



Hadrian's Wall Community Archaeology Project

# Heddon on the Wall survey

## Project Design (February 2018)



*Front cover. Aerial view of Hadrian's Wall and the vallum between Heddon the Wall (left) and Throckley (right), with the area of Scheduled Monument no 1010616 (within which the project will take place) outlined in red. See text for site description and project aims and objectives. (Aerial image © Google).*

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## 1. The Hadrian's Wall Community Archaeology Project

The Hadrian's Wall Community Archaeology Project (HWCAP), scheduled to run for three years from autumn 2018, is based at the University of Newcastle and largely funded by the Heritage Lottery Fund. It aims to complete a wide range of fieldwork at several sites throughout the World Heritage Site. Most of this work will be completed by volunteers, with training and supervision provided by project staff based at the University of Newcastle; participation is open to all, regardless of past experience. Much of the work is being specifically designed to address serious management issues at parts of the Wall complex that have been designated as 'at risk' (Historic England 2017a) for reasons such as visitor pressure, scrub growth or plough damage, while also addressing research priorities identified within the Hadrian's Wall Research Framework (Symonds & Mason 2009). This pilot study is being undertaken as part of the project's Development Phase, to test and refine a number of practical issues. Feedback from participating volunteers is important and will help in due course with the planning and delivery of other project fieldwork.

A Project Design such as this one will be produced for all project fieldwork. The purpose of the Project Design is twofold. First, to provide background information for participating volunteers. Second, to provide information for applications for any necessary legal consents, such as scheduled monument consent, that are required for some project work. In this case, a Section 42 licence, under the terms of the Ancient Monuments and Archaeological Areas Act 1979, is required for the undertaking of geophysical survey on the site of a scheduled monument.

## 2. Hadrian's Wall at Heddon

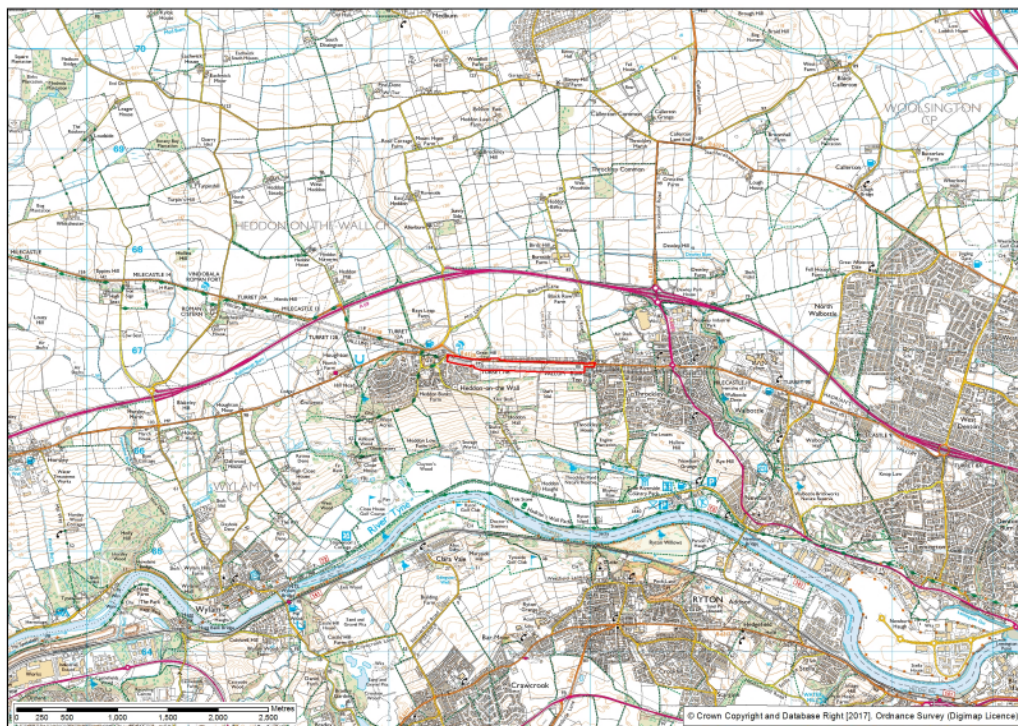
The following information is reproduced from the National Heritage List maintained by Historic England ([www.historicengland.org.uk/listing/the-list/](http://www.historicengland.org.uk/listing/the-list/))

Scheduled Monument number: 1010616.

Site name: Hadrian's Wall and vallum from Throckley to East Town House, Heddon-on-the-Wall in wall mile 11.

The monument includes a section of Hadrian's Wall, its outer ditch and the vallum between Throckley and East Town House, Heddon-on-the-Wall (fig 3.1). From various places in this section of the Wall corridor there are wide views northwards towards the Scottish Border and south west along Tynedale to the North Pennines. At the east end of this section, the Wall survives as a buried feature below the course of the modern road, the B6528. Its line was recorded during roadworks in November 1926 and it was found to be of broad wall type. In the west end of this section there is a 255m stretch of upstanding consolidated wall between 2.8m and 3m in width, reaching a maximum height of 1.7m. The core was originally set in puddled clay, but is now reset in mortar to preserve the work. The upstanding section of the Wall is in the care of the Secretary of State. Turret 11b was located by excavation in 1919. It survives

as a buried feature below the B6528. The location of Turret 11a has not yet been confirmed though it probably lies along the line of the wall somewhere opposite the Royal French Arms public house. During 1879 a hoard of over 5000 silver Roman coins was found just to the south of the Wall below the main road somewhere to the east of this turret site. The wall ditch is thought to survive as a buried feature underlying the gardens of the houses to the north of the Hexham Road (B6528), which are not included in the scheduling. However, west of the houses the ditch survives as an earthwork with a maximum depth of 1.9m and there is some rubble strewn over its scarps. In the west end of this section, opposite the consolidated stretch of wall, is a section of ditch, also in the care of the Secretary of State, which reaches a maximum depth of 1.4m. The vallum survives as an earthwork in the field south of the B6528. It lies about 50m south of the wall line along this stretch of the corridor. In the east end of this section the vallum mounds have been reduced by ploughing, although the vallum ditch is still visible, reaching a depth of up to 1m. It is most evident in the east end in the small stand of trees at the entrance of the drive to Heddon Hall. On the summit of Great Hill, however, the works of the vallum are very well marked. The ditch is cut through the freestone rock and the south scarp shows Roman tool marks. The course of the Roman road known as the Military Way, which ran along the corridor between the Wall and the vallum linking the turrets, milecastles and forts, is not yet confirmed in this section of the corridor. The field boundaries, all English Heritage fixtures and fittings and surface of the B6528 road and drive to Heddon Hall are excluded from the scheduling, but the ground beneath all these features is included.



*Fig 2.1. Map showing the location of Scheduled Monument no. 1010616 (Hadrian's Wall and vallum from Throckley to East Town House, Heddon-on-the-Wall in wall mile 11) outlined in red. All project fieldwork will take place within this scheduled area.*

### 3. Aims of this fieldwork module

Scheduled monument number: 1010616 (Hadrian's Wall and vallum from Throckley to East Town House, Heddon-on-the-Wall in wall mile 11) is included on the current Heritage at Risk Register (Historic England 2017a) due to the fact that part of it is ploughed on an annual basis and is therefore deemed to be under threat. However, the Heritage at Risk register records both the monument's current condition and the trend in its condition as 'unknown'.

The key aim of this module of the HWCAP is to provide information relating to the current condition of the monument at Heddon that can be used to help plan its future management. It will also provide results of academic value, linked in particular to questions about the vallum raised in the Hadrian's Wall Research Framework. In addition, it provides an ideal opportunity for volunteers to learn the basics of archaeological topographic and geophysical survey, as well as learning more about this sector of the World Heritage Site. As the HWCAP's first fieldwork module, undertaken during the project's Development Phase, this also provides an important opportunity to test various aspects of general project methodology with volunteers in the field.

This site was included in a recent survey of Heritage at Risk sites along the line of the Wall (Frodsham 2016). In this, it was noted that the section open to the public at Heddon, in the west, is well managed with no obvious management problems. East of this, the line of the Wall is overlain by the modern road, but the vallum runs parallel to the road in fields to the south. Immediately east of the publicly accessible area, a well-preserved length of vallum passes through quite dense scrubby woodland on the southern slopes of Great Hill, beyond which the vallum survives as a much less prominent earthwork through three large fields before disappearing beneath the built up area of Throckley.

The westernmost of these three fields is pasture and is not ploughed. The vallum ditch is still clearly visible here as an earthwork, although it varies in size, being less obvious to the east. The central and eastern fields are ploughed annually, and the vallum is much less clear within them than in the western field. While the backfilled vallum ditch must survive beneath the ploughsoil, it is not clear whether any sign of the vallum banks or other features survive, or indeed whether they are still being damaged each time the fields are ploughed. It is quite possible that rates of survival and damage vary throughout the three fields, due to variations in microtopography.

While it may be the case that little further damage is being done each year as all features other than the infilled ditch may have already been ploughed away, it is also possible that the process of destruction is at a critical stage and features that currently survive for potential investigation could soon be lost. In addition to the vallum, it is possible that remnants of the Military Way (as yet not recorded along this portion of the Wall), and other features, may survive beneath or within the ploughsoil. The recent HAR survey recommends that the area should be subjected to detailed topographic and geophysical

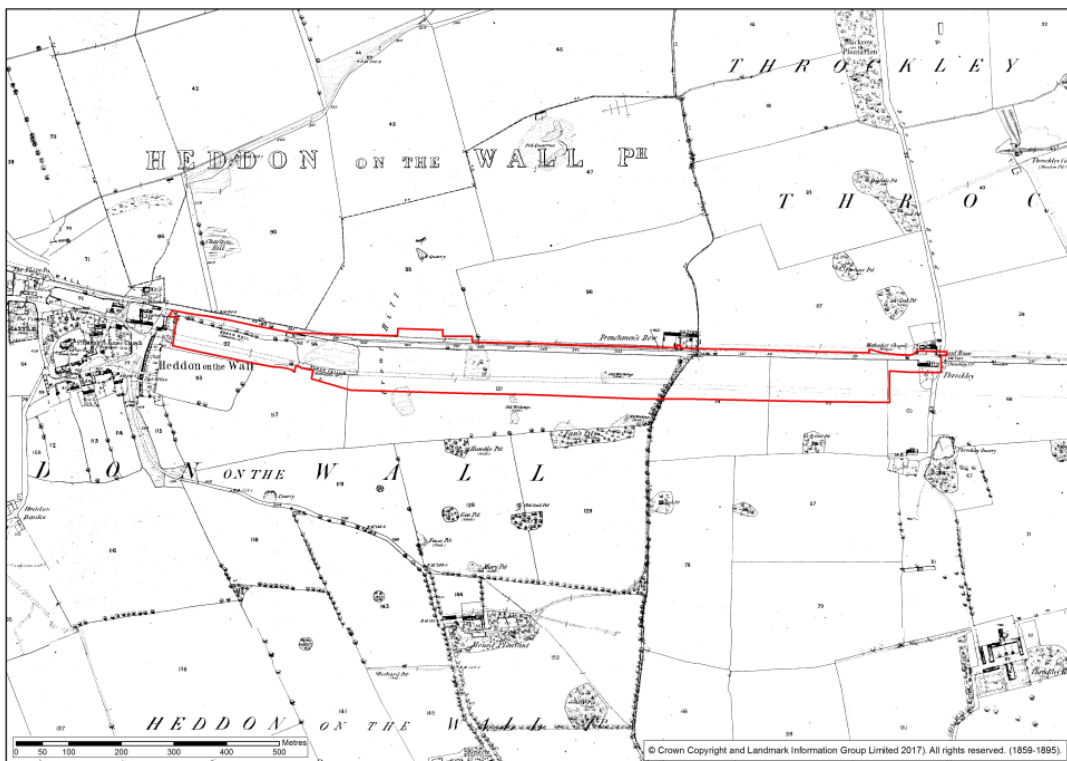
survey in order to provide information about its current condition. It is precisely this work that the current project is designed to accomplish. It was also recommended that a number of excavation trenches should be dug across the line of the vallum, which would potentially be of great academic value in addition to providing information to inform future management, but a decision about this cannot be made in advance of the survey phase.



*Fig 3.1. Aerial view of the project area (© Google) with scheduled monument no 1010616, within which all project work will take place, outlined in red.*



*Fig 3.2. Lidar Digital Surface Model (DSM) of the project area. The line of the vallum, and many other features, can be seen much more clearly here than on the aerial image above.*



*Fig 3.3. OS First Edition map of the same area as Figs 3.1 and 3.2, showing many industrial features in the area in addition to Roman remains.*





*Fig 3.4. The overgrown section of vallum on Great Hill.*



*Fig 3.5. Looking westwards along the line of the vallum from the east end of the large pasture field in the centre of the scheduled area.*



*Fig 3.6. Looking westwards along the line of the vallum from the eastern edge of the scheduled area (at the centre of the view, on the far horizon, the same almost triangular-shaped tree can be seen as in fig 3.5).*

## 4. Methodology

### 4.1 Introduction

It is proposed that the survey will be completed in two phases. Phase 1 will be completed as the pilot project in March 2018, but the two eastern fields are in cultivation and inaccessible at this time. Consequently, Phase 2, concentrating on the eastern fields but also including further work elsewhere, will follow in Autumn 2018, assuming the Delivery Phase of the project gets underway as planned. Phase 1 is planned to be a useful piece of work in its own right, and a report on this will be produced as a standalone document. However, the report will be revised following completion of Phase 2 to include interpretation of the results of both surveys.

### 4.2 Volunteer opportunities

This project has been designed to provide important information about the condition of the scheduled monument, and also to provide practical training in archaeological field survey for project volunteers. All the proposed work will be undertaken by volunteers, with professional training and supervision provided.

Phase 1 will be completed in three days, consisting of six half-day sessions. There will be four types of survey, all of which will take place simultaneously on each of the three survey days. Volunteers will get to participate in two surveys, one in the morning and one in the afternoon, on each day. Over the three days, several different areas will be surveyed. On completion of fieldwork, all data will be combined into a comprehensive report that will be circulated to all participants. This report will enable everyone to see how their individual contributions have contributed to an important survey that will be important to the future study and management of the World Heritage Site.

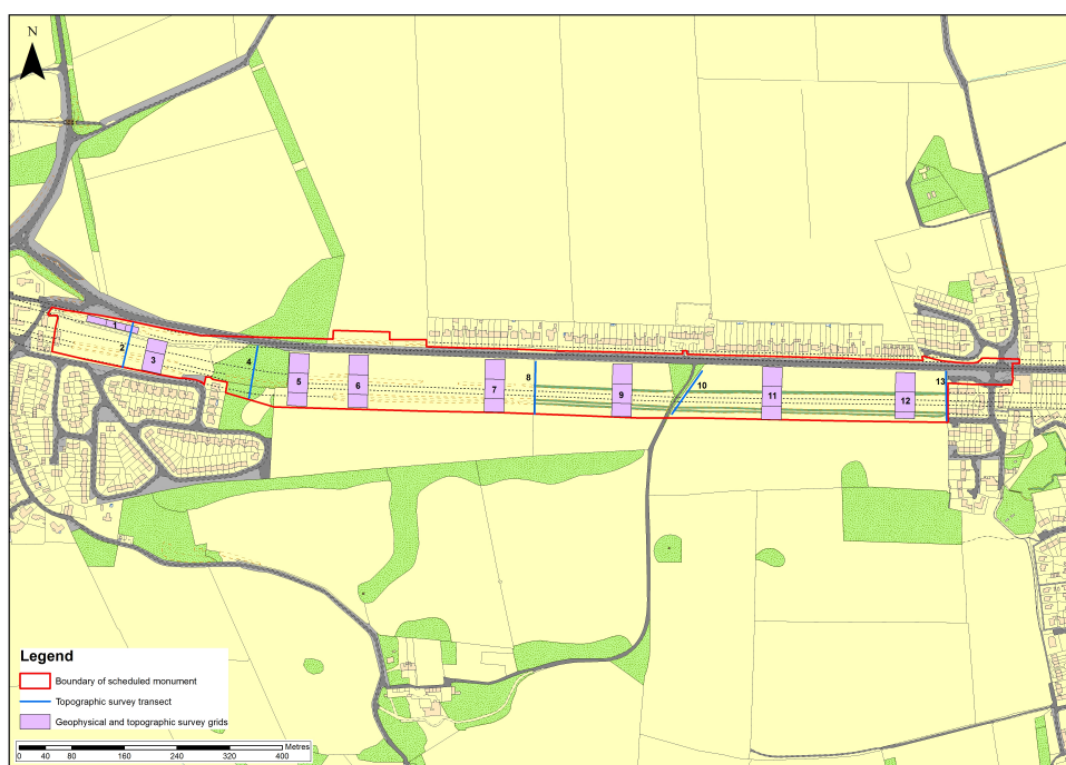
No previous experience is expected as full training and constant supervision will be provided. The four survey methods (further details of which are provided below) are:

1. **Topographic survey.** Using modern technology, this will produce accurate models of the current ground surface. Important in their own right, the results of this work are essential to enable accurate presentation of the results of the three other methods.
2. **Ground penetrating radar.** This technique allows us to see sections through the ground, including evidence of buried features such as ditches.
3. **Geophysical survey - gradiometry.** By measuring variations in the magnetic susceptibility of buried deposits, this technique can locate features such as ditches, walls, tracks, ovens or kilns.
4. **Geophysical survey - earth resistance.** By passing an electrical current through the ground, this technique enables the detection of buried features such as walls and ditches.

In combination, the results of these four techniques will hopefully give us a good idea of the nature of the vallum and any other features that may survive within the survey areas.

Prior to the commencement of fieldwork, there will be a start-up workshop on **Thursday 8<sup>th</sup> March 7-9pm, at Heddon W.I. Hall**, to introduce participants to the project and the project team, familiarise them with the equipment to be used on the survey days, go through the risk assessment and answer any questions that anyone may have.

During fieldwork, participants will be encouraged to take part in general discussion with project staff about the purpose and nature of the Wall and the vallum; participation should thus lead to enhanced understanding of the World Heritage Site in addition to the gaining of practical survey skills and a very detailed understanding of the Wall at Heddon.



**Fig. 4.1. Location of the proposed survey areas.**

*Areas 5, 6 and 7, and topographic sections 8, 10 and 13, will be completed during Phase 1 (March 2018). All other areas and sections will be completed during Phase 2 (Autumn 2018).*

*Areas 1, 3, 5, 6, 7, 9, 11 and 12 will be surveyed using all four techniques outlined here (topographic, resistivity, magnetometry and ground-penetrating radar). The sections (numbered 2, 4, 8, 10 and 13) will be recorded only by topographic survey.*

*Area 1 is located to investigate the possible presence of features on the berm, between the Wall and the Wall ditch. All other areas are concerned primarily with the investigation of the vallum.*

### **4.3 Common Survey Methodology**

For each survey area, a survey grid consisting of a series of 30m squares will be laid out using network RTK GNSS (Global Navigation Satellite System) survey grade equipment. Each survey area will be located on the British National Grid to enable easy transfer, in due course, to the project GIS. Control points will be established in order to position and orientation of the Total Station Theodolite (TST). A number of reference points will be collected (i.e. corners of buildings, manholes, pavement) to provide permanent points of reference for the survey. All surveys will be carried out in accordance with national standards and guidelines (ADS 2015, HE 2017b).

### **4.4 Topographic survey**

#### **Introduction**

Topographic survey will be utilised to examine the topography of the areas under investigation, focusing specifically on the north/south mounds and ditch of the Vallum. Sufficient spacing of the readings should also allow for the identification of slight features in this landscape, if present, including possibly the Military Way and intervallum mound. The position of the proposed survey grids at Heddon-on-the-Wall fall in open areas with good mobile signal, allowing the use of the network RTK GNSS. A Total Station Theodolite (TST) will also be used as backup in case of signal interruption.

#### **Methods**

The topographic survey will be undertaken using a Leica Viva GNSS (Global Navigation Satellite System) with CS15 controller and a Leica Builder 505 Total Station TST. Data will be collected along one metre spaced traverses with a sampling density of one metre within a framework of 30x30 metre grids. Higher resolution (i.e. a more dense mesh of point data) will be used for breaks of slope and other archaeological features encountered within each 30x30 metre grid. The two different sets of equipment (GNSS, TST) will be utilised with the same point sampling strategy in order to give volunteers experience of using the different technologies. In accordance with accepted practice, a photographic record of the grids, with appropriate notes, will precede the topographic survey.

#### **Analysis**

The raw data will be quality checked and processed using propriety software (Leica Geo Office). The spatial analysis will be undertaken in ArcGIS. Digital output will be integrated into the underlying geodatabase for the project to provide a digital terrain model (DTM) on which the geophysical survey results can be rectified and displayed. Representation of the topographic data will be provided as a DTM model, selected profiles and as a hachured plan, produced using ArcGIS.

## 4.5 Ground Penetrating Radar (GPR)

### Introduction

Ground Penetrating Radar (GPR) is a very high frequency electromagnetic technique used to produce high-resolution images from the subsurface. GPR is used for both the detection of both material remains and the characterisation of subsurface stratigraphy. Provisional on-site trials in February 2018 suggest that the technique will provide useful results. Subject to limitations caused by attenuation, detection of sub-surface remains to a depth of up to 5 metres should be possible. Calculation of velocity estimates for the sites using parabola fitting within the GPR software will be undertaken post-survey. Final reports from the survey stage of this project will provide full details of the data processing undertaken. Positional discrepancies caused by antenna tilt effects do not appear to be a problem with the proposed GPR survey areas. If such problems were to be encountered static topographic shift could be achieved using the available ReflexW software.

### Methods

The GPR surveys will be carried out using an Utsi Groundvue 3 GPR system using a 400MHZ antenna. Zigzag traverses will be surveyed at 0.5 metre intervals with samples readings taken at 0.05 metre intervals along each traverse. Where conditions dictate, variation from the standard 30mx30m survey grid may be employed to maximise survey efficiency. As with all GPR survey the computation of depth is reliant on an understanding of the velocity of the electro-magnetic signal through the material being surveyed. Since GPR signal attenuation is greater in soils with a high conductivity, reference to soil and geological data will be made for each survey area. The success of the GPR methodology will partly depend on the amount of EM signal attenuation experienced at any given site.

### Analysis

Analysis will be undertaken using a combination of GPRSlice, ReflexW and Reflex3D software. Data will be presented as both X and Y scans and combined XY slices. Where applicable, calculations of signal velocity will take account of the data from the digital geology and soil databases. Remodelling of the data to correct the distortion caused by slope and antenna tilt will, if necessary, be undertaken utilising the topographic survey data.

## 4.6 Gradiometry

### Introduction

Gradiometry is an established technique for the rapid detection of sub-surface archaeological features. The proposed survey area at Heddon presents a good opportunity to successfully apply gradiometry as a technique.

### Methods

A Bartington 601 dual sensor fluxgate gradiometer will be used to carry out the survey. In accordance with accepted practice, initial data will be collected using a one metre traverse and 0.25 metre sample within a framework of 30x30 metre grids. Higher data collection rates and/or parallel traverses may

be adopted where results from initial survey suggest this would be advantageous. Data will be processed using Geoplot 3.0v. Graphical output will be transferred to ArcGIS and georeferenced to British National Grid. Processed gradiometer data will be held as part of the geodatabase within ArcGIS enabling comparison with other geophysical survey data in 'real space'.

### **Analysis**

Analysis will be undertaken using a combination of specialist geophysical software (Geoplot 3.0v) and spatial analysis using ArcGIS. Digital output will be integrated in the underlying geodatabase for the project allowing rapid comparison of results from different geophysical survey methods. Representation of the data in relation to topographic models of the sites, collected during GPR survey will also be undertaken.

## **4.7 Earth Resistance**

### **Introduction**

Earth resistance survey is a long established technique for the detection of buried structures and large negative features such as pits or ditches, exactly the type of feature that is expected to be located within this project's survey areas.

### **Methods**

Resistance survey will be carried out using a Geoscan RM15D Advanced equipped with a MPX15 multiplexer. In the first instance data will be collected on the standard grid using a series of one metre traverses with reading sampled at a rate of one per metre. The survey of smaller selected areas of very high archaeological potential with an increased data collection rate of 0.5 metre traverse and 0.5 metre sample may be undertaken during Phase 2, depending on the results of Phase 1.

### **Analysis**

Statistical treatment of the data will be carried out using a combination of Geoplot 3.0v and ArcGIS. Manipulation of the raw data set to enhance the recognition of sub-surface features will be presented alongside the untreated data and a detailed log of this analysis will form part of the survey archive. Integration of the processed data into the GIS geodatabase will be used to provide comparison of data sets within a common spatial framework.

## **4.8 Common Outputs**

A report and archive will be compiled for each technique in accordance with Historic England guidelines and compliant with the data standards and format required by the ADS (ADS 2015 HE 2017b).

### **Report**

A combined report, including results acquired by each technique, will be produced in accordance with Historic England guidelines and will adhere to the structure set out in the ClfA guidelines (ClfA2014). Copies of this report

will be provided to the Inspector of Hadrian's Wall at Historic England, the Northumberland Historic Environment Record, and the Archaeology Data Service (ADS). The project will apply to the OASIS project for an OASIS project number. In addition, a summary of the results, along with the report, will be posted on the project website and thus made generally available worldwide. Depending on the quality of the results, a brief summary report may be produced for publication in *Archaeologia Aeliana* or other appropriate journal.

### Archive

All data will be incorporated within a project archive designed to comply with the data standards and format required by the ADS (ADS 2015, HE 2017b). The site archive will comprise all data collected and generated during the survey (geophysical data, site and working photographic records with cross-referenced log) and assessment stages (CAD generated site plans and a comprehensive site report). The archive will adhere to the ClfA *Standards and Guidance notes for creation, compilation, transfer and deposition of archaeological archives*. It will also be prepared in accordance with the specifications outlined in *Management of Archaeological Projects 2* (English Heritage 1991: Appendix 3).



Fig 4.2. Geophysical survey methods. Top left: Soil resistance. Top right: Gradiometry. Bottom: Ground penetrating radar.

## 5. Project Personnel

Overall project direction will be by **Alex Turner** of Newcastle University who is the Hadrian's Wall Community Archaeology Project (HWCAP) Digital Heritage Officer and has much experience in all the survey methods outlined above. Alex Turner will also be responsible for the interpretation of the results and the production of the project report and archive.

Training and supervision in the field will be provided by Alex Turner in collaboration with the following project staff:

**Rob Collins.** HWCAP Manager and Research Coordinator, and Lecturer in Material Culture of the Northern Frontier in the School of Archaeology, Newcastle University.

**Nicky Garland.** HWCAP Support Officer & Research Assistant.

**Kerry Shaw.** HWCAP Volunteer Coordinator and Community Liaison Officer.

**Paul Frodsham** (ORACLE Heritage Services). Project Consultant - Community Archaeology.

## 6. Timetable

Phase 1 fieldwork will take place on Saturday 10<sup>th</sup> March, Monday 12<sup>th</sup> March, and Tuesday 13<sup>th</sup> March 2018. Work will take place from 9.30am - 4pm each day. All participants will be given ample notice of when and where to meet each day.

The Phase 1 project report and archive will be produced within one calendar month of the completion of fieldwork.

The timetable for Phase 2 is yet to be determined. A revised Project Design, incorporating the results from Phase 1, will be produced in advance of Phase 2. It is currently proposed that Phase 2 fieldwork will take place in October or November 2018.

## 7. Land owner and legal consents

The land on which this work will take place is owned and farmed by Mr Michael Cheesbrough of Heddon Haugh Farm, Heddon-on-the-Wall, who has kindly given his consent for work to proceed. All volunteers are asked to respect the fact that this is private land in agricultural use, and not to do anything that might cause any disruption to agricultural activity. In particular, access to site must only be by the prescribed route, and all aspects of the project Risk Assessment must be adhered to at all times.



The work is taking place in accordance with permission granted in a Section 42 licence (for geophysical survey on a scheduled monument) granted by Historic England under the terms of the Ancient Monuments and Archaeological Areas Act 1979. No work is permitted other than that specifically approved within the terms of this licence.

## **8. Health and safety**

All work will take place in strict accordance with a comprehensive risk assessment that will be discussed with participants in advance of commencement of work. A first aid kit and at least one qualified first-aider will be on site every day.

All participating volunteers will be required to provide a name and contact telephone number for someone who project staff can contact in the unlikely event of a medical emergency.

Comprehensive insurance for all project staff and volunteers while on site is provided by the University of Newcastle.

## **9. Further information**

Any questions about this project should be directed in the first instance, preferably by email, to Kerry Shaw, whose contact details are provided below.

### **Kerry Shaw**

*Volunteer Co-ordinator and Community Liaison Officer*

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## References

ADS 2015 *Guideline for Depositors. Version 3.0*. Available at <http://archaeologydataservice.ac.uk/advice/guidelinesForDepositors.xhtml> [Accessed 20.02.18]

CIfA (2014) *Standard and Guidance for Archaeological Geophysical Survey*. Chartered Institute for Archaeologists.

Frodsham, P. 2016. *Hadrian's Wall World Heritage Site. Heritage at Risk Survey. (Consultation Draft)*. Unpublished report for the Hadrian's Wall Community Champions Project.

Historic England 2017a. *Heritage at Risk, North East*.

Historic England 2017b. *Understanding the Archaeology of Landscapes. 2nd edition*. Swindon: Historic England.

Symonds M. & Mason, D. 2009. *Frontiers of Knowledge: A Research Framework for Hadrian's Wall*. Durham County Council.

Volunteers wishing to find out more about geophysical survey may wish to consult one or more of the following:

David, A, Linford, N, & Linford, P, 2008 *Geophysical Survey in Archaeological Field Evaluation*. Historic England.

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

Schmidt, A, 2013 *Geophysical Data in Archaeology: A Guide to Good Practice*. Archaeology Data Service & Digital Antiquity, Oxbow.