

GEOPHYSICAL SURVEY

AND

ARCHAEOLOGICAL APPRAISAL

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GREENWOOD AVENUE

BURNHOPE

COUNTY DURHAM

prepared for

John Taylor Architects

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Client	John Taylor Architects
Location	Greenwood Avenue, Burnhope, County Durham, DH7 0EB
Grid Ref	NZ 18974 47618

GREENWOOD AVENUE, BURNHOPE, COUNTY DURHAM GEOPHYSICAL SURVEY AND ARCHAEOLOGICAL ASSESSMENT REPORT

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Digital Contents

Report copy (PDF) A4 scaled figures: Minimally processed data Processed data Interpreted data XY data Site grid map Site photographs and catalogue

Disclaimer

The results of geophysical survey may not reveal all potential archaeology and do not provide a comprehensive map of the sub-surface, but only responses relative to the environment. Geological, agricultural and modern responses may mask archaeological features. Short-lived features may not give strong responses. Only clear features have been interpreted and discussed in this report.

GREENWOOD AVENUE, BURNHOPE, COUNTY DURHAM GEOPHYSICAL SURVEY AND ARCHAEOLOGICAL ASSESSMENT REPORT

Summary

Northern Archaeological Associates Ltd was commissioned by John Taylor Architects Ltd to undertake a geophysical survey and archaeological appraisal of land to the east of Greenwood Avenue, Burnhope, County Durham (NGR: NZ 18974 47618). The assessment works were required to assess the archaeological potential of the site in support of a planning application for a residential development on the site.

The proposed development area comprised approximately 0.74 ha of mixed use land divided by a central field boundary. A row of houses fronting Greenwood Avenue occupied the west of the proposed development area (PDA) from the mid-20th century until their recent demolition at the beginning of the 21st century. Since the removal of these houses, the west of the site has contained uncultivated grassland. The east of the PDA is shown on historic maps to have belonged to agricultural land throughout the 19th and 20th centuries and at the time of survey contained pasture.

A Historic Environment Record (HER) search of the PDA and surrounding 1km study area has revealed two heritage assets, which include the mining village of Burnhope and possible medieval earthworks to the north-east of Burnhope village. HER events include an Environmental Impact Assessment at Langley Park Wind Farm, a desk-based assessment of land at Whitehouse Avenue in Burnhope and the Lanchester Community Heritage Audit Project 2015–2017. None of the events have identified any significant heritage assets within the PDA or its direct vicinity.

The geophysical survey was carried out on 5th April 2018. Rubble and building debris relating to the former houses in the west of the survey area has caused a high level of magnetic disturbance within the results. It is possible that the strong responses of the modern material within the topsoil has masked potential responses of features, if present, that are buried lower in the substrata. It should also be noted that if buried features are present in the western side of the PDA, it is likely that they were, to some extent, damaged or destroyed during the erection and destruction of the former houses along Greenwood Avenue.

The majority of magnetic anomalies identified within the eastern side of the survey area are likely to relate to either modern or agricultural activity.

Several informal linear anomalies were identified. Although these appear to belong to the same rectilinear feature, they are on the same orientation as regularly spaced linear anomalies interpreted as being of an agricultural nature. Consequently, detailed interpretation was difficult, as it is uncertain if these linear anomalies are of an archaeological nature, or instead denote agricultural activity.

Numerous alignments of weakly enhanced, regularly spaced linear anomalies were identified. Anomalies on an east-west alignment corresponded with weak linear features identified on LiDAR data and so it is possible that they are indicative of ridge and furrow. Those on a northsouth alignment were congruent with the orientation of modern agricultural regimes shown on aerial photographs of the site. A third alignment of anomalies with a very weak increase in magnetic response was identified running on north-west to south-east alignment. It is likely that these anomalies are also caused by agricultural activity, but their exact origin is uncertain.

Numerous linear and curvilinear trends, and amorphous positive responses were identified within the survey results, but weak increases in magnetic response and incomplete patterning resulted in a tentative interpretation. Consequently, it is uncertain if they are of an agricultural, modern, geological or archaeological nature.

Several bipolar anomalies are present within the results and are considered to be of a modern nature. In particular, there is a linear bipolar anomaly running on a north-west to south-east orientation that is likely to be indicative of a buried utility.

There is a high level of magnetic disturbance along the western perimeter of the survey area. This was considered to be caused above ground features, such as metal fencing, as well as an accumulation of surface material, possibly partly inclusive of building material associated with the former houses that previously occupied the west of the PDA.

1.0 INTRODUCTION

1.1 Northern Archaeological Associates Ltd (NAA) was commissioned by John Taylor Architects Ltd to undertake a geophysical survey and archaeological appraisal of land to the east of Greenwood Avenue, Burnhope, County Durham (NGR: NZ 18974 47618). The survey was required to assess the archaeological potential of the site in support of a planning application for a residential development.

2.0 LOCATION, TOPOGRAPHY AND GEOLOGY

Location

2.1 The site comprises two fields to the east of Greenwood Avenue, which is to the south of the village of Burnhope, located approximately 9.4km north-west of Durham, and 2.2km to the east of Lanchester (Fig. 1). The area targeted with geophysical survey was bordered by agricultural land to the south and east, Greenwood Avenue and recreational land to the west, and a residential area to the north.

Geology and soils

2.2 The solid geology of the survey area consists of Carboniferous sandstone from the Pennine Middle Coal Measures formation with superficial deposits of Devensian Diamicton, which is composed of various grain-sizes (BGS 2018). The soils are mapped as belonging to the Brickfield 3 Association (Soil Survey of England and Wales 1983), consisting primarily of loamy and clayey surface-water gley soils (Jarvis *et al.* 1984, 123).

Topography and land-use

2.3 The topography of the survey area comprises of a fairly level field with a slight downward slope to the south. The north end of the site lies at 241m above Ordnance Datum (aOD) and the south at 235m aOD.

3.0 AIMS AND OBJECTIVES

Archaeological Assessment

- 3.1 The principal objectives of the archaeological appraisal was to:
 - identify all recorded archaeological sites, finds and buildings/structures within the study area; and

• assess the potential effects of the proposals in terms of the construction and operational impacts on the archaeology resource.

Geophysical Survey

- 3.2 The aim of the survey was to:
 - assess the potential for previously unrecorded sites of archaeological interest;
 - attempt to characterise the nature of any subsurface remains within the survey boundary and to identify possible concentrations of past activity in order to inform the requirement for any further archaeological investigation at the site; and
 - produce a report including raw and processed greyscale images of the areas and interpretations of these results.

4.0 METHODOLOGY

Archaeological Assessment

- 4.1 This report provides details of all known historic and archaeological sites ("heritage assets") within a 0.5km study area that extended from the development boundary, based on Historic Environment Records and Cartographic Sources only (Fig. 2).
- 4.2 The following resources were consulted during the creation of this appraisal:
 - County Durham Historic Environment Record
 - Historic mapping
 - Historic England Heritage List for England website
 - Historic England PastScape website
 - Archaeology Data Service
- 4.3 The report assesses the potential for unrecorded heritage assets of archaeological interest to be present within the site boundary. The potential physical impact of the proposed development on heritage assets is discussed, but the assessment of impacts on the setting of designated assets is beyond the scope of the specification for this report. The report has been produced in accordance with the relevant standards and guidance published by NPPF Planning guidance (2014), English Heritage (2008a, 2011), Historic England (2015a, 2015b), and the Chartered Institute for Archaeologists (2017).

Geophysical Survey

- 4.4 The geophysical survey was undertaken as a gradiometer survey using the Bartington Grad601-2 dual magnetic gradiometer system with data logger. The readings were recorded at a resolution of 0.01nT and data was collected with a traverse interval of 1m and a sample interval of 0.25m. All recorded survey data was collected with reference to a site survey grid comprised of individual 30m x 30m squares. The grid was established using Real Time Kinematic (RTK) differential GPS equipment and marked out using non-metallic survey markers. All grid nodes were set out with a positional accuracy of at least 0.1m as per existing guidelines (English Heritage 2008b; ClfA 2014) and could be relocated on the ground by a third party. The base lines used to create the survey grids are shown on Figure 8 and further details are available in Appendix C.
- 4.5 The processing was undertaken using Geoplot 3.0 software and consisted of standard processing procedures. Details of processing steps applied to collected data are given in Appendix D.
- 4.6 On the greyscale plot (Fig. 9 and 10, left), positive readings are shown as increasingly darker areas and negative readings as increasingly lighter areas. The XY-trace plot demonstrates the readings as offsets from a central line (Fig. 9, right). The interpreted data uses colour coding to highlight specific readings in the survey area (Fig. 10, right). In this report, the word anomaly is used to refer to any outstanding high or low readings forming a particular shape or covering a specific area. Appendix E details the terminology and characterisation of anomalies used for interpreting data.

Surface conditions and other mitigating factors

- 4.7 The PDA covers an area of approximately 0.9ha, of which 0.74ha was suitable to be covered by geophysical survey.
- 4.8 The survey area was divided into two areas by a central field boundary, which ran on a north-northwest to south-southwest (Fig. 2). Field boundaries comprised trees, hedgerow and metal fencing. There were no physical boundaries to the west, south or south-east of the PDA, and a metal gate was used for access between the east and west of the survey area. It was necessary to avoid all metal objects to ensure that magnetic responses did not impinge on the survey results and mask potential buried features.

- 4.9 Prior to survey works, it was proposed that there was a high likelihood of buried building material with a high level of magnetic susceptibility within the west of the site, where houses had recently been demolished. During survey works, it was also noted that features associated with the former houses were still extant in the west of the PDA, such as drain covers. However, given the small size of the survey area and unknown level of buried disturbance, geophysical survey was completed over the whole of the PDA.
- 4.10 At the time of survey, the PDA was covered in snow. Although this had no direct affect on instruments, extra precaution was required to avoid buried obstacles, especially in the east of the PDA, where there were areas of uneven ground and high vegetation.

5.0 PLANNING POLICY

- 5.1 The main planning policy documents against which this proposal needs to be considered in respect of the historic environment are the National Planning Policy Framework (DCLG 2012; Appendix A), the North East of England Plan Regional Spatial Strategy to 2021 (GONE 2008), and the Derwentside District Local Plan (adopted 1997).
- 5.2 The Derwentside District Local Plan (adopted 1997) allocates two areas within Burnhope as potential areas for housing development: land at Whitehouse Farm and land to the south of Vale View. The Derwentside District Local Plan (1997) details that these sites are likely to improve the urban fabric and regeneration of Burnhope, as would other additional small sites that met the terms outlined in policy HO5 (Table 1).

Domuontaido Dia	trict Local Plan (1997) relevant to the site
Derwentside Dis	the Local Flam (1997) relevant to the site
	New housing should be built in sustainable locations where people have easy access
HO5:	to transport, jobs, shops, schools and other facilities. Whilst residential development
Development	on large sites other than those shown on the proposals man will normally be
	of large sites other than those shown of the proposition hap with normally be
on Small Sites	unacceptable, there are many smaller sites (of less than 0.4 nectares) within towns
	and villages that are capable of being developed.
	Within Burnhope two sites have been allocated for housing development, at
	Whitehouse Farm and South of Vale View, with a combined capacity for 80 new
	dwellings. It is hoped that the identification of these sites will continue the process of
	regeneration within the village begun with the successful Estates Action Scheme
	there and help to secure environmental improvements and support local services.
	The above sites, together with those with existing planning permissions, should be
HO7:	sufficient to achieve these goals and meet local need within the plan period without
Development	the necessity for extensions to the built up area of the village which may detract from
Limit for	its environment. Additional small sites may however be approved provided they
Lanchester and	meet the terms of Policy HO5. The issue of a settlement boundary, which would below
Burnhone	to define a limit to development for the whole village, still needs to be looked at
Dunnope	lo demonstration de de de la contration de
	However, it is considered that this exercise can only be carried out property when an
	Inset is prepared for Burnhope. This will allow a comprehensive analysis of the wider
	needs of the community to be undertaken, and help provide a local context for
	longer term development. The Council intends, therefore, to proceed with making a
	formal alteration to the District Local Plan in report of Burnhope, at the earliest
	in the later at the District Local Franking in Spect of Duminope, at the earliest
	practicable opportunity following its adoption.

Table 1: Derwentside District Local Plan (1997) as relevant to the site

5.3 Land to the north of the PDA that surrounds the Whitehouse farm is suggested to be a 'large' site for proposed housing development. At the conception of this plan, the PDA contained houses along Greenwood Avenue and it is assumed that the reconstruction of this area falls under this same stipulation of the Derwentside District Local Plan (1997).

6.0 SUMMARY OF RECORDED HERITAGE ASSETS AND ARCHAEOLOGICAL POTENTIAL

6.1 The appraisal identified a total of two heritage assets within 1km of the proposed development boundary. Two heritage events have been identified within the 0.5km search area surrounding the PDA. A further heritage event is located on a site approximately 1.2km to the east of the PDA within a study area that reaches into a 1km area surrounding of PDA. HER data have been allocated a unique number (HA), and are itemised in Table 1 along with their respective Durham County Council Historic Environment Record (HER) number and are located on Figure 2. Heritage assets are graded based on professional judgement. The criteria by which they are assessed in relation to the PDA is detailed in Appendix B.

HA	HER	NGR	Name	Monument Description	Period	Grade
1	H1864	NZ 194 486	Earthworks at Burnhope	Earthworks, unidentified but possibly of Medieval settlement form. OS maps show that area around grid ref was subject to quarrying/mining activity, however the 2003 DCC {vertical} aerial photograph shows some features to the north of the Church which may be indicative of earlier settlement.	Medieval (1066–1540)	Low
2	H4361	NZ 191 484	Burnhope village	The village's quick growth can be attributed to the mining industry. The owners of Burnhope pit in 1873 were fined for the unsanitary conditions their work force lived in. Also renowned for being the only place outside Durham city where the Durham Miners Gala has been held (1926). this was due to the General strike when miners were not allowed to march through the streets of the city.	Georgian (1714–1830) to 21st century (2001–2100)	Low

Table 2: Durham County Council HER Heritage features

Table 3: Durham County Council HER Events

HA	HER	NGR	Name	Monument Description	Grade
3	E9713	NZ 18937 47715	Desk-Based Assessment of Land at Whitehouse Avenue, Burnhope, 2006	In May 2006, Pre-Construct Archaeology carried out a desk-based assessment of land at Whitehouse Farm, Burnhope ahead of a proposed residential development. A documentary and cartographic search was made and site visits undertaken. The site is an area of approximately 0.57 hectares. The earliest parts of the farm probably date to the 18th-19th centuries, although earlier remains at this location are possible. The potential for sub-surface archaeological remains was considered to be high, and some parts of the standing buildings may have architectural significance at a regional level. Evidence of human activity in the Roman, medieval and post-medieval periods was identified within a radius of 2km around the proposed development area.	Low
				The report recommends that building recording be undertaken, including a photographic survey. Monitoring of groundworks was also suggested.	
4	E64096	Multiple to south of PDA	Lanchester Community Heritage Audit Project 2015– 2017	From 2015 to 2017, the North of England Civic Trust and Lanchester Parish Council carried out the Lanchester Community Heritage Audit project. This identified and recorded all the heritage assets within the parish.	Low

HA	HER	NGR	Name	Monument Description	Grade
	E8235	NZ 20295 47213 (beyond 1km search area)	Environmental Impact Assessment, Langley Wind Farm 2005	In January 2005, The Brigantia Archaeological Practice carried out a desk-based assessment as part of an environmental impact assessment for Langley Wind Farm. It was identified that the southern part of the site, where turbines 1–3 are located, has been subject to open-cast mining in the past. Turbine 4 is located on previously undisturbed land (apart from agriculture practices). Archaeological monitoring works suggested during construction phase.	Low

7.0 DESIGNATED HERITAGE ASSETS

World Heritage Sites

7.1 There are no World Heritage Sites within the PDA or within 0.5km of the PDA. The nearest World Heritage Site is Durham Castle and Cathedral, which is located approximately 10km away.

Scheduled Monuments

7.2 There are no scheduled monuments within the PDA or within the 0.5km study area. The nearest scheduled monument is the Old Hall at Langley, which is located approximately 2.3km away.

Listed Buildings

7.3 There are no listed buildings within the PDA or within the 0.5km study area.

Conservation Areas

7.4 The PDA does not lie within a conservation area. The nearest conservation area is the town of Lanchester, which is located approximately 2km away.

Historic Parks and Gardens

7.5 There are no registered historic parks or gardens within the PDA or the 0.5km study area.

Registered Battlefields

7.6 There are no registered battlefields within the PDA or the 0.5km study area.

8.0 UNDESIGNATED HERITAGE ASSETS

Pre-medieval

- 8.1 There is sparse recorded evidence of activity within the PDA or its local environ predating the medieval period.
- 8.2 Several unclassified earthworks have been identified on aerial photographs to the south-east of the PDA, in the vicinity of Durham road. One cropmark suggesting a sub-rectangular enclosure is recorded on aerial photographs approximately 2.1km to the south-east of the PDA and possibly denotes an Iron Age or Romano-British enclosed settlement and field system.
- 8.3 The nearby town of Lanchester lies directly to the north-east of *Longovicium* Roman fort and associated *vicus*, which was built along the Roman Road of Dere Street. The lack of evidence of significant Roman settlement activity within or nearby the PDA would suggest that it lay within rural lands within the locality of *Longovicium*.
- 8.4 No recorded remains of an early medieval date have been discovered within the PDA or its local environ. The toponymy of Burnhope is suggested to potentially have Anglo-Saxon origins, as Burnhope is derived from the old English for 'stream valley'. Conversely, it should be noted that nearby places share the same name as Burnhope Village, such as Burnhope Farm, which is documented on historic maps prior to the first reference of Burnhope village. Consequently, if the Anglo-Saxon settlement of Burnhope did exist, it is uncertain as to where and what its proximity to the modern village of Burnhope is.

Medieval

- 8.5 Numerous villages surrounding Burnhope were recorded in the Boldon Book of 1183 (Morris 1982), such as the villages of Lanchester, Witton Gilbert, and Langley. This suggests that during the medieval period the PDA was unlikely to have been part of a substantial rural settlement, and instead was located within an agricultural landscape composed of isolated farmsteads.
- 8.6 Earthworks that possibly relate to a medieval settlement were identified on aerial photographs approximately 1.02km north-northeast of the PDA (HA1). If these earthworks are indicative of a medieval settlement, the full extent and preservation of the buried remains is uncertain. Historic maps dated to the 19th and 20th centuries

have consistently recorded substantial quarrying directly to the south of the earthworks, so it plausible that some level of destruction has occurred.

8.7 Although the extent of a medieval settlement, if any, within the local environs of the PDA is uncertain, it is likely that the area in the vicinity of the PDA was subject to mining activity since at least the late medieval period. The earliest evidence of such is found within the accounts of mines administered by the Bishop's Master Foresters, dated to 1426, which record the mines at Burnhope as not being active during 1426 (Fairburn 1996, 22).

Post-medieval

- 8.8 The 1768 map of County Palatinate Durham identifies a place named Burnhope, but it is likely that it refers to a small farmstead located to the south-east of Burnhope village (Fig. 3), which is labelled as Burnhope cottage on the 1898 Ordnance Survey (OS) map (Fig. 5). Therefore, it is suggested that settlement, if any, within the modern Burnhope village area was fairly minor at this time.
- 8.9 Burnhope lies within a mining landscape, as demonstrated by the volume of quarries, shafts and collieries recorded in its local environ on 19th century historic maps. Although sources are scant as to its exact origin, the village of Burnhope is likely to have grown rapidly as a mining village (HA2). Burnhope is first shown on the First Edition six-inch OS map of 1861 and appears as a triangular shaped mining village to the north of Burnhope colliery. Burnhope colliery appears to have been well established by the time the 1861 OS map was published, and in its immediate environ there are two shafts, coke ovens, a gasometer, well and smithy. Although not labelled, the Burnhope Waggonway, which opened in 1850, is shown to run on a north–south orientation from the north of the colliery and is recorded as serving the Burnhope Colliery from the Stanhope and Tyne Railway. The PDA lies approximately 0.6km to the south-west of the colliery, within agricultural land to the south of a building labelled 'White House' (Fig. 4).
- 8.10 Little has changed to the fabric of the PDA between the 1861 and 1898 OS maps. The PDA still appears to belong to agricultural land to the south of the 'White House'. Conversely, both settlement and mining activity in the wider 0.5km study area has increased between the two OS maps. The 1989 OS map shows the addition of numerous new rows of houses within Burnhope village, the most noticeable of which

is Pavilion Terrace, located approximately 0.55km to the north-west of the PDA. In 1894, the colliery is recorded as having an output of 800–900 tons per day and lay within an 837-acre area owned by Utrick Alexander Ritson, Esq. On the 1898 OS map, the colliery has been extended to the south and comprises several pits, those to the south are labelled Fortune Pit and Annie Pit. An old mine shaft has also been recorded directly to the south of the PDA, but its relationship, if any, to the Burnhope colliery is unclear (Fig. 5).

Modern

- 8.11 Mining continued to be the focus of the village's economy during the early modern period, with Burnhope colliery being the source of industrial activity. Although the 1923 OS Map shows that the PDA still lay within agricultural land, the settlement at Whitehouse Farm to the north of the PDA has grown and Burnhope village appears to have expanded along Holmside Lane. Two no longer extant buildings are shown to the south-west of the PDA and are labelled as Engine Cottage and Jaw Blades (Fig. 6).
- 8.12 The importance of Burnhope within the network of mining villages during the early modern period is possibly demonstrated by it hosting the Miners' Gala in 1926 when the Durham Miners' Gala was cancelled due to strikes (HA2).
- 8.13 The 1946 25-inch OS Map shows the erection of new roads and associated housing in Burnhope along Whitehouse Avenue and Greenwood Avenue directly to the west of the White House. By the 1961 1:25,000 OS Map, the quarry (recorded as Ibbetson's Sike Quarry on the 1946 OS Map) to the north of Burnhope has been labelled as disused and Burnhope Colliery and associated wagonway are no longer extant (Fig. 7).

9.0 GEOPHYSICAL SURVEY RESULTS (Fig. 10)

Area 1

9.1 Area 1 is saturated by magnetic disturbance or 'noise', which is likely to be caused by buried building material and rubble associated with the former houses that fronted Greenwood Avenue. It is possible that the magnetic disturbance in this area has masked potential responses of any features buried deeper in the substrata. However, any features that relate to buried remains, if present, are likely to have either been destroyed to some extent during the erection and demolition of the houses formerly lining Greenwood Avenue.

Area 2

- 9.2 There are a series of linear anomalies in the north of the survey area that appear to belong to the same rectilinear features (L1). A distinction has been made between the changes in strength of anomaly responses, so that anomalies composed of a more distinct increase in magnetic response have been labelled 'greater' and those with weaker increases 'lesser'. Although these anomalies appear to form a rectilinear feature and possibly denote potential buried features of an archaeological origin, they appear on the same orientation as features identified as being caused by agricultural activity. Consequently, it is difficult to ascertain whether L1 denotes buried archaeological remains, or is instead indicative of agricultural activity.
- 9.3 There are numerous isolated anomalies with an amorphous shape across the survey area. Those with a coherent patterning or broader form have been identified within the interpretation; however, given the lack of anomalies conclusively identified as being of an archaeological nature, a very tentative interpretation applies, and their origin is currently unknown. It is possible that A1 belong to similar activity as that depicted by L1 and either relates to buried infilled features or agricultural activity. However, given A1's proximity to the edge of the field and the presence of the residential area to the north of the survey area, it is equally possible that A1 instead denotes a build-up of modern surface material. A concentration of isolated amorphous responses occurs in the south of the survey area (A2). The informal distribution and lack of coherent patterning resulted in a tentative interpretation, as it is unclear if these anomalies are indicative of infilled features, agricultural activity, modern material within the topsoil of the site, or belong to geological or pedological changes within the substrata.
- 9.4 There are several linear trends comprising incomplete patterning or weak increases in magnetic response. These fail to produce the necessary patterning or increases in magnetic response to enable them to be interpreted fully, and as a consequence their origin is unknown.
- 9.5 There are three possible alignments of regularly spaced linear anomalies considered likely to relate to agricultural activity. Anomalies running on a west-southwest to east-northeast orientation appear to correspond with potential linear features identified on LiDAR data and so are potentially indicative of earlier agricultural features, such as ridge and furrow. Anomalies on a north-northwest to south-southeast orientation appear on the same alignment as modern field boundaries and so were considered to

potentially relate to modern agricultural practices. Regularly spaced linear anomalies on a north-west to south-east alignment are composed of very faint increases in magnetic response, and consequently it was not possible to provide a detailed interpretation to their origin.

- 9.6 There is a bipolar linear anomaly running on a north-northwest to south-southeast orientation on the same alignment as the field boundary forming the north-east edge of the PDA. It is likely that the linear bipolar anomaly is indicative of a buried utility. It should be noted that the strength and size of the anomaly associated with this suspected buried utility is suggested to reflect the highly magnetic responses of the ferrous material of a buried pipe rather than actual feature dimensions.
- 9.7 Several isolated bipolar responses have been identified. These are considered to be modern and caused by highly magnetic material, such as ferrous objects.
- 9.8 Dipolar anomalies are often likely to relate to ferrous or modern objects buried in the topsoil and so isolated 'spikes' have not been depicted on interpretation plots. Generally, there appears to be a high level of magnetic 'noise' across the site. In particular, an area of increased magnetic response has been identified in the west of Area B that is composed of a high concentration of dipolar and bipolar anomalies. Given the former land use in Area A, it is plausible that dipolar and bipolar anomalies in Area B are in part caused by building material, as well as other modern surface material.

10.0 IMPACTS

- 10.1 The proposed development comprises the construction of a residential development, with associated landscaping and infrastructure. The construction will require the excavation of foundation trenches for houses, service runs for utilities, the stripping and regarding for the construction of roads, in addition to landscaping and removal of overburden, though at the time of this assessment no details of the construction methodology were provided. The following processes involved with the construction phase of the development have the potential to impact on known or potential archaeological remains which might survive at the site:
 - stripping of overburden;
 - excavation including foundations, installation of services and landscaping;

- movement of heavy plant and machinery; and
- contractors compound, storage of equipment, materials and spoil.
- 10.2 The proposed development would not have any physical constructional impact on designated heritage assets within the study area. Two HER sites have been identified within a 1km search of the PDA. Neither of these lie in the direct vicinity of the PDA and development within the PDA is unlikely to affect these sites to a greater extent than that already caused by modern activity, including the former houses that until recently occupied the west of the PDA.
- 10.3 Although the results of the geophysical survey have largely detected modern or agricultural activity, several linear and amorphous anomalies and trends have been identified that are of an unknown origin. Therefore, there is a moderate potential for previously unrecorded buried remains.

11.0 CONCLUSIONS AND RECOMENDATIONS

- 11.1 The proposed development includes the erection of a new housing estate and associated infrastructure to the south of the village of Burnhope, County Durham.
- 11.2 A rapid desk-based assessment of the PDA has shown Burnhope to lie within an agricultural landscape to the east of Lanchester. During the 19th and 20th centuries, the mining industry saw Burnhope rapidly develop as mining village. By the mid-20th century, Burnhope village had grown to encompass land within the west of the PDA with a row of houses fronting Greenwood Avenue. At the beginning of the 21st century, the houses were demolished and the area has since comprises uncultivated grassland. The east of the PDA is shown on historic maps to have belonged to agricultural land throughout the 19th and 20th centuries and presently contains pasture.
- 11.3 The PDA does not pose any threat to known archaeological assets. A HER search at Durham County Council revealed two non-designated heritage sites and three heritage events within a 1km search area of the PDA. No features of an archaeological significance were identified within the immediate vicinity of the PDA, or would be affected to a greater level than that already imposed by the already extant nearby modern development.

- 11.4 Modern activity such as building material associated with the former houses fronting Greenwood Avenue in the west of the PDA has resulted in a high level of magnetic disturbance within the geophysical survey results.
- 11.5 Anomalies identified in the east of the PDA are considered to largely be of a modern or agricultural nature. A series of linear features has been identified that possibly relates to a buried rectilinear feature. However, interpretation was very tentative, as these linear anomalies may instead belong to a series of regularly spaced linear features that are suggested to denote agricultural activity. There are also several amorphous anomalies and linear trends that lack the necessary patterning for detailed interpretation, and consequently their origin is unknown.

12.0 STORAGE AND CURATION

12.1 The records of the geophysical survey are currently held by NAA. All material will be appropriately packaged for long-term storage in accordance with national guidelines (English Heritage 2008; CIfA 2014). An online OASIS form will be completed on the results of the works within three months of the completion of the project under the reference number northern1-314744. This will include submission of a pdf version of the final report to the Archaeology Data Service via the OASIS form

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Historic England National Heritage List for England: <u>https://historicengland.org.uk/advice/hpg/heritage-assets/nhle/</u>

Google Earth: <u>http://earth.google.co.uk</u>

Magic (DEFRA): <u>http://magic.defra.gov.uk/MagicMap.aspx</u>

NPPF Planning Practice Guidance: <u>https://www.gov.uk/government/collections/planning-</u> <u>practice-guidance</u>

British Geological Survey GeoIndex - https://www.bgs.ac.uk/

Cartographic Sources

1766 map of County Palatinate of Durham

- 1861 Ordnance Survey six-inch Durham sheet XIX (surveyed 1853)
- 1898 Ordnance Survey six-inch Yorkshire sheet XIX.NW (revised 1893)
- 1923 Ordnance Survey 25-inch Yorkshire sheet XIX.NW (revised 1913)
- 1961 Ordnance Survey six-inch Yorkshire sheet NZ14 (revised 1913)

APPENDIX A: RELEVANT NPPF POLICIES

National Planning	Policy Framework (NPPF) (2012)
Paragraph 128	"In determining applications, local planning authorities should require an applicant
0.1	to describe the significance of any heritage assets affected, including any
	contribution made by their setting. The level of detail should be proportionate to the
	assets' importance and no more than is sufficient to understand the potential impact
	of the proposal on their significance. As a minimum, the relevant historic
	environment record should have been consulted and heritage assets assessed using
	appropriate expertise where necessary. Where a site on which development is
	proposed includes or has the potential to include heritage assets with archaeological
	interest, local planning authorities should require developers to submit an
	appropriate desk-based assessment and, where necessary, a field evaluation"
Paragraph 129	"Local planning authorities should identify and assess the particular significance of
r urugruph 125	any heritage asset that may be affected by a proposal (including by development
	affecting the setting of a heritage asset) taking account of the available evidence and
	any necessary expertise. They should take this assessment into account when
	considering the impact of a proposal on a horitage asset to avoid or minimize
	conflict between the heritage asset's concervation and any aspect of the proposal "
Deve grouph 121	Lin determining planning applications local authorities should take account of
Paragraph 151	the desirability of sustaining and onbanging boritage assets and putting them to a
	the desirability of sustaining and enhancing nemage assets and putting them to a
	the positive contribution that preservation of heritage coasts can make to sustainable
	ine positive contribution that preservation of heritage assets can make to sustainable
	communities including their economic vitality
	the desirability of new development to making a positive contribution to local
D	Character and distinctiveness
Paragraph 132	when considering the impact of a proposed development on the significance of a
	designated neritage asset, great weight should be given to the asset's conservation.
	The more important the asset, the greater the weight should be. Significance can be
	harmed or lost through alteration or destruction of the heritage asset or development
	within its setting. As heritage assets are irreplaceable, any harm or loss should
	require clear and convincing justification. Substantial harm to or loss of a grade II
	Listed Building, park or garden should be exceptional. Substantial harm to or loss of
	designated heritage assets of the highest significance, notably scheduled monuments,
	protected wreck sites, battlefields, grade I and II* listed buildings, grade I or II*
	registered parks and gardens and World Heritage Sites, should be wholly
	exceptional.
Paragraph 133	Where a proposed development will lead to substantial harm to or total loss of
	significance of a designated heritage asset, local planning authorities should refuse
	consent, unless it can be demonstrated that the substantial harm or loss is necessary
	to achieve substantial public benefits that outweigh that harm or loss, or all of the
	following apply:
	the nature of the heritage asset prevents all reasonable uses of the site; and
	no viable use of the heritage asset itself can be found in the medium term through
	appropriate marketing that will enable its conservation; and
	conservation by grant funding or some form of charitable or public ownership is
	demonstrably not possible; and
	the harm or loss is outweighed by the benefit of bringing the site back into use
Paragraph 134	Where a development proposal will lead to less than substantial harm to the
	significance of a designated heritage asset, this harm should be weighed against the
D 1 405	public benefits, including securing its optimum viable use.
Paragraph 135	The effect of an application on the significance of a non-designated heritage asset
	should be taken into account in determining the application. In weighing
	applications that affect directly or indirectly non-designated heritage assets, a
	balanced judgement will be required having regard to the scale of any harm or loss
D 407	and the significance of the heritage asset
Paragraph 137	Local planning authorities should look for opportunities for new development within
	Conservation Areas and World Heritage Sites and within the setting of heritage assets
	to enhance or better reveal their significance. Proposals that preserve those elements
	of the setting that make a positive contribution to or better reveal the significance of
	the asset should be treated favourably.
Paragraph 138	Not all elements of a World Heritage Site or Conservation Area will necessarily
	contribute to its significance. Loss of a building (or other element) which makes a

	positive contribution to the significance of the Conservation Area or World Heritage Site should be treated either as substantial harm under paragraph 133 or less than substantial harm under paragraph 134, as appropriate, taking into account the relative significance of the element affected and its contribution to the significance of the Conservation Area or World Heritage Site as a whole.
Paragraph 139	Non-designated heritage assets of archaeological interest that are demonstrably of
01	equivalent significance to scheduled monuments, should be considered subject to
	the policies for designated horitage asset
	the policies for designated nemage assets.
Paragraph 141	Local planning authorities should make information about the significance of the
	historic environment gathered as part of plan-making or development management
	publicly accessible. They should also require developers to record and advance
	understanding of the significance of any heritage assets to be lost (wholly or in part)
	in a manner proportionate to their importance and the impact, and to make this
	evidence (and any archive generated) nublicly accessible * However, the ability to
	endered and any areinvergenerated patients in deciding whether each loss
	record evidence of our past should not be a factor in deciding whether such loss
	should be permitted
	*Copies of evidence should be deposited with the relevant Historic Environment
	Record, and any archives with a local museum or other public depository.

NPPF Glossary:

This glossary sets out the definitions for heritage and archaeological issues which should be treated as a material consideration in the planning process. Those definitions of relevance to the current application are:

Historic environment:

• All aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity (whether visible, buried or submerged), as well as landscaped areas and planted or managed flora.

Heritage assets:

• A building, monument, site, place, area or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest. Heritage asset includes designated heritage assets and assets identified by the LPA (including local listing).

Archaeological interest:

• There will be archaeological interest in a heritage asset if it holds, or potentially may hold, evidence of past human activity worthy of expert investigation at some point. Heritage assets with archaeological interest are the primary source of evidence about the substance and evolution of places, and of the people and cultures that made them.

Setting of a heritage asset:

• The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive or negative contribution to the significance of an asset, may affect the ability to appreciate that significance, or may be neutral.

Significance (for heritage policy):

• The value of a heritage asset to this and future generations because of its heritage interest. That interest may be archaeological, architectural, artistic or historic. Significance derives not only from a heritage asset's physical presence, but also from its setting.

Historic environment record:

• Information services that seek to provide access to comprehensive and dynamic resources relating to the historic environment of a defined geographic area for public benefit and use.

APPENDIX B: ASSESSMENT CRITERIA

Table B1: Criteria for Establishing Sensitivity and Importance of Archaeological Remains (Modified from DMRB Table 5.1)

Very High/International	 World Heritage Sites (including nominated sites). Assets of acknowledged international importance. Assets that can contribute significantly to acknowledged international research objectives.
High/National	 Scheduled Ancient Monuments (including proposed sites). Undesignated assets of schedulable quality and importance. Upper tier Archaeological Priority Areas, where used by LPA Assets that can contribute significantly to acknowledged national research objectives
Medium/Regional	 Designated or undesignated assets that contribute to regional research objectives. Remaining tier Archaeological Priority Areas, where used by LPA
Low/Local	 Designated and undesignated assets of local importance. Assets compromised by poor preservation and/or poor survival of contextual associations. Assets of limited value, but with potential to contribute to local research objectives.
Negligible	Assets with very little or no surviving archaeological interest.
Unknown	• The importance of the resource has not been ascertained

Magnitude of impact

'Impact' refers to a predicted change to the baseline environment arising from either the construction or operation of the scheme. Impacts can be both negative or positive, and reversible or irreversible. Table B2 below sets out the criteria adopted for this assessment and is based on the criteria set out in the DMRB cultural heritage guidance Tables 5.3.

Table.B2: Factors in the Assessment of the Magnitude of Impact on Archaeological Remains (Modified from DMRB Table 5.3)

Major Change	Change to most or all key/fundamental archaeological materials, such that the resource is totally altered. Where adverse, this would equate to destroyed or left completely illegible.
	Comprehensive changes to setting.
Moderate	Changes to many key archaeological materials, such that the resource is clearly modified, if
	adverse, it would be substantial harm or loss of legibility.
	Considerable changes to setting that affect the character of the asset.
Minor	Changes to key archaeological materials, such that the asset is slightly altered. In terms of
	adverse impact. This would be minor or less than substantial harm or loss to the asset or slight
	loss of legibility.
	Slight changes to setting.
Negligible	Very minor changes to archaeological materials, or setting.
No Change	No change to fabric or setting of historic building

Significance of effect of impact

The significance of the impact of the proposals on heritage assets is determined by the interaction of receptor value/sensitivity and impact magnitude. Impacts can be positive (i.e. enhance the heritage asset) or negative (i.e. detrimental to the resource). Table B3 below sets out the criteria adopted for this assessment and is based on the criteria set out in the DMRB cultural heritage guidance Tables 5.4.

Table B3: Archaeological	Remains: Significance	e of Effects Matrix (l	based on DMRB Table 5.4)

ΊTΥ	Very high	Neutral	Minor	Moderate/ Substantial	Substantial	Substantial
NITI\	High	Neutral	Minor	Moderate/Minor	Moderate/ Substantial	Substantial
: / SEN	Medium	Neutral	Negligible	Minor	Moderate	Moderate/ Substantial
ALUE	Low	Neutral	Negligible	Negligible	Minor	Minor/ Moderate
>	Negligible	Neutral	Neutral	Negligible	Negligible	Minor
		No change	Negligible	Minor	Moderate	Major
			N	MAGNITUDE OF IMPAC	Т	

APPENDIX C

TECHNICAL INFORMATION

GRADIOMETER SURVEY

Magnetic surveys measure distortions in the earth's magnetic field caused by small magnetic fields associated with buried features (Gaffney and Gater 2003, 36) that have either remnant or induced magnetic properties (Aspinal *et al.* 2008, 21–26). Human activity and inhabitation often alters the magnetic properties of materials (Aspinal *et al.* 2008, 21) resulting in the ability for numerous archaeological features to be detected through magnetic surveys. Intensive burning or heating can result in materials attaining a thermoremanent magnetisation; examples of which include kilns, ovens, heaths and brick structures (Aspinal *et al.* 2008, 27; Gaffney and Gater 2003, 37). When topsoil rich with iron oxides, fills a man-made depression in the subsoil, it creates an infilled feature, such as a pit or ditch, with a higher magnetic susceptibility compared to the surrounding soil (Aspinal *et al.* 2008, 37–41; Gaffney and Gater 2003, 22–26). Magnetic surveys can also detect features with a lower magnetically susceptibility than the surrounding soil, an example of which is a stone wall.

LIMITATIONS

Poor results can be due to several factors including short lived archaeological occupation/use or sites with minimal cut or built features. Results can also be limited in areas with soils naturally deficient in iron compounds or in areas with soils overlying naturally magnetic geology, which will produce strong responses masking archaeological features.

Overlying layers, such as demolition rubble or layers of made ground, can hide any earlier archaeological features. The presence of above ground structures and underground services containing ferrous material can distort or mask nearby features.

Particularly uneven or steep ground can increase the processing required, or distort results beyond the capabilities of processing. It is also possible in areas containing dramatic topographical changes that natural weathering, such as hillwash, often in combination with intensive modern ploughing, will reduced the topsoil on slopes and towards the peaks of hills and possibly destroy or truncate potential archaeological features. Conversely features at the bottom of slopes may be covered by a greater layer of topsoil and so if buried features are present they appear faint within the results, if at all.

Over processing of data can also obscure or remove features, especially if there are on the same orientation as the direction of data collection. Consequently, where possible, attempts are made to ensure data is not collected on the same orientation as known potential features and that data quality is sufficient to minimise the required data processing.

INSTRUMENTATION

The data was collected using handheld Bartington Grad 601-2 fluxgate gradiometers. The Bartington 601-2 is a single axis, vertical component fluxgate gradiometer comprising a data logger battery cassette and two sensors. The sensors are Grad-01-1000L cylindrical gradiometer sensors mounted on a rigid carrying frame; each sensor contains two fluxgate magnetometers with 1m vertical separation.

The difference in the magnetic field between the two fluxgates in each sensor is measured in nanoTesla (nT). NAA gradiometer data is recorded with a range of ± 100 nT, which equates to a resolution of 0.01nT. It should be noted that the actual resolution is limited to 0.03nT as a consequence of internal instrumental noise (Bartington Instruments Ltd n.d., 23).

The gradiometer records two lines of data on each traverse, the grids are walked in a zig-zag pattern amounting to 15 traverses. The gradiometers are calibrated at the start of every day and recalibrated whenever necessary.

SURVEY DETAILS

Table A1: Survey summary

	Survey
Grid size Traverse interval Reading interval Direction of 1st traverse	30mx30m 1m 0.25m N
Number of Grids	22
Area covered	0.74ha

Table A2: Baseline co-ordinates (baseline is shown on Fig. 2)

Grid point (gp) A	Grid point (gp) B
NGR: 418988.8593 547604.5781	NGR: 419018.8593 547604.5781

|--|

Item	Detail
Geology	Carboniferous sandstone from the Pennine Middle Coal Measures formation
Superficial deposits Soils	Devensian Diamicton Brickfield 3 Association
Topography	north end of the site lies at 241m and the south at 235m above Ordnance Datum
Land use	Mixed (west of site: uncultivated grassland / east: pasture)
Weather / conditions prior to and during survey	Snow prior to survey – sunny whilst on site

APPENDIX D

DATA PROCESSING INFORMATION

Gradiometer survey data is downloaded using the Bartington Grad 601 software and the processing was undertaken using Geoplot 3.0 software.

Table B1: Commonly applied techniques

Process	Effect
Zero mean traverse	Removes stripping which can occur as a consequence of using multi sensor arrays or a 'zigzag' data collection method by setting the mean reading for each traverse to zero.
Destagger	Removes stagger in the data introduced through inconsistence data collection pace and often exacerbated through the 'zig-zag' methodology.
Clip	Clips data above or below a set value to potentially enhance potential weaker anomalies.
Despike	Removes random spikes or high readings to reduce the appearance of dominant readings, often created by modern ferrous objects that can distort the results.
Low pass filter	Removes low frequency waves or broad anomalies such as those caused by strong or large gradual variations in the soil's magnetic susceptibility often caused by geological or natural changes in the substrata.
Interpolation	Used to smooth or reduce the blocky appearance of data by improving the spatial density and balance the quantity of data points in the X and Y directions.

Table	B2:	Processing	steps
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Minimal Processing	Increased Processing
Zero mean traverse +5/-5Destagger:	 Low Pass Filter Interpolate Y, Expand - Linear, x2
Area A	
- All: 1	
- 8:1	
- 9:1	
- 11:1	
- 12:3	
- 13:1	
Area B - All: 1	

APPENDIX E

DATA VISUALISATION INFORMATION

FIGURES

The data was used to produce a series of images to demonstrate the results of surveys these are detailed below:

- Greyscale/Colourscale Plot: This visualised the results as a shaded drawing with highest readings showing as black, running through different shades to lowest showing as white.
- XY-trace Plot: This creates a line drawing showing the peaks and troughs of the readings as vertical offset from a centreline.
- Interpreted Plot: Through detailed analysis anomalies have been interpreted and possible features identified. Interpretation drawings are used to show potential features and in particular to reinforce and clarify the written interpretation of the data. Anomalies have been characterised using the terminology detailed in the following section, and have been assigned colour coding outlined in keys found on the relevant figures associated with this report.

MAGNETIC ANOMALIES AND TERMINOLOGY

Terminology	Detail
Anomaly	Any outstanding high or low readings forming a particular shape or covering a specific area with the survey results.
Feature	A man-made or naturally created object or material that has been detected through investigation works and has sufficient characteristics or supporting evidence for positive identification.
Magnetic susceptibility	The ability of a buried feature to be magnetically induced when a magnetic field is applied
Magnetic response	The strength of the changes in magnetic values caused by a buried feature with either a greater or lesser ability to be magnetised compared with the soil around it.
	Anomalies are considered to either have strong / weak or positive / negative responses.
	The strength of magnetic response (along with patterning) can be essential in determining the nature of an anomaly, but it should be noted that the size or strength of the magnetic response does not correlate with the size of the buried feature.
Patterning of an anomaly	The shape or form of an individual anomaly
Thermoremanence	The affect caused when a material has been magnetically altered through a process of heating. Thermoremanent magnetisation occurs when an object or material is heated passed the Curie Point and acquires a permanent magnetisation that is associated with the magnetic field that they cooled within (Gaffney and Gater 2003, 37)

Table C1: Lexicon of terminology

Different anomalies can represent different features created by human, agricultural or modern activity, or natural pedological or geological changes in the substrata.

Anomalies interpreted with a 'greater' categorisation are considered more likely to be of the interpreted characterisation; whereas a more tentative interpretation is applied to those with a 'lesser' categorisation as a consequence of weaker increases in magnetic response or the anomalies incomplete patterning or irregular form.

The strength and size of anomalies can vary depending on the magnetic properties of the feature, the magnetic susceptibility of the soil, the depth to which the feature is buried, and the state of preservation.

Characterisation	Detail
Archaeology	
Positive linear response	Linear anomalies with a positive or negative magnetic responses that lack the necessary patterning to be conclusively interpreted, but are likely to relate to an infilled linear feature.
Positive response	Isolated anomalies or anomalies with a more amorphous form possibly represent infilled features or thermomagnetic features such as areas of heating/burning of an archaeological origin.
	Unless associated with conclusively identified archaeological remains, such as linear anomalies, absolute identification of positive responses can be problematic as it is often not possible to decipher if they are of an archaeological, modern or agricultural origin. Consequently, isolated positive responses are not shown within the interpretation unless composed of a broad form or belonging to a series of isolated positive responses.
	Bipolar responses considered likely to be of an archaeological are also interpreted as isolated anomaly (archaeology). These are considered to relate to material with a very strong magnetic susceptibility or thermoremanent magnetisation.
Trends	Weak and diffuse anomalies with an uncertain origin are denoted by trends. It is possible that these belong to archaeological features, but given their weak signatures or incomplete patterning it is equally plausible that they relate to agricultural features or natural soil formations.
Agriculture	
Agriculture (ridge and furrow?)	Broadly spaced linear anomalies that are possibly indicative of earlier forms of agriculture, such as ridge and furrow. These often correspond with the location of earthworks visible on the ground or identified on aerial photos or LiDAR survey coverage.
Agriculture (modern?)	Regularly spaced linear anomalies that are possibly of a modern agricultural nature. However, the lack of supporting information, weak responses, or non-uniform distribution means that it is unclear as to the nature of the agricultural process they are caused by.
Agriculture (unknown)	Weak, irregularly spaced or isolated linear anomalies that possibly relate to agricultural activity. Given the tentative interpretation, the agricultural process they are caused by is also likely to unknown.

Table C2: Characterisation of anomalies

Characterisation	Detail
Modern	
Bipolar response (modern)	Positive anomalies with associated negative 'halo' (bipolar) denote features with a strong magnetic response are likely to be of a modern origin.
	Isolated bipolar responses of a modern nature are likely to relate to buried ferrous material or objects, such as metallic agricultural debris. If a trend is noted in the alignment or spacing of isolated bipolar responses, it is possible that they are indicative of ferrous fittings or connectors used on buried non-magnetic buried utilities.
	Linear bipolar anomalies are likely to be indicative of modern services.
Dipolar response	Dipolar anomalies relate to individual spike within the data and tend to be caused by ferrous objects. These responses have only been shown when located near to archaeological features.
	When the site is located in a mining landscape it is possible that identified dipolar anomalies relate to mining activity and are indicative of further pits or mine shafts.
Area of increased magnetic response	Areas of increased magnetic response denote areas of disturbance containing a high concentration of dipolar and / or bipolar responses. These are generally considered to be caused by modern debris in the top soil, although it is possible that the disturbance is in part also caused by isolated archaeological material or geological or pedological changes in the substrata.



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Greenwood Avenue, Burnhope, County Durham: site location

Figure 1



Greenwood Avenue, Burnhope, County Durham: heritage assets

Figure 2



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Greenwood Avenue, Burnhope, County Durham: Map of County Palatinate Durham, 1768

Figure 3



Greenwood Avenue, Burnhope, County Durham: Ordnance Survey map of 1861 Figure 4



⁸ Greenwood Avenue, Burnhope, County Durham: Ordnance Survey map of 1898 Figure 5



Greenwood Avenue, Burnhope, County Durham: Ordnance Survey map of 1923 Figure 6



Greenwood Avenue, Burnhope, County Durham: Ordnance Survey map of 1961 Figure 7







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Greenwood Avenue, Burnhope, County Durham: processed greyscale plot and interpretation of gradiometer survey results

