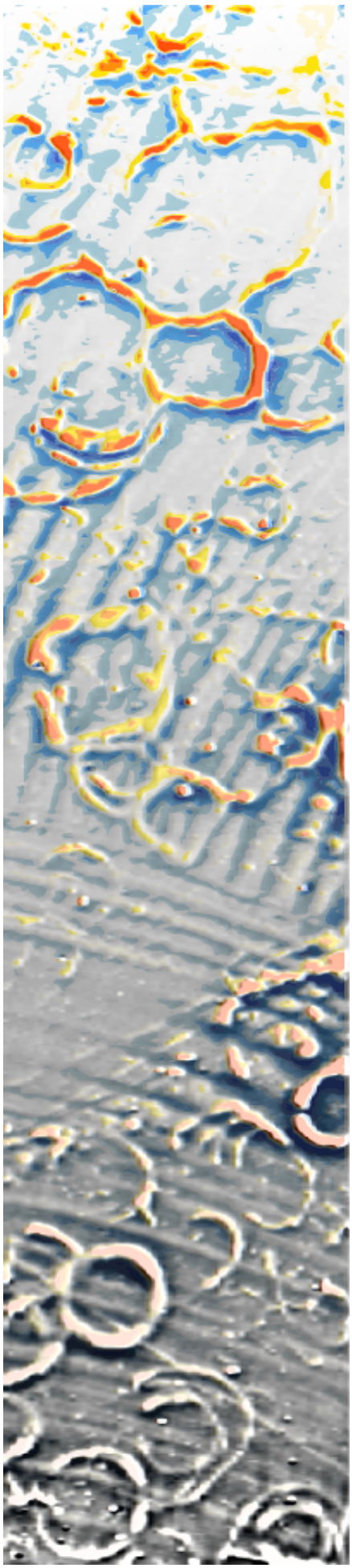

Park Head, St. Eval, Cornwall

Geophysical Survey Report

Produced for the National Trust

Unlocking Our Coastal Heritage Project

Project code NTC127

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Non-Technical Summary

A magnetic survey was commissioned by the National Trust to prospect land at Park Head for buried structures of archaeological interest, under the aegis of the Unlocking Our Coastal Heritage project.

The survey revealed that the headland has been cultivated over potentially a long time, with evidence for multiple field systems. Enclosure ditches not obviously related to cultivation were also found. A known barrow was surveyed over and found to be strongly magnetic which implies that it has been re-used, perhaps as a beacon or to support a structure. A separate area of modified, possibly heated, ground was found nearby.

Digital Data

Item	Sent to	Sent date
CAD – Vector Elements	Jim Parry email	01/08/13

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1 Introduction

Land at the Park Head promontory fort near St. Eval was surveyed using a fluxgate gradiometer as part of the National Trust's Unlocking our Coastal Heritage project to prospect for buried structures of archaeological interest.

1.1 Location

Country	England
County	Cornwall
Nearest Settlement	St. Eval
Central Co-ordinates	184465, 71296

Approximately 1.5 hectares were surveyed across the open ground of the headland.

1.2 Constraints & variations

Some areas were too overgrown to be surveyed and survey was not conducted close to cliff edges, to safeguard personnel.

2 Context

2.1 Archaeology

The following information is quoted verbatim from the brief (Parry, 2012):

2.1.1 Prehistoric

"The earliest indications of human activity within the survey area are represented by a number of Mesolithic flint flakes, blades and core fragments recovered across the headland in irregular scatters. This matches the nature and pattern of Mesolithic activity recorded along this part of the coastline.

A group of eight Bronze Age barrows is situated on Park Head. They form an irregular scatter over the headland; no pattern is clear from their location. Most of the barrows are extant, though all have been mutilated. Six of the barrows are Scheduled. A brief description of these barrows along with their HBSMR PRN is given below:

*90245 (SW 8444 7120) A disturbed bowl barrow 0.7m high, and 26m in diameter at its widest along the cliff edge situated on the very edge of the cliff, and partially destroyed by cliff falls (National Trust 1984). This is apart of SAM 645a-f which includes NTSMR numbers (90245*0, 90256*0, 90248*0, 90249*0, 90250*0 and 90251*0).*

*90246 (SW 8441 7130) A large bowl barrow, 17.5 m in diameter, and 1m high, it has a slight hollow on top (National Trust 1984). This is apart of SAM 645a-f which includes NTSMR numbers (90245*0, 90256*0, 90248*0, 90249*0, 90250*0 and 90251*0).*

90247 (SW 8479 7148) This barrow, originally approximately 12m in diameter, has been dug out to leave only a very slight rim (National Trust 1984). Not scheduled (21780.3)

*90248 (SW 8478 7150) A bowl barrow 14.5m in diameter and 0.6m high, it is apparently unexcavated. It is very close to barrow 90247*0 (National Trust 1984). This is apart of SAM 645af which includes NTSMR numbers (90245*0, 90256*0, 90248*0, 90249*0, 90250*0 and 90251*0).*

90249 (SW 8481 7157) A bowl barrow 0.9m high and approximately 10.7m in diameter, with a small excavation hollow in the top (National Trust 1984). This is apart of SAM 645a-f which includes NTSMR

*numbers (90245*0, 90256*0, 90248*0, 90249*0, 90250*0 and 90251*0).*

*90250 (SW 8461 7126) A large bowl barrow 0.8m high and 25m in diameter (National Trust 1984). This is part of SAM 645a-f which includes NTSMR numbers (90245*0, 90256*0, 90248*0, 90249*0, 90250*0 and 90251*0).*

90251 (SW 8447 7101) A bowl barrow 1.7m high and 18m diameter (National Trust 1984). This is apart of

*SAM 645a-f which includes NTSMR numbers (90245*0, 90256*0, 90248*0, 90249*0, 90250*0 and 90251*0).*

90252 (SW 8454 7084) This is the southernmost of the group of barrows on Park Head; it stands 50m from the cliff top. This barrow was rediscovered by Sheppard in 1978, from the coastal path; it is covered by gorse elsewhere. It was indicated on Thomas's survey sheet (b3) and may have been used as a beacon in the early C19 (b2). This barrow occurs close to the junction of two field boundaries. It is approximately 30 m in diameter , but its profile is obscured by vegetation (National Trust 1984).

To the south west of the survey area, possible Iron Age activity is noted from a single bank which possibly forms part of a larger univallate rectilinear enclosure, 45m wide, visible as a cropmark on aerial photographs."

2.1.2 Medieval

"The nearby settlement of Pentire is first recorded in 1208 when it is spelt "Pentire". The name is Cornish and contains the element pen-tyr meaning 'headland'. Pentire is still occupied. Possible vestiges of a medieval strip field system have been recorded south west of Pentire Farm. To the north east of Pentire Farm is a filed called "Yoke Stitch Moor" on the 1840's tithe map, 'stitches' being the cornish term for medieval strip fields."

2.1.3 Post-Medieval

"During this period the landscape continues to be managed to varying degrees through agriculture with much of the medieval field system retaining its characteristic layout. The early post-medieval period is represented by the remains of a possible field system consisting of narrow, straight ridge and furrow, or, more likely, cultivation marks, visible as low earth banks up to 180m long, on air photographs."

2.2 Environment

Superficial 1: 50000 BGS	None recorded
Bedrock 1:50000 BGS	1:50,000 Eifelian to Frasnian Trevose Slate Formation and Rosenum Formation (Undifferentiated) - Slate and Siltstone (TVRN)
Topography	Undulating
Hydrology	Mostly naturally drained, some artificial drainage in southern part
Current Land Use	Heathland
Historic Land Use	Arable
Vegetation Cover	Grass and low scrub
Sources of Interference	None of significance

The Devonian bedrock is likely to support sufficient natural susceptibility enhancement to allow the detection of features cut into the bedrock or with fills containing former topsoil.

Use of a vertical gradiometer at this site will have suppressed deep variation from the bedrock geology and hence most anomalies will have their origin in the soil, or be due to variations in the surface of the bedrock if the soil is shallow. Magnetic debris in the soil can be expected to have a major effect upon the measurement.

3 Methodology

3.1 Survey

3.1.1 Technical equipment

Measured variable	Vertical component of vertical magnetic field component nT/m
Instrument	Bartington Grad 601-2
Configuration	Carried dual gradiometer
Sensitivity	0.1 nT
QA Procedure	Continuous observation
Spatial resolution	1.0m between lines, 0.25m along line interval

3.1.2 Monitoring & quality assessment

Quality monitoring is by continuous observation during data collection and examination of the data after download.

3.2 Data processing

3.2.1 Procedure

All data processing is minimised and limited to what is essential for the class of data being collected, e.g. reduction of orientation effects, suppression of single point defects (drop-outs or spikes) etc. The processing stream for this data is as follows:

Process	Software	Parameters
Shear collection	ArcheoSurveyor	
Heading correction	ArcheoSurveyor	Zero median line
Cross line interpretation	Surfer	0.25m x 0.25m cubic spline
Imaging and presentation	Manifold GIS	

Data is ported as data surfaces (not images) into Manifold GIS for final imaging and detailed analysis. Specialist analysis is undertaken using proprietary software.

General information on processes commonly applied to data can be found in standard text books and also in the 2008 English Heritage Guidelines "Geophysical Survey in Archaeological Field Evaluation" at http://www.helm.org.uk/upload/pdf/Geophysical_LoRes.pdf.

All archived data includes process metadata.

3.3 Interpretation framework

3.3.1 Resources

Numerous sources are used in the interpretive process which takes into account shallow geological conditions, past and present land use, drainage, weather before and during survey, topography and any previous knowledge about the site and the surrounding area. Old Ordnance Survey mapping is consulted and also older sources if available.

3.3.2 Magnetic

Interpretative logic is based on structural class and examples are given below. For example a linear field or

gradient enhancement defining an enclosed or semi-enclosed shape is likely to be a ditch fill, if there is no evidence for accumulation of susceptible material against a non-magnetic structure. Weakly dipolar discrete anomalies of small size are likely to have shallow non-ferrous sources and are therefore likely to be pits. Larger ones of the same class could also be pits or locally-deeper topsoil but if strongly magnetic could also be hearths. Strongly dipolar discrete anomalies are in all cases likely to be ferrous or similarly magnetic debris, although small repeatedly heated and in-situ hearths can produce similar anomalies. Reduced field strength (or gradient) linear anomalies without pronounced dipolar form are likely to be caused by relatively low susceptibility materials, e.g. masonry walls, stony banks or stony or sandy ditch fills.

3.4 Standards & guidance

All work was conducted in accordance with the following standards and guidance:

- David et al, "Geophysical Survey in Archaeological Field Evaluation", English Heritage, 2008.
- "Standard and Guidance for Archaeological Field Evaluation", Institute for Archaeologists, 2008.

In addition, all work is undertaken in accordance with the high professional standards and technical competence expected by the Geological Society of London and the European Association of Geoscientists and Engineers.

All personnel are experienced surveyors trained to use the equipment in accordance with the manufacturer's expectations. All aspects of the work are monitored and directed by fully qualified professional geophysicists.

4 Catalogue

Label	Anomaly Type	Feature Type	Description	Easting	Northing
1	Linear enhanced dipolar	Fill - Ditch	A narrow probable ditch fill that might have partly defined a sub-rectangular enclosure	184361.6	71381.7
2	Texture	Natural	This area of uniform magnetic gradient will most likely have a natural origin, perhaps thinner soil over bedrock	184388.3	71363.5
3	Texture	Natural	See [2]	184378.7	71317.8
4	Linear enhanced dipolar	Fill - Ditch	Possible ditch fill, probably a continuation of [9] and hence also [7]. It seems likely to have been a former field boundary	184373.3	71358.9
5	Linear reduced dipolar	Fill / structure	Probable former field boundary	184443.4	71363.3
6	Linear reduced dipolar	Fill / structure	Possible former field boundary, perhaps related to [5] and [16], though if a ditch it could also be earlier	184429.6	71350.6
7	Linear reduced dipolar	Fill / structure	Probable former field boundary	184440.9	71339.1
8	Linear enhanced dipolar	Fill - Ditch	This seems to be a narrow (< 1.5m) enclosure ditch, evidently of different phase to [6], [7] and [16] but perhaps still an element of a former field system. See also [13]	184435.9	71327.6
9	Linear enhanced dipolar	Fill - Ditch	A weak band c1m wide of enhanced magnetic gradient implies material with raised magnetic susceptibility is present in the soil and hence structures [7] and [4] are probable continuous across the less magnetic ground [2]	184397.5	71350.6
10	Area strongly enhanced (group)	Fills / debris?	Similar to the site of the barrow (14], this area has been modified and in a way that strongly augments the magnetic field, e.g. by cyclic heating of the soil. Could this be the site of a beacon? If so, the structure of radiating spoke-like anomalies is difficult to understand	184410.2	71345.6
11	Discrete strong dipolar (sample)	Fill - pit / Debris	Apparently associated with [10] are a number of strongly magnetic dipolar anomalies around its periphery. They are too large and irregular to be the bases of fence stanchions (for example) so pits with fills containing heated soil or debris might be more likely?	184405.4	71336.4
12	Linear enhanced dipolar	Fill - Ditch	A narrow (< 1.5m) ditch fill defines the NW corner of an enclosure that might, or might not, relate to the the complex of which [8] and [13] are members	184381.2	71298.4

13	Linear enhanced dipolar	Fill - Ditch?	See [8]: this seems to be a narrow (< 1.5m) enclosure ditch, evidently of different phase to [6], [7] and [16] but perhaps still an element of a former field system	184395.4	71278.4
14	Area strong dipolar	Debris - structure	Ring-shaped anomaly and very strongly magnetic so likely to include fired materials and with an approximate diameter of 13m. The Ordnance Survey mark this as a 'barrow', however, the magnetic data suggests that to either be something else or to have been modified, e.g. by being used a beacon or the base of a structure	184419.6	71302.2
15	Linear reduced dipolar	Fill / structure	Probable very narrow (c0.5m) ditch fill	184429.2	71293.6
16	Linear reduced dipolar	Fill / structure	Probable former field boundary	184445.3	71278.9
17	Linear enhanced dipolar	Fill - Ditch	Possible ditch fill (very little within survey) and if so perhaps it relates to [18]	184451.1	71270.1
18	Linear enhanced dipolar	Fill - Ditch?	Possible narrow (< 1.5m) enclosure ditch, parallel to [16] and therefore perhaps part of the same complex	184443.7	71265.9
19	Linear reduced dipolar	Fill / structure	One of two (see also [20]) parallel structures, perhaps ditch fills or wall bases, or alternatively cultivation features (their ~6m spacing is similar to that of ridge and furrow for example) as their orientation is similar to more obvious examples immediately to the south	184429.4	71252.5
20	Linear reduced dipolar	Fill / structure	See [19]	184421.3	71246.9
21	Area enhanced gradient	Fill - Ditch?	Uncertain interpretation	184436.2	71276.2
22	Strongly enhanced linear dipolar	Ferrous?	Service, e.g. a pipe or cable?	184426.5	71229.3
23	Variable strong dipolar	Debris?	Possibly modern (buried) debris or an area of heated soil	184452.5	71330.1
24	Linear reduced dipolar	Fill / structure	Probable former field boundary	184489.8	71177.5

5 Discussion

5.1 Introduction

The sections below first discuss the geophysical context within which the results need to be considered and then specific features or anomalies of particular interest. Not all will be discussed here and the reader is advised to consult the catalogue (ibid) in conjunction with the graphical elements of this report.

5.2 Principles

In general, topsoil is more magnetic than subsoil which can be slightly more magnetic than parent geology, whether sands, gravels or clays, however, there are exceptions to this. The reasons for this are natural and are due to biological processes in the topsoil that change iron between various oxidation states, each differently magnetic. Where there is an accumulation of topsoil or where topsoil has been incorporated into other features, a greater magnetic susceptibility will result.

Within landscapes soil tends to accumulate in negative features like pits and ditches and will include soil particles with thermo-remanent magnetization (TRM) through exposure to heat if there is settlement or industry nearby. In addition, particles slowly settling out of stationary water will attempt to align with the ambient magnetic field at the time, creating a deposit with depositional remanent magnetization (DRM).

As a consequence, magnetic survey is nearly always more a case of mapping accumulated magnetic soils than structures which would not be detected unless magnetic in their own right, e.g. built of brick or tile. As a prospecting tool it is thus indirect. Fortunately, the mechanisms outlined above are commonplace and favoured by human activity and it is nearly always the case that cut features will alter in some way the local magnetic field.

5.2.1 Instrumentation

The use of a vertical gradiometer sensitises the measurement process to within a particular depth extent governed by the instrument sensitivity and the sensor separation. In this case the extent is approximately one meter, i.e. sufficient for the detection of buried archaeological structures of normal magnetic susceptibility. As especially strong response will be measured from magnetic sources at the surface; conversely variations in deep alluvium or within the shallow geology will not normally be detected.

5.3 Character & principal results

5.3.1 Geology

The Devonian slate and siltstone is supporting significant natural magnetic susceptibility enhancement, as would be expected. However, there are areas of low contrast which will reflect a change in soil depth or chemistry. It is interesting to observe that these lay along a line of weaker rock extending across the headland and manifest as each end as deep erosion and collapse features.

5.3.2 Land use

The promontory appears to have been cultivated throughout and the direction directions of cultivation imply this has happened at different dates, e.g. within different phases of enclosure. The presence of probable land drains in the southern part of the survey implies relatively recent (e.g. from the early 1800s) efforts at land improvement as well as cultivation and despite the relative proximity of the cliff edge.

There are clearly multiple field systems but it is not possible to reliably extract the form of each. Boundaries depicted on 19th century Ordnance Survey maps align approximately with [5], [7] and [16] and are parallel with the cultivation visible in the southern part of the survey. This would imply these represent the latest

phase of enclosure and therefore, by association, differently angled boundaries and cultivation to be earlier. An area of strongly magnetic cultivation southwest of [14] would be an candidate for this, as well as [8], [13], etc.

5.3.3 Archaeology

The most prominent aspect of the result is the barrow [14], plotted by the Ordnance Survey and therefore an expected monument. However, it is extremely magnetic (> 150 nT) which is not expected from a barrow and implies it re-use. The shape of the anomaly implies a relatively non-magnetic core to the mound whereas the rest of the mound is magnetic. It might be that the centre has been disturbed (and re-filled?) after magnetisation of the soil.

The reason for the magnetic enhancement is not obvious but could result from repeated use of the mound as the base of a beacon, the surface soil becoming steadily more magnetised as a result.

A further possible location of heated soil is [10] where strong magnetic anomalies loosely radiate out from a core of about the same size as [14]. Whether this is the site of another barrow is unclear; the Ordnance Survey have nothing plotted at this location. The layout of the structure is difficult to understand and does not appear to be due to later cultivation across it.

Around the southern flank of the core structure are a number (3 - 4?) of what appear to be discrete structures [11], perhaps pits with strongly magnetic fills. This could also be heated soil, which might lend credibility to interpretation of [10] as a barrow.

There are numerous ditch fills or boundary structures, some broadly parallel e.g. [5], [7], and [16] and hence likely to be former field boundaries. Others, e.g. [6] cut across these. A further set, [8], [12] and perhaps also [18] seem to belong to an earlier set of enclosures though their date is uncertain.

5.4 Conclusions

One known barrow [14] has been located and the possible site of a second found nearby. The known site has been re-used in the past and might have been the site of a beacon. The other possible barrow is also associated with strong magnetic fields but the irregular layout of these does not lend itself to interpretation.

The entire headland, with the probable exception of known barrow [14] has been cultivated and judging the multiple sets of enclosures would suggest the land has been in arable production for quite a while. It has not been possible to provide dates for this but it is possible that some elements of the enclosures have origins in prehistory.

5.5 Caveats

Geophysical survey is a systematic measurement of some physical property related to the earth. There are numerous sources of disturbance of this property, some due to archaeological features, some due to the measuring method, and others that relate to the environment in which the measurement is made. No disturbance, or 'anomaly', is capable of providing an unambiguous and comprehensive description of a feature, in particular in archaeological contexts where there are a myriad of factors involved.

The measured anomaly is generated by the presence or absence of certain materials within a feature, not by the feature itself. Not all archaeological features produce disturbances that can be detected by a particular instrument or methodology. For this reason, the absence of an anomaly must never be taken to mean the absence of an archaeological feature. The best surveys are those which use a variety of techniques over the same ground at resolutions adequate for the detection of a range of different features.

Where the specification is by a third party ArchaeoPhysica will always endeavour to produce the best possible result within any imposed constraints and any perceived failure of the specification remains the responsibility of that third party.

Where third party sources are used in interpretation or analysis ArchaeoPhysica will endeavour to verify their

accuracy within reasonable limits but responsibility for any errors or omissions remains with the originator.

Any recommendations are made based upon the skills and experience of staff at ArchaeoPhysica and the information available to them at the time. ArchaeoPhysica is not responsible for the manner in which these may or may not be carried out, nor for any matters arising from the same.

5.6 Bibliography

Parry, 2012, "Unlocking Our Coastal Heritage Project: Park Head Bronze Age Barrow, Lower Butter Cove, St Eval – Brief for Geophysical Survey", the National Trust, unpublished

5.7 Acknowledgements

Jim Parry, National Trust archaeologist, and the National Trust wardens are thanked for their help and support throughout the survey. The site-specific advice given by staff of Cornwall Council HES is gratefully acknowledged.

6 Appendices

6.1 Project metadata

Project Name	Park Head, Cornwall
Project Code	NTC127
Client	The National Trust
Fieldwork Dates	30th April, 1st May 2013
Field Personnel	M Edwards
Data Processing Personnel	R Dean, MJ Roseveare
Reporting Personnel	MJ Roseveare, ACK Roseveare
Draft Report Date	31st July 2013
Final Report Date	

6.2 Qualifications & experience

All work is undertaken by qualified and experienced geophysicists who have specialised in the detection and mapping of near surface structures in archaeology and other disciplines using a wide variety of techniques. There is always a geophysicist qualified to post-graduate level on site during fieldwork and all processing and interpretation is undertaken under the direct influence of either the same individual or someone of similar qualifications and experience.

ArchaeoPhysica meets with ease the requirements of English Heritage in their 2008 Guidance "Geophysical Survey in Archaeological Field Evaluation" section 2.8 entitled "Competence of survey personnel". The company is one of the most experienced in European archaeological prospection and is a key professional player. It only employs people with recognised geoscience qualifications and capable of becoming Fellows of the Geological Society of London, the Chartered UK body for geophysicists and geologists.

6.3 Safety

Safety procedures follow the recommendations of the International Association of Geophysical Contractors (IAGC).

Principal personnel have passed the Rescue Emergency Care – Emergency First Aid course and CSCS cards are being sought for those members of staff currently without them.

All personnel are issued with appropriate PPE and receive training in its use. On all sites health and safety management is performed by the Project Geophysicist under supervision by the Operations Manager.

Health and safety policy documentation is reviewed every 12 months, or sooner if there is a change in UK legislation, a reported breach of such legislation, a reported Incident or Near Miss, or changes to ArchaeoPhysica's activities. Anne Roseveare, Operations Manager, has overall responsibility for conducting this review and ensuring documentation is maintained.

We are happy to confirm that ArchaeoPhysica has suffered no reportable accidents since its inception in 1998.

6.4 Archiving

ArchaeoPhysica maintains an archive for all its projects, access to which is permitted for research purposes. Copyright and intellectual property rights are retained by ArchaeoPhysica on all material it has produced, the client having full licence to use such material as benefits their project.

Archive formation is in the spirit of Schmidt, A., 2001, "Geophysical Data in Archaeology: A Guide to Good Practice", ADS.

Access is by appointment only. Some content is restricted and not available to third parties. There is no automatic right of access to this archive by members of the public. Some material retains commercial value and a charge may be made for its use. An administrative charge may be made for some enquiries, depending upon the exact nature of the request.

The archive contains all survey and project data, communications, field notes, reports and other related material including copies of third party data (e.g. CAD mapping, etc.) in digital form. Many are in proprietary formats while report components are available in PDF format.

In addition, there are paper elements to some project archives, usually provided by the client. Nearly all elements of the archive that are generated by ArchaeoPhysica are digital.

It is the client's responsibility to ensure that reports are distributed to all parties with a necessary interest in the project, e.g. local government offices, including the HER where present. ArchaeoPhysica reserves the right to display data from projects on its website and in other marketing or research publications, usually with the consent of the client. Information that might locate the project is normally removed unless otherwise authorised by the client.