



Archaeological Services  
University of Durham

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# **Rushpool Cottages Flood Alleviation Scheme, west of Neasham Road, Darlington, County Durham**

## **geophysical surveys**

*on behalf of*

**Northumbrian Water Ltd**

**Report 2116**  
November 2008

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***Northumbrian Water Ltd***

*Estates and Conservation Team, Abbey Road, Pity Me, Durham DH1 5FJ*

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## **1. Summary**

### ***The project***

- 1.1 This report presents the results of geophysical surveys conducted in advance of proposed pipe-laying west of Neasham Road, Darlington. The works comprised the geophysical survey of two areas totalling 0.5ha in size.
- 1.2 The works were commissioned by Northumbrian Water Ltd and conducted by Archaeological Services Durham University.

### ***Results***

- 1.3 No features of likely archaeological significance were identified, though it was not possible to collect data in some areas due to ground conditions.
- 1.4 Ferrous pipes were identified in both areas surveyed.

## **2. Project background**

### ***Location*** (Figure 1)

- 2.1 The study area was located opposite Rushpool Cottages, west of Neasham Road, to the south of Darlington, County Durham (NGR centre: NZ 31181 11324). Surveys were conducted in two areas.

### ***Development proposal***

- 2.2 The development proposal is for the installation of a new pipeline as part of a flood alleviation scheme.

### ***Objective***

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

### ***Methods statement***

- 2.4 The surveys have been undertaken in accordance with a specification provided by Durham County Council Archaeology Section (Appendix).

### ***Dates***

- 2.5 Fieldwork was undertaken between on 11<sup>th</sup> November 2008. This report was prepared between 12<sup>th</sup> and 28<sup>th</sup> November 2008.

### ***Personnel***

- 2.6 Fieldwork was conducted by Ed Davies and Natalie Swann (Supervisor). This report was prepared by Natalie Swann, with illustrations by David Graham and Janine Wilson, and edited by Duncan Hale, the Project Manager.

### ***Archive/OASIS***

- 2.7 The site code is **DNR08**, for **Darlington Neasham Road 2008**. The survey archive will be supplied on CD to the Bowes Museum in due course. Archaeological Services is registered with the **Online Access to the Index of archaeological investigationS** project (OASIS). The OASIS ID number for this project is **archaeol3-52009**.

## **3. Archaeological and historical background**

- 3.1 In recent years the use of aerial photography has established that there are a number prehistoric settlement sites and other potential archaeological sites in the Rushpool Cottages/Neasham area.



#### **4. Landuse, topography and geology**

- 4.1 At the time of survey the central part of the proposed development area comprised two fields of pasture. It was not possible to collect data at the western end of the site due to piles of building rubble and spoilheaps associated with the adjacent building site there. Also, it was not possible to conduct survey at the east end of site due to an established pond and high reeds to the west of the road and metal buildings to the east of road.
- 4.2 The study area was predominantly level with a mean elevation of 34m OD.
- 4.3 The underlying solid geology of the area comprises Roxby Formation, overlain by Devensian glacio-lacustrine deposits.

#### **5. Geophysical survey**

##### ***Standards***

- 5.1 The surveys and reporting were conducted in accordance with English Heritage guidelines *Geophysical survey in archaeological field evaluation, 2<sup>nd</sup> edition* (David, Linford & Linford 2008); the Institute of Field Archaeologists Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2002).

##### ***Technique selection***

- 5.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a variety of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar and electromagnetic survey. Some techniques are more suitable than others in particular situations, depending on a variety of site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.
- 5.3 In this instance, based on nearby aerial photographic evidence, it was considered likely that cut features such as ditches and pits might be present on the site, and that other types of feature such as trackways, wall foundations and fired structures (for example kilns and hearths) might also be present.
- 5.4 Given the anticipated shallowness of targets and the non-igneous geological environment of the study area a geomagnetic technique, fluxgate gradiometry, was considered appropriate for detecting the types of feature mentioned above. This technique involves the use of hand-held magnetometers to detect and record anomalies in the vertical component of the Earth's magnetic field caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect archaeological features.

### ***Field methods***

- 5.5 A 30m grid was established across each survey area and tied-in to known, mapped Ordnance Survey points using a Leica GS50 global positioning system.
- 5.6 Measurements of vertical geomagnetic field gradient were determined using a Bartington Grad601-2 dual fluxgate gradiometer. A zig-zag traverse scheme was employed and data were logged in 30m grid units. The instrument sensitivity was set to 0.1nT, the sample interval to 0.25m and the traverse interval to 1.0m, thus providing 3600 sample measurements per 30m grid unit.
- 5.7 Data were downloaded on site into a laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

### ***Data processing***

- 5.8 Geoplot v.3 software was used to process the geophysical data and to produce both continuous tone greyscale images and trace plots of the raw (unfiltered) data. The greyscale images and interpretations are presented in Figures 2-4; the trace plots are provided in Figure 5. In the greyscale images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. A palette bar relates the greyscale intensities to anomaly values in nanoTesla.
- 5.9 The following basic processing functions have been applied to the data/each dataset:

|                           |   |
|---------------------------|---|
| <i>clip</i>               | clips, or limits data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic.        |
| <i>zero mean traverse</i> | sets the background mean of each traverse within a grid to zero; for removing striping effects in the traverse direction and removing grid edge discontinuities.    |
| <i>despike</i>            | locates and suppresses iron spikes in gradiometer data.   |
| <i>interpolate</i>        | increases the number of data points in a survey to match sample and traverse intervals. In this instance the data have been interpolated to 0.25 x 0.25m intervals. |

### ***Interpretation: anomaly types***

- 5.10 Colour-coded geophysical interpretation plans are provided in Figure 3. One type of geomagnetic anomaly has been distinguished in the data:
- |                         |  |
|-------------------------|--|
| <i>dipolar magnetic</i> | paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials (including fences and service pipes) and/or fired structures such as kilns or hearths. |
|-------------------------|--|

### ***Interpretation: features***

- 5.11 Small, discrete dipolar magnetic anomalies have been detected in both of the survey areas. These almost certainly reflect items of near-surface ferrous and/or fired debris, such as horseshoes and brick fragments, and in most cases have little or no archaeological significance. A sample of these is shown on the geophysical interpretation plans, however, they have been omitted from the archaeological interpretation plans and the following discussion.
- 5.12 Intense dipolar magnetic anomalies were detected along both the eastern and western edges of both survey areas. These anomalies correspond to the locations of known service pipes with the exception of the westernmost anomalies. The presence of an inspection cover there, and the intensity of the geomagnetic anomalies, suggests that a pipe or drain also lies along that land boundary.

## **6. Conclusions**

- 6.1 Two small geomagnetic surveys were undertaken west of Neasham Road, Darlington, County Durham.
- 6.2 No features of likely archaeological significance were identified, though it was not possible to collect data in some areas due to ground conditions.
- 6.3 Ferrous pipes were identified in both areas surveyed.

## **7. Sources**

David, A, Linford, N, & Linford, P, 2008 *Geophysical survey in archaeological field evaluation, 2<sup>nd</sup> edition*, English Heritage

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

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

## Appendix: Project specification

**SPECIFICATION FOR A ARCHAEOLOGICAL GEOPHYSICAL SURVEY  
For Rushpoole Cottages Flood Alleviation Scheme  
DARLINGTON  
Co. Durham**

### 1.0 Site Location

- 1.1 The proposed pipeline route lies to the south of Darlington, north of Hurworth on Tees, and to the east of Neasham Road County Durham. The site is also crossed by Strait Lane.
- 1.2 The pipeline is centred on OS grid reference NZ3118111324 (see Figure 1).
- 1.3 The site is currently agricultural and the pipeline route is approx 240 metres in length.

### 2.0 The Development

- 2.1 The client for this work is Northumbria Water Ltd.
- 2.2 It is proposed to install 300mm pipeline via open cut trenching with a max working width of 5 metres and depth of cover between 1.2 and 5m. The pipeline will not follow an existing route.

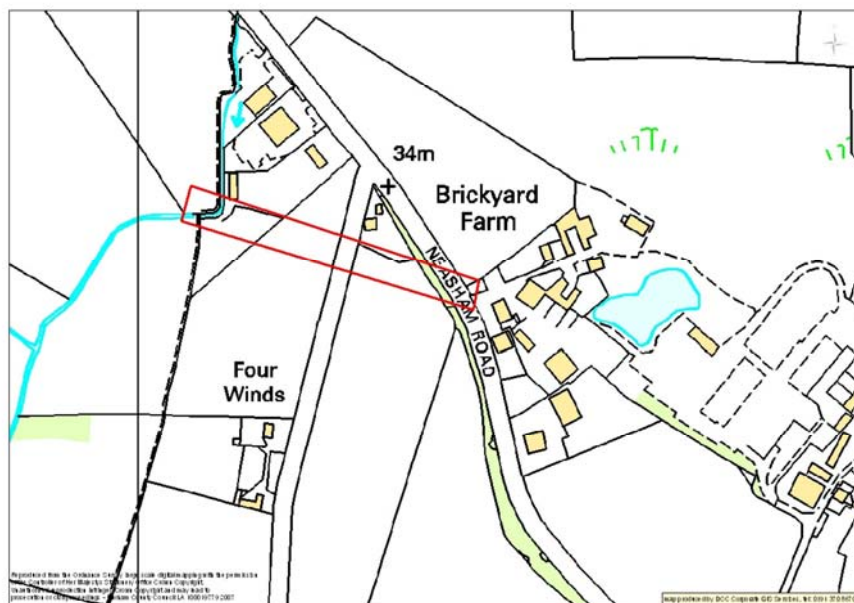


Figure 1: Site location shown in red (© Durham County Council)



### 3.0 Archaeological and Historical Background

- 3.1 In recent years air photography has established that there are a number of unidentified sites and prehistoric settlement sites in the vicinity of Rushpool Cottages/ Neasham area.

### 4.0 Archaeological brief

- 4.1 This brief sets out the standards and methodology for the geophysical survey, how it must be carried out, to mitigate the impact of the proposed pipeline development.
- 4.2 In order to evaluate the archaeological potential for remains of any period, the site must first be sampled by geophysical survey.
- 4.3 The overall objectives of the project are to determine if there are any deposits or features relating to archaeological/historical land use. Specific aims and objectives must be indicated by the appointed archaeological contractor and must take into account the recently published research framework for the North-East (NERRF).
- 4.4 **This brief does not constitute the "written scheme of investigation" which must be submitted by Hartlepool Water and approved by Durham County Council Archaeology Section in advance of any ground works commencing on the site.**

### Geophysical survey

- 4.5 The use of remote sensing geophysical techniques (magnetometer survey, unless another method can be shown to be more effective) will be required to help define the potential archaeological features which may exist on the site.
- 4.5 Given the nature of the ground works, the survey must cover 100% of the route except where ground conditions, vegetation or water cover makes it impracticable. In addition a buffer zone along both sides of the pipeline will be needed to consider 'the impact of the development on obtaining geophysical data in the future'. In particular ferrous pipelines will produce a large area of magnetic disturbance, up to 20m either side of the pipeline, which will compromise the subsequent acquisition of magnetic and electromagnetic data, once in place it will not be possible to detect archaeological remains using a magnetometer within a radius of about 20m either side of the pipe". (English Heritage 2008).
- 4.6 Given the size of the pipe and the working area, a 15m buffer zone is considered appropriate. This is required on either side of the proposed line of the pipe which will equal a 30m wide transect overall.
- 4.7 The overall purpose of the geophysical survey will be:
- to establish the presence/absence, and nature of any archaeological anomalies within the area specified
  - to define the extent of any such anomalies, and to characterise, if possible
  - to establish the presence/absence, and nature of any known modern anomalies within the area of proposed development which may affect the results
- 4.8 Methodologies must be clearly costed in the tender document and information on how the contractor proposes to conduct the work clearly set out in the project design document.
- 4.9 A 30m survey grid must be placed across the site and must be accurately tied in to local topographic features and overlaid onto an OS map base. The grid tie-in information should be made available in,



or with, the final report so that the location plan can be related to the OS National Grid. Once the survey is complete any markers used must be removed from site. The results, including archaeological interpretation of the data must be set out in a report format with maps and must be available to aid placement of the subsequent evaluation trenches.

- 4.10 **Depending on the results of the evaluation phase, further works may be required to mitigate the impact of the scheme on any archaeological remains.** This will be dealt with by a separate brief should this be required.

## **5.0 OASIS**

- 5.1 The Durham County Council Archaeology Section supports the Online Access to Index of Archaeological Investigations (OASIS) Project. The overall aim of the OASIS project is to provide an online index to the mass of archaeological grey literature that has been produced as a result of the advent of large scale developer funded fieldwork.
- 5.2 The archaeological contractor must therefore complete the online OASIS form at <http://ads.ahds.ac.uk/project/oasis/> within 3 months of completion of the work. Contractors are advised to ensure that adequate time and costings are built into their tenders to allow the forms to be filled in.
- 5.3 Technical advice must be sought in the first instance from OASIS ([oasis@ads.ahds.ac.uk](mailto:oasis@ads.ahds.ac.uk)) and not from Durham County Council Archaeology Section.
- 5.4 Once a report has become a public document by submission to or incorporation into the SMR, Durham County Council Archaeology Section will validate the OASIS form thus placing the information into the public domain on the OASIS website.
- 5.5 The archaeological consultant or contractor must indicate that they agree to this procedure within the specification/project design/written scheme of investigation submitted to Durham County Council Archaeology Section for approval

## **6.0 Health and Safety Policy**

- 6.1 Contractors are expected to abide by the 1974 *Health and Safety Act* and its subsequent amendments as stated in the *Construction and Design Management Regulations 1994*. Appropriate provision of first aid, telephone and safety clothing as described in the *SCAUM* manual on archaeological health and safety must be followed. Each site must have a nominated safety officer.
- 6.2 The undertaking of a risk assessment prior to the commencement of works is required. A copy of the risk assessment must be circulated to the client and any other sub-contractors working on the site at the same time. Contractors must ensure that all staff working on the site are fully briefed on all health and safety issues relating to the site prior to working there.
- 6.3 Adequate and secure safety fencing must be placed around excavated trenches in order to inhibit easy access by the public. Clear signage regarding excavation trenches must be displayed on the fences and site perimeter as necessary. These items must be agreed with the client prior to work commencing and detailed in the WSI.
- 6.4 Contractors are advised to identify the location of any services or overhead wires which may cross the site and ensure that they are clearly marked before trenching commences so that they can be avoided.



- 6.5 The archaeological contractor is responsible for all on-site safety issues in relation to the archaeological works.

## **7.0 Publication**

- 7.1 All assessments, evaluations and watching briefs which do not progress to further excavation and research (with the relevant post-excavation and publication scheme and costs), must have a time and budget allocation identified for publication. This must be to a minimum standard to include a summary of the work, findings, dates, illustrations and photographs and references to where the archive is lodged.
- 7.2 Editors of regional journals, either the *Durham Archaeological Journal* or *Archaeologia Aeliana* must be contacted for information on outline publication costs, fuller figures may be worked out on completion of the watching brief. As the final note is largely unpredictable in advance a contingency sum must be set aside at the outset of work in the tender.
- 7.3 County Durham Archaeology Section produces an annual publication every March which highlights the archaeological work conducted in the county over the previous 12 months. To this end, it is now a requirement of every specification that a précis of archaeological works conducted in the county as a result of PPG16 must be submitted to the DCC Archaeology Section.
- 7.4 The précis must be no more than 500 words in length and it would be appreciated if JPEG or TIFF images of a minimum of 300dpi are also included. The summary must be sent to the County Archaeologist by the beginning of December of the same year in which the work was conducted.

## **8.0 The Report**

- 8.1 At least two paper copies of the report must be sent to the client as well as one bound paper copy to the HER as well as **one digital copy with images** which can be used to enhance the on-line HER website *Keys To The Past* (PDF on CD-Rom is acceptable). The geophysical survey report must include the following:
- executive summary
  - a site location plan to at least 1:10,000 scale with 10 figure central grid reference
  - OASIS reference number
  - contractor's details including date work carried out
  - nature and extent of the proposed development, including developer/client details
  - description of the site location and geology
  - geophysical technical and processing information
  - geophysical results
  - geophysical discussion and interpretation
  - a plot of the raw geophysical data (to an appropriate scale)
  - geophysical plots must show the location of modern intrusions (i.e. services etc)
  - geophysical X-Y trace and greyscale and/or dot density plots (to an appropriate scale)
  - geophysical interpretative feature map (to an appropriate scale)
  - discussion of the results of field work
  - suggestions regarding the need for, and scope of, any further archaeological work, including publication
  - bibliography
- 8.2 A report synthesising the results of the works must be produced for the client and the County Durham HER. This must include a site location plan with NGR references, and also be accompanied by additional plans/map extracts to display noted and recorded archaeological features as appropriate.



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

#### **9.0 The Tender**

- 9.1 Tenders for the work must include a method statement and the following:
- 9.2 Brief details of the organisation and the number of staff who are proposing to carry out the work including any relevant specialisms or experience.
- 9.3 The earliest date at which the work can be commenced and the amount of notice required to initiate the fieldwork.
- 9.4 Details concerning proposed methods of recording.
- 9.5 Statement agreeing to complete the OASIS forms on completion of the evaluation report.
- 9.6 An estimate of how long the work will take broken down by time and cost in terms of data collection and report production (the anticipated extent of the work must be confirmed with the client in advance) on a *per diem* basis where possible (this is particularly in reference to the specialists' costs). The tender must include a breakdown of costs attributable to:
- travelling and subsistence
  - geophysical survey
  - report production
  - archiving deposition charge
  - publication
  - administration
  - other

#### **10.0 Submission of Report**

- 10.1 A final paper copy and PDF on CD-Rom of the report, the précis and digital images of the site for the *Keys To The Past* website must be sent to the Archaeology Section, Durham County Council for inclusion into the County Durham Archaeological Archive (SMR) at:

Archaeology Team, Adult & Community Services, Culture & Leisure, Durham County Council, The Rivergreen Centre, Aykley Heads, Durham, DH1 5TS

#### **11.0 Notice**

- 11.1 The County Archaeologist must be given two weeks notice in writing of the commencement of evaluation works. During such works the County Archaeologist or her nominated representative must be allowed access to the site and excavations at all reasonable times.

#### **12.0 References**

- |                               |      |   |
|-------------------------------|------|---|
| Archaeological Archives Forum | 2007 | <i>Archaeological Archives: A guide to best practice in creation, compilation, transfer and curation.</i> |
|-------------------------------|------|---|





*Geophysical Survey: Bradley OCCS (Highways) Derwentside*

|  |      |   |
|--|------|---|
| English Heritage                         | 1991 | <i>Management of Archaeological Projects 2</i>  |
|  | 2002 | <i>Guidelines for Environmental Archaeology: a guide to the theory and practice of methods from sampling and recording to post-excavation</i> |
|  | 2006 | <i>Understanding Historic Buildings: A Guide to Good Recording Practice</i>   |
|  | 2008 | <i>Geophysical Surveys in Field Evaluation</i>  |
| Institute of Field Archaeologists        | 1999 | <i>Standard and Guidance: Archaeological Excavation</i>   |
|  | 2001 | <i>Standards and Guidance For The Archaeological Investigation and Recording of Standing Buildings or Structures</i>                          |
| United Kingdom Institute of Conservation | 1990 | <i>Guidelines for the Preparation of Excavation</i>   |

**27 October 2008**  
**Deborah Anderson**  
**DCC Archaeology**





Archaeological Services  
University of Durham

Rushpool Cottages Flood Alleviation Scheme,  
west of Neasham Road, Darlington, County Durham

geophysical surveys

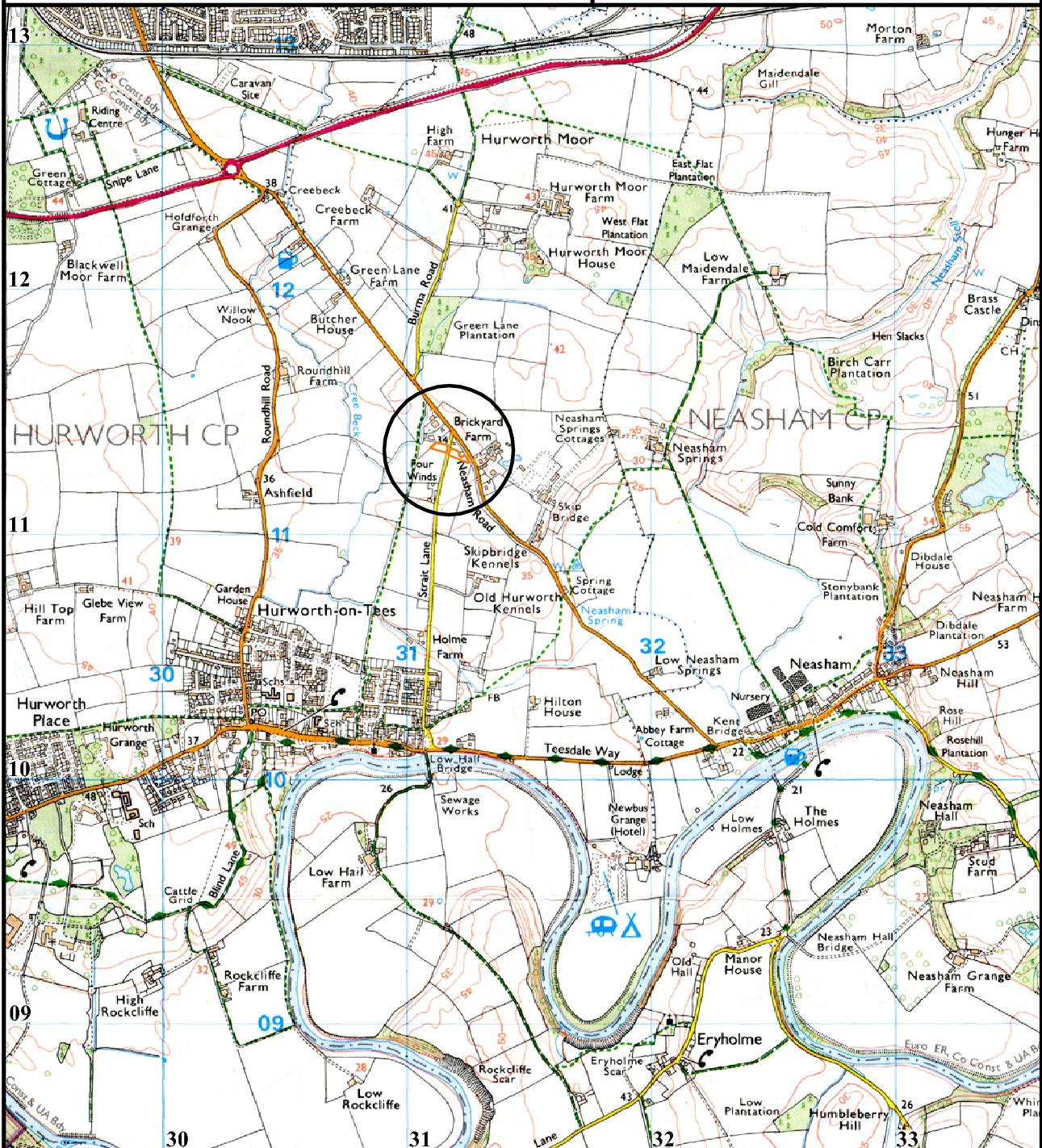
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Figure 1

Site location

on behalf of  
**Northumbrian Water Ltd**

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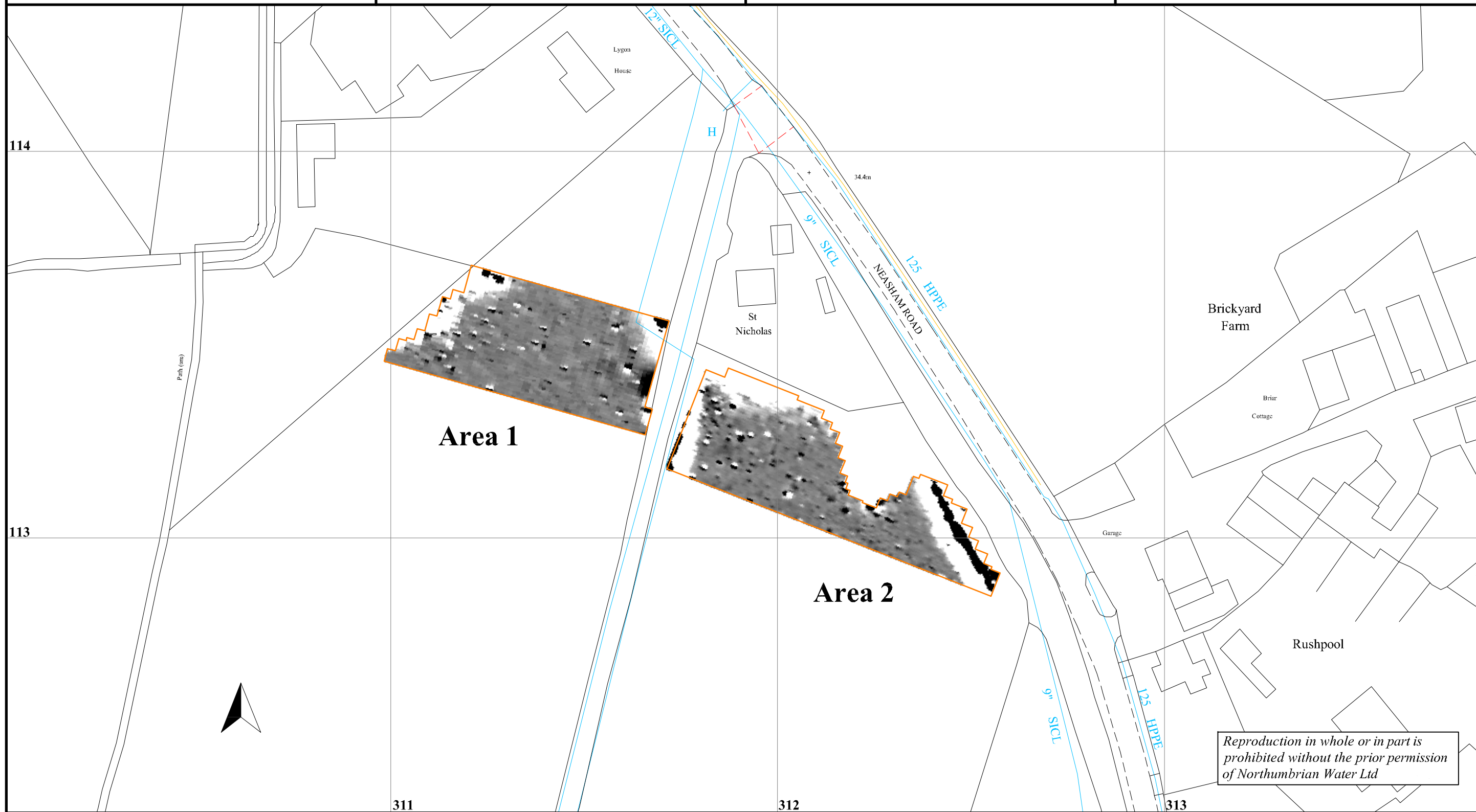
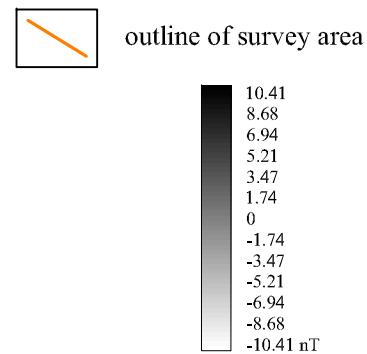
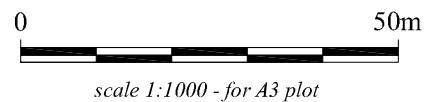


site location



scale 1:25 000 - for A4 plot

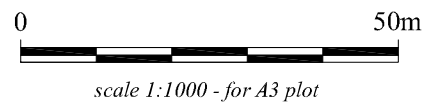






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outline of survey area

dipolar magnetic anomalies

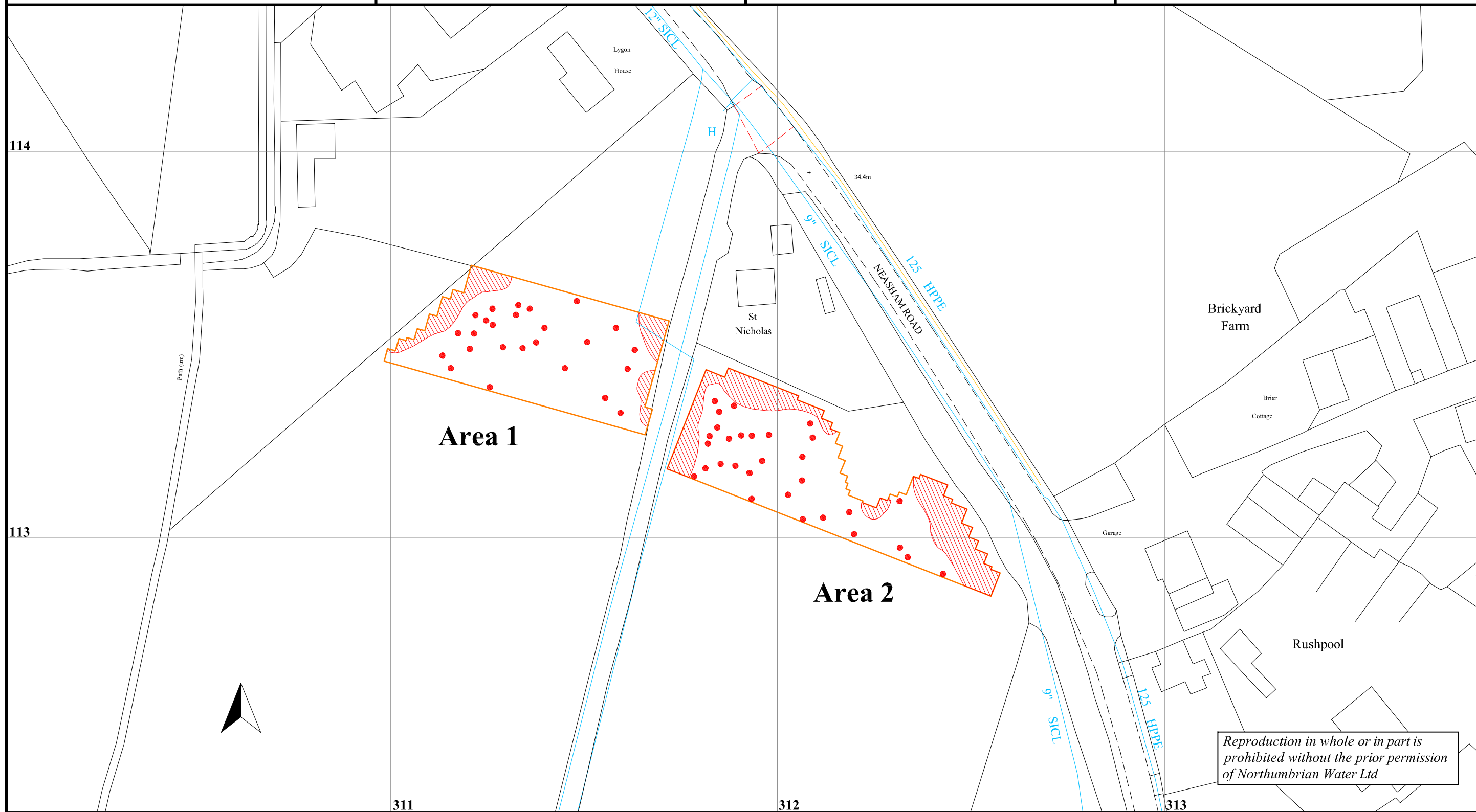
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County Durham**

**geophysical surveys**

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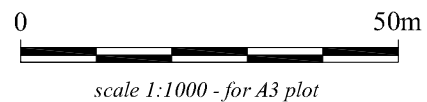
Figure 3




*Geophysical interpretations*

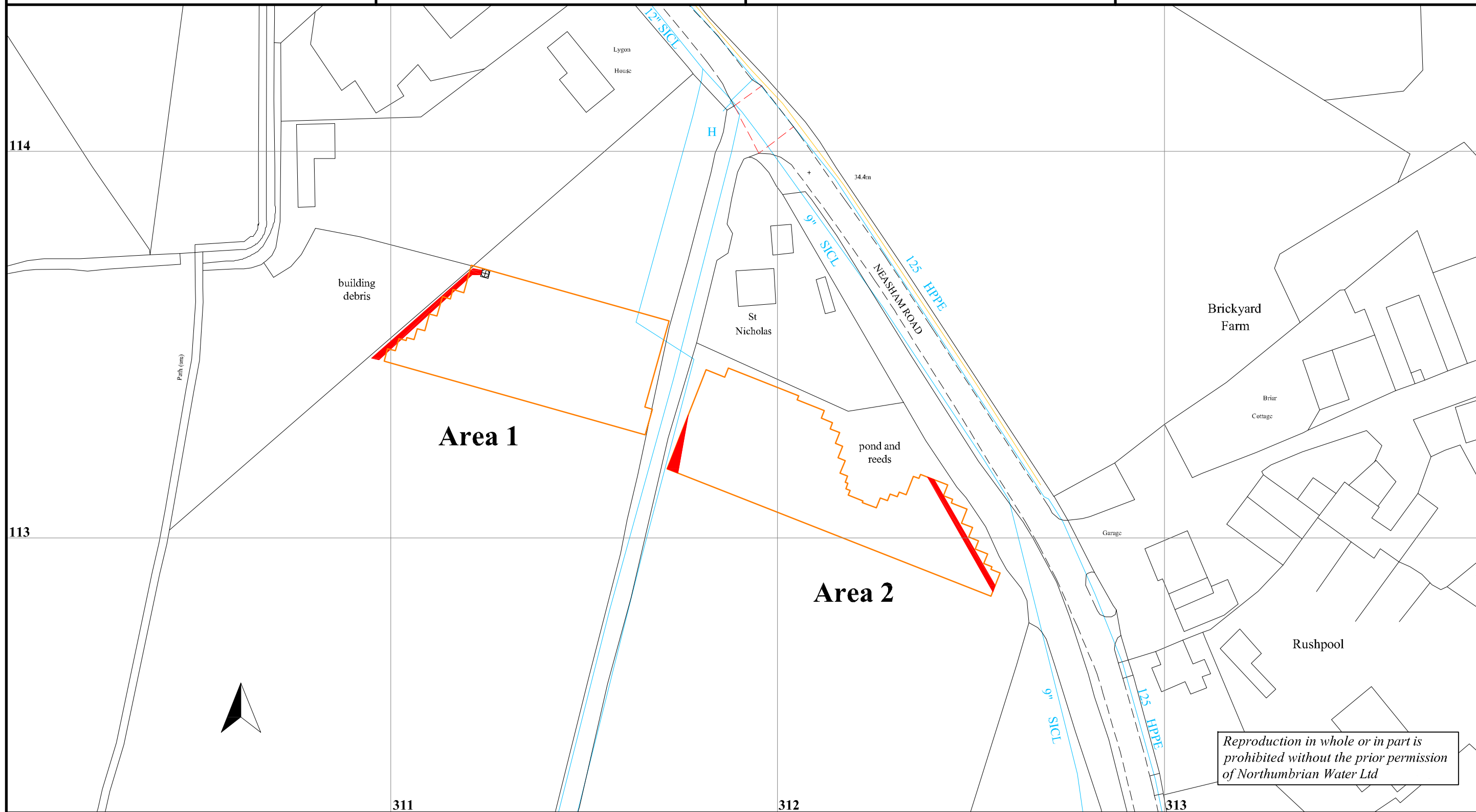


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-  outline of survey area
-  service pipes
-  manhole



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**Figure 5: Trace plots of geophysical data**

