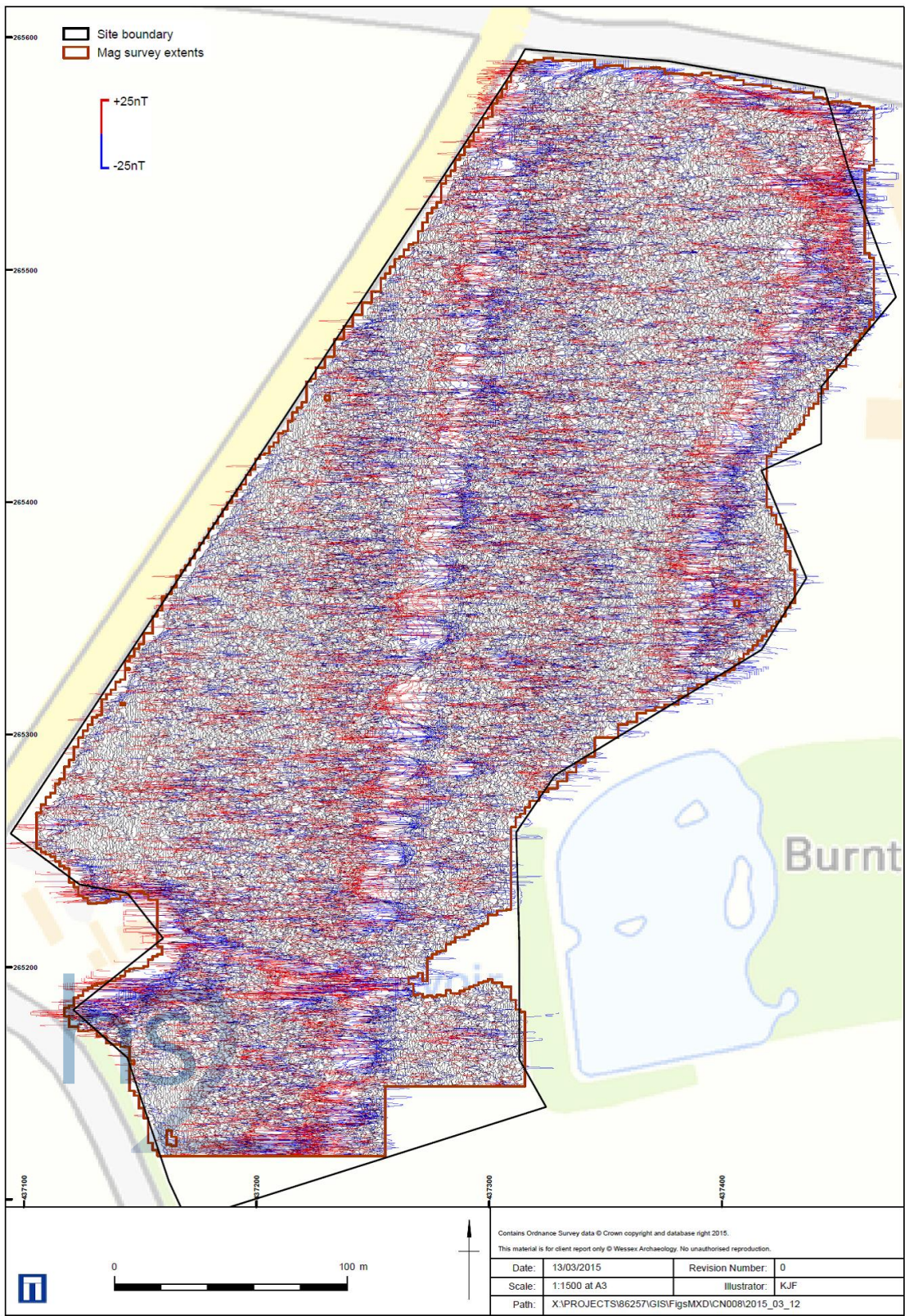
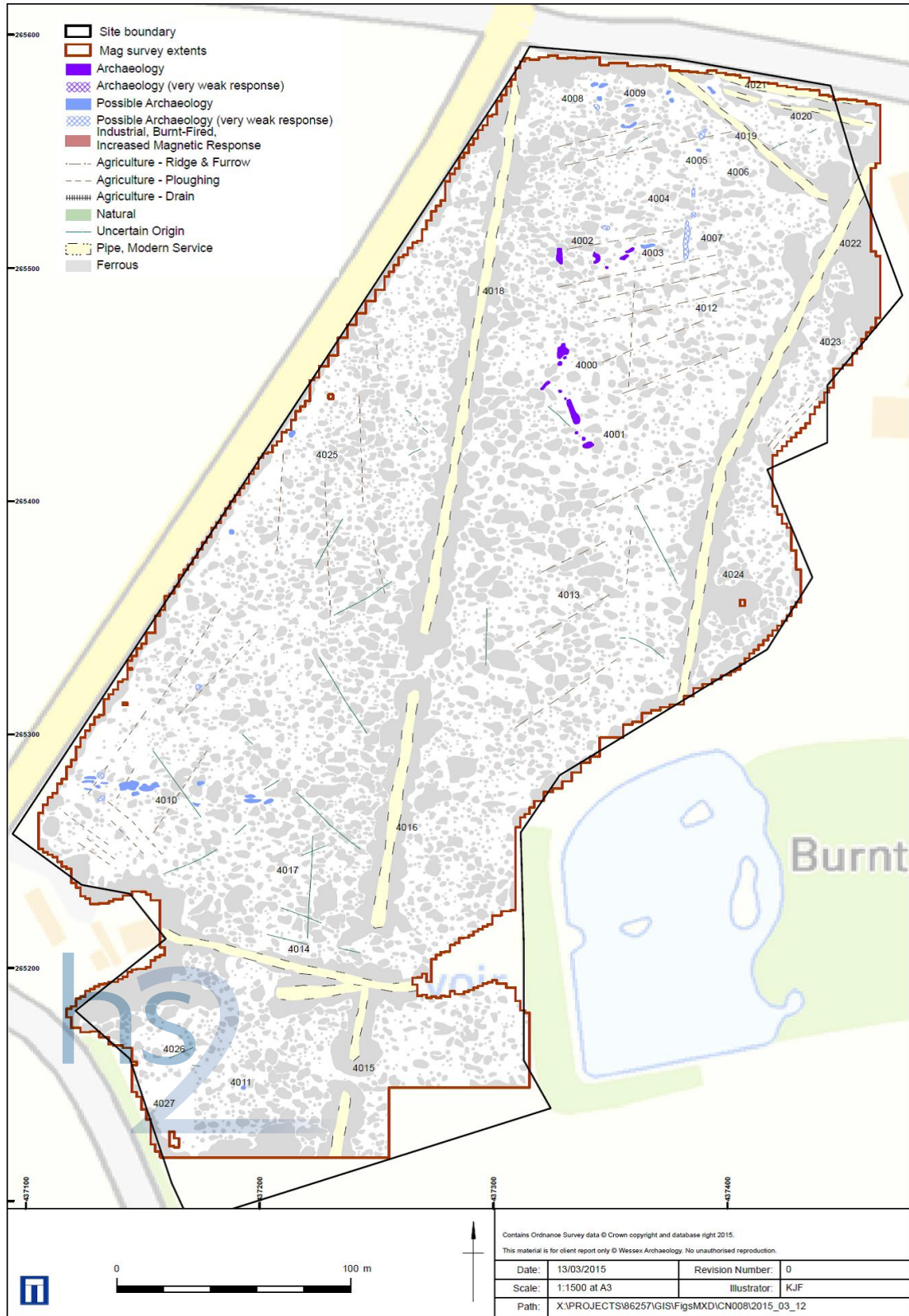


Figure 4 - CN008 interpretation



2.2 CNoog Additional Land Off Fosse Way

Introduction

2.2.1 The survey of CNoog was not reported in the main ES due to access being unavailable.

Project Background

2.2.2 Wessex Archaeology was commissioned on the behalf of HS2, to carry out a geophysical survey of area CNoog off Fosse Way, near Offchurch, Warwickshire (Figure 5), hereafter “the site” (centred on NGR 437087, 265505). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of the HS2 scheme.

2.2.3 The geophysical survey undertaken here has been preceded by a desk-based research (HS2 Environmental Statement, 2013) and a remote sensing survey comprising LiDAR and hyperspectral survey and analysis (Volume 5 appendix CH-004-017, ES 3.5.2.17.2)(i). Geophysical survey areas have been identified based on the archaeological potential and conclusions identified in these reports.

2.2.4 This site, CNoog, was selected for geophysical survey as it is considered to be an area at high risk (risk model score: 2) with potential for Roman remains and is proposed to be an area of major construction works.

Site Details

2.2.5 The site comprises a single arable field located approximately 1.1km, east of Offchurch, Warwickshire. It is bounded to the north by Long Itchington Road, to the south-east by Fosse Way (B4455) and to the south-west by farmland and Welsh Road. The gradiometer survey covered 6.8ha out of the proposed survey area of 7.5ha as some of the area was unsurveyable due to obstruction from a bird scarer device.

2.2.6 The site lies on an area of gently sloping land that falls away towards the south. The northern region of the survey area lies at a height of 100m aOD and the land falls to less than 85m aOD at the southern end of the site.

2.2.7 The solid geology is recorded as Mercia Mudstone Formation (Early Triassic) (Ordnance Survey (OS) 1957). There are superficial deposits recorded on site including bands of Thrussington Member throughout, with Wolston sand and gravel to the northwest and Dunsmore gravel to the northeast of the site. (Ordnance Survey (OS), 1977).

2.2.8 The soils within the Site are likely to comprise the typical brownearths of the 541r (Wick 1) association with clayey soils of 572f (Whimple 3) association to the north (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological Background

2.2.9 For a detailed assessment of the known archaeology of the site and surrounding area the relevant DBA should be consulted -(volume 5 appendix Ch-001-017, ES 3.5.2.17.4). A summary of relevant sites within approximately 1km of the survey area are summarised and have been included to provide context and inform the geophysical interpretation. Sites referred to can be found either within the gazetteer for CFA17 (Volume 5 appendix CH-002-017, ES 3.5.2.17.5) ES

(OFC numbers) in the supplementary survey works (WA numbers) or in the Warwickshire SMR (MWA/HWA numbers).

2.2.10 The current landscape is characterised as very large irregular fields with curvilinear boundaries (HWA8171). Remote sensing identified the route of the Fosse Way which borders the southeast of the site (WA18.9) (Wessex Archaeology, 2013).

2.2.11 Approximately 0.5km to the east of the site and to the southeast of Burnt Heath Farm is an undated cropmark enclosure discovered from aerial photographs, it is an incomplete circular enclosure containing a small rectangular enclosure (OFC 009). There are two undated cropmark enclosures approximately 0.8km to the south-west of the site boundary (MWA 4635; OFC014). They are all undated but may be prehistoric in origin due to their form and layout.

2.2.12 The Roman road of the Fosse Way borders the south-eastern boundary of the site (OFC012). Although the Roman road no longer survives as a surface feature there is considered to be increased archaeological potential for Roman remains in its vicinity immediately to the northwest and southeast of the modern Fosse Way road.

2.2.13 No sites or findspots area recorded within the survey area but in the immediate surroundings find spots dated to the Neolithic, Roman and post-medieval periods have been recorded. A Neolithic axe (MWA9276) was found 150m south-east of the site, whilst Roman and post-medieval pottery has been found in a number of places within the 1km survey area (MWA2243, MWA2230, MW4545).

2.2.14 The site lies within the parish of Offchurch which is characterised by medieval enclosed field systems with the village of Offchurch itself located to the west of the site. Earthworks surrounding the village provide evidence of settlement shrinkage. Ridge-and-furrow is also evident, with five plots located in the vicinity (OFC 027, 036, 044, 047 and 048). Other medieval earthworks and deposits associated with extant built heritage are likely to survive in the village cores and particularly near the medieval churches with earthworks forming an enclosure (OFC 023).

Survey Objectives

2.2.15 A WSI was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology, 2014). The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site;
- to determine the general nature of the remains present; and
- to combine the results of the geophysical surveys with data from other archaeological assessments carried out as part of the project in order to analyse the archaeological potential of the survey locations.

2.2.16 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

Methods

Survey Dates

- 2.2.17 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between the 6 - 10 February 2015.

Grid Location

- 2.2.18 The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds Historic England recommendations (Historic England, 2008).
- 2.2.19 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments Used and Survey Method

- 2.2.20 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with Historic England guidelines (Historic England, 2008).
- 2.2.21 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data Processing

- 2.2.22 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (± 5 nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.
- 2.2.23 Further details of the geophysical and survey equipment, methods and processing are described in Annex 1.

Data Presentation

- 2.2.24 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then passed to Atkins' graphics team who produced the final figures in GIS (ESRI ArcMap 10).
- 2.2.25 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ± 25 nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.

Results

- 2.2.26 The gradiometer survey has been successful in identifying anomalies of possible archaeological interest, along with numerous trends. The results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2000 (Figures 6 to 8).
- 2.2.27 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 8). Full definitions of the interpretation terms used in this report are provided in Annex 2.
- 2.2.28 Ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: Archaeology

- 2.2.29 The most significant anomalies of archaeological potential are a cluster of pit type anomalies at 4000, with a magnetic strength in excess of +3nT. The anomalies are oval and elongated in shape and may indicate either pits or ditch sections. Several ferrous anomalies and some curvilinear trends in the vicinity of these anomalies of archaeological potential may be associated, and of archaeological interest.
- 2.2.30 There are several oval and sub-oval pit-type anomalies across the site, such as at 4001 and 4002, which do not form any identifiable layout or concentrations. These anomalies have been classed as possible archaeology but could also be in response to changes in the superficial geology or natural features such as a tree throw.
- 2.2.31 An area of the site has weak, regularly spaced alternating positive and negative linear trends which have been interpreted as the remains of ridge and furrow. These are oriented north-northwest to south-southeast and can be seen at 4003 and 4004 with a second smaller area in the north-western corner of the site at 4005.
- 2.2.32 Two weakly positive anomalies at 4006 have been identified as natural in origin due to their broad and weak profiles and irregular shape.
- 2.2.33 The remaining anomalies across the site are weak, positive, parallel linear trends visible between 4008 and 4010 which have been interpreted as the result of ploughing and presumed to be post-medieval and modern in origin. They are oriented in a north-west to south-east direction and are on a different alignment to the presumed ridge and furrow.
- 2.2.34 An area of increased magnetic response is identified at 4009 in the southern area of the site adjacent to the current field boundary. While not distinctly dipolar in profile and indicative of ferrous material their location adjacent to the field boundary and road suggests they are probably in response to ferrous material in the vicinity.
- 2.2.35 Several trends have been identified, such as the large curvilinear trend at 4010. These could prove to be archaeological in origin but they are too weak and indistinct to be further characterised at this time.

Interpretation: Modern Services

- 2.2.36 No modern services were identified within the survey data.

- 2.2.37 Gradiometer data will not be able to locate and identify all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

Conclusions

- 2.2.38 The detailed gradiometer survey has been successful in detecting anomalies of likely and possible archaeological interest within the site, in addition to regions of increased magnetic response, evidence of ploughing and trends of uncertain origin.

Discussion

- 2.2.39 The data shows an area of archaeological potential at 4000 that contains pit and possible ditch-type responses together with several other anomalies and trends. This concentration of possible features is situated at the base of a gentle slope and in close proximity to the known Roman road. As such this is an area where there is considered to be a high potential for archaeological activity
- 2.2.40 The areas of ridge and furrow are interesting in that the stronger contrasting anomalies identified are located within the sloping area within the site around 4003 and 4004 with the ridge and furrow orientated along rather than across the contours. The area in the north-west of the site at 4005 is located in much flatter area and here the anomalies are much fainter and weakly contrasting. While ridge and furrow has been identified from LiDAR data in areas surrounding the site, within the site this has only been identified through geophysical survey further contributing to the understanding of the medieval landscape and settlement pattern in this parish.
- 2.2.41 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

References

Historic England, (2008), Geophysical Survey in Archaeological Field Evaluation. Research and Professional Service Guideline No. 1, 2nd Edition

HS2 Environmental Statement, (2013), London-West Midlands Environmental Statement, Volume 5: Technical Appendices: CFA17: Offchurch to Cubbington Baseline Report: Cultural Heritage. Report Reference: CH-001-017

Ordnance Survey (OS), (1957), Sheet 2, Geological Map of Great Britain. England and Wales: Ordnance Survey: Chessington

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Soil Survey of England and Wales, (1983), Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.

Wessex Archaeology, (2013), LiDAR and Hyperspectral Analysis Report Reference 86252.01

Wessex Archaeology, (2014), HS2: Geophysical Survey Written Scheme of Investigation. Report Reference: 86257.01.

HER Records Consulted

HWA8171 - Historic Landscape Characterisation: Very large irregular fields with curvilinear boundaries
 MWA2230 - Find spot - Imperial pottery
 MWA2243 - Find spot - Roman pottery sherd
 MWA4545 - Roman to modern tiles
 MWA4635 - Undated cropmark enclosure
 MWA9276 - Neolithic axe found in Offchurch
 OFC009 - Burnt Heath Farm cropmark
 OFC012 - Fosse Way Roman road
 OFC014 - Fosseyway Cottage cropmarks
 OFC023 - Offchurch earthwork enclosures
 OFC027 - Valley fields ridge and furrow
 OFC036 - Lower Grange ridge and furrow
 OFC044 - Mill Lane ridge and furrow
 OFC047 - Rugby Road ridge and furrow
 OFC048 - Coventry Road ridge and furrow

Figure 5- CNoog Site location

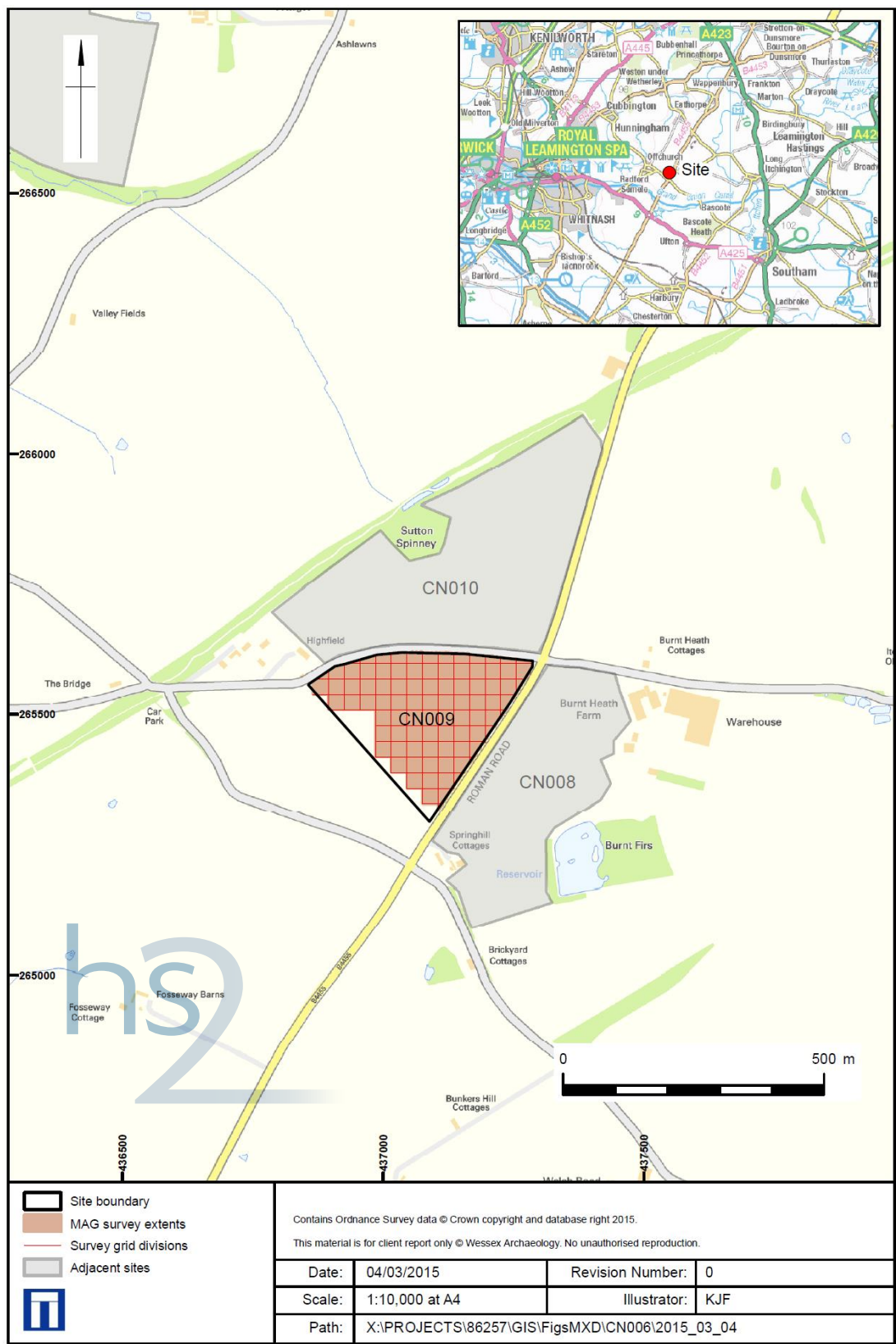


Figure 6 - CNoog greyscale

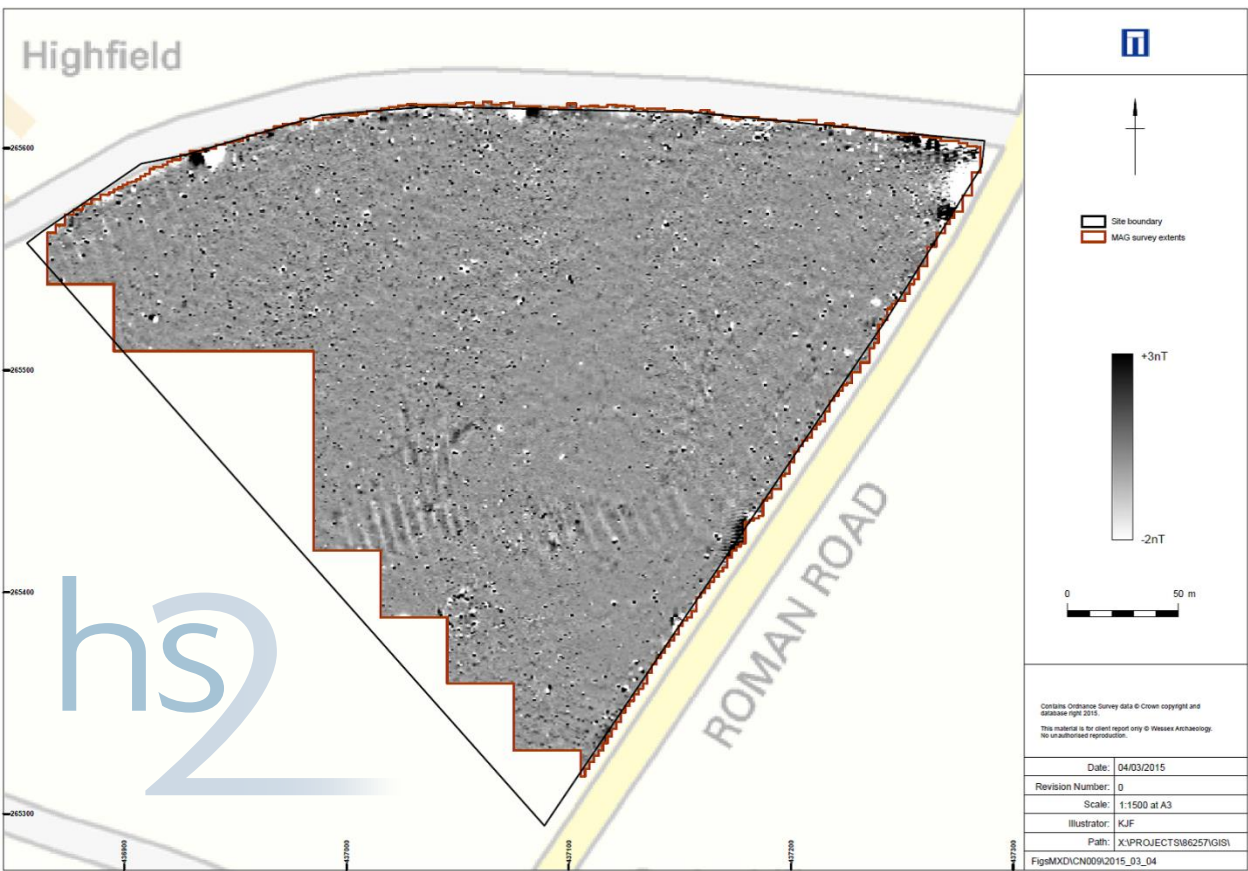


Figure 7. CNoog XY trace

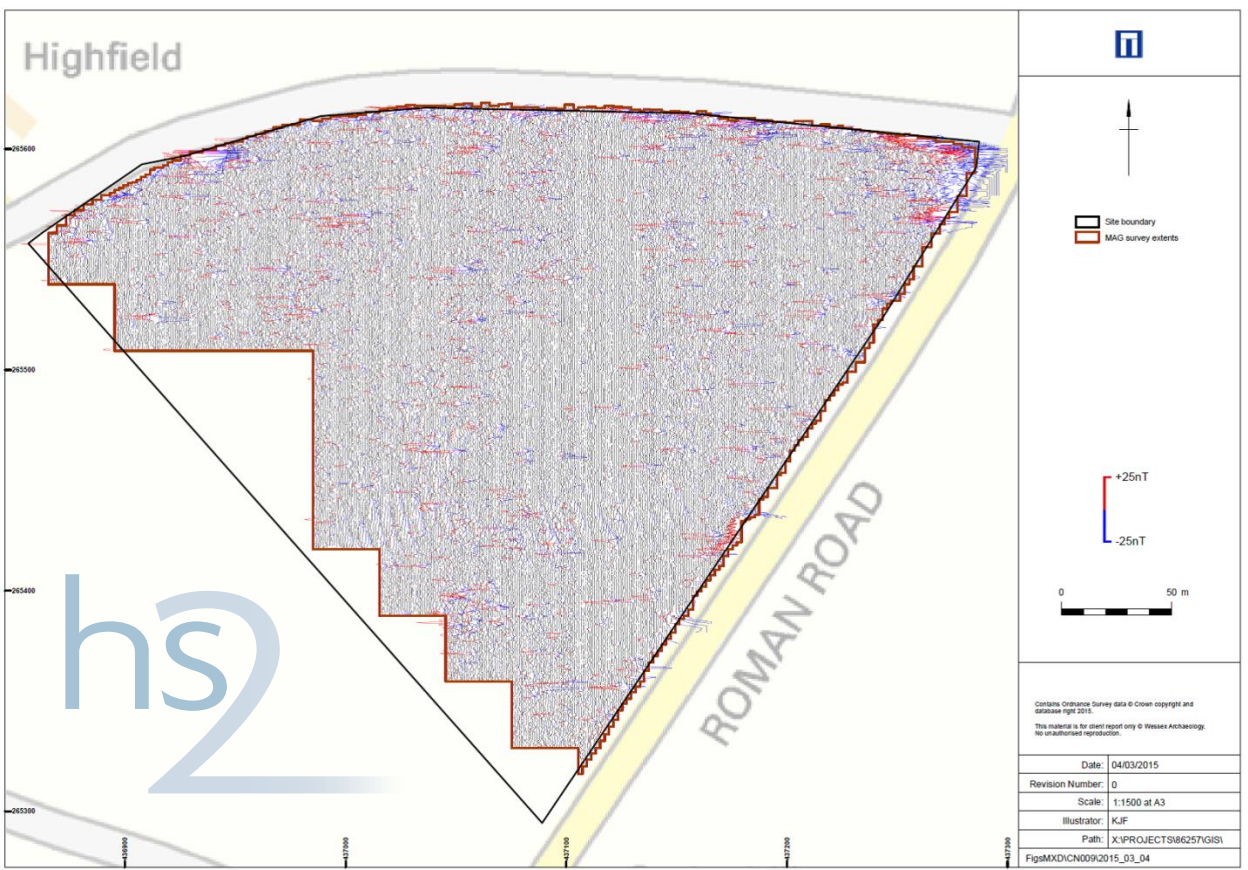
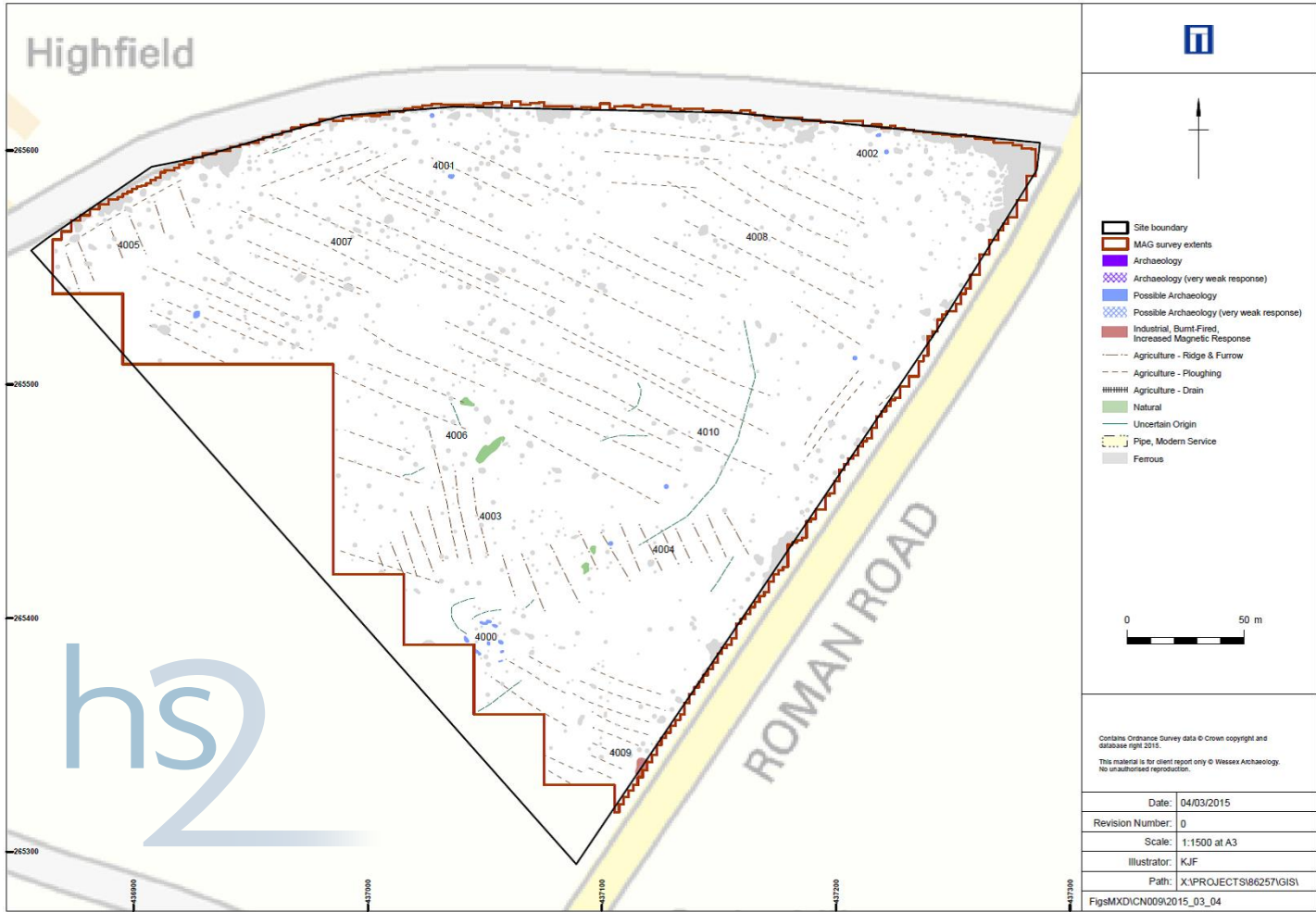


Figure 8 - CNoog interpretation



2.3 CNo10 Land South of Sutton Spinney

Introduction

2.3.1 The survey of CNo10 was not reported in the main ES due to access being unavailable.

Project Background

2.3.2 Wessex Archaeology was commissioned on the behalf of HS2, to carry out a geophysical survey of area CNo10 off Fosse Way, near Offchurch, Warwickshire (Figure 9), hereafter “the site” (centred on NGR 437215, 265768). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of the HS2 scheme.

2.3.3 The geophysical survey undertaken here has been preceded by a Desk-Based Assessment (DBA) (HS2 Environmental Statement 2013) and a remote sensing survey comprising LiDAR and hyperspectral survey and analysis ((Volume 5 appendix CH-004-017, ES 3.5.2.17.2)). Geophysical survey areas have been identified based on the archaeological potential and conclusions identified in these reports.

2.3.4 This site, CNo10, was selected for geophysical survey as it is considered to be an area at high risk (risk model score: 2) with the potential for Roman archaeological remains and it will be an area of major construction works.

Site Details

2.3.5 The site comprises a single arable field located approximately 1.2km east of Offchurch, Warwickshire. The site is bounded to the north-east by a thick treeline, to the east by Fosse Way (B4455) and to the south by Long Itchington Road. The gradiometer survey covered 13.8ha out of a proposed survey area of 14.4ha.

2.3.6 The site lies on an area of gently sloping land that falls away towards the north-west. The south-east region of the survey area lies at a height of 100m aOD and falls from this height to less than 90m aOD at the north-east of the site.

2.3.7 The solid geology is recorded as Mercia Mudstone Formation (Early Triassic) (Ordnance Survey (OS) 1957). The superficial deposits recorded on the site include areas of Dunsmore Gravel to the south-east, a band of Thrussington Member in the centre of the site and Wolston sand and gravel to the north-west of the site. (Ordnance Survey (OS) 1977).

2.3.8 The soils underlying the site are likely to comprise the typical brownearths of the 541r (Wick 1) association (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through gradiometer survey.

Archaeological Background

2.3.9 For a detailed assessment of the known archaeology of the site and surrounding area the relevant DBA should be consulted ((volume 5 appendix Ch-001-017, ES 3.5.2.17.4). A summary of relevant sites within approximately 1km of the survey area are provided below and have been included to provide context and inform the geophysical interpretation. sites referred to can be found either within the gazetteer for CFA17 (Volume 5 appendix CH-002-017, ES 3.5.2.17.5) (OFC numbers) in the supplementary survey works (WA numbers) or in the Warwickshire SMR (MWA/HWA numbers).

2.3.10 The current landscape is characterised as very large irregular fields with curvilinear boundaries (HWA8171). Remote sensing identified the route of the Fosse Way which borders the south-east of the site (WA17.9) (Wessex Archaeology 2013).

2.3.11 Approximately 0.5km to the east of the site and to the south-east of Burnt Heath Farm is an undated cropmark enclosure discovered from aerial photographs. This cropmark is an incomplete circular enclosure containing a small rectangular enclosure (OFC 009). There are two undated cropmark enclosures approximately 0.8km to the south-west of the site boundary (MWA 4635; OFC019). They are all undated but may be prehistoric in origin due to their form and layout.

2.3.12 The Roman road of the Fosse Way borders the eastern boundary of the site (OFC012). Although the Roman road no longer survives as a surface feature there is considered to be increased archaeological potential for Roman remains in its vicinity immediately to the north-west and south-east of the modern Fosse Way road.

2.3.13 No sites or findspots area recorded within the survey area but in the immediate surroundings find spots dated to the Neolithic, Roman and Imperial periods have been recorded. A Neolithic axe (MWA9276) was found 150m south-east of the site, whilst Roman and post-medieval pottery has been found in a number of places within the 1km survey area (MWA2243, MWA2230, MWA4545).

2.3.14 The site lies within the parish of Offchurch which is characterised by medieval enclosed field systems with the village of Offchurch itself located to the west of the site with surrounding earthworks displaying evidence of settlement shrinkage. Ridge-and-furrow is still evident with five plots located in the survey area (OFC 027, 036, 044, 047 and 048). Other medieval earthworks and deposits associated with extant built heritage are likely to survive in the village cores and particularly near the medieval churches with earthworks forming an enclosure (OFC 023).

Survey Objectives

2.3.15 A WSI was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology, 2014). The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site;
- to determine the general nature of the remains present; and
- to combine the results of the geophysical surveys with data from other archaeological assessments carried out as part of the project in order to analyse the archaeological potential of the survey locations.

2.3.16 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

Methods

Survey Dates

- 2.3.17 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between the 4 - 10 February 2015.

Grid Location

- 2.3.18 The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds Historic England recommendations (Historic England, 2008).
- 2.3.19 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments Used and Survey Method

- 2.3.20 The gradiometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with Historic England guidelines (Historic England, 2008).
- 2.3.21 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data Processing

- 2.3.22 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (± 5 nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.
- 2.3.23 Further details of the geophysical and survey equipment, methods and processing are described in Annex 1.

Data Presentation

- 2.3.24 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then passed to Atkins' graphics team who produced the final figures in GIS (ESRI ArcMap 10).
- 2.3.25 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ± 25 nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.

Results

- 2.3.26 The gradiometer survey has been successful in identifying anomalies of possible archaeological interest, along with numerous trends. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (Figures 10 to 15).
- 2.3.27 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figures 14 and 15). Full definitions of the interpretation terms used in this report are provided in Annex 2.
- 2.3.28 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: Archaeology

- 2.3.29 A small cluster of pit-type anomalies at 4000 have been classed as possible archaeology. They are oval-shaped positive anomalies with a magnetic strength of +2nT and they lie within a wider area of positive linear trends at 4001 that have been interpreted as ridge-and-furrow. These are oriented in a north-west to south-east direction and are distinct from narrower and weaker ploughing trends in that they are broader with pronounced negative areas between them.
- 2.3.30 Two potential ditch-like anomalies at 4002 take the form of weakly positive linear anomalies in an approximate L-shaped layout measuring approximately 12 x 8m. There are two further weakly positive oval-shaped anomalies nearby which appear to be possible pits. This feature is interpreted as possible archaeology (very weak response) as it is on a completely different orientation to the current field boundaries or to ploughing and ridge-and-furrow trends elsewhere across the site.
- 2.3.31 There are a few further isolated pit-type anomalies at 4003, 4004 and 4005, they are weak positive oval shaped anomalies and are classed as possible archaeology. They do not form a concentration or a significant distribution to be interpreted further.
- 2.3.32 A pair or parallel, weak curvilinear anomalies at 4004 are interpreted as agricultural, probably ploughing trends, but they could also be a track as it follows the route of the current field boundary.
- 2.3.33 Ploughing trends are visible at 4003 and 4005 which are regular spaced, linear trends that are closely spaced and predominantly oriented in a north-west to south-east direction. As well as ploughing trends there are several weak linear and curvilinear trends, such as at 4006, which are ephemeral and do not form any significant patterns or distributions therefore they cannot be characterised further.
- 2.3.34 In the north-east half of the field around 4007 and 4008 is an area containing several features of possible archaeological interest. A concentration around 4007 of weak, positive, oval and sub-oval anomalies is potentially a number of pits and although their distribution is random they have interpreted as possible archaeology. At 4008 are two broad and weakly positive linears in an L-shaped layout. They have been classed as possible archaeology (very weak response) and their identification is tentative due to their weak contrast, it could possibly represent a natural change in the superficial geology.

- 2.3.35 There are very few anomalies of possible archaeological interest elsewhere in this area with a couple of examples between 4008 and 4009 and at 4010.
- 2.3.36 Across this area of the site are a number of linear repeating bipolar anomalies which are a typical response of ceramic field drains. Where faint linears continue or are intermittent they have been interpreted as linear trends of uncertain origin but when they are on the same orientation as the more obvious field drain responses they are assumed to be former field drains.
- 2.3.37 At 4011 abutting the modern field boundary is a large area containing numerous large and small dipolar anomalies with a section of repeating linear dipolar anomalies. The dipolar anomalies are typical of ferrous and this whole area is assumed to have a large amount of ferrous debris with possibly a short section of pipe within it. An approximate linear scatter of dipolar anomalies can be identified between 4007 and 4008 and extending in a northwest - southeast direction terminating at the ferrous debris area of 4011. This could possibly be the remains of a former internal field boundary visible on former Ordnance Survey (OS) mapping but no longer existing (Ordnance Survey (OS) 1887).

Interpretation: Modern Services

- 2.3.38 There is one short section of pipe or modern service within the area of ferrous anomalies at 4011. It does not extend beyond this area.
- 2.3.39 Gradiometer data will not be able to locate and identify all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

Conclusions

- 2.3.40 The detailed gradiometer survey has been successful in detecting anomalies of likely and possible archaeological interest within the site, in addition to areas of ridge-and-furrow, a complex of field drains, numerous ploughing trends and trends of uncertain origin.

Discussion

- 2.3.41 The data shows some possible archaeological features primarily in the south-west area of the site and in the form of pit-type anomalies at 4000 and 4007 and two possible L-shaped anomalies at 4002 and 4008. Apart from these features there are some isolated pits across the site but nothing to suggest a concentration or spatial distribution of any significance such as at 4000. The remaining features of note are two areas of ridge-and-furrow at 4001 and 4007 which are both oriented in the same north-west to south-east direction.
- 2.3.42 There are only a few possible pit-type anomalies in the north-west of the site possibly due to the complex of ceramic field drains visible across the area. The construction of the field drains could have destroyed any possible archaeological remains.
- 2.3.43 There is a short section of pipe or modern service within a larger area of ferrous debris at 4011, this is also an area where a possible former internal field boundary terminates as seen on available Ordnance Survey mapping (Ordnance Survey,(OS) 1887).
- 2.3.44 The relative dimensions of the modern services identified by the gradiometer survey are indicative of the strength of their magnetic response, which is dependent upon the materials used in their construction and the backfill of the service trenches. The physical dimensions of

the services indicated may therefore differ from their magnetic extents in plan. It is assumed that the centreline of services is coincident with the centreline of their anomalies. It is difficult to estimate the depth of burial of the services through

- 2.3.45 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

References

Historic England, (2008), Geophysical Survey in Archaeological Field Evaluation. Research and Professional Service Guideline No. 1, 2nd Edition

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Ordnance Survey(OS), (1977), Quaternary Map of the United Kingdom: South. Ordnance Survey: Southampton

Soil Survey of England and Wales, (1983), Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.

Wessex Archaeology, (2013), LiDAR and Hyperspectral Analysis Report Reference 86252.01

Wessex Archaeology, (2014), HS2: Geophysical Survey Written Scheme of Investigation. Report Reference: 86257.01.

HER Records Consulted

HWA8171 - Historic Landscape Characterisation: Very large irregular fields with curvilinear boundaries
 MWA2230 - Find spot - Imperial pottery
 MWA2243 - Find spot - Roman pottery sherd
 MWA4545 - Roman to modern tiles
 MWA4635 - Undated cropmark enclosure
 MWA9276 - Neolithic axe found in Offchurch
 OFC009 - Burnt Heath Farm cropmark
 OFC012 - Fosse Way Roman road
 OFC014 - Fosseyway Cottage cropmarks
 OFC023 - Offchurch earthwork enclosures
 OFC027 - Valley fields ridge and furrow
 OFC036 - Lower Grange ridge and furrow
 OFC044 - Mill Lane ridge and furrow
 OFC047 - Rugby Road ridge and furrow
 OFC048 - Coventry Road ridge and furrow

Figure 9 - CN010 site location

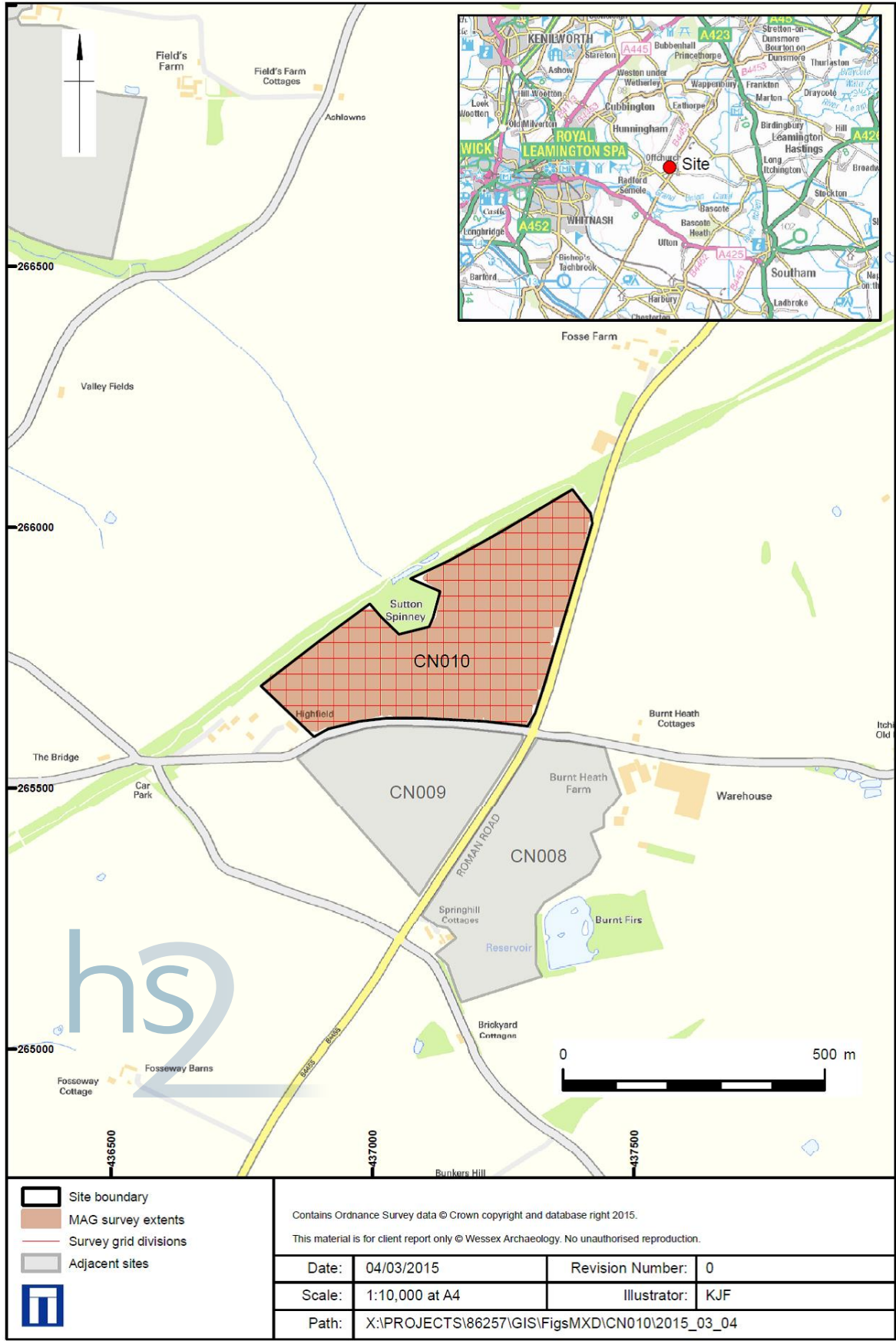


Figure 10 - CN010 greyscale, west side

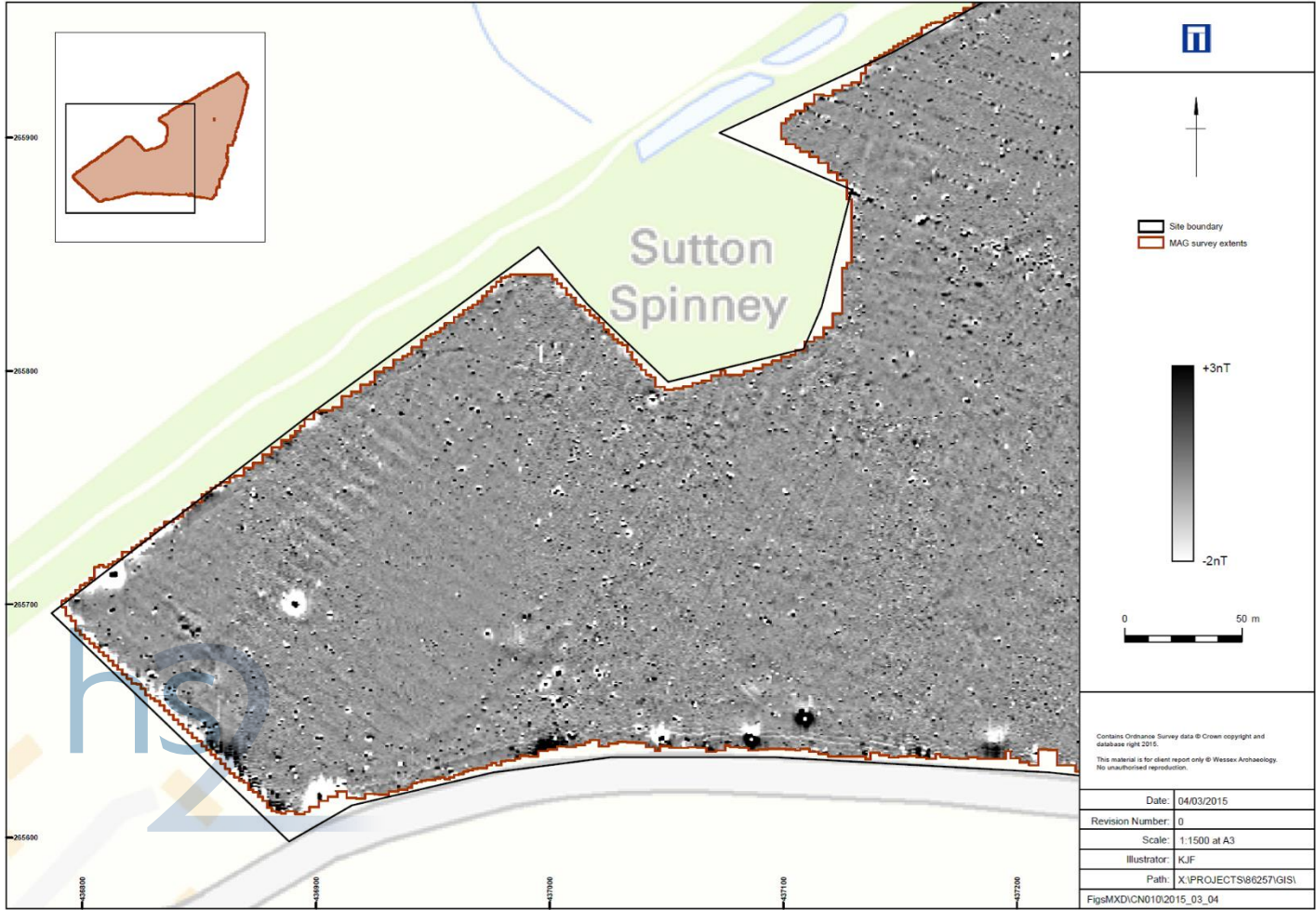


Figure 11 - CNo10 greyscale, east side



Figure 12 - CNo10 XY trace, west side

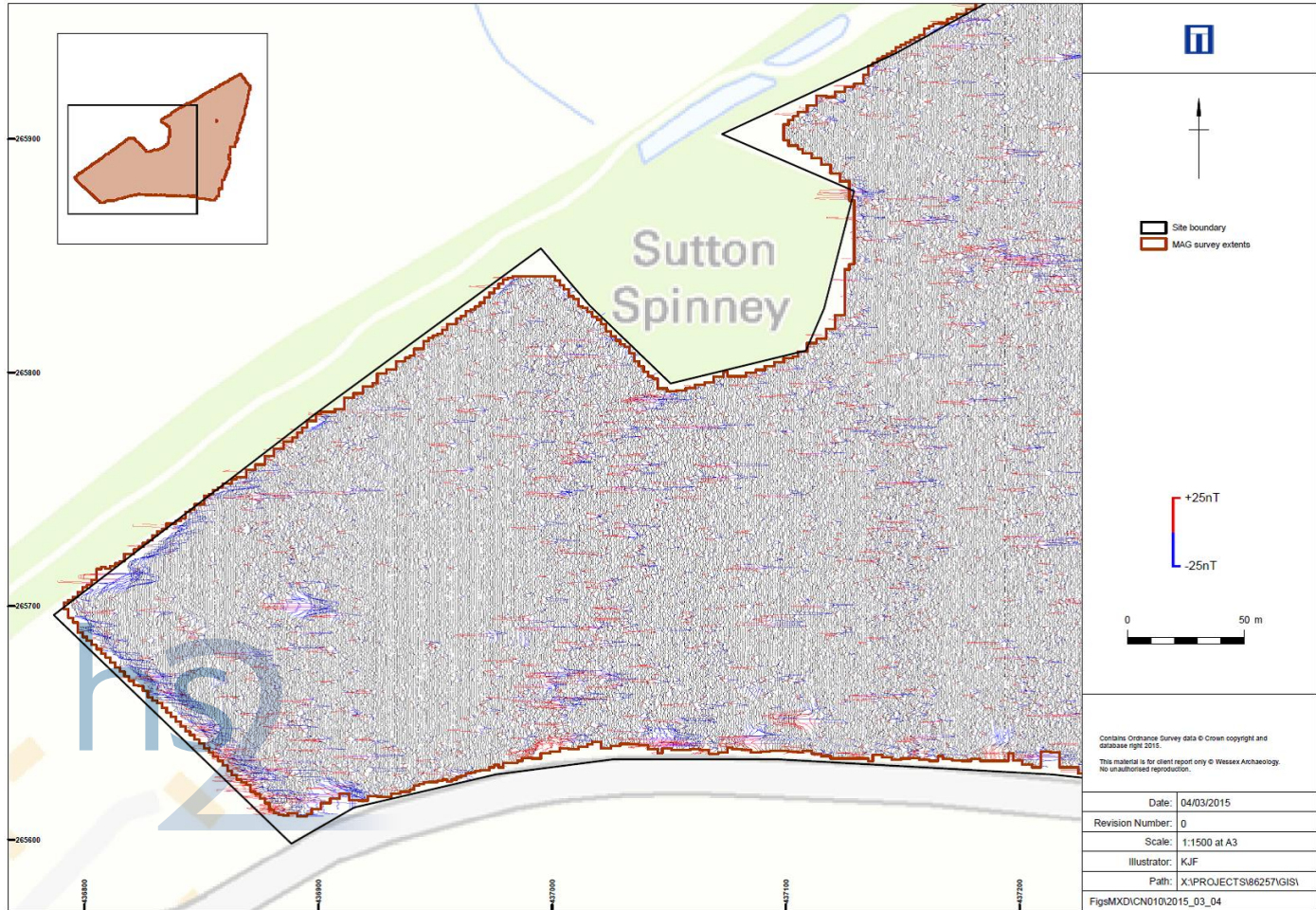


Figure 13 - CNo10 XY trace, east side

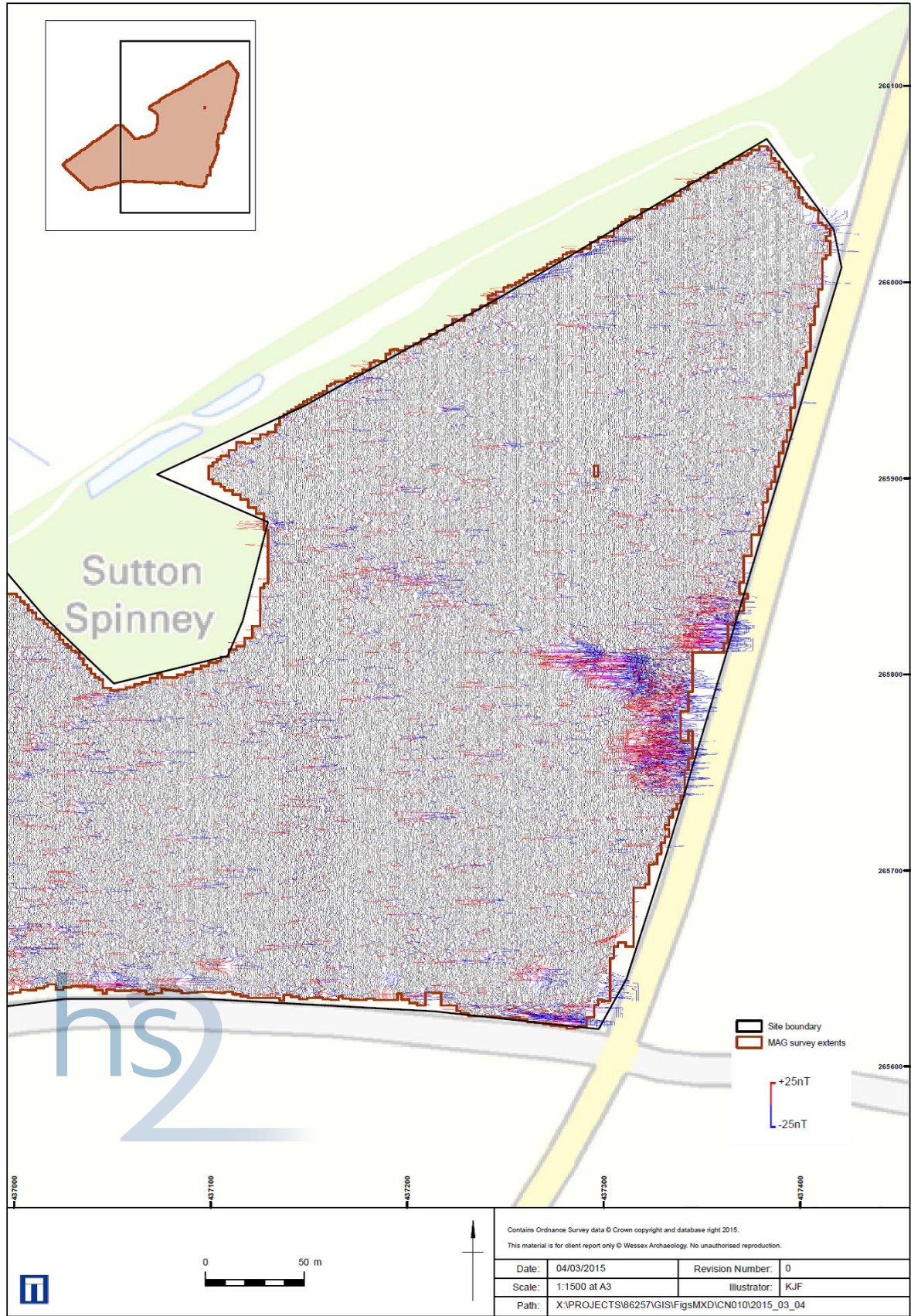


Figure 14 - CNo10 Interpretation, west side

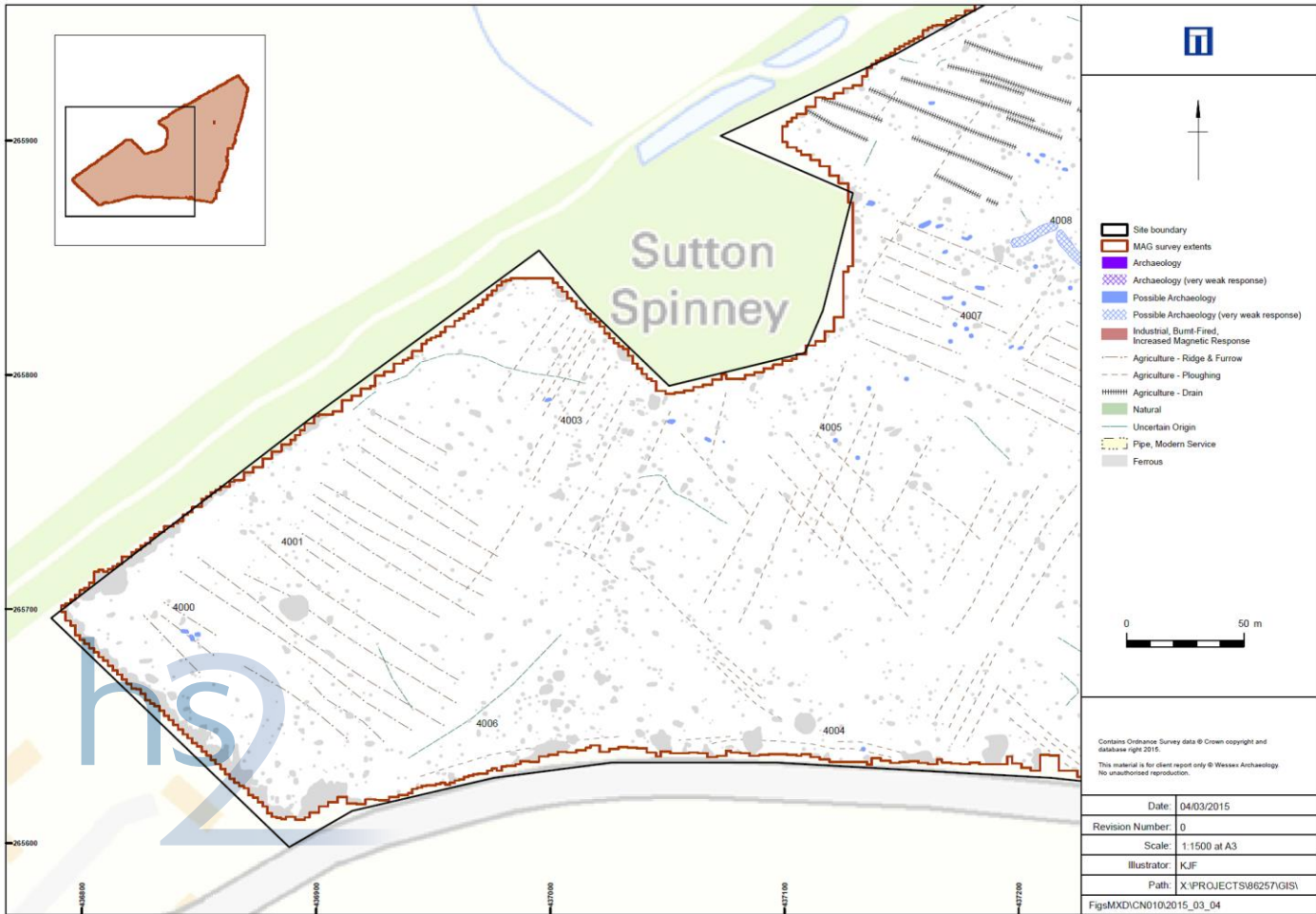
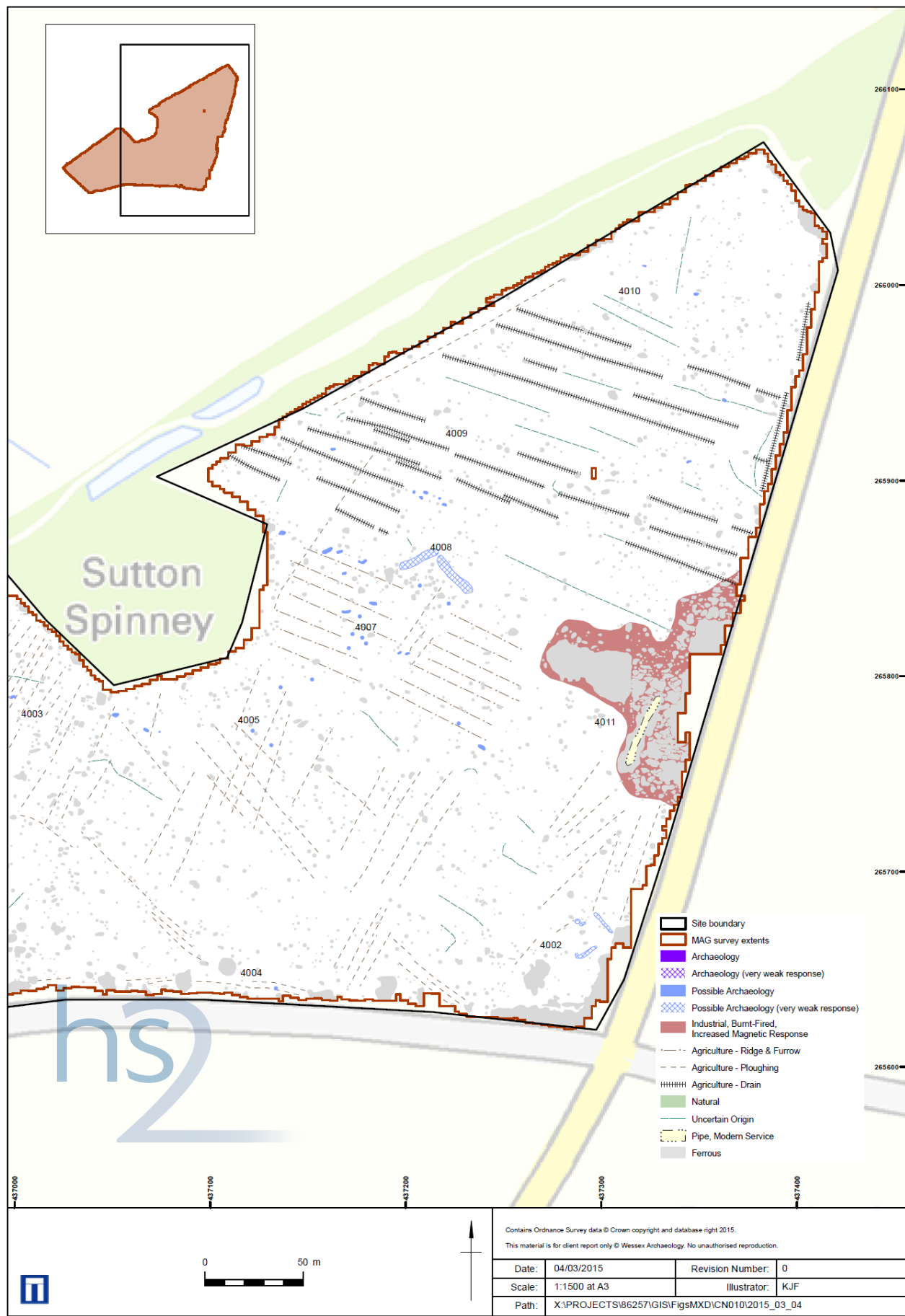


Figure 15 - CNo10 interpretation, east side



2.4 CNo11 Land near Fields Farm

Introduction

2.4.1 The survey of CNo11 was not reported in the main ES due to access being unavailable.

Project Background

2.4.2 Wessex Archaeology was on the behalf of HS2 Ltd, to carry out a geophysical survey of area CNo11 close to Hunningham, near Royal Leamington Spa, Warwickshire (Figure 16), hereafter “the site” (centred on NGR 436290 266759). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

2.4.3 The geophysical survey undertaken here has been preceded by a Desk-Based Assessment (DBA) (HS2 Environmental Statement, 2013a) and a remote sensing survey comprising LiDAR and hyperspectral survey and analysis (HS2 Environmental Statement, 2013b). Geophysical survey areas have been identified based on the archaeological potential and conclusions identified in these reports.

2.4.4 This site, CNo11, was selected for geophysical survey as it is considered to be an area of increased archaeological potential at medium risk to borderline high risk due to its topographic position around a river course on an area of gravels (risk model score: 3 borderline 2; see below).

Site Details

2.4.5 The site comprises three arable fields located approximately 4.3km north-east of Royal Leamington Spa, Warwickshire. The survey extents are defined by field boundaries on all sides with farm buildings of Field's Farm to the north and north-east. The gradiometer survey covered 15.7ha of the 17.4ha site with a small area lost to field boundaries and surface obstructions.

2.4.6 The site lies on an area of generally flat land that rises fairly steeply towards the east. The highest point of the survey area is to the east and lies at a height of a little over 70m aOD and falls from this height to less than 58m aOD at the western edge, towards the River Leam. A narrow area of woodland known as Ash Beds borders the southern site boundary around a small unnamed stream that flows into the River Leam.

2.4.7 The solid geology is recorded as Mercia Mudstone (Triassic) and the superficial geology is recorded as river terrace deposits with boulder clay and morainic drift close by (Ordnance Survey (OS) 1957 and 1977).

2.4.8 The soils underlying the south-east half of the site are likely to be stagnogley argillic brown earths of the 572f (Whimple 3) association (SSEW, 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through gradiometer survey.

Archaeological Background

2.4.9 For a detailed assessment of the known archaeology of the site and surrounding area the relevant desk-based assessment (DBA) should be consulted (volume 5 appendix Ch-001-017, ES 3.5.2.17.4). A summary of relevant sites within 1km of the survey area are summarised below and have been included to provide context and inform the geophysical interpretation. sites referred to can be found either within the gazetteer for CFA17 (Volume 5 appendix CH-

002-017, ES 3.5.2.17.5)ES (OFC numbers) in the supplementary survey works (WA numbers) or in the Warwickshire SMR (MWA/HWA numbers).

2.4.10 The survey area is characterised as very large irregular post-war fields with curvilinear and straight boundaries (HWA8604). Remote sensing revealed a number of linear earthworks probably representing disused former field boundaries (WA17.12) (Wessex Archaeology, 2013).

2.4.11 Few clear prehistoric, Roman or post-Roman records exist in the immediate vicinity of CNo11 although a number of significant sites lie within the wider area around the site. No sites are known within the survey area but 1km to the north-east are four possible linear features observed as cropmarks on aerial photographs and interpreted as a potential prehistoric pit alignment (MWA4870). In addition to this there are several find spots recorded of flints (undated) and Roman items (not specified) in the immediate vicinity at Hunningham (e.g. MWA6005; MWA5272).

2.4.12 sites within the wider CFA include a Palaeolithic site of potential international importance at Waverley Wood Farm Pit (OFC041) and the former Roman road known as the Fosse Way (OFC012) (HS2 Environmental Statement, 2013a).

2.4.13 The site lies between the shrunken medieval settlements and earthwork enclosures of Offchurch to the south-west (OFC23; OFC024) and Hunningham to the north-east (MWA9523; MWA2526; MWA7268). Medieval remains are present in close proximity to the site in the form of fragmentary remains of ridge and furrow in the field to the north-west of the survey area that was observed from LiDAR data (WA2.12).

2.4.14 Post-medieval remains include a watermill and timber bridge named Weston Mill crossing the River Leam to the north of the site (OFC038) and Offchurch Mill and associated bridge crossing the River Leam to the south-west of the site on the outskirts of the village (MWA2214; 2221). A quarry pit is located approximately 1km to the north-east of the site (MWA2534).

2.4.15 A World War II lighting decoy and a bombing decoy lie to the north-east of the survey area and they were designed to confuse enemy aircraft and protect assets in Coventry. Two buildings related to this complex remain upstanding (OFC034). A Hawker Hurricane Mark I British fighter plane crashed within 1km of the survey area (Historic England V6680).

2.4.16 Undated records include the finding of a quernstone to the north-east of the site (MWA5078).

Survey Objectives

2.4.17 A WSI was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology, 2014). The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site;
- to determine the general nature of the remains present; and
- to combine the results of the geophysical surveys with data from other archaeological assessments carried out as part of the project in order to analyse the archaeological

potential of the survey locations.

- 2.4.18 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

Methods

Survey Dates

- 2.4.19 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team on the 12th and between the 17 - 19 March 2015.

Grid Location

- 2.4.20 The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds Historic England recommendations (Historic England, 2008).
- 2.4.21 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments Used and Survey Method

- 2.4.22 The gradiometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with Historic England guidelines (Historic England, 2008).
- 2.4.23 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data Processing

- 2.4.24 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (± 5 nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.
- 2.4.25 Further details of the geophysical and survey equipment, methods and processing are described in Annex 1.

Data Presentation

- 2.4.26 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then passed to Atkins' graphics team who produced the final figures in GIS (ESRI ArcMap 10).

- 2.4.27 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ± 25 nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:2000.

Results

- 2.4.28 The gradiometer survey has been successful in identifying a few anomalies of possible archaeological interest, along with numerous trends of uncertain origin. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2000 (Figures 17 to 19).
- 2.4.29 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 19). Full definitions of the interpretation terms used in this report are provided in Appendix 2.
- 2.4.30 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: Archaeology

- 2.4.31 The geophysical survey has detected a significant number of archaeological features concentrated in the western field with a continuation of some of these features into the eastern field.
- 2.4.32 The majority of the archaeological features are concentrated within a circular ditch. The response from the ditch varies across the site most likely due to the difference in the superficial deposits and their respective depths as the land climbs more steeply towards the east compared to the majority of the enclosure on the lower lying flat area. Between 4000 and 4001 an intermittent positive curvilinear anomaly extends with a magnetic strength of between +1 and +1.5nT and this linear is again picked up at 4002 but as a weaker positive anomaly with a magnetic strength of < +1nT. The enclosure ditch then disappears at its northern edge but a large positive curvilinear anomaly is visible again at 4003 to 4005 and presumed to be the same feature due to its layout and form. It has a strong magnetic response of between +7nT and +10nT and appears wider in size than the corresponding ditch on the opposite side of the site.
- 2.4.33 At 4004 is a rectilinear ditch that appears attached to the outer enclosure ditch and is possibly an internal subdivision. The larger circular positive anomaly adjacent to it is possibly a pit due to its shape and both anomalies have similar magnetic strength as the outer enclosure ditch. A second larger internal ditch is to the south-west of 4005 and it is of a similar response and shape to the anomalies at 4003 and 4004.
- 2.4.34 The enclosure ditch is interrupted around 4006 and 4007 by several ditch responses of linear and curvilinear positive anomalies with a magnetic strength of between +3nT and +9nT with the strongest values over the possible ring ditch
- 2.4.35 The enclosure ditch anomaly is not identifiable within this area at all and suggests it might not have existed in this area. At 4007 is a narrow and approximately rectangular positive anomaly that is possibly on the same alignment as the enclosure ditch but it is wider in size and stronger in response to that of the enclosure ditch and suggests that it is not the same feature.

- 2.4.36 The majority of the features within the enclosure ditch are positive linear and intermittently linear anomalies interpreted as Archaeology and Archaeology (very weak response) depending on their magnetic strength. The anomalies are typical of ditches and they interconnect and are mostly aligned on similar orientations so that there are several rectilinear enclosures visible with multiple internal divisions.
- 2.4.37 The most prominent and identifiable is the larger rectilinear enclosure subdivided into narrow corridors and internal rectangular enclosures around 4008 to 4011. There is a second larger but more intermittent rectilinear enclosure with internal subdivisions extending between 4012 and 4013. The rectilinear enclosures are either side of a central area running north-east to south-west at 4018 and possibly interpreted as the main "street" or access through the settlement.
- 2.4.38 Within the circular enclosure ditch are at least five annular or intermittent curvilinear ditch anomalies that are interpreted as Archaeology and most probably ring ditches. These can be seen at 4014; 4015; there are two adjacent to each other at 4016 and a further two adjacent to each other just to the north of 4008. Whilst the ring ditch at 4015 is in an area on its own the other ring ditches are within the internal rectilinear enclosures and appear to be truncated by the linear ditches suggesting they are an earlier phase of the settlement, see especially the two ring ditches at 4016.
- 2.4.39 An intermittent L-shaped ditch at 4017 lies at an oblique angle to the other ditches and enclosures; it is possibly a different type of feature or phase of the site.
- 2.4.40 Within the rectilinear enclosure areas, although some possible pit type of response have been identified there are no obvious concentrations or clusters. There are, however, at least six large circular shaped positive anomalies at 4018, to the north and south of 4019 and at 4020 that have been interpreted as Archaeology or Possible Archaeology and could represent pits. They are all of a similar size being between 3 and 5m in diameter and all have a relatively strong magnetic value of between +3nT and +10nT with one of the pits to the south of 4019 having a magnetic strength of >+30nT suggesting a possible ferrous/ceramic/burnt component or equally there could be modern ferrous debris in the same location to explain this higher value. Anomaly 4018 in particular is of interest because of its location and its isolation compared to the other pit anomalies around 4019 and 4020 that occur along the current field boundary therefore an association with this cannot be ruled out.
- 2.4.41 To the west of the circular enclosure around 4022 is an approximately rectangular enclosure identified as a U-shaped positive anomaly, if the fourth side is present it is beyond the survey boundary. Within the rectangular enclosure are several oval and circular shaped positive anomalies all identified as Possible Archaeology, they are weaker in response at between +1 to +2nT than the surrounding ditch anomaly which has a magnetic strength of >+5nT. There are no internal subdivisions identified within this enclosure.
- 2.4.42 An east-west linear ditch feature extends across the eastern area of the circular enclosure settlement at 4021 which has been interpreted as Archaeology. A similarly oriented linear runs parallel but to the north just below 4004, however it has been interpreted as ploughing or could even be a track as it appears as a negative linear anomaly and does not appear in the interior of the circular enclosure ditch.
- 2.4.43 Between the rectangular enclosure at 4022 and the circular enclosure ditch are a number of weak, positive linear, curvilinear and circular anomalies identified around 4023 and 4024. They are interpreted as Archaeology and Possible Archaeology depending on their form and magnetic strength with some very ephemeral anomalies interpreted as Possible Archaeology (very weak response). They are weaker in response and appear more ephemeral than the main area of enclosures but they represent ditches and smaller, discrete cut features such as pits. The relationship between these features and the rectangular enclosure and between this area and the circular enclosure settlement cannot be established from this geophysical data. The only clear indication of phasing is that the ridge and furrow linear anomalies truncate the rectangular enclosure resulting in the ditch anomaly becoming intermittent in its response.
- 2.4.44 The area around 4023 and 4024 also has a lower concentration of ridge and furrow and ferrous anomalies therefore it could be a more general trend that features are not as detectable or are not as surviving in this area possibly due to factors such as the superficial geology or the topography.
- 2.4.45 A weakly positive ditch anomaly at 4025 is interpreted as Possible Archaeology as it is a single anomaly and does not appear as part of a larger enclosure or group of features.
- 2.4.46 At least two linear positive anomalies in an approximate north-south orientation at 4027 represent ditches and are interpreted as Archaeology (very weak response). The angle of these anomalies suggests they run into the larger ditch anomaly between 4003 and 4004.
- 2.4.47 To the north-west and the west of the site are numerous parallel positive linear which are regularly spaced at an interval of approximately 8m. These anomalies around 4028 and 4029 are interpreted as ridge and furrow with further areas visible at 4030 to 4032 although these are more ephemeral and not in such a large concentration.
- 2.4.48 A number of trends are identified across the site primarily of single linear and curvilinear weakly positive anomalies, they are of uncertain origin as they cannot be characterised further. The trends around 4019 are within the circular enclosure ditch and are in proximity to anomalies of archaeological interest and therefore could be in response to very weak ephemeral anomalies associated with the rectilinear enclosure identified.
- 2.4.49 There are a number of weak and broad irregular shaped anomalies around 4031 and 4033 in the area where the ground starts to climb. These have been interpreted as Natural in origin and are distinct in form and strength from the ditch anomalies of 4003 to 4005.
- 2.4.50 Compared to the background response from the western field where there is a relatively low concentration of dipolar anomalies across the area, the eastern field has two particularly high concentrations of dipolar anomalies at 4034 and 4035. The area around 4034 is in the interior of the circular enclosure ditch and although some feature of archaeological interest have been identified they are much fewer in number and not as defined as in the western field. This area is generally low-lying with the second concentration of dipolar anomalies at the top of the slope at 4035.
- 2.4.51 A modern service is identified at 4036 and probably associated with its construction is an area of increased magnetic response and a large number of ferrous anomalies in this area of the site possibly indicating a spread of debris and presumed to be modern in origin.
- 2.4.52 One modern service has been identified within the geophysical data at 4036 running east-west parallel to the northern boundary of the site.

Interpretation: Modern Services

- 2.4.53 Gradiometer data will not be able to locate and identify all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

Conclusions

- 2.4.54 The detailed gradiometer survey has been successful in detecting anomalies of possible archaeological interest within the Site, in addition to areas of ridge and furrow, ploughing trends and trends of uncertain origin.

Discussion

- 2.4.55 This area was identified as an area of increased archaeological potential and the gradiometer survey has detected significant anomalies of archaeological interest relating to an enclosed settlement with internal enclosures and ring ditches with further enclosures to the west and areas of ridge and furrow. This site should be assessed together with CN012 directly north of this site and also located on an area of gravels. Significant anomalies of archaeological interest were identified from this survey area too.
- 2.4.56 A large circular ditch encloses an area containing several rectilinear enclosures located either side of a main axis. The rectilinear enclosures are further subdivided and contain numerous parallel and aligned ditches with the majority of the features in the western half of the survey but some enclosures have also been identified to the east.
- 2.4.57 At least five annular or curvilinear ditch features are identified in the data and are interpreted as ring ditches. Although this is not possible to suggest a relationship for all of these, at 4016 the ditches of the rectilinear enclosures appear to truncate the ring ditches suggesting they pre-date these larger rectilinear enclosures.
- 2.4.58 The enclosure ditch is interrupted by an area of interconnecting linear and some annular and curvilinear ditches and it is not clear from the data whether the large circular enclosure ditch continued through here.
- 2.4.59 There is also no circular enclosure ditch identified to the north between 4002 and 4003 but there are fewer anomalies in general within this area as a whole. It is possible that features exist but are not being detected due to factors such as the superficial geology, the depth of the feature or the topography or they could equally not have survived due to modern agricultural activities.
- 2.4.60 Further settlement is evident to the west of the circular enclosure in the form of a rectangular ditch enclosure and several anomalies possibly representing smaller enclosures and/or pits. The relationship between these areas cannot be established from the geophysics.
- 2.4.61 Several large pit type anomalies have been interpreted as Archaeology with the main emphasis being on the anomaly at 4018 as it is isolated from the rest and appears with the enclosure areas rather than along and in the vicinity of the current field boundary.
- 2.4.62 Ridge and furrow is visible in greatest concentration around 4028 and 4029 where it truncated the rectangular enclosure and there are lower concentrations around 4030 to 4032.
- 2.4.63 A large concentration of dipolar anomalies within the circular enclosure ditch in the eastern field is possibly masking weaker anomalies of potential archaeological interest if you compare this area with the number of features identified in the western field.

- 2.4.64 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

References

Historic England, (2008), Geophysical Survey in Archaeological Field Evaluation. Research and Professional Service Guideline No. 1, 2nd Edition

HS2 Environmental Statement, (2013a), London-West Midlands Environmental Statement, Volume 5: Technical Appendices: CFA17: Offchurch and Cubbington Baseline Report (CH-001-017): Cultural Heritage. Report Reference: ES 3.5.2.17.4

HS2 Environmental Statement, (2013b), London-West Midlands Environmental Statement, Volume 5: Technical Appendices: CFA17: Offchurch and Cubbington Survey Reports (CH-004-017): LiDAR and Hyperspectral survey report. Report Reference ES 3.5.2.17.7

Ordnance Survey (OS), (1957), Sheet 2, Geological Map of Great Britain. England and Wales: Ordnance Survey: Chessington

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Soil Survey of England and Wales, (1983), Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.

Wessex Archaeology, (2013), LiDAR and Hyperspectral Analysis Report Reference 86252.01

Wessex Archaeology, (2014), HS2: Geophysical Survey Written Scheme of Investigation: Warwickshire Report Reference: 86257.01.

HER Records Consulted

HWA8604 - Historic Landscape Characterisation: very large irregular post-war fields with curvilinear and straight boundaries
 MWA2214 - Offchurch Mill
 MWA2221 - Offchurch Bridge
 MWA2526 - Site of Medieval shrunken Settlement at the Vicarage, Hunningham
 MWA2534 - Quarry
 MWA4870 - prehistoric pit alignment
 MWA5078 - Findspot - Undated quern stone
 MWA5272 - Findspot - Roman finds, Hunningham
 MWA6005 - Findspot - Neolithic flint
 MWA7268 - Medieval Settlement Earthworks, Hunningham
 MWA9523 - Hunningham Medieval Settlement
 OFC012 - Fosse Way Roman Road
 OFC023 - Offchurch earthwork enclosures
 OFC024 - Manor Farm, Offchurch, shrunken medieval settlement
 OFC034 - False Coventry/Hunningham Lighting Decoy site

OFCo38 - Weston Mill and Bridge
OFCo41 - Bytham River

Historic England PastScape Records Consulted

HE V668o - Hawker Hurricane Mark I British fighter

Figure 16 - CN011 site location

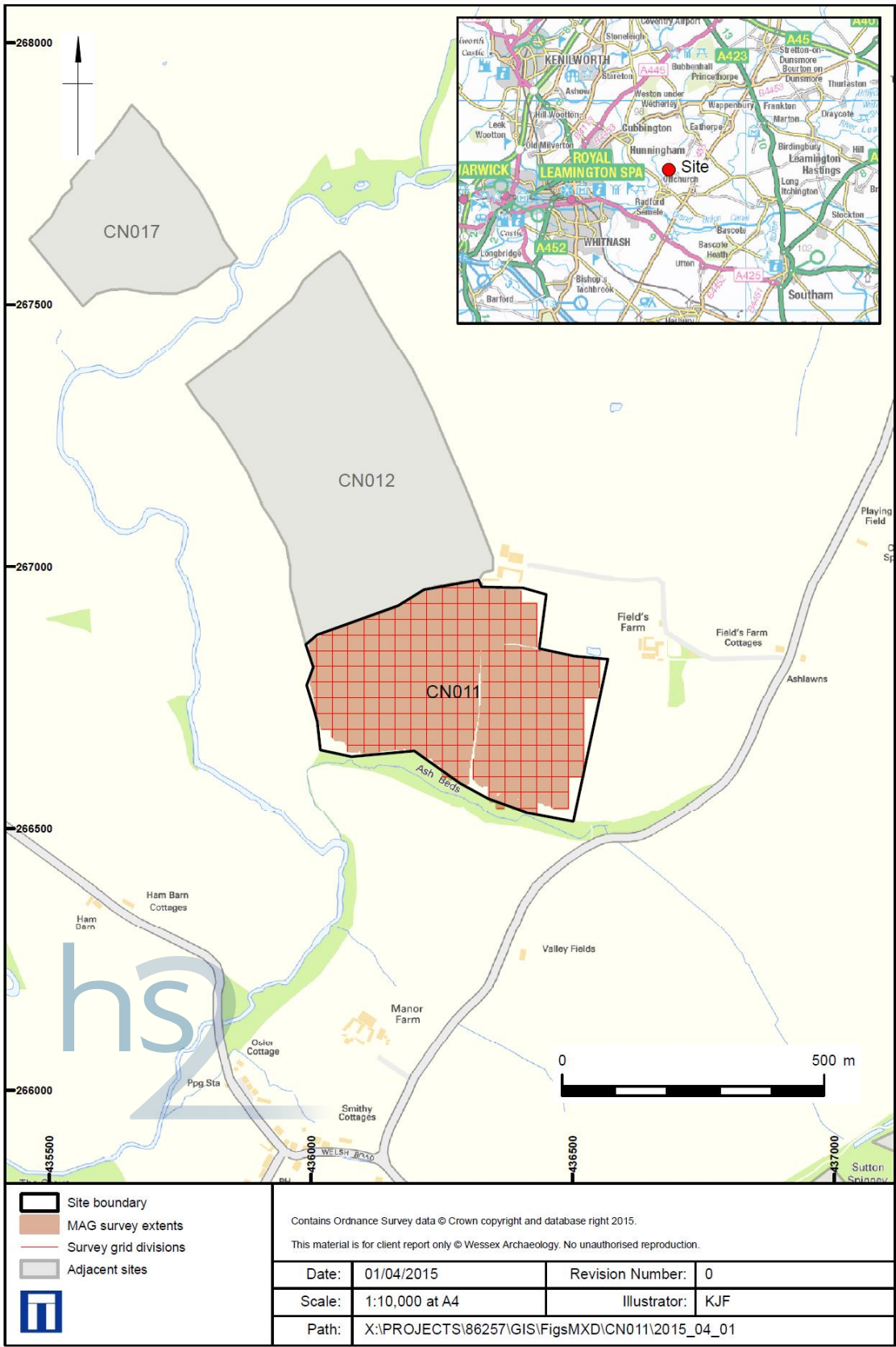


Figure 17 - Cno11 XY trace

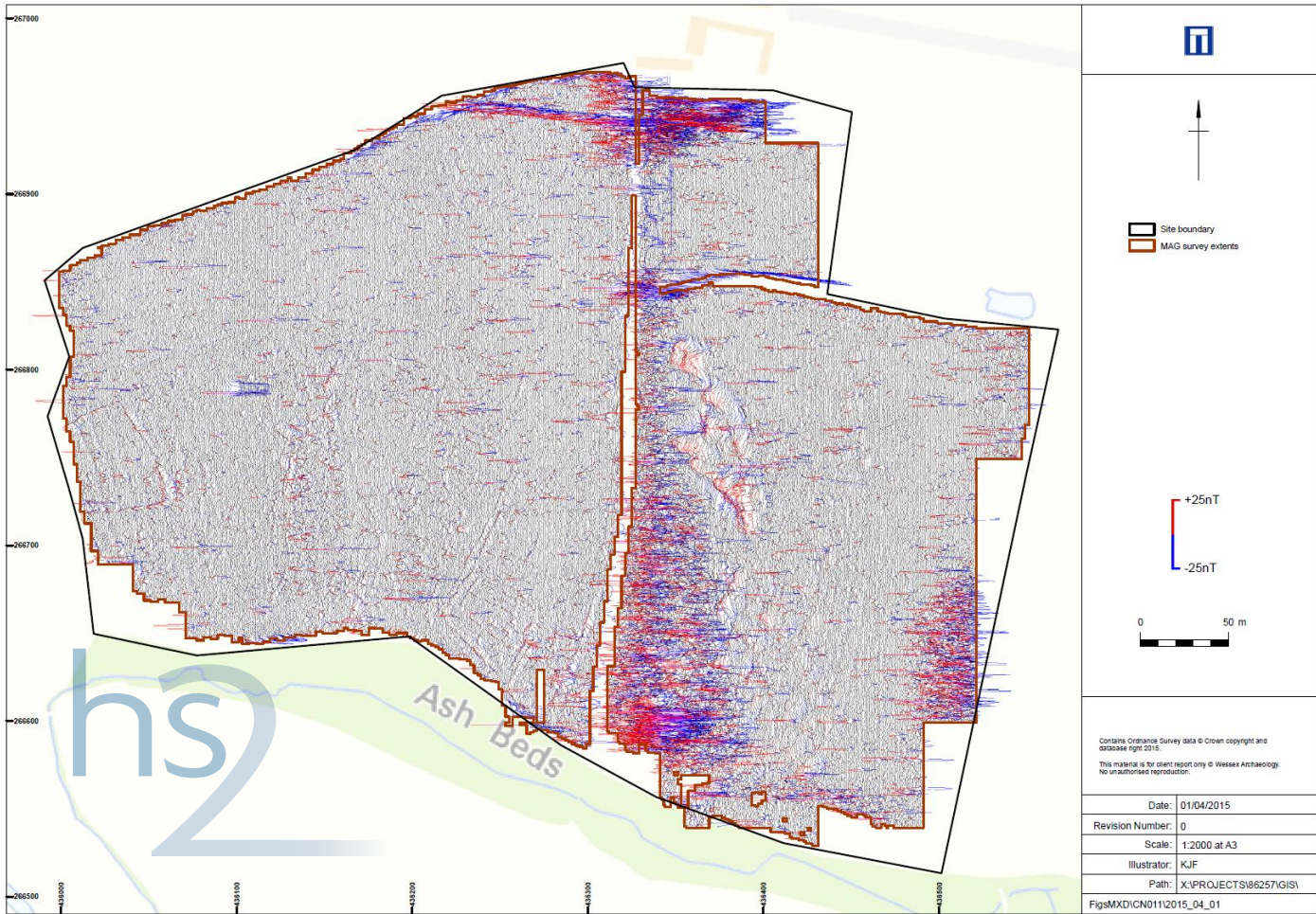


Figure 18- CN011 Greyscale

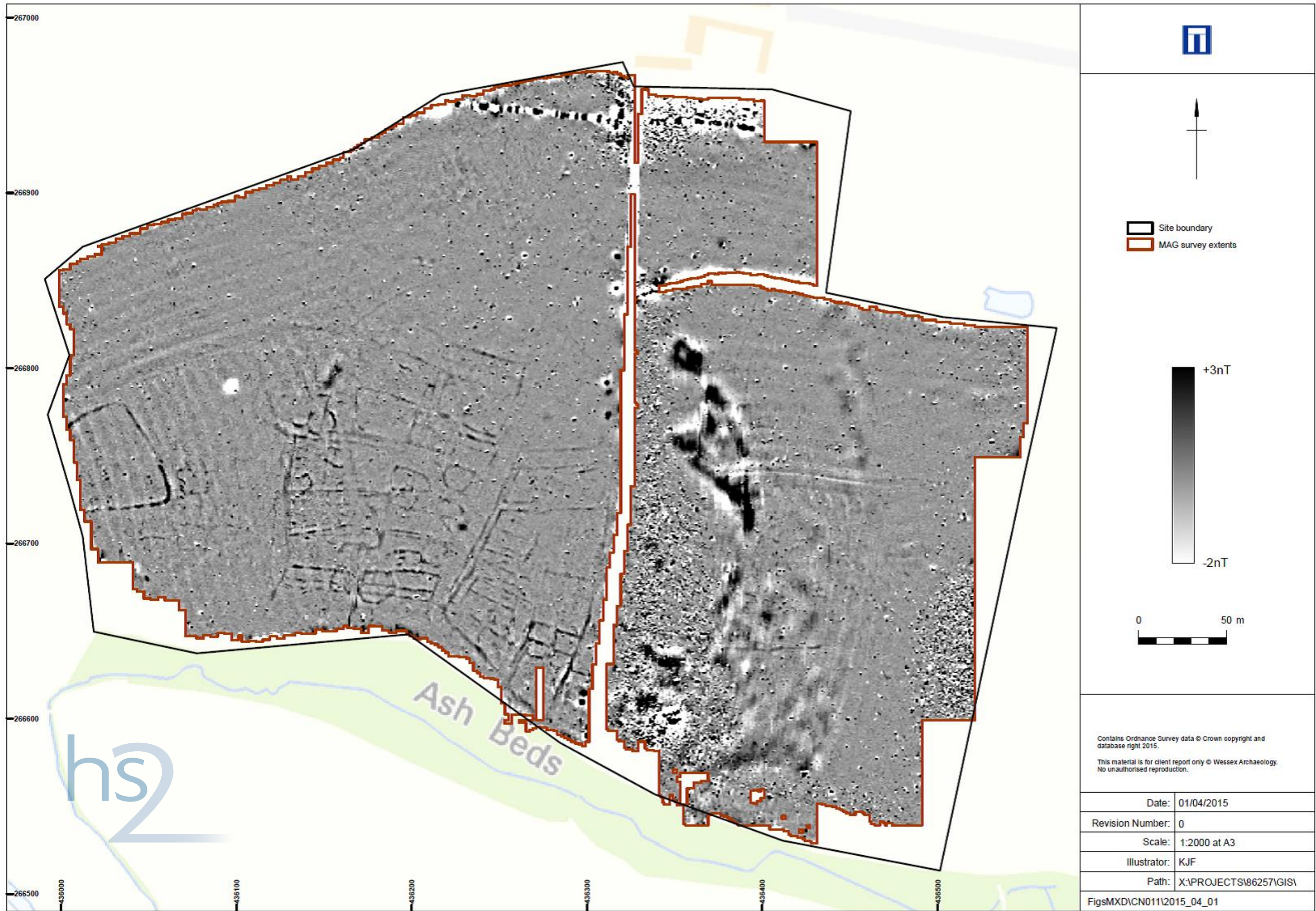
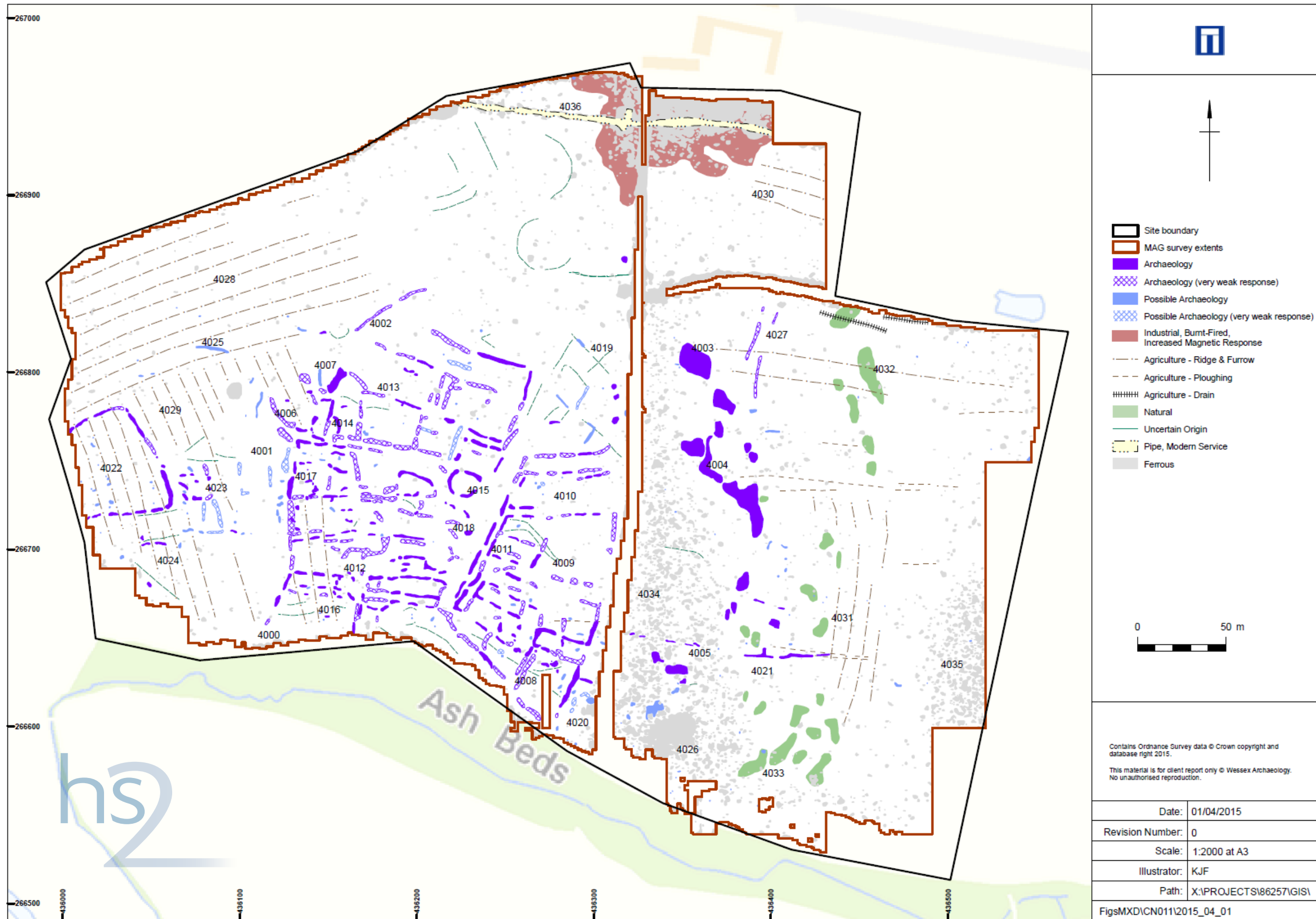


Figure 19 - CNo11 interpretation



2.5 CNo12 Land east of the River Leam

Introduction

- 2.5.1 The survey of CNo12 was not reported in the main ES due to access being unavailable.

Project Background

- 2.5.2 Wessex Archaeology was commissioned on the behalf of HS2, to carry out a geophysical survey of area CNo12 close to Hunningham, near Royal Leamington Spa, Warwickshire (Figure 20), hereafter "the site" (centred on NGR 436100, 267200). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of the HS2 scheme.
- 2.5.3 The geophysical survey undertaken here has been preceded by a desk-based assessment (HS2 Environmental Statement 2013a) and a remote sensing survey comprising LiDAR and hyperspectral survey and analysis (HS2 Environmental Statement, 2013b). Geophysical survey areas have been identified based on the archaeological potential and conclusions identified in these reports.
- 2.5.4 This site, CNo12, was selected for geophysical survey as it is considered to be an area of increased archaeological potential at medium risk to borderline high risk due to its topographic position around a river course on an area of gravels (risk model score: 3 borderline 2; see below).

Site Details

- 2.5.5 The site comprises two arable fields located approximately 4.5km northeast of Royal Leamington Spa, Warwickshire. The survey extents are defined by field boundaries on all sides with farm buildings of Field's Farm southeast corner of the survey area. The gradiometer survey covered 21.8ha of the 22.6ha site with a small area lost to field boundaries and surface obstructions.
- 2.5.6 The site lies on a very gentle west facing slope that slopes down toward the River Leam further to the west and north. The highest point of the survey area is to the east and lies at a height of a little over 60m aOD and falls from this height to less than 60m aOD at the western edge. Aside from the River Leam the only other watercourses recorded in the vicinity of the site are small unnamed streams that emerge from springs.
- 2.5.7 The solid geology is recorded as Mercia Mudstone (Triassic) and the superficial geology is recorded as river terrace deposits with boulder clay and morainic drift close by (Ordnance Survey (OS) 1957 and 1977).
- 2.5.8 The soils underlying most of the site are likely to be typical brown earths of the 541r (Wick 1) association. Stagnogley argillic brown earths of the 572f (Whimple 3) association lie close to the east and typical stagnogley soils of the 711b (Brockhurst 1) association lie close to west (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological Background

- 2.5.9 For a detailed assessment of the known archaeology of the site and surrounding area the relevant desk-based assessment (DBA) should be consulted (volume 5 appendix Ch-001-017,

ES 3.5.2.17.4). A summary of relevant sites within 1km of the survey area is presented below and is included to provide context and inform the geophysical interpretation. sites referred to can be found either within the gazetteer for CFA17 (Volume 5 appendix CH-002-017, ES 3.5.2.17.5)ES (OFC numbers) in the supplementary survey works (WA numbers) or in the Warwickshire SMR (MWA/HWA numbers).

- 2.5.10 The survey area is characterised as very large irregular post-war fields with curvilinear and straight boundaries (HWA8604). Remote sensing revealed a number of linear earthworks probably representing disused former field boundaries (WA17.15) (HS2 Environmental Statement, 2013b).
- 2.5.11 Few clear prehistoric, Roman or post-Roman records exist in the immediate vicinity of CNo11 although a number of significant sites lie within the wider area around CFA17. No sites are known within the survey area but 1km to the north-east are four possible linear features observed as cropmarks on aerial photographs and interpreted as a potential prehistoric pit alignment (MWA4870). In addition to this there are several findspots of flints and Roman items (not specified) recorded in the immediate vicinity at Hunningham (e.g. MWA6005; MWA5272).
- 2.5.12 site within the wider area include a Palaeolithic site of potential international importance at Waverley Wood Farm Pit (OFC041) and the former Roman road known as the Fosse Way (OFC012) (HS2 Environmental Statement, 2013a).
- 2.5.13 The site lies between the shrunken medieval settlements and earthwork enclosures of Offchurch to the south-west (OFC23; OFC024) and Hunningham to the north-east (MWA9523; MWA2526; MWA7268). Medieval remains are present in close proximity to the site in the form of fragmentary remains of ridge and furrow in the field to the north-west of the survey area that was observed from LiDAR data (WA2.12).
- 2.5.14 Post-medieval remains include a watermill and timber bridge named Weston Mill crossing the River Leam to the north of the site (OFC038) and Offchurch Mill and associated bridge crossing the River Leam to the south-west of the site on the outskirts of the village (MWA2214; 2221). A quarry pit is located approximately 1km to the north-east of the site (MWA2534).
- 2.5.15 A World War II lighting decoy and a bombing decoy lie to the north-east of the survey area. These were designed to confuse enemy aircraft and protect assets in Coventry. Two buildings related to this complex remain upstanding (OFC034). A Hawker Hurricane Mark I British fighter plane crashed within 1km of the survey area (Historic England V6680).
- 2.5.16 Undated records include the finding of a quernstone to the north-east of the site (MWA5078).

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 - to clarify the presence/absence and extent of any buried archaeological remains within the site;

- to determine the general nature of the remains present; and
 - to combine the results of the geophysical surveys with data from other archaeological assessments carried out as part of the project in order to analyse the archaeological potential of the survey locations.
- 2.5.18 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.
- Methods**
- Survey Dates*
- 2.5.19 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between the 5 - 12 March 2015.
- Grid Location*
- 2.5.20 The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds Historic England recommendations (Historic England, 2008).
- 2.5.21 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.
- Instruments Used and Survey Method*
- 2.5.22 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with Historic England guidelines (Historic England, 2008).
- 2.5.23 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.
- Data Processing*
- 2.5.24 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function ($\pm 5\text{nT}$ thresholds) applied to correct for any variation between the two Bartington sensors used, a multiply function and a de-step function to account for variations in traverse position due to varying ground cover and topography. These three steps were applied to all survey data, with no interpolation applied.
- 2.5.25 Further details of the geophysical and survey equipment, methods and processing are described in Annex 1.
- Data Presentation*
- 2.5.26 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification.

The data images and interpretation shapefiles were then passed to Atkins' graphics team who produced the final figures in GIS (ESRI ArcMap 10).

- 2.5.27 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and $\pm 25\text{nT}$ at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:2000.

Results

- 2.5.28 The gradiometer survey has been successful in identifying numerous anomalies of likely and possible archaeological interest, along with numerous trends of uncertain origin. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2000 (Figures 20 to 29). An additional set of figures have been produced at a scale of 1:1000 to show an area of concentrated archaeological features in detail (Figures 23, 26, and 29).
- 2.5.29 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figures 27 to 29). Full definitions of the interpretation terms used in this report are provided in Annex 2.
- 2.5.30 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: Archaeology

- 2.5.31 The most significant group of anomalies are located toward the centre of the survey area and comprise at least two adjoining large sub-rectangular enclosures around 4000 and 4001. Both of these enclosures measure around 80m x 75m and both show signs of internal divisions.
- 2.5.32 Small rectangular sub-enclosures can be seen within and butting up against the larger enclosures at 4002 to 4005; a possible larger sub-enclosure lies to the south of 4005. These sub-enclosures typically measure less than 25m in length and less than 20m in width. There are few clear internal features visible within these small enclosed areas.
- 2.5.33 The larger enclosures also contain other sub-dividing ditches such as 4006 that splits the eastern of the two enclosures. Another weaker dividing ditch is visible in the western enclosure on a similar alignment to 4006 to the northeast of 4000.
- 2.5.34 Five clear ring and oval shaped ditches are visible inside and outside the two enclosures at 4007 to 4011. These are likely to be roundhouses and all five appear to measure around 10m in diameter. Some other incomplete arcs and possible outlying ring ditches are visible at 4012 and around 4013 that may indicate that other ring ditches are present both within and outside these enclosures.
- 2.5.35 Some sub-rectangular anomalies are visible at 4014 and 4015 with the former seemingly interrupted by the ditch at 4006. These may also represent structures built within the enclosure and the interruption of 4014 likely suggests that at least two phases of occupation are evident within this area.
- 2.5.36 Smaller features such as short sections of ditch and pits are visible within these enclosures, such as around 4016. Some of the fragmentary ditch sections could have formed part of larger structures.

- 2.5.37 All of the features discussed are considered to be cut features such as pits, ditches or gullies and have been classed as either archaeology or archaeology weak response depending on their magnetic values.
- 2.5.38 These archaeological anomalies can measure over +5nT at their strongest regions to as low as +0.5nT at their weakest. The weakest regions of some features coincide with the ridge and furrow which suggests that the furrows have removed some of the archaeological deposits whereas the ridges have protected them. This varying damage from medieval or post-medieval ridge and furrow provides a relative date for these enclosures and the presence of roundhouses provides further evidence that this settlement area is very likely to be pre-medieval, possibly Romano-British.
- 2.5.39 Weaker ditch-like anomalies are visible further away from the main enclosed area at 4017 to 4019. The ditches around 4017 and 4018 share alignments with the enclosures but the pair of ditches at 4019 are aligned more closely with the modern field boundaries. All have been classed as possible archaeology (weak response).
- 2.5.40 Another ditch is visible at 4020 but this follows the line of a former field boundary that is visible on OS maps as early as 1887, but seems to have been removed by the 1985 edition OS map. This boundary is classed as possible archaeology weak response.
- 2.5.41 Other weak isolated ditches are visible in the data such as at 4021; these are classed as possible archaeology weak response.
- 2.5.42 A modern service is visible at 4022 but this will be discussed in more detail in the next section of the report.
- 2.5.43 The northern field shows a much lower concentration of ferrous responses than the southern field. This difference is most likely the result of differing materials added to each field with manure/compost added to the southern field that contained trace amounts of ceramic/metallic material.
- 2.5.44 The most noticeable feature in the north is a large L-shaped land division that runs through the area at 4023 to 4026. This feature has varying magnetic values across its length and like some features in the vicinity of the enclosed area is disrupted by the ridge and furrow. The line of the ditches is fairly straight apart from the section marked at 4026 which is curving and slightly irregular. This feature is not marked on any of the OS maps consulted although it does appear to roughly line up with a boundary marked on an 1813 map drawn by Henry Stevens. This feature has been interpreted as archaeology although the irregular section at 4026 is interpreted as possible archaeology due to its shape in plan.
- 2.5.45 A small L-shaped ditch is visible at 4027 although it is not clear what function this may have served. This has been interpreted as archaeology weak response.
- 2.5.46 The remaining anomalies are numerous weak linear trends running through the area such as at 4028, spreads of increased magnetic response as at 4029 and natural deposits such as around 4030. The trends are considered to be of uncertain origin and could prove to be anything from agricultural features to weak archaeological features. The spreads of increased magnetic response are likely to relate to areas of intense human activity but could equally relate to the deposition of modern material or even geological deposits. The spreads of natural responses are likely to relate to underlying geological variation such as from gravel deposits.
- 2.5.47 There are numerous small positive anomalies classed as possible archaeology spread throughout the dataset. Many are likely to relate to natural features such as tree throws or gravel deposits but some may prove to be small archaeological cut features such as pits. As there is no significant patterning to their spatial distribution these features are regarded as having a low archaeological potential.
- 2.5.48 As has been mentioned ridge and furrow can be seen running across much of the survey area and the change in direction of this ridge and furrow shows evidence of the former scheme of dividing the land. Ridge and furrow is particularly noticeable across the north and central area of the site.
- Interpretation: Modern Services**
- 2.5.49 One modern service has been identified within the geophysical data at 4022. The form of the anomaly suggests that this service may prove to be a cable.
- 2.5.50 It is not clear from the geophysical data whether the services identified are in active use or not. Also gradiometer data will not be able to locate and identify all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.
- Conclusions**
- 2.5.51 The detailed gradiometer survey has been successful in detecting anomalies of likely and possible archaeological interest within the site, in addition to areas of ridge and furrow, ploughing trends and trends of uncertain origin.
- Discussion**
- 2.5.52 The most significant features detected are the two adjoining sub-rectangular enclosures at 4000 and 4001. Analysis of the geophysical data shows sub-divisions are evident that suggest areas were divided into different zones of activity and the presence of ring ditches strongly suggests these enclosures served as a settlement area. These features appear to be interrupted by the ridge and furrow, suggesting that these enclosures are pre-medieval in date, and possibly Romano-British.
- 2.5.53 The ditches detected appear to gradually peter into the background as they extend away from the core of the settlement and this may suggest that more archaeology is present here than was detected in the geophysical survey.
- 2.5.54 A land division was detected in the north of the survey area that may correlate with a boundary recorded on an 1813 edition map drawn by Henry Stevens. The initial date of this feature is unclear so its archaeological significance is also unclear. Its relationship with the settlement enclosures, if any exists, is also unclear.
- 2.5.55 Ridge and furrow was detected across the survey area and changes in the direction of this are evident in the geophysical data. The ridge and furrow was not clearly observed in the LiDAR data but these changes in direction of the ridge and furrow were evident as broad, low earthworks.
- 2.5.56 The larger southern field shows a much higher concentration of ferrous responses than the field to the north. This is likely to relate to different agricultural use of these fields in recent centuries, with more material added to the southern field during manuring that contained

magnetic debris. This higher concentration of ferrous responses will make the identification of small or weak archaeological features more difficult and in places may obscure features completely,

- 2.5.57 The relative dimensions of the modern services identified by the gradiometer survey are indicative of the strength of their magnetic response, which is dependent upon the materials used in their construction and the backfill of the service trenches. The physical dimensions of the services indicated may therefore differ from their magnetic extents in plan; it is assumed that the centreline of services is coincident with the centreline of their anomalies. It is difficult to estimate the depth of burial of the services through gradiometer survey.

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Soil Survey of England and Wales, (1983), Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.

Stevens, H., (1813), Warwick. [Online, Accessed 02/04/2015]. Available at: <http://www.bl.uk/onlinegallery/onlineex/ordsurvdraw/w/0020sd000000012u00215000.html>

Wessex Archaeology, (2014), HS2: Geophysical Survey Written Scheme of Investigation: Warwickshire Report Reference: 86257.01.

HER Records Consulted

HWA8604 - Historic Landscape Characterisation: very large irregular post-war fields with curvilinear and straight boundaries
MWA2214 - Offchurch Mill
MWA2221 - Offchurch Bridge
MWA2526 - Site of Medieval shrunken Settlement at the Vicarage, Hunningham
MWA2534 - Quarry
MWA4870 - prehistoric pit alignment
MWA5078 - Findspot - Undated quern stone
MWA5272 - Findspot - Roman finds, Hunningham
MWA6005 - Findspot - Neolithic flint
MWA7268 - Medieval Settlement Earthworks, Hunningham
MWA9523 - Hunningham Medieval Settlement
OFC012 - Fosse Way Roman Road
OFC023 - Offchurch earthwork enclosures
OFC024 - Manor Farm, Offchurch, shrunken medieval settlement
OFC034 - False Coventry/Hunningham Lighting Decoy Site
OFC038 - Weston Mill and Bridge
OFC041 - Bytham River

Historic England PastScape Records Consulted

HE V6680 - Hawker Hurricane Mark I British fighter

Figure 20 - CN012 site location

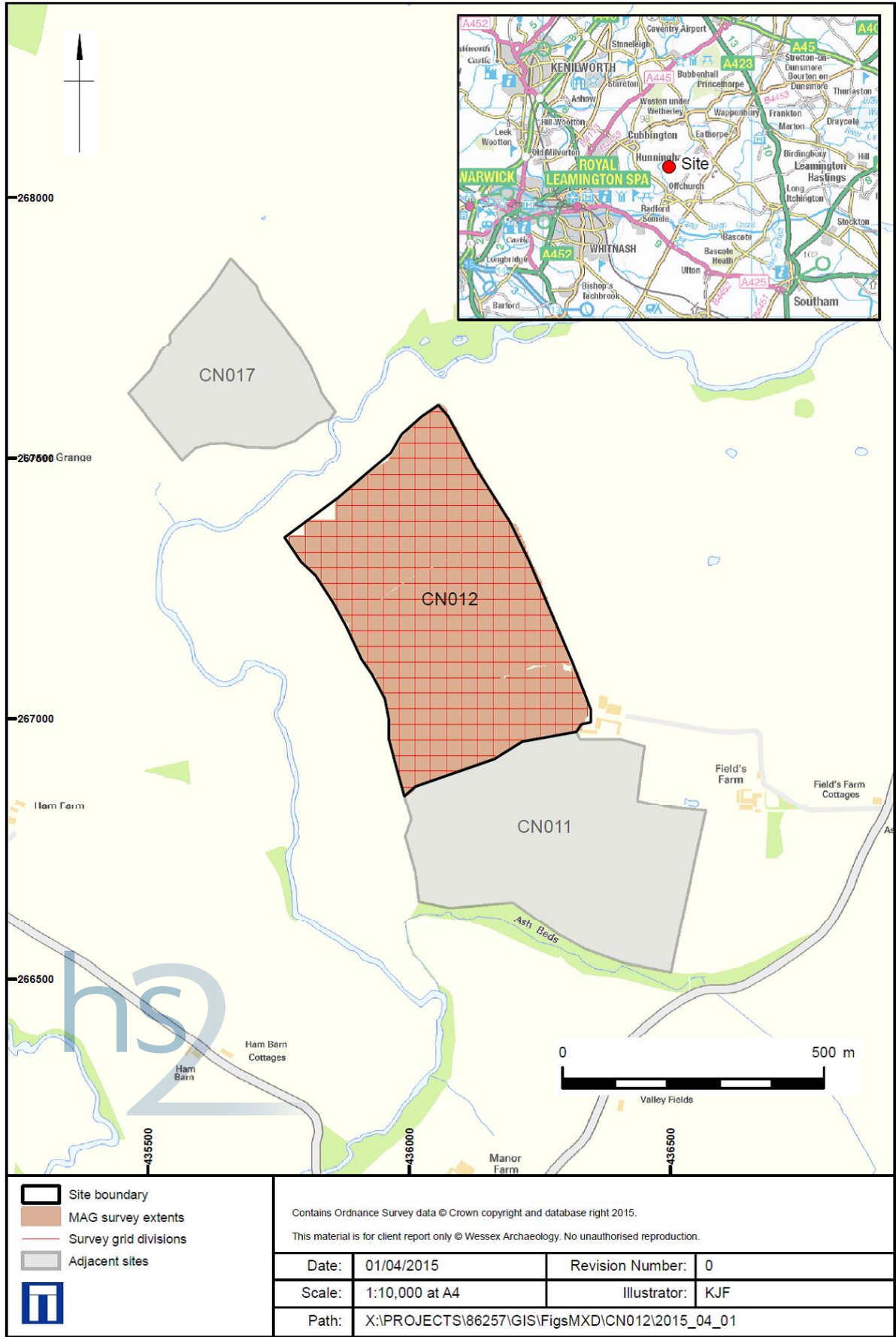


Figure 21 - CN012 greyscale, south side

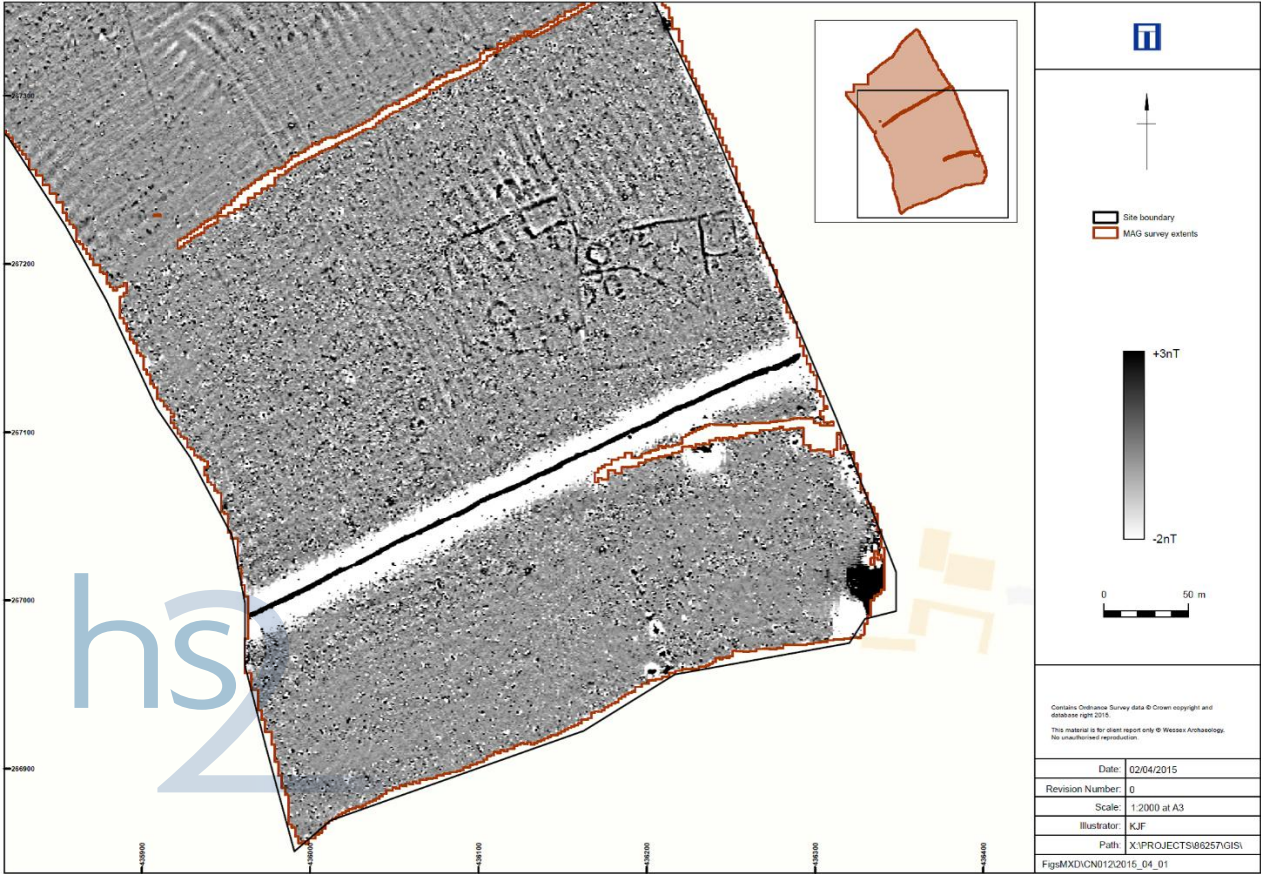


Figure 22. CN012 greyscale, north side

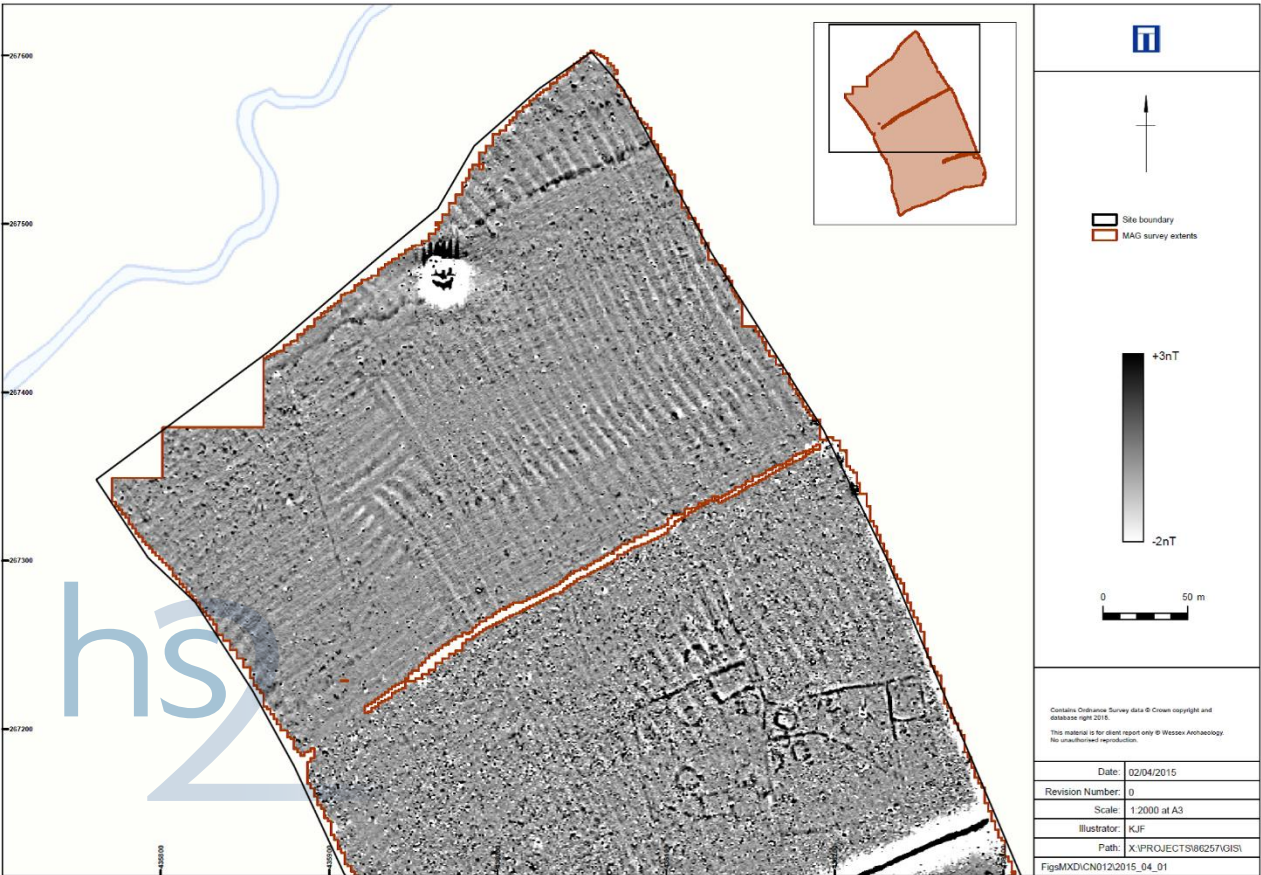


Figure 23 - CNo12 greyscale, detail

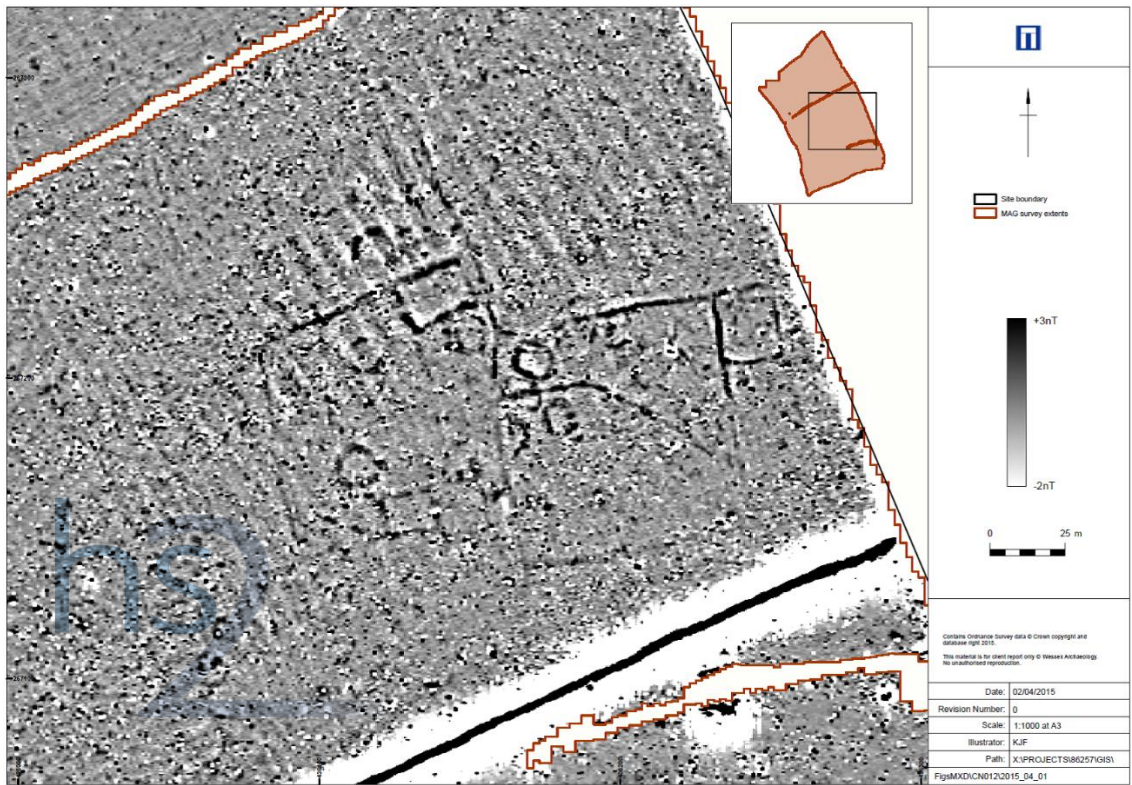


Figure 24 - CNo12 XY trace, south side

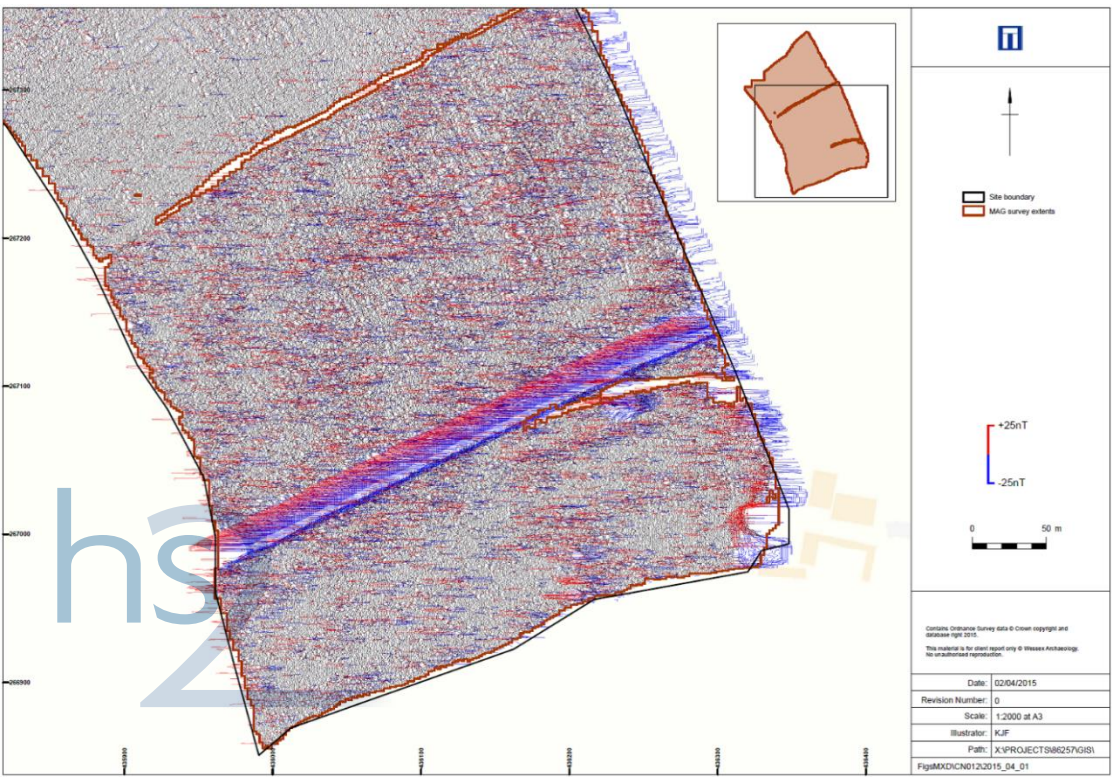


Figure 25 - CNo12 XY trace, north side

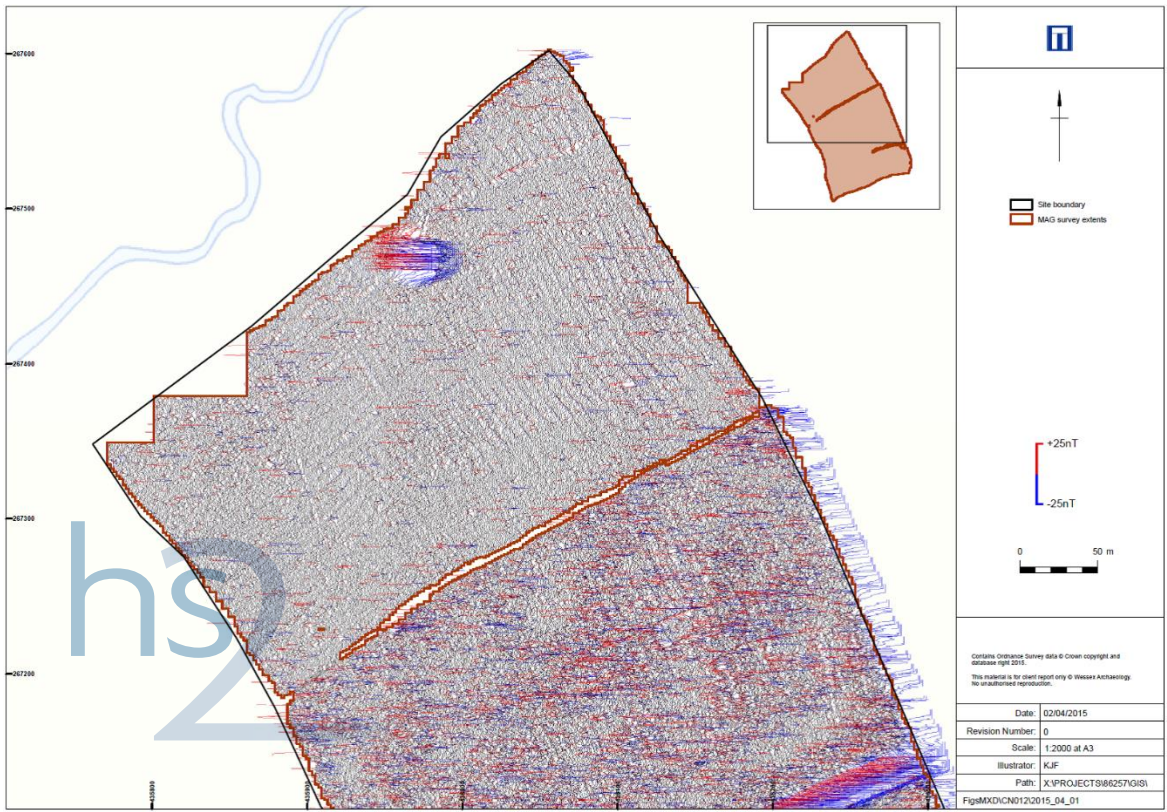


Figure 26 - CNo12 XY trace, detail

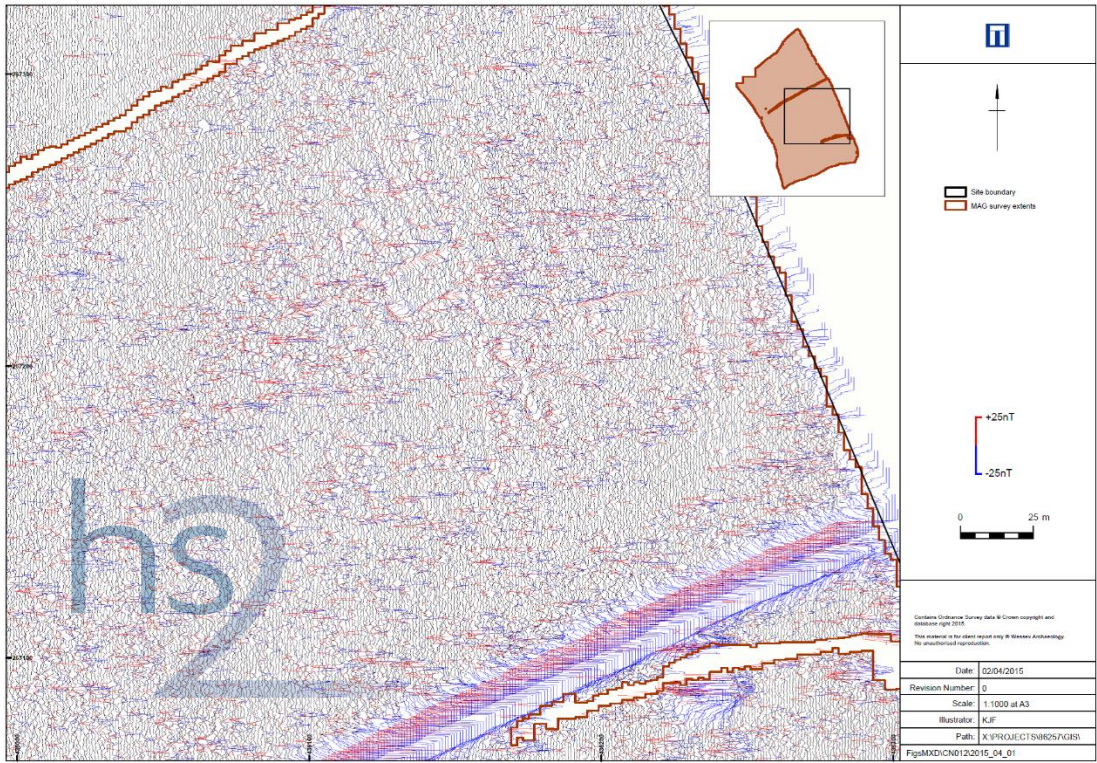


Figure 27 - CNo12 interpretation, south side

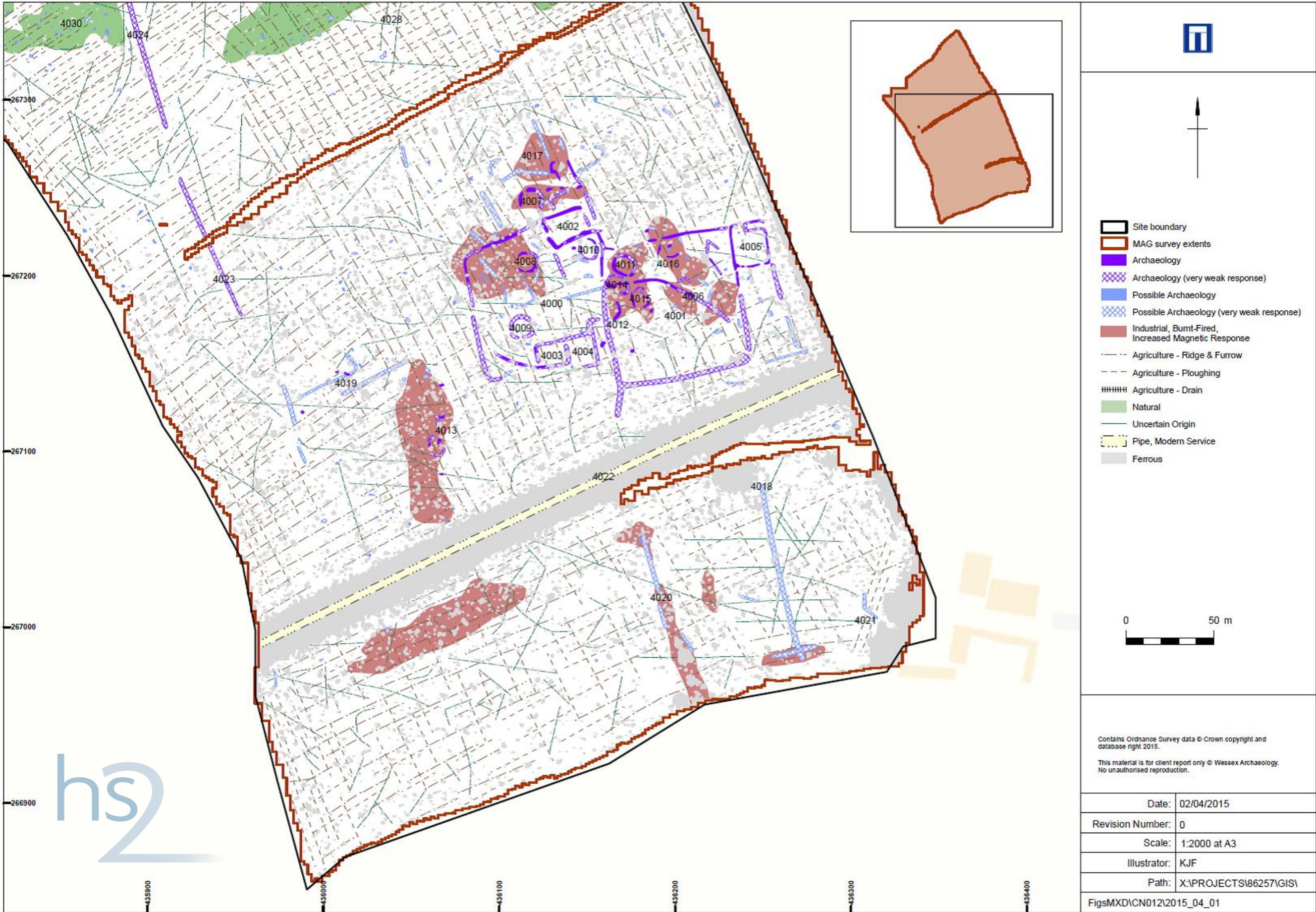


Figure 28 - CNo12 Interpretation, north side

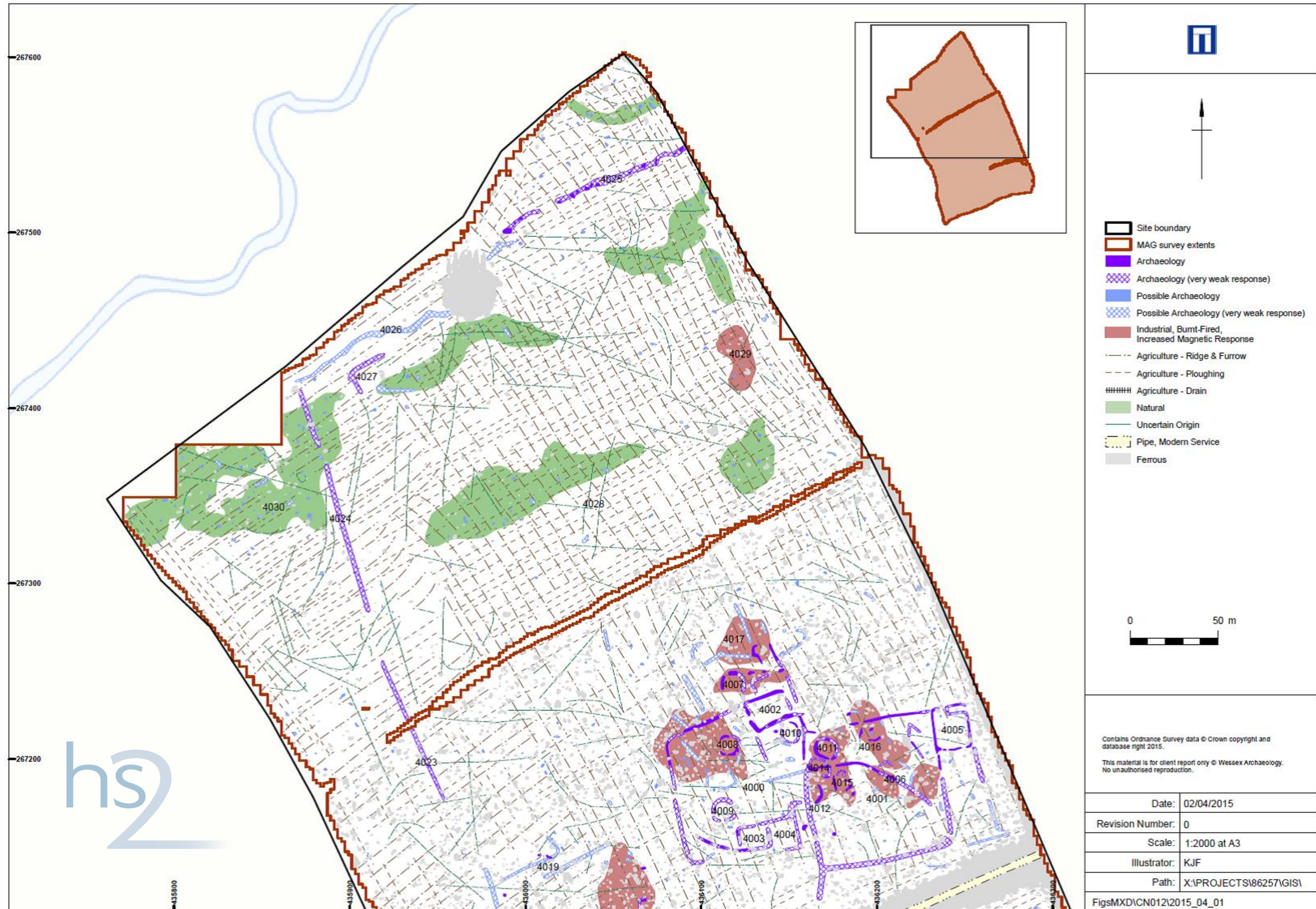
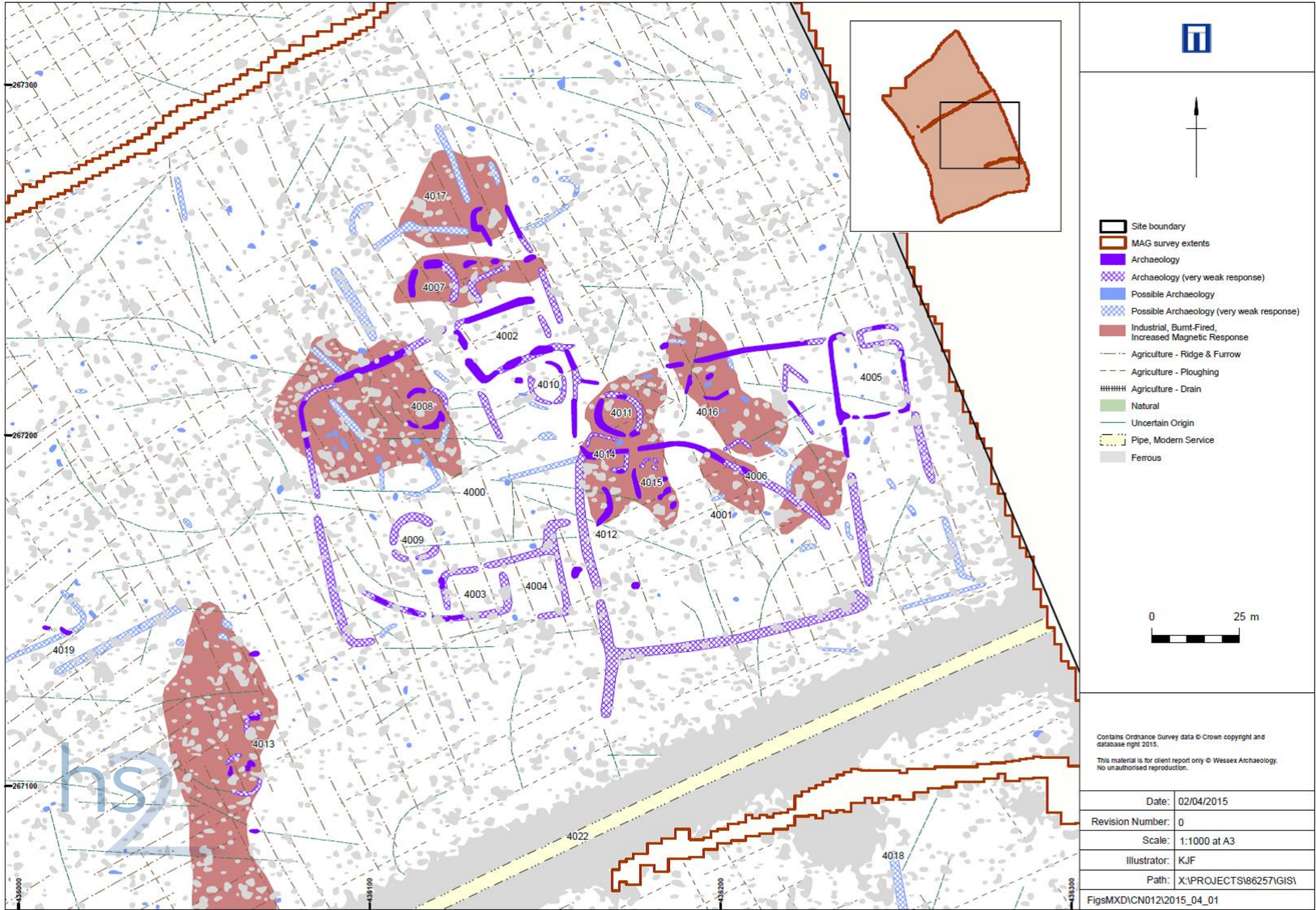


Figure 29 - CN012 interpretation detail



2.6 CNo17 land near Lower Grange

Introduction

2.6.1 The survey of CNo17 was not reported in the main ES due to access being unavailable.

Project Background

2.6.2 Wessex Archaeology was commissioned on the behalf of HS2 Ltd, to carry out a geophysical survey of area CNo17 close to Lower Grange, near Royal Leamington Spa, Warwickshire (Figure 30), hereafter “the site” (centred on NGR 435675 267650). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of the HS2 scheme.

2.6.3 The geophysical survey undertaken here has been preceded by a Desk-Based Assessment (volume 5 appendix Ch-001-017, ES 3.5.2.17.4) and a remote sensing survey comprising LiDAR and hyperspectral survey and analysis (HS2 Environmental Statement, 2013b). Geophysical survey areas have been identified based on the archaeological potential and conclusions identified in these reports.

2.6.4 This site, CNo17, was selected for geophysical survey as it is considered to be an area at medium risk to borderline high risk due to its topographic position around a river course on an area of gravels (risk model score: 3 borderline 2).

Site Details

2.6.5 The site is comprised of one arable field located approximately 4km northeast of Royal Leamington Spa, Warwickshire. The survey extents are defined by field boundaries on all sides. The gradiometer survey covered 7.7ha of the 8.3ha site with only a very small area lost to field boundaries and surface obstructions.

2.6.6 The site lies on an area of gently sloping land that falls away towards the southeast. The highest point of the survey area is to the northwest and lies at a height of a little over 65m aOD (above Ordnance Datum) and falls from this height to less than 60m aOD at the south-east edge, a short distance from the River Leam. A small unnamed stream flows along the northeast edge of the site and into the River Leam.

2.6.7 The solid geology is recorded as Keuper Marl (Triassic) and the superficial geology is recorded as river terrace deposits with boulder clay and morainic drift close by (Ordnance Survey (OS), 1957 and 1977).

2.6.8 The soils underlying the southeast half of the site are likely to be typical stagnogley soils of the 711m (Salop) association. Typical argillic pelosols of the 431 (Worcester) association are likely to lie under northeast half of the site (SSEW, 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological Background

2.6.9 For a detailed assessment of the known archaeology of the site and surrounding area the relevant desk-based assessment (DBA) should be consulted (HS2 Environmental Statement 2013a). A summary of relevant sites within 1km of the survey area are summarised and have been included to provide context and inform the geophysical interpretation. sites referred to can be found either within the gazetteer for CFA17 (Volume 5 appendix CH-002-017, ES

3.5.2.17.5)ES (OFC numbers) in the supplementary survey works (WA numbers) or in the Warwickshire SMR (MWA numbers).

2.6.10 Few clear prehistoric, Roman or post-Roman records exist in the immediate vicinity of CNo17 although a number of significant sites lie within the wider area around CFA17. These sites include a Palaeolithic site of potential international importance at Waverley Wood Farm Pit and the former Roman road known as the Fosse Way (HS2 Environmental Statement, 2013a).

2.6.11 Medieval remains are present in close proximity to the site in the form of ridge and furrow that has been observed at Cubbington Primary School (OFCo42) and fragmentary remains in the field to the west of the survey area that was observed from LiDAR data (WA17.4).

2.6.12 Post-medieval remains include a watermill and bridge named Weston Mill that was in use up to the late 19th century. It is possible this site was in use from the medieval and appears on maps as early as 1725. A timber bridge crossing the River Leam is associated with the mill (OFCo38).

2.6.13 A World War II lighting decoy lies to the east of the survey area and was designed to confuse enemy aircraft and protect assets in Coventry. Two buildings related to this complex remain upstanding (OFCo34). A Hawker Hurricane Mark I British fighter plane crashed within 1km of the survey area (Historic England V6680).

2.6.14 Undated records include the finding of quernstones to the southeast of the site (MWA13118) and an area known as Gallows Knob near Cubbington where criminals are reputed to have been hanged (MWA2519).

Survey Objectives

2.6.15 A WSI was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology 2014). The stated aims include the following:

- To conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- To clarify the presence/absence and extent of any buried archaeological remains within the site;
- To determine the general nature of the remains present; and
- To combine the results of the geophysical surveys with data from other archaeological assessments carried out as part of the project in order to analyse the archaeological potential of the survey locations.

2.6.16 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

Methods

Survey Dates

2.6.17 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between the 26-27 February 2015.

Grid Location

- 2.6.18 The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds Historic England recommendations (Historic England, 2008).
- 2.6.19 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments Used and Survey Method

- 2.6.20 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with Historic England guidelines (Historic England, 2008).
- 2.6.21 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data Processing

- 2.6.22 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (± 5 nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.
- 2.6.23 Further details of the geophysical and survey equipment, methods and processing are described in Annex 1.

Data Presentation

- 2.6.24 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then passed to Atkins' graphics team who produced the final figures in GIS (ESRI ArcMap 10).
- 2.6.25 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ± 25 nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.

Results

Introduction

- 2.6.26 The gradiometer survey has been successful in identifying a few anomalies of possible archaeological interest, along with numerous trends of uncertain origin. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (Figures 31 to 33).

- 2.6.27 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 33). Full definitions of the interpretation terms used in this report are provided in Annex 2.

- 2.6.28 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: Archaeology

- 2.6.29 The most significant looking anomaly is a weak curvilinear positive response at 4000; this feature has very weak magnetic values around +0.5nT and could represent a ditch. This feature has been classed as possible archaeology as a geological explanation for its formation cannot be ruled out.
- 2.6.30 Other small sub-circular and sub-oval positive responses such as the example south of 4001 are visible across the dataset. It is unclear whether these small anomalies represent cut archaeological features or are natural; given they have no obvious patterning in their spatial distribution they have all been classed as possible archaeology.
- 2.6.31 An isolated section of ceramic field drain can be seen at 4002. Ridge and furrow and ploughing scars can be seen running across the entire field.
- 2.6.32 A broad band of bipolar responses can be seen running through the field at a NNW-SSE alignment at 4003. This spread is presumed to be geological either corresponding to gravel deposits or some other water lain deposit. Trends of uncertain origin highlight some of the curvilinear responses that define this area.
- 2.6.33 Outside of this geological spread are other trends of uncertain origin; some may correspond to agricultural or modern activity whereas other could prove to be weak archaeological features.

Interpretation: Modern Services

- 2.6.34 No modern services have been identified within the geophysical data.
- 2.6.35 Gradiometer data will not be able to locate and identify all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

Conclusions

- 2.6.36 The detailed gradiometer survey has been successful in detecting a few anomalies of possible archaeological interest within the site, in addition to an area of ridge and furrow, regions of increased magnetic response, numerous ploughing trends and trends of uncertain origin.

Discussion

- 2.6.37 No definite anomalies of archaeological interest have been identified; a possible ditch at 4000 may prove to be of significance but could equally prove to be geological given the close proximity of a band of clear geological responses.
- 2.6.38 Some small pit-like responses have been detected within this field but it should be noted that there is a good chance many of these anomalies correspond to natural features.

- 2.6.39

Ridge and furrow can be seen running across much of the data suggesting some element of the former medieval landscape survives below ground. Other features including ploughing scars and a field drain relate to more recent agricultural use of this area.
- 2.6.40

It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

References

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Wessex Archaeology, (2014), HS2: Geophysical Survey Written Scheme of Investigation. Report Reference: 86257.01.

HER Records Consulted

MWA2519 - Gallows Knob, Mill Lane, Cubbington

MWA13118 - Quernstones findspot

Historic England PastScape Records Consulted

HE V668o - Hawker Hurricane Mark I British fighter

Figure 30 - CN017 site location

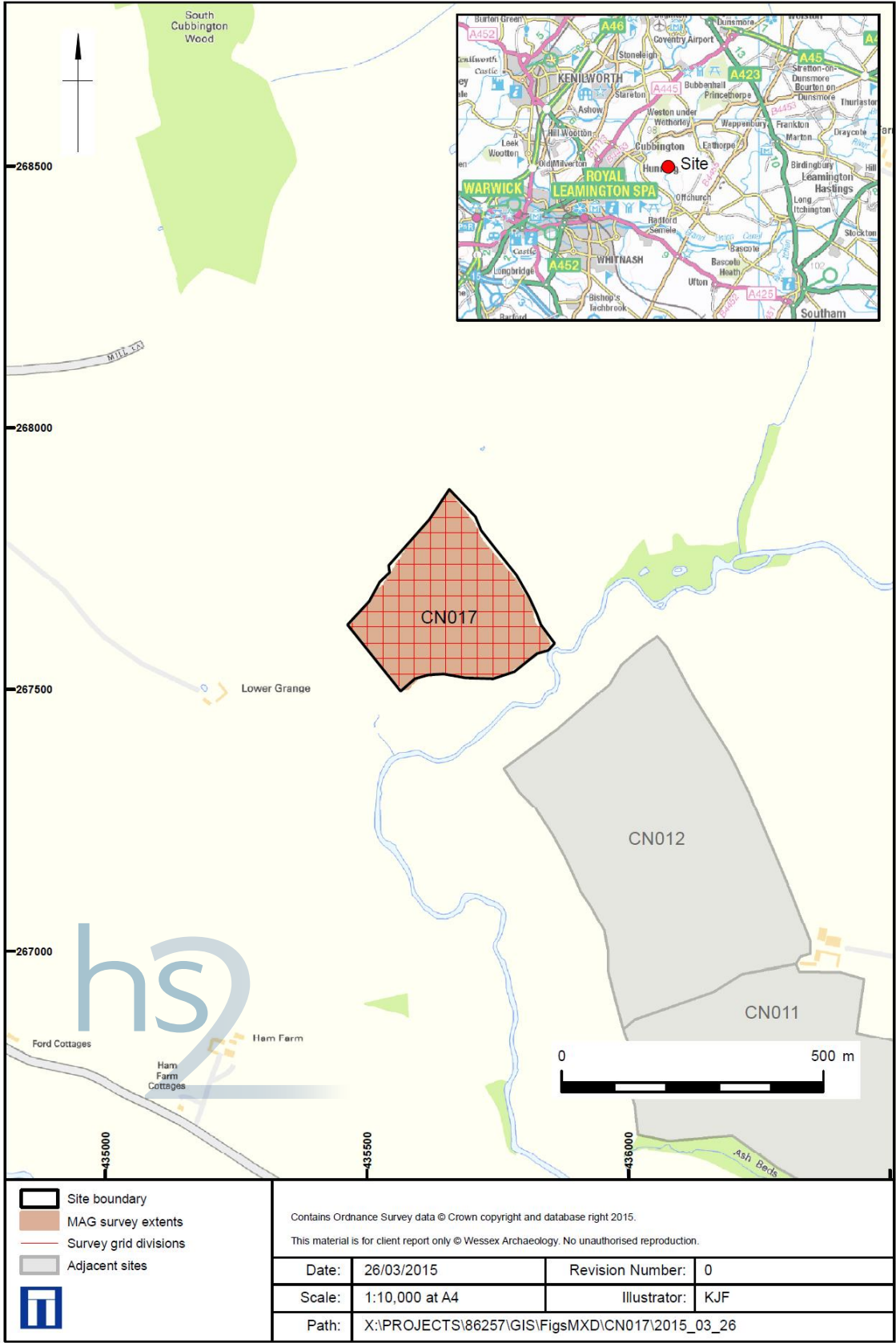


Figure 31 - CNo17 greyscale

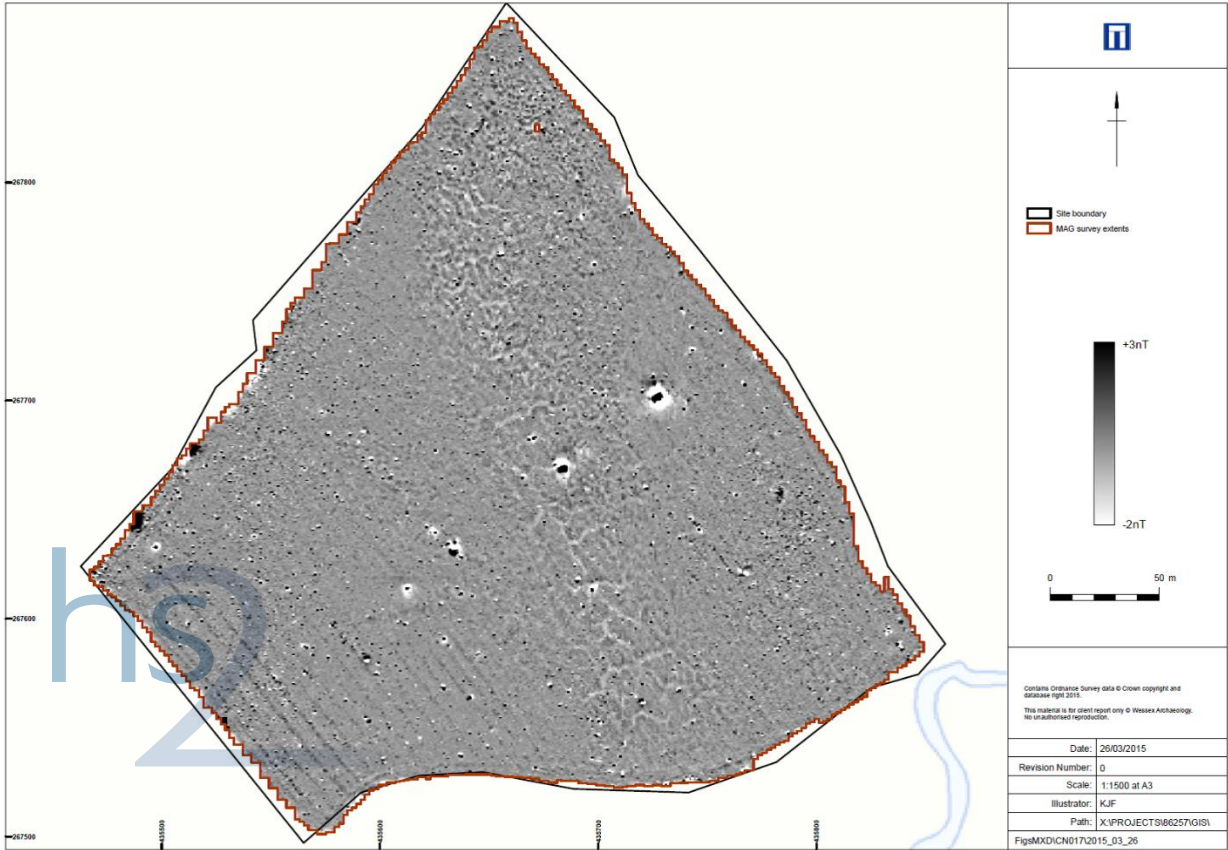


Figure 32 - CNo17 XY trace

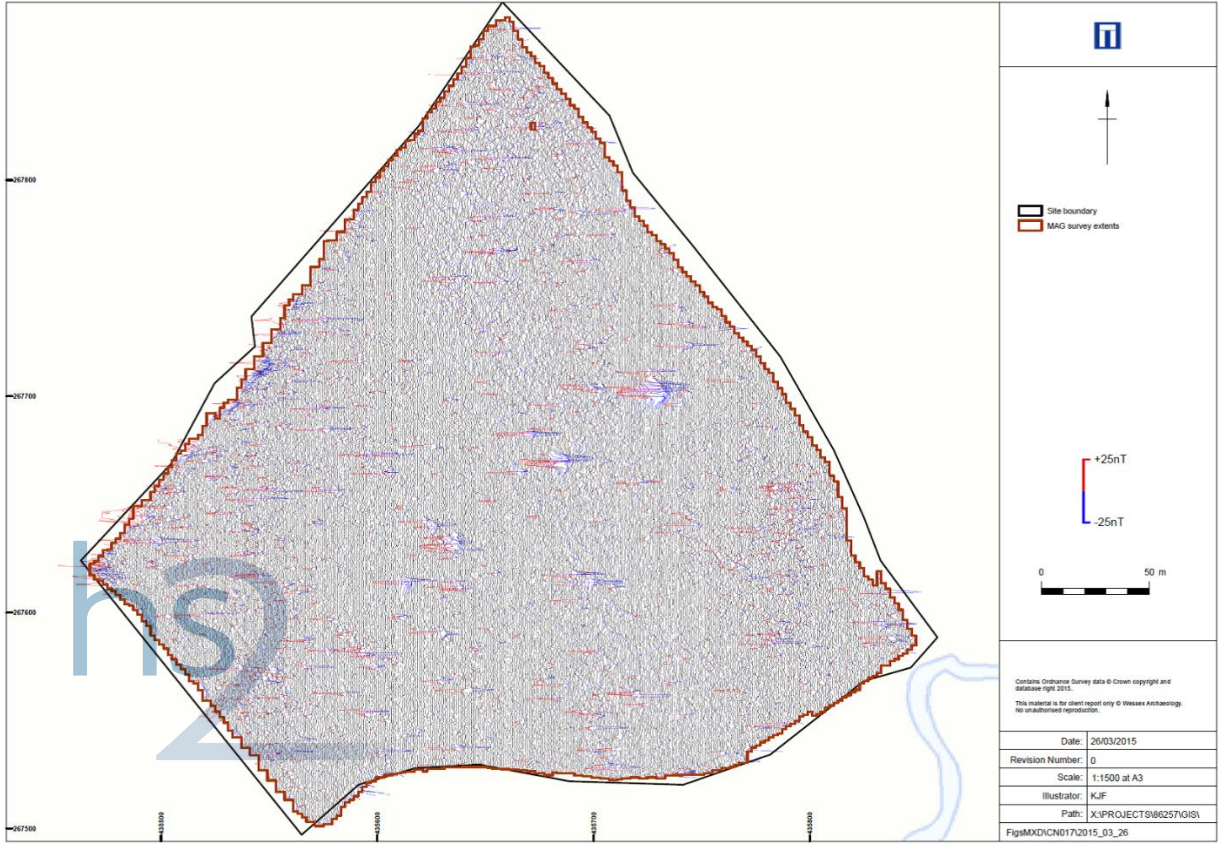
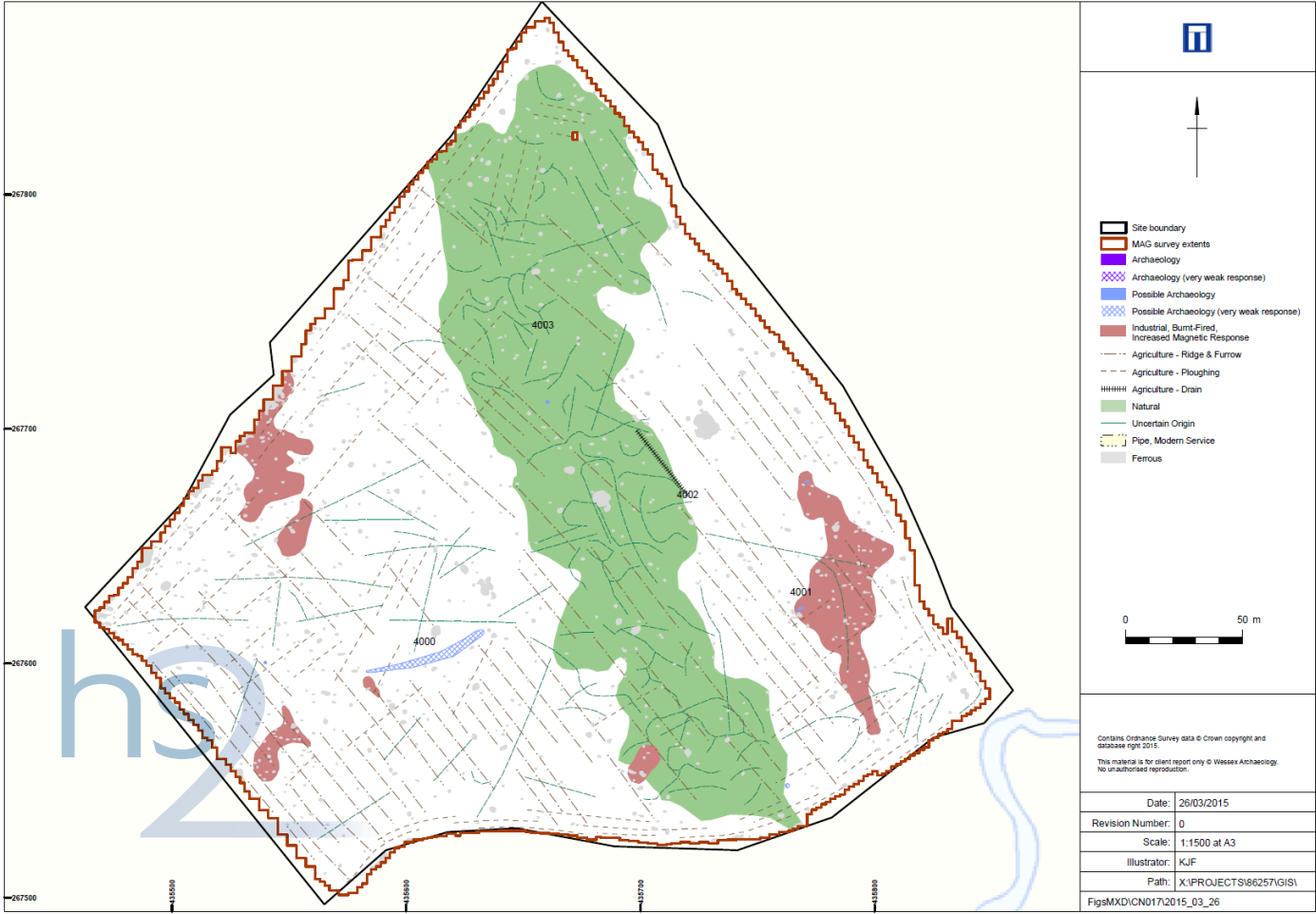


Figure 33 - CNo17 interpretation



2.7 Annex 1: survey equipment and data processing

Survey methods and equipment

- 2.7.1 The magnetic data for this project was acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.
- 2.7.2 The gradiometers have an effective resolution of 0.03nT over a ± 100 nT range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.
- 2.7.3 Wessex Archaeology conducts detailed gradiometer surveys using an accurate 20m or 30m site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey (OS) and Leica Geosystems, allowing positions to be determined with a precision of 0.02m in real-time and therefore exceed the level of accuracy recommended by Historic England (2008) for geophysical surveys.
- 2.7.4 The detailed surveys consist of 20m x 20m or 30m x 30m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20m or 30m grid respectively, and are the recommended methodologies for archaeological surveys of this type (Historic England 2008).
- 2.7.5 Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125m intervals along traverses spaced up to 0.25m apart, resulting in a maximum of 28800 readings per 30m grid, exceeding that recommended by Historic England (2008) for characterisation surveys.

Post-processing

- 2.7.6 The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.
- 2.7.7 As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the Global Positioning System (GPS) information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.
- 2.7.8 Typical data and image processing steps may include:
- destripe - Applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
 - destagger - Shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;

- despoke - Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data);
- deslope - This function is used to remove a linear trend within a data set. It is most commonly used to remove grid edge discontinuities that can result from applying zero mean traverse to a data set; and
- multiply - The multiply function multiplies the data by a negative or positive constant value. It has a variety of functions but its typical use is to normalise data that has been collected with sensors at different heights from the ground.

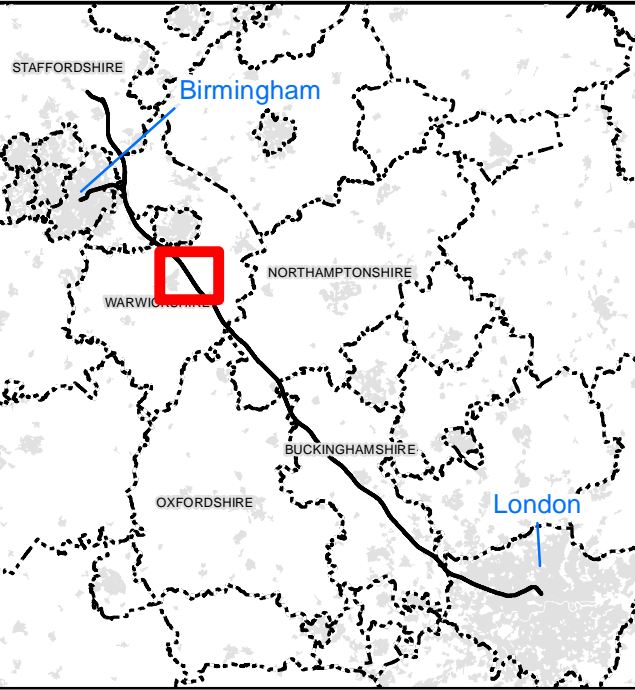
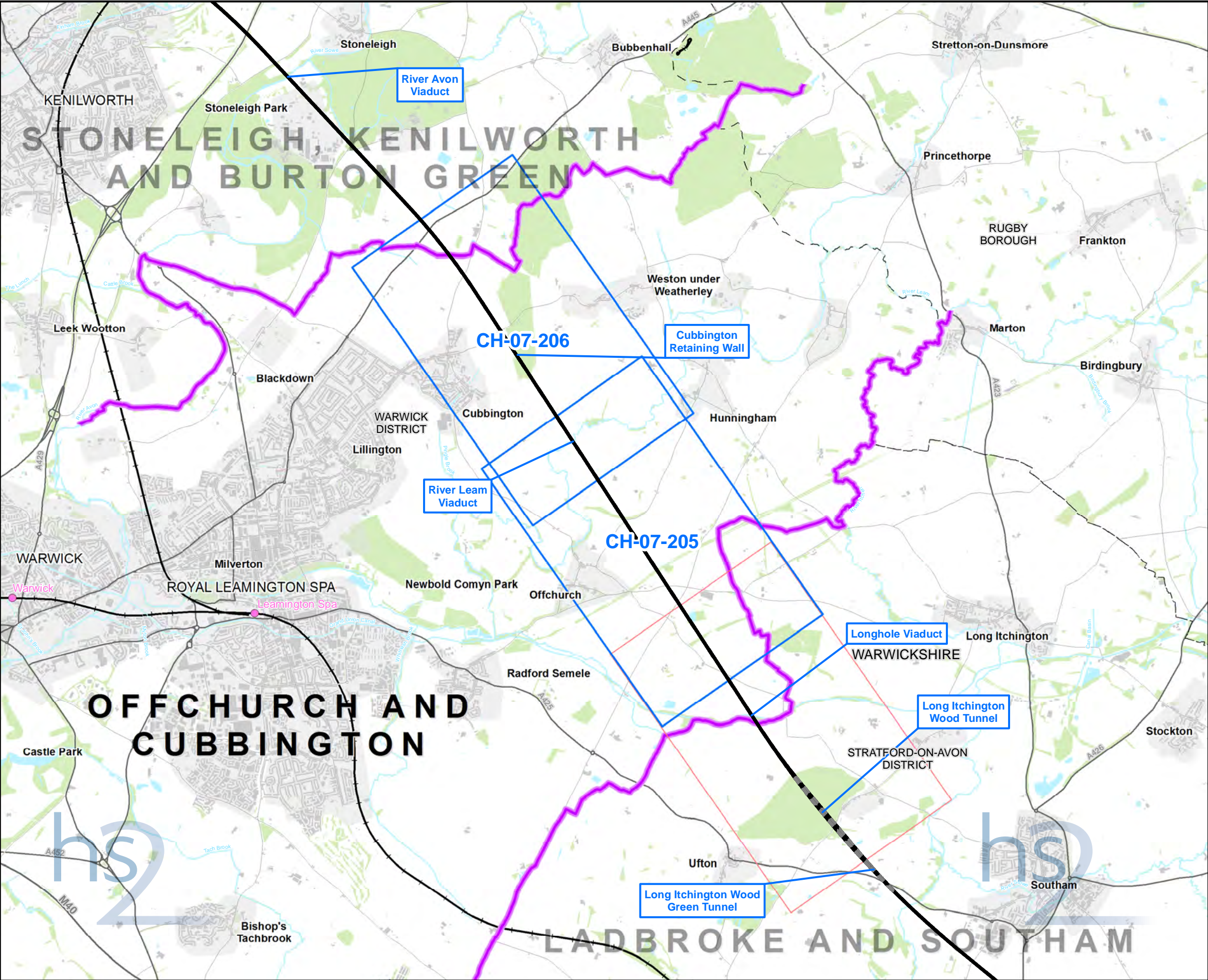
2.7.9 Typical displays of the data used during processing and analysis:

- XY Plot - Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies; and
- greyscale - Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.

2.8 Annex 2: geophysical interpretation

Interpretation categories

- 2.8.1 The interpretation methodology used by Wessex Archaeology separates the anomalies into two main categories: archaeological and unidentified responses.
- 2.8.2 The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:
- archaeology - used when there is a clear geophysical response and anthropogenic pattern; and
 - possible archaeology - used for features which give a response but which form no discernible pattern or trend.
- 2.8.3 The unidentified category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:
- industrial, Burnt-Fired, Increased magnetic response - used for areas dominated by bipolar and dipolar anomalies which may have some archaeological potential;
 - uncertain Origin - used for low amplitude or indistinct linear anomalies;
 - ferrous - used for responses caused by ferrous material. These anomalies are likely to be of modern origin;
 - agricultural - used for linear trends that can be shown to relate to agricultural activity including ridge and furrow, drainage and ploughing scars; and
 - natural - used for spreads of anomalies that are considered to be geological or more discrete anomalies considered to be natural.
- 2.8.4 Finally, utilities such as water pipes are marked where they have been identified along with ceramic field drains.



Map Series Information:

This map series shows archaeological geophysical survey locations within the land required for the construction of the Proposed Scheme

Main Map Legend

Route in tunnel

Route on surface

Depot, station, headhouse or portal building

Community forum boundary

Existing railway station

County boundary

District/Borough boundary

Map sheets included in this community forum with amendment

Map sheets not included in this community forum

Map Number

CH-07-INDEX-CFA17

Map Name

Index Map of:
Archaeological Geophysical Survey -
Location
SES and AP2 ES
Community Forum Area CFA17:
Offchurch and Cubbington

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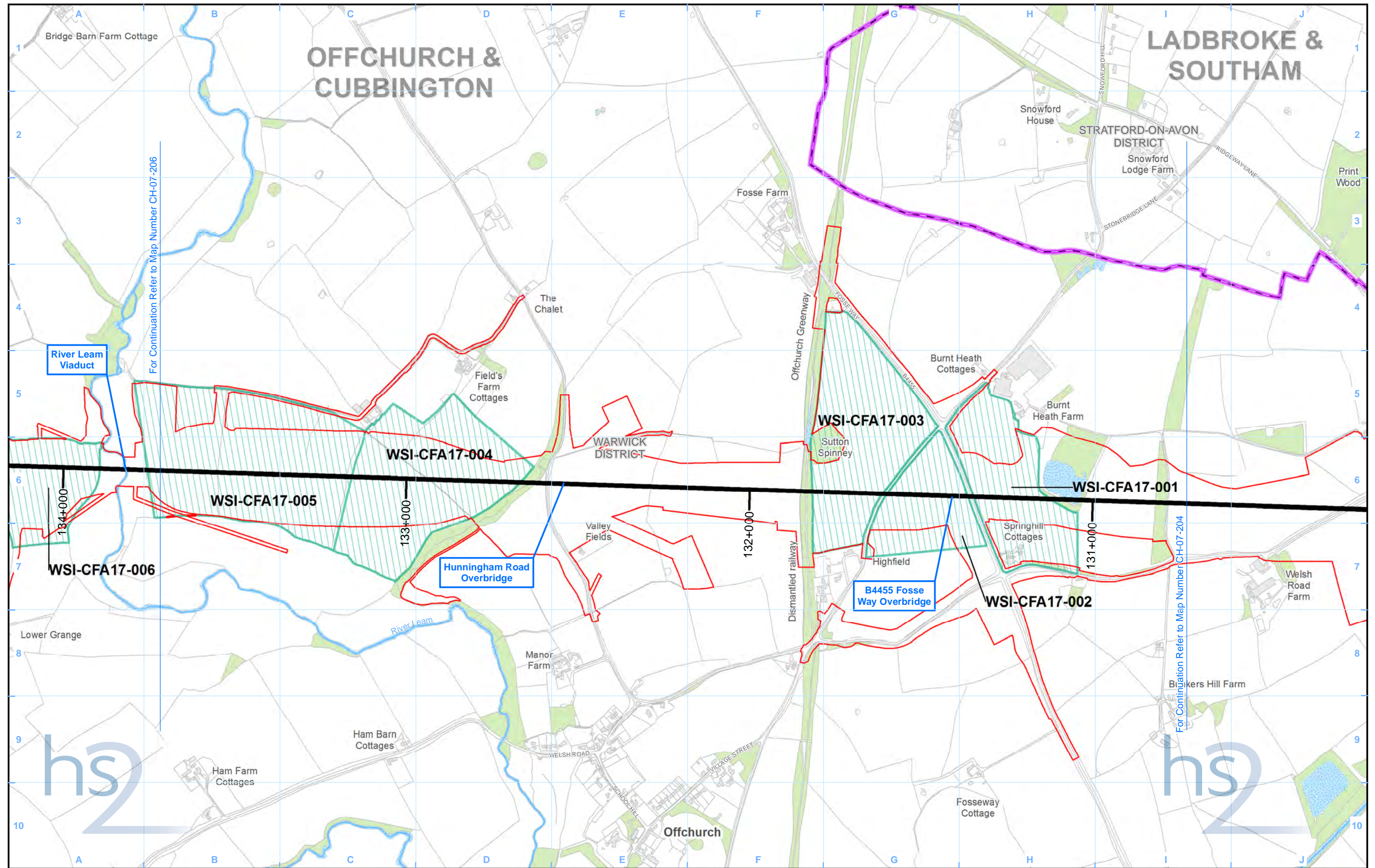
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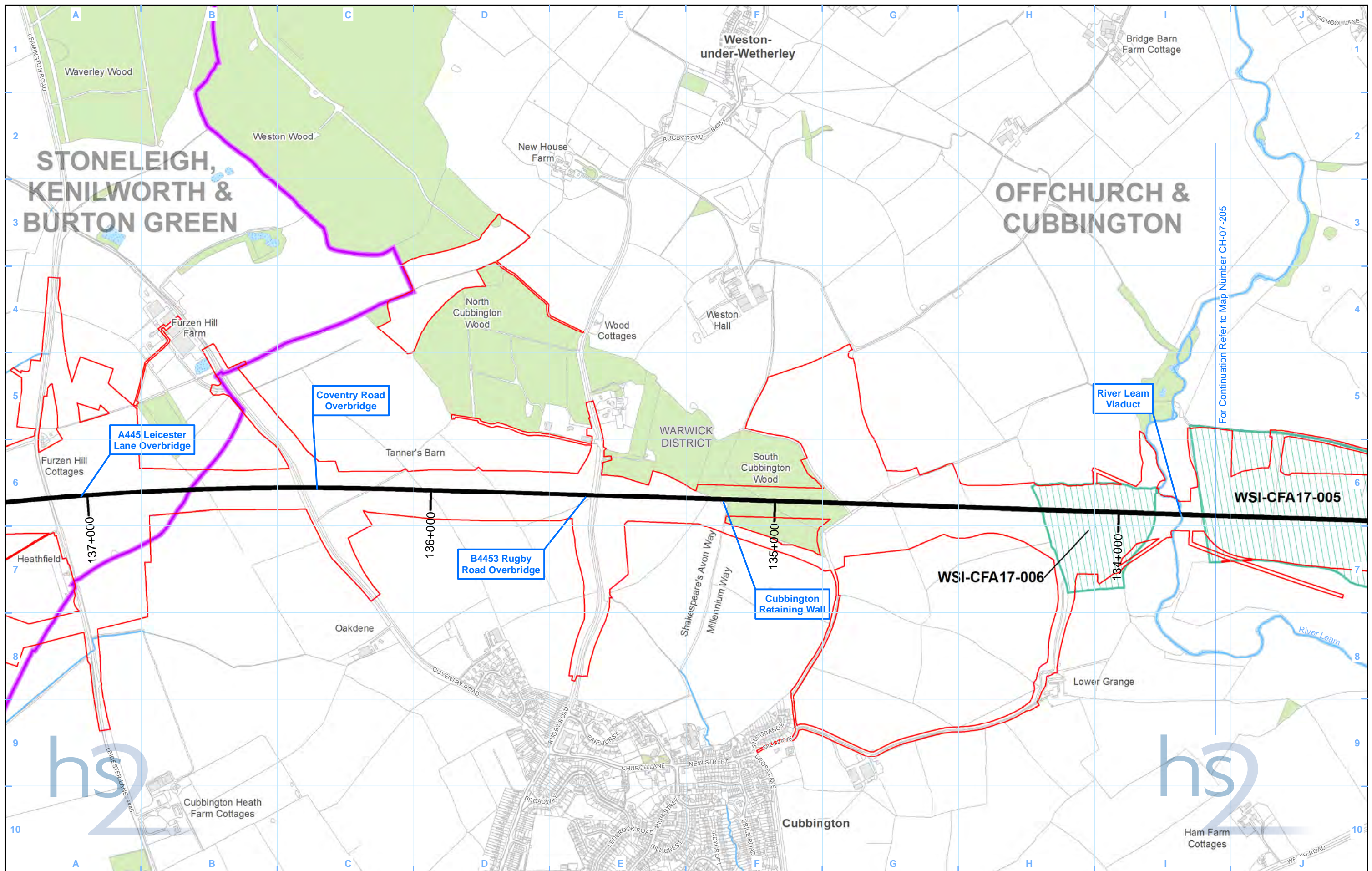
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Doc Number: C253-ATK-EV-MAP-030-001851-AP02-P01

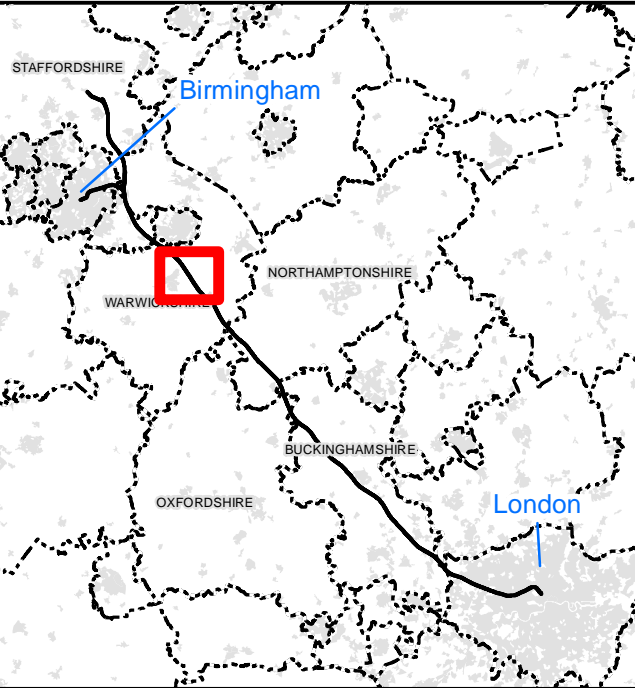
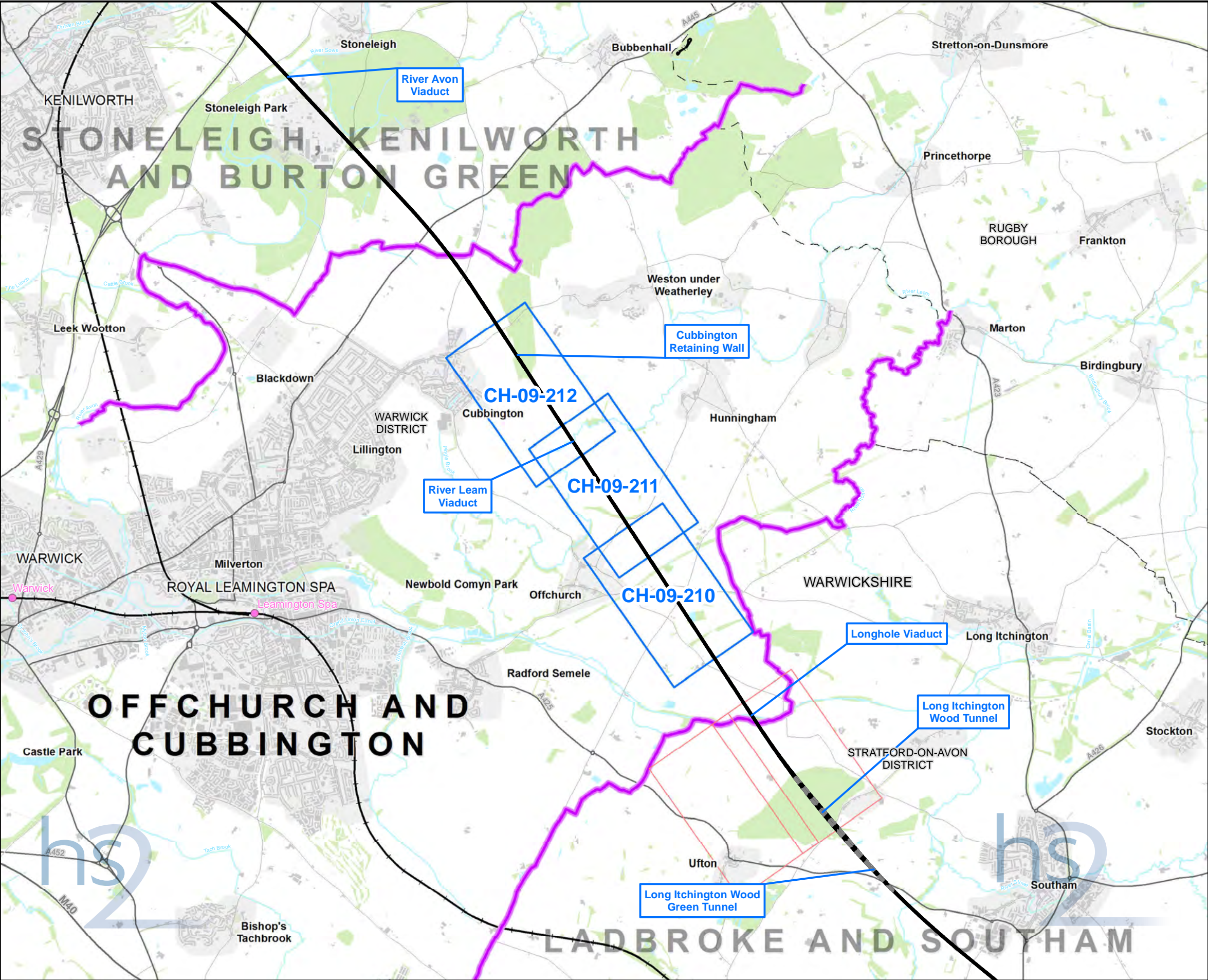
Date: 17/06/15



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Route in tunnel	Watercourse	Map Name Archaeological Geophysical Survey - Location SES and AP2 ES	
Route on surface	Water body	Community Forum Area CFA17: Offchurch and Cubbington	
Depot, station, headhouse or portal building	Woodland		
Land potentially required during construction	Area identified for survey 2014		
Community forum boundary	Geophysical and Fieldwalking surveys		
County boundary	Geophysical surveys		
District/Borough boundary	Areas surveyed in 2013		
	Fieldwalking surveys completed		
	Geophysical surveys completed		



Legend		Map Number CH-07-206	Map Name Archaeological Geophysical Survey - Location SES and AP2 ES Community Forum Area CFA17: Offchurch and Cubbington	 HS2 Ltd accept no responsibility for any circumstances, which arise from the reproduction of this map after alteration, amendment or abbreviation or if it is issued in part or issued incomplete in any way. Registered in England. Registration number 06791686. Registered office: One Canada Square, London, E14 5AB. © Crown copyright and database rights 2015. Ordnance Survey Licence Number 100049190. Doc Number: C253-ATK-EV-MAP-030-001792-AP02-P01 Date: 17/06/15
 Route in tunnel  Route on surface  Depot, station, headhouse or portal building  Land potentially required during construction  Community forum boundary  County boundary  District/Borough boundary	 Watercourse  Water body  Woodland  Area identified for survey 2014  Geophysical and Fieldwalking surveys  Geophysical surveys  Areas surveyed in 2013  Fieldwalking surveys completed  Geophysical surveys completed			



Map Series Information:

This map series shows magnetometer survey results within the land required for the construction of the Proposed Scheme

Main Map Legend

Route in tunnel

Route on surface

Depot, station, headhouse or portal building

Community forum boundary

Existing railway station

County boundary

District/Borough boundary

Map sheets included in this community forum with amendment

Map sheets not included in this community forum

Map Number

CH-09-INDEX-CFA17

Map Name

Index Map of:
Archaeological Geophysical
Survey - Magnetometer Data Plot
SES and AP2 ES
Community Forum Area CFA17:
Offchurch and Cubbington

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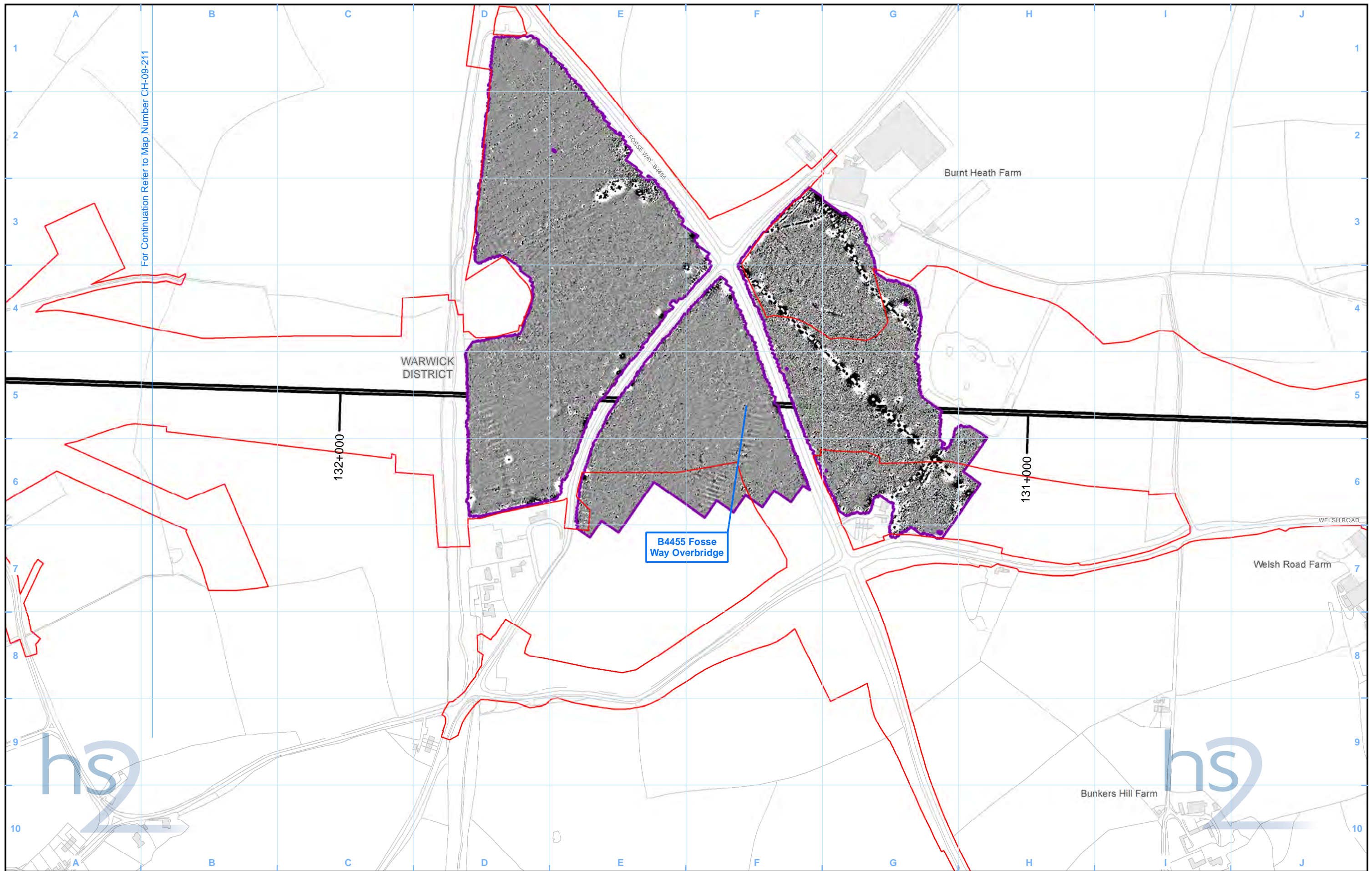
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Metres

Doc Number: C253-ATK-EV-MAP-030-001858-AP02-P01

Date: 10/06/15



- Legend**
- Route in tunnel
 - Route on surface
 - Depot, station, headhouse or portal building
 - Land potentially required during construction
 - Community forum boundary
 - District/Borough boundary
 - Edge of geophysical survey

Map Number
CH-09-210

Map Name
**Archaeological Geophysical
Survey - Magnetometer Data Plot
SES and AP2 ES**

Community Forum Area CFA17:
Offchurch and Cubbington

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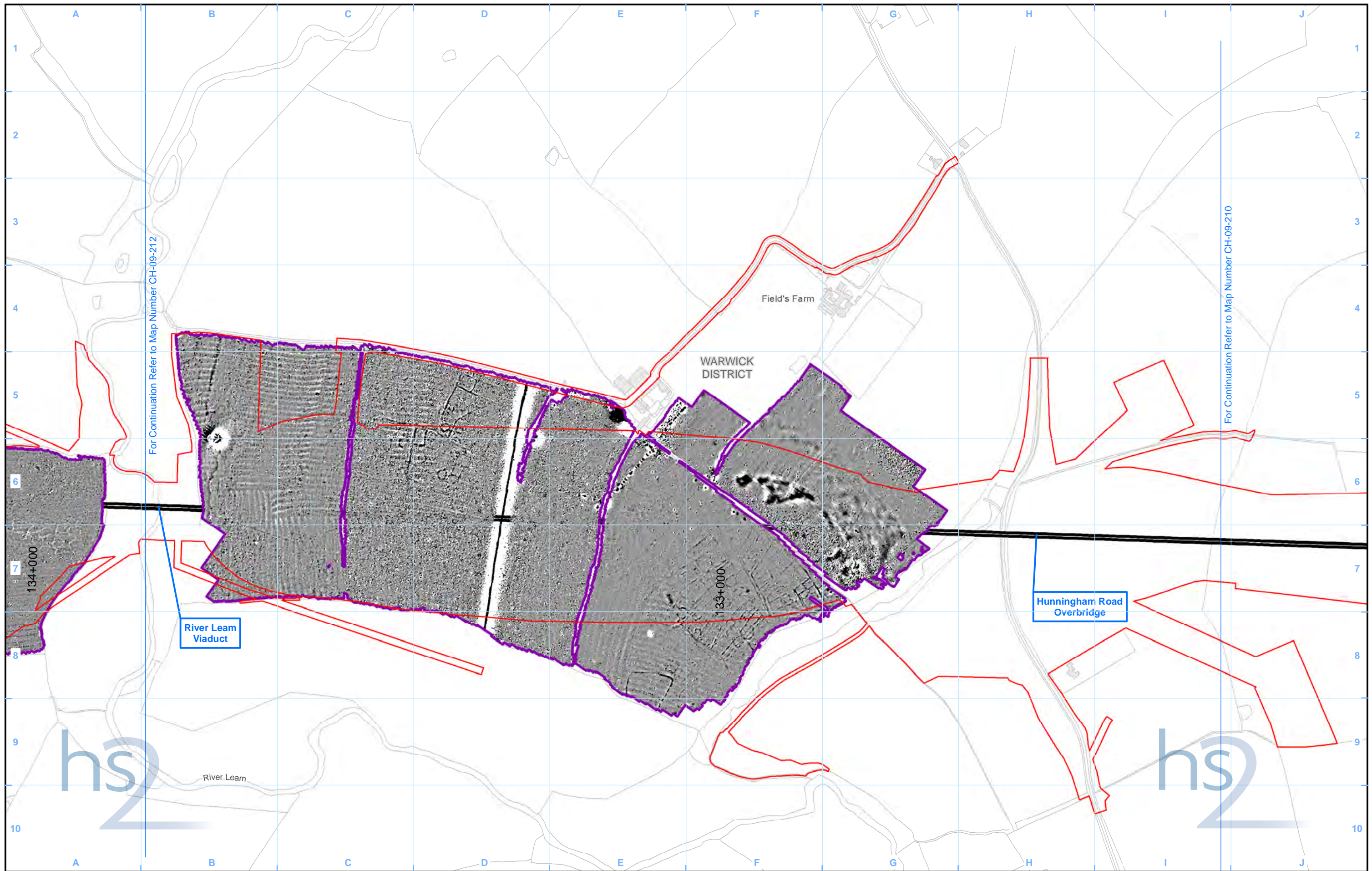
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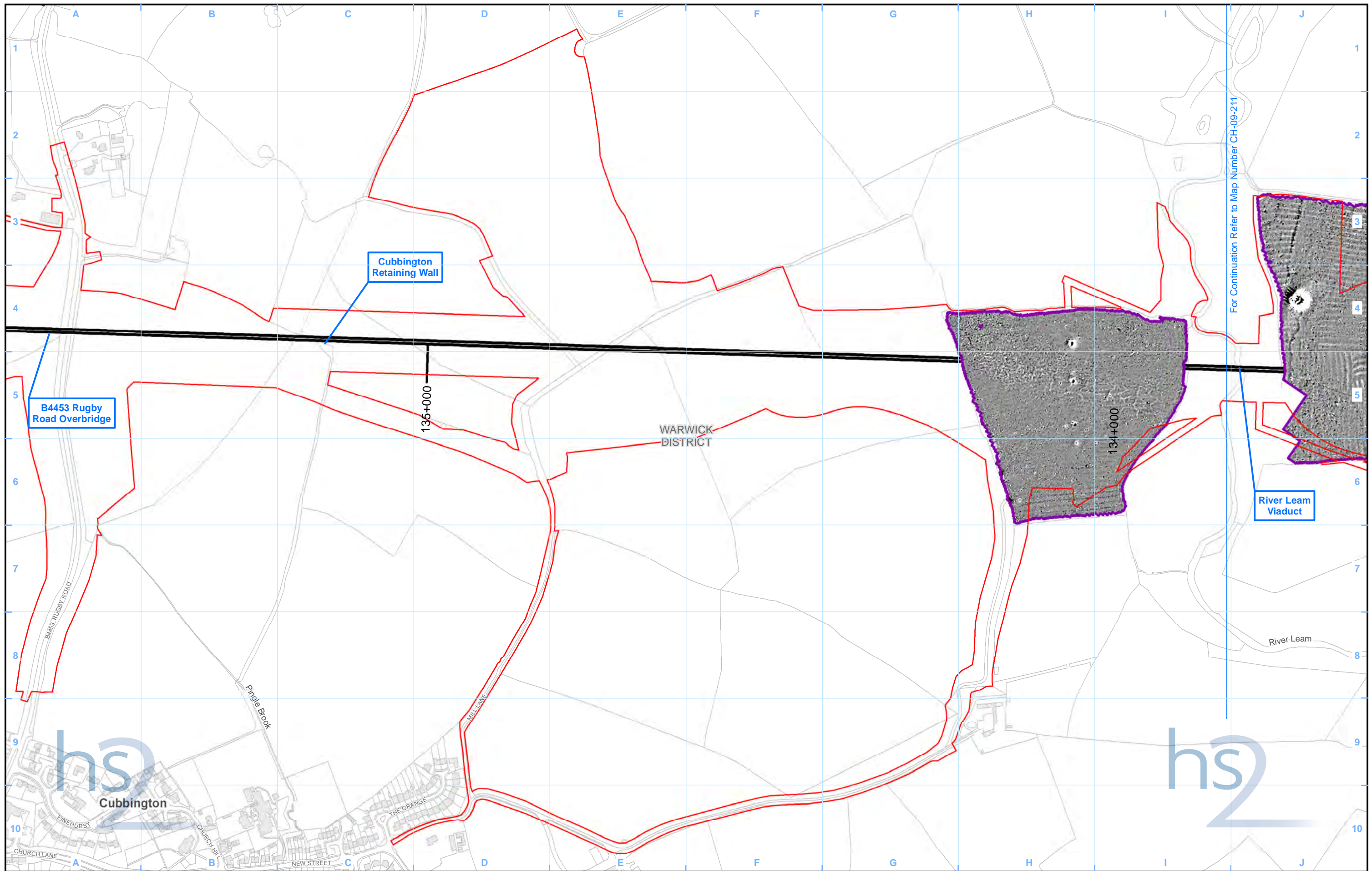
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Metres

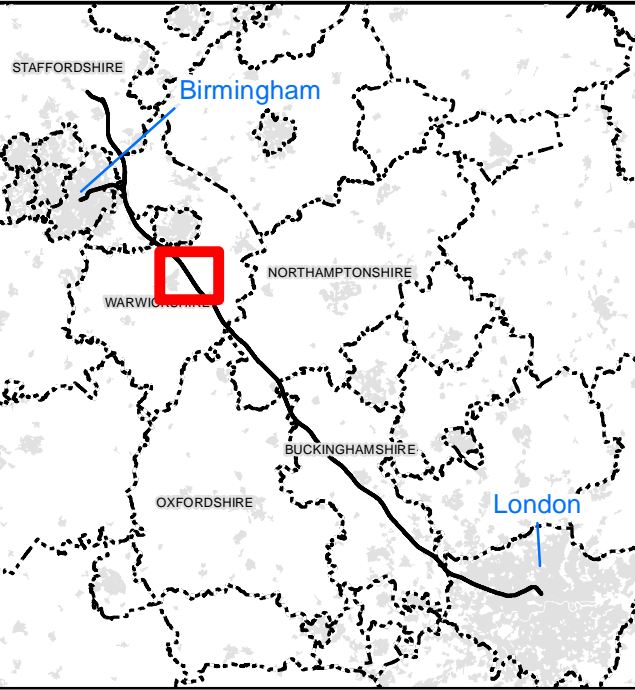
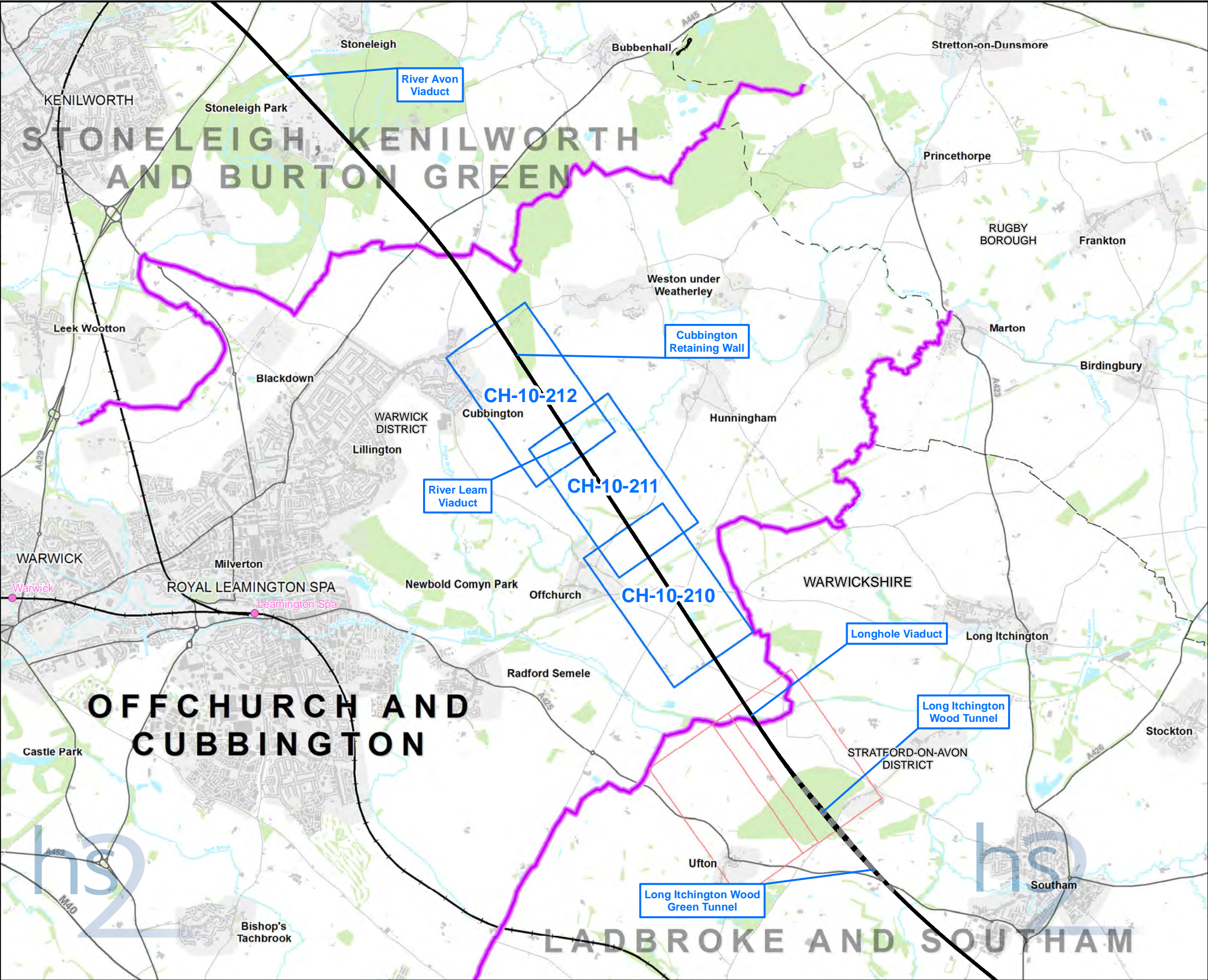
Doc Number: C253-ATK-EV-MAP-030-001811-AP02-P01 **Date:** 08/06/15



Legend <ul style="list-style-type: none">Route in tunnelRoute on surfaceDepot, station, headhouse or portal buildingLand potentially required during constructionCommunity forum boundaryDistrict/Borough boundaryEdge of geophysical survey	Map Number CH-09-211	<p>HS2 Ltd accept no responsibility for any circumstances, which arise from the reproduction of this map after alteration, amendment or abbreviation or if it is issued in part or issued incomplete in any way.</p> <p>Registered in England. Registration number 06791686. Registered office: One Canada Square, London, E14 5AB.</p> <p>© Crown copyright and database rights 2015. Ordnance Survey Licence Number 100049190.</p> <p>Scale at A3: 1:5,000</p> <p>0 50 100 150 200 Metres</p> <p>Doc Number: C253-ATK-EV-MAP-030-001812-AP02-P01 Date: 08/06/15</p>
	Map Name Archaeological Geophysical Survey - Magnetometer Data Plot SES and AP2 ES	
	Community Forum Area CFA17: Offchurch and Cubbington	



Legend <ul style="list-style-type: none">Route in tunnelRoute on surfaceDepot, station, headhouse or portal buildingLand potentially required during constructionCommunity forum boundaryDistrict/Borough boundaryEdge of geophysical survey	Map Number CH-09-212	<p>HS2 Ltd accept no responsibility for any circumstances, which arise from the reproduction of this map after alteration, amendment or abbreviation or if it is issued in part or issued incomplete in any way.</p> <p>Registered in England. Registration number 06791686. Registered office: One Canada Square, London, E14 5AB.</p> <p>© Crown copyright and database rights 2015. Ordnance Survey Licence Number 100049190.</p> <p>Scale at A3: 1:5,000</p> <p>0 50 100 150 200 Metres</p> <p>Doc Number: C253-ATK-EV-MAP-030-001813-AP02-P01 Date: 08/06/15</p>
	Map Name Archaeological Geophysical Survey - Magnetometer Data Plot SES and AP2 ES	
	Community Forum Area CFA17: Offchurch and Cubbington	



Map Series Information:

This map series shows interpretation of magnetometer survey results within the land required for the construction of the Proposed Scheme

Main Map Legend

Route in tunnel

Route on surface

Depot, station, headhouse or portal building

Community forum boundary

Existing railway station

County boundary

District/Borough boundary

Map sheets included in this community forum with amendment

Map sheets not included in this community forum

Map Number

CH-10-INDEX-CFA17

Map Name

Index Map of:
Archaeological Geophysical
Survey - Interpretation Plot
SES and AP2 ES
Community Forum Area CFA17:
Offchurch and Cubbington

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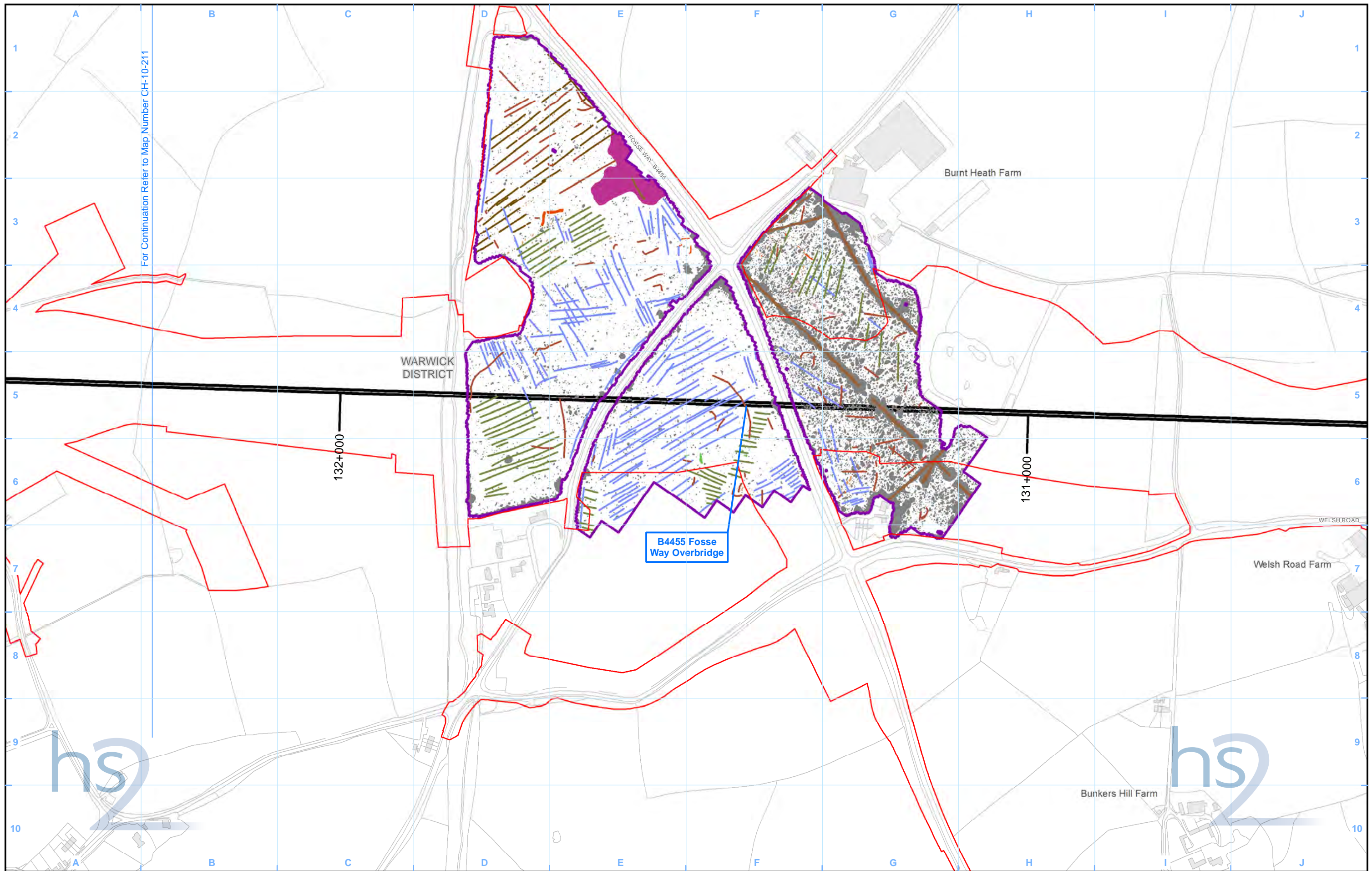
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Date: 10/06/15



Legend				
Route in tunnel	Geophysical survey results	Uncertain origin	Old field boundary	Ridge and furrow
Route on surface	Possible archaeology (VWR)	Archaeology (discrete)	Increased magnetic response	Uncertain
Depot, station, headhouse or portal building	Drain	Archaeology (zone)	Industrial burnt fired	
Land potentially required during construction	Pipe	Archaeology (VWR)	Modern service	
Community forum boundary	Plough	Possible archaeology (VWR)	Natural	
District/Borough boundary	Ridge and furrow	Possible archaeology	Pipe, modern service	
Edge of geophysical survey	Trend	Ferrous	Plough	

Map Number	CH-10-210
Map Name	Archaeological Geophysical Survey - Interpretation Plot SES and AP2 ES Community Forum Area CFA17: Offchurch and Cubbington

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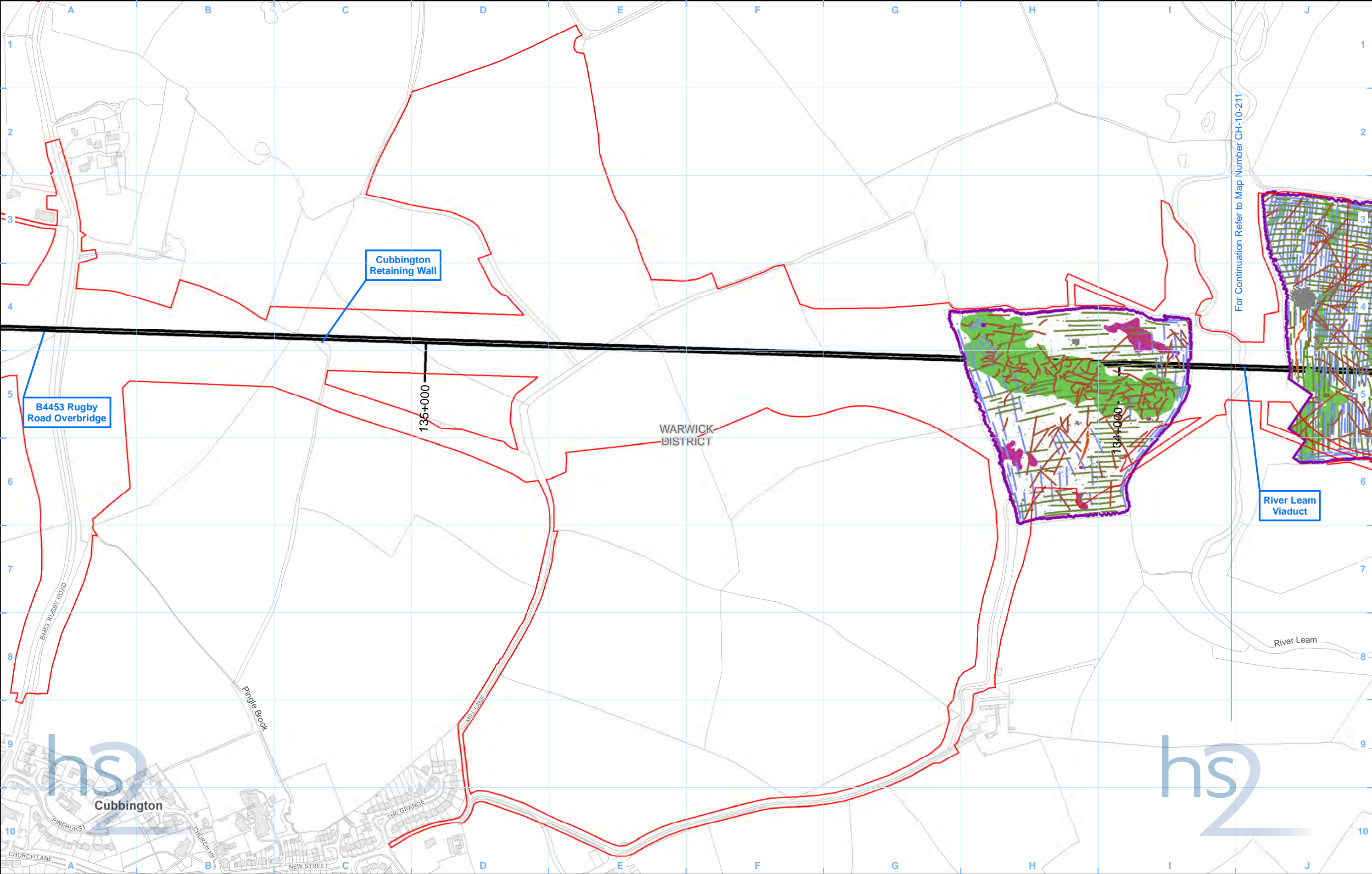
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0 50 100 150 200 Metres

Doc Number: C253-ATK-EV-MAP-030-001832-AP02-P01

Date: 08/06/15



Legend				
Route in tunnel	Geophysical survey results		Uncertain origin	Old field boundary
Route on surface	Possible archaeology (VWR)	Archaeology (discrete)	Archaeology (zone)	Increased magnetic response
Depot, station, headhouse or portal building	Drain	Archaeology (VWR)	Possible archaeology (VWR)	Industrial burnt fired
Land potentially required during construction	Pipe	Possible archaeology	Natural	Modern service
Community forum boundary	Plough	Ferrous	Pipe, modern service	Uncertain
District/Borough boundary	Ridge and furrow	Plough		
Edge of geophysical survey	Trend			

Map Number	CH-10-212
Map Name	Archaeological Geophysical Survey - Interpretation Plot SES and AP2 ES Community Forum Area CFA17: Offchurch and Cubbington

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