# Investigations into the history and archaeology at Bilsham Farm, Pilning, South Gloucestershire

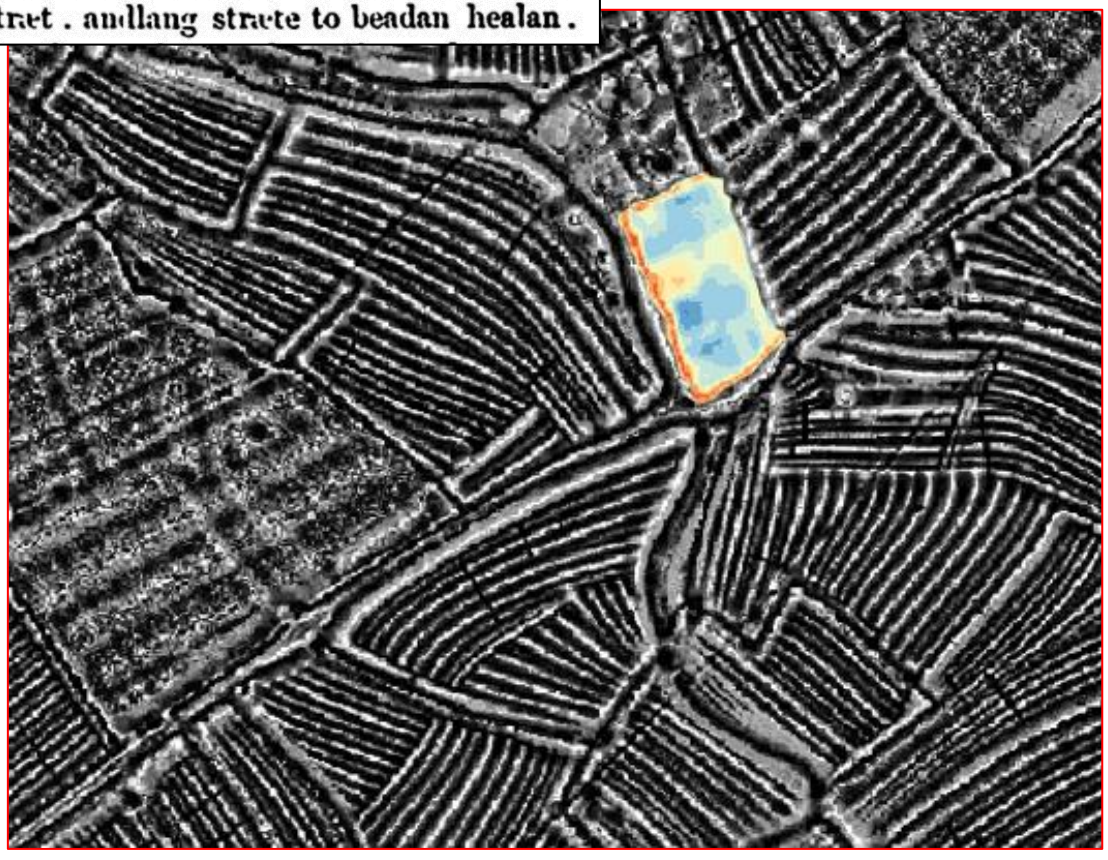
Section 1:- History – Margaret Orchard

Section 2:- Archaeology – David Lambie

January 2022

*Divisiones Ælvestona* . þis synd þara . v . hida land gemæru æt Alfestune . Ærest on hring pylle . of hring pylle duddingdene . andlang denes on þa ealdan mær dic . andlang dice pest on gerihte on smita pull . of smita pylle pest rihte on blaca ford . of blaca forda innan hreodham . of hreodhamme on cildes hammes pest ende . þonne norð on gerihte to hreodpican on þa ealdan stræt . and lang stræt to norðpican . of norðpican eft and lang strete to billes ham . of billes hamme eft on gerihte innan myccla pyll . of myccla pylle on smala pyll . andlang pylles on hpita gærstune . of hpita gæ[r]stune on ða mær dic . andlang dice to normæde norð hyrnan . þonn norð rihte on ða dic innan hola pyll . and lang hola pylles eft on ða mær dic . ðonne eft be ðære dic to ðær stanenan bricge . of þære bricge suð innan þærbyrdes croft . eall on buton . eft on þa mær dic . and lang dic to mærcumbe . and lang cumbes midperd to ðære ealdan stræt . andlang stræte to beadan healan .

*From Northwick back along the street to Bilsham; from Bilsham straight back to the great pill.*



# OVERVIEW

The Heritage Lottery Fund (HLF) Project *A Forgotten Landscape* included several programmes for the community, one of which trained volunteers in archaeological techniques. Another programme trained volunteers in using and reviewing lidar data collected by the Environment Agency and when the lidar data for the part of South Gloucestershire close to the River Severn were visualised interesting features were identified in a field next to Bilsham Farm, Pilning, South Gloucestershire (Grid Ref ST 56978 87108. Easting: 356978. Northing: 187108). Field boundaries in the area have changed little over time and this field with interesting features was the south westerly part of field number 382 in the 1840 Tithe Apportionment of Shirehampton Tithing, Parish of Westbury upon Trym.

Although the surfaces of the surrounding fields are covered with ridge-and-furrow earthworks, the undulations in the field under investigation are completely different in character. The research into the history of Bilsham, now Bilsham Farm, was stimulated by these lidar findings.

Following are summaries of the information found out to date about this site at Bilsham Farm. The first, as section 1, describes the research carried out by one of the volunteers, Margaret Orchard, into the history of the site. The second report, as section 2 by David Lambie, captures the original lidar results and describes the archaeological investigations carried out at this site. These were performed by a number of the volunteers trained in archaeology by the HLF-funded project, *A Forgotten Landscape*.

# Frontispiece

Extract from *Cartularium Saxonicum, detailing component in Grant by King Eadwig to the Church of St Peter at Bath, of lands at Alveston and Cold Ashton.* Reference to "billes ham" highlighted.
Image from:- **Birch, W De Gray (1893)** *Cartularium Saxonicum, Volume 3: A.D. 948-975: A Collection of Charters Relating to Anglo-Saxon History* p 113, Charter 936.
*Image from Google Books Project and used for non-profit purpose, in accordance with declared usage rights*

"Open positiveness" interpretation of lidar data analysed during this project. *These Environment Agency data are used in accordance with the "Open Government Licence".*
*Analysis using RVT (Kokalj et al, 2016)*

# Investigations into the History and Archaeology of Bilsham, South Gloucestershire.

## Section 1: The History of Bilsham

***Margaret Orchard***

This report summarises information available about the history of Bilsham, in the Parish of Pilning,and Severn Beach, South Gloucestershire and the people who have lived there. It was carried out as part of the project funded by the Heritage Lottery Fund (HLF) *A Forgotten Landscape.*

Bilsham Farm is the name now given to the group of buildings and fields in part of the district of South Gloucestershire. It was previously identified as a hamlet known simply as Bilsham. The present farmhouse appears to be C18 or C19[1]. Recorded archaeological features close-by are areas of medieval ridge-and-furrow in some of the fields adjacent to the farmhouse[2],[3] and earthworks forming the remains of two rectangular enclosures, with possibly the remains of a building, at the NW end of a broad drove west, north west of the farmhouse[4].

Bilsham Farm is in the middle of the triangle of land made by the villages of Olveston, Aust and Northwick on the Avon levels 1.5km inland from the east bank of the Severn Estuary. It is at approximately 9 m above Ordnance Datum in an area that historically has been prone to flooding. Before construction of sea defences and drainage of the marsh enabled the area to be put to pasture it was previously salt-marsh or freshwater fen. The geology is principally estuarine alluvium overlying mudstone[5,6.]

Although prone to flooding the area has been occupied and farmed for thousands of years with considerable archaeological evidence having been found for Romano-British settlement around Bilsham Farm. The closest sites are at: Northwick, found during excavations that preceded construction of the Second Severn Crossing; at Aust, found during excavations that preceded construction by Wessex Water of a discharge pipeline; and at Ingst found during preliminary excavations before the proposed construction of a Wind Farm[7].

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[1] South Gloucestershire Council, 'Bilsham Farm' <https://archaeologydataservice.ac.uk/archsearch/record?titleId=87546> [accessed 2 November 2019].
[2] Crowther, S and Dickson, A, *An Archaeological Survey in the Severn Vale, Gloucestershire: A Highlight Report for the National Mapping Programme NMP* (Historic England, 2016) <https://research.historicengland.org.uk/Report.aspx?i=15715> [accessed 13 November 2019].
[3] South Gloucestershire Council, 'Ridge and Furrow Cultivation Bilsham Farm Bilsham Lane Pilning', HER 19403.
[4] South Gloucestershire Council, 'Farm (Site of) West North West of Bilsham Farm - Ariadne Portal' <http://ariadne2.isti.cnr.it/page/14314755> [accessed 2 November 2019].
[5] Michael Allen J, Robert G Scaife, and Julie Gardiner, 'The Physical Evolution of the North Avon Levels: Summary Results from the Second Severn Crossing English Approaches Project', *Archaeology in the Severn Estuary*, 21 (2010), 1–8.
[6] Young, A, 'Wessex Water Oldbury-on Severn to Aust Discharge Pipeline, South Gloucestershire, Archaeological Surveys and Excavations 2003-4', *Archaeology in the Severn Estuary*, 17 (2006), 77–142.
[7] Riley, R, Barnes, I, and Collard, M, *M48/M4 Wind Farm Ingst South Gloucestershire Archaeological Evaluation* (Cotswold Archaeology, 2013).

There is also evidence from extant records showing that Bilsham has been occupied for more than a thousand years. The earliest known record of Bilsham is in the Boundary Charter for Olveston of A.D. 955 - 959 drawn up on the occasion of the restoration of land at Olveston by King Eadwig to the Church of St Peter, Bath[8]. In this Charter Bilsham is recorded in Old English as *billes hamme* which is interpreted by A H Smith in *The Place-names of Gloucestershire* as being the water-meadow or land enclosed in a bend belonging to Bil[9]. Bilsham is still bounded by water courses. The largest are named (the Lords Rhine to the North and North East and Bilsham Rhine to the North West) and flow into Cake Pill before draining into the River Severn. Other smaller ditches bound individual fields or groups of fields and drain into the Rhines.

The most recent translation of the boundary around Bilsham which was described in 955-959 is from The Electronic Sawyer[8]:

> *"to the old road; along the street to Northwick; from Northwick back [perhaps 'east'] along the street to Bilsham; from Bilsham straight back [perhaps 'due east'] to the great pill"*

Bilsham, as *Biles hamme*, is mentioned again in a lease granted in 990 by Oswald, Archbishop of Worcester[10].

The *street* mentioned in the King Eadwig's charter of 955-959 is now called Bilsham Lane and it is still a boundary but now between Olveston Parish and the Northwick part of Pilning & Severn Beach Parish with Bilsham Farm being in Northwick. Pilning & Severn Beach Parish is a relatively modern parish but up to 1894 Northwick was a chapelry and tithing in the parish of Henbury[11].

Henbury was first mentioned in 692, when Aethred, King of Mercia gave the manor to Oftfor, Bishop of Worcester[12]. By the 13th century it was part of the Bishop of Worcester's combined manor of Redwick and Northwick with land being leased by the Bishop to tenants[13]. Previously, around 1093, a charter of the then Bishop of Worcester, Wulfstan, endowed Henbury church and all of its tithes to Westbury on Trym's monastery, which Wulfstan had acquired for the Worcester diocese around that time[14,15]. The land in Northwick, which was in a parish within the Diocese of Worcester, was therefore owned by the Bishop of Worcester. So in medieval times the lane now called Bilsham Lane was the boundary between two ecclesiastic manors and two parishes in different Dioceses.

Ownership of the land changed completely following the Reformation, abolition of the abbeys and monasteries, and confiscation of their property by Henry VIII. In 1547 much of the land belonging to the bishops of Worcester, including the Manor of Henbury, was passed to the powerful courtier,

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[8] 'Charter: King Eadwig to the Church of St Peter, Bath; Restoration of 5 Hides (Mansae) at Olveston, and 5 at Cold Ashton, Gloucs., Granted to the Minster by King Athelstan', 955 <http://www.esawyer.org.uk/charter/664.html> [accessed 20 July 2019].

[9] Smith, AH, *The Place-Names of Gloucestershire* (Cambridge University Press, 1965).

[10] 'Lease: Oswald, Archbishop of Worcester, to Æthelmær, His Man; Lease, for Three Lives, of 1 Hide at Compton Greenfield and 1 at Marsh, Gloucs., in Return for 2 Pounds of Silver and Livestock, with Postscript Granting the Worthig at Brynes Hamme Which Æthelm Owned. Bounds of Marsh.', 990 <http://www.esawyer.org.uk/charter/1362.html#> [accessed 20 July 2019].

[11] Plaster, Andrew, 'Northwick', *Bristol & Avon Family History Society Journal*, 138 (2009) <https://www.bafhs.org.uk/our-parishes/other-parishes/159-northwick> [accessed 10 May 2019].

[12] 'Charter: Æthelred, King of Mercia, to Oftfor, Bishop, and St Peter's Church, Worcester; Grant of 30 Hides (Cassati) at Henbury and Aust, Gloucs.', 691 <http://www.esawyer.org.uk/charter/77.html> [accessed 23 July 2019].

[13] Binns, Sue, 'Medieval Redwick, South Gloucestershire', *The Regional Historian*, New Series Vol 1 (2018), 54–59.

[14] 'St Mary's Church, Parish of Henbury: A Brief History' <https://www.stmarys-henbury.co.uk/who-we-are/st-mary-s-church-a-brief-history/> [accessed 23 July 2019].

[15] Page, William (Ed), 'College: Westbury-on-Trym', in *A History of the County of Gloucester* (Victoria County History, 1907), II, 106–8 <https://www.british-history.ac.uk/vch/glos/vol2/pp106-108> [accessed 23 July 2019].

Sir Ralph Sadleir. It is likely that individual farms were in the hands of tenants and when the estate of Ralph Sadler, grandson of Sir Ralph Sadleir, was surveyed in 1608[16] William Trye and George Smythe were listed as free tenants in the Redwick and Northwick part of the Manor of Henbury.

The earliest known record of land ownership at Bilsham is within a collection of records held by Gloucestershire Archives[17]. The deeds of messuages and lands at Redwick and Northwick, dated 1625 include those for three closes known as Bilsham's Paddock.

The earliest named residents of Bilsham appear twenty two years later in the last will and testament of John Williams[18]. John Williams is writing his will in February 1657 and describes himself as being a yeoman of Bilsham in the Parish of Northwick and county of Gloucester. Also named in this will is George Bradley of Bilsham and Robert Mansell of Northwick.

The River Severn is renowned for its ability to flood at times of heavy rainfall and high tides. Bilsham sits firmly in the area of land close to the banks of the River that has been regularly flooded. Great damage was sustained particularly in 1606, 1628, 1687, 1703 and 1737[19, 20]. As there are no buildings at Bilsham that predate the 18th Century it is possible that any buildings at Bilsham standing before these floods were severely damaged by the floods and were subsequently rebuilt.

The earliest known map of this area is the 1810 Survey of Lands in the Hundred of Henbury, Property of the Lords[21]. The Survey included a map of Bilsham Green (Figure 1) and showed three plots inclosed from Bilsham Green. These inclosures may be some of the features identified as earthworks West North West of Bilsham Farm[4].

The 1810 Survey of Lands also identified the people to whom the three plots were leased. Plot 12 was at the end of the Green, had been inclosed from the Green, and was calculated to be 20 perches in area. It was leased to the Rev Andrew Daubeny and was bounded by a field also owned by him. Reverend Andrew Daubeny died in 1836 in Backwell, Somerset, and in his Will dated 17 June 1835, left to his son, the Rev Andrew Alfred Daubeny:

> "*all that my farm and lands at Northwick and Bilsom in the Parish of Henbury…….now let to Thomas Taylor"* [22].

Plots 13 (21 perches) and 14 (34 perches) were both gardens inclosed from Bilsham Green. Plot 13 was leased to Sarah Williams whereas plot 14 was leased to Thos Mitchell & Mary Lee.

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[16] Ralph Sadler, *Survey of Ralph Sadler Estate*, 1608 <http://archive.org/details/SurveyOfRalphSadlerEstate> [accessed 3 March 2019].

[17] 'Deeds of Messuages and Lands at Redwick and Northwick in the Parish of Henbury Including 2 Closes of Meadow Known as Bishops Lands, Messuage Formerly Inhabited by Thomas Dyer, One Toft Called Bundyes, 3 Closes Known as Bilsham's Paddock', Gloucestershire Archives <http://ww3.gloucestershire.gov.uk/CalmView/Record.aspx?src=CalmView.Catalog&id=D284%2f1&pos=1> [accessed 31 October 2019].

[18] John Williams, 'Will of John Williams of Bilsham in the Parish of Northwick and the County of Gloucester' (National Archives, 1384), National Archives, PROB 11; Piece: 278 <https://search.ancestry.co.uk/cgi-bin/sse.dll?indiv=1&dbid=5111&h=956162&tid=&pid=&usePUB=true&_phsrc=SSH58&_phstart=successSource> [accessed 31 October 2019].

[19] Samuel Rudder, *A New History of Gloucestershire*, 1779, Scan of original. <https://commons.wikimedia.org/w/index.php?title=File:Samuel_Rudder_A_New_History_of_Gloucestershire_1779.pdf&page=1> [accessed 28 February 2019].

[20] John E. Morgan, 'Flooding in Early Modern England : Cultures of Coping in Gloucestershire and Lincolnshire' (unpublished phd, University of Warwick, 2015) <http://webcat.warwick.ac.uk/record=b2870373~S1> [accessed 2 November 2019].

[21] 'Survey of Lands in the Hundred of Henbury, Property of the Lords.', c1810, Bristol Archives, 39978.

[22] 'Will of Reverend Andrew Daubeny, Clerk of Backwell , Somerset', 1836, The National Archives, Kew, PROB 11/1867/440.

The 1839 Tithe Apportionment Survey is a complete survey of ownership and occupation at field and buildings level of Henbury Parish[23]. The Tithe Map which accompanies the Survey identifies two fields next to Bilsham Farm as being in Westbury Parish (Figure 2a). These two fields are included in the 1840 Survey of the Detached Lands of Shirehampton Tithings of the Parish of Westbury upon Trym[24] as field number 381 and field number 382 and are shown on the accompanying extract from the Tithe Map (Figure 2b). Neither field is given a specific name but is described as a close in Bilsham near Northwick. Both fields are laid down to pasture; are owned by Thomas Lyddon Edwards Esquire and are occupied by Richard Williams. The Henbury Tithe Apportionment records Bilsham Farm house and building and the fields which surround the Westbury fields as being owned and occupied by William Millett.

When Bilsham Farm was auctioned in 1870 all the fields for sale were identified by number on the respective tithe apportionment and their name[25]. The names of the fields in the Parish of Henbury correspond to their names listed in the 1839 Henbury Tithe Apportionment. The fields in Westbury upon Trym were also named: field 381 was arable divided into two and named *The Three Acres* and *The Two Acres*; field 382 was pasture and named *The Home Ground.*

The earliest Ordnance Survey mapping of the area was carried out in 1880 (Figure 3). The area has changed little since then with Bilsham Farm remaining in private ownership, field boundaries being almost unchanged and the fields still laid to pasture and grazing.

**Acknowledgements**

This research would not have been carried out without support and encouragement from Rebecca Bennett of *The Forgotten Landscape Project.* I am also grateful to the staff of Bristol Archives for their help and for permission to publish the extract from the 1810 Survey of Lands.

[23] 'Tithe Apportionment of Henbury except Charlton (Parish), Gloucestershire. Valuation: Jacob Player Sturge and James Marmont, Bristol. Apportionment Is Divided into Tithings.', 1839, The National Archives, Kew, IR 29/13/104 <https://www.thegenealogist.co.uk/> [accessed 1 December 2017].
[24] 'Tithe Apportionment of Shirehampton (Tithing in the Parish of Westbury-on-Trym), Gloucestershire.V Aluation: Young Sturge and Jacob Player Sturge, Bristol', 1840, The National Archives, Kew, IR 29/13/176 <https://www.thegenealogist.co.uk/> [accessed 23 January 2018].
[25] 'Sales by Auction. Bilsham Farm, Northwick, Gloucestershire. Valuable Grazing Farm', *The Western Daily Press*, 28 June 1870, p. 1, British Newspaper Archive, BL_0000264_18700628_028_0001.

**Fig 1: Map of Bilsham Green in the 1810 Survey of Lands in the Hundred of Henbury, Property of the Lords. Bristol Archives. Accessed 16th November 2017 (Note that orientation is inverted when compared with modern maps)**

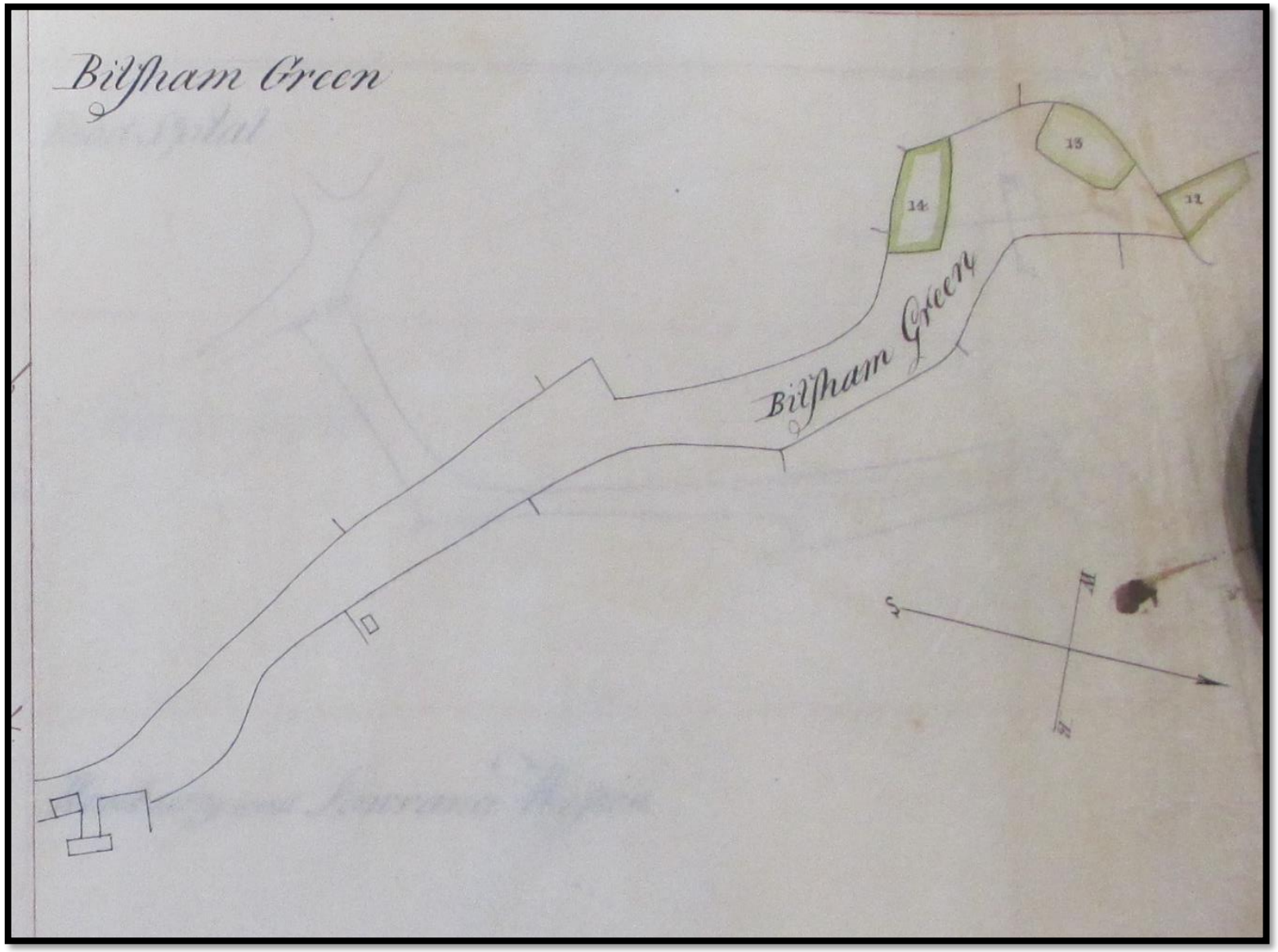


**Fig 2a: Bilsham on the 1839 Tithe map for the Parish of Henbury. https://www.thegenealogist.co.uk/tithe/ Acces 25th January 2018.**

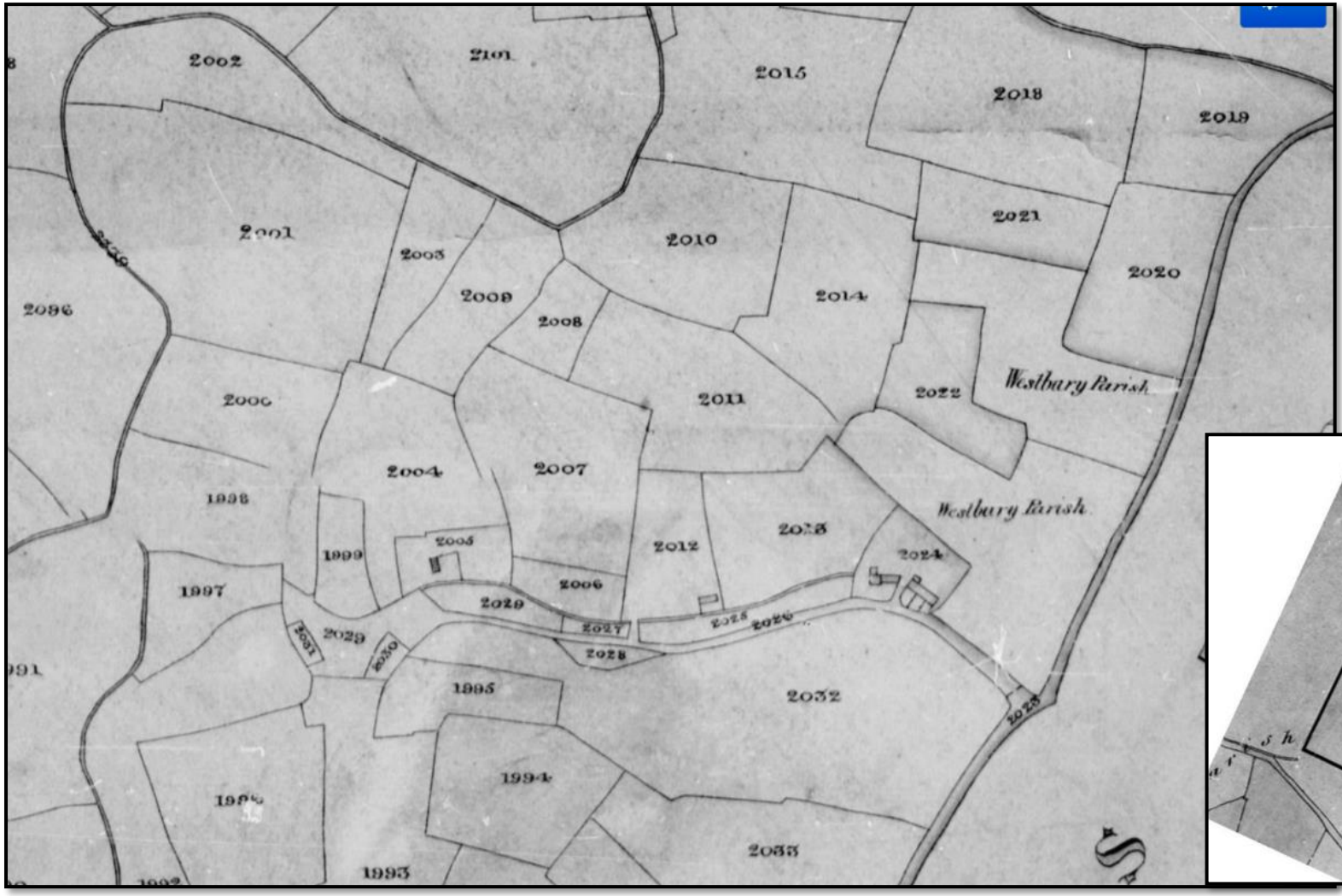



**Fig 2b: 1839 Tithe map for Westbury-on-Trym. Fields at Bilsham included within the map of Shirehampton Tithing**

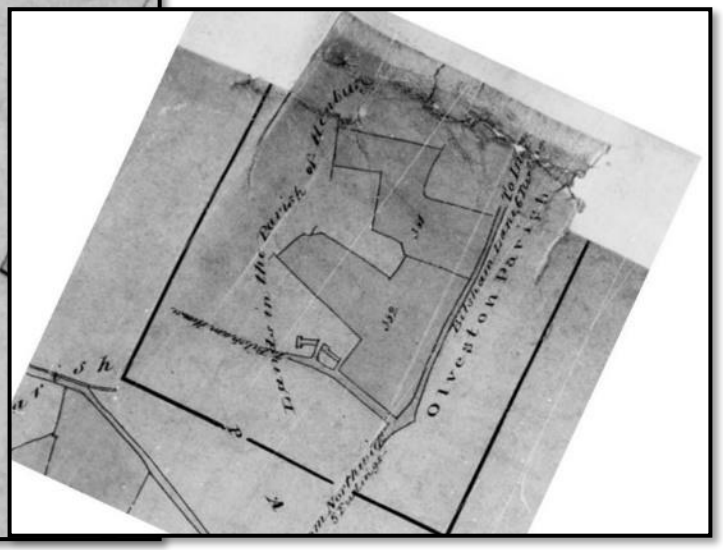
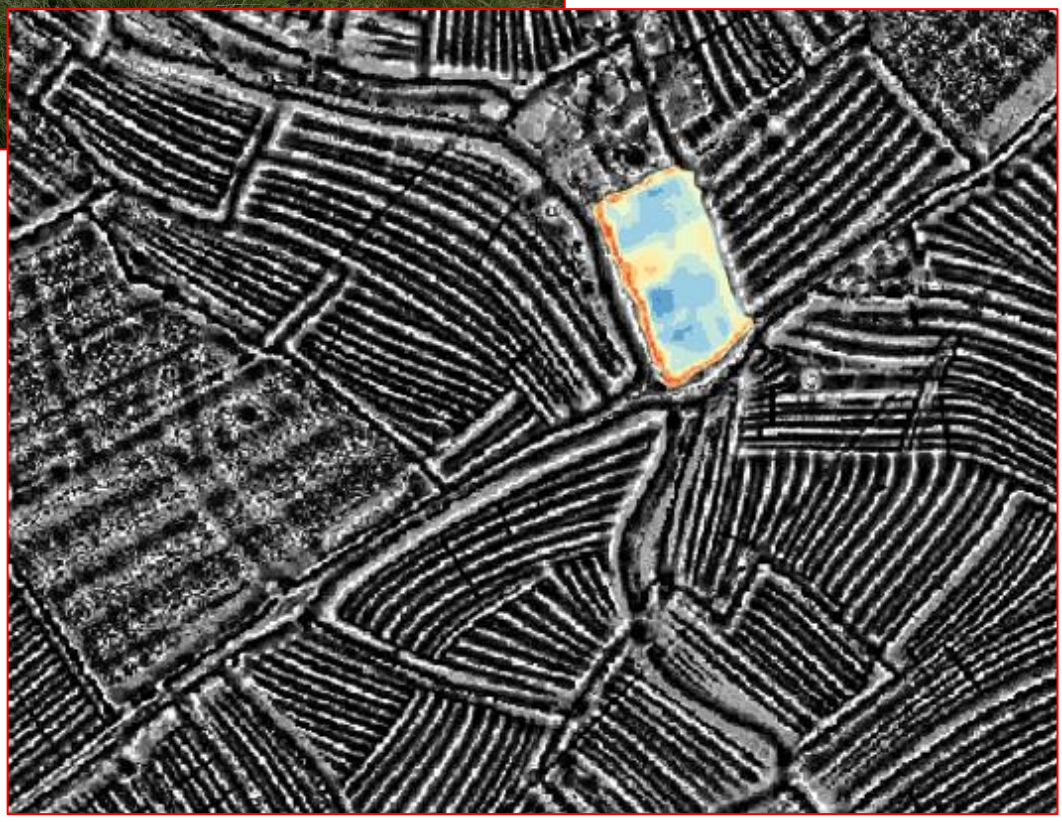


**Fig 3: Bilsham surveyed in 1880. Extract from Ordnance Survey Six Inch Map, Gloucestershire Sheet LXII.SE. National Library of Scotland. http://maps.nls.uk/view/101454282. Accessed 16th November 2017.**

Investigations into the History and Archaeology of Bilsham, South Gloucestershire.

## Section 2: Archaeological investigations at Bilsham Farm, Pilning, South Gloucestershire

***David Lambie***



# Contents

# Figures



# Section frontispiece:-

Photograph across the site, south east to north west (David Lambie)

"Open positiveness" interpretation of lidar data analysed during this project. *These Environment Agency data are used in accordance with the "Open Government Licence".*
*Analysis using RVT (Kokalj et al, 2016)*

# 1. Summary

This site (NGR 357021, 187047) was discovered as part of a review of South Gloucestershire lidar data, organised and planned by "A Forgotten Landscape" project, a Lottery funded community heritage project, based in the Lower Severn Vale Levels (South Gloucestershire Council, 2015). The aim of the lidar review was to identify any currently unknown archaeology in the region. It was performed by a number of volunteers, who were trained in lidar assessment and given access to lidar data and old maps through the HEROS platform (HEROS, nd).

The site in question (figure 2), directly south of Bilsham Farm, is around 7 miles north of the centre of Bristol (figure 1). The lidar data from the site show a very different character to the lidar data from the surrounding area, where ridge and furrow is common (figures 3, 4).

This section discusses the archaeological work on this site. It includes:-

- Lidar data review
- South Gloucestershire Historic Environment Record review
- Gradiometric survey
- Earth resistance survey
- Depth probing survey

The local tithe maps (see section 1) show that two fields, including the one containing the site, were detached parts of the parish of Westbury on Trym at the time the tithe map was drawn. In contrast, the surrounding fields were part of Henbury Parish, Bristol. It is possible that this may reflect a different use of the site.

No evidence of a building, or other features, was noted in the Historic Environment Record (HER) reviews.

The gradiometry survey results show little or no evidence of features (figure 8).

The earth resistance survey results give the most interesting view of the site with the high resistance anomalies seen in figures 9 to 12. The evident features cover an area of about 40m by 40m with individual features up to about 5m across. It is not clear whether the responses extend beyond the field, under the farm track to the west and, therefore, beyond the area accessible for survey. The earth resistance results are not clear enough to make an unequivocal statement on the extent and shapes of the features. Their date and purpose are not known.

Depth probing identified that a layer of hard rock or stones exists around 0.1 to 0.15m from the soil surface in regions of high earth resistance (figure 14).

If this project were to be taken forward it is recommended that test pits are dug over selected areas perhaps a trench put in across the more regular features to see if they can illuminate the site's past.

# 2. Acknowledgements

Help for this project has come from a number of places and is, in all cases, gratefully received: -

- Angus McEwen-Smith kindly gave permission for the work on the land
- Mary Lennox for guidance on the work, data analysis and proof reading the report.
- Volunteer surveyors from YaDAG, AFL team conducted the surveys and analysis: Mary Knight, David Lambie, Mary Lennox, Margaret Orchard, Paul Rosser, Jeff Sargent and Davina Williams
- South Gloucestershire Council's County Archaeologist, Paul Driscoll, offered support, guidance and permission to use the South Gloucestershire County geophysics kit.
- Rebecca Bennett for professional support.

# 3. Introduction

## 3.1. Site references

| | |
|---|---|
| Name | Bilsham Farm |
| County | South Gloucestershire |
| Parish | Olveston Civil Parish |
| Altitude | Around 7m above mean sea level |
| UK grid reference | 357021, 187047 |
| Location | 1.5km South West of Ingst, South Gloucestershire, off Bilsham Lane, BS35 4HD |
| Pastscape ref: | N/A |
| NMR NUMBER: | N/A |
| Historic England List entry Number: | N/A |
| South Gloucestershire Council HER Number: | N/A |

## 3.2. Background

This site (NGR 357021, 187047) was discovered as part of a review of South Gloucestershire lidar data, organised and planned by "A Forgotten Landscape" project, a Lottery funded community heritage project, based in the Lower Severn Vale Levels (South Gloucestershire Council, 2015). The aim of the lidar review was to identify any currently unknown archaeology in the region. It was performed by a number of volunteers, who were trained in lidar assessment and given access to lidar data and old maps through the HEROS platform (HEROS, nd).

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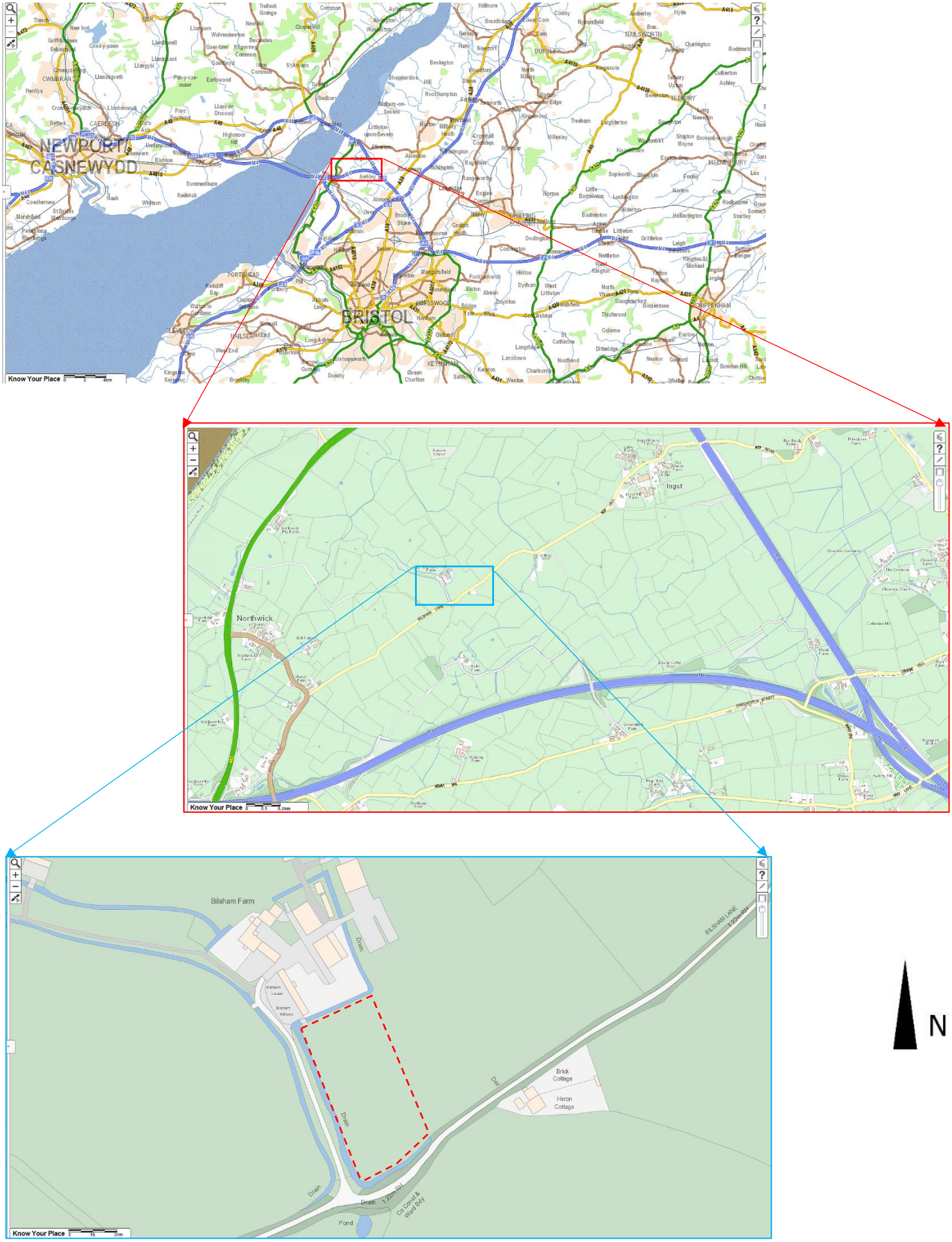


*Figure 1:- Location of the site (Know Your Place, undated, downloaded 30th August 2019). Site outlined in red.* *OS data © Crown copyright & database rights 2019 Ordnance Survey 100023406)*

## 3.3. Aims and objectives

AIM:- survey of site at Bilsham Farm to assess likelihood of buried prehistoric or historical features.

OBJECTIVES:- The objectives of the work reported here are:-

- Assessment of lidar measurements of the site looking for features to distinguish from surrounding fields
- Review of the South Gloucestershire Historical Environment Record
- Gradiometric survey of the site to discover any evident magnetic anomalies on the site
- Earth resistance survey of the site to discover any evident earth resistance anomalies
- Soil depth probing to support interpretation of resistance results and give guidance on soil depth
- Recommend future activities

## 3.4. Report overview

This report discusses the work to date on this field, including:-

Section 1:- Summarises the work done and conclusions

Section 2:- Acknowledges help received by the project

Section 3:- Gives an overview of the site, the aims and objectives of the project

Section 4:- Describes the different methods used

Section 5:- Presents the results and discussion of the results

Section 6:- Details the conclusions

Section 7:- Details recommendations for further work

Section 8:- Contains references

Appendix 1:- Reports the geophysics analysis histories

Appendix 2:- Presents the near raw geophysical data

Appendix 3:- Details the probing results

Appendix 4:- Presents results of alternative view of the Lidar analyses

Appendix 5:- Presents the Lidar references

## 3.5. Description of the location

The site is currently used for grazing cattle and sheep, it is low lying, at around 7m above ordinance datum and in a region of largely flat fields, criss-crossed by deep drainage ditches. A local resident, Graham Harding, has lived in adjacent hamlet, Ingst, for around 60 years. He said that in his memory it had always been grazed and never ploughed. Also said that he did not recall it ever flooding (Harding, 2019).

*Figure 2:- View across the site looking north-west. Taken 3rd September 2019 (David Lambie)*

The site sits among a rich body of ridge and furrow in surrounding fields but the site of interest shows no sign of this. However, there are evident humps and hollows in the field (figures 3 and 4).


*Figure 3:- Lidar results from the area around the site. Site outlined in red.*
*Positive openness calculated from Lidar data (data.gov.uk, nd). Downloaded 15th May 2019.*
*Minimum (e.g. bottom of ditch) 1.4° Black*
*Maximum (e.g. top of hump) 131° White*
*These Environment Agency data are used in accordance with the "Open Government Licence".*
*Analysis using RVT (Kokalj et al, 2016)*

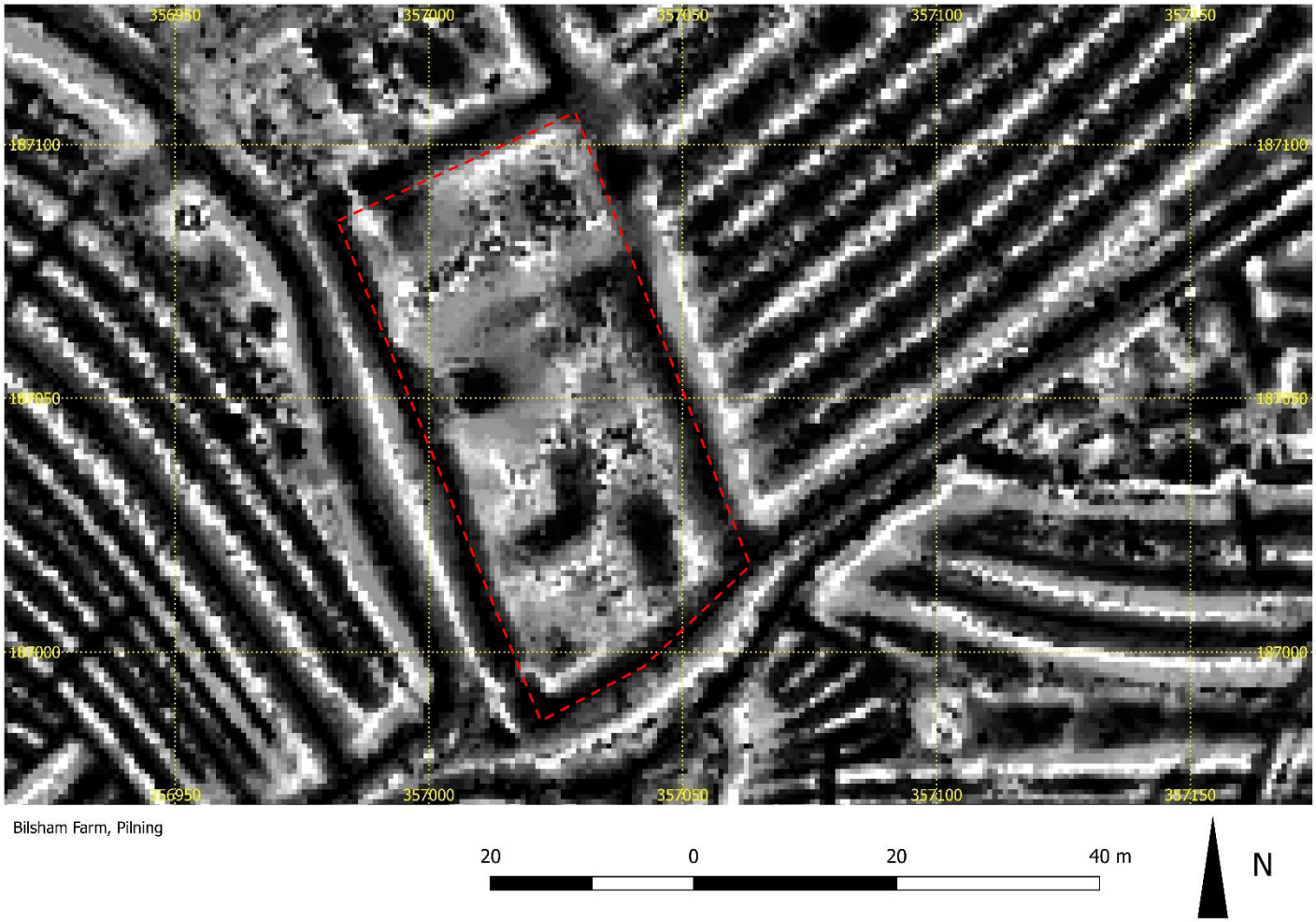


*Figure 4:- Closer view of the site lidar, outlined in red*
*Positive openness calculated from Lidar data (data.gov.uk, nd). Downloaded 15th May 2019.*
*Minimum (e.g. bottom of ditch) 1.4° Black*
*Maximum (e.g. top of hump) 131° White*
*These Environment Agency data are used in accordance with the "Open Government Licence".*
*Analysis using RVT (Kokalj et al, 2016)*

# 4. Methods

## 4.1. Lidar

Data presented here are from the 2015 digital terrain model for square ST58 at 1m resolution. All 4 quadrants of data (NE, NW, SE, SW) were downloaded on 15th May 2019 from the DEFRA website (DEFRA, nd) since the site is very near the centre of the 10km square. Specific details of the data downloads are reported in Appendix 3.

Analysis of the data was conducted using RVT 1.2 Win64 (Kokalj et al, 2016) and the results were presented using QGIS 2.18 (QGIS, nd) (Appendix 4)

## 4.2. Historical Environment Record

A review was made of the HER both via the Know your Place website and directly from HER records available to the volunteers. Historical mapping of the area available on Know Your Place was also reviewed.

## 4.3. Gradiometry

A gradiometry survey was undertaken using a Geoscan FM 256 fluxgate gradiometer (15th February 2019 and 8th March 2019). Grids were laid out over the survey area, aligning with the field sides to make the surveying efficient. Their locations were recorded with reference to two telegraph poles in the field and identifiable fence posts. These were used to align the results to the background map.

The traverse interval was 1 metre and the sample interval 0.125 metres using a zig-zag path. Before each survey session, care was taken to ensure the gradiometer was allowed to reach equilibrium with air temperature, that it was effectively balanced to all compass points and vertically, and that it was zeroed in the direction of first traverse. The settings were regularly checked during each survey session and at each change of surveyor.

The data (measured in nano-tesla) were logged via the built-in data logger, then downloaded to a laptop after each survey session, before being analysed using Geoplot. Data was assembled into a composite image, de-spiked or clipped to remove the distorting high magnitude effects of surface or near surface iron objects. The data were then inspected to identify the distorting effects of gates, wire fences and other large metal objects and these highly distorting data were replaced by dummy values (which the software ignores in subsequent analysis). Each grid was edge-matched to give a uniform visual appearance (zero mean grid) and any stripe errors removed with zero mean traverse. The data were interpolated in the x and y directions to improve the images for interpretation. Every effort was made to keep processing to a minimum to avoid introducing artificially generated “features”.

## 4.4. Earth resistance

The same grids were used for the earth resistance survey as for the gradiometry survey.

The resistance survey was undertaken using a Geoscan RM15 with multiplexer MPX15 using two pairs of electrodes on a frame, each at a 0.5 metre separation. Remote probes were positioned at least 15m from the measurement location. A standard method was employed in all survey areas; repeated zig-zag parallel traverses were made at 1 metre traverse intervals and 0.5 metre sample intervals across each 20 metre grid square. The survey was undertaken in a zig-zag manner, recording the data in ohms with the inbuilt data logger.
Data was downloaded to a laptop and analysed with Geoplot. Care was taken to process each grid in a similar manner, with the data being assembled into a composite image, before being inspected

for erroneously high occasional readings, which were removed by de-spiking or clipping. The particular resistivity equipment used seemed to be unduly sensitive to jarring if hidden, but near surface, stones were hit, which generated “spikes” in the data. The data were interpolated in the x and y directions to improve the images for interpretation. Every effort was made to keep processing to a minimum to avoid introducing artificially generated “features”.

There were two tranches of resistance testing.

1. The first tranche was completed with 2 day’s work (3rd July 2018 and 11th December 2018). Very different weather conditions prevailed on these two days. The first was after an extensive drought, whereas the second followed a significant amount of rain. There was a big difference in the character of the results taken on these two days. Significant processing or the data was needed match both the mean and variances of the data sets. This left uncertainty over the results, so a second tranche of measurements (see below) were taken to get clearer results and confirm those already collected.
2. In the second tranche (26th March 2019) the focus was the region with evident anomalies. The physical set up was the same as before as was the sampling process. However, the multiplexer was programmed to take measurements between pairs of probes from the array of four probes set 0.5m apart. The readings were
    a. Two readings with a 0.5m spacing (as above),
    b. two readings at 1m spacing and
    c. one reading at 1.5m spacing.

    Here, only the pair of readings at 0.5m spacing have been reported. They were combined in Geoplot to produce the second set of measurements equivalent to the standard method reported above.

## 4.5. Probing

Four traverses of probing were completed. Metal rods of about 1.1m length and 3mm diameter were pushed by hand into the soil at measured locations. They were pressed as hard as the individual could into the soil and the depth achieved was recorded by noting the ground level on the rod and measuring with a tape measure to the end of the rod. These measurements are recorded to the nearest centimetre.

These measurements were taken on two occasions, the first (traverse 1, 8th March 2019 was a single traverse down along the baseline of the grid was performed with single readings at 5m intervals conducted by one volunteer.

On a subsequent occasion (4th September 2019) this process was repeated for 3 traverses across high resistance features in the earth resistance data. Three individuals made repeat measurements at each location. If the person taking the reading felt they had "Hit" an obstruction and this was what stopped the probe going further, this was recorded as a "Hit". If a "Hit" was not recorded then the depth may be greater than this measured value. Sometimes the “Hit” was clearly audible. At other times repeat probings went further than the “Hit” reading. It is likely that sometimes stones in the soil were struck and repeats missed these. This variability is discussed below.

# 5. Results and discussion

## 5.1. Lidar

### 5.1.1. Lidar results

Basic height contours from the Environment Agency lidar data are presented below for the site and nearby fields. The near parallel lines of blue and yellow in the surroundings show the widespread ridge and furrow around the site.

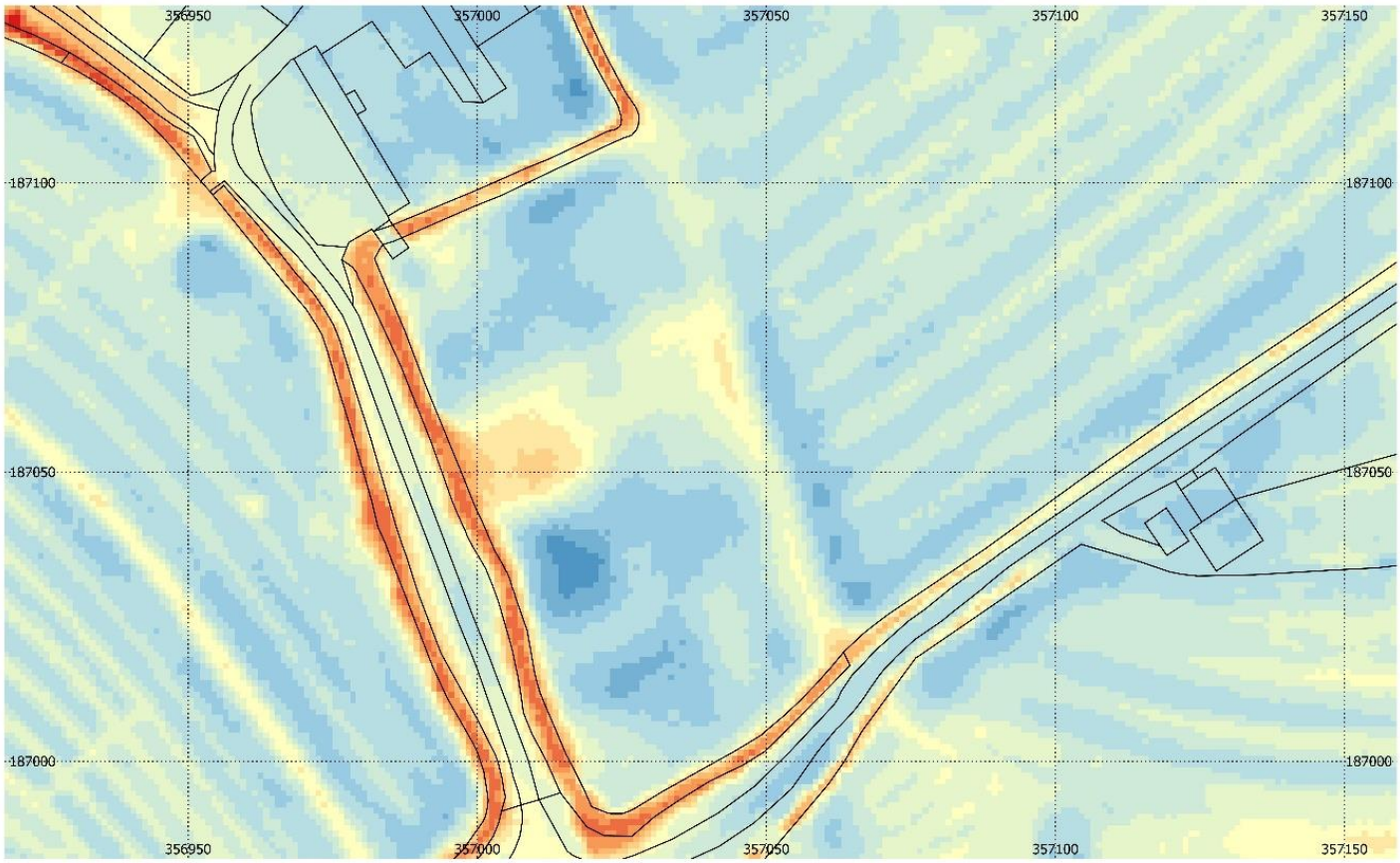


*Figure 5:- Height Contours AOD from lidar data (data.gov.uk, nd). Downloaded 15th May 2019. These Environment Agency data are used in accordance with the "Open Government Licence". MasterMap data provided by South Gloucestershire Council for this project 9th July 2018.*

*OS data © Crown copyright & database rights 2019 Ordnance Survey*

### 5.1.2. Lidar Discussion

Figures 3, 4 and 5, together with the alternative interpretations of the Lidar data presented in Appendix 4, show that this field was different in character to those around it. It has no trace of ridge and furrow cultivation but contains notable bumps, up to 1m metre from trough to crest. The crests are typically around 20m apart. This contrasts with the surrounding ridge and furrow, which is rather variable but, near the site, is typically about 0.3m from trough to crest with the crests about 10m apart.

It appears that, in its history, the site has been treated very differently to the area around. This clear difference in character is what alerted the group to the field.

## 5.2. Historical Environment Record

The details of the historical investigation are in section 1. Examination of the HER record brought up several very local events. None refer specifically to the site. Figure 6 captures the locations on the map and the text from the records is reproduced below.

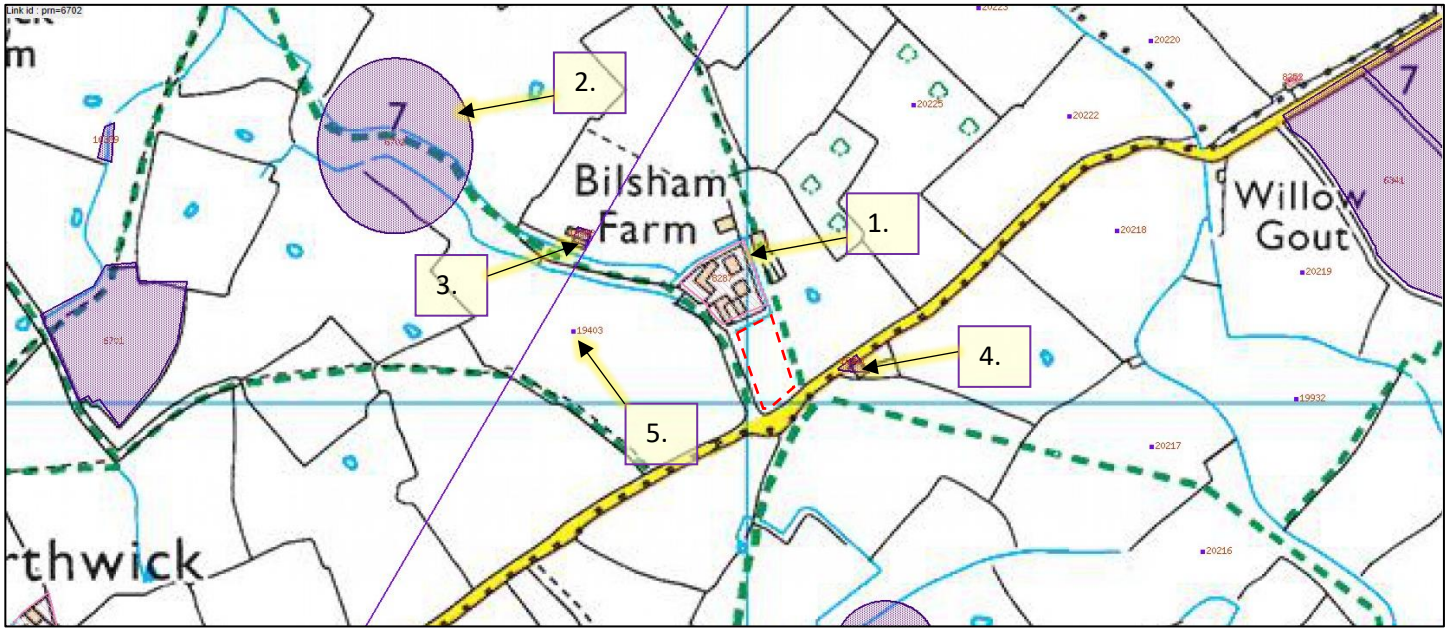


*Figure 6:- South Gloucestershire HER map showing features around the site of interest.*
*OS data © Crown copyright & database rights 2019 Ordnance Survey*

1. PRN 8287:- Settlement - Bilsham Farm Pilning, (C950). The name “Billes Hamme” is recorded in Smith (1964). The current farmhouse appears to be 18/19C.
2. PRN 6702:- Enclosure Pilning Farm, Pilning. Earthworks forming the remains of two rectangular enclosures, with possibly the remains of a building, at the north west end of a broad drove. McDonnel (1989)
3. PRN 16388:- Barn Bilsham Farm Pilning, A small building, probably a barn, was noted at this location on the 25” 1st edition OS map
4. PRN 16311:- A small building, probably a barn, was noted at this location on the 25” 1st edition OS map. (South Gloucestershire Council, 2008)
5. PRN19403:- An area of ridge and furrow cultivation was noted on an aerial photograph

The earthworks noted above (PRN6702) can, most likely, be seen as green areas marked on the Survey of Lands map, noted in fig. 1 of section 1. In this map the extent of Bilsham Green is recorded together with some identified features. In figure 7, this map is repeated with North to the top of the page. Beside this map is the lidar data with a outline of the map features superimposed. This shows that the basic outline, the green features and adjacent field boundaries can still be seen.

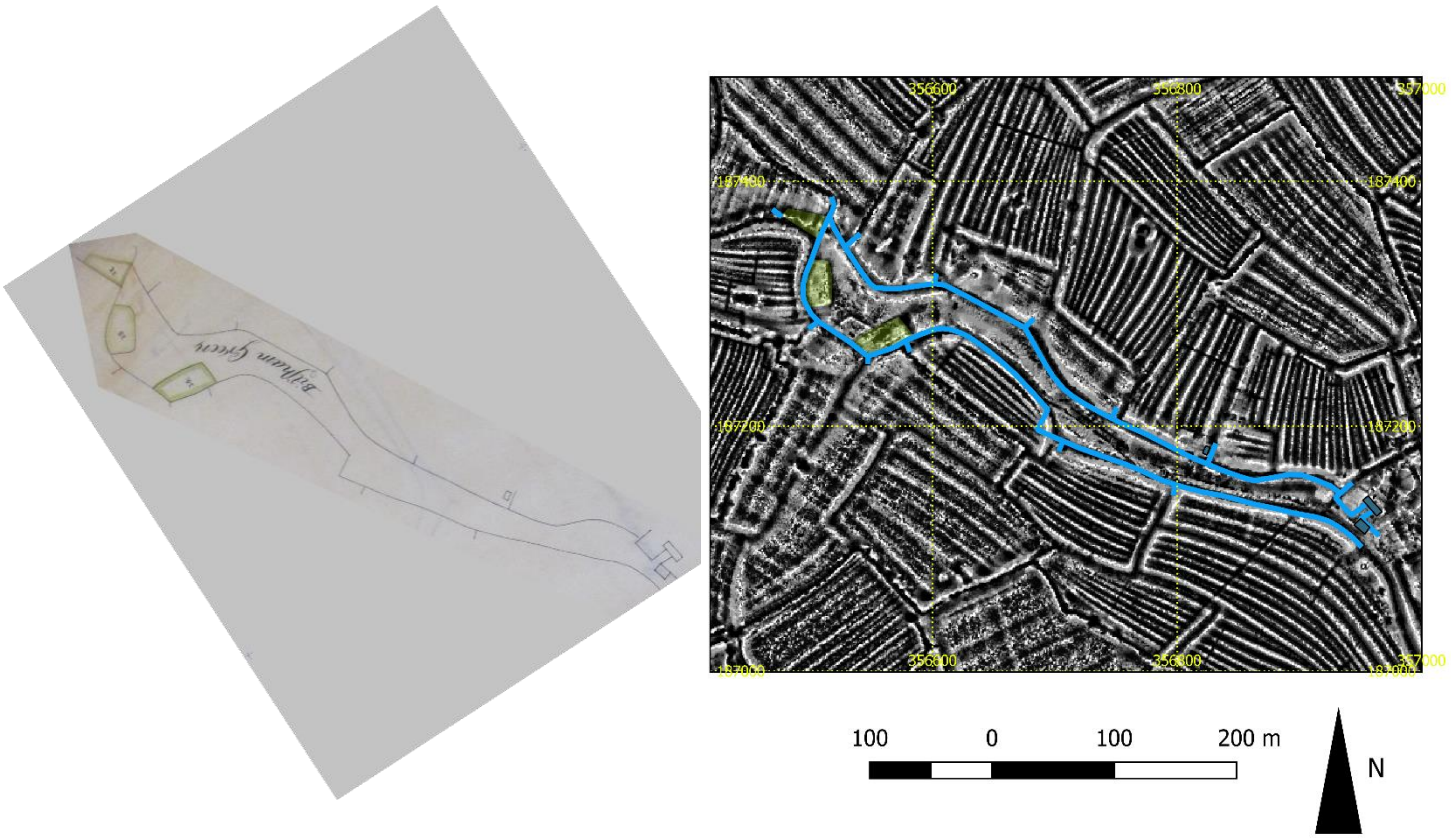


*Figure 7:- Left- Bilsham Green in an extract from the "Survey of Lands" map 1810, section 1, figure 1. Here, it is orientated with north up the page.*
*Right - Lidar results from the area around the site. Copy of Bilsham Green outline shown in blue, features from the map in green*
*Positive openness calculated from Lidar data (data.gov.uk, nd). Downloaded 15th May 2019.*
*Minimum (e.g. bottom of ditch) 1.4° Black Maximum (e.g. top of hump) 131° White*
*These Environment Agency data are used in accordance with the "Open Government Licence".*
*Analysis using RVT (Kokalj et al, 2016)*

## 5.3. Geophysical results – Gradiometry

### 5.3.1. Gradiometry results

Ten 20m by 20m grids were surveyed with a gradiometer. The processed results are included in figure 8, overlain on the MasterMap and lidar contours of soil surface height.

### 5.3.2. Gradiometry discussion

We cannot identify significant features from the gradiometry results. There is a weak response in the form of a north/south feature with low response but in among the variation in the field this may well be simple variation in the data. We do not draw any conclusions on the basis of these data.

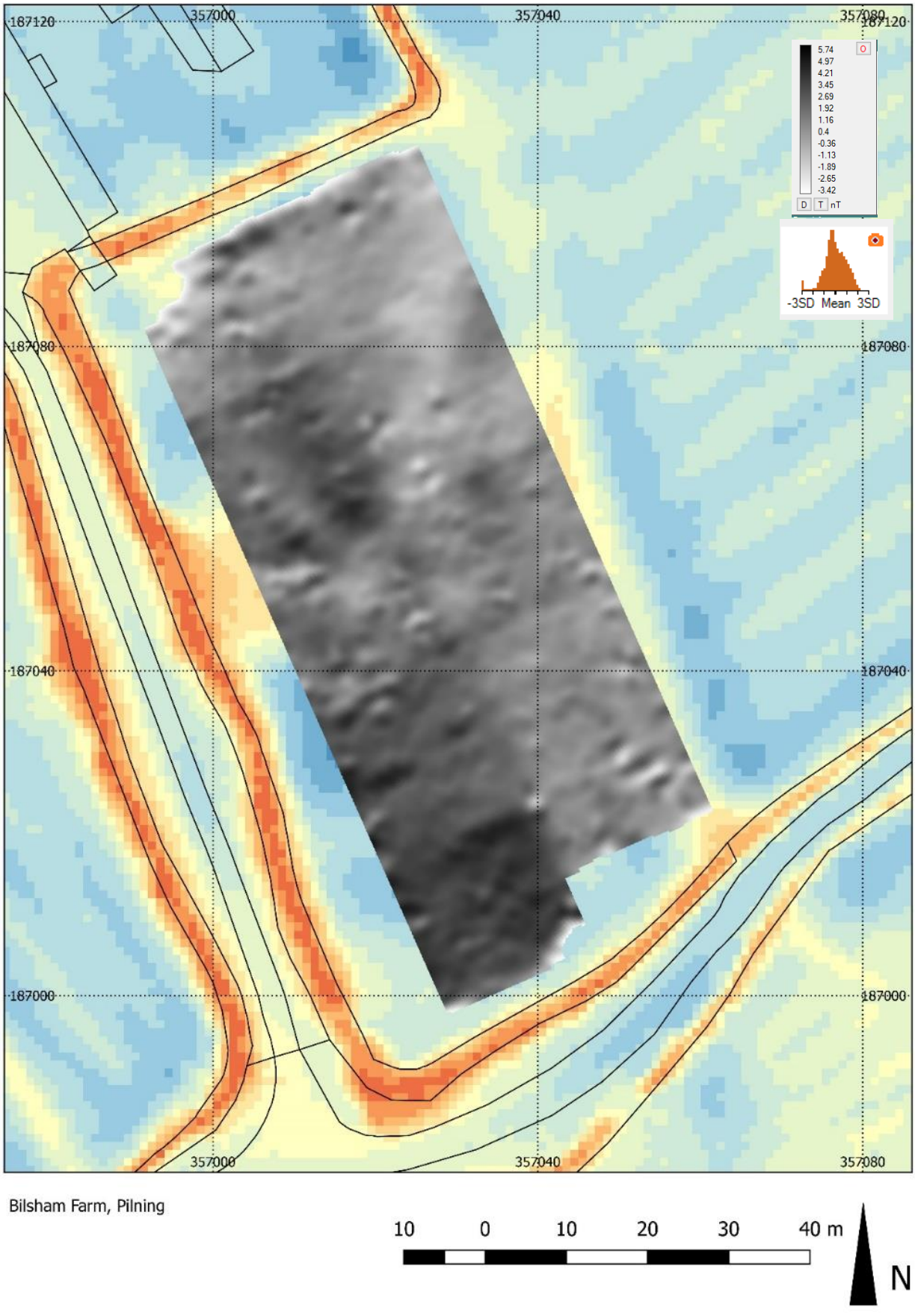


*Figure 8:- Results of gradiometry survey, dark reflects high values.*
*Height Contours AOD from Lidar data (data.gov.uk, nd). Downloaded 15th May 2019. These Environment Agency data are used in accordance with the "Open Government Licence".*
*MasterMap data provided by South Gloucestershire Council for this project 9th July 2018*
*OS data © Crown copyright & database rights 2019 Ordnance Survey*

## 5.4. Geophysical results – Earth resistance

### 5.4.1. Earth Resistance - results

The following figures are processed results from the earth resistance surveys. Figure 9 shows the results of the second, more focused, earth resistance survey, overlain on the MasterMap and lidar contours of soil surface height. Figure 10 is a closer view. Figure 11 overlays these on the earlier broader earth resistance survey to put it in context. Finally Figure 12 reflects the transcription of the key features.

### 5.4.2. Earth Resistance - discussion

There are notable high resistance features in the earth resistance data that do not reflect the topography of the site.

The evident features cover an area of about 40m by 40m with individual features up to about 5m across. It is not clear whether the responses extend beyond the field, under the farm track to the west and, therefore, beyond the area accessible for survey. The earth resistance results are not clear enough to make unequivocal statement on the extent and shapes of the features. If these features are man-made, rather than natural, their date and purpose are not known.

Interpreting the features is rather speculative but here they have been divided into two: irregular features (outlined in green in figure 12) and features that may be linear features of nearly constant width (outlined in red in figure 12).

Potentially the linear, parallel sided feature may reflect a man-made origin. The irregular features may come from many sources: hard floors, fallen walls, bedrock etc.

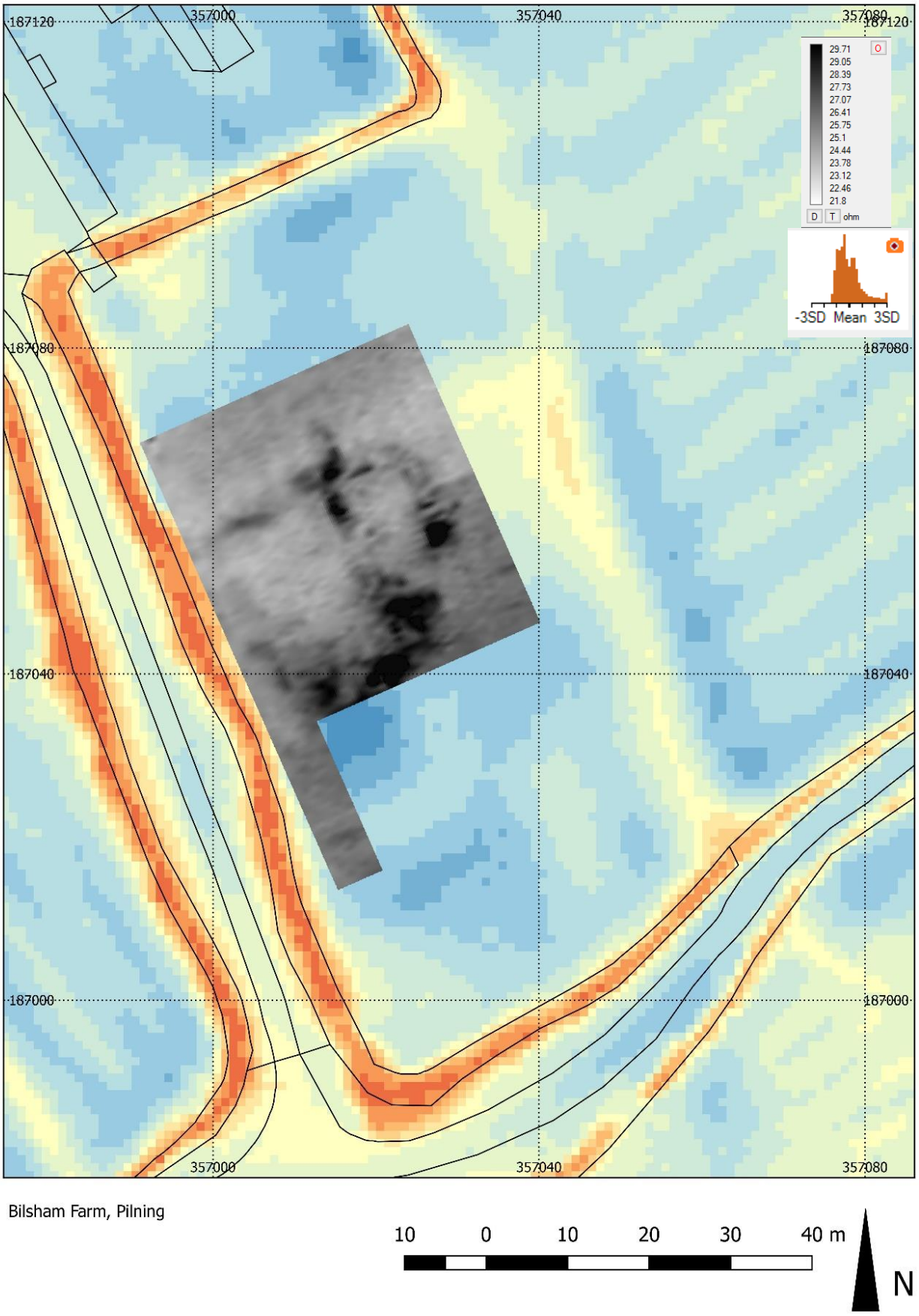


*Figure 9:- Results of focussed second earth resistance survey. Dark is high resistance.*
*Height Contours AOD from Lidar data (data.gov.uk, nd). Downloaded 15th May 2019. These Environment Agency data are used in accordance with the "Open Government Licence". MasterMap data provided by South Gloucestershire Council for this project 9th July 2018.*

*OS data © Crown copyright & database rights 2019 Ordnance Survey*

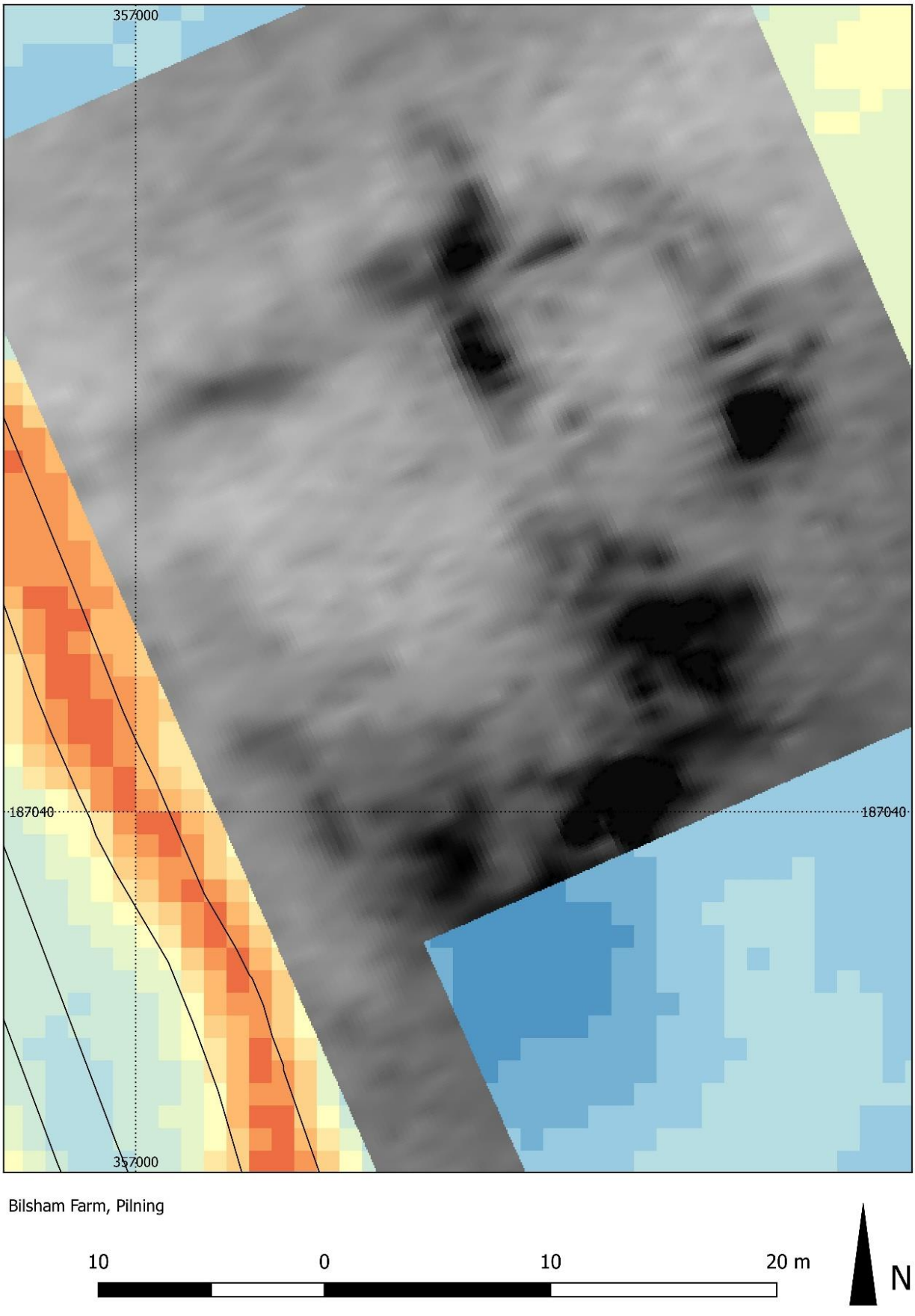


*Figure 10:- Results of focussed second earth resistance survey - closer view. Dark is high resistance. Height Contours AOD from Lidar data (data.gov.uk, nd). Downloaded 15th May 2019. These Environment Agency data are used in accordance with the "Open Government Licence".*
*MasterMap data provided by South Gloucestershire Council for this project 9th July 2018*
*OS data © Crown copyright & database rights 2019 Ordnance Survey*

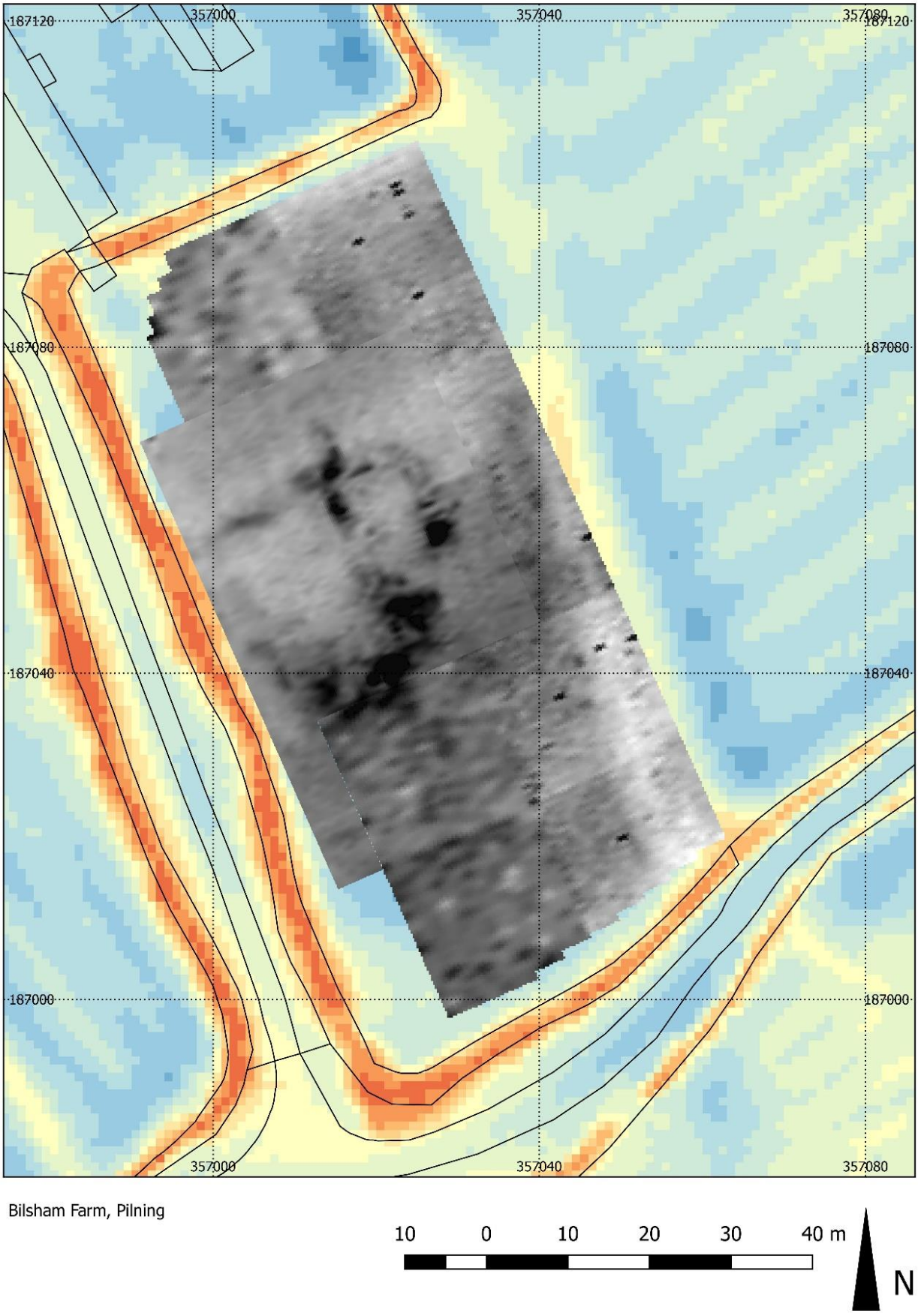


*Figure 11:- Combined results of first and second tranches of earth resistance surveys.*
*Dark is high resistance.*
*Height Contours AOD from Lidar data (data.gov.uk, nd). Downloaded 15th May 2019. These Environment Agency data are used in accordance with the "Open Government Licence".*
*MasterMap data provided by South Gloucestershire Council for this project 9th July 2018*
*OS data © Crown copyright & database rights 2019 Ordnance Survey*

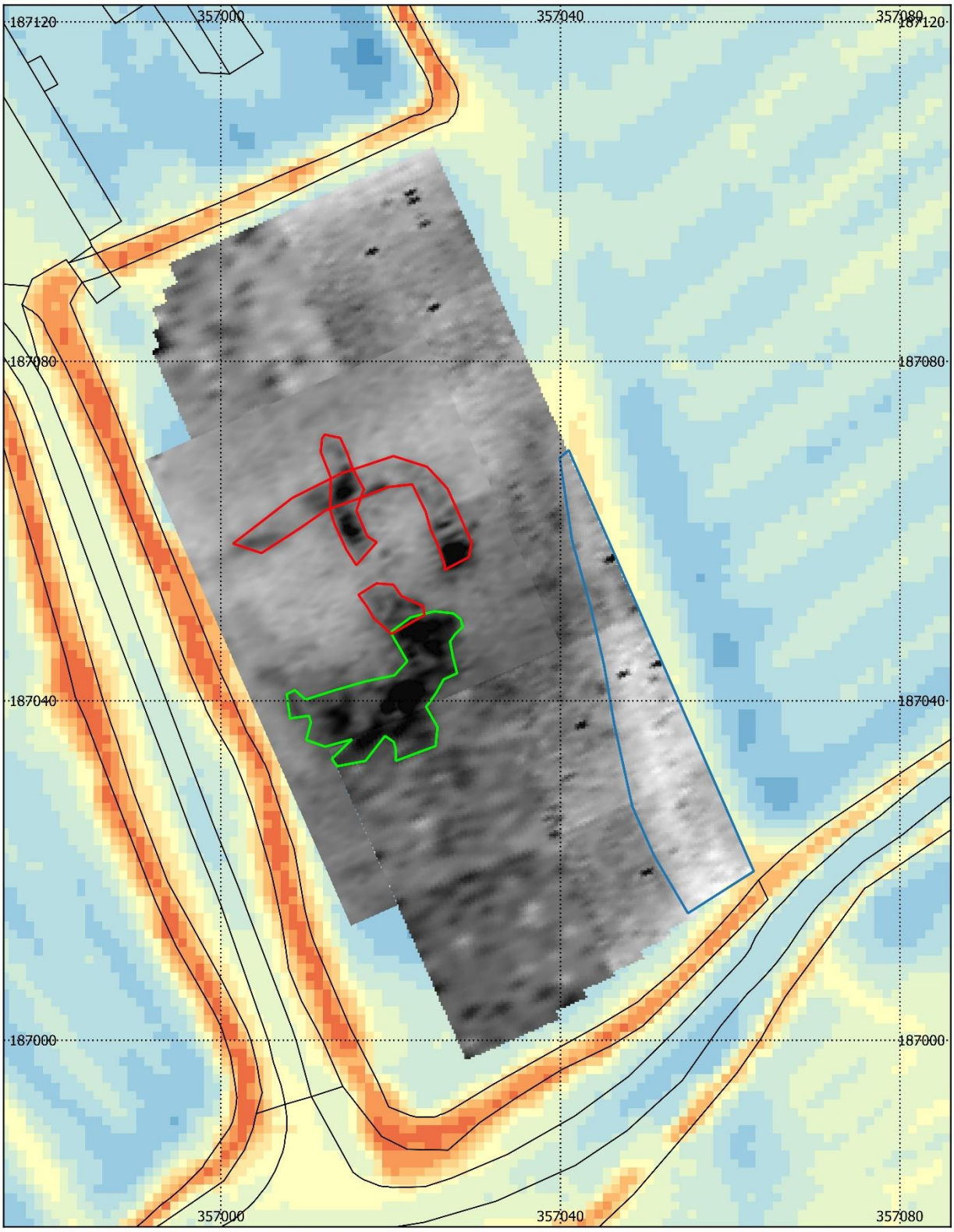


*Figure 12:- Transcription of identified features in earth resistance work.*
*High resistance features which appear to be linear and of similar width are in red; high resistance irregular features are in green; low resistance features in blue*
*Contours AOD from Lidar data (data.gov.uk, nd). Downloaded 15th May 2019. These Environment Agency data are used in accordance with the "Open Government Licence".*
*MasterMap data provided by South Gloucestershire Council for this project 9th July 2018*
*OS data © Crown copyright & database rights 2019 Ordnance Survey*

## 5.5. Probing

### 5.5.1. Probing results

Probing was undertaken on traverses identified in orange in figure 13.

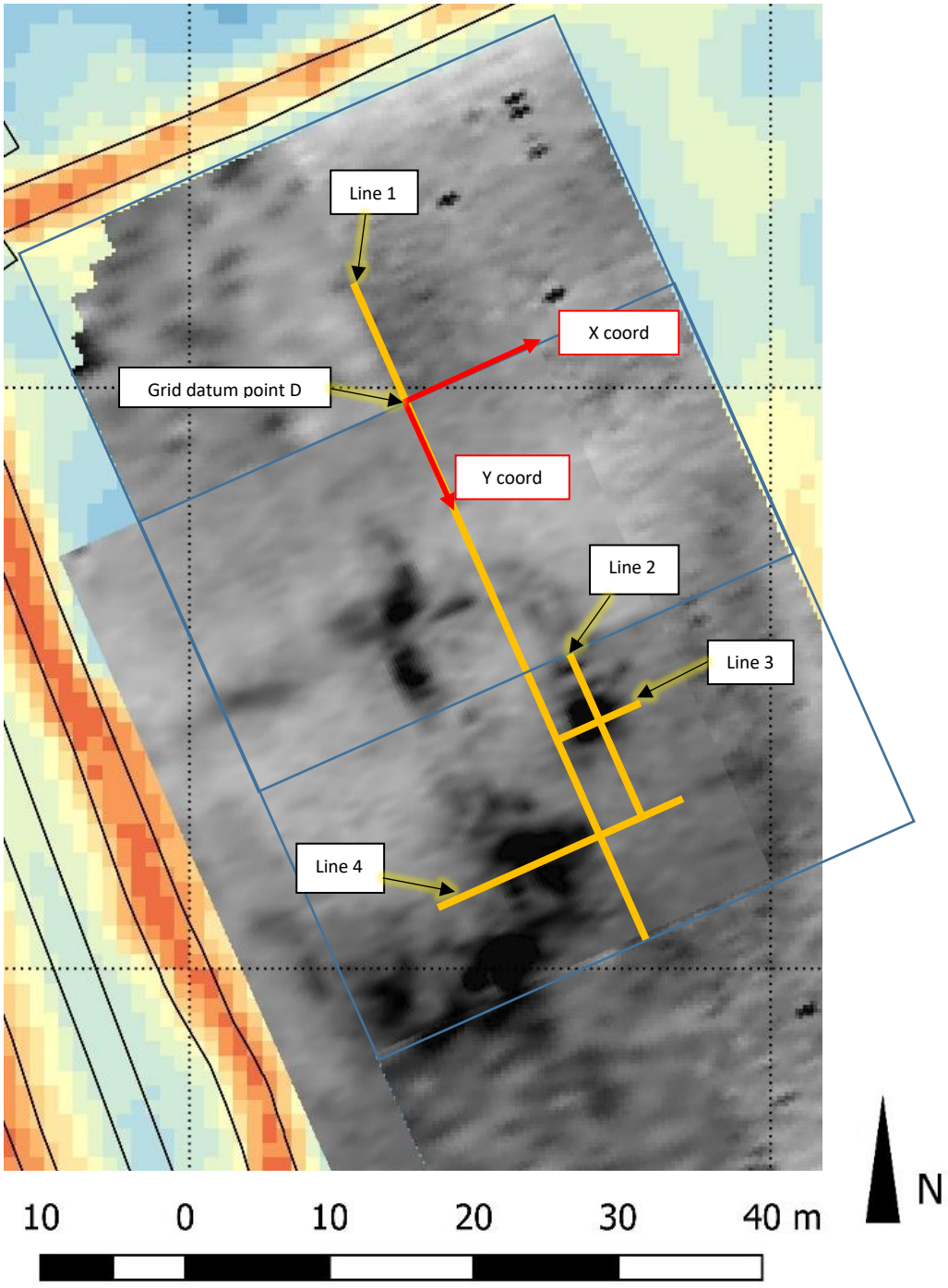


*Figure 13:- Definition of the coordinate system used for reporting probing traverses*
*Contours AOD from Lidar data (data.gov.uk, nd). Downloaded 15th May 2019. These Environment Agency data are used in accordance with the "Open Government Licence".*
*MasterMap data provided by South Gloucestershire Council for this project 9th July 2018*
*OS data © Crown copyright & database rights 2019 Ordnance Survey*

Data were taken on 4 traverses and are reported in Appendix 3.

These data are presented in figure 14. Here the deepest probing attained are recorded as a blue line. If the deepest reading was noted as a "Hit" the point is marked with a green circle. If the variation in the depths recorded was less than 4cm then the point is recorded with an orange triangle

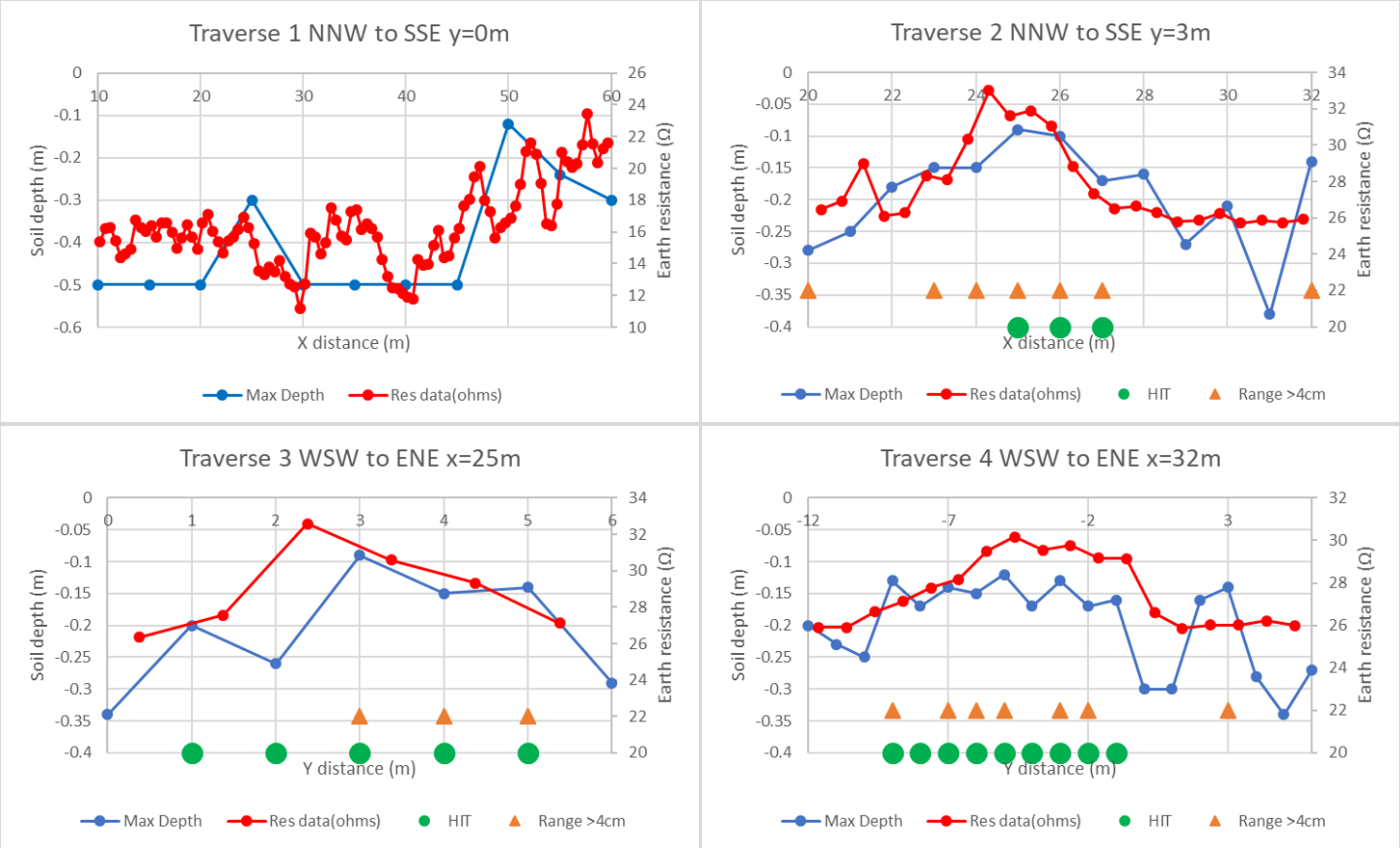


*Figure 14:- Plots of the earth resistance measurements compared to the soil depth from probing. "Hits" and readings with low reading variability are marked. Where the probe does not register a "Hit" the sol is probably deeper than shown. Note:- x and y scales are very different and slopes in the graphs are much steeper than those in the field.*

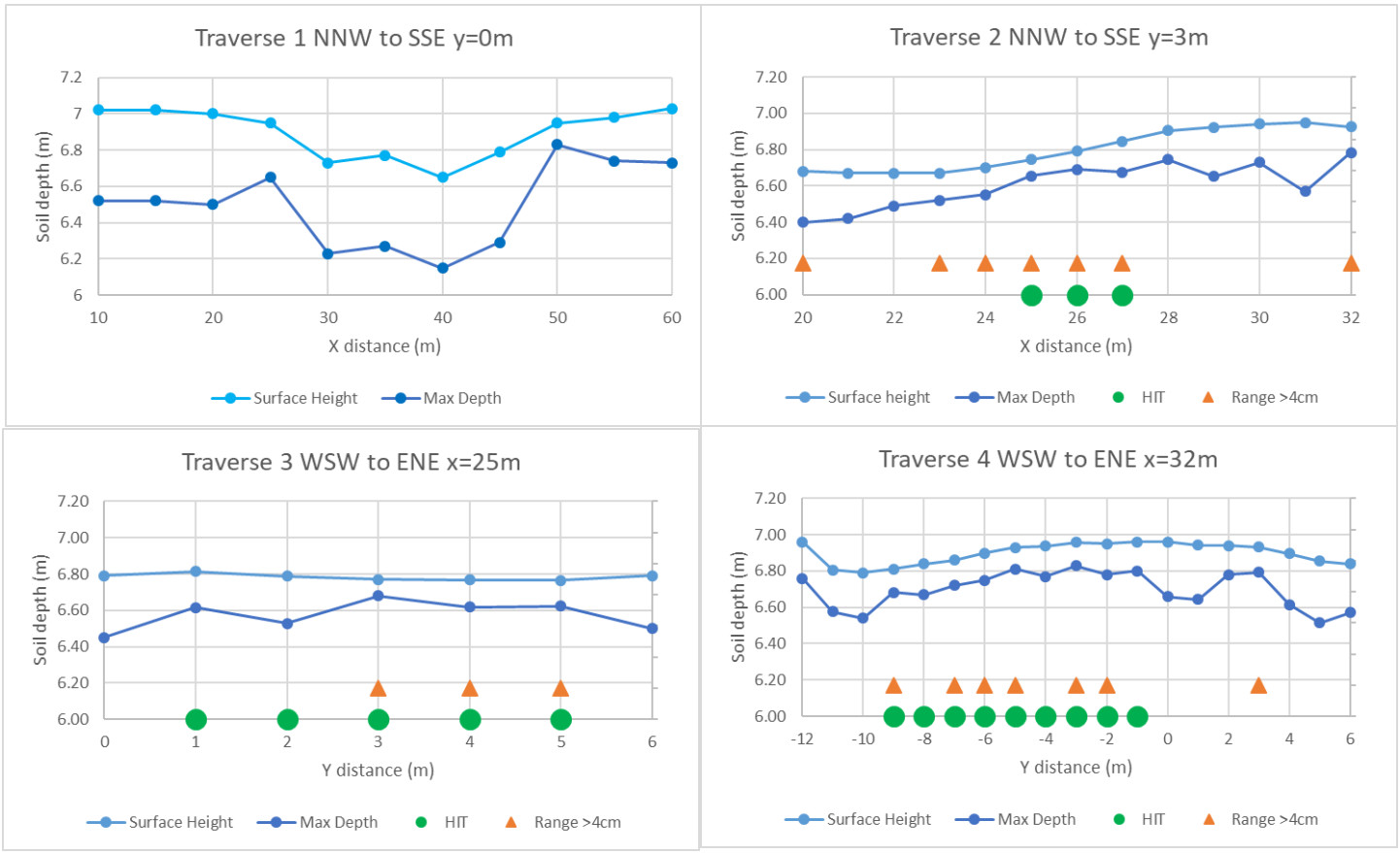


*Figure 15:- Probing depths plotted in absolute terms with reference to AOD. Soil surface is compared with the location that the probing stopped. "Hits" and low reading variability are marked. Where the probe does not register a "Hit" the soil is probably deeper than shown. Note:- x and y scales are very different and slopes shown are not representative of reality.*

### 5.5.2. Probing Discussion

There is a lot of scatter in the data but, in general, the high resistance data correlates with the shallow soil depths, low variability in readings and consistent "Hits". In the high resistance locations probed, the depth of the covering soil is around 0.10 to 0.15 m. Where the soil is deeper the measurements vary much more and while sometimes "Hits" are recorded this is not consistent. In these deep locations it is clearly difficult to get reliable measurements. This may reflect differences in technique of the different surveyors or perhaps the probe is hitting, or just missing, isolated stones in the soil.

Overall, this gives good evidence that, where the earth resistances recorded are high, there is generally only around 0.10 to 0.15m of soil above the features and they are quite "robust".

To identify the levels of probed features Above Ordnance Datum (AOD) the soil surface height can be interpolated from the lidar data and the probing depth subtracted from it. These results are shown in figure 15.

We cannot interpret a better understanding of the features with AOD data than with the simple depth plots (figure 14), the depth of soil above the hard surfaces is roughly constant. It is notable that where the soil surface is highest, the depth of soil is large. This shows that the surface relief does not follow the upper horizon of subterranean features.

## 6. Conclusions

1. Survey of lidar data revealed a site with topographic features that differed notably from the extensive surrounding ridge and furrow cultivation marks
2. Local respondent noted that the ground has not been ploughed in living memory
3. There is nothing specifically about the site in the South Gloucestershire HER.
4. The field containing the site, and the adjacent one, are detached parts of the Parish of Westbury upon Trym. This is a different relationship to that of the surrounding fields which are part of the Parish of Henbury. Perhaps this is a hint towards a difference in their usage in the past.
5. The gradiometry survey results showed no significant features
6. An earth resistance survey over the site gave the most significant features of the project so far, notable high resistance anomalies. Some of these look potentially man-made but establishing what they represent will require excavation.
7. Probing established that the depth of soil over high resistance features was about 0.1 to 0.15m. They also showed that the overall topographic features were unlikely to have been formed by variable bedrock contours under a shallow soil layer.

## 7. Recommendations for further work

If this site were to be investigated further, the next step would be some small test pit or trial trenches over some of the features to further understand the earth resistance results.

## 8. References


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**South Gloucestershire Council (2008)** *Aerial Survey of South Gloucestershire – As cited on HER*

# 9. APPENDIX 1 - Geophysics Analysis histories

**Gradiometry data**

Clip Min=-20 Max=20
==========
Stripe Defect Removal in Non-Bipolar Data
==========
Clip Min=-16 Max=16
Clip Min=-8 Max=8
Clip Min=-5 Max=6
Interpolate Y, Expand - SinX/X, x2
Interpolate Y, Expand - Linear, x2
LPF X=2 Y=1 Wt=G Applications=1
LPF X=3 Y=3 Wt=G Applications=1
LPF X=3 Y=3 Wt=G Applications=1
LPF X=3 Y=3 Wt=G Applications=1
LPF X=3 Y=3 Wt=G Applications=1

**First Earth Resistance data – broad study**

These data were gathered in 2 survey days. The first was very dry and followed a long dry spell the second followed significant rain. These were processed separately to align both the mean values and the variation levels in the data.

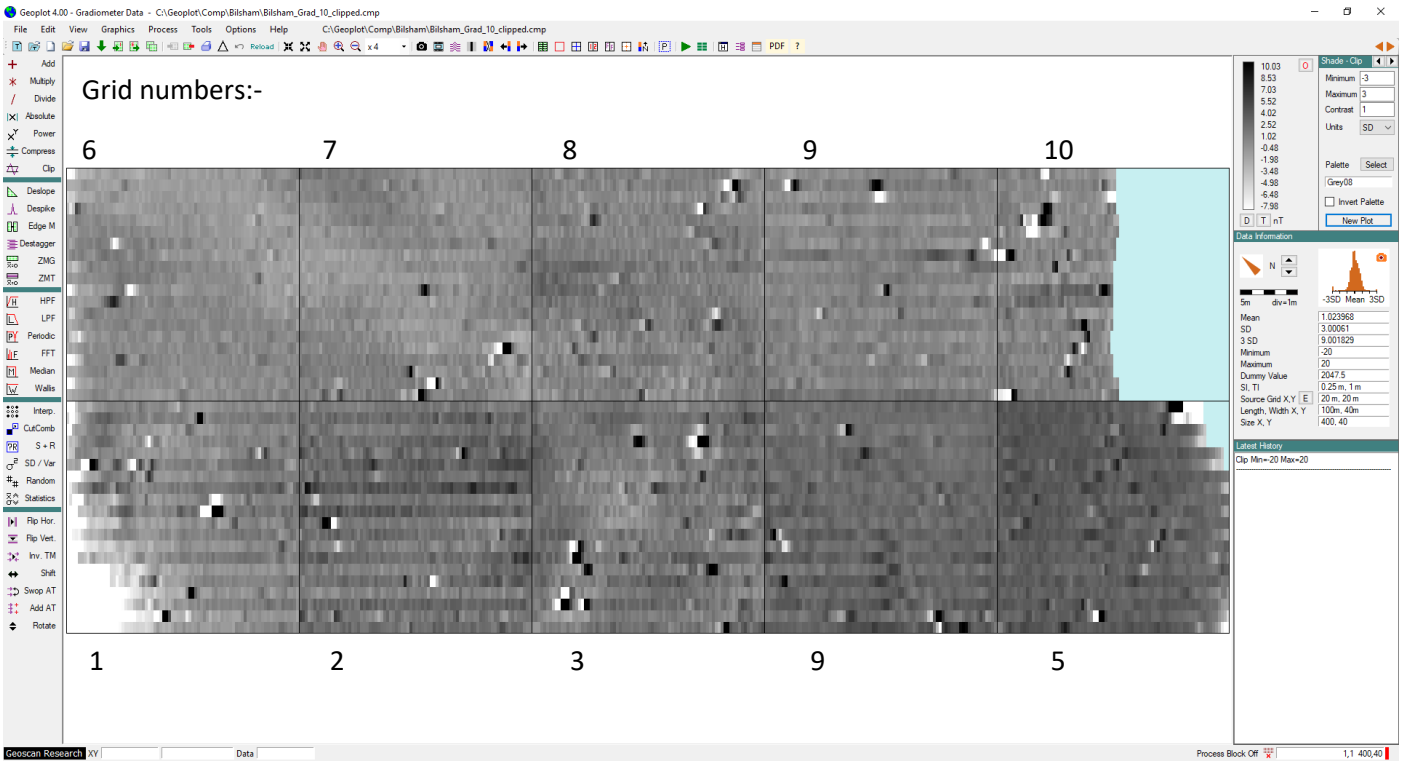
Multiply 4.6, Bl(Inc) 1,1 200,20
Em6T Em7T Em8T Em9T Em10T
Clip Min=0 Max=30
LPF X=2 Y=2 Wt=G Applications=1
, Bl(Inc) 1,21 200,40
Interpolate Y, Expand - SinX/X, x2
Interpolate X, Expand - SinX/X, x2
Interpolate Y, Expand - Linear, x2
Interpolate X, Expand - Linear, x2

**Second Earth Resistance data – focussed study**

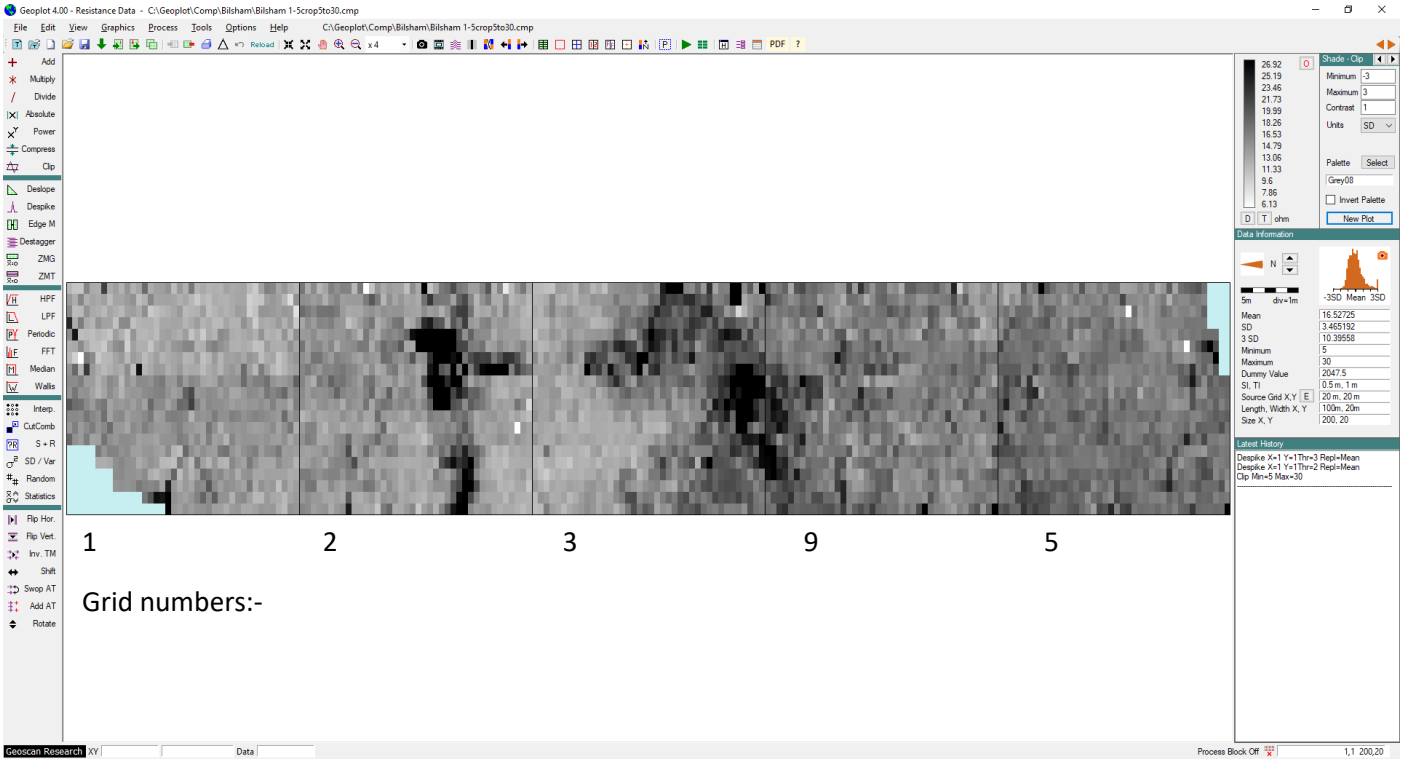
Import Spreadsheet Comma SV
Em4R Em4B Em4T Em5T Em5B Em8R
Despike X=1 Y=1Thr=3 Repl=Mean
Interpolate Y, Expand - SinX/X, x2
Interpolate X, Expand - SinX/X, x2
Interpolate X, Expand - Linear, x2
Interpolate Y, Expand - Linear, x2

# 10. APPENDIX 2 – Minimally processed measurements

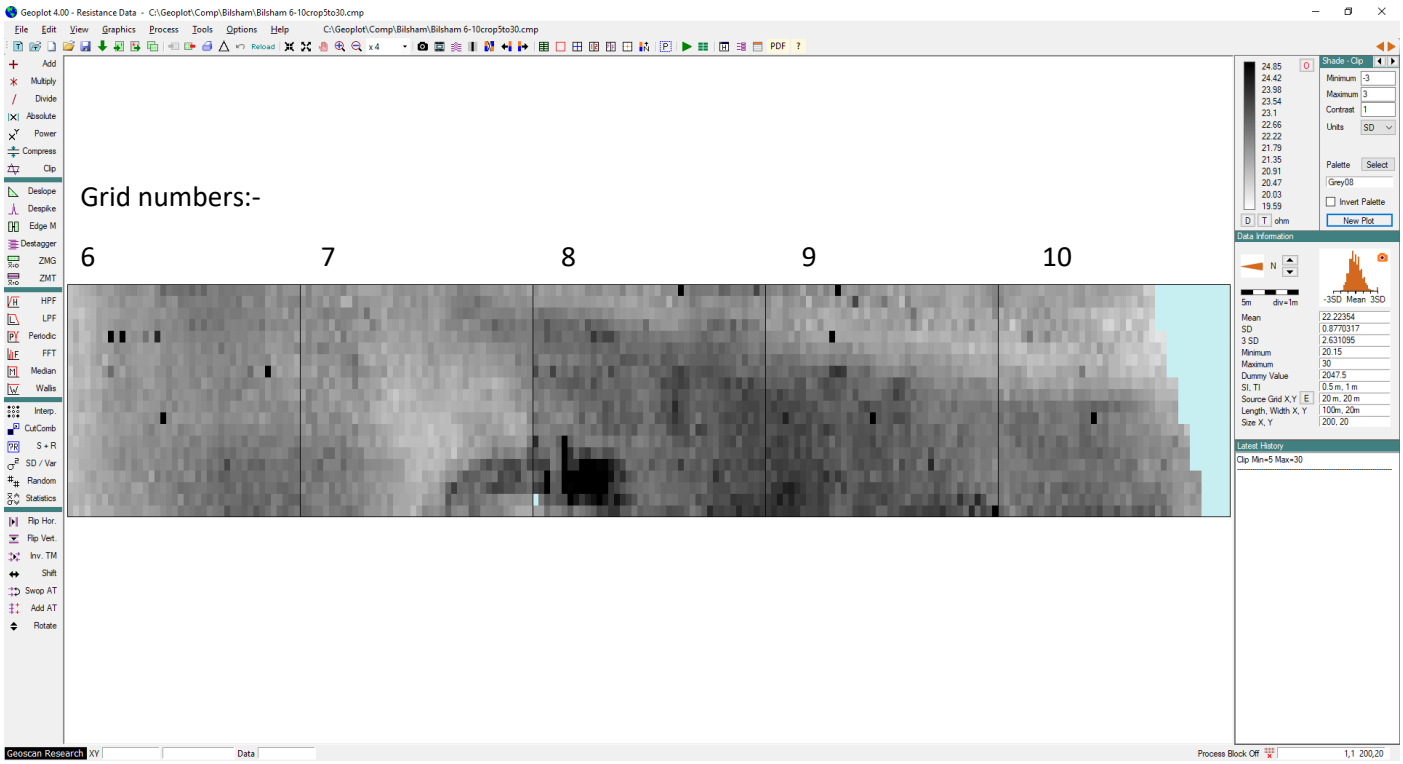
Gradiometer results with minimal processing.



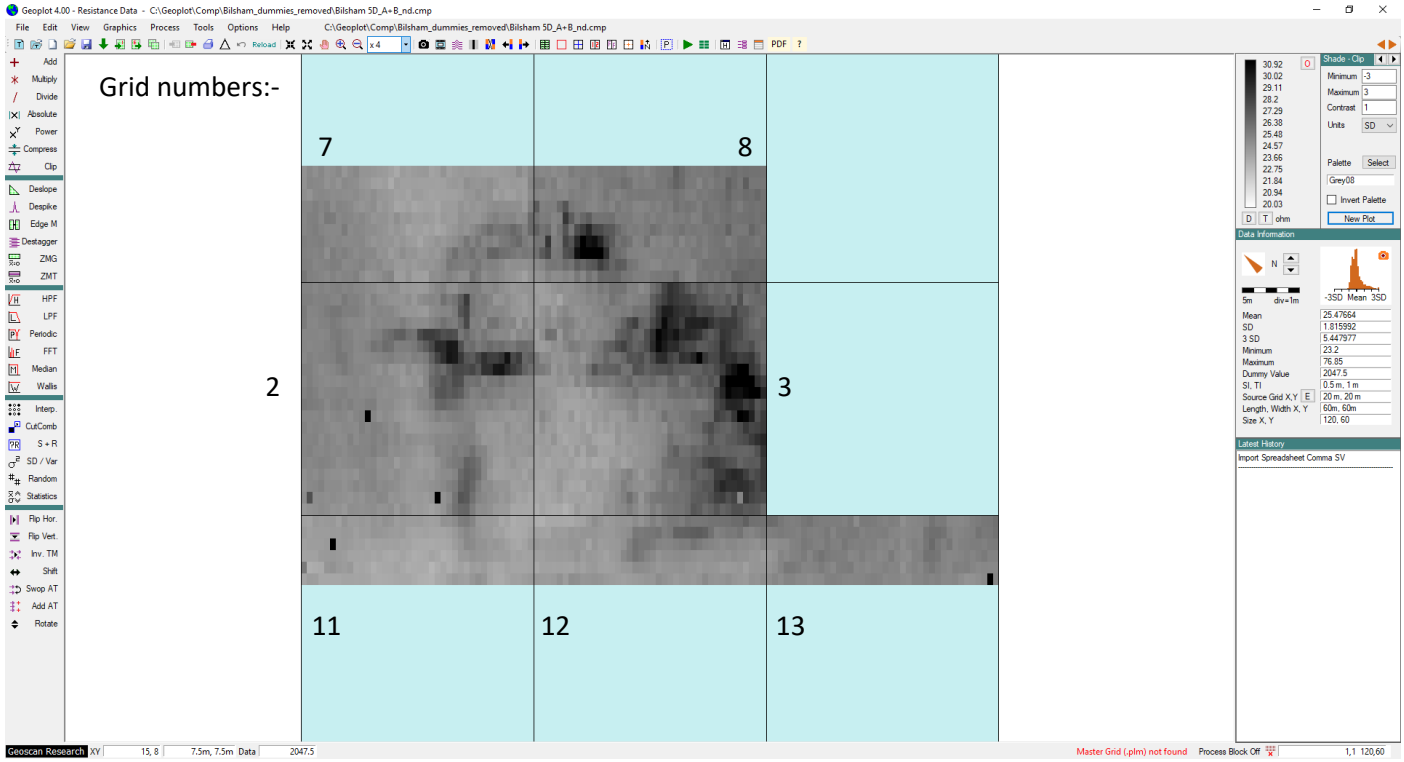

First resistance survey – grids 1 to 5, west grids, minimal processing



First resistance survey – grids 6 to 10, east grids, minimal processing




Second resistance survey all grids, minimal processing



# 11. APPENDIX 3 – Probing measurements

Data were taken on 4 traverses and are reported in the following tables. The locations are recorded via the x and y coordinates laid out in figure 13. The datum location of x=y=0 is the corner point of the geophysics grid, "D", marked on the figure

Traverse 1 Initial traverse (8th March 2019) up the spine of the site y = 0m line.
Reading spacing 5m. No attempt was made to record "Hits"

| X coord (m) | Y coord (m) | Depth (cm) | Surface Height AOD (m) |
|---|---|---|---|
| -10 | 0 | 65 | 7.02 |
| -5 | 0 | 50 | 7.02 |
| 0 | 0 | 50 | 7.00 |
| 5 | 0 | 30 | 6.95 |
| 10 | 0 | 60 | 6.73 |
| 15 | 0 | 50 | 6.77 |
| 20 | 0 | 50 | 6.65 |
| 25 | 0 | 50 | 6.79 |
| 30 | 0 | 12 | 6.95 |
| 35 | 0 | 24 | 6.98 |
| 40 | 0 | 30 | 7.03 |

Traverse 2 (4th September 2019) through region of high resistance along y = 3m line.
Reading spacing 1m. **Bold readings** recorded as "Hits". Surface height interpolated from lidar data.

| X-coord (m) | Y-coord (m) | Depth 1 (cm) | Depth 2 (cm) | Depth 3 (cm) | Depth 4 (cm) | Maximum depth (cm) | Range (cm) | Surface Height AOD (m) |
|---|---|---|---|---|---|---|---|---|
| 20 | 3 | 25 | 28 | | | 28 | 3 | 6.68 |
| 21 | 3 | 15 | 15 | 25 | | 25 | 10 | 6.67 |
| 22 | 3 | 11 | 18 | 15 | | 18 | 7 | 6.67 |
| 23 | 3 | 12 | 15 | 12 | | 15 | 3 | 6.67 |
| 24 | 3 | 12 | 15 | 12 | | 15 | 3 | 6.70 |
| 25 | 3 | **8** | **9** | **8** | **9** | 9 | 1 | 6.75 |
| 26 | 3 | **10** | **9** | **10** | | 10 | 1 | 6.79 |
| 27 | 3 | **16** | **16** | **17** | | 17 | 1 | 6.85 |
| 28 | 3 | 9 | 12 | 16 | | 16 | 7 | 6.90 |
| 29 | 3 | 20 | 22 | 27 | 16 | 27 | 11 | 6.92 |
| 30 | 3 | 14 | 21 | 12 | | 21 | 9 | 6.94 |
| 31 | 3 | 31 | 38 | | | 38 | 7 | 6.95 |
| 32 | 3 | 11 | 14 | 11 | | 14 | 3 | 6.93 |

Traverse 3 (4th September 2019) through region of high resistance perpendicular to traverse 2 along x = 25m line.
Reading spacing 1m. **Bold readings** recorded as "Hits". Surface height interpolated from lidar data.

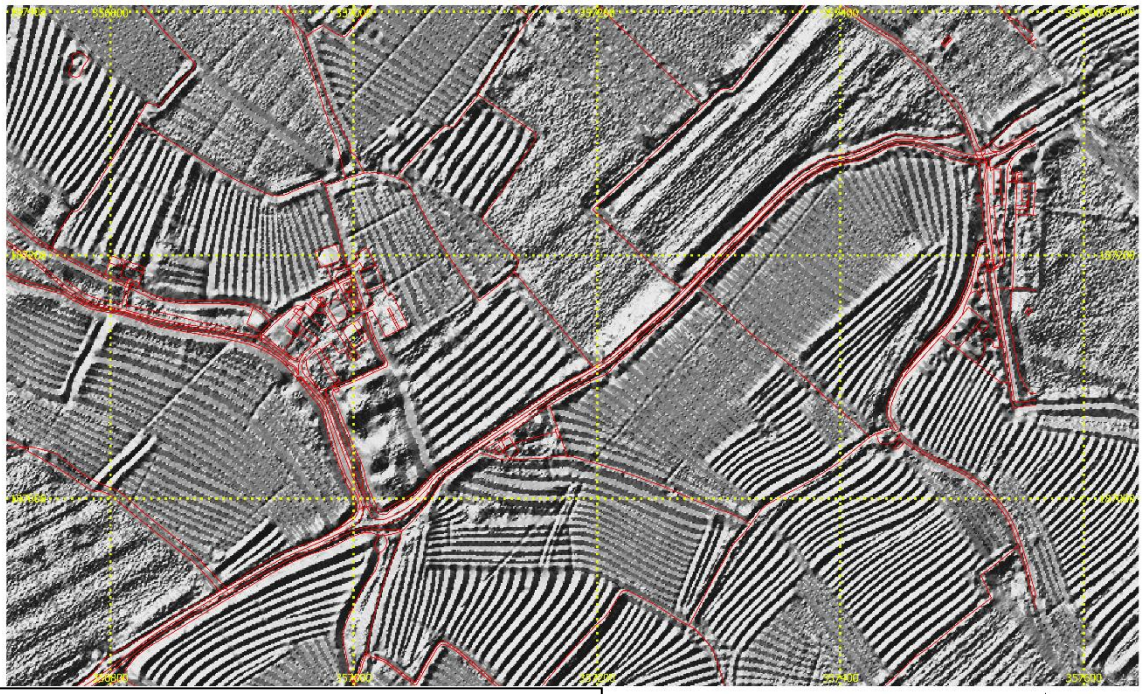
| X-coord (m) | Y-coord (m) | Depth 1 (cm) | Depth 2 (cm) | Depth 3 (cm) | Depth 4 (cm) | Maximum depth (cm) | Range (cm) | Surface Height AOD (m) |
|---|---|---|---|---|---|---|---|---|
| 25 | 0 | 16 | 16 | 34 | | 34 | 18 | 6.79 |
| 25 | 1 | 15 | **20** | **16** | | 20 | 5 | 6.81 |
| 25 | 2 | **15** | **26** | **18** | | 26 | 11 | 6.79 |
| 25 | 3 | **8** | **9** | **8** | **9** | 9 | 1 | 6.77 |
| 25 | 4 | **15** | **14** | **13** | | 15 | 2 | 6.77 |
| 25 | 5 | **13** | **14** | **12** | | 14 | 2 | 6.76 |
| 25 | 6 | **18** | 29 | 14 | **12** | 29 | 17 | 6.79 |

Traverse 4 (4th September 2019) through second high resistance region along x = 32m line.
Reading spacing 1m. **Bold readings** recorded as "Hits" Surface height interpolated from lidar data.

| X-coord (m) | Y-coord (m) | Depth 1 (cm) | Depth 2 (cm) | Depth 3 (cm) | Depth 4 (cm) | Maximum (cm) | Range (cm) | Surface Height AOD (m) |
|---|---|---|---|---|---|---|---|---|
| 32 | -12 | **13** | 16 | 20 | | 20 | 7 | 6.96 |
| 32 | -11 | **11** | 15 | 23 | | 23 | 12 | 6.81 |
| 32 | -10 | **12** | 17 | 25 | | 25 | 13 | 6.79 |
| 32 | -9 | **11** | **10** | **13** | | 13 | 3 | 6.81 |
| 32 | -8 | **17** | 17 | **13** | | 17 | 4 | 6.84 |
| 32 | -7 | **14** | **14** | **14** | | 14 | 0 | 6.86 |
| 32 | -6 | **12** | **15** | **14** | | 15 | 3 | 6.90 |
| 32 | -5 | **10** | **12** | **12** | | 12 | 2 | 6.93 |
| 32 | -4 | **13** | **17** | 14 | | 17 | 4 | 6.94 |
| 32 | -3 | **12** | **13** | **13** | | 13 | 1 | 6.96 |
| 32 | -2 | **17** | **14** | **14** | | 17 | 3 | 6.95 |
| 32 | -1 | **11** | **16** | **10** | | 16 | 6 | 6.96 |
| 32 | 0 | **30** | **13** | 11 | 29 | 30 | 19 | 6.96 |
| 32 | 1 | 30 | **11** | **20** | | 30 | 19 | 6.94 |
| 32 | 2 | **10** | 16 | **12** | | 16 | 6 | 6.94 |
| 32 | 3 | **11** | 14 | **11** | | 14 | 3 | 6.93 |
| 32 | 4 | 13 | 22 | 28 | | 28 | 15 | 6.90 |
| 32 | 5 | 13 | 34 | **14** | | 34 | 21 | 6.86 |
| 32 | 6 | **11** | 27 | 21 | | 27 | 16 | 6.84 |

These data are presented in figure 14.

# 12. APPENDIX 4 – Alternate views of Lidar data



Hill shade interpretation calculated from Lidar data (data.gov.uk, nd). Downloaded 15th May 2019.
Azimuth 315° Elevation 35°
Range:- -1 Black to +1 White (RVT units)
These Environment Agency data are used in accordance with the "Open Government Licence". Analysis using RVT (Kokalj et al, 2016)

0 100 200 300 m

N

Sky-View Factor calculated from Lidar data (data.gov.uk, nd). Downloaded 15th May 2019.
Radius 10 pixels. 16 Search directions
Range:- 0 Black to 0.8 White (RVT units)
These Environment Agency data are used in accordance with the "Open Government Licence". Analysis using RVT (Kokalj et al, 2016)

0 100 200 300 m

N

Open positiveness calculated from Lidar data (data.gov.uk, nd).
Downloaded 15th May 2019.
Radius 10 pixels. 16 Search directions
Range:- 1.4° Black to 131° White
These Environment Agency data are used in accordance with the "Open Government Licence". Analysis using RVT (Kokalj et al, 2016)


# 13. APPENDIX 5 – Lidar data references

https://environment.data.gov.uk/DefraDataDownload/?Mode=survey

A consistent set of data recorded in the same flight was downloaded, 15th May 2019, from the most recent 1m spacing data available on the website at the time:- LIDAR-DTM-1M-2015-ST58ne

Specific files:-

dtm_F0181528_20150406_20150407_mm_units.asc
dtm_F0181529_20150406_20150407_mm_units.asc
dtm_F0181530_20150406_20150407_mm_units.asc
dtm_F0181535_20150406_20150407_mm_units.asc
dtm_F0181536_20150406_20150407_mm_units.asc
dtm_F0181537_20150406_20150407_mm_units.asc
dtm_F0181541_20150406_20150407_mm_units.asc
dtm_F0181542_20150406_20150407_mm_units.asc
dtm_F0181543_20150406_20150407_mm_units.asc