



## **Graven Hill, Bicester**

### **Barrus Development D1 & D4 - Written Scheme of Investigation for an Archaeological Watching Brief**

March 2019

#### **Waterman Infrastructure & Environment Ltd**

Merchants House, Wapping Road, Bristol BS1 4RW  
[www.watermangroup.com](http://www.watermangroup.com)







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## Quality Assurance – Approval Status

This document has been prepared and checked in accordance with  
Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015 and BS OHSAS 18001:2007)

Issue	Date	Prepared by	Checked by	Approved by
Final	March 2019	Michael Fleming <i>Graduate Heritage Consultant</i> 	Andrew Holmes <i>Associate Director</i>	Andrew Holmes <i>Associate Director</i> 

## Comments

## Disclaimer

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#### **Contents**

Graven Hill, Bicester

Document Reference: WIE15089

WIE15089\_101\_1\_1\_2\_WSI

## 1. Introduction

### Project Background

- 1.1. This Written Scheme of Investigation (WSI) is for an archaeological Watching Brief to monitor and record any significant archaeological remains or deposits during the construction of an office building by E P Barrus Limited (hereafter referred to as the 'Client') in support of the proposed redevelopment of the D1 and D4 sites within Land Transfer Area 2 (LTA2), sites D and E, MOD Bicester, OX25 2PX, centred on National Grid Reference (NGR) 459046 219738 (hereafter 'the Site' **Figure 1 and 2**).
- 1.2. This archaeological monitoring work forms the mitigation response to the proposed construction of a new office building and associated works to the south of the existing D1 building. The new building will be linked to the existing facility.
- 1.3. This WSI has been prepared in line with Pre-Commencement Condition C48 and C49 under the current outline planning permission following a S73 variation, reference 18/0325/OUT, and are as follows;

#### C48

*"With the exception of Phase 0, Phase 1a and Phase 1b as shown on Drawing No: 19820-A- L-573-V, prior to any demolition and the commencement of any development on each phase of development, a professional archaeological organisation acceptable to the Local Planning Authority shall prepare an overarching Archaeological Written Scheme of Investigation providing for evaluation of the Graven Hill Site and the principles of any subsequent mitigation and post excavation analysis and publication, which shall be submitted to and approved in writing by the Local Planning Authority.*

*Reason - To safeguard the identification, recording, analysis and archiving of heritage assets before they are lost and to advance understanding of the heritage assets in their wider context through publication and dissemination of the evidence in accordance with Government guidance contained within the National Planning Policy Framework."*

#### C49

*"With the exception of Phase 0, Phase 1a and Phase 1b as shown on Drawing No: 1982-A- L-573-V, and following approval of the Written Scheme of Investigation referred to in condition 48, prior to any demolition and the commencement of any development on each phase of development (other than in accordance with the agreed Written Scheme of Investigation), a staged programme of archaeological evaluation and mitigation shall be carried out by the commissioned archaeological organisation in accordance with the approved Written Scheme of Investigation.*

*Reason: To safeguard the identification, recording, analysis and archiving of heritage assets before they are lost and to advance understanding of the heritage assets in their wider context through publication and dissemination of the evidence in accordance with Government guidance contained within the National Planning Policy Framework."*

### Scope of Document

- 1.4. This WSI sets out the methodologies and standards that will be employed by an appointed Archaeological Contractor to fulfil the above Condition C48 and C49 with regards to an archaeological Watching Brief and will be submitted for approval prior to implementation to the Oxfordshire County Archaeological Services Officer (OCASO) advising Cherwell District Council (CDC).
- 1.5. This document conforms with current best practice and to the guidance and frameworks outlined in

Management of Research Projects in the Historic Environment (MoRPHE)<sup>1</sup>, the Chartered Institute for Archaeologists' (CIfA) Standard and Guidance for Archaeological Watching Brief<sup>2</sup>, English Heritage (Historic England) Conservation Principles, Policies and Guidance<sup>3</sup>, The Solent Thames Research Framework<sup>4</sup> and The Cherwell Local Plan<sup>5</sup>.

## Site Description

- 1.6. The Site is located within Oxfordshire, covering approximately 7.3ha, centred on NGR 459046 219738 (**Figure 1 and 2**). The Site is situated within the proposed LTA2 Employment Area, which is currently part of MOD Bicester and surrounds buildings D1 and D4. with the land includes open grassland and hard-standing to the east, a trainline to the south, woodland to the west Graven Hill and Anniversary Avenue to the north.
- 1.7. The proposed development includes the provision of one office building with associated service utilities, access roads, and pedestrian walkways, soft landscaping, re-use of existing buildings and highway improvement works<sup>6</sup>.

Figure 1: Site Location



<sup>1</sup> Historic England, 2015, *Management of Research Projects in the Historic Environment: The MoRPHE Project Managers' Guide*. Swindon; Centre for Archaeology Guidelines

<sup>2</sup> CIfA, 2014, *Standard and guidance: archaeological watching brief*. CIfA; Reading

<sup>3</sup> English Heritage, 2008, *Conservation Principles, Policies and Guidance*.

<sup>4</sup> Hey G. and Hinds J. (eds), 2014. *Solent-Thames Research Framework for the Historic Environment: Resource Assessments and Research Agendas*, Oxford Wessex Monograph No. 6, Berfords Information Press: Oxfordshire

<sup>5</sup> Cherwell District Council (CDC), January 2014, *The Cherwell Local Plan 2016-2031 Submission*

<sup>6</sup> Ridge, June 2018. *Ground Condition Assessment, E P Barrus, Graven Hill, Units D1 And D4*. (Unpublished Client Report; 5005462-815)

*Source: OS Data © Crown Copyright and Database Right 2018  
[Accessed via ArcGIS Online 18<sup>th</sup> March 2019]<sup>7</sup>*

## **Geology and Topography**

- 1.8. The British Geological Survey notes no superficial geology; however, bedrock geology comprises of Peterborough Member mudstone of the Oxford Clay Formation overlying Kellaways Sand and Clay members (Kellaways Formation) and mudstone Cornbrash Formation<sup>8</sup>.
- 1.9. Much of the Site lies between approximately 70m to 65m above Ordnance Datum (aOD), sloping downhill to the south.

<sup>7</sup> ArcGIS Online [Accessed on 18th March 2019]

<sup>8</sup> Geology of Britain Viewer, British Geological Society - <http://mapapps.bgs.ac.uk/geologyofbritain/home.html> [Accessed on 18th March 2019]

## 2. Archaeological and Historical Background

- 2.1. The archaeological background of the Site is summarised below from the previous Amec Environmental Statement<sup>9</sup>. This is followed by updated information under each period heading following the results of field investigations and mitigation undertaken as part of original Planning Condition 71 for LTA1.

### Prehistoric (500,000 BC to AD 43)

- 2.2. Prehistoric remains have been recorded within the Site including:
- 2.3. A Neolithic polished flint axe fragment within subsoil, recovered by an evaluation by Oxford Archaeology in LTA1 in 2016.
- 2.4. Iron Age activity within the north of the Site was uncovered by Oxford Archaeology in 2016, as well as on the slope of Graven Hill in LTA1 in Areas A, C and E.
- 2.5. Within the wider area, evidence of Prehistoric artefactual and settlement activity within 1km of the Site begins with Mesolithic activity onwards in the form of residual flint flakes approximately 1km to the north-west of the Site<sup>10</sup>.
- 2.6. Aerial photography potentially indicates Bronze Age ring ditches to the north-west of the Site<sup>11</sup>. Potential Bronze Age settlement activity in the form of a 'banjo-type' enclosure, three hut circles and a number of ditches have also been identified on aerial photography to the south-west of the Scheduled Monument of Alchester Roman town [13904]<sup>12</sup>.
- 2.7. Nearby Iron Age settlement activity has been noted at Chesterton Lane<sup>13</sup> in advance of constructing the A41 dual carriageway and Bicester Fields Farm<sup>14</sup> to the north of Graven Hill. The later excavation may have been of relatively high status based on the artefact typology.
- 2.8. Remaining prehistoric material includes findspots such as a Bronze Age 'palstave' axe [16086] recovered near Alchester Roman Town and a Bronze Age spearhead [13922] from south of Graven Hill. The Historic Environment Record (HER) also records a number late Iron Age pottery findspots<sup>15</sup>.
- 2.9. It should be noted that a potential Iron Age Hill Fort associated with a linear earthwork, still observable within Graven Hill Wood, was excavated by Oxford University on top of Graven Hill in 1999. The excavation however, revealed no obvious Iron Age evidence there, which may instead represent post-medieval agricultural lynchets. No other Iron Age activity has been noted for the earthwork.

### Romano-British (AD 43 to AD 410)

- 2.10. Romano-British activity has been observed within Areas A and B in the form of Akeman Street and rectilinear enclosures within the LTA1 Site.
- 2.11. Another Roman period settlement site has been excavated to the north of Graven Hill at Oxford Road<sup>16,17</sup>.

<sup>9</sup> Amec, September 2011. *Future Defence Storage and Redistribution Programme – Redevelopment of MOD Bicester – Environmental Statement*

<sup>10</sup> Oxoniensia, 2000. *The excavation of a Late Iron Age enclosed settlement at Bicester Fields Farm, Bicester, Oxon* Issue: 64 pp. 153 - 233 "The excavation of a Late Iron Age enclosed settlement at Bicester Fields Farm, Bicester, Oxon." in Oxoniensia Issue : 64 (2000), Pages: 153 - 233

<sup>11</sup> Air Photo Services Ltd, 2005. *Land southwest of Bicester, Oxfordshire: Interpretation of Aerial Photographs for Archaeology*. Project No. 0418

<sup>12</sup> Historic England, [Accessed on 10th January 2018] Available from:

[http://www.heritagegateway.org.uk/Gateway/Results\\_Single.aspx?uid=MOX5141&resourceID=1033](http://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=MOX5141&resourceID=1033)

<sup>13</sup> P M Booth, J Evans and J Hiller, 1991. *Excavations in the Extramural Settlement of Roman Alchester, Oxfordshire*, in Oxford Archaeology Monograph, 1

<sup>14</sup> Oxford Archaeological Unit, 1998. *Bicester Fields Farm, Bicester, Oxfordshire – Archaeological Evaluation Report*

<sup>15</sup> Amec, September 2011. *Future Defence Storage and Redistribution Programme – Redevelopment of MOD Bicester – Environmental Statement*

<sup>16</sup> Bevan, L. and Leach, P., 1993. *An Archaeological Evaluation at Oxford Road, Bicester, Oxfordshire (BUFAU Report 277)*

<sup>17</sup> Oxoniensia (Mould, C.), 1996. *An Archaeological Excavation at Oxford Road, Bicester, Oxfordshire* Issue: 61

Evaluation revealed extensive survival of late Iron Age and Romano-British settlement within the floodplain of Langford Brook. All identified features were preserved under post-Roman alluvium and appeared to represent two phases of occupation. The earlier phase was dated to the 1st century AD, and the latter phase to the 2nd century AD. It was interpreted as a low status rural site typical of Upper Thames region for the period, at a time when increasing agricultural intensification required use of previously marginal land.

- 2.12. The principal settlement site of Roman date within the area is the town of Alchester, a Scheduled Monument. Together with the associated Roman roads, one of which crosses the Site, Alchester defines the Roman settlement pattern in the immediate surrounds of the Site.
- 2.13. Other areas of Roman settlement were also present, including a site which has been excavated at London Road in Bicester (Oxfordshire HER ref. 26005). This was within an area of raised ground between two paleochannels, and comprised a large number of ditches, pits and postholes. The excavation presented a picture of settlement within an area which was generally wet and marshy.
- 2.14. A feature of interest in the early OS editions is the course of Langford Lane, which ran within the Graven Hill Site boundary. From its current location at Alchester, the lane continued toward Merton, remaining outside of the Site boundary. The other branch continued to the east, following a line on the north side of Graven Hill, within the Site boundary, joining the line of Akeman Street at Wretchwick Farm. Given its location, it is possible that this may be a survival of the original Roman Road which led east from Alchester to link with Akeman Street. This route appears to have survived the initial construction of the Graven Hill ordnance depot as it can be seen on aerial photographs of 1945 as a double line of trees.
- 2.15. There is also a significant body of evidence of Roman occupation documented in the Oxfordshire HER in the form of numerous artefacts, many of which have been found within and around the Alchester site or along the known routes of Roman roads.

#### **Medieval (AD 410- AD 1540)**

- 2.16. There is relatively little known of the early medieval settlement within the area, though the Roman town at Alchester was abandoned, perhaps from around the 5th century AD. Bicester appears to have been established as a Saxon settlement in the 6th century and was named as Burencestre in the Domesday Book. The name has been described as either meaning 'fort of Bern' with 'Bern' being derived from the personal name for Beorna<sup>18</sup>, or alternatively being derived from two separate elements – 'byrgen' meaning burial mound, and 'ceaster' meaning Roman fort<sup>19</sup>. The earliest excavated evidence for settlement within the town is from a site to the rear of the King's Arms<sup>20</sup>, which lies to the north of Graven Hill. Excavated remains included pits, gullies and evidence for a number of sunken-feature buildings, which may represent former houses.
- 2.17. The first edition Ordnance Survey (OS) map of 1885 includes the note site of battle between the Danes and Saxons in AD 871 within Graven Hill Wood. However, there is no other known reference to an early medieval battle at this location and it is not clear on what this is based. Without further evidence, this record should be treated with caution.
- 2.18. The first edition OS also indicates the boundary between the parishes of Ambrosden and Merton cutting across Graven Hill Wood. The division into two halves may be significant since they are divided by a dry ditch starting at the northern 300' contour and rising with the landscape to possibly 370' and down again

<sup>18</sup> British History Online, [accessed 10th March 2019]. Lobel, M.D.(ed), 1959, *The market town of Bicester A History of the County of Oxford: Volume 6*, pp. 14-56 Available from: <http://www.british-history.ac.uk/vch/oxon/vol6/pp14-56>

<sup>19</sup> Ekwall, E., 1960. *The Concise English Dictionary of English Place-names*

<sup>20</sup> Harding, P & Roberts, M, 2000. *King's Arms, Bicester, Oxfordshire. Assessment Report on the Results of the Archaeological Excavation Including Proposals for Post-Excavation Analysis and Publication* (Wessex Archaeology)

to the southern 300' contour.

- 2.19. Ambrosden formed the principal medieval settlement within its parish, though other settlements are also known, such as the one at Arncott. During the medieval period, much of the land around Graven Hill appears to have been in arable use, and the Victoria County History<sup>21</sup> records that the agricultural land of Ambrosden village was organised around three main fields known by the 17th century as East, South and West Fields. The extent of arable cultivation is indicated on aerial photographs of the 1940s which show ridge and furrow earthworks (derived from medieval and post-medieval ploughing) on much of the land surrounding the hill, including some of the lower slopes.
- 2.20. In addition to the surviving settlements of medieval origin, there was also a medieval settlement at Wretchwick, to the north of Graven Hill, and possibly extending into its lower slopes. Wretchwick, now a Scheduled Monument, was in the possession of Bicester Priory, before being depopulated by the priory to make way for sheep grazing.

### **Post-medieval to Modern (AD 1540- Present)**

- 2.21. The Site is shown in detail on a series of OS Maps dating from 1880 onwards. In 1880, the Graven Hill Site is shown comprising a series of enclosed fields arranged around Graven Hill Wood. A single farmstead was present within the Site boundary in 1880, located on the southern edge of Graven Hill Wood, and known as Mount Pleasant. A building is shown on this location on the aerial photographs of 1944-45 and it is possible that Mount Pleasant remained until the development of St David's Barracks in the 1950s.
- 2.22. The major development of the 20th century, which has shaped the current form of the Site, was the establishment of the Central Ordnance Depot in 1941 during World War Two. The Bicester site was chosen as being suitable as it was located within southern England, with good road and rail links, and with enough space for the creation of a dispersed complex required for protection against air attack. The depot was to spread over a wide area, occupying several sites from Graven Hill in the north to Arncott and Piddington in the south, collectively known as MOD Bicester.
- 2.23. The selection of MOD Bicester was approved in May 1941 and construction began soon after. Initial construction involved the laying of a 42-mile military rail network within and linking the various sites, followed by construction of the warehouse buildings. Graven Hill comprised D Site (armaments stores) to the south and E Site (small arms) to the north. Stores began to be issued from the MOD Bicester depot in August 1942, and it remained a key supply point for the army for the remainder of the war.
- 2.24. The entry of the United States into the war led to the arrival of large numbers of American troops into Britain, and it was necessary to provide depot facilities for their equipment. This operation was codenamed Bolero and at Bicester it involved the construction of temporary warehouse in the form of groups of Romney huts served by rail spurs and roads. The completed depot at MOD Bicester served as a key facility in supplying equipment for the Normandy landings in June 1944 and subsequent European campaign. It was also necessary to provide accommodation within the depot for a workforce which during construction reached 24,000, and this was provided by Nissen huts organised into nine self-contained camps. Three of these, Camp Nos. 5, 6 and 7 were located on the slopes around Graven Hill Wood. This is depicted in the earliest aerial photography available for the Site. In 1944 much of the agricultural land surrounding the depot was occupied by ridge and furrow and areas of ridge and furrow also survived within the depot. Changes visible on aerial photographs within the Graven Hill Site are:
- 2.25. Construction of St David's Barracks by 1954;
- 2.26. Hutted accommodation north of Graven Hill Wood had been removed by 1959;

<sup>21</sup> British History Online, [accessed 10th March 2019]. Lobel, M.D.(ed), 1959, *Parishes: Merton, A History of the County of Oxford: Volume 5, Bullingdon Hundred*, pp. 221-234 Available from: <http://www.british-history.ac.uk/vch/oxon/vol5/pp221-234>

- 2.27. More of the hutted accommodation had been removed by 1966 and trees within the Graven Hill Wood had been felled;
- 2.28. Only a small number of accommodation huts were still present by 1975. Graven Hill Wood had been replanted and no ridge and furrow earthworks are shown to survive within the Site; and
- 2.29. All accommodation huts had been removed by 1989.
- 2.30. In addition, a sequence of aerial photographs shows the gradual ploughing out of ridge and furrow features from the surrounding agricultural land, which was mostly lost by 1975.
- 2.31. MOD Bicester continued to operate as a Central Ordnance Depot in the post-war period, though the military workforce was gradually replaced by an increasing number of civilian workers. This meant the need for civilian workers to move into the area and some new housing to be built in Bicester to accommodate them. The temporary hutted accommodation camps were gradually removed and in 1956 new barracks had been completed to the west of Graven Hill Wood on the current St David's Barracks site. Other changes include the removal of some of the Bolero warehouses in the period after WWII.
- 2.32. In 2006, two trial trenches were excavated within a former tennis court at St David's Barracks in advance of the construction of an accommodation block, though no archaeological features were subsequently identified<sup>22</sup>.

#### **Archaeological Discoveries Within LTA1**

- 2.33. A summary of archaeological investigations carried out within LTA1 is provided below.

##### **Pre-Construct Archaeology (PCA) Geotechnical Watching Brief<sup>23</sup>**

- 2.34. Pre-Construct Archaeology undertook monitoring of 54 geotechnical trial pits (TP's) to a maximum depth of approximately 3m within the Site in March 2015. The watching brief recorded naturally deposited clays sealed by subsoil deposits and modern topsoil in a majority of the TP's except those to the north and north-east of the Site. Two trial pits contained a likely stone surface and five recovered a historic agricultural deposit, potentially medieval in date.

##### **Oxford Archaeology Evaluation<sup>24</sup>**

- 2.35. Oxford Archaeology produced a report on their findings from a 55-trench evaluation within LTA1 in April 2016. Five separate locations were identified spanning from the late Iron Age, Romano-British and medieval periods, indicating varied archaeological potential. The findings revealed the following:
- 2.36. A residual Neolithic polished flint axe fragment to the north-west of the Site.
- 2.37. A dispersed group of well-preserved Late Iron Age ditches and pits spread over 100m around the lower slope directly north-west of Graven Hill with further ditches to the north of Circular Road.
- 2.38. Romano-British activity was encountered to the north of LTA1, adjacent to the 'Rodney House Building' in the form of linear field or enclosure boundary ditches, three of which contained mid to late 2nd century pottery assemblages which possibly relates to a known building beyond the Site to the north-west at Langford Park Farm.
- 2.39. Further likely Romano-British activity was investigated in the form of 'Akeman Street' aligned roughly east-west across the Site and identified by an extant hedgerow and historically defined by a double hedge

<sup>22</sup> Granville Laws, 2007. *Bicester, St David's Barracks* (SP 5833 2052) in *South Midlands Archaeology*, vol. 37

<sup>23</sup> Pre-Construct Archaeology (PCA), June 2015. *Graven Hill, Bicester, Oxfordshire – An Archaeological Watching Brief* (Unpublished Client Report)

<sup>24</sup> Oxford Archaeology, April 2016, *Bicester MOD, Graven Hill, Bicester, Oxfordshire, Evaluation Report*. (Unpublished Client Report: 6275-6276)

line boundary enclosing a track. Although undated, the road surface was sealed by layers of silting prior to the military use of the Site.

#### [Oxford Archaeology Watching Brief<sup>25</sup>](#)

- 2.40. Oxford Archaeology produced a report on their findings from a watching brief during the removal of foundations following the demolition of the Rodney House Building as well as undertaking five additional targeted evaluation trenches in 2016 to supplement the results of the previous evaluation. Although no archaeological activity was observed during the watching brief, the evaluation revealed the following:
- 2.41. Further shallow likely Iron Age linear features and shallow curvilinear ditches and larger linear ditches dating from the late Iron Age to the north of Circular Road.
- 2.42. Three shallow linear features were recorded, one of which produced a single sherd of Roman pottery to the north of Graven Hill.
- 2.43. The presence of the Roman 'Akeman Street', comprising of limestone set within a shallow terrace into the north-east slope of Graven Hill.

#### [Oxford Archaeology Watching Brief and Strip, Map and Record Excavation<sup>26</sup>](#)

- 2.44. Oxford Archaeology undertook a watching brief on road construction and five strip, map and record excavations in February 2017. A brief summary of results is described below;

##### [Area A](#)

North-west to south-east aligned late Iron Age ditches, intercutting pits and a small enclosure down the slope of Graven Hill. Moderate artefact assemblages and charred plant remains were also recovered for further analysis.

Remains of Roman 'Akeman Street' truncated by modern military land use.

##### [Area B](#)

Mid to late Romano-British activity was discovered in the form of north-south aligned ditches, possibly associated with known settlement to the north-west.

A late Romano-British rectilinear field system likely to have been peripheral to a settlement was also discovered.

##### [Area C](#)

Iron Age enclosure ditches and pits were revealed with possible settlement activity in the form of curvilinear gullies.

An isolated pit containing early to mid-Saxon artefacts, normally typical burial objects. These included round brooches, a chain and a pin.

##### [Area D](#)

Part of a deserted medieval village (DMV) were discovered comprising of at least six buildings with stone foundations. These were likely set out in a courtyard arrangement with well-preserved external surfaces and drains, stratified sequences and little post-occupation truncation. Associated earlier boundary

<sup>25</sup> Oxford Archaeology, September 2016, *Bicester MoD, Graven Hill, Bicester, Oxfordshire, Archaeological Watching Brief and Evaluation Report*. (Unpublished Client Report)

<sup>26</sup> Oxford Archaeology, 2017, *Bicester MoD, Graven Hill, Bicester, Oxfordshire, Archaeological Watching Brief and Strip Map and Record*. (Unpublished Client Report)

ditches appear to have been infilled with stone and built over in places. A trackway was also discovered, heading towards the scheduled Deserted Medieval Village of 'Wretchwick', located to the north-east of Site. The pottery range indicates this new Deserted Medieval Village was likely to have been occupied during the 12th to 14th centuries.

#### *Area E*

Mid to late Iron Age enclosures and pits were discovered and considered to form part of a wider focus of settlement activity around Graven Hill. Further curvilinear ditches and enclosures were also evident from geophysical survey of this area.

#### *Archaeological Surveys Ltd (AS) Geophysical Survey<sup>27</sup>*

- 2.45. Geophysical survey in the area of the sports pitch to the south-east of LTA1 detected several anomalies. The results were not conclusive whether the anomalies were associated with terracing and construction of the pitches, or with buried archaeological remains.

#### **Geophysical Survey Within the Site**

#### *Archaeological Surveys Ltd (AS) Geophysical Survey<sup>28</sup>*

- 2.46. A copy of this report can be found within **Appendix A**. A total of 1.2ha of the Site was surveyed and it detected several anomalies. The results were not conclusive as to whether anomalies could be attributed to pre-WWII archaeological activity, with the survey also be affected by strong magnetic debris and modern service locations.

<sup>27</sup> Archaeological Surveys (AS), 2011. *MOD Bicester, Graven Hill, Oxfordshire: Magnetometer Survey Report*. (Unpublished Client Report)

<sup>28</sup> Archaeological Surveys (AS), October 2018. *Barrus Development – D1 & D4, Graven Hill Land Transfer Area 2, Bicester, Oxfordshire, Magnetometer Survey Report*. (Unpublished Client Report: J762)

### **3. Aims and Objectives**

- 3.1. This document sets out a programme of Site investigations and reporting to ensure an appropriate level of recording is undertaken of archaeological assets prior to their loss or partial loss within the Site.
- 3.2. The aims of these tasks will be:
- To determine the presence and / or absence of archaeological remains within the office building development area plus associated works and where remains are present, make a full record to current ClfA standards;
  - To determine the approximate extent, condition and state of preservation of any remains;
  - To confirm the approximate date or range of dates of the remains;
  - To sample deposits to assess potential paleoenvironmental evidence;
  - To produce a report on the results of the Archaeological Watching Brief; and
  - To ensure adequate provision for archival deposition of the archaeological record.

## 4. Methodology

- 4.1. No construction or excavations, etc. can proceed until the OCASO has confirmed approval of the WSI in writing.
- 4.2. An archaeological Watching Brief will be undertaken by an appropriately experienced ClfA registered archaeologist(s) to monitor archaeological features and potential palaeoenvironmental deposits within the proposed location of the new office building and associated works. Work will be carried out according to ClfA's Standard and Guidance for an Archaeological Watching Brief<sup>29</sup> and in line with CDC guidelines.
- 4.3. The attending archaeologist will have the authority to halt work for sufficient time to enable them to clean, inspect and record any archaeological remains. Should significant archaeological deposits be revealed during the archaeological Watching Brief, the deposits will be archaeologically sampled and recorded in accordance with the methodology for recording as described below.
- 4.4. If complex archaeological features or deposits are encountered the Principal Contractor and the Archaeological Consultant will be informed in the first instance. The Principal Contractor will allow reasonable access to the identified features or deposits and allow excavation and recording. Excavation will include sampling of features or deposits to recover artefacts, ecofacts and dating evidence.
- 4.5. Spoil will be visually scanned and metal-detected by trained archaeological personnel for the purposes of finds retrieval where appropriate. Metal detectors may also be used as appropriate to scan archaeological features prior to and during excavation.
- 4.6. Should extensive or well-preserved remains be found which require a change in the excavation regime and may extend the scope of archaeological works, this will need agreement with the Archaeological Consultant, the Client and the OCASO advising CDC, while also ensuring no unreasonable delay is caused to the groundworks programme.
- 4.7. The watching brief will provide an opportunity, if needed, for the Archaeological Contractor to signal, before the destruction of the material in question, that an archaeological find has been made for which the resources allocated are not sufficient to support a treatment to a satisfactory and proper standard. The Archaeological Consultant and the OCASO should then be informed and an appropriate mitigation strategy agreed.
- 4.8. The Watching Brief will be maintained throughout the programme of ground investigations until consultations between Waterman and the OCASO conclude that the potential for archaeological remains to be encountered has been exhausted and no further monitoring is required.
- 4.9. The recording system will be compatible with Historic England and ClfA standards and guidance.
- 4.10. Mechanical excavation will be undertaken using a toothless ditching bucket under constant supervision by the Archaeological Contractor once deposits of archaeological merit are observed by the archaeologist.
- 4.11. Any mechanical excavations will either proceed until the required level for the ground investigation has been reached or until the top of archaeological deposits and features are revealed, whichever is encountered first.
- 4.12. The excavation and recording of archaeological deposits and features by the Archaeological Contractor will be commensurate with the scale of work and using their own pro-forma paperwork system. Where practical and appropriate to the aims of the WSI, excavation will include sampling of features and deposits to recover artefacts, ecofacts, dating evidence, and stratigraphic relationships. Recording will

<sup>29</sup> ClfA, December 2014. *Standard and Guidance for an Archaeological Watching Brief*. ClfA; Reading

include written, drawn, and photographic elements.

- 4.13. All drawn records of excavated archaeological features and deposits will be compiled, including sections and plans, drawn to 1:10 scale for sections and 1:20 for plans. These will include OS National Grid References (NGR) and heights above Ordnance Datum (aOD). The plan outlines of the excavated areas should be plotted on to a copy of an Ordnance Survey base map of not smaller than 1:2500 scale.
- 4.14. Archaeological features and deposits will be surveyed using appropriate Total Station/GPS survey equipment and related to Ordnance Survey to a 3D accuracy limit of 50mm.
- 4.15. A full digital photographic record will be made during the fieldwork, embedded with appropriate metadata within the image and also ensure long term accessibility of the image set.

## 5. Finds and Samples

### General

- 5.1. Finds will be treated in accordance with the relevant guidance given in the ClfA Standard and Guidance, the UK Institute of Conservators Guidelines Conservation Guideline No 2 and the Museums and Galleries Commissions Standards in the Museum Care of Archaeological Collections<sup>30</sup>, except where superseded by statements as follows:
- 5.2. All artefacts from excavated contexts will be retained to clarify the date and/or function of the feature or deposit. No finds will be discarded without prior approval of the OCASO and the Oxfordshire County Museum Service (OCMS).
- 5.3. Consideration will also be given to the recovery of specialist samples for scientific analysis, particularly samples for absolute dating, structural materials and cultural / environmental evidence. Environmental samples will be taken from suitable deposits and examined for carbonised remains, macroscopic plant remains, pollen, seeds, insect, molluscs, etc.
- 5.4. All finds and samples will be treated in a proper manner to prevent deterioration and according to guidance given in ClfA's Standard and guidance for an archaeological watching brief. This will involve cleaning and conservation where necessary and labelling, cataloguing and secure storage in appropriate containers.
- 5.5. The Archaeological Contractor will need to demonstrate that arrangements are in hand to cover all necessary processing, conservation and specialist analysis of finds and samples, including if necessary, the conservation of organic and composite materials and dendro-chronological and environmental analysis of samples.

### Human remains

- 5.6. In the event of articulated, disarticulated, cremated or unburnt human remains being discovered on Site they will be left *in situ*, covered and protected. The Principal Contractor and the Archaeological Consultant will be informed. Waterman will in turn inform the Coroner and OCASO. The removal and further excavation / processing of human remains would be subject a Ministry of Justice Licence and follow guidance set out under appropriate guidelines.

### Treasure

- 5.7. In the event of any treasure being encountered on Site that falls under the Treasure Act (1996), the Archaeological Contractor will notify the Principal Contractor and Waterman who will in turn inform the Coroner, the OCASO and the Client before artefacts are approved for excavation and removal from Site.

<sup>30</sup> Museums and Galleries Commission, 1992, *Standards in the Museum Care of Archaeological Collections*

## **6. Monitoring and Access**

- 6.1. The OCASO and Waterman shall be afforded full and safe access to inspect the archaeological works where required to ensure that they are being conducted to required professional standards and in accordance with the agreed method statement.
- 6.2. To facilitate this, a Site works programme will be issued by the Principal Contractor to the Archaeological Consultant, the OCASO and the Archaeological Contractor. The start of the Watching Brief will also be confirmed by Waterman with the OCASO no less than two weeks prior to undertaking the Watching Brief.

## **7. Health & Safety**

- 7.1. Health and Safety considerations and safe working practices will override archaeological considerations at all times.
- 7.2. All work must be carried out in accordance with the Health and Safety at Work etc. Act 1974 and the Management of Health and Safety Regulations 1992, all other relevant Health and Safety legislation, regulations as well as codes of practice in force at the time and any specific requirements (including PPE) of the Principal Contractor. The Principal Contractor will control all aspects of the Safe System of Work (SSoW) for the Site through their Construction Phase Plan (CPP).
- 7.3. The Archaeological Contractor will supply a copy of their Health and Safety Policy and a Dynamic Risk Assessment to the Client before the commencement of any fieldwork. This must consider hazards posed by the activities of the Principal Contractor on Site, where those hazards might pose a risk to employees of the Archaeological Contractor. This must have been read, understood and signed by all staff attending Site.
- 7.4. Available ground condition reports and drawings will be provided to the Archaeological Contractor by the Principal Contractor where relevant. The Principal Contractor will be responsible for the identification and protection of any above- and below-ground services within the groundwork area radio-detected using Cable Avoidance Tools (CAT and Genny). The Principal Contractor will be responsible for any damage and repairs to Site services and any associated business/ private home interruption.
- 7.5. All relevant reports and drawings associated with ground conditions and services shall be provided to the Archaeological Contractors by the Principal Contractor; however, any further information deemed necessary shall be obtained by the Archaeological Contractor prior to any intrusive works commencing.
- 7.6. The Principal Contractor will be responsible for supplying any assessments on the potential risks of Unexploded Ordnance for the Site to the Archaeological Contractor ahead of the mitigation.
- 7.7. There is a potential for intrusive ground investigation works to expose unforeseen contamination at the Site, such as asbestos containing materials (ACMs).
- 7.8. The Archaeological Contractor shall detail adequate control measures within their method statements should unforeseen contamination be encountered. This will include detailed inductions for all staff attending site for the first time and regular toolbox talks to keep teams aware of and updated on any changing conditions within the development site.
- 7.9. Barriers, hoardings and warning notices shall be installed by the Principal Contractor, as appropriate.
- 7.10. Spoil shall be kept at a safe distance from any excavation edges. The location of the spoil heap/s may be within the Site or spoil may be removed off-site immediately.
- 7.11. No existing rights of way or accesses shall be blocked during the course of site work, unless this has been undertaken by the Principal Contractor, in advance.
- 7.12. No trees or protected species shall be harmed by site works.
- 7.13. Adjacent public roads shall be kept free of mud and spoil.
- 7.14. To ensure wildlife legislation is adhered to, this document shall be read in conjunction with the method statement(s) for ecological mitigation, where they exist, and any areas of overlap shall need to be considered in terms of both ecological and archaeological works proposed, with a view of establishing a programme of works which complies with both methodologies.
- 7.15. Should a protected species be identified, works shall stop and the Archaeological Consultant be advised.

- 7.16. The Client's Ecologist will then provide advice on how to manage any constraints posed by the protected species.

## 8. Watching Brief Report

- 8.1. A draft Watching Brief report will be submitted by the Archaeological Contractor to the Archaeological Consultant within **four weeks** of completion of the Watching Brief for review. The report will be the property of the Client and be a confidential document at this stage. Waterman will be responsible for submitting a final version to the OCASO for approval.
- 8.2. Once the Watching Brief report is finalised, a hard copy of the final report will be submitted by the Archaeological Contractor to a suitable archive. A .pdf format copy will be submitted to the OCASO for inclusion in the Oxfordshire Historic Environment Record (HER). GIS (shape) files of the final phased excavated Site plan should also be provided to the OCASO. In addition, the photographic record of the works will be made available to the National Monuments Record (NMR) prior to archiving to enable selection of suitable materials for copying for inclusion into the HER. Once submitted, the final report will become a public document.
- 8.3. The report should include the following content, as appropriate:
  - A non-technical summary;
  - An introduction;
  - A review of the aims and objectives;
  - Methodology;
  - A summary of results including a description of the nature, extent, date, condition and significance of any archaeological and environmental materials uncovered with specialist opinions and parallels from other sites in the area;
  - A table of all artefacts recovered from the archaeological works;
  - an interpretation of the results should be produced, and attention should be given to the significance of the remains in local, regional and national terms, if appropriate;
  - Conclusions;
  - Illustrations including plans and section drawings at suitable scales plus general and detailed photographs where appropriate;
  - References; and
  - Historic Environment Record summary form
- 8.4. The assessment report will be reviewed by the Archaeological Consultant prior to submission to the OCASO for agreement. Following any necessary revisions, a final version will be produced and submitted to the Archaeological Consultant who will submit to the OCASO for acceptance.
- 8.5. The Archaeological Contractor will also initiate an OASIS online record and complete the key fields (<http://oasis.ac.uk/pages/wiki/Main>). The OASIS form will be completed for submission including an uploaded .pdf version of the entire report. Copies of the OASIS record will be integrated into the relevant local and national records through the Archaeology Data Service (ADS) catalogue subject to confidentiality restrictions.

### Additional Reporting

- 8.6. In the event of significant remains being found that warrant publication of the results of the Watching Brief, a summary report shall be prepared by the Archaeological Contractor and issued to the Archaeological Consultant for review prior to submitting to the OCASO for acceptance. The report shall then be entered in the relevant local journal.

## 9. Archiving

- 9.1. The complete Site archive, which comprises the archaeological Watching Brief report and any excavation *pro-forma* and artefacts recovered, will be quantified, ordered, indexed and made internally consistent. This includes written elements, plans and drawings, photographic prints and transparencies (where appropriate) as well as other primary data recovered. The archive will also contain a Site 'Harris Matrix', a Site summary giving a preliminary account of the discoveries and brief written observations on the artefactual and environmental data as a minimum requirement.
- 9.2. The Site archive will also include a summary of all archaeological investigations and mitigation for the Site, incorporating the results of all final assessment and analysis reports, and thereby provide an integrated record.
- 9.3. Work on the Site archive will be completed by the Archaeological Contractor within **twelve calendar months** of completion of the archaeological Watching Brief.
- 9.4. All artefacts (e.g. pottery, metalwork, objects in worked flint and stone, wood, bone, horn and leather, slag) and ecofacts (organic finds such as bones, preserved ancient plant remains, seeds, pollen and charcoal, soil samples) recovered during the archaeological Watching Brief will be made available to the Archaeological Contractor pending completion of the report, to be stored during the course of the mitigation at the Archaeological Contractor's secure offices or usual place of secure storage of archaeological finds until the archive can be deposited with the OCMS by the Archaeological Contractor.
- 9.5. All artefacts recovered during the archaeological Watching Brief will be suitably washed (where the condition of the artefacts allows) and correctly marked by the Archaeological Contractor. All artefacts and ecofacts must be bagged and boxed by the Archaeological Contractor, in accordance with current guidelines of the United Kingdom Institute for Conservation (UKIC) / RESCUE *publication First Aid for Finds*<sup>31</sup>. All 'small finds' will be boxed together, separate from bulk finds.
- 9.6. Subject to the legislation of the Treasure Act 1996, all artefacts and ecofacts unearthed from the archaeological Watching Brief and all other elements of the Site archive (as defined in *Management of Research Projects in the Historic Environment*<sup>32</sup>) should be deposited by the Archaeological Contractor in an appropriate museum registered or provisionally registered by the Museums and Galleries Commission and deemed acceptable to the OCASO. No artefacts or ecofacts from the Site will be deposited in the relevant depository without the prior written consent of the land owner. Should the land owner be unwilling to deposit the archive with the OCMS, a full record, including a photographic and drawn survey will be made of all artefacts and elements being withheld.
- 9.7. In the absence of an appropriate archive destination, provision should be made by the Archaeological Contractor for retaining the project archive, until a suitable depository is made available and arrangements have been made for the transfer of the complete archive.
- 9.8. The Archaeological Contractor will ensure that the appropriate Collections Manager is notified and liaised with at an early stage. It is the responsibility of the Archaeological Contractor to meet the OCMSs reasonable requirements with regard to the preparation of archives for deposition.
- 9.9. Provision will be made for the payment of a 'deposit grant' at the time of archive transfer towards the costs of archive curation in perpetuity. The rates and requirements currently employed by archive stores elsewhere in the country and by the OCMS for its archive store shall be used for guidance.
- 9.10. Prior to the deposition of finds with the OCMS, the Archaeological Contractor will agree with the museum

<sup>31</sup> Watkinson, D. and Neal, V., 1998, *First Aid for Finds*. Rescue and United Kingdom Institute for Conservation Archaeology Section; 3rd Edition

<sup>32</sup> Historic England, April 2015. *Management of Research Projects in the Historic Environment - The MoRPHE Project Managers' Guide*.

the sample or quantity of bulk finds (pottery, animal and human bone, other ecofactual material, building material, burnt flint, worked flint and stone) to be deposited.

- 9.11. All excavated artefacts, ecofacts and all other elements of the Site archive should be delivered by the Archaeological Contractor to the OCMS as one deposit. Where this arrangement is not practicable, lists will be submitted by the Archaeological Contractor to the museum of objects not deposited, together with information as to the quantity involved and their current location, reasons why items have not been deposited and a timetable for their ultimate deposition.
- 9.12. Subject to the resources available and to discussions with the OCMS, all articles needing conservation will be properly stabilised by the Archaeological Contractor prior to their deposition at the recipient museum and records of their treatment lodged with the museum. Those items for which available resources do not permit stabilisation will be separately packed and listed by the Archaeological Contractor.
- 9.13. Prior to commencement of the archaeological Watching Brief the Archaeological Contractor will obtain from the OCMS an accession number(s) as appropriate, for excavated artefacts and ecofacts from the project and any guidelines regarding deposition of such artefacts and ecofacts specific to the museum.
- 9.14. All finds, excluding those agreed with the OCMS or on grounds of size/material, will be marked by the Archaeological Contractor with the museum's accession number.
- 9.15. Artefacts and ecofacts deposited by the Archaeological Contractor with the OCMS will be accompanied by the remainder of the original Site archive (or a complete duplicate record). A microfiche security copy of the Site archive should also be supplied by the Archaeological Contractor to the museum.
- 9.16. Subject to the agreement of the landowner, all artefacts and ecofacts recovered from the archaeological excavations will be deposited by the Archaeological Contractor with the OCMS within **five years** from the date of completion of the investigation.
- 9.17. Copyright of the written, drawn and photographic elements of the Site archive will be held jointly with the Archaeological Contractor and the OCMS.
- 9.18. The following documents should be adhered to:
  - Standards in the Museum Care of Archaeological Collections<sup>33</sup>;
  - Management of Research Projects in the Historic Environment<sup>34</sup>; and
  - MoRPHE applicable Technical Guides and Project Planning Notes (PPN)<sup>35</sup>.

<sup>33</sup> Museum and Galleries Commission, 1992. *Standards in the Museum Care of Archaeological Collections*

<sup>34</sup> Historic England, April 2015. *Management of Research Projects in the Historic Environment - The MoRPHE Project Managers' Guide*

<sup>35</sup> Available from <https://www.historicengland.org.uk/images-books/publications/morphe-project-managers-guide/>

## 10. Specific Requirements

### General

- 10.1. The Archaeological Contractor shall provide a lead contact for the fieldwork phases and brief career profile of the Site Manager, which demonstrates their suitability to manage the fieldwork.
- 10.2. Any significant variations to the proposed methodology set out in WSIs shall be agreed with the Archaeological Consultant and the OCASO in advance.

### Insurance

- 10.3. The Archaeological Contractor shall hold Employers Liability Insurance, Public Liability Insurance and Professional Indemnity Insurance. Proof of these insurances shall be supplied to the Client.
- 10.4. The Archaeological Consultant and the Archaeological Contractor shall not be liable to indemnify the Client against any compensation or damages for or with respect to:
- The use or occupation of land (which has been provided by the Client) by the Project or for the purposes of completing the Project. Interference whether temporary or permanent with any right of way, light, air or water or other easement or quasi easement which are unavoidable result of the Project in accordance with the Agreement;
  - Any other damage which is the unavoidable result of the Project in accordance with the Agreement; and
  - Injuries or damage to persons or property resulting from any act or neglect or breach of statutory duty done or committed by the Client or his agents, servants or their contractors (not being employed by Waterman) or for or in respect of any claims demands proceedings damages costs charges and expenses in respect thereof or in relation thereto.

### Standards and Procedures

- 10.5. The Archaeological Consultant and the Archaeological Contractor will conform to the standards and regulations of professional conduct outlined in the ClfA *Code of Conduct*<sup>36</sup>, the ClfA *Regulations for Professional Conduct*<sup>37</sup>, the ClfA *Standards and Guidance for an Archaeological Watching Brief*, Historic England's *Management of Research Projects in the Historic Environment (MoRPHE) Project Managers Guide* and the CDCs Local Plan<sup>38</sup>.
- 10.6. Project Archaeologists will be recognised in an appropriate Area of Competence by the ClfA.

<sup>36</sup> ClfA, December 2014, *Code of Conduct*. ClfA; Reading

<sup>37</sup> ClfA, April 2017, *Regulations for Professional Conduct*. ClfA; Reading

<sup>38</sup> Cherwell District Council (CDC), January 2014, *The Cherwell Local Plan 2016-2031 Submission*

## **11. Copyright and Confidentiality**

- 11.1. The Archaeological Consultant and the Archaeological Contractor will retain full copyright of any commissioned reports, tender documents or other project documents, under the Copyright, Designs and Patents Act 1988 with all rights reserved; excepting that it will provide an exclusive licence to the Client in all matters directly relating to the project as described in this WSI.
- 11.2. The Archaeological Consultant and the Archaeological Contractor will assign copyright to the Client upon written request but retain the right to be identified as an author of all project documentation and reports as defined in the Copyright, Designs and Patents Act 1988 (Chapter IV. S.79).
- 11.3. The Archaeological Consultant will advise the Client of any such materials supplied in the course of projects that are not Waterman's or the Archaeological Contractor's copyright.
- 11.4. The Archaeological Consultant undertakes to respect all requirements for confidentiality about the Client's proposals provided that these are clearly stated. It is expected that such conditions shall not unreasonably impede the satisfactory performance of the services required. Waterman further undertakes to keep confidential any conclusions about the likely implications of such proposals for the historic environment. It is expected that clients respect Waterman's general ethical obligations not to suppress significant archaeological data for an unreasonable period.

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## FIGURES

Figure 2 : Site Development Boundary





## **APPENDICES**

### **Appendices**

Graven Hill, Bicester

Document Reference: WIE15089

WIE15089\_101\_1\_1\_2\_WSI

- A. Archaeological Surveys (AS), October 2018. *Barrus Development – D1 & D4, Graven Hill Land Transfer Area 2, Bicester, Oxfordshire, Magnetometer Survey Report.* (Unpublished Client Report: J762)**



**Barrus Development – D1 & D4  
Graven Hill Land Transfer Area 2  
Bicester  
Oxfordshire**

**MAGNETOMETER SURVEY REPORT**

for

**Waterman Infrastructure &  
Environment Ltd**

Kerry Donaldson & David Sabin

October 2018

Ref. no. J762

ARCHAEOLOGICAL SURVEYS LTD

**Barrus Development – D1 & D4  
Graven Hill Land Transfer Area 2  
Bicester  
Oxfordshire**

**Magnetometer Survey Report**

for

**Waterman Infrastructure &  
Environment Ltd**

Fieldwork by David Sabin BSc (Hons) MCIfA and Kerry Donaldson BSc (Hons)  
Report by Kerry Donaldson  
Report checked by David Sabin  
Primary archive location - Archaeological Surveys Ltd, Yatesbury, Wiltshire

Survey date – 26<sup>th</sup> September 2018  
Ordnance Survey Grid Reference – **SP 59080 19820**



Archaeological Surveys Ltd  
1 West Nolands, Nolands Road, Yatesbury, Calne, Wiltshire, SN11 8YD  
Tel: 01249 814231 Fax: 0871 661 8804  
Email: [info@archaeological-surveys.co.uk](mailto:info@archaeological-surveys.co.uk)  
Web: [www.archaeological-surveys.co.uk](http://www.archaeological-surveys.co.uk)

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## SUMMARY

Magnetometry was carried out by Archaeological Surveys Ltd, on behalf of Waterman Infrastructure & Environment Ltd, over an area of land outlined for transfer to the Graven Hill Village Development, Bicester in Oxfordshire. Six small survey areas of grass were covered in the vicinity of Buildings D1 & D4 within the current MoD Bicester storage depot. The results demonstrate the presence of high magnitude magnetic anomalies associated with services and above ground structures with widespread magnetic debris relating to ferrous material within the soils. No anomalies could be attributed to features pre-dating the WWII construction of the site, and it is likely that the majority of the areas have been subject to some degree of landscaping.

## 1 INTRODUCTION

### 1.1 *Survey background*

- 1.1.1 Archaeological Surveys Ltd was commissioned by Waterman Infrastructure & Environment Ltd to undertake a magnetometer survey of an area of land at D site within the military storage depot of MoD Bicester which is due to be transferred to Graven Hill Village Development Company. Graven Hill has been a military site since WWII and much of the land to the north has already been transferred to the Graven Hill Village Development Company for residential development within Land Transfer Area 1 (LTA1).
- 1.1.2 The land surrounding buildings D1 and D4 is the first part of Land Transfer Area 2 (LTA2) and will entail the construction of new roads, a pedestrian route and a new office as part of a commercial development by E.P. Barrus Ltd. The survey forms part of an archaeological assessment of the development area.
- 1.1.3 The geophysical survey was carried out in accordance with a Written Scheme of Investigation (WSI) produced by Archaeological Surveys (2018).

### 1.2 *Survey objectives and techniques*

- 1.2.1 The objective of the survey was to use magnetometry to locate geophysical anomalies that may be archaeological in origin so that they may be assessed prior to development of the site. The methodology is considered an efficient and effective approach to archaeological prospection.
- 1.2.2 Geophysical survey can provide useful information on the archaeological potential of a site; however, the outcome of any survey relies on a number of factors and as a consequence results can vary. The success in meeting the aims and objectives of a survey is, therefore, often impossible to predetermine.

### 1.3 Standards, guidance and recommendations for the use of this report

- 1.3.1 The survey and report generally follow the recommendations set out by: European Archaeological Council (2015) *Guidelines for the Use of Geophysics in Archaeology*; Institute for Archaeologists (2002) *The use of Geophysical Techniques in Archaeological Evaluations*. The work has been carried out to the Chartered Institute for Archaeologists (2014) *Standard and Guidance for Archaeological Geophysical Survey*. Note: currently Historic England (2018) no longer support the guidelines set out in English Heritage (2008) *Geophysical survey in archaeological field evaluation* and there are currently no plans to update the document. As a consequence other sources of written guidance referring to this document may be out of date and/or contain unsupported information (e.g. Chartered Institute for Archaeologists, 2014).
- 1.3.2 Archaeological Surveys Ltd provide a detailed geophysical survey report and it is recommended that where possible the contents should be considered in full. The Summary provides a brief overview of the results with more detail available in the Discussion and/or Conclusion. The *List of anomalies* within the Results provides a detailed assessment of the anomalies within separate categories which can be useful in inferring a level of confidence to the interpretation. Quality and factors influencing the interpretation of anomalies is also set out within the results.
- 1.3.3 It is recommended that the full report should always be considered when using data and interpretation plots; where this is not possible, in the field for example, the abstraction and interpretation plots should retain their colour coding and be used with a corresponding legend.
- 1.3.4 Where targeting of anomalies by excavation is to be carried out, care should be taken to place trenches over solid lines or features visible on the abstraction and interpretation plots. Archaeological Surveys abstraction and interpretation avoids the use of dashed or dotted lines; broken or fragmented anomalies may well correspond closely with subsurface truncation.

### 1.4 Site location, description and survey conditions

- 1.4.1 The site is located towards the southern edge of the Graven Hill Village Development. It is centred on Ordnance Survey National Grid Reference (OS NGR) SP 59080 29820, see Figs 01 and 02.
- 1.4.2 The geophysical survey covers approximately 1.2ha over six separate survey areas. Area 1 (0.15ha) lies in the north eastern part of the site adjacent to water tanks and buildings. Area 2 (0.17ha) contains a number of extant but disused munitions stores and a number of bases of removed munitions stores. Area 3 (0.06ha) is a very small area that lies to the south of Area 2. Area 4 (0.15ha) is situated to the south of Building D1. Area 5 (0.6ha) is the largest

open space to the south of Area 4 and Area 6 (0.1ha) lies to the north of Area 5.

- 1.4.3 The development boundary also includes several areas of hardstanding. These were scanned with the magnetometer to observe the magnitude of anomalies and the extremely high values indicate that they contain ferrous material likely to relate to reinforcing. The areas were, therefore, not considered suitable for detailed magnetometer survey.
- 1.4.4 The ground conditions across the site were generally considered to be favourable for the collection of magnetometry data due to short grass cover. Weather conditions during the survey were fine.

## **1.5 Site history and archaeological potential**

- 1.5.1 Previous archaeological investigations have been carried out over the wider Graven Hill site outlined for LTA1 to the north of the present survey area. These include two geophysical surveys (Archaeological Surveys, 2010 & 2011) as well as trial trench evaluation across much of the LTA1 site (Oxford Archaeology, 2016).
- 1.5.2 The nearest previous geophysical survey area (Area G) from the 2011 survey lies just to the north east of the present development boundary, and a number of positive and negative linear and possible rectilinear anomalies were previously located. The area had been used as a sports field and magnetic debris and disturbance was encountered. It was, therefore, not certain if the weaker, positive and negative anomalies were directly associated with the sports field or if they related to possible cut features. This area was not evaluated by Oxford Archaeology. Elsewhere within the wider Graven Hill site many of the anomalies did relate to archaeological features, including the Roman road of Akeman Street lying approximately 650m north east of the current survey area.
- 1.5.3 The site has been in military use since WWII when it was first established as the Central Ordnance Depot in 1941 and supplied equipment for the D-Day Normandy landings. It is still widely used as a military storage depot. It contains numerous buildings, services, roads, railway lines and other infrastructure, with associated landscaping works. This is likely to result in widespread magnetic contamination but also possible truncation and/or deeper burial of earlier features within some areas.

## **1.6 Geology and soils**

- 1.6.1 The underlying solid geology across the site is Jurassic mudstone from the Peterborough Member (formerly Lower Oxford Clay Member) (BGS, 2017).
- 1.6.2 The overlying soil across the survey area is from the Denchworth association and is a pelo-stagnogley soil. It consists of a slowly permeable, seasonally

waterlogged, clayey soil (Soil Survey of England and Wales, 1983).

- 1.6.3 Magnetometry survey carried out across similar soils has produced good results, although there can be lack of magnetic contrast between the fill of cut features and the material into which they are cut. The underlying geology and soils are, therefore, considered acceptable for magnetic survey.

## 2 METHODOLOGY

### 2.1 *Technical synopsis*

- 2.1.1 Magnetometry survey records localised magnetic fields that can be associated with features formed by human activity. Magnetic susceptibility and magnetic thermoremnance are factors associated with the formation of localised fields. Additional details are set out below and within Appendix A.
- 2.1.2 Iron minerals within the soil may become altered by burning and the break down of biological material; effectively the magnetic susceptibility of the soil is increased, and the iron minerals become magnetic in the presence of the Earth's magnetic field. Accumulations of magnetically enhanced soils within features, such as pits and ditches, may produce magnetic anomalies that can be mapped by magnetic prospection.
- 2.1.3 Magnetic thermoremnance can occur when ferrous minerals have been heated to high temperatures such as in a kiln, hearth, oven etc. On cooling, a permanent magnetisation may be acquired due to the presence of the Earth's magnetic field. Certain natural processes associated with the formation of some igneous and metamorphic rock may also result in magnetic thermoremnance.
- 2.1.4 The localised variations in magnetism are measured as sub-units of the Tesla, which is a SI unit of magnetic flux density. These sub-units are nano Teslas (nT), which are equivalent to  $10^{-9}$  Tesla (T).

### 2.2 *Equipment configuration, data collection and survey detail*

- 2.2.1 The detailed magnetic survey was carried out using a SENSYS MAGNETO®MXPDA 5 channel cart-based system. The instrument has 5 fluxgate gradiometers (FGM650) spaced 0.5m apart with readings recorded at 20 Hz. The cart is pushed at walking speed and not towed. Each sensor is not zeroed in the field as the vertical axis alignment is precisely fixed leaving sensor offsets that are removed during data processing. The fixing of the vertical alignment ensures the sensors are not unduly influenced by localised magnetic fields and that the vertical component of a magnetic anomaly is measured. The gradiometers have a range of recording data between  $\pm 0.1$ nT and  $\pm 10,000$ nT. They are linked to a Leica GS10 RTK GPS with data recorded by SENSYS MAGNETO®MXPDA software on a rugged PDA computer system.

- 2.2.2 Due to the fixed offsets within the fluxgate sensors, as a result of the manufacturing and tensioning process, the survey data do not provide a visually useful dataset until a zero median traverse algorithm is applied. It is recognised that this has the potential to affect some anomalies detrimentally by removing linear features orientated parallel to survey transects. However, this has not been noted as a particular problem with the system due to the high resolution data collection, generally long length of traverses and variability within the magnetic characteristics of a linear anomaly.
- 2.2.3 Data are collected along a series of parallel survey transects to achieve 100% coverage of the surveyable land. The length of each transect is variable and relates to the size of the survey area and other factors including ground conditions. A visual display allows accurate placing of transects and helps maintain the correct separation between adjacent traverses. Data are not collected within fixed grids and data points are considered to be random even though the data are collected in a systematic manner covering all accessible areas (Aspinall, Gaffney and Schmidt, 2009).
- 2.2.4 Fluxgate sensors are highly sensitive to temperature change and this manifests as drift during the course of a survey. This can be particularly noticeable during the morning as temperatures rise and the equipment warms or cools. Sensor drift within the course of a traverse will appear as a line trending from negative to positive after processing with a zero median traverse algorithm. To remove the potential for temperature drift, data were collected after a 20 minute stabilisation period and traverses were limited to a time of generally <30s.

### 2.3 *Data processing and presentation*

- 2.3.1 Magnetic data collected by the MAGNETO®MXPDA cart-based system are initially prepared using SENSYS MAGNETO®DLMGPS software. The software effectively allocates a geographic position for each data point and can compensate for fixed offsets present within the FGM650 sensors. The offsets are positive or negative values present on all fluxgate gradiometer sensors. Some systems use manual or electronic balancing to effectively zero the sensors; however, this is a short term measure that is prone to drift through temperature changes and vibration and can easily be incorrectly set due to localised magnetic fields. The FGM650 sensors are very accurately aligned to the vertical magnetic gradient and are highly stable showing negligible drift on long traverses. The offset values are removed using TerraSurveyor software.
- 2.3.2 Survey tracks are analysed and georeferenced raw data (UTM Z30N) are then exported in ASCII format for further analysis and display within TerraSurveyor. The removal of offset values (compensation) of the sensors is also carried out in TerraSurveyor using a zero median traverse function. Data are then considered to be minimally processed. Note: without the zero median traverse function it is not possible to create a meaningful data plot as all sensors have a different offset value. Although a zero median traverse algorithm can remove

anomalies aligned with the survey tracks, in practice this rarely occurs due to the use of long traverses, high resolution measurement and variability within the magnetic susceptibility of long linear features.

- 2.3.3 The minimally processed data are collected between limits of  $\pm 10000\text{nT}$  and clipped for display at  $\pm 20\text{nT}$  for Areas 1, 5 & 6 and  $\pm 100\text{nT}$  for Areas 2, 3 & 4.. In order to show the extreme magnitude of the responses, areas have been shown clipped at  $\pm 100\text{nT}$  with values over  $75\text{nT}$  in red and under  $-75\text{nT}$  in blue (Fig 04). Data are interpolated to a resolution of effectively  $0.5\text{m}$  between tracks and  $0.15\text{m}$  along each survey track.
- 2.3.4 Additional data processing has been carried out for Area 5 in the form of high pass filtering. This effectively removes low frequency variation along a traverse that has been caused by large magnetic bodies, cultivation or rapid temperature change. Data treated to additional processing has been compared to unprocessed data to ensure that no significant anomalies have been removed.
- 2.3.5 Appendix C contains metadata concerning the survey and data attributes and is derived directly from TerraSurveyor. Reference should be made to Appendix B for further information on processing.
- 2.3.6 A TIF file is produced by TerraSurveyor software along with an associated world file (.TFW) that allows automatic georeferencing (OSGB36 datum) when using GIS or CAD software. The main form of data display used in the report is the minimally processed greyscale plot. With regard to the Sensys MXPDA, minimally processed data are considered by the manufacturer to be data that are compensated by SENSYS MAGNETO DLMGPS software, see 2.3.1 and 2.3.2. Note: traceplots are not considered to be appropriate as they do not provide an accurate or useful assessment of the magnetic anomalies due to the very high density of data collection.
- 2.3.7 The raster images are combined with base mapping using ProgeCAD Professional 2016, creating DWG (2010) file formats. All images are externally referenced to the CAD drawing in order to maintain good graphical quality. The CAD plots are effectively georeferenced facilitating relocation of features using GPS, resection method, etc.
- 2.3.8 An abstraction and interpretation is drawn and plotted for all geophysical anomalies located by the survey. Anomalies are abstracted using colour coded points, lines and polygons. All plots are scaled to landscape A3 for paper printing. Appendix E sets out CAD layer names with colour and graphic content for each interpretation category, see 3.3.
- 2.3.9 A brief summary of each anomaly, with an appropriate reference number, is set out in list form within the results (Section 3) to allow a rapid and objective assessment of features within each survey area.
- 2.3.10 A digital archive is produced with this report, see Appendix D below. The

main archive is held at the offices of Archaeological Surveys Ltd.

### 3 RESULTS

#### 3.1 *General assessment of survey results*

- 3.1.1 The detailed magnetic survey was carried out over a total of six survey areas covering approximately 1.2ha.
- 3.1.2 Magnetic anomalies located can be generally classified as positive linear anomalies of an uncertain origin, areas of magnetic debris and disturbance, strong discrete dipolar anomalies relating to ferrous objects and strong multiple dipolar linear anomalies relating to buried services or pipelines.

#### 3.2 *Statement of data quality and factors influencing the interpretation of anomalies*

- 3.2.1 Data are considered representative of the magnetic anomalies present within the site. There are no significant defects within the dataset.
- 3.2.2 Numerous high magnitude magnetic anomalies were located by the survey and these are associated with services and both above and below surface ferrous objects. Any features of archaeological potential within the vicinity of these anomalies may not be visible within the dataset as a consequence.
- 3.2.3 The site has clearly been subject to landscaping and levelling which has the potential to truncate subsurface archaeological features or increase the depth of soil cover preventing their location if they are magnetically weak. In addition, soil spreads contaminated with small ferrous objects add a significant level of magnetic 'noise' which may also obscure weakly magnetic features.

#### 3.3 *Data interpretation*

- 3.3.1 The list of sub-headings below attempts to define a number of separate categories that reflect the range and type of features located during the survey. A basic explanation of the characteristics of the magnetic anomalies is set out for each category in order to justify interpretation, see Table 1.

Interpretation category	Description and origin of anomalies
<b><i>Anomalies with an uncertain origin</i></b>	The category applies to a range of anomalies where <u>there is not enough evidence to confidently suggest an origin</u> . Anomalies in this category <u>may well be related to archaeologically significant features, but equally relatively modern features, geological/pedological features and agricultural features should be considered</u> . Morphology may be unclear or uncharacteristic and there may be a lack of additional supporting information. Positive anomalies are indicative of magnetically enhanced soils that may form the fill of 'cut' features or may be produced by accumulation within layers or 'earthwork' features; soils subject to burning

	may also produce positive anomalies. Negative anomalies are produced by material of comparatively low magnetic susceptibility such as stone and subsoil.
<b>Anomalies associated with magnetic debris</b>	Magnetic debris often appears as areas containing many small dipolar anomalies that may range from weak to very strong in magnitude. They often occur where there has been dumping or ground make-up and are related to magnetically thermoremanent materials such as brick or tile or other small fragments of ferrous material. This type of response is occasionally associated with kilns, furnace structures, hearths and nail spreads from former wooden structures or rooves and <u>may, therefore, be archaeologically significant</u> . It is also possible that the response may be caused by natural material such as certain gravels and fragments of igneous or metamorphic rock. Strong discrete dipolar anomalies are responses to ferrous objects within the topsoil.
<b>Anomalies with a modern origin</b>	The magnetic response is often strong and dipolar indicative of ferrous material and may be associated with extant above surface features such as wire fencing, cables, pylons etc.. Often a significant area around these features has a strong magnetic flux which may create magnetic disturbance; such disturbance can effectively obscure low magnitude anomalies if they are present. Fluxgate sensors may respond erratically adjacent to strong magnetic sources. Buried services may produce characteristic multiple dipolar anomalies dependant upon their construction.

Table 1: List and description of interpretation categories

### 3.4 Assessment of anomalies

- 3.4.1 All of the survey areas contain a number of services, the majority of which are of steel/iron construction and very strongly magnetic. The results also demonstrate the presence of widespread magnetic debris which is likely to indicate the presence of waste ferrous material within the soil. Within Area 2, a number of extant and partly removed munitions stores have steel/iron reinforcing that has caused widespread magnetic disturbance. Only a small number of positive linear anomalies can be seen in Area 5, but these bound zones of magnetic debris and are likely to be associated.

## 4 CONCLUSION

- 4.1.1 The detailed magnetometer survey was affected by strongly magnetic debris and disturbance from modern services, infrastructure and ferrous objects within the ground make-up surrounding Buildings D1 & D4. A small number of positive linear anomalies were located in Area 5 to the south of D1, but these bound zones of magnetic debris and are likely to be directly associated. No anomalies could be attributed to features pre-dating the WWII construction of the site.

## 5 REFERENCES

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## Appendix A – basic principles of magnetic survey

Iron minerals are always present to some degree within the topsoil and enhancement associated with human activity is related to increases in the level of magnetic susceptibility and thermoremanent material. Magnetic susceptibility is an induced magnetism within a material when it is in the presence of a magnetic field. This can be thought of as effectively permanent due to the presence of the Earth's magnetic field. Thermoremanent magnetism occurs when ferrous material is heated beyond a specific temperature known as the Curie Point. Demagnetisation occurs at this temperature with re-magnetisation by the Earth's magnetic field upon cooling.

Enhancement of magnetic susceptibility can occur in areas subject to burning and complex fermentation processes on biological material; these are frequently associated with human settlement. Thermoremanent features include ovens, hearths, and kilns. In addition thermoremanent material such as tile and brick may also be associated with human activity and settlement.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil can create an area of enhancement compared with surrounding soils and subsoils into which the feature is cut. Mapping enhanced areas will produce linear and discrete anomalies allowing an assessment and characterisation of hidden subsurface features.

It should be noted that areas of negative enhancement can be produced from material having lower magnetic properties compared to the topsoil. This is common for many sedimentary bedrocks and subsoils which were often used in the construction of banks and walls etc. Mapping these 'negative' anomalies may also reveal archaeological features.

Magnetic survey or magnetometry can be carried out using a fluxgate gradiometer and may be referred to as gradiometry. The SENSYS gradiometer is a passive instrument consisting of two fluxgate sensors mounted vertically 65cm apart. The instrument is carried about 10-20cm above the ground surface and the upper sensor measures the Earth's magnetic field as does the lower sensor but this is influenced to a greater degree by any localised buried magnetic field. The difference between the two sensors will relate to the strength of the magnetic field created by the buried feature.

There are a number of factors that may affect the magnetic survey and these include soil type, local geology and previous human activity. Situations arise where magnetic disturbance associated with modern services, metal fencing, dumped waste material etc., obscures low magnitude fields associated with archaeological features.

## Appendix B – data processing notes

### *Clipping*

Minimum and maximum values are set and replace data outside of the range with those values. Extreme values are removed improving colour or greyscale contrast associated with data values that may be archaeologically significant. It has been found that clipping data to ranges between  $\pm 5\text{nT}$  and  $\pm 3\text{nT}$  often improves the appearance of features associated with archaeology. Different ranges are applied to data in order to determine the most suitable for anomaly abstraction and display.

### *Zero (destripe) Median/Mean Traverse*

The median (or mean) of each traverse is calculated ignoring data outside a threshold value, the median (or mean) is then subtracted from the traverse. The process is used to equalise differences between the baseline value of gradiometer sensors.

### *High Pass Filtering*

A mathematical process used to remove low frequency anomalies relating to survey tracks, modern agricultural features and other large magnetic bodies within or adjacent to survey areas.

### *Low Pass Filtering*

A mathematical process used to remove high frequency anomalies relating to uneven ground, vibration, etc.

## Appendix C – survey and data information

### Area 1

Filename: J762-mag-Area1.xcp  
 Description: Imported as Composite from: J762-mag-Area1.asc  
 Instrument Type: Sensys DLMGPS  
 Units: nT  
 UTM Zone: 30U  
 Survey corner coordinates (X/Y): OSGB36  
 Northwest corner: 459083.56, 219990.40 m  
 Southeast corner: 459218.71, 219919.0 m  
 Collection Method: Randomised  
 Sensors: 5  
 Dummy Value: 32702  
 Source GPS Points: 91900  
 Dimensions  
 Composite Size (readings): 901 x 476  
 Survey Size (meters): 135 m x 71.4 m  
 Grid Size: 135 m x 71.4 m  
 X Interval: 0.15 m  
 Y Interval: 0.15 m  
 Stats  
 Max: 22.10  
 Min: -22.00  
 Std Dev: 11.22  
 Mean: 0.16  
 Median: -0.04  
 Composite Area: 0.96497 ha  
 Surveyed Area: 0.3173 ha  
 PROGRAM  
 Name: TerraSurveyor  
 Version: 3.0.23.0  
 GPS based Proce6  
 1 Base Layer.  
 2 Unit Conversion Layer (Lat/Long to OSGB36).  
 3 DeStripe Median Traverse:  
 4 Clip from -20.00 to 20.00 nT

### Area 2

Filename: J762-mag-Area2.xcp  
 Description: Imported as Composite from: J762-mag-Area2.asc  
 Survey corner coordinates (X/Y): OSGB36  
 Northwest corner: 459093.49, 219931.46 m  
 Southeast corner: 459134.14, 219849.56 m  
 Source GPS Points: 63300  
 Dimensions  
 Composite Size (readings): 271 x 546  
 Survey Size (meters): 40.7 m x 81.9 m  
 Grid Size: 40.7 m x 81.9 m  
 X Interval: 0.15 m  
 Y Interval: 0.15 m  
 Stats  
 Max: 110.50  
 Min: -110.00  
 Std Dev: 62.65  
 Mean: 0.72  
 Median: 1.49  
 Composite Area: 0.33292 ha  
 Surveyed Area: 0.2007 ha  
 GPS based Proce4  
 1 Base Layer.  
 2 Unit Conversion Layer (Lat/Long to OSGB36).  
 3 DeStripe Median Traverse:  
 4 Clip from -100.00 to 100.00 nT

### Area 3

Filename: J762-mag-Area3.xcp  
 Description: Imported as Composite from: J762-mag-Area3.asc  
 Survey corner coordinates (X/Y): OSGB36  
 Northwest corner: 459110.97, 219850.93 m  
 Southeast corner: 459160.62, 219820.33 m  
 Source GPS Points: 20100  
 Dimensions  
 Composite Size (readings): 331 x 204  
 Survey Size (meters): 49.7 m x 30.6 m  
 Grid Size: 49.7 m x 30.6 m  
 X Interval: 0.15 m  
 Y Interval: 0.15 m  
 Stats  
 Max: 110.50  
 Min: -110.00  
 Std Dev: 49.64  
 Mean: 0.46  
 Median: 0.18  
 Composite Area: 0.15193 ha  
 Surveyed Area: 0.070686 ha  
 GPS based Proce4  
 1 Base Layer.

- 2 Unit Conversion Layer (Lat/Long to OSGB36).
- 3 DeStripe Median Traverse:
- 4 Clip from -100.00 to 100.00 nT

### Area 4

Filename: J762-mag-Area4.xcp  
 Description: Imported as Composite from: J762-mag-Area4.asc  
 Survey corner coordinates (X/Y): OSGB36  
 Northwest corner: 459002.47, 219830.33 m  
 Southeast corner: 459125.475, 219800.48 m  
 Source GPS Points: 40000  
 Dimensions  
 Composite Size (readings): 820 x 199  
 Survey Size (meters): 123 m x 29.9 m  
 Grid Size: 123 m x 29.9 m  
 X Interval: 0.15 m  
 Y Interval: 0.15 m  
 Stats  
 Max: 110.50  
 Min: -110.00  
 Std Dev: 59.37  
 Mean: 1.40  
 Median: -0.25  
 Composite Area: 0.36716 ha  
 Surveyed Area: 0.16499 ha  
 GPS based Proce4  
 1 Base Layer.  
 2 Unit Conversion Layer (Lat/Long to OSGB36).  
 3 DeStripe Median Traverse:  
 4 Clip from -100.00 to 100.00 nT

### Area 5

Filename: J762-mag-Area5.xcp  
 Description: Imported as Composite from: J762-mag-Area5.asc  
 Survey corner coordinates (X/Y): OSGB36  
 Northwest corner: 458907.33, 219796.73 m  
 Southeast corner: 459095.43, 219713.78 m  
 Dummy Value: 32702  
 Source GPS Points: 157100  
 Dimensions  
 Composite Size (readings): 1254 x 553  
 Survey Size (meters): 188 m x 83 m  
 Grid Size: 188 m x 83 m  
 X Interval: 0.15 m  
 Y Interval: 0.15 m  
 Stats  
 Max: 22.10  
 Min: -22.00  
 Std Dev: 11.13  
 Mean: -0.38  
 Median: 0.03  
 Composite Area: 1.5603 ha  
 Surveyed Area: 0.59147 ha  
 GPS based Proce5  
 1 Base Layer.  
 2 Unit Conversion Layer (Lat/Long to OSGB36).  
 3 DeStripe Median Traverse:  
 4 High pass Uniform (median) filter: Window dia: 300  
 5 Clip from -20.00 to 20.00 nT

### Area 6

Filename: J762-mag-Area6.xcp  
 Description: Imported as Composite from: J762-mag-Area7.asc  
 Survey corner coordinates (X/Y): OSGB36  
 Northwest corner: 458916.14, 219798.40 m  
 Southeast corner: 458987.84, 219775.30 m  
 Source GPS Points: 26800  
 Dimensions  
 Composite Size (readings): 478 x 154  
 Survey Size (meters): 71.7 m x 23.1 m  
 Grid Size: 71.7 m x 23.1 m  
 X Interval: 0.15 m  
 Y Interval: 0.15 m  
 Stats  
 Max: 22.10  
 Min: -22.00  
 Std Dev: 14.61  
 Mean: -0.01  
 Median: 0.61  
 Composite Area: 0.16563 ha  
 Surveyed Area: 0.09173 ha  
 GPS based Proce4  
 1 Base Layer.  
 2 Unit Conversion Layer (Lat/Long to OSGB36).  
 3 DeStripe Median Traverse:  
 4 Clip from -20.00 to 20.00 n

## Appendix D – digital archive

Archaeological Surveys Ltd hold the primary digital archive at their offices in Wiltshire. Data are backed-up onto an on-site data storage drive and at the earliest opportunity data are copied to CD ROM for storage on-site and off-site.

A draft copy will be supplied to the Waterman Infrastructure & Environment Heritage Consultant for comment and review. The Consultant will then submit a copy to the county archaeologist for comment and the agreed final copy will be supplied in PDF format to the Oxfordshire Historic Environment Record on the understanding that it will become a public document after an appropriate period of time (generally not exceeding six months).. The report will also be uploaded to the Online Access to the Index of archaeological investigations (OASIS).

Archive contents:

File type	Naming scheme	Description
Data	J762-mag-[area number/name].asc J762-mag-[area number/name].xcp J762-mag-[area number/name]-proc.xcp	Raw data as ASCII CSV TerraSurveyor raw data TerraSurveyor minimally processed data
Graphics	J762-mag-[area number/name]-proc.tif	Image in TIF format
Drawing	J762-[version number].dwg	CAD file in 2010 dwg format
Report	J762 report.odt	Report text in Open Office odt format

Table 2: Archive metadata

## Appendix E – CAD layers for abstraction and interpretation plots

The table below sets out Archaeological Surveys Ltd CAD layer names with associated colours and graphical content. Where CAD files are available layers may be extracted for further CAD/GIS use. Note: hatched polygon boundaries are contained within layers with the RGB colour code 254, 255, 255 (near white) in order to prevent their visibility.






Report sub-heading and associated CAD layer names	Colour with RGB index	Layer content
<b>Anomalies with an uncertain origin</b>		
AS-ABST MAG POS LINEAR UNCERTAIN	 255,127,0	Line, polyline or polygon (solid)
<b>Anomalies associated with magnetic debris</b>		
AS-ABST MAG DEBRIS	 132, 132, 132	Polygon (cross hatched ANSI37)
AS-ABST MAG STRONG DIPOLAR	 132, 132, 132	Solid donut, point or polygon (solid)
<b>Anomalies with a modern origin</b>		
AS-ABST MAG DISTURBANCE	 132, 132, 132	Polygon (hatched ANSI31)
AS-ABST MAG SERVICE	 132, 132, 132	Line or polyline

Table 3: CAD layering

## Appendix F – copyright and intellectual property

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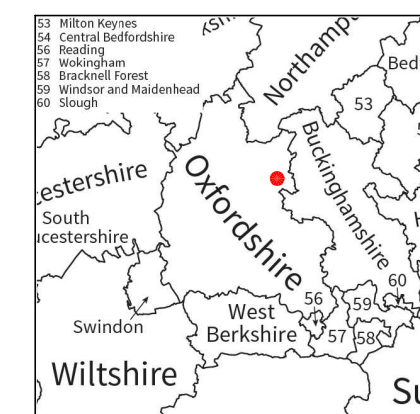
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**Geophysical Survey  
Barrus Development - D1 & D4  
Graven Hill Land Transfer Area 2  
Bicester  
Oxfordshire**

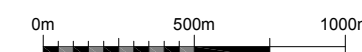
**Map of survey area**



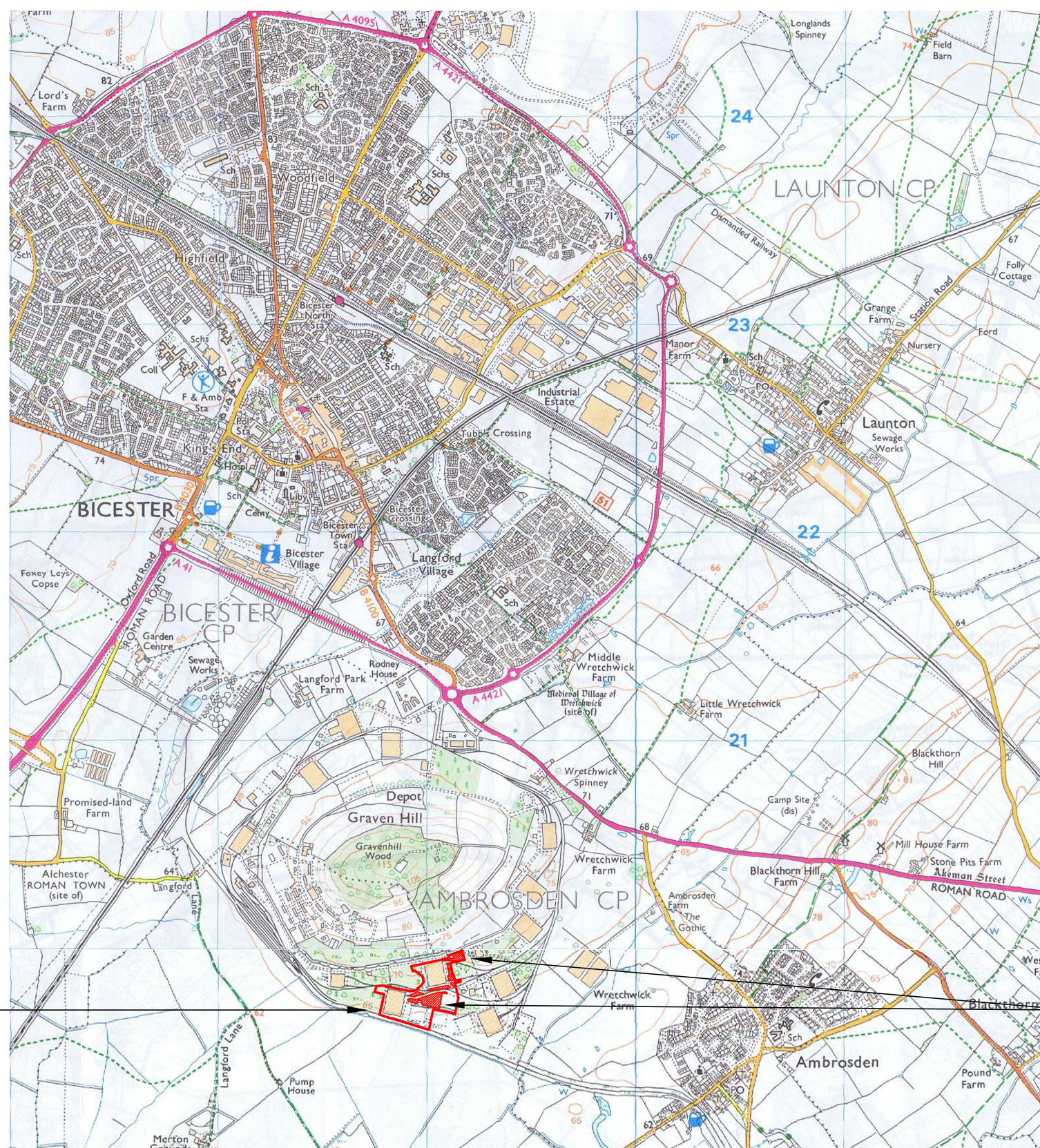
● Survey location

Site centred on OS NGR  
SP 59080 19820

SCALE 1:25 000



SCALE TRUE AT A3



Development boundary

Survey locations



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Bicester  
Oxfordshire**

**Referencing information**

Referencing grid to OSGB36 datum at 50m intervals

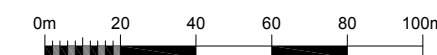
Data collected at 20Hz and georeferenced to ETRS89 zone 30 with conversion to OSGB36 using OSTN02

● 458950 219750



Development boundary

**SCALE 1:2000**



SCALE TRUE AT A3

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**DJS**

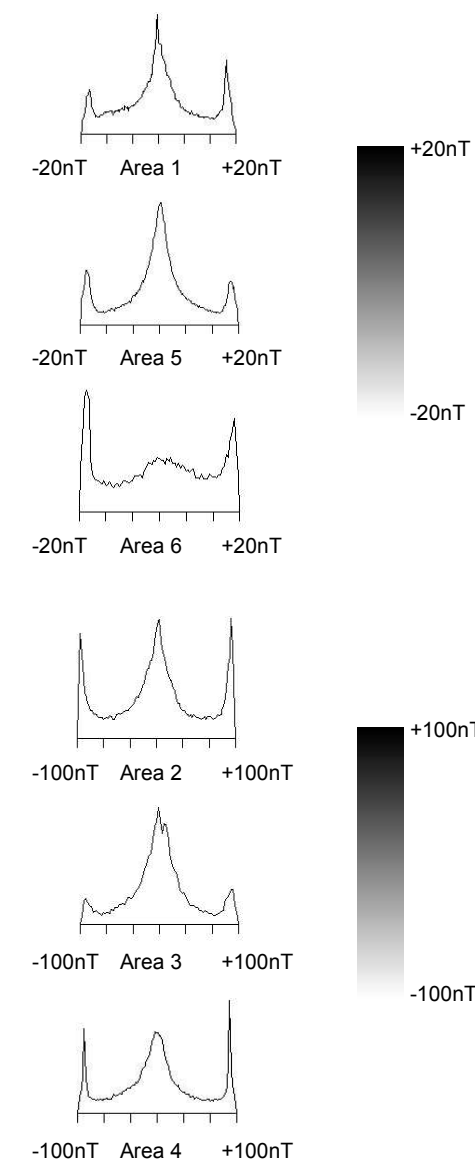
**FIG 02**



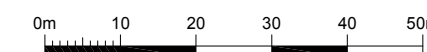


**Geophysical Survey**  
**Barrus Development - D1 & D4**  
**Graven Hill Land Transfer Area 2**  
**Bicester**  
**Oxfordshire**

**Greyscale plot of minimally  
processed magnetometer data**



**SCALE 1:1000**

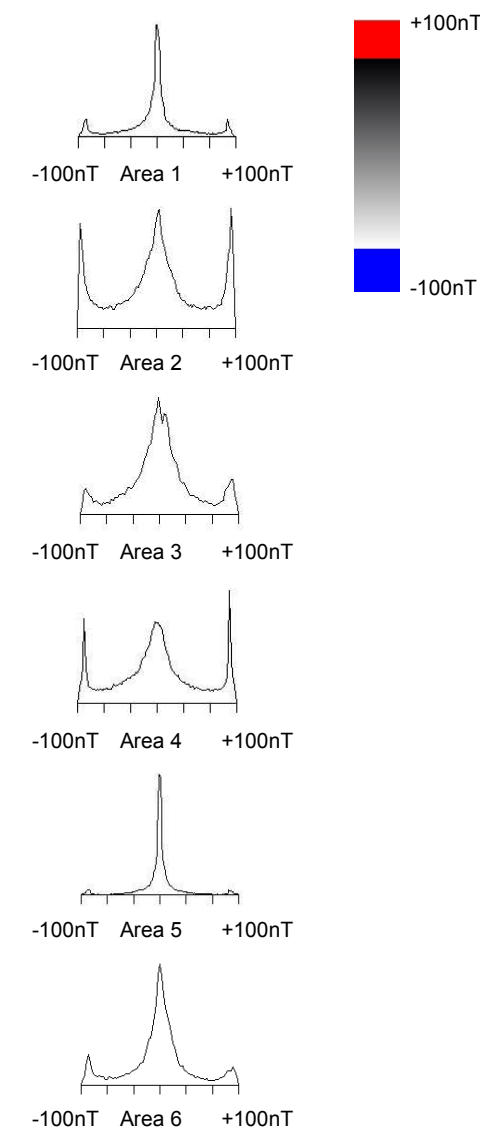


SCALE TRUE AT A3

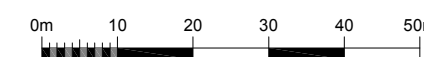


**Geophysical Survey**  
**Barrus Development - D1 & D4**  
**Graven Hill Land Transfer Area 2**  
**Bicester**  
**Oxfordshire**

**Greyscale plot of minimally  
processed magnetometer data  
clipped at  $\pm 100\text{nT}$  with extreme  
values highlighted**



**SCALE 1:1000**



SCALE TRUE AT A3

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**KTD**

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**FIG 04**



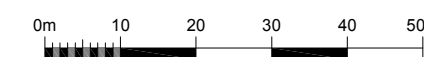


**Geophysical Survey  
Barrus Development - D1 & D4  
Graven Hill Land Transfer Area 2  
Bicester  
Oxfordshire**

## Abstraction and interpretation of magnetic anomalies

-  Positive linear anomaly - ditch-like feature of uncertain origin
-  Magnetic debris - spread of magnetically thermoremanent/ferrous material
-  Magnetic disturbance from ferrous material
-  Strong multiple dipolar linear anomaly - pipeline / cable / service
-  Strong dipolar anomaly - ferrous object

SCALE 1:1000

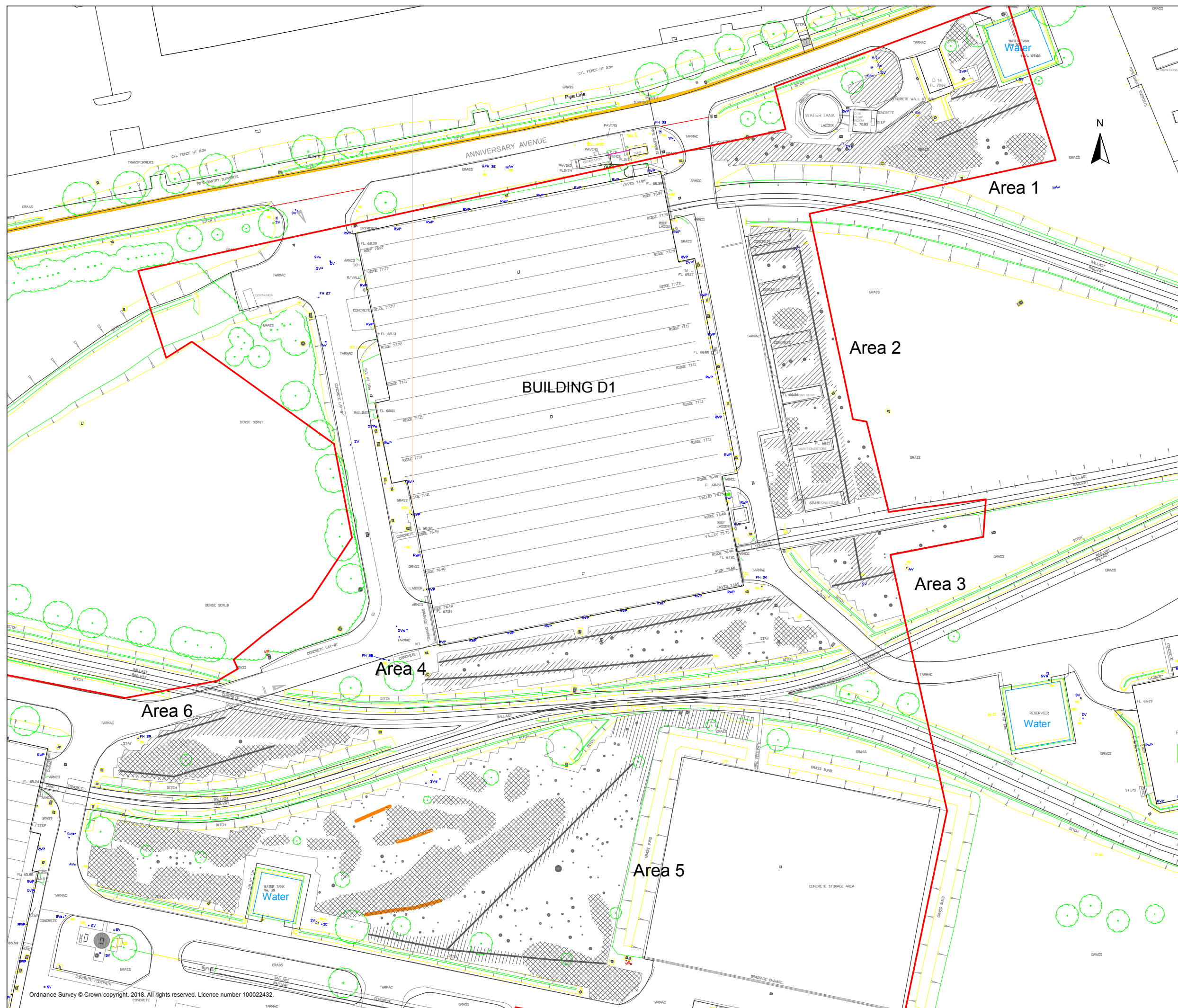


SCALE TRUE AT A3

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FIG 05



## UK and Ireland Office Locations

