E162

High Speed Two Phase 2a (West Midlands - Crewe)

Background Information and Data

CA5: South Cheshire

Cultural heritage survey reports (BID-CH-004-005)

July 2017

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Department for Transport

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1 Introduction

1.1.1 This document presents the results of cultural heritage surveys carried out in the South Cheshire community area (CA5) relevant to High Speed Rail (West Midlands - Crewe). Geophysical surveys and remote sensing studies have been undertaken.

1.1.2 The cultural heritage assessment is detailed in the High Speed Rail (West Midlands - Crewe) Environmental Statement (ES)[1]. Volumes 2, 3 and 4 discuss cultural heritage effects and Volume 5, Appendices, sets out the following:

1.1.3 a cultural heritage baseline report for each community area;

1.1.4 a gazetteer of heritage assets for each community area;

1.1.5 a cultural heritage impact assessment table for each community area;

1.1.6 a route-wide historic landscape character report; and

1.1.7 a route-wide geoarchaeology desk study report.

[1] HS2 Ltd (2017), *High Speed Rail (West Midlands-Crewe) Environmental Statement*, www.gov.uk/hs2

2 Geophysical survey report

2.1 Introduction

2.1.1 This document presents the results of the geophysical survey carried out along the South Cheshire area. The surveyed areas are shown in Figure 1.

2.1.2 The works undertaken conform with current best practice and guidance for geophysical surveys as outlined in the Chartered Institute for Archaeologists' Standards and Guidance for archaeological geophysical survey[2] and Historic England's (HE; formerly English Heritage) Guidelines Geophysical Survey in Archaeological Field Evaluation[3]. For more information see the Technical Note on geophysical survey in the Environmental Impact Assessment Scope and Methodology Report (SMR) Addendum (ES Volume 5: Appendix CT-001-002).

2.1.3 Geophysical surveys of multiple areas between Lichfield and Crewe were undertaken in association with environmental assessments being completed for the Proposed Scheme. This report provides the results of non-intrusive geophysical surveys on the South Cheshire area of the route of the Proposed Scheme between August 2016 and January 2017. The South Cheshire area of the route is approximately 10km from the south of Checkley to north Crewe.

2.1.4 The geophysical surveys undertaken were preceded by desk-based research and a remote sensing survey (described in Section 3 of this report) comprising light detection and ranging (LiDAR) survey, as well as Aerial Photographic transcription and analysis. This work was used to generate an archaeological risk model which informed the locations selected for geophysical survey. The final survey areas were in part dictated by accessibility, as well as by potential and the risk model.

2.1.5 Archaeological Background for each area of survey presents a brief summary of the known archaeological assets within and surrounding the individual survey areas.

2.2 Survey objectives

Aims of the fieldwork

2.2.1 The aim of this survey is to establish the presence/absence, extent and character of detectable archaeological remains within the survey area, including both the testing of previously recorded sites and the identification of additional locations of archaeological potential not previously recorded.

Objectives of the fieldwork

2.2.2 The results of the surveys will be combined with data from other archaeological assessments carried out as part of the project, such as desk-top studies and LiDAR

[2] Chartered Institute for Archaeologists (2014), *Standard and Guidance for archaeological geophysical survey*
[3] English Heritage (2008), *Geophysical Survey in Archaeological Field Evaluation*, Research and Professional Service Guideline No. 1, 2nd Edition

data, in order to analyse the archaeological potential of the survey locations with a view to contributing to the preparation of the ES for the Proposed Scheme; and the development of a programme of archaeological investigation.

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

2.3 Methods

Introduction

2.3.1 All surveys covered within this report adhere to the same methodology, as set out below, and conform to HE guidelines and recommendations[4] and the HS2 technical note.

Grid location

2.3.2 The individual survey grid nodes were established at 30m by 30m intervals using a Leica Viva Real Time Kinetic (RTK) Global Navigation Satellite System (GNSS) instrument, which is precise to approximately 0.02m and therefore exceeds HE recommendations[5].

2.3.3 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, which may lead to misalignment. 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

2.3.4 The magnetic survey was conducted using Bartington Grad-01-1000L fluxgate gradiometers, which have a vertical separation of 1m between sensors. These are positioned with horizontal separations of 1m on either a hand-held Bartington Grad-601-2 instrument carrying two gradiometers, or a Bartington cart system carrying four gradiometers. Data were collected at 0.25 m intervals along transects spaced 1m apart with an effective sensitivity of 0.03 nT[6], in accordance with HE guidelines[7].

2.3.5 For the hand-held system, data were collected in the zigzag method with grids orientated north to south (Grid North). The first direction walked for each grid was on a northward heading. The cart system also collected data in a zigzag method north to south, but the position of readings is recorded by GPS rather than a grid system.

2.3.6 Further details of the geophysical and survey equipment and methods are provided in Annex A.

[4] English Heritage (2008)
[5] English Heritage (2008)
[6] nT = unit of magnetic density flux
[7] English Heritage (2008)

Data processing

2.3.7 Data from the survey were subject to minimal data correction processes. For hand-held data, 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. For the cart system, a smooth is applied to the data achieving a similar effect as the ZMT in the hand-held data.

2.3.8 Further details of geophysical data processing are provided in Annex A.

Data presentation

2.3.9 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. The data images and interpretation shapefiles were then used to produce the final figures in a Geographic Information system (GIS (ESRI ArcMap 10)).

2.3.10 The gradiometer data are displayed at -2 nT (white) to +3 nT (black) for the greyscale image and ±25 nT at 25 nT per cm for the XY trace plots for all hand-held collected data. Due to technical limitations XY trace plots cannot be produced for data collected by the cart systems.

Assumptions and limitations

2.3.11 Gradiometer survey will detect numerous ferrous anomalies. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation. In areas with a large amount of ferrous responses, such as those covered by 'green waste', it is possible that archaeological anomalies will be masked. As such, accurate interpretation in affected areas is likely to be limited or impossible.

2.3.12 It should be noted that, in all areas, small, weakly magnetised features may produce responses below the detection threshold of magnetometers. It may, therefore, be the case that further archaeological features may be present than have been identified through geophysical survey.

2.3.13 Best efforts are made to provide accurate analysis of the geophysical data. This includes using all available resources to inform interpretations and drawing on experience from previous surveys. However, the true date and character of anomalies can only be accurately defined by a programme of ground-truthing (such as trenching or trial pitting).

2.3.14 Further details of the interpretation of geophysical survey results are provided in Annex B.

Sources

2.3.15 Reference numbers used within the archaeological background sections below are from the relevant county Historic Environment Records (HER) or other stated source. Records are prefixed as follows:

- national heritage list for England = NHLE (designated assets);
- SHER = Staffordshire HER;
- CHER = Cheshire HER;
- AP= Aerial Photograph; and
- LiDAR = Light Detection and Ranging.

2.4 CA5-3177 land south-west of Chorlton

Site details

2.4.1 A geophysical survey was carried out over area CA5-3177 at land south-west of Chorlton, Staffordshire (centred on National Grid Reference (NGR) 373053, 349608 (Figure 2)).

2.4.2 The area was selected for geophysical survey as it is considered to be an area with elevated archaeological potential due to the presence of post-medieval agricultural and quarrying activity in the surrounding area.

2.4.3 The area comprises an irregular parcel of land covering areas within two fields to the south-west of Chorlton, Staffordshire, 6.9km south-south-east of Crewe, and approximately 15.8km west-north-west of the centre of Stoke-on-Trent. The limits of the geophysical survey area are defined by hedgerow field boundaries and predefined survey extents within the fields. The gradiometer survey covered 7.5ha of the 8.1ha survey area, with any outstanding area deemed unsuitable for survey due to overgrown field boundaries.

2.4.4 This survey area lies on relatively flat ground. The northern area of the survey peaks at approximately 68m above Ordnance Datum (AOD) and the southern area at approximately to 72m AOD.

2.4.5 There are no overhead cables or water courses present over the survey area. The internal field boundaries are formed of hedgerows and fence lines.

2.4.6 The underlying geology is recorded as Wilkesley Halite Member. No superficial deposits are recorded[8]. The soils underlying this survey area are likely to comprise the typical stagnogley soils of the Clifton (711n) association[9]. Soils in such geological

[8] British Geological Survey (2015), http://www.bgs.ac.uk
[9] Soil Survey of England and Wales (1983), *Sheet 3, Soils of Midland and Western England*, Ordnance Survey: Southampton

settings have been demonstrated to produce magnetic contrasts suitable for the detection of anomalies through gradiometer survey.

Archaeological background

2.4.7 There are no known features within the survey area, however, a large area of narrow ridge and furrow lies to the west of the survey area, suggestive of post-medieval cultivation (LiDAR3144). Also within this area a series of former fields boundaries has been identified which are also visible on the 1st edition Ordnance Survey map (LiDAR3142). Several hollows and small ponds within this area may be the result of earlier quarrying activity (LiDAR3140, 3143).

Results

2.4.8 The gradiometer survey carried out between 14-15 November 2016 using hand-held systems has identified anomalies relating to modern agricultural activity, natural features, and ferrous responses.

2.4.9 Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2000 (Figures 3 - 5). The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trend (Figure 5).

Interpretation: agricultural

2.4.10 The dataset presents several linear anomalies. These anomalies have all been interpreted as former field boundaries consistent with boundaries visible on historic mapping (1st edition OS 1876). 5-3177-001 is aligned north to south in the north of the survey area and appears to intersect with 5-3177-002, aligned north-west to south-east across a large area of variable magnetic background (5-3177-007). 5-3177-003 projects northwards from 5-3177-002, with 5-3177-004 continuing to the south. 5-3177-005 appears to extend eastwards from the southern terminus of 5-3177-004. In the southern portion of the dataset, a smaller anomaly (5-3177-006) has been identified, aligned approximately east to west.

2.4.11 Across the survey area, numerous parallel linear trend anomalies of a very low magnitude (+1 nT), have been identified. These are consistent with modern agricultural activity such as ploughing (such as at 5-3177-007).

2.4.12 5-3177-008 to the south of the northern portion of the survey area suggests a much lower magnitude and less varied magnetic response (-20 - +24 nT). This is indicative of the spreading of green waste as a method of fertilisation.

2.4.13 Two areas of dipolar linear anomalies (5-3177-009 and 5-3177-010) were detected in the north and south of the survey area. These responses are indicative of fired materials, such as ceramics, and are likely related to land drains.

Interpretation: geological or natural

2.4.14 Predominantly in the northern portion of the survey area, two areas of significantly variable magnetic background were identified at 5-3177-008. This varied effect is caused by a notably increased variation in magnetic susceptibility of the underlying deposits in these areas compared to the surrounding survey area.

2.4.15 In the southern portion of the survey area, broad low magnitude, linear anomalies (5-3177-011) measuring approximately 2.5 – 3.0m wide and of varying lengths (up to 70m). These have been interpreted as evidence of the build-up of natural, magnetically susceptible sands and gravels in the underlying deposits. There is also an area of small discrete anomalies (5-3177-012) likely to be of the same origin.

Interpretation: modern

2.4.16 Two areas of dipolar responses (5-3177-013 and 5-3177-014) have been detected in the centre of the survey area. The exact origin of these anomalies is not clear; however they are likely to be areas of modern made ground related to the backfilling of ponds or hollows.

2.4.17 The cause of 5-3177-015 is hard to identify as the response is varied, and even dipolar in some areas (-34 nT – +53 nT). This varied response is more indicative of an area of infilling. No quarrying is mapped in this area on historic mapping and the presence of a field drain to the south-east is suggestive of a possible area of flooding or wetland that has been drained and infilled.

Conclusions

2.4.18 The survey has not identified any anomalies of archaeological origin. There is no visible evidence for post-medieval extraction which is recorded in the surrounding area. The area shows notable agricultural and made ground, with several former field boundaries, ploughing trends and green waste spreads being identified. Some of the anomalies thought to be made ground may be evidence for quarrying activity, however, their location and form suggests they are more likely related to modern agricultural activity.

2.5 CA5-3256 land at Chorlton

Site details

2.5.1 A geophysical survey was carried out over area CA5-3256 at land at the village of Chorlton, Staffordshire (centred on NGR 372828,350022 (Figure 6)).

2.5.2 The area was selected for geophysical survey as it is considered to be an area with elevated archaeological potential due to the presence of post-medieval agricultural and quarrying activity in the surrounding area, identified from the LiDAR data and aerial photography assessment.

2.5.3 The area comprises a rectangular parcel of land covering areas within a single field just off Waybutt Lane, Chorlton, Staffordshire, 6.3km south-south-east of Crewe, and approximately 16.0km west north-west of the centre of Stoke-on-Trent. The limits of the geophysical survey area are defined by hedgerow field boundaries. The gradiometer survey covered 2.7ha of the 4.0ha survey area, with any outstanding area, deemed unsuitable for survey due to over grown scrub land within the field. This survey area lies on relatively flat ground at approximately 68 – 69m AOD. There are no overhead cables or water courses present over the survey area, however a considerable amount is considered to be overgrown and unsuitable for survey.

2.5.4 The underlying geology is recorded as Wilkesley Halite Member with superficial glaciofluvial deposits[10]. The soils underlying this survey area are likely to comprise the typical stagnogley soils of the Clifton (711n) association[11]. Soils in such geological settings have been demonstrated to produce magnetic contrasts suitable for the detection of anomalies through gradiometer survey.

Archaeological background

2.5.5 A possible moat has been identified from the 1843 tithe map in the field immediately to the north of the survey area (CHERMCH5736). If confirmed, this could indicate medieval occupation within the area.

2.5.6 Two curvilinear features have been identified within the survey area, the exact date and nature of these is unclear although they may be the result of recent agricultural activity (LiDAR3145). Several linear features are also visible to the north-west of the area; these could reflect earlier field divisions or may be more recent in date (LiDAR3145).

2.5.7 Ridge and furrow has been identified in LiDAR data and through the aerial photography assessment immediately to the west of the survey area (LiDAR3144). The characteristically narrow form of these earthworks suggests a post-medieval date.

2.5.8 Large cut features to the south-west of the survey area are likely to relate to quarrying activity (LiDAR3143). An 'Old Sand Pit' is marked on the 1st edition Ordnance Survey map in the field to the north.

Results

2.5.9 The gradiometer survey carried out on the 16 November 2016 using hand-held systems has identified a possible archaeological anomaly, as well as anomalies relating to modern agricultural activity and ferrous responses.

2.5.10 Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2000 (Figures 7 - 9). The interpretation of the datasets

[10] British Geological Survey (2015)
[11] Soil Survey of England and Wales (1983)

highlights the presence of potential archaeological anomalies, ferrous / burnt or fired objects, and magnetic trend (Figure 9).

Interpretation: archaeology

2.5.11 One discrete positive anomaly at the southern most extreme of the survey area has been identified as possible archaeology (5-3256-001). The anomaly measures approximately 2.5m in diameter. This feature may relate to the surrounding potential for quarry pits, however, it could equally relate to natural pitting in the bedrock or tree throw.

Interpretation: agricultural

2.5.12 Curving across the south-west corner of the survey area, a low magnitude, linear anomaly aligned approximately south-east to north-west has been identified (5-3256-002). This anomaly corresponds to a former field boundary present on historic mapping of the area.

2.5.13 Across the survey area, low magnitude, closely spaced, linear anomalies have been identified. This type of anomaly is indicative of modern agricultural activity and likely to be evidence of ploughing.

Interpretation: modern

2.5.14 Predominantly along the eastern periphery of the survey area a variable magnetic background has been detected (5-3256-003). This is likely related to the construction of the housing development to the southern end of Freshwater Drive.

2.5.15 Along the western periphery of the survey area, a high magnitude (+/- 100 nT) dipolar, linear anomaly has been identified. This is ferrous disturbance from the adjacent train tracks.

Conclusions

2.5.16 The survey has identified one potential feature of possible archaeological origin which may relate to the historic extraction activity recorded in the surrounding area. Agricultural features, including a former field boundary and ploughing activity, as well as evidence of industrial and modern land use during modern development in the area have also been identified.

2.6 CA5-3290 land at Chorlton

Site details

2.6.1 A geophysical survey was carried out over area CA5-3290 at land at the village of Chorlton, Staffordshire (centred on NGR 372736, 350245 (Figure 10)).

2.6.2 The area was selected for geophysical survey as it is considered to be an area with elevated archaeological potential due to the presence of a possible moat and later post-medieval agricultural and quarrying activity in the surrounding area.

2.6.3 The area comprises a single field, to the south-west of the junction of Chorlton Lane and Waybutt Lane, in Chorlton, Staffordshire, 6.2km south-south-east of Crewe, and approximately 16.0km west north-west of the centre of Stoke-on-Trent. The limits of the geophysical survey area are defined by hedgerow field boundaries. The gradiometer survey covered 1.9ha of the 2.1ha survey area, with any outstanding area deemed unsuitable for survey due to overgrown field boundaries. This survey area lies on relatively flat ground at approximately 68-69m AOD.

2.6.4 There is a single overhead cable traversing the north of the survey area. No water courses are present over the survey area.

2.6.5 The underlying geology is recorded as Wilkesley Halite Member with superficial glaciofluvial deposits[12]. The soils underlying this survey area are likely to comprise the typical stagnogley soils of the Clifton (711n) association[13]. Soils in such geological settings have been demonstrated to produce magnetic contrasts suitable for the detection of anomalies through gradiometer survey.

Archaeological background

2.6.6 Within the area of the survey area a possible moat has been identified from the 1843 tithe map, although no above ground remains are presently visible (CHERMCH5736). If confirmed this could indicate medieval occupation within the area.

2.6.7 Ridge and furrow has been identified in LiDAR data and through the aerial photography assessment immediately to the west of the survey area (LiDAR3144). The characteristically narrow form of these earthworks suggests a post-medieval date.

2.6.8 An 'Old Sand Pit' is marked on the 1st edition Ordnance Survey map in the northern part of the survey area along with a long structure or barn.

2.6.9 Linear features to the west of the area (LiDAR3145) and parallel curvilinear features to the south of the survey area (LiDAR3147) may be the result of recent agricultural activity but could reflect earlier boundaries.

Results

2.6.10 The gradiometer survey carried out on the 18 November 2016 using hand-held systems has identified anomalies of possible archaeological origin, as well as those relating to modern agricultural activity, natural, and ferrous responses.

2.6.11 Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2000 (Figures 11 - 13). The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trend (Figure 13).

[12] British Geological Survey (2015)
[13] Soil Survey of England and Wales (1983)

Interpretation: archaeology

2.6.12 An area of possible archaeology has been identified in the north-west corner of the dataset (5-3290-001). This is seen in the form of a fragmented positive recti-linear anomaly with several discrete positive anomalies surrounding it. These may form part of a recti-linear feature which could relate to the moated site recorded on the 1843 tithe map of the area (CHERMCH5736).

2.6.13 To the south, 5-3290-002 outlines several positive pit-like features possibly relating to settlement activity. However, they may, on further investigation, relate to natural pitting in the bedrock or tree throws.

Interpretation: agricultural

2.6.14 A linear area of ferrous responses (5-3290-003) has been identified to the north-west of the area. This is likely related to a former field boundary present on the 1875 Ordnance Survey map of the area.

2.6.15 Through the centre and south of the survey area, parallel linear trend anomalies have been identified. These are aligned broadly north-north-west to south-south-west and are indicative of ploughing activity in the area. Whilst this is thought to be modern, it may relate to the post-medieval ridge and furrow activity recorded in the surrounding area. Evidence for land drainage has also been noted.

Interpretation: geological or natural

2.6.16 Two areas of low magnitude, magnetic variation have been identified in the centre and north-east of the survey (5-3290-004 and 5-3290-005). These are likely to be due to variation in the magnetic susceptibility of the underlying geology or soils and therefore have been interpreted as natural in origin.

Interpretation: modern

2.6.17 A single, high magnitude (+/- 100 nT) dipolar anomaly has been identified in the north of the survey area (5-3290-006). This surrounds a modern overhead cable support.

Conclusions

2.6.18 The survey has identified several anomalies of possible archaeological origin, predominantly to the western periphery of the survey area. These may relate to a former moated site recorded in the area and pit features. The area also shows a number of agricultural anomalies including a former field boundary, ploughing trends, and numerous modern ferrous anomalies.

2.7 CA5-3317 land east of Lane End Farm

Site details

2.7.1 A geophysical survey was carried out over area CA5-3317 at land east of Land End Farm, Staffordshire (centred on NGR 372766, 349683 (Figure 14)).

2.7.2 The area was selected for geophysical survey as it is considered to be an area with elevated archaeological potential due to the potential medieval and post-medieval agricultural and extractive activity within the survey area. There is also a possible medieval moated site at the northern edge of the survey area.

2.7.3 The area comprises five fields, to the west of Chorlton, Staffordshire, 6.5km south of Crewe, and approximately 16.1km west north-west of the centre of Stoke-on-Trent. The limits of the geophysical survey area are defined by hedgerow field boundaries. The gradiometer survey covered 12.7ha of the 27.5ha survey area.

2.7.4 This survey area lies on relatively flat ground at approximately 69m AOD across the survey area.

2.7.5 There are no overhead cables or water courses present over the survey area.

2.7.6 The underlying geology is recorded as Wilkesley Halite Member of halite stone and mudstone with superficial deposits of till recorded across the majority of the area with peat mapped at the very southern edge[14]. The soils underlying this survey area are likely to comprise the typical stagnogley soils of the Clifton (711n) association[15]. Although the presence of overlying deposits of till may reduce the effectiveness of the survey, potentially providing false positive readings, soils in such geological settings have been demonstrated to produce magnetic contrasts suitable for the detection of anomalies through gradiometer survey.

Archaeological background

2.7.7 Narrow ridge and furrow, probably from the post-medieval period, has been identified from aerial photographs across the survey area (AP168). This has also been identified on the northern part of the survey area by the LiDAR assessment (LiDAR3144). Additionally, a number of former field boundaries which are depicted on historic maps have been identified (LiDAR3142) as well as other linear features which do not correlate with known boundaries (LiDAR3145).

2.7.8 Several possible post-medieval former extraction pits have been identified on the southern and western parts of the survey area (LiDAR3140, 3143). The surviving ponds in the survey area and surrounds probably represent further former mineral extraction activity.

2.7.9 To the north-east of the survey area is a possible medieval moated site recorded in the HER from the Chorlton tithe map (CHERMCH5736). This has been truncated by the subsequent building of the West Coast Main Line. There is the potential for remains to extend to the west of the railway, within the survey area. There is a possible section of relict boundary shown on the 1st edition Ordnance Survey map, within the northern edge of the survey area, which may be related to this.

[14] British Geological Survey (2015)
[15] Soil Survey of England and Wales (1983)

Results

2.7.10 The gradiometer survey was carried out between 14 – 16 November 2016 using a cart system identified areas of ridge and furrow and anomalies of possible archaeological origin, as well as those relating to modern agricultural activity and ferrous responses.

2.7.11 Results are presented as a series of greyscale plots and archaeological interpretations, at a scale of 1:2000 (Figures 15 - 18). The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 18).

Interpretation: archaeology

2.7.12 Throughout the survey area, several areas of broadly spaced, low magnitude, parallel, linear anomalies have been identified. These are aligned south-west to north-east at 5-3317-001, west-south-west to east-south-east at 5-3317-002, north-west to south-east at 5-3317-003, north-east to south-west at 5-3317-04 and north-west to south-east at 5-3317-005 respectively. The anomalies are detected at a variety of alignments across the entire survey area and have been interpreted as evidence of ridge and furrow cultivation. The relatively straight nature of these anomalies suggests these may be post-medieval in date, which is supported by other similar instances previously recorded in the surrounding area.

2.7.13 Several low magnitude dipolar linear anomalies (5-3317-006) which suggest cut features such as ditches have been identified to the north-west of the survey area. These could conceivably be related to the possible medieval moated site recorded in the HER but could only be confirmed on further investigation (CHERMCH5736).

Interpretation: agricultural

2.7.14 Several positive linear anomalies have been identified by the survey which correlate to former field boundaries present on historic mapping (1st edition OS 1876). Anomalies at 5-3317-007 aligned east to west, at 5-3317-008 aligned north-west to south-east, at 5-3317-009 and 5-3317-010 aligned north-east to south-west, at 5-3317-011 aligned north-west to south-east, and at 5-3317-012 aligned east to west. These are indicative of historic land divisions which are no longer surviving within the survey area.

Interpretation: geological or natural

2.7.15 One area has been identified as natural in origin (5-3317-013). The anomaly presents as a low magnitude (+4-7 nT), undefined anomaly and interpreted as being caused by the gradual build-up of magnetically susceptible deposits in the underlying geology or soils.

Interpretation: modern

2.7.16 Several areas of variable magnetic background have been identified by the survey, presenting as fairly large areas of disturbance visible in the relatively sterile background (5-3317-014 to 5-3317-018). Generally, these anomalies are present around

the perimeter of internal field boundaries and as such are considered to be areas of surface spreads or localised burning.

Conclusions

2.7.17 The survey has identified areas of post-medieval ridge and furrow, as well as some features tentatively ascribed a possible archaeological origin due their proximity to the possible moated site but may represent modern features, such as field drains. The area also shows agricultural features including several former boundaries present on historic mapping and numerous modern ferrous anomalies.

2.8 CA5-3343 land at Chorlton

Site details

2.8.1 A geophysical survey was carried out over area CA5-3343 at land at Chorlton, Staffordshire (centred on NGR 372445, 351039 (Figure 19)).

2.8.2 The area was selected for geophysical survey as it is considered to be an area with elevated archaeological potential due to the potential medieval and post-medieval agricultural and extractive activity within the survey area.

2.8.3 The area comprises an irregular parcel of land across three fields, to the north-west of Chorlton, Staffordshire, 4.9km south-east of Crewe, and approximately 16.6km north-west of the centre of Stoke-on-Trent. The limits of the geophysical survey area are defined by hedgerow field boundaries. The gradiometer survey covered 0.8ha of the 2.4ha survey area, with the remaining survey area considered unsuitable for survey due to overgrown scrubland and areas of hard standing. This survey area lies on flat ground at an elevation of approximately 65m AOD. There is one set of overhead cables traversing the southern portion of the survey area and no water courses are present over the survey area.

2.8.4 The underlying geology is recorded as Wilkesley Halite Member overlain by glaciofluvial deposits[16]. The soils underlying the south of the survey area are likely to comprise the typical stagnogley soils of the Clifton (711n) association, whilst the north is likely covered by typical sandy gley soils of the Blackwood (821b) association[17]. Soils in such geological settings have been demonstrated to produce magnetic contrasts suitable for the detection of anomalies through gradiometer survey.

Archaeological background

2.8.5 A number of linear features are visible in the LiDAR data immediately to the north, south and west of the survey area, several of which can be seen to correspond to field boundaries depicted on late 19th century Ordnance Survey mapping (LiDAR3150, 3153, 3155). Areas of small irregular fields can be seen on the Ordnance Survey map to the

[16] British Geological Survey (2015)
[17] Soil Survey of England and Wales (1983)

north and south of the area suggestive of informal enclosure. Several small ponds in the wider landscape may be the remnants of former extraction pits.

2.8.6 Immediately to the south of the survey area narrow ridge and furrow, identified by the aerial photography assessment suggests post-medieval cultivation (AP168).

2.8.7 To the north-east of the area is the site of a former Wesleyan Methodist Chapel (CHERMCH20926). The chapel was constructed from corrugated iron and opened in 1905.

Results

2.8.8 The gradiometer survey was carried out on the 21 November 2016 using hand-held systems has identified anomalies relating to modern agricultural activity and ferrous responses.

2.8.9 Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2000 (Figures 20 - 22). The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous / burnt or fired objects, and magnetic trend (Figure 22).

Interpretation: agricultural

2.8.10 Several areas of dipolar responses (5-3343-001 – 5-3343-005) have been detected across the survey area. These may relate either to areas of made ground or the spreading of green waste as fertiliser.

Conclusions

2.8.11 The survey has not identified any anomalies of definite or possible archaeological origin. There is no visible evidence of medieval or post medieval agricultural or extraction activity within the dataset. The area presents numerous modern ferrous anomalies likely related to made ground or green waste. Whilst this has the potential to mask weaker archaeological anomalies, the areas are mostly localised around the current field boundaries, leaving the majority of the surveyed area unaffected.

2.9 CA5-3431 Heath Farm

Site details

2.9.1 A geophysical survey was carried out over area CA5-3431 at land at Heath Farm, Staffordshire (centred on NGR 372112, 350997 (Figure 23)).

2.9.2 The area was selected for geophysical survey as it is considered to be an area with elevated archaeological potential due to the presence of former field boundaries, extraction pits, and possible ridge and furrow in the area.

2.9.3 The area comprises an irregular parcel of land across ten fields, to the north-west of Chorlton, Staffordshire, 5.3km south-south-east of Crewe, and approximately 17.0km north-west of the centre of Stoke-on-Trent. The limits of the geophysical survey area

are defined by hedgerow field boundaries. The gradiometer survey covered 13.6ha of the 27.3ha survey area.

2.9.4 This survey area lies on flat ground at an elevation of around 65m AOD across the survey area.

2.9.5 There is one set of overhead cables traversing the area, running to the north-west of Heath Farm and joining an internal field boundary and projection to the north-east along the boundary. There are several small ponds and larger lake within the bounds of the survey area.

2.9.6 The underlying geology is recorded as Wilkesley Halite Member – Halite stone and mudstone overlain by glaciofluvial deposits of sands and gravel[18]. The underlying soils are likely to be typical sandy gley soils of the Blackwood (821b) association[19]. Soils in such geological settings have been demonstrated to produce magnetic contrasts suitable for the detection of anomalies through gradiometer survey.

Archaeological background

2.9.7 The south-east of the survey area is mapped as containing now levelled narrow ridge and furrow, characteristic of post-medieval agriculture.

2.9.8 The LiDAR data shows an area of faint features to the south of Heath Farm which correlate with an orchard show on historic maps (LiDAR 3152). Just to the south of this is the location of the now demolished Chorlton heath farm, which is depicted on the 1st edition Ordnance Survey maps but has been removed by the 2nd edition.

2.9.9 The LiDAR data also shows several linear features which are likely former field boundaries, most of which correspond with boundaries depicted on historic maps, along with two parcels of possible former ridge and furrow (LiDAR3150, 3151, 3154).

2.9.10 The surviving ponds in the south-east of the survey area are likely to represent former extractive pits. An old sand pit is marked on the 1st Edition Ordnance Survey map to the south of Chorlton Heath Farm. The map also shows several other ponds which are no longer surviving across the site, which may also be former extractive pits or waterholes.

Results

2.9.11 The gradiometer survey, carried out between 22 – 25 November 2016 using a cart system, identified anomalies of archaeological and possible archaeological origin, agricultural activity, and ferrous responses.

2.9.12 Results are presented as a series of greyscale plots and archaeological interpretations, at a scale of 1:2000 (Figures 24 - 27). The interpretation of the datasets highlights the

[18] British Geological Survey (2015)
[19] Soil Survey of England and Wales (1983)

presence of potential archaeological anomalies, ferrous / burnt or fired objects, and magnetic trend (Figures 25 and 27).

Interpretation: archaeology

2.9.13 Several high magnitude (+/-100 nT), dipolar responses have been detected as large, spreading areas. To the north a large area is covering approximately 0.7ha (5-3431-001). Further south, 5-3431-002 – 5-3431-005 cover smaller areas. These are indicative of areas of back filling, likely related to former extraction in the area. This is supported by 'old sand pits' being recorded in the area on historic mapping.

2.9.14 One small band of linear anomalies has been identified to the south-east of the surveyed area (5-3431-006). The anomaly measures approximately 80m long by 3.5m wide and is aligned east to west. The anomaly has one small rectilinear section to the western end, aligned north to south at right angles to the majority of the anomaly. This type of anomaly is consistent with enclosures or land divisions and could date to anytime from the late prehistoric to medieval period.

Interpretation: agricultural

2.9.15 Two linear bands of high magnitude (+/- 100 nT) aligned east to west (5-3431-007) and north to south (5-3431-008) have been identified by the survey. These have been interpreted as former field boundaries. 5-3431-007 is associated with the construction of Heath Farm in the late 19th century and is first depicted on the 1909-10 edition Ordnance Survey map. On the 1876-1877 1st edition Ordnance Survey map 5-3431-008 can be seen to correspond with a linear strip of access land from the later demolished Chorlton Heath Farm.

2.9.16 Similar dipolar high magnitude linear responses have been detected to the west of 5-3431-007 and 5-3431-008 respectively (5-3431-009 and 5-3431-010). These represent modern trackways currently in use and visible on site.

2.9.17 Areas of low magnitude (+1 – +2 nT), parallel linear response have been identified across the south-eastern survey area. These anomalies are aligned north to south and north-west to south-east (5-3431-011). Two further areas lie to the north, orientated north to south (5-3431-012) and east to west (5-3431-013). This type of anomaly is indicative of modern agricultural activity in the area, such as ploughing.

2.9.18 Dipolar linear anomalies have been identified across much of the survey area (5-3431-014 – 5-3431-020). These are interpreted as a large network of land drains covering the agricultural land.

Interpretation: modern services

2.9.19 A large, high magnitude (+/- 100 nT), linear anomaly (5-3431-021) has been detected aligned north to south across the northern area of the survey just south of Heath Farm. This has been interpreted as a modern service. A further service is evident in the north-east of the area (5-3431-022).

Conclusions

2.9.20 The survey has identified several anomalies likely related to post-medieval sand pits and extraction. A further area of possible archaeological origin, considered part of an undated enclosure or former land division has also been identified. The area has evidence of agricultural activity with anomalies consistent with ploughing, land division and drainage systems present, as well as modern services.

3 Remote sensing report

3.1 Introduction

3.1.1 This report outlines the results of the archaeological remote sensing survey of the South Cheshire area. The survey involved the systematic mapping, recording, analysis and interpretation of potential archaeological sites from aerial photographs, multi-spectral imagery and LiDAR data.

3.1.2 The aim was to accurately map and record the form and extent of archaeological features visible as cropmarks, soil marks, earthworks or structures in order to inform the baseline assessment of the cultural heritage resource.

3.2 Study area

3.2.1 The Study Area comprised a 250m buffer for LiDAR and multi-spectral data, and a 350m buffer for aerial photographic survey extending from the limits of the land required for the Proposed Scheme.

3.3 Methodology

LiDAR data

3.3.1 Airborne LiDAR data is produced by an aircraft-mounted laser linked to a differential Global Positioning System (dGPS) and an Inertial Navigation System (INS). A cloud of measurement points is taken as the aircraft flies over the landscape by firing the laser at the ground in a regular pattern and measuring the time it takes for signals to be reflected to the instrument. The resultant 'point cloud' is typically recorded at spatial resolutions of between 0.25m and 2m, with a vertical tolerance of up to 0.2m, and this can be used to generate highly detailed landscape visualisations.

3.3.2 These visualisations can be used to identify archaeological features which are expressed in the form of localised and often subtle variations in ground profile (e.g. earthworks). This can include features that are barely, if at all, perceptible at ground level.

3.3.3 Point clouds can be presented in the form of a Digital Surface Model (DSM), which includes the heights of objects such as buildings, vegetation and vehicles, as well as the terrain surface.

3.3.4 The data can also be filtered digitally to create a Digital Terrain Model (DTM), filters out objects (e.g. vegetation cover) and models the underlying ground surface.

3.3.5 The use of DTMs in archaeological prospection offers an advantage over conventional aerial photograph assessment as features can often be identified in areas of relatively dense tree or vegetation cover.

3.3.6 Where a laser pulse encounters multiple surfaces, such as a tree canopy and the ground beneath, multiple measurable reflections can be recorded. The first returned pulse represents the first surface encountered with the last return representing the final surface encountered. By filtering out all but the last returns the ground surface beneath vegetation can be represented.

3.3.7 Surface and terrain models can be processed to create shaded relief, or 'hillshade' images to visualise the LiDAR data. This process entails the casting of a simulated light source at a fixed altitude and azimuth across the landscape to create virtual shadows which emphasise variations in relief. The examination of hillshade images is particularly useful for the purposes of archaeological prospection, as features which retain some surface expression can appear more prominent when illuminated by an artificial light source.

Multi-spectral imagery

3.3.8 Multi-spectral data is gathered using an airborne sensor which is capable of detecting electromagnetic radiant energy from the ground surface in the form of reflected solar radiation or thermal radiation emitted by target objects. Data is typically collected within a number of discrete spectral bands, ranging from the visible to the longwave infra-red.

3.3.9 The resultant data can be used to generate a series of geo-referenced images within discrete regions of the electromagnetic spectrum, such as the Near-Infrared (NIR), or manipulated to generate a spectral transformation of two or more spectral bands. Subsequent examination of the multi-spectral imaging can enable the identification of archaeological features via a range of physical, chemical, biological and environmental signatures, including some which may be undetectable, or poorly resolved in visible wavelengths.

3.3.10 For example, it has long been recognised that contrasting patterns of vegetation stress or vigour can be correlated with sub-surface archaeological features. These proxy indicators have traditionally been detected via cropmarks visible on conventional aerial photography. However, wavelengths outside the visible spectrum are also sensitive to changes in vegetation health. Under certain conditions, vegetation stress and vigour responses can be expressed more clearly within these wavelengths than within visible spectra. Thus, examination of multi-spectral imaging offers the potential to improve detection rates of archaeological features over remote sensing techniques which rely solely on the narrow visible range of the electromagnetic spectrum.

Aerial photography

3.3.11 Two types of aerial photograph were used for this assessment. Vertical aerial photographs are taken for military, commercial and general-purpose survey using a camera mounted inside a modified aircraft. The aircraft is flown on a pre-planned set

of overlapping flight-lines which cover the survey area completely. The camera points straight towards the ground. The vertical viewpoint provides aerial photographic coverage from a fixed scale and constant 180° angles at the centre of each frame. The overlap between the areas covered by each consecutive frame is usually 60%. This overlap between frames enables the photo interpreter to study each pair of vertical photos under a stereoscope and see the landscape in 3D.

3.3.12 The stereoscope combines the two images to allow the interpreter to see a single three-dimensional image of the ground surface. Vertical aerial photographs carry inherent distortions introduced by variations in perspective and ground height, but are essentially 'map-like' in appearance. They are generally taken for non-archaeological, civil and military purposes and form the basic data from which most modern maps are compiled. Vertical aerial photographs are a very useful source of archaeological data, particularly in areas such as this, where features survive as earthworks

3.3.13 Oblique aerial photographs are taken using a hand held camera by an aerial archaeologist to portray features which have been identified during specialist survey. These photos are extremely useful, but contain inherent perspective distortions, which must be accounted for in rectification and mapping procedures. In this case, both vertical aerial photographs, and specialist obliques were available for interpretation. The sources of aerial photographs used for this assessment are detailed below.

3.4 Data sources

LiDAR

3.4.1 Two LiDAR datasets were acquired for the purposes of the assessment. The first of these, at 0.2m horizontal cell resolution, was acquired specifically for the purposes of informing the design and EIA process for the Proposed Scheme. The 0.2m LiDAR data was captured during a series of flights between June and July 2014 and covers an area of 500m either side of the centreline of the Proposed Scheme. This does not provide full coverage of the study area.

3.4.2 The second dataset, at 2m horizontal cell resolution, was sourced from the Environment Agency's LiDAR data archive and was consulted as it provided greater coverage of the study area.

3.4.3 Both LiDAR datasets were supplied in ASCII format as a DTM and processed to create a series of hillshade images lit from the north-west, north-east, south-east and south-west. A composite shaded relief image was also created from each of the LiDAR datasets using a technique known as Principal Component Analysis (PCA). No additional processing of the LiDAR data was undertaken for the purposes of this assessment.

Multi-spectral

3.4.4 The multi-spectral data used in this assessment was acquired in tandem with the 0.2m LiDAR data. The imagery was supplied in the following spectral bands and indices: Simple Ratio Index (SR), Normalized Difference Vegetation Index (NDVI), Near Infra-Red (NIR), False Colour Infra-Red and Red-Green-Blue (RGB) (i.e. conventional imagery within the visible region of the electromagnetic spectrum). No additional processing of the multi-spectral data was undertaken for the purposes of this assessment.

Aerial photography

3.4.5 The following sources of aerial photographs and data were searched and used for this assessment:

- Historic England Archive: The Engine House, Fire Fly Avenue, Swindon. Air photo enquiry number 98518, undertaken in January 2016, covered both Whitmore Heath to Madeley area and the South Cheshire area;
- The Cambridge University Collection of Aerial Photographs (CUCAP): Department of Geography, University of Cambridge. This collection was closed during the timeframe of this project, however some irregular access was granted for limited periods during February and March 2016, and prior to its full closure in June 2016. The CUCAP archive contains no aerial photographs which cover the South Cheshire area;
- Online aerial images: All timelines of ortho-rectified mosaics of vertical aerial photographs at www.earth.google.com (Google Earth) were consulted online for this assessment and used extensively between January and April 2016; and
- The HE National Mapping Programme (NMP) did not cover this area in the timeframe of this assessment.

3.5 Identification, digitisation and interpretation

LiDAR and multi-spectral

3.5.1 Features of potential archaeological interest were identified by detailed visual examination of both the multi-spectral and LiDAR imagery, in conjunction with other relevant datasets (outlined below). The 3D Analyst tool in ArcGIS 10.2.2 was used to examine changes in ground profile on the DTMs where features of potential interest were identified. Digitisation of identified features was then undertaken manually within ArcGIS 10.2.2.

3.5.2 Extant historical features within the landscape, such as field systems, ponds, roads, farms and other structures were excluded where these are recorded on current Ordnance Survey mapping. Exceptions were made where the assessment indicated that archaeological or historical landscape features might extend beyond their current mapped extents.

3.5.3 Identified features were assigned a unique numerical identifier and briefly described. The potential origin of each feature was interpreted based on a consideration of its form, landscape context and other relevant datasets, described below. Where possible, a broad date range was assigned to each feature by reference to conventionally defined archaeological periods.

Aerial photography

3.5.4 The oblique aerial photographs were sorted into individual sites, which later became the aerial photography sites listed in Annex C, then examined in detail visually, either on screen or as paper prints. The stereo pairs or runs of vertical aerial photographs were examined using a magnifying mirror stereoscope to identify detail in 3D. Single vertical images were examined visually and under 4x magnification.

3.5.5 With permission from the archives, the paper photographs were captured digitally by re-photographing them and digital photographs were captured as JPG files. These images are very numerous, and may not be reproduced or published but have been used to derived the digitised interpretative data within the GIS. All timelines which were available at Google Earth were interpreted in detail and selected portions saved as JPG file images for geo-referencing and interpretation.

3.5.6 Following selection and sorting into site areas, photographs were filed and referenced as JPG images and were geo-referenced using control points derived from the 1:2500 scale Ordnance Survey Mastermap data layer, using the Quantum GIS 2.10 referencer tool and AirPhoto 3.58. The georeferenced raster files were set as a separate layer in QGIS and digitised to project standards to create SHP files for the line and polygon data which recorded the interpretations of ditched, embanked and other features which were identified during the survey.

3.5.7 As with the multi-spectral and LiDAR surveys, the aerial photographic survey excluded surviving historical features within the landscape, such as field systems, ponds, roads, farms and other structures these are recorded on current Ordnance Survey mapping. Exceptions were made where the assessment indicated that archaeological or historical landscape features might extend beyond their current mapped extents or held some interest or significance to the survey.

3.5.8 Identified features were assigned a unique numerical identifier and briefly described within the GIS attribute tables assigned to each polygon which identified a 'site' or area of interest. As with the multi-spectral and LiDAR recording protocols, the potential origin of each feature was interpreted based on a consideration of its form, landscape context and other relevant datasets, described below. Where possible, a broad date range was assigned to each feature by reference to conventionally defined archaeological periods, or if this was not certain or possible, an 'unknown' date was assigned.

3.6 Limitations

Coverage

LiDAR and multi-spectral

3.6.1 The study area for the assessment of LiDAR and multi-spectral data was based on the land required for the Proposed Scheme, which was established at an earlier stage in the design process for the Proposed Scheme.

3.6.2 The 0.2m LiDAR and multi-spectral data were collected within a 500m buffer extending from the centre of the route of the Proposed Scheme.

3.6.3 Coverage of the 2m resolution LiDAR dataset was complete for the entirety of the study area.

Aerial photographs

3.6.4 The data from the aerial photographic cover search at HE were converted to CSV files and integrated to the working GIS to assess the coverage of both vertical and oblique aerial photos.

3.6.5 The search identified 27 oblique aerial photos within the South Cheshire area. One survey by HE portrayed Chorlton, and another, taken by aerofilms in 1948, showed the railway head at Crewe. Neither showed buried heritage assets as crop marks.

3.6.6 There were 44 vertical aerial photographic sorties containing 489 frames taken between 1945 and 2001 over both the South Cheshire area. Some 1955 and post 1989 photographs were not held as prints for consultation. The 1940s verticals however provided a good insight into the landscape in the South Cheshire area, as did later surveys which were available in the archive.

3.6.7 The more recent images at Google Earth supplied full coverage of the area, and were used for this assessment in accordance with observations made by Scollar and Palmer[20]. These images showed some crop marked buried features which are discussed below at sites 165 and 167.

Analysis

LiDAR and multi-spectral

3.6.8 Aside from gaps in the coverage of the datasets, outlined above, a number of other factors can be expected to have affected the detection rates and interpretation of archaeological features during the assessment.

3.6.9 One of the principal limitations of the assessment is that features were identified and interpreted in the absence of ground level observations. This can result in interpretation errors where localised variations in ground profile which are of very recent or natural origin resemble archaeological features. This issue was alleviated by

[20] Scollar, I. and Palmer, R. (2008), *Using Google Earth Imagery*, AARGnews 37, 15 - 21

comparing the LiDAR images against conventional aerial photographic imagery (i.e. within the visible region of the electromagnetic spectrum). In addition, the veracity of the survey results will be tested in the field during further stages of work.

3.6.10 There are also certain methodological limitations which are inherent to the remote sensing techniques employed during the assessment. For instance, multi-spectral imaging, unlike filtered LiDAR data, is rarely of use for identifying archaeological features within wooded environments.

3.6.11 Although shaded relief images can greatly aid visualisation of LiDAR data, no single direction of illumination can simultaneously reveal all relief features. For example, when a hillshade is lit from a single direction, any features aligned with the source of light can be hidden, since they do not cast any shadow. This technical imitation was overcome by examining a composite shaded relief image, alongside a series of hillshades illuminated from multiple directions.

3.6.12 The angle of illumination can also influence the visibility of relief features. For example, visualisation of subtle variations in relief may require low illumination elevation, which can in turn obscure detail in steeper areas of the image. As the imagery used during the assessment was illuminated from a single fixed angle, this may have influenced the detection rates of archaeological features. However, the effect of this is likely to be relatively slight, as the study area is not characterised by dramatic changes in relief.

3.6.13 The filtering process which is applied to LiDAR data when generating a DTM may not be able to entirely remove the masking effect of low-level vegetation, and can also result in some loss of detail. The latter effect was seen intermittently across the 20cm LiDAR imagery, where the filtering occasionally produced a greatly simplified geometric surface. This may have obscured some features of interest, although only within extremely localised areas.

3.6.14 The horizontal cell resolution of LiDAR data can also influence the detection rates of archaeological features. This can occur where the spacing of point measurements is sufficiently wide to conceal, or reduce the visibility of small archaeological features. However, this is unlikely to have affected the assessment due to the availability of highly detailed 20cm resolution LiDAR data.

3.6.15 It was determined that some types of feature, particularly surviving ridge and furrow landforms, were often more clearly visible on the LiDAR imagery generated from the 2m resolution data than the 20cm data. It is possible that, despite filtering, subtle changes in ground profile may have been masked by low level vegetation due to the fine granularity of the 20cm data, whereas this effect was 'evened out' in the images generated from the coarser 2m data. Consequently, the detection rates for some types of archaeological feature may have been reduced where 2m resolution LiDAR data was unavailable.

3.6.16 Multi-spectral signatures are widely used in other environmental disciplines to accurately classify and map vegetation and geology types. Unfortunately, archaeological sites and features have not been demonstrated to exhibit distinctive spectral signatures that can be used for generic detection purposes. The effectiveness of using multi-spectral data to identify archaeology can be significantly influenced by a range of factors, including the underlying geology, soil moisture content and vegetation cover. However, current understanding of the processes which determine whether and how archaeological features are expressed in the electromagnetic spectrum is incomplete. In practise, this means that it can be difficult to predict whether archaeological features will be identifiable in any given sensor.

3.6.17 Aerial photograph assessments are often based on sequences of historical imagery, which provide a series of 'snapshots' of the landscape under different conditions. In contrast, LiDAR and multi-spectral data are typically gathered at a single or series of closely spaced points in time. This can explain why features identified from aerial photographs cannot always be detected on LiDAR and multi-spectral images of the same area. For example, multi-spectral data collection may be undertaken outside of the window of opportunity where conditions are optimal for the detection of archaeological features which, as noted previously, can be difficult to predict.

3.6.18 Ploughing or development may have destroyed any surface expression of archaeological features that are recognisable on historical aerial photographs. This was evidently the case at a number of locations within the study area, where examination of the LiDAR and multi-spectral data was unable to replicate the results of conventional aerial photographic surveys.

3.6.19 Much of the study area coincides with arable fields which have been subject to intensive modern agricultural techniques. As a result, the prominence of archaeological features may have been greatly reduced by ploughing across large parts of the study area. This may have resulted in a differential in the detection rate of archaeological features between fields which have been intensively ploughed, and areas which have not, such as within parks (unless extensively landscaped) or land which has predominantly been under pasture.

Aerial photographs

3.6.20 Interpretation of aerial photographs relies on visual identification of heritage assets on aerial photos as typically, the effects they have on growing crops and other vegetation, marks in soils, or as surviving features or earthworks which are more visible at times of clear low light which casts shadows.

3.6.21 It is important to note that aerial photographs usually only show part of the horizontal and vertical extent of buried and upstanding features. Their capacity to reveal features as crop marks, vegetation marks, soil marks or as the shadows cast by banks, ditches and walls, depends upon a number of environmental and agricultural factors prevalent at the time of the photographic survey. It is perfectly possible for many years'

photography over one site to show nothing at all, and then for one instance of survey to reveal complex buried crop marked features. The direction of light at the time of photography, with reference to shadows cast and crop or soil marked features highlighted, can also affect the visibility of features on aerial photographs. Unlike digitally processed LiDAR and other data, the azimuth of the sun cannot be changed on a conventional aerial photo.

3.6.22 Land use in the South Cheshire area also presents limitations to the visibility of features. A cropped arable regime of cereals often allows the formation of crop marks, whereas grassland, unless seen in times of extreme moisture stress, can mask the appearance of buried features.

3.6.23 Aerial photographs cannot be used to detect features in heavily wooded areas in the same manner as LiDAR surveys. LiDAR may penetrate gaps in the tree canopy to provide a digital model of the ground surface beneath.

3.6.24 Aerial photographic evidence is thus limited by seasonal, agricultural, land use, meteorological, lighting and environmental factors which affect the extent to which either buried or upstanding archaeological features and structures can be detected.

3.6.25 It is thus advantageous to examine a range of photos taken under a variety of environmental conditions to build up a comprehensive interpretation of the archaeological landscape. The visibility of archaeological features may differ from year to year and be obscured by differential depths of soil or differing types of vegetation, and individual photographs most often record only a small percentage of the actual extent of buried or upstanding features.

3.6.26 The aerial photos taken in the 1940s often recorded surviving medieval fields and parkland features, and provided a starting point for the assessment of erosion and attrition of features due to modern ploughing. This ability to 'see back in time' and the use of aerial photos as historic documents is helpful when constructing landscape histories or tracing the progress of erosion.

3.6.27 Buried features are also 'masked' in areas of unsuitable land use for site visibility or the formation of crop marks, such as woodland, scrub, unimproved pasture or alluviated areas. Medieval ploughing, producing the typical ridges and furrows caused by the turning of a heavy ox-drawn plough, also often mask underlying deposits on aerial imagery.

3.6.28 It is also important to note that the perception of the environment and expectation of what is to be found often may limit the interpreter's openness to all features which may be noticed and identified. This perception factor is mitigated by repeated examination of imagery taken in different years and under different conditions, and by teamwork between two or more interpreters checking the data. 'Photo fatigue' is also a factor in drop-off rates of discovery or perception of features and, in this case, could have been a very real limitation to consistent and accurate observation. This

was mitigated by alternating activities, checking with team workers and taking adequate visual breaks particularly when using a stereoscope to see large sorties over extensive areas of land.

3.6.29 These limitations and advantages were considered carefully whilst interpreting features from aerial photographs and the interpretations are built up from observations of many photographs, if available, over a range of instances of photography by two or more air photo analysts.

3.6.30 The study area presented some evidence for crop marked buried features, over a mixture of clayey substrates and a higher proportion of pastoral land use and transportation and warehousing land use where the LLAU terminates at Crewe.

3.7 Results

LiDAR and multi-spectral

Overview

3.7.1 A total of 69 individual features, or groups of features of possible archaeological interest were identified within the study area. The majority of these were identified on the LiDAR imagery, with a smaller number also visible on the multi-spectral imagery. Very few features were visible solely on the multi-spectral imagery.

3.7.2 The features could predominantly be ascribed to one of three interpretative classes; surviving ridge and furrow landforms, relict field boundaries or disused extractive pits. However, a small number of features of potentially elevated archaeological significance were identified during the assessment.

3.7.3 Features identified during the remote sensing assessment are described in Annex C, illustrated in Figures 28 - 38, and listed in CH-002-005. The principal findings of the assessment are presented below.

Possible deserted medieval village north of Gonsley Green Farm

3.7.4 Amongst the most notable features identified within the Study Area were an extensive series of field boundaries, ploughing headlands, possible enclosures and / or building platforms located to the north of Gonsley Green Farm (3139; Figure 32). Although these are spread across an area of approximately 23 hectares, the features are most prominent 200m north of the farm buildings. Several possible quarry pits or ponds (3138; Figure 32) were also identified within this area.

3.7.5 Some of the linear features could be correlated with land divisions shown on late 19th century Ordnance Survey maps. However, several of these features may represent parts of a substantially earlier settled agricultural landscape. The Cheshire HER contains an entry (MCH11049) which relates to the site of a possible deserted medieval village in this location. This settlement, from which the place-name Gonsley Green appears to derive, was documented as Godewyneslegh in AD1311.

3.7.6 The Cheshire HER entry indicates that earthworks associated with the settlement have previously been recorded during assessments of aerial photographs. Many of the features identified from the LiDAR data were also detected during the aerial photograph assessment undertaken to inform the EIA for the Proposed Scheme.

Crotia Mill pond and other associated features

3.7.7 A north-south aligned linear depression identified immediately to the north of the A500 and south of Crotia Mill (Cheshire HER MCH9671) can be correlated with the former mill pond (Cheshire HER MCH9672) and part of the mill race (Cheshire HER MCH9673), as shown on late 19th and early 20th century Ordnance Survey maps. A slightly sinuous 200m long linear feature to the south of the A500 appears to represent the continuation of the infilled mill race. A number of linear depressions which might represent associated water management features (3174; Figure 36) were also identified to the south-west of the mill.

3.7.8 The mill pond and the northern part of the mill race appear to have been partially infilled and no longer hold water. However, an 800m long section of the mill race remains extant as a watercourse to the south of Weston Lane. It runs along the western edge of Weston parallel to the Basford Brook, from which it branches off north of Burrow Coppice.

3.7.9 The date of the mill pond and race are not known. However, the corresponding entries in the Cheshire HER note that Crotia Mill may have been mentioned in the 14th century as 'le moleyn de schawe', suggesting that the mill pond and race may have medieval origins. The mill is depicted on a map of 1775, and was also referred to variously as Cowshall or Crowfall during the mid 19th century.

Ridge and furrow

3.7.10 Amongst the most common features identified during the assessment were characteristic landforms derived from medieval and/or post medieval ridge and furrow cultivation. These included groups of selions ('furlongs', 'gores' and 'butts') contained within individual parcels and, less commonly, the surviving ploughing headlands, foreras (access routes) and baulks which divided them. Few, if any of the ridge and furrow landforms identified from the LiDAR and Multi-spectral data appear to have previously been recorded in the Cheshire HER.

3.7.11 The distribution of these landforms across the Study Area is likely to reflect differential rates of preservation, which are likely to have been heavily influenced by the location and intensity of modern and historical ploughing. However, these areas of relict ridge and furrow could provide some indication that areas of associated medieval and/or early post-medieval occupation may be located in their vicinity.

3.7.12 The surviving ridge and furrow landforms identified during the assessment were distributed intermittently across the Study Area. However, notable concentrations of ridge and furrow landforms were identified in the area to the north and east of

Shavington Hall (3169; Figure 36) and north of Shavington House (3176; Figure 37). The selions in these areas were typically straight and narrow, suggesting that they may be of late medieval or early post medieval date.

3.7.13 A small group of ridge and furrow landforms (3130; Figure 31) was also identified to the west of Lower Den Farm, along with several sinuous linear features, some of which can be correlated with land divisions shown on early Ordnance Survey maps. The areas of ridge and furrow lie immediately adjacent to the site of a former farmstead recorded in the Cheshire HER (MCH23614). The farmstead, which is labelled as Lower Den farm on early Ordnance Survey maps, is also depicted on a map of 1777 and may have been documented as early as AD1614. The farm buildings were demolished by the early 20th century and a new farm constructed nearby.

3.7.14 Another concentration of possible ridge and furrow landforms (3184; Figure 38) was identified to the east of Gresty Green Farm. However, the 'selions' are very straight and narrow, and are orientated perpendicular to the course of the Gresty Brook. This could suggest that the features are actually associated with post-medieval drainage, rather than medieval cultivation. Similar landforms were also identified to the east of Blakenhall, along with a number of linear features (3122, 3123, 3124, and 3126; Figure 30). Again these features may be associated with post medieval drainage rather than medieval cultivation practises.

Field boundaries

3.7.15 A large proportion of the geographical expanse contained within the Study Area is composed of fields under a mixture of arable cultivation and pasture. It is probable that the spatial patterning of these field systems is largely the product of the Enclosure acts of the 18th and 19th centuries. However, some elements within the spatial patterning of these field systems may correspond with earlier land divisions, including fossilised components of medieval open field systems.

3.7.16 Subsequent opening out of previously enclosed fields, particularly during the 20th century, has resulted in the loss of numerous field boundaries, including many examples recorded on late 19th century and early 20th century Ordnance Survey maps.

3.7.17 Numerous linear features were evident on the LiDAR imagery, typically in the form of (often very faint) linear banks and depressions. In many instances, these features were interpreted as former field boundaries on the basis that they appeared to respect existing field systems and/or could be correlated with land divisions shown on early Ordnance Survey maps.

Extractive pits and ponds

3.7.18 Amongst the most frequently identified features were small depressions, often sub-circular in plan and typically in the range of 20-50m in diameter. These depressions were distributed throughout the Study Area, although there was a notable concentration of these in the southern part of the South Cheshire area, between

Chorlton and Wrinehill. The features were most commonly identified within, or at the edges of agricultural fields. However, a small number were also identified within woodland or in close proximity to areas of settlement.

3.7.19 Although a natural origin might be ascribed to some of the depressions, the majority of these features are likely to be the result of human activity. Although their date and original purpose often cannot be distinguished with certainty, it is likely that many of these features represent various forms of extractive pits, or open-cast workings. At least 72 individual features were identified as possible former extraction pits within the Study Area. Many of the numerous ponds which exist across the rural landscape of the Study Area may also have originated as extractive pits.

3.7.20 A post-medieval date is likely for the majority of these features, although occasional examples could be earlier in origin. In many instances, a minimum age can be confirmed on the basis that they can be correlated with features depicted by late 19th and early 20th century Ordnance Survey mapping.

3.7.21 Where shown on early Ordnance Survey maps, these features are occasionally labelled as 'Sand Pits', although the term may have been used generically to refer to various types of disused extractive pit. Some of these features may have been dug to quarry stone or gravel, while some may have been used to extract clay for marling fields or for local brick production.

3.7.22 Corresponding mounds, which might represent the spoil heaps derived from these excavations, were only occasionally identified in the vicinity of the depressions. This may corroborate the suggestion that these were predominantly dug with the aim of extracting material in bulk, rather than creating hollows in the land surface for some other purpose. However, subsequent levelling by ploughing or natural processes may have significantly reduced the visibility of any former spoil heaps.

3.7.23 Extractive pits were often associated with trackways, either deliberately constructed or formed naturally through use, for the hauling away of excavated material. However, few traces of any such features were identified. These depressions rarely exhibited any other characteristics in form that might be expected of former extractive pits, such as a shallow approach or access on one side, or steeper working faces. However, this might be readily explained by the fact that many have become substantially infilled.

3.7.24 In a few instances, the depressions identified during the assessment may have been deliberately excavated to create ponds rather than for extractive purposes, for example to provide access to water for farm animals, or for other agricultural uses.

Other features

3.7.25 Other features identified included groups of linear depressions and banks which possibly derive from woodland management activities, near Randilow Farmhouse (3110; Figure 29), west of Weston Hall (3157; Figure 34) and within Burrow Coppice

(3158; Figure 34). A series of parallel linear features (3152; Figure 33) contained within a square parcel of land south of Heath Farm could be associated with a former orchard shown on early Ordnance Survey maps to the north of a now demolished farmstead named 'Chorltonheath'.

3.7.26 A small number of linear features which do not clearly appear to respect existing field systems or correspond with land divisions shown on early Ordnance Survey maps were also identified (e.g. 3113, Figure 29; 3129, Figure 30; 3145, Figure 33; 3147, Figure 33; 3153, Figure 33; 3156, Figure 34; 3180 Figure 36). In many instances, the origin of these features is uncertain, although plausible interpretations include former field boundaries, drains and trackways or footpaths. However, some of these features could be considerably older and potentially of greater significance.

Aerial photographs

Overview

3.7.27 Features identified from aerial photographs during the remote sensing assessment are described in Annex C, illustrated in Figures 28 - 38 and listed in Appendix CH-002-005. The principal findings of the assessment are presented below.

3.7.28 The South Cheshire area had not, at the time of survey (January - May 2016), been surveyed by NMP projects[21], and contains only 27 oblique aerial photos, some of which portray general landscapes outside the buffer at Chorlton. The remainder of the obliques were taken in the 1940s by AeroFilms and show the railway infrastructure at Crewe.

3.7.29 The South Cheshire area contains areas of surviving and more eroded medieval agricultural land, which, in places, may overlie and mask earlier deposits.

3.7.30 There are only two places where buried cut features show as distinct crop marks, but this does indicate some potential in arable areas or in grassland when the soil moisture levels are low.

Undated

3.7.31 Site 167 (Figure 32) at Gonsley Green Farm (coordinates 372946, 348980) shows marks in crops and grass over an area of buried ditched enclosures, boundaries and ditches. This site may be a post medieval field system, but it is not yet dated. It was surviving as land boundaries in the 1940s.

Prehistoric periods

3.7.32 No sites have been identified from aerial photos in the South Cheshire area which may be firmly dated to the prehistoric period. Due to the limitations of non-intrusive survey, this does not indicate total absence of possible prehistoric heritage assets.

[21] Bax, S.(2014), *Staffordshire National Mapping Programme, Phase 1 – Eastern River Confluences, Aerial Survey Mapping Summary Repor*t, National Heritage Protection Commissions Programme: Project Number 6613, Archaeological Research Services Ltd., English Heritage

Iron Age/Roman

3.7.33 No sites have been identified from aerial photos in the South Cheshire area which may be dated to the Iron Age or Roman periods. Due to the limitations of non-intrusive survey, this does not indicate total absence of possible Iron Age or Roman heritage assets.

Medieval

3.7.34 The South Cheshire area was farmed in the medieval period and there are some visible areas of eroded and slightly upstanding ridge and furrow. There are no visible areas of medieval settlement which may be defined from aerial photos and it is likely that these may lie beneath modern settlements and hamlets in this area.

Post-medieval

3.7.35 The post-medieval landscape is visible on aerial photographs in a more sparse fashion in the South Cheshire area than to the south in the Fradley to Colton, Colwich to Yarlet and Stone and Swynnerton areas. There are some areas of narrow ridge and furrow and boundaries, which are less apparent and widespread than in the Fradley to Colton, Colwich to Yarlet and Stone and Swynnerton areas.

3.7.36 Former field boundaries, which were surviving in the 1940s, show as crop marks at the 2006 timeline displayed at Google Earth at site 165 (Figure 31) to the north of Ash Tree Farm (coordinates 372851, 347691).

Modern

3.7.37 Aerial photos taken by Aerofilms in the 1940s show the railway head at Crewe. Site 170 was an area of Second World War anti glider trenches, which overlay an area of narrow ridge and furrow, to the east side of the railway. This site is now built over by modern infrastructure, and lay at coordinates 371683, 354048 between a spur of the railway line and Weston Road.

3.8 Summary

LiDAR and multi-spectral

3.8.1 The results of the assessment were largely consistent with expectations based on the rural character of the study area. The majority of features identified during the assessment are likely to represent disused extractive pits or quarries of post-medieval date, or former field boundaries laid out, or formalised in the 18th or 19th centuries. The former field boundaries may, in some instances, also correlate with medieval land divisions. The assessment also identified several areas containing surviving ridge and furrow landforms, of which few, if any of which had previously been recorded in the Cheshire HER.

3.8.2 Identified sites or features of potentially elevated significance include a possible deserted medieval settlement (3139; Figure 32) north of Gonsley Green Farm, and an

infilled mill pond, mill race and possible water management features (3174; Figure 36) associated with Crotia Mill.

Aerial photography

3.8.3 Aerial photographs taken between the 1940s and the present time show some evidence for crop marked pre-modern landscapes in the South Cheshire area. As with the Whitmore Heath to Madeley area, the general lack of any prehistoric or Iron Age/Roman discovery may be due to lack of specialist reconnaissance, coupled with a less responsive more pastoral land use regime.

3.8.4 Cropmarks have been visible however over boundary and farmstead features at sites 165 and 167 which were surviving in the 1940s. This shows some potential for recording buried features from the air as crop marks in parts of the South Cheshire area.

3.8.5 The South Cheshire area was farmed in the medieval period, with areas of medieval agricultural land use visible as residual earthworks in specific places.

3.8.6 Post-medieval boundaries and narrow ridge and furrow show within the South Cheshire area on aerial photos, but their occurrence is sparse in comparison to the Fradley to Colton, Colwich to Yarlet and Stone and Swynnerton areas.

3.8.7 There is evidence for Second World War defensive anti-glider trenches which were surviving in the 1940s and are now built over, to the east of the railway head at Crewe. Aerofilms and the Royal Air Force recorded the appearance of the railway at Crewe, which was largely as at present, in the 1940s.

3.8.8 The potential for further discovery, particularly of pre-medieval heritage assets within South Cheshire area is unknown.

3.9 Conclusions

3.9.1 Features identified within South Cheshire area from the LiDAR and aerial photography largely relate to medieval and post-medieval agricultural activity, with some post-medieval quarrying activity.

3.9.2 Where there is a lack of correlation between the LiDAR and AP assessments this suggests that many of the features identified from APs no longer survive as earthwork features, however, this does not preclude the below ground survival of archaeological remains.

3.9.3 There are inherent difficulties involved in transcribing and accurately locating cropmark features. Accordingly, degree of caution should be exercised in relying on position of individual features, as these may in actually fact be located some distance from location indicated.

4 References

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Annex A: Survey equipment and data processing

Survey methods and equipment

The magnetic data for this project was acquired using both a Bartington 601-2 dual magnetic gradiometer system and a non-magnetic cart system. The handheld instrument has two gradiometer assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. The cart instrument has four gradiometers fixed horizontally 1m apart allowing multiple traverses to be recorded simultaneously. The gradiometers are the same, each containing two fluxgate magnetometers arranged vertically with a 1m separation, and measure 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.

The gradiometers have an effective resolution of 0.03nT over a ±100nT range, and measurements from each sensor are logged at intervals of 0.25m.

Detailed handheld gradiometer surveys were conducted using an accurate 20m or 30m site grid, which is achieved using a Leica Viva RTK GNSS instrument. The cart-based system relies upon accurate GPS location data which is collected using a Leica Viva system with rover and base station. The Leica Viva systems receive corrections from a network of reference stations operated by the Ordnance Survey 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 HE for geophysical surveys.

The detailed surveys consist of 20m by 20m or 30m by 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.

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 HE for characterisation surveys.

Post-processing

The magnetic data collected during the detail survey are downloaded from the Bartington cart 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.

The cart-based system generally requires a lesser amount of post-processing than the handheld Bartington Grad 601-2 fluxgate gradiometer instrument. This is largely because mounting the gradiometers on the cart reduces the occurrence of operator error; caused by inconsistent walking speeds and deviation in traverse position due to varying ground cover and topography.

Typical data and image processing steps for hand-held data 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;
- despike – 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.

Typical data and image processing steps for the non-magnetic cart fitted system may include:

- smooth – applying a smooth function removes any small scale spiking or 'fuzziness', generally caused by internal system noise. This effectively 'destripes' the data and reduces the appearance of dominant anomalous readings; and
- spline interpolation – gridding the data with splines allows the application of minimum and maximum data values and reduces oscillations for potential fields such as gravity or magnetic.

Typical displays of the data used during processing and analysis:

- XY Plot (hand-held data only) – 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.

Annex B: Geophysical interpretation

Interpretation categories

The interpretation methodology used separated the anomalies into two main categories: archaeological and unidentified responses.

The archaeological category has been 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.

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:

- agricultural - used for linear trends that can be shown to relate to agricultural activity including ridge and furrow, drainage and ploughing scars;
- 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; and
- natural - used for spreads of anomalies considered to be geological or more discrete anomalies considered to be natural.

Finally, services such as water pipes are marked where they have been identified along with ceramic field drains.

Annex C: Sites identified by remote sensing

Table 1: LiDAR and multi-spectral sites within the South Cheshire area

LiDAR and multi-spectral site ID	Aerial photography site ID	Gazetteer ID	Period	Description
3103			Unknown	A pit feature measuring 60m by 35m in a field to the north of Checkley Brook, possibly related to previous extraction.
3105			Post-medieval/ modern	Two linear features to the south-west of Randilow Cottage. The south-west feature measures 275m and represents a former field boundary. The north-west feature is unmapped but may also represent former field boundary.
3106			Unknown	A 45m by 25m it feature, possibly related to previous extraction.
3108			Unknown	Pit features to the south-west of Randilow Farmhouse, possibly related to previous extraction.
3110			Unknown	Two blocks of ridge features on a WNW-ESE alignment within woodland, possibly related to woodland management, although may be residual ridge and furrow earthworks.
3111			Unknown, possibly medieval/post-medieval	Possible ridge and furrow to the south-west of Randilow Farmhouse, cut by a possible extraction pit. The features lie on an ESE-WNW alignment and may also be related to recent agricultural activity.
3112			Unknown	An irregularly shaped mound to the east of Randilow Farmhouse, possibly a spoil heap.
3113			Unknown	A prominent 120m long ditch feature to the south of Randilow Farmhouse. It is unmapped and appears to be recent in origin.
3114			Unknown, possibly medieval/post-medieval	Faint traces of possible ridge and furrow to the north of Checkley Lane. In 2m resolution data only.
3116			Post-medieval/ modern	A series of pit features across the landscape to the west of Bunkers Hill. Some are marked as sand pits and ponds on historic mapping, suggesting that those unmapped features are also related to previous extraction.
3117			Post-medieval/	An interrupted linear feature forming the remains of a former field boundary. The features measure a combined 290m.

LiDAR and multi-spectral site ID	Aerial photography site ID	Gazetteer ID	Period	Description
			modern	
3118			Unknown	A pit feature measuring 50m at its widest point to the east of Grange Villas, possibly related to previous extraction.
3120			Post-medieval/ modern	An interrupted linear feature forming the remains of a former field boundary. The features measure a combined 220m.
3121		SCH089	Post-medieval/ modern	A series of linear features representing the remains of former filed boundaries, spread across 4.2 hectares.
3122		SCH089	Post-medieval/ modern	A 360m long former field boundary, abutted to the north-west by an additional linear feature which may represent the remains of an unmapped former field boundary.
3123		SCH089	Unknown	A series of linear features representing drainage features. The features are unmapped and may be of recent origin.
3124		SCH089	Unknown, possibly medieval/modern	Blocks of possible ridge and furrow. The western features - located across 1.2 hectares and on an E-W alignment - may be related to recent agricultural activity or post-medieval drainage. The north-east block measures 0.15 hectares and the features lie on a WSW-ENE alignment. The south-east block measures 0.3 hectares, with features lying on a SSE-NNW alignment.
3126			Unknown, possibly medieval/modern	A block of possible ridge and furrow to the south of Den Lane. The features are located across 0.4 hectares and are aligned on an approximate E-W alignment. Additional linear features can be traced further to the north and may represent former field boundaries.
3128			Unknown	Two pit features, possibly related to previous extraction. The northern feature measures 35m by 15m and the southern feature measures 25m by 10m.
3129			Unknown	A sinuous, 330m long linear feature, possibly representing a former field boundary. The feature may also be natural in origin.
3130		SCH090	Unknown, possibly medieval/modern	A series of linear features to the west of Lower Den, many of which reflect the locations of former field boundaries in the area. Three blocks of possible ridge and furrow can also be traced. The south-west block lies on a NNW-SSE alignment and covers 0.1 hectares. The eastern block lies on an approximate E-W alignment and covers 0.4 hectares. The north block lies on a SSW-NNE alignment and covers 0.1 hectares.
3132			Unknown	A sub-rectangular depression in a field, possibly related to previous extraction. The feature measures 110m by 95m.

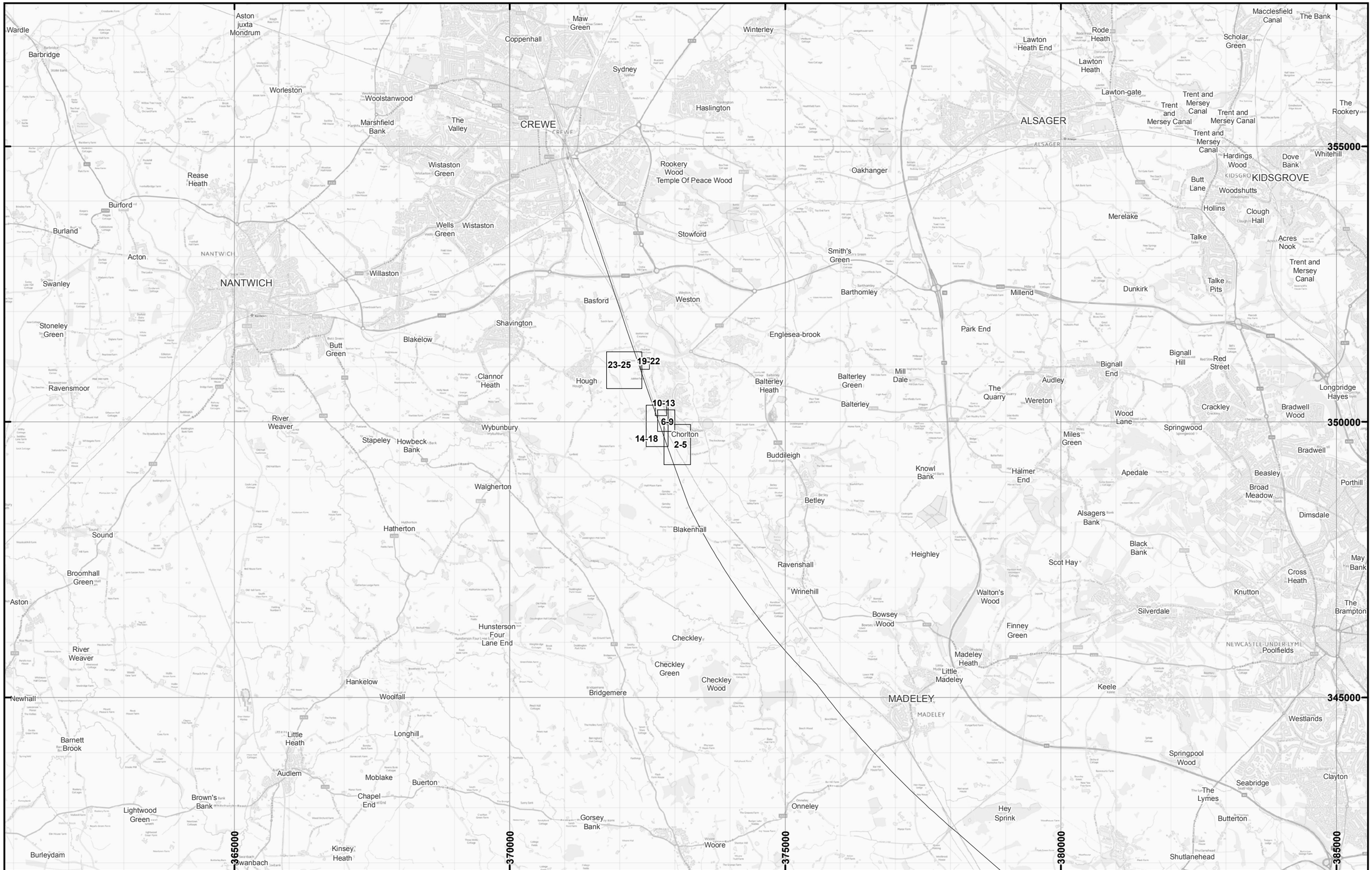
LiDAR and multi-spectral site ID	Aerial photography site ID	Gazetteer ID	Period	Description
3134			Post-medieval/ modern	Two linear features located to the east of New Farm and both representing former field boundaries. The northern feature lies on a WNW-ESE alignment and extends for 320m. The southern feature curves for 275m.
3135			Unknown, possibly medieval/modern	A 115m long E-W aligned former field boundary splitting two parcels of possible ridge and furrow, the northern block covering 0.5 hectares and the southern block covering 0.3 hectares. A further possible block lies to the south and covers an area of 0.5 hectares. All features lie on a WNW-ESE alignment and may also be the result of recent agricultural activity.
3136			Post-medieval/ modern	Two pit features to the south of Harehill Rough, both present on historic mapping as areas of extraction. The western feature measures 25m by 30m. The second feature lies 195m to the south-east and measures 35m by 20m.
3137	167	SCH020	Medieval/post-medieval	Two blocks of ridge and furrow to the east of Gonsley Green Farm. The northern block is triangular in form and covers 0.1 hectares. The southern block covers 0.5 hectares. The ridge and furrow lies on an approximate N-S alignment. The blocks are split by a modern field boundary.
3138		SCH020	Unknown	Four unmapped pit features to the east of Gonsley Green Farm, possibly representing former sand pits, measuring 65m to 20m across at their greatest extents. Other sand pits are recorded in the immediate area and remain as ponds.
3139	167	SCH020	Unknown, possibly medieval/post-medieval	A large number of former field boundaries and/or plough headlands are present across the landscape to the north of Gonsley Green Farm. A number of the former field boundaries are present on historic mapping. A number of possible plough headlands are present immediately west of the railway line in an area contained within an area measuring 4.5 hectares in extent. Further to the west it is possible to trace a number of possible enclosures or house platforms. These are particularly prominent 200m north of the farm buildings. All features are contained within a 23 hectare area.
3140			Post-medieval/ modern	A number of former ponds and other cut features probably relating to former extraction are present to the east of the railway line. The features are contained within a 2.2 hectare area.
3141		SCH020; SCH096	Post-medieval/ modern	A 150m long, NW-SE aligned feature representing a former field boundary.
3142	168		Post-medieval/ modern	A number of linear features representing former field boundaries. Three features are parallel and lie on a WSW-ENE alignment, measuring 145m to 215m in length. They abut a 175m long SE-NW aligned feature.
3143			Post-medieval/ modern	Large cut features to the south-east of Lane End Farm, representing the remains of former areas of extraction.

LiDAR and multi-spectral site ID	Aerial photography site ID	Gazetteer ID	Period	Description
3144	168		Unknown, possibly medieval/post-medieval	Two blocks of faint ridge features, possibly representing ridge and furrow, to the south-west of Lane End Farm. The eastern block is contained within a 1.8 hectare area and is aligned WSW-ENE. The western block is fainter but shares an alignment with the eastern block. It is contained within a 2.6 hectare area.
3145	?168		Unknown	Four linear features to the south of New Cottages, none of which is present on historic mapping. They may represent former field boundaries, but may also be a product of recent agricultural activity.
3146	168		Post-medieval/ modern	Linear features to the west of Lane End Farm, representing former field boundaries and largely on a WSW-ENE alignment.
3147			Unknown	Two curved parallel linear features in a field to the west of Freshwater Drive. The features measure 105m and 135m in length. They may be related to recent agricultural activity.
3148	168		Post-medieval/ modern	A series of former field boundaries to the north of Dairy Farm and located across an 8.5 hectare area.
3149			Unknown	Two pit features, unmapped but possibly a result of previous extraction. The south-western measures 55m by 30m at its greatest extent and the north-eastern one 95m by 35m.
3150		SCH079	Post-medieval/ modern	A series of former field boundaries to the south of Heath Farm, located across a 6.2 hectare area.
3151		SCH079	Unknown, possibly medieval/post-medieval	A small parcel of possible ridge and furrow to the south of Heath Farm. The features are aligned NNW-SSE and contained within a 0.25 hectare area.
3152		SCH079	Post-medieval/ modern	A number of faint ridge features to the south of Heath Farm, probably related to a former orchard present on historic mapping.
3153			Unknown	A series of linear features to the north of Jubilee Farm, some possibly representing former field boundaries. The features are contained within a 0.3 hectare area.

LiDAR and multi-spectral site ID	Aerial photography site ID	Gazetteer ID	Period	Description
3154	168		Post-medieval/ modern	A small parcel of possible ridge and furrow between two ponds to the south of Heath Farm. The features lie on an E-W alignment and cover an area of 0.1 hectares.
3155			Post-medieval/ modern	A series of linear features located to the south of Chorlton Bank Farm, representing the remains of former field boundaries. The features are located across 4 hectares.
3156			Unknown	Linear features to the south of Wychwood Park. The features are unmapped but may represent former field boundaries. They are formed of a SSW-NNE aligned feature, abutted by an E-W aligned feature.
3157			Unknown	Features in woodland to the west of Weston Hall, probably related to recent woodland management. The features cover a 0.4 hectare area.
3158			Unknown	Features in Burrow Coppice, probably related to recent woodland management. The features cover a 0.25 hectare area and are bounded by ditch features.
3159			Post-medieval/ modern	A 60m long, WSW-ENE aligned linear feature in Burrow Coppice representing the remains of a former field boundary.
3163			Unknown, possibly medieval/post-medieval	A parcel of possible ridge and furrow to the east of Hough, contained within a 0.3 hectare area and lying on a SW-NE alignment. The features may also relate to recent agricultural activity. Further linear anomalies can be traced to the west and north and possibly represent former field boundaries, although these features are not present on historic mapping.
3164			Post-medieval/ modern	Two parallel linear features to the south of Bosford House, representing the remains of former field boundaries. The features lie on a SW-NE alignment and measure 70m (western) and 200m (eastern) in length.
3165			Unknown, possibly medieval/post-medieval	Two blocks of possible ridge and furrow to the west of Sutch Farm. The western block is aligned N-S and contained within a 0.4 hectare area. The eastern block is aligned E-W and is contained within a 0.2 hectare area.
3166			Unknown	A small pit feature, 5m in diameter, in a field to the north of Sutch Farm. It is possibly related to former extraction.
3167			Post-medieval/	Linear features to eth south-west of Basford representing the remains of former field boundaries.

LiDAR and multi-spectral site ID	Aerial photography site ID	Gazetteer ID	Period	Description
			modern	
3168			Unknown	A pit feature in a field to the east of Shavington Hall, possibly representing a former pond as other examples lie within the immediate surroundings. It measures 30m by 25m at its greatest extent.
3169	169		Medieval/ modern	A number of blocks of ridge and furrow (up to 2.9 hectares in extent) and former field boundaries to the north of Basford. Some blocks are faint and some may reflect recent activity. All features follow a largely N-S alignment. A number of additional linear features may present unmapped former field boundaries. The features are located across a 24 hectare area.
3172		SCH045	Unknown, possibly medieval/modern	Possible ridge and furrow and ditch features to the north of Larch Farm. The ridge and furrow, aligned N-S, can be traced across 0.5 hectares and is cut by an E-W aligned ditch to the south.
3173	169	SCH081	Unknown	A 0.5 hectare block of SW-NE aligned ridge features to the east of Crotia Mill Farm, possibly representing remains of ridge and furrow. The features may be of more recent date.
3174		SCH081	Post-medieval/ modern	A long linear depression, which corresponds with the former mill pond and mill race associated with Crotia Mill, now infilled. A series of possible infilled channels to the west of Crotia Mill Farm may also be related to the former mill.
3175			Post-medieval/ modern	A 105m long, WSW-ENE aligned former field boundary to the east of Dairy House.
3176		SCH080	Unknown	Ridge features located either side of the A500 to the north-east of Shavington House. The features are located across a combined 1.9 hectares and are possibly recent in date.
3177			Unknown	Two pit features in a field to the north of the A500, possibly representing previous extraction. Both are sub-oval in shape and measure 30m (northern pit) and 40m (southern pit) at their greatest extents.
3179			Post-medieval/ modern	A series of irregularly shaped pit features representing former ponds and possible former ponds to the north-east of Crotia Mill Farm. The features range in length from 75m to 35 and are contained within a 1.7 hectare area.
3180			Unknown	A 600m long linear feature to the east of the railway line. The feature is of possibly recent origin.
3181	169		Post-medieval/ modern	Former field boundaries to the west of Basford Hall Sorting Sidings, former of a 155m N-S aligned ditch abutted by a 60m long WSW-ENE aligned feature.

LiDAR and multi-spectral site ID	Aerial photography site ID	Gazetteer ID	Period	Description
3182		SCH080	Unknown	Faint ridge features to the west of Springbank. The western block measures 120m x 30m at its greatest extent. A second block lies 15m to the south-east and is contained within a 40m by 20m area. The features may be recent in origin.
3183		SCH080	Unknown	A pit feature, measuring 20m by 20m at its greatest extent, possibly representing a former area of extraction.
3184		SCH080	Unknown, possibly medieval/modern	A number of blocks of possible ridge and furrow and possible associated former field boundaries to the north of the B5071 to the east of Gresty Green Farm. The ridge features follow a largely N-S alignment in the west. To the east, the alignment is SW-NE.
3185			Unknown, possibly medieval/post-medieval	Three faint blocks of possible ridge and furrow, aligned approximately N-S, and located across 0.9 hectares.



Legend

—— HS2 Phase 2a centre line

Map Number: Figure 1

Map Name: CA5 Surveyed Areas - Geophysics

Community Area: 5

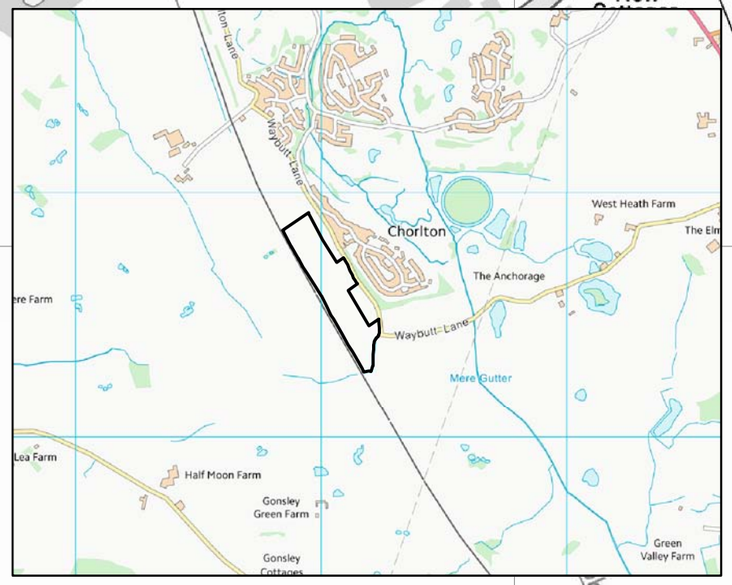
Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:62,500

0 625 1,250 1,875 2,500 Metres

Doc Number: C861-ARP-EV-MAP-WE01-000001

Date: 24/05/17



Chorlton

FRESHWATER DRIVE

HAMPSTEAD DRIVE

FERNDOWN WAY

Golf Course

Meridian Canal Fishery

The Anchorage

WAYBUTT LANE

Mere Gutter

350000

349500

372500

373000

373500

374000

Legend

- Site boundary
- Detail Survey Extents
- Survey grid divisions

Map Number: Figure 2

Map Name: CA5-3177 Site location

Community Area: 5-3177

Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:5,000

0 50 100 150 200 Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

A

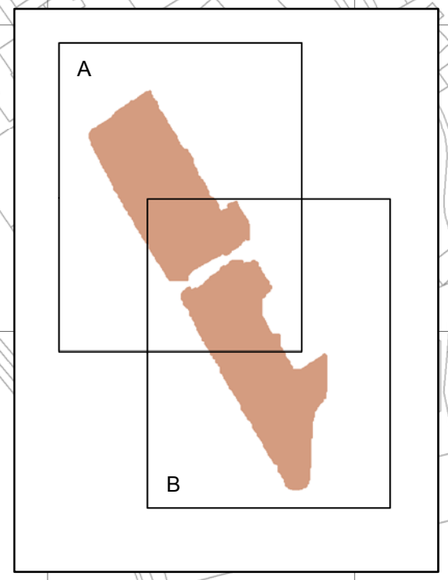
B

372900
373000
373100
373200
373300
349900
349800
349700
349600
349500
349400
349300

Chorlton

+3nT

-2nT



Legend

Site boundary

Detail Survey Extents

Map Number

Figure 3

Map Name

CA5-3177 Greyscale plot

Community Area:
5-3177

Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80
Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

A

B

372900
373000
373100
373200
373300
349900
349800
349700
349600
349500
349400
349300

Chorlton

+25nT

-25nT

Legend

Site boundary

Detail Survey Extents

Map Number: Figure 4

Map Name: CA5-3177 XY Trace

Community Area: 5-3177

Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80 Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

A

B

372900

373000

373100

373200

373300

349900

349800

349700

349600

349500

349400

349300

5-3177-001

5-3177-002

5-3177-003

5-3177-004

5-3177-005

5-3177-006

5-3177-007

5-3177-008

5-3177-009

5-3177-010

5-3177-011

5-3177-012

5-3177-013

5-3177-014

5-3177-015

Chorlton

Legend

- Site boundary
- Detail Survey Extents
- Uncertain Origin
- Agriculture - Ploughing
- Agriculture - Drain
- Industrial, Burnt-Fired, Increased Magnetic Response
- Natural
- Ferrous
- Former Field Boundary

Map Number: Figure 5

Map Name: CA5-3177 Interpretation

Community Area: 5-3177

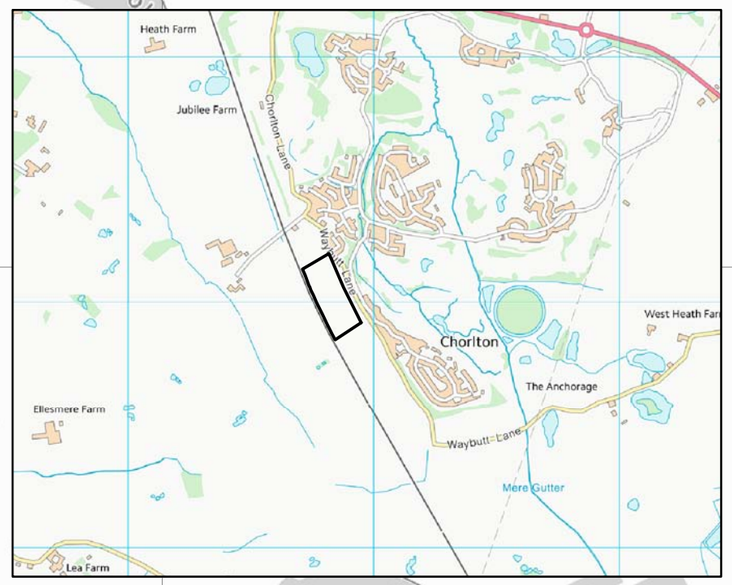
Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80 Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17



Golf Course

CHORLTON LANE

Bridge Cottage

CHILTERN CLOSE

FAIRHAVEN

HENLEY R

WESTWOOD C

SPRINGWATER DRIVE

ASHBOURNE DRIVE

KINGSDOWN CL

Mere Gutter

SANDFORD CRESCENT

REDBOURNE D

WYCHWOOD PARK

KENDAL WAY

FRESHWATER DRIVE

WAYBUTT LANE

Dairy Farm

New Cottages

Chorlton

Lane End Farm

Swill Brook

Golf Course

Meridian Canal Fishery

FRESHWATER DRIVE

HAMPSTEAD DRIVE

FERNDOWN WAY

WAYBUTT LANE

350500

350000

349500

372000

372500

373000

373500

Legend

- Site boundary
- Detail Survey Extents
- Survey grid divisions

Map Number: Figure 6

Map Name: CA5-3256 Site location

Community Area: 5-3256

Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:5,000

0 50 100 150 200 Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

372500
372600
372700
372800
372900
373000
373100
373200

350200
350100
350000
349900
349800

+3nT
-2nT

Chorlton

Legend

Site boundary
Detail Survey Extents

Map Number
Figure 7

Map Name
CA5-3256 Greyscale plot

Community Area:
5-3256

Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80
Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

372500
372600
372700
372800
372900
373000
373100
373200

350200
350100
350000
349900
349800

+25nT

-25nT

Chorlton

Legend

Site boundary

Detail Survey Extents

Map Number

Figure 8

Map Name

CA5-3256 XY Trace

Community Area:
5-3256

Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80
Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

372500
372600
372700
372800
372900
373000
373100
373200
350200
350100
350000
349900
349800
5-3256-003
5-3256-002
5-3256-001
Chorlton

Legend

- Site boundary
- Detail Survey Extents
- Possible Archaeology
- Uncertain Origin
- Agriculture - Ploughing
- Industrial, Burnt-Fired, Increased Magnetic Response
- Natural
- Ferrous
- Former Field Boundary

Map Number
Figure 9

Map Name
CA5-3256 Interpretation

Community Area:
5-3256

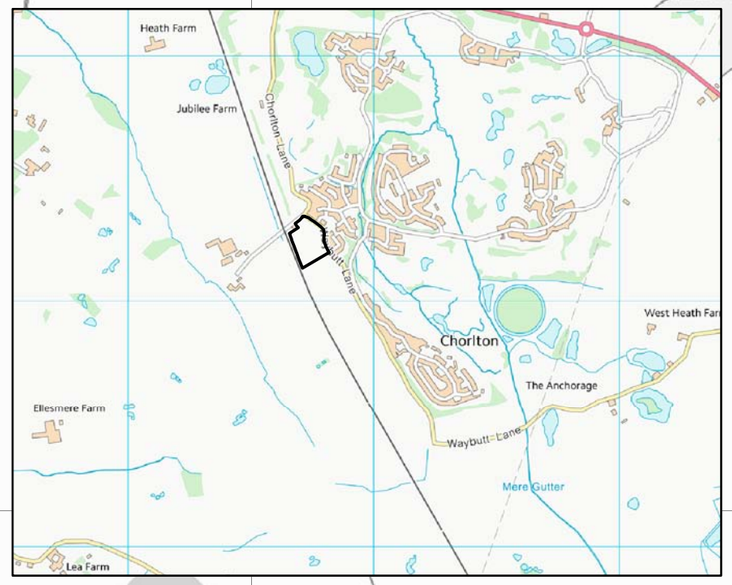
Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80
Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17



Golf Course

Jubilee Farm

CHORLTON LANE

ABBEYDENBRIDGE CL

Golf Course

Club

350500

CHILTERN CLOSE

FAIRHAVEN

HENLEY R

WESTWOOD C

Bridge Cottage

SPRINGWATER DRIVE

ASHBOURNE KINGSDOWN CL

ASHBOURNE DRIVE

Mere Gutter

SANDFORD CRESCENT

REDBOURNE D

WYCHWOOD PARK

Dairy Farm

New Cottages

Chorlton

WAYBUTT LANE

FRESHWATER DRIVE

KENDAL WAY

Lane End Farm

Swill Brook

FRESHWATER DRIVE

HAMPST

FERN

350000

Golf Course

Meridian Canal Fishery

372000

372500

373000

373500

Legend

- Site boundary
- Detail Survey Extents
- Survey grid divisions

Map Number: Figure 10

Map Name: CA5-3290 Site location

Community Area: 5-3290

Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:5,000

0 50 100 150 200 Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

372400
372500
372600
372700
372800
372900
373000
373100

350500
350400
350300
350200
350100

+3nT
-2nT

Legend

Site boundary
Detail Survey Extents

Map Number
Figure 11

Map Name
CA5-3290 Greyscale plot

Community Area:
5-3290

Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80
Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

372400
372500
372600
372700
372800
372900
373000
373100
350500
350400
350300
350200
350100
+25nT
-25nT

Legend

- Site boundary
- Detail Survey Extents

Map Number: Figure 12

Map Name: CA5-3290 XY Trace

Community Area: 5-3290

Scale at A3: 1:2,000

0 20 40 60 80
Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

372400
372500
372600
372700
372800
372900
373000
373100
350500
350400
350300
350200
350100
5-3290-005
5-3290-006
5-3290-003
5-3290-001
5-3290-004
5-3290-002

Legend

- Site boundary
- Detail Survey Extents
- Possible Archaeology
- Uncertain Origin
- Agriculture - Ploughing
- Former Field Boundary
- Natural
- Ferrous

Map Number
Figure 13

Map Name
CA5-3290 Interpretation

Community Area:
5-3290

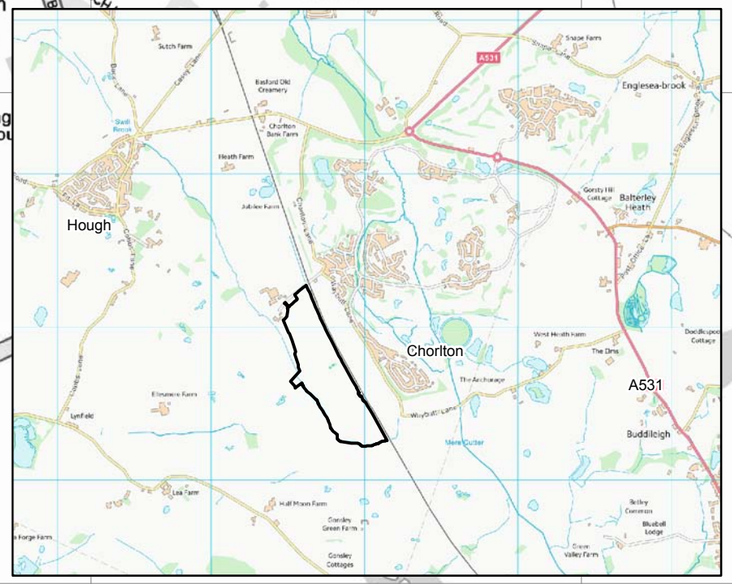
Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80
Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17



Bridge Cottage
Dairy Farm
New Cottages
Lane End Farm
Chorlton
Swill Brook
Ellesmere Farm
Golf Course
Meridian Canal Fishery
Mere Gutter
CHILTERN CLOSE
FAIRHAVEN
HENLEY R
WESTWOOD CL
SPRINGWATER DRIVE
ASHBOURNE DRIVE
KINGSDOWN CL
SANDFORD CRESCENT
WYCHWOOD PARK
WAYBUTT LANE
FRESHWATER DRIVE
KENDAL WAY
HAMPSTEAD DRIVE
FERNDOWN WAY

350500
350000
349500
371500
372000
372500
373000
373500

Legend

- Site boundary
- Detail Survey Extents
- Survey grid divisions

Map Number: Figure 14

Map Name: CA5-3317 Site location

Community Area: 5-3317

Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

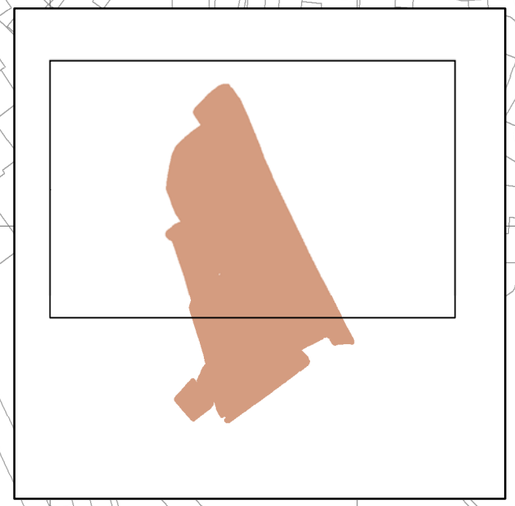
Scale at A3: 1:6,250

0 60 120 180 240 Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

350300
350200
350100
350000
349900
372300
372400
372500
372600
372700
372800
372900
373000



Legend

Site boundary
Detail Survey Extents

Map Number
Figure 15

Map Name
CA5-3317 Greyscale plot (north)

Community Area:
CA5-3317

Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:12,000

0 20 40 60 80
Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

Legend

- Site boundary
- Detail Survey Extents
- Possible Archaeology
- Uncertain Origin
- Agriculture - Ridge & Furrow
- Agriculture - Ploughing
- Industrial, Burnt-Fired, Increased Magnetic Response
- Natural
- Ferrous
- Former Field Boundary

Map Number: Figure 16

Map Name: CA5-3317 Interpretation (north)

Community Area: CA5-3317

Scale at A3: 1:12,000

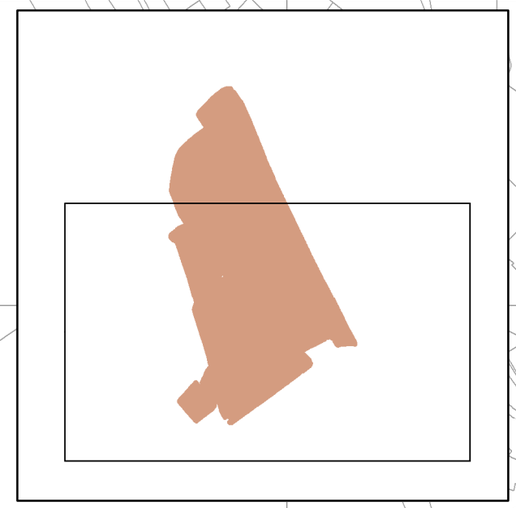
0 20 40 60 80 Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

372300
372400
372500
372600
372700
372800
372900
373000

350000
349900
349800
349700
349600



Legend

- Site boundary
- Detail Survey Extents

Map Number: Figure 17

Map Name: CA5-3317 Greyscale plot (south)

Community Area: CA5-3317

Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80 Metres

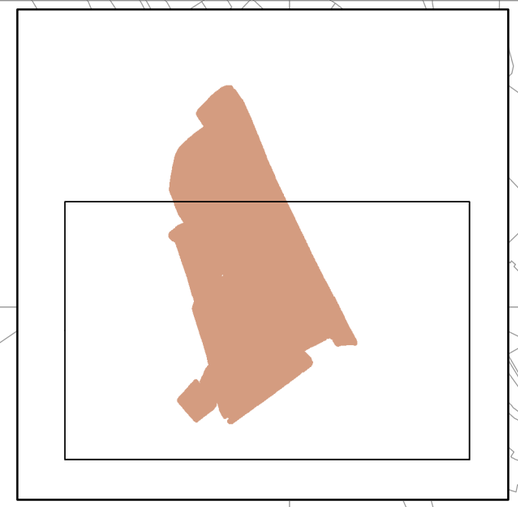
Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

372300 372400 372500 372600 372700 372800 372900 373000

350000 349900 349800 349700 349600

5-3317-008
5-3317-010
5-3317-013
5-3317-006
5-3317-016
5-3317-011
5-3317-018
5-3317-003
5-3317-002
5-3317-017
5-3317-005
5-3317-004



Legend

- Site boundary
- Detail Survey Extents
- Possible Archaeology
- Uncertain Origin
- Agriculture - Ridge & Furrow
- Agriculture - Ploughing
- Industrial, Burnt-Fired, Increased Magnetic Response
- Natural
- Ferrous
- Former Field Boundary

Map Number
Figure 18

Map Name
CA5-3317 Interpretation (south)

Community Area:
CA5-3317

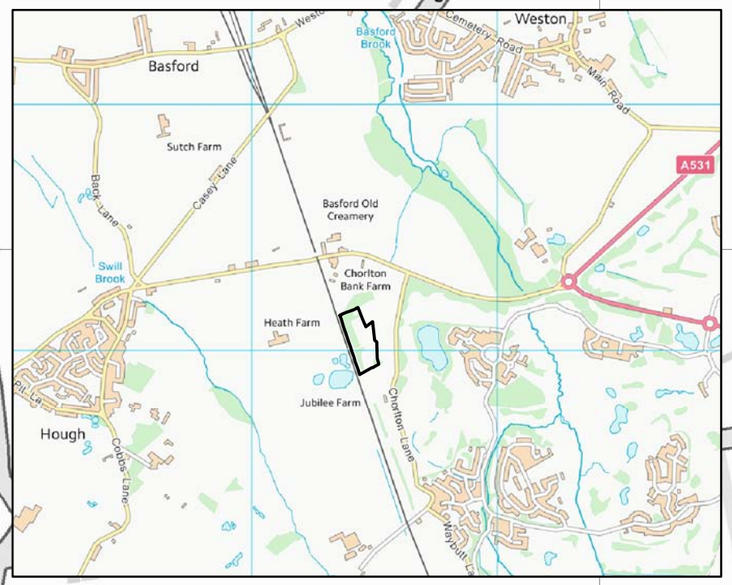
Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80
Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17



Weston Hall

Basford Dairy Store

Basford House

Oakleigh Cottage

Chorlton Bank Farm

A531

A531

351500

PW

Heath Farm

KINGSWOOD AVE

CRES

CHALFONT

EDENBRIDGE CL

ABBEYDALE C

Golf Course

Jubilee Farm

CHORLTON LANE

Golf Cou

Hough

Swill Brook

Hough Common

Birchwood House

Kennels

BIRCH LANE

The Hollies Farm

371500

372000

372500

373000

350500

Legend

- Site boundary
- Detail Survey Extents
- Survey grid divisions

Map Number: Figure 19

Map Name: CA5-3343 Site location

Community Area: 5-3343

Scale at A3: 1:5,000

0 50 100 150 200 Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

372100
372200
372300
372400
372500
372600
372700
372800
351300
351200
351100
351000
350900
+3nT
-2nT
Jubilee Farm

Legend

Site boundary
Detail Survey Extents

Map Number
Figure 20

Map Name
CA5-3343 Greyscale plot

Community Area:
5-3343

Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80
Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

372100
372200
372300
372400
372500
372600
372700
372800
351300
351200
351100
351000
350900
+25nT
-25nT
Jubilee Farm

Legend

Site boundary
Detail Survey Extents

Map Number
Figure 21

Map Name
CA5-3343 XY Trace

Community Area:
5-3343

Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80
Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

372100
372200
372300
372400
372500
372600
372700
372800
351300
351200
351100
351000
350900
5-3343-001
5-3343-002
5-3343-003
5-3343-004
5-3343-005
Jubilee Farm

Legend

- Site boundary
- Detail Survey Extents
- Industrial, Burnt-Fired, Increased Magnetic Response
- Ferrous

Map Number
Figure 22

Map Name
CA5-3343 Interpretation

Community Area:
5-3343

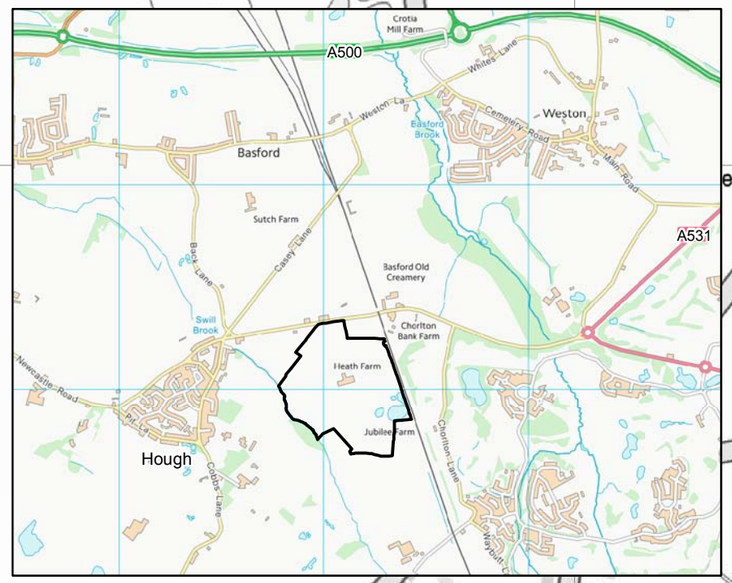
Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80
Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17



Legend

- Site boundary
- Detail Survey Extents
- Survey grid divisions

Map Number: Figure 23

Map Name: CA5-3431 Site location

Community Area: 5-3431

Registered in England. Registration number 06791686. Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:5,000

0 50 100 150 200 Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

371800
371900
372000
372100
372200
372300
372400
372500

351200
351100
351000
350900
350800

Heath Farm

+3nT
-2nT

Legend

Site boundary
Detail Survey Extents

Map Number
Figure 24

Map Name
CA5-3431 Greyscale plot (north)

Community Area:
5-3431

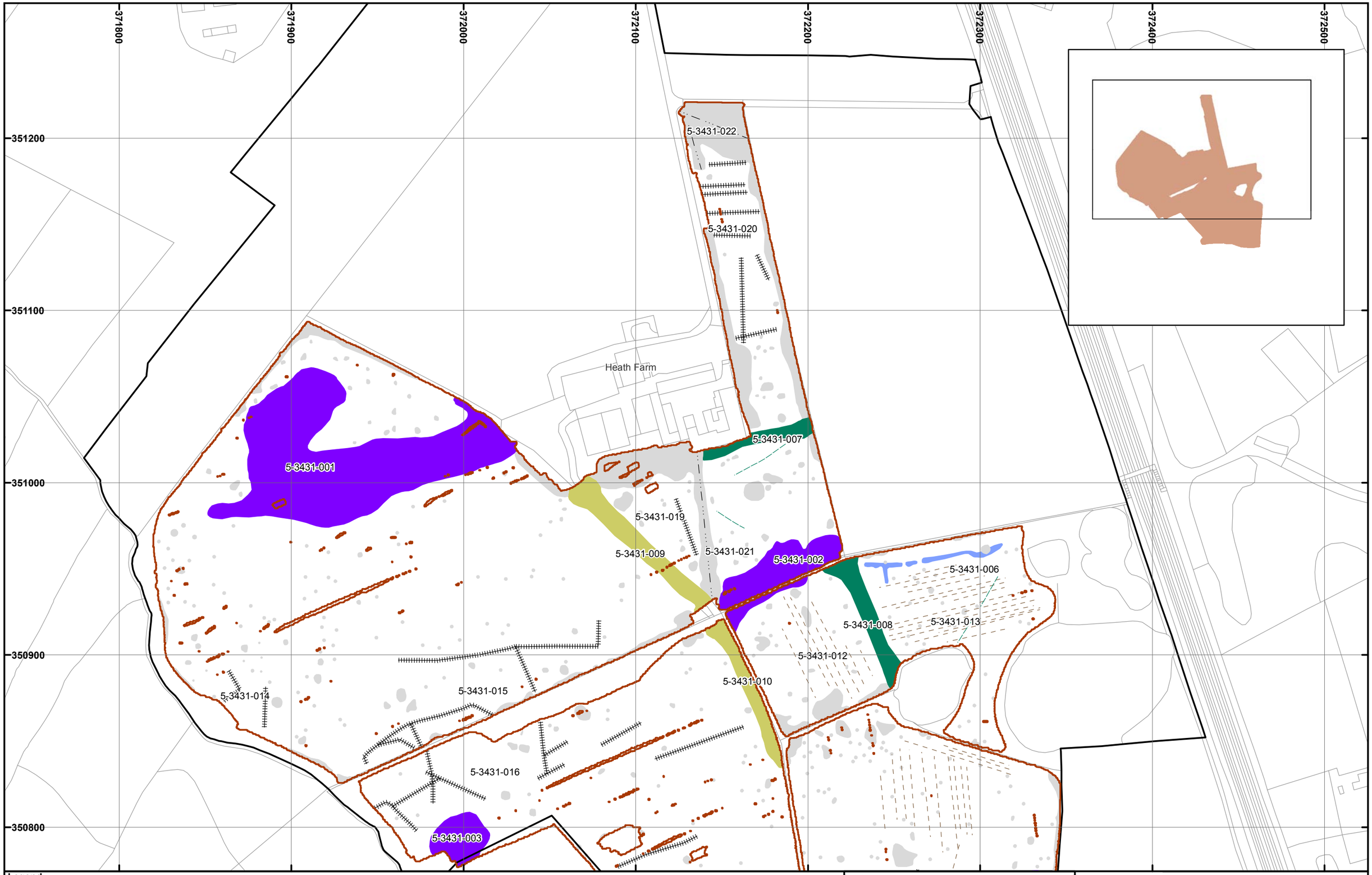
Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80
Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17



Legend

- Site boundary
- Detail Survey Extents
- Archaeology
- Possible Archaeology
- Uncertain Origin
- Agriculture - Ploughing
- Agriculture - Drain
- Ferrous
- Pipe, Modern Service
- Former Field Boundary
- Trackway

Map Number: Figure 25

Map Name: CA5-3431 Interpretation (north)

Community Area: 5-3431

Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80 Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

371800
371900
372000
372100
372200
372300
372400
372500
351100
351000
350900
350800
350700
Heath Farm
Jubilee Farm
+3nT
-2nT

Legend

Site boundary
Detail Survey Extents

Map Number
Figure 26

Map Name
CA5-3431 Greyscale plot (south)

Community Area:
5-3431

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Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80
Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17

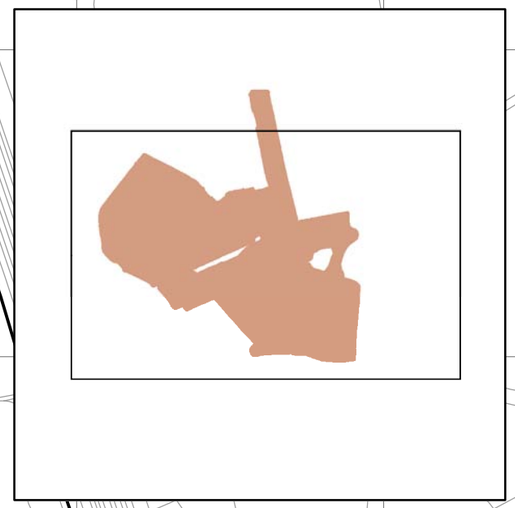
371800 371900 372000 372100 372200 372300 372400 372500

351100 351000 350900 350800 350700

Heath Farm

Jubilee Farm

5-3431-001
5-3431-002
5-3431-003
5-3431-004
5-3431-005
5-3431-006
5-3431-007
5-3431-008
5-3431-009
5-3431-010
5-3431-011
5-3431-012
5-3431-013
5-3431-014
5-3431-015
5-3431-016
5-3431-017
5-3431-018
5-3431-019
5-3431-021



Legend

- Site boundary
- Detail Survey Extents
- Archaeology
- Possible Archaeology
- Uncertain Origin
- Agriculture - Ploughing
- Agriculture - Drain
- Ferrous
- Pipe, Modern Service
- Former Field Boundary
- Trackway

Map Number: Figure 27

Map Name: CA5-3431 Interpretation (south)

Community Area: 5-3431

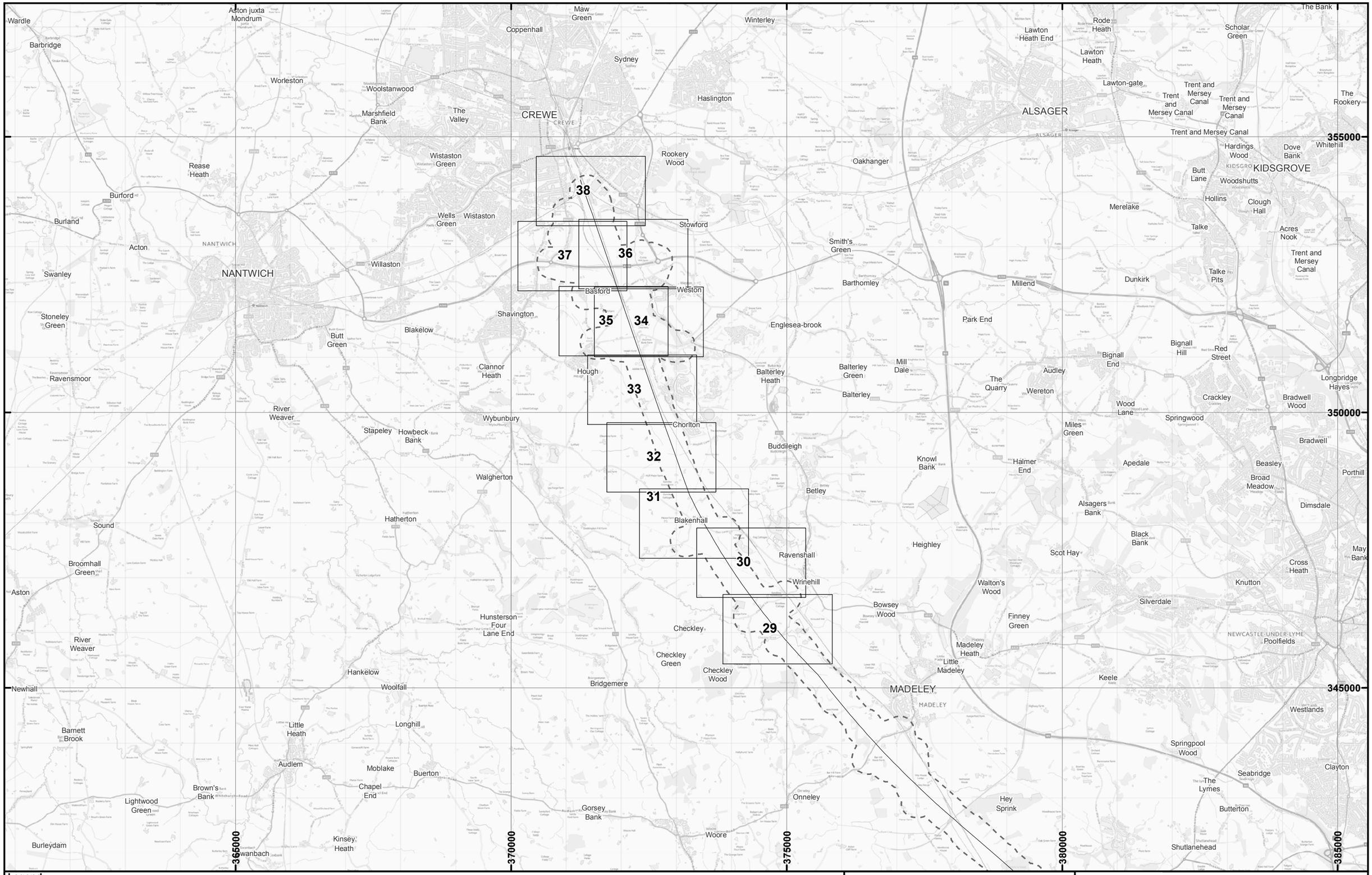
Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:2,000

0 20 40 60 80 Metres

Doc Number: C861-ARP-EV-MAP-WS07-000001

Date: 21/04/17



Legend

- LiDAR/multi-spectral study area
- HS2 Phase 2a centre line

Map Number: Figure 28

Map Name: CA5 Remote Sensing Map Index

Community Area: 5

Scale at A3: 1:62,500

0 625 1,250 1,875 2,500 Metres

Doc Number: C861-ARP-EV-MAP-WE01-000001

Date: 24/05/17

374000

379000

346000

3116
3117
3118
3105
3106
3111
3112
3113
3108
3110
3103
3104
3102
3098
3098
3096
3097
3099
3095
3093
3094
3188
162
SCH001
WHM067
WHM066
WHM064
240+400
240+300
240+200
240+100
240+000
239+900
239+800
239+700
239+600
239+500
239+400
239+300
239+200
239+100
239+000
238+900
238+800

Legend

- Land required for the Proposed Scheme
- LiDAR/multi-spectral study area
- HS2 Phase 2a centre line
- Gazetteer entry with overlapping features

NMP

- Bank
- Ditch
- Extent of feature
- Ridge and furrow
- Structure
- Monument polygon

AP

- Bank
- Ditch
- Structure
- Monument polygon

LiDAR/multi-spectral

- Polygons
- Lines

Feature labelling

42 = AP/NMP
FRC001 = Gazetteer
1102 = Remote Sensing

Map Number
Figure 29

Map Name
Remote Sensing Survey Data
CA5 (Map 1)

Community Area:
05

Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:5,000

0 50 100 150 200
Metres

Doc Number:

Date: 25/05/17

374000

375000

347000

3130

3130

3128

3126

3126

3122

3124

166

SCH089

3116

3123

3134

3185

3121

3129

3120

3114

3112

241+800

241+700

241+600

241+500

241+400

241+300

241+200

241+100

241+000

240+900

240+800

240+700

240+600

240+500

240+400

Legend

Land required for the Proposed Scheme

LiDAR/multi-spectral study area

HS2 Phase 2a centre line

Gazetteer entry with overlapping features

NMP

Bank

Ditch

Extent of feature

Ridge and furrow

Structure

Monument polygon

AP

Bank

Ditch

Possible feature

Structure

Monument polygon

LiDAR/multi-spectral

Polygons

Lines

Feature labelling

42 = AP/NMP

FRC001 = Gazetteer

1102 = Remote Sensing

Map Number

Figure 30

Map Name

Remote Sensing Survey Data
CA5 (Map 2)

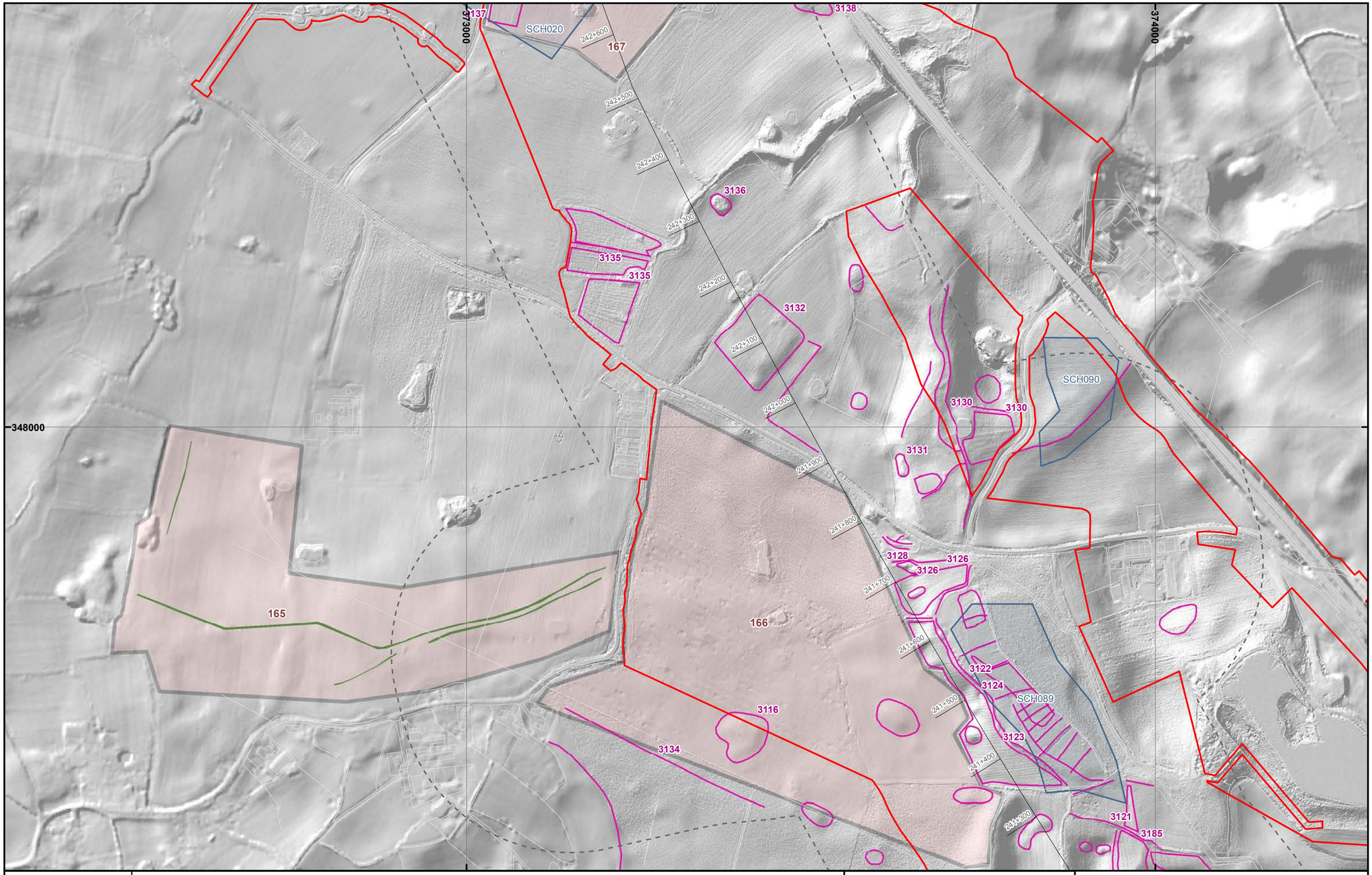
Community Area:
05

Scale at A3: 1:5,000

0 50 100 150 200
Metres

Doc Number:

Date: 25/05/17



Legend

- Land required for the Proposed Scheme
- LiDAR/multi-spectral study area
- HS2 Phase 2a centre line
- Gazetteer entry with overlapping features

NMP
- Bank
- Ditch
- Extent of feature
- Ridge and furrow

AP
- Structure
- Monument polygon
- Bank
- Ditch

LiDAR/multi-spectral
- Possible feature
- Structure
- Monument polygon
- Polygons

- Lines

Feature labelling

42 = AP/NMP
FRC001 = Gazetteer
1102 = Remote Sensing

Map Number: Figure 31

Map Name: Remote Sensing Survey Data CA5 (Map 3)

Community Area: 05

Scale at A3: 1:5,000

0 50 100 150 200 Metres

Doc Number:

Date: 25/05/17

372000

373000

349000

3146

3144

3143

3142

3140

168

3141

3139

167

3137

3138

SCH096

SCH020

243+900

243+800

243+700

243+600

243+500

243+400

243+300

243+200

243+100

243+000

242+900

242+800

242+700

242+600

Legend

- Land required for the Proposed Scheme
- LiDAR/multi-spectral study area
- HS2 Phase 2a centre line
- Gazetteer entry with overlapping features

NMP

- Bank
- Ditch
- Extent of feature
- Ridge and furrow
- Structure
- Monument polygon

AP

- Bank
- Ditch

- Possible feature
- Structure
- Monument polygon

LiDAR/multi-spectral

- Polygons
- Lines

Feature labelling

42 = AP/NMP

FRC001 = Gazetteer

1102 = Remote Sensing

Map Number

Figure 32

Map Name

Remote Sensing Survey Data
CA5 (Map 4)

Community Area:
05

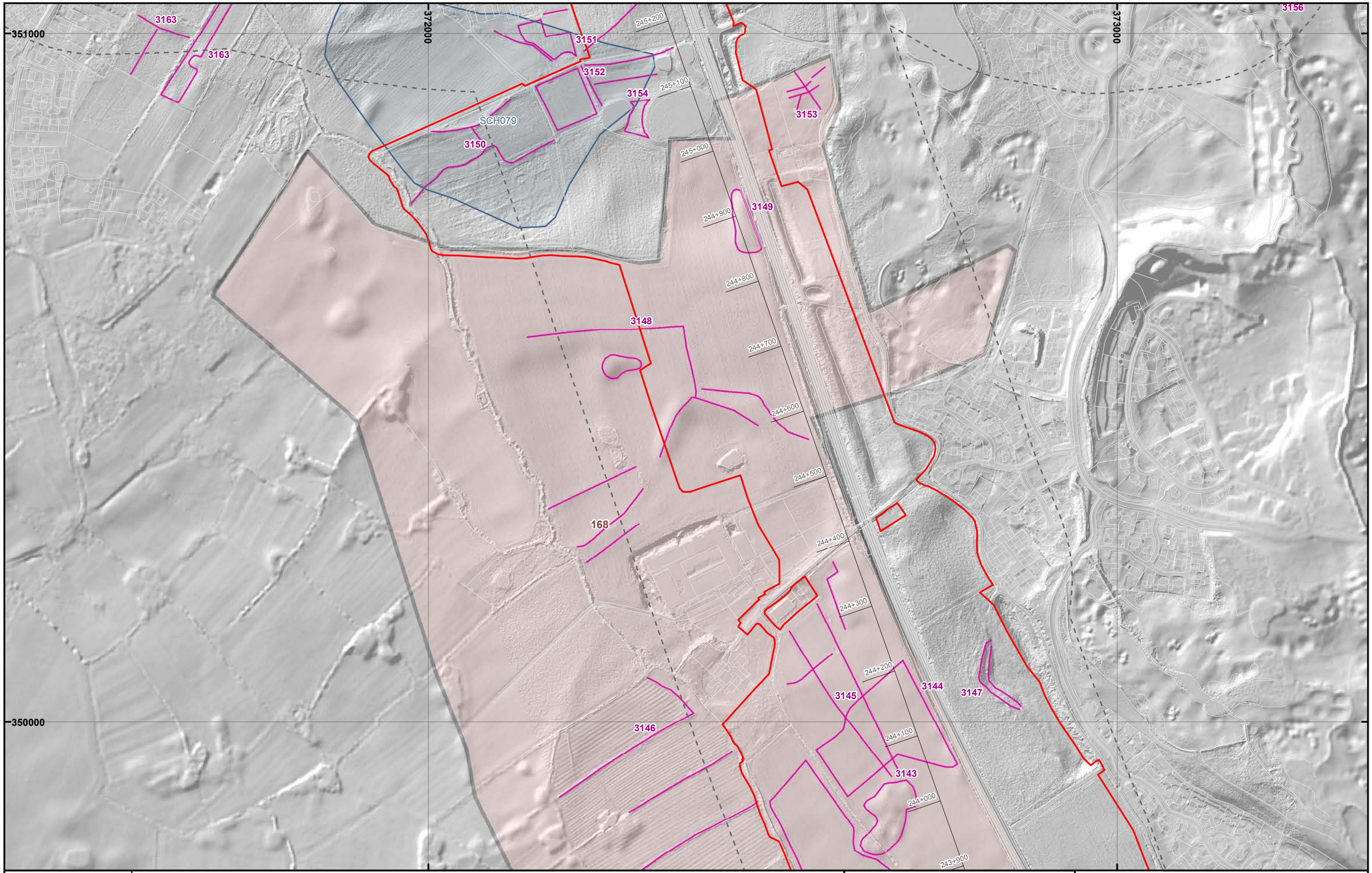
Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:5,000

0 50 100 150 200 Metres

Doc Number:

Date: 25/05/17



Legend

- CCB
- LiDAR/multi-spectral study area
- HS2 Phase 2a centre line
- Gazetteer entry with overlapping features

NMP

- Bank
- Ditch
- Extent of feature
- Ridge and furrow
- Structure
- Monument polygon

AP

- Bank
- Ditch

- Possible feature
- Structure
- Monument polygon

LiDAR/multi-spectral

- Polygons
- Lines

Feature labelling

42 = AP/NMP
FRC001 = Gazetteer
1102 = Remote Sensing

Map Number: Figure 33

Map Name: Remote Sensing Survey Data CA5 (Map 5)

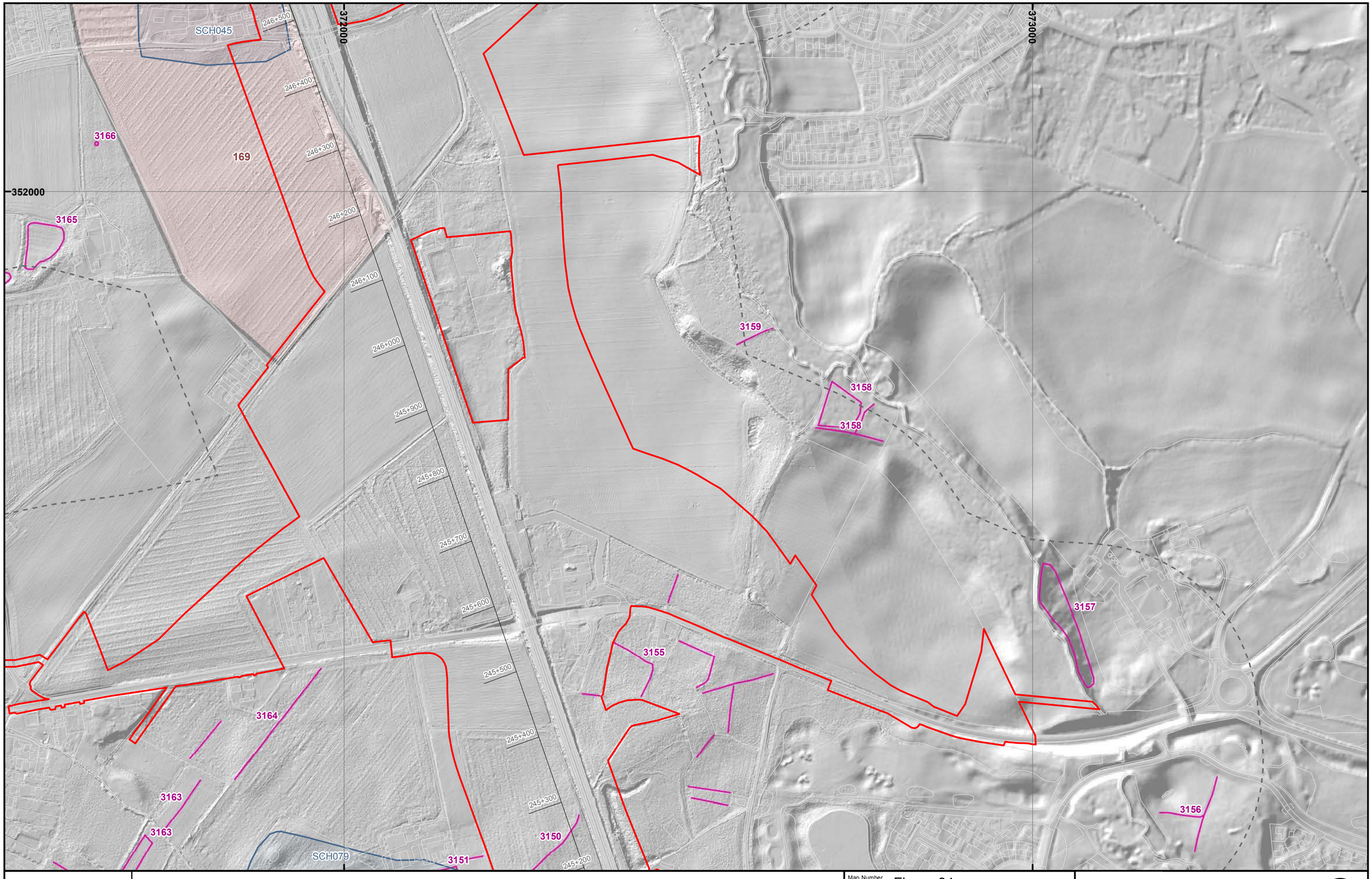
Community Area: 05

Scale at A3: 1:5,000

0 50 100 150 200 Metres

Doc Number:

Date: 25/05/17



Legend

- Land required for Proposed Scheme
- LiDAR/multi-spectral study area
- HS2 Phase 2a centre line
- Gazetteer entry with overlapping features

NMP
- Bank
- Ditch
- Extent of feature
- Ridge and furrow
- Structure
- Monument polygon

AP
- Bank
- Ditch
- Possible feature
- Structure
- Monument polygon

LiDAR/multi-spectral
- Polygons
- Lines

Feature labelling
42 = AP/NMP
FRC001 = Gazetteer
1102 = Remote Sensing

Map Number
Figure 34

Map Name
Remote Sensing Survey Data
CA5 (Map 6)

Community Area:
05

Scale at A3: 1:5,000

0 50 100 150 200 Metres

Doc Number:

Date: 25/05/17

371000
372000
352000
3169
3169
3167
3166
3165
SCH045
246+500
246+400
169
246+300
246+200
246+100
246+000
245+900
245+800
245+700
245+600
245+500
245+400
245+300
3159
3158
3158
3155
3164
3163
3163
3150
SCH079

Legend

- Land required for Proposed Scheme
- LiDAR/multi-spectral study area
- HS2 Phase 2a centre line
- Gazetteer entry with overlapping features

NMP
- Bank
- Ditch
- Extent of feature
- Ridge and furrow
- Structure
- Monument polygon

AP
- Bank
- Ditch
- Structure
- Monument polygon

LiDAR/multi-spectral
- Polygons
- Possible feature
- Structure
- Monument polygon
- Lines

Feature labelling
42 = AP/NMP
FRC001 = Gazetteer
1102 = Remote Sensing

Map Number
Figure 35

Map Name
Remote Sensing Survey Data
CA5 (Map 7)

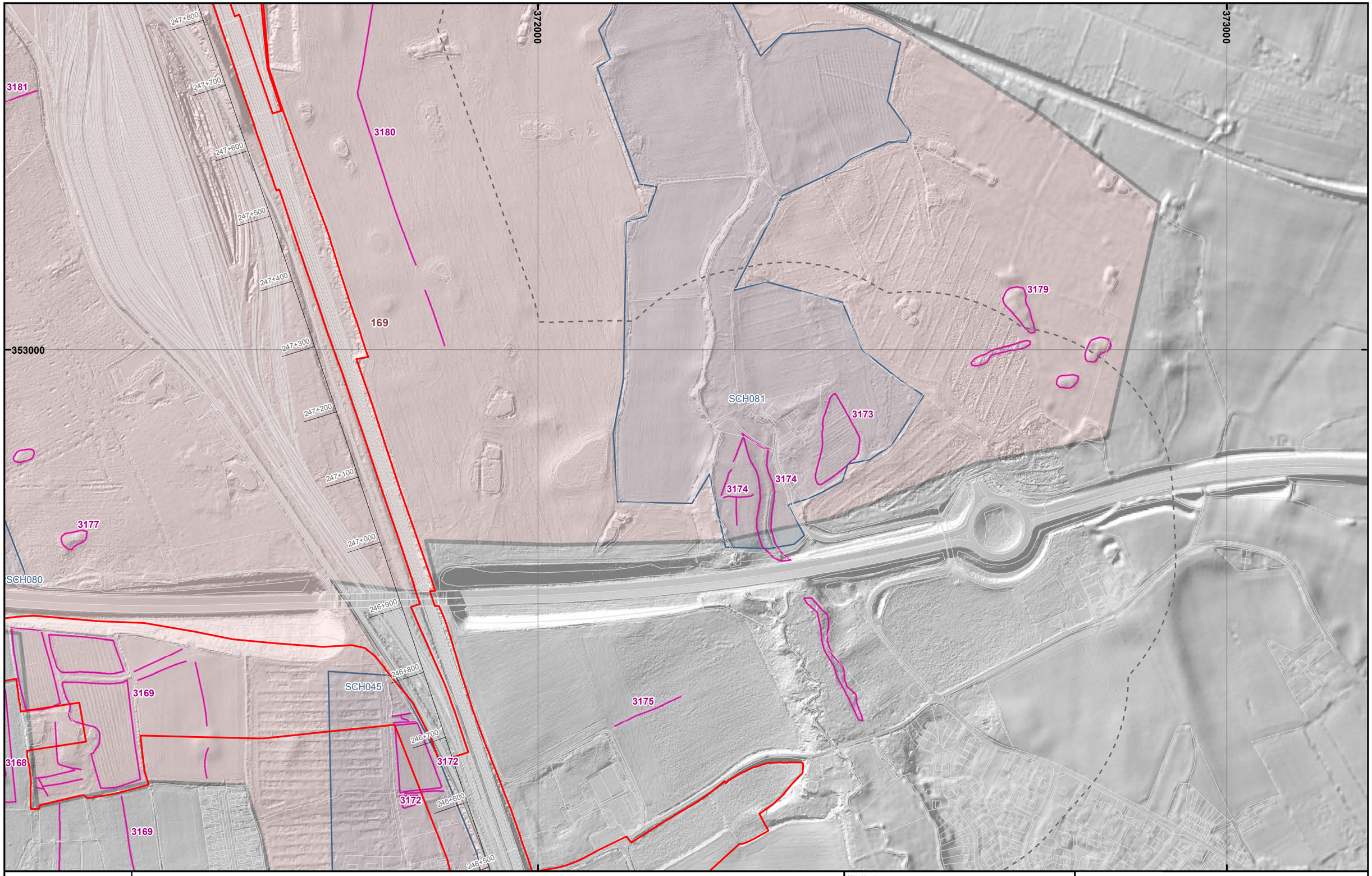
Community Area:
05

Scale at A3: 1:5,000

0 50 100 150 200
Metres

Doc Number:

Date: 25/05/17



Legend

- Land required for the Proposed Scheme
- LiDAR/multi-spectral study area
- HS2 Phase 2a centre line
- Gazetteer entry with overlapping features

NMP
- Bank
- Ditch
- Extent of feature
- Ridge and furrow

- Structure
- Monument polygon

AP
- Bank
- Ditch

- Possible feature
- Structure
- Monument polygon

LiDAR/multi-spectral
- Polygons

- Lines

Feature labelling

42 = AP/NMP
FRC001 = Gazetteer
1102 = Remote Sensing

Map Number: Figure 36

Map Name: Remote Sensing Survey Data CA5 (Map 8)

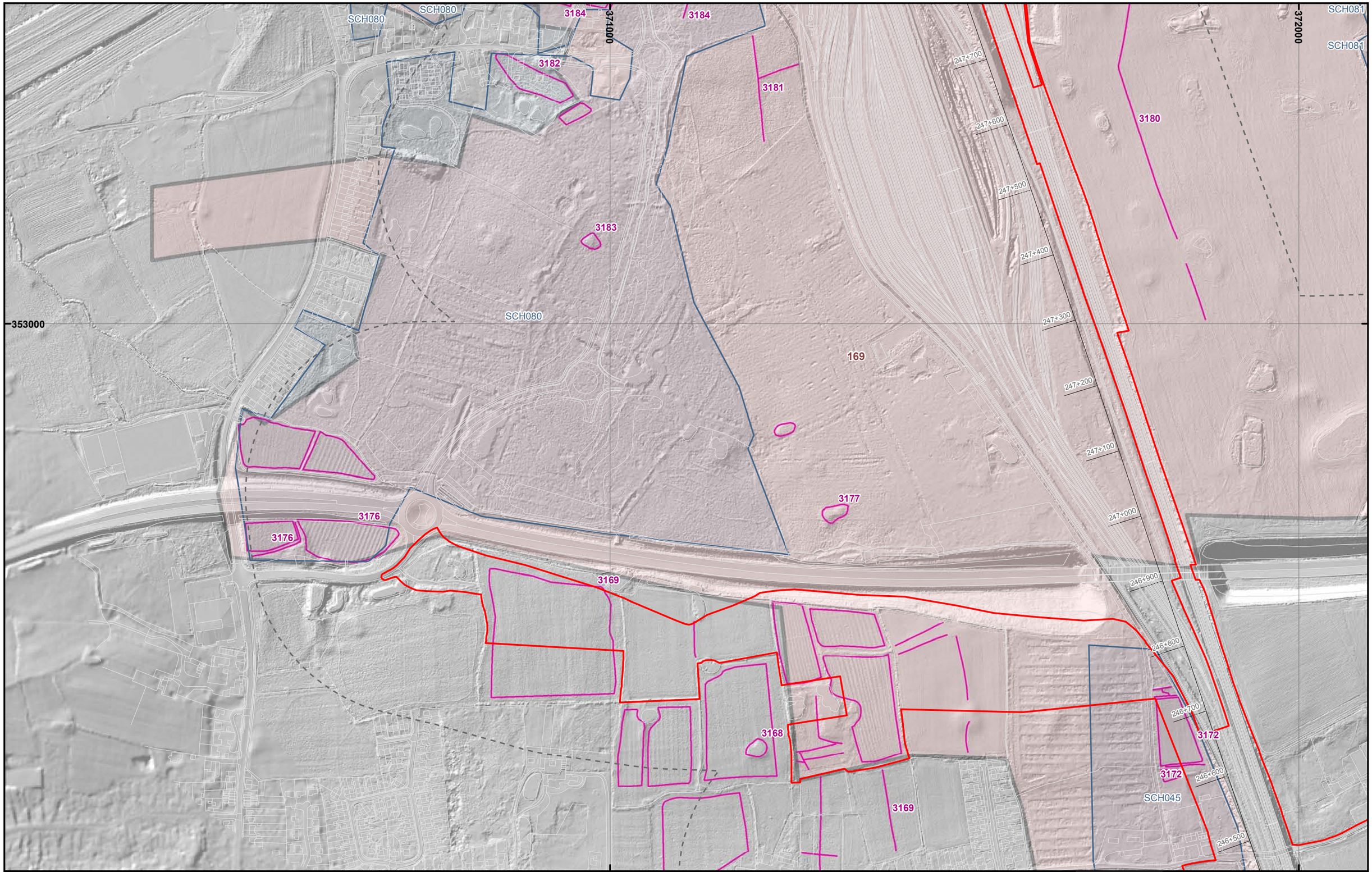
Community Area: 05

Scale at A3: 1:5,000

0 50 100 150 200 Metres

Doc Number:

Date: 25/05/17



Legend

- Land required for the Proposed Scheme
- LiDAR/multi-spectral study area
- HS2 Phase 2a centre line
- Gazetteer entry with overlapping features

NMP
- Bank
- Ditch
- Extent of feature
- Ridge and furrow

- Structure
- Monument polygon

AP
- Bank
- Ditch

- Possible feature
- Structure
- Monument polygon

LiDAR/multi-spectral
- Polygons

- Lines

Feature labelling
42 = AP/NMP
FRC001 = Gazetteer
1102 = Remote Sensing

Map Number: Figure 37

Map Name: Remote Sensing Survey Data CA5 (Map 9)

Community Area: 05

Scale at A3: 1:5,000

0 50 100 150 200 Metres

Doc Number:

Date: 25/05/17

371000

372000

354000

248+500

248+400

248+300

248+200

248+100

248+000

247+900

247+800

170

169

3184

3184

SCH080

SCH080

SCH080

3182

3181

3180

SCH072

SCH081

Legend

- Land required for the Proposed Scheme
- LiDAR/multi-spectral study area
- HS2 Phase 2a centre line
- Gazetteer entry with overlapping features

NMP

- Bank
- Ditch
- Extent of feature
- Ridge and furrow
- Structure
- Monument polygon

AP

- Bank
- Ditch
- Possible feature
- Structure
- Monument polygon

LiDAR/multi-spectral

- Polygons
- Lines

Feature labelling

42 = AP/NMP

FRC001 = Gazetteer

1102 = Remote Sensing

Map Number

Figure 38

Map Name

Remote Sensing Survey Data
CA5 (Map 10)

Community Area:
05

Registered in England. Registration number 06791686.
Registered office: Eland House, Bressenden Place, London SW1E 5DU.

Scale at A3: 1:5,000

0 50 100 150 200
Metres

Doc Number:

Date: 25/05/17

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Snow Hill Queensway
Birmingham B4 6GA

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HS2Enquiries@hs2.org.uk

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