Archaeological evaluation
at The Paddocks
Willersey Road
Badsey
Evesham
WR11 7HD

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30th April 2021

WSM 72810 (geophysical survey)
WSM 72807 (evaluation)

Oasis ref martinco1- 421007

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Introduction

An archaeological evaluation was carried out at The Paddocks, Willersey Road, Badsey, Evesham, WR11 7HD SP 079 419; Fig 1) at the request of Helen Watson, Planning Consultant, engaged by Badsey and Aldington Parish Council (the client). This work was undertaken in compliance with a written scheme of investigation provided by Martin Cook BA MCIfA, informed by various discussions between the author, the Parish Council and the Archaeology and Planning Advisor of Wychavon District Council. The written scheme of investigation was approved by Aidan Smyth, Archaeology and Planning Advisor, of Wychavon District Council (event numbers WSM 72810 - geophysical survey and WSM 72807 - evaluation). The archaeological project involved a magnetometry and ground penetrating radar survey carried out by SUMO Survey and an archaeological evaluation carried out by the author at The Paddocks, Willersey Road, Badsey, Evesham, WR11 7HD, subsequent analysis and a report.

Summary

Geophysics survey and an archaeological evaluation were carried out at The Paddocks, Willersey Road, Badsey, Evesham, WR11 7HD. The geophysics survey identified badly degraded ridge and furrow and the evaluation found no significant archaeological features and a very few, mostly modern, finds.

A summary will be published in West Midlands Archaeology.

The documentary material

Geology and topography

The search area sits within a rolling lowland topography based on bedrock geology made up of mudstone and superficial geology made up of clay, silt, sand and gravel. The region is mostly arable with intensive glasshouse agriculture seen on the fringes of the villages. The landscape comprises regular, planned enclosure, except for Bretforton, where remnants of enclosed strip fields remain. Settlement is historically nucleated, however, 20th century ribbon development, localised industry and a prison have eroded this character. Within the search area modern expansion and an isolated farmstead are surrounded by modern subdivision, piecemeal enclosure, field amalgamation and horticultural nurseries.

Historic mapping

The earliest available mapping is the pre-enclosure map of 1812 (Fig 2.1). This could not be reproduced due to copyright but the information was transcribed onto a modern Ordnance Survey base. This shows that the area of the site was common land at this time. The pre-enclosure map itself (Fig 2.2) shows that the land was allocated to the Reverend Charles Phillpott. The first edition Ordnance Survey map of 1885 (Fig 2.3) shows a simple field with a southern boundary formed by two straight lines. The Ordnance Survey maps of 1902 and 1923 (Figs 2.4 and 2.5) hint at this boundary becoming slightly sinuous. The Ordnance Survey map of 1946 (Fig 2.6) shows the same effect with an internal boundary having a pronounced reversed 'S' shape.

Other mapping

The LIDAR survey of the site shows clear ridge and furrow across the field, running west to east, although it is not as pronounced as elsewhere in the parish.

The Worcestershire Historic Environment Record

There are a number of landscape components or monuments nearby or adjacent to the site. By proximity to the site these are:

The site itself
Events
WSM 02732
Unstratified Romano-British coin, west of Willersey Road

WSM 72810
Geophysical Survey at The Paddocks, Willersey Road, - this project

Historic landscape character
HWR 8728
Fields and enclosed land – post WWII

Adjacent to the site
Historic buildings and monuments
WSM 30628
Postulated Roman Road from Hinton on the Green to Ryknild Street - 43 AD to 410 AD

WSM 34471
Ridge and furrow earthworks at Bowers Hill Farm, Bretforton - late 11th century AD to 18th century AD

WSM 70184
Ridge and furrow earthworks at Happylands Pig Farm - medieval 1066 AD to 1539 AD

WSM 70185
Ridge and furrow earthworks, south of Marlborough House - medieval 1066 AD to 1539 AD

Commentary on the documentary material
The Historic Environmental Record describes the postulated Roman Road from Hinton on the Green to Ryknild Street as 'conjectural' and a Roman coin has been found on the field. The evidence for Roman activity is therefore very limited.

Conversely, agricultural use of the land is particularly well attested with a strong response by both the LIDAR plot and the magnetometry survey (see below, **The geophysical surveys**). The changing nature of the southern field boundary and, in particular, the sinuous shape of the internal boundary shown on the Ordnance Survey map of 1946 (Fig 2.6) may indicate that the ridge and furrow was of a comparatively late date. It is now barely visible at ground level, indicating that it has been ploughed-out. This could have begun as a result of the considerable extension of arable land during the Second World War.

The fieldwork

General
Fieldwork took place on the 7th and the 9th to 11th December 2020 (geophysics) and between the 12th April and the 14th April 2021 (evaluation). The geophysical surveys were to comprise magnetometry over the whole of the site (Fig 3.2) and ground penetrating radar in the south-west quarter of the site (Fig 3.3) where a cemetery was proposed. The evaluation was to comprise the excavation of twelve linear trenches, all but one of them 20m long by 1.6m wide and the remaining one approximately 3m square arranged across the field (Fig 3.4). Two of the linear trenches, trenches 5 and 11, were not excavated with the agreement of the Archaeology and Planning Advisor of Wychavon District Council after the rest of the trenches had found little or nothing.

The results of the geophysical surveys are presented in summary form below, with the full report being included as Appendix 3. A full description of the contexts is given in Appendix 1. Contexts are described in summary form below.

The geophysical surveys

Magnetometer and Ground Penetrating Radar (GPR) surveys were conducted over land off Willersey Road, Badsey, Worcestershire (Fradgley 2021, Appendix 3). These identified no definite archaeological anomalies. Evidence for former ridge and furrow was seen across the whole of the survey area in the magnetometer results (Fig 3.2). The ridge and furrow is significantly broader in the northern half of the field compared to the southern. Linear trends and a small discrete response of uncertain origin, plus a modern pathway, were visible in the GPR data (Fig 3.3).

The evaluation

Description

General

The deposits in the trenches were substantially the same, comprising topsoil, subsoil and natural subsoil, varying significantly only in thickness, with land drains present in a couple of cases and one trench having an outcrop of bedrock. Three trenches have been described below to illustrate the variation. Contexts are described in outline, the full context descriptions are available in Appendix 1.

Trench 1 (Figs 4.1 and 5 and section 1, Fig 4.4)

A dark grey brown sandy clay loam with occasional small rounded stones (context 001; topsoil) overlay a light reddy brown sandy clay with occasional small rounded stones (context 002; subsoil) which in turn overlay a mid green grey tenacious clay(context 003; natural subsoil). At the base of the subsoil was a ceramic pipe (context 004; land drain)

Trench 8 (Figs 4.2 and 14 and section 7, Fig 4.5)

A dark grey brown sandy clay loam with occasional small rounded stones (context 023; topsoil)
Overlay a light orange brown sandy clay with common small rounded stones (context 024; subsoil) which in turn overlay an orange grey tenacious clay (context 025; natural subsoil)

Trench 10 (Figs 4.3, 16, 17 and section 9, Fig 4.6)

A dark grey brown sandy clay loam with occasional small rounded stones (context 031; topsoil) overlay a light orange brown sandy clay with common small rounded stones (context 032; subsoil) which in turn overlay an orange grey tenacious clay (context 033; natural subsoil). At the base of the subsoil an outcrop of the Blue Lias formation and Charmouth mudstone (context 034; bedrock) was encountered. This, fracturing naturally into near right-angle blocks, initially had the appearance of something man-made but once cleaned-up it was clear that it was of natural origin.

The variation in deposit thickness

The top soil and subsoil varied markedly in depth. There was little consistency but thicker deposits of topsoil seemed to correlate with the position of furrows and thinner deposits with ridges.

The finds

The discussion below is a summary of the finds and of their associated location or contexts by period. Where possible, dates have been allocated and the importance of individual finds commented upon as necessary.

The assemblage recovered from the site totalled 11 finds weighing 312g (see Appendix 2, Table 1). All material came from topsoil and subsoil (contexts 002, 006, 026 and 032; Figs 20 to 26). Level of preservation was fair, with finds displaying moderate levels of surface abrasion. Material dated to the Roman and modern periods.

Roman

A single sherd of locally produced oxidised Severn Valley ware was recovered from Trench 8 (context 026). The sherd could be identified as the rim of a narrow-mouthed everted rim jar (*cf.*Webster 1976, no.1) and dated mid 1st-4th century.

Modern

Material of modern date formed the bulk of the assemblage and consisted of eight fragments of ceramic land drain (contexts 002 and 006), one sherd of pottery (context 032) and a piece of glass handle (context 006).

The pottery was of a highly fired stoneware (fabric 81.4), with an olive-green glaze, possibly from a large jar or jug form. Stoneware vessels of this type are commonly identified in assemblages of mid 19th-mid 20th century date.

The glass handle was pale green in colour and of a barley twist design, with two clear moulding seams running down the length. It is most likely Victorian in date.

Discussion

The only features identified by the project was degraded ridge and furrow, shown clearly by the magnetometry survey and inferred from the evaluation and land drains. There was a single sherd of Roman pottery but finds in general were modern and few in number. Elsewhere (Cook 2020b), this paucity of historic finds has been taken to indicate land that has been under pasture for a considerable time.

It is common, when undertaking work of this nature in rural areas, to encounter a low-level of ceramic finds in the topsoil and subsoil. This 'background' level of finds frequently dates to the 19th or earlier 20th centuries and occasionally a little earlier (eg Cook 2019a, Cook 2019b, Cook 2020a, *etc*). They are the remains of pottery vessels, presumed to have been broken in the homestead, discarded in more general compost, and later spread on to the fields (Finberg 1951). Finberg went on to note that:

the main source of manure for the peasant farmer [was] *household waste. For the archaeologist, this is the very material which leaves a readable signature in the soil, most commonly in the form of ceramic scatters.*

As the Whittlewood Survey, and other research (Dyer, Jones and Page 2005; Jones 2004) showed, if analyzed carefully, these scatters can hold vital information for the reconstruction of the medieval arable and the identification of the different farming regimes used in its exploitation.

Conversely, the absence of such low-level ceramic scatters may suggest an area that has been pasture, or in the case of Badsey, common land, for a very long time.

Significance

The geophysics project identified ridge and furrow across the whole of the site but this is badly degraded and hardly visible at the surface. The evaluation identified no significant archaeological features and very few finds, most of which were of modern date. The site has no archaeological significance.

Bibliography

Traditional sources

Cook, M, 2019a *Archaeological evaluation at Bear Hill House, Alvechurch, Birmingham, Worcestershire, B48 7JX*, WSM 71636

Cook, M, 2019b *Archaeological watching brief at Adsett Cottage, Main Street, Beckford, GL20 7AD*, WSM 71002

Cook, M, 2020a *Archaeological watching brief at The Willows, Evesham Road, White Ladies Aston, WR7 4QQ*, WSM 70797

Cook, M, 2020b *Archaeological evaluation at Greville Hall Farm, Cheltenham Road, Hinton-on-the-Green, Evesham, WR11 7QX*

Dyer, C, Jones, R, and Page, M, 2005 *The Whittlewood Project: medieval settlements and landscapes in the Whittlewood Area*

Finberg, H P R, 1951 *Tavistock Abbey. A Study in the Social and Economic History of Devon*, Cambridge: Cambridge University Press

Fradgley, R, 2021 *Geophysical survey: Willersey Road, Badsey, Worcestershire*; SUMO Survey, report 01069

Jones, R, 2004 *Signatures in the soil: the use of pottery in manure scatters in the identification of medieval arable farming regimes*, in The Archaeological Journal, **161**, 159-188

Acknowledgements

The author would particularly like to thank Helen Watson, Planning Consultant, Gary Bailey, Phillip Cordelle, Ian Devine, Andrea Evans, Michael Tennant and Alan Tutton, all of Badsey and Aldington Parish Council, Steve who provided and drove the mechanical excavator and Aidan Smyth of Wychavon District Council for their kind cooperation.

Archive

The physical archive consists of:

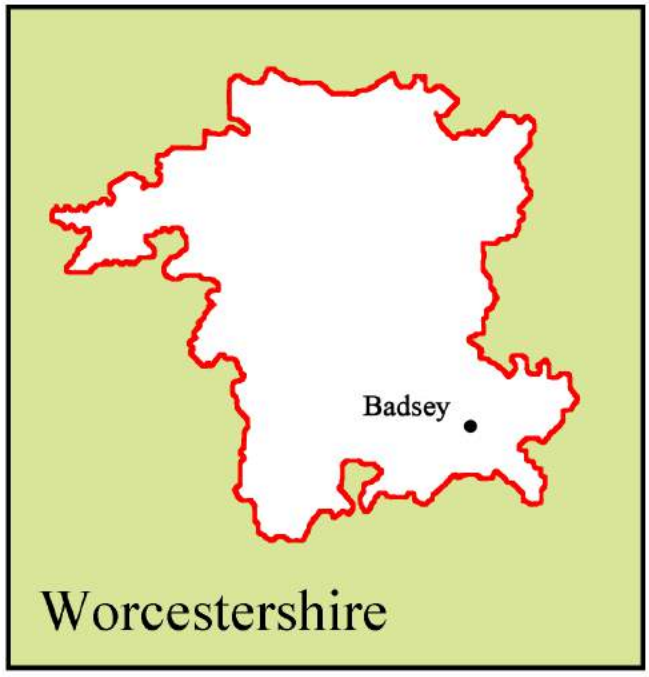
34	Context sheets
2	Drawings
1	Hard copy of the report
1	Hard copy of the report illustrations
1	Hard copy of the WSI

It will be deposited at Worcestershire County Museum, Hartlebury upon approval of the report. It is anticipated that the finds, comprising a single fragment of nib tile, will not be of interest to the museum. However, the museum will be consulted in this respect before disposal.

The digital archive consists of:

1	Digital copy of the report (.docx format)
29	Illustrations (.bmp format)

It will be deposited with the Archaeology Data Service upon approval of the report.



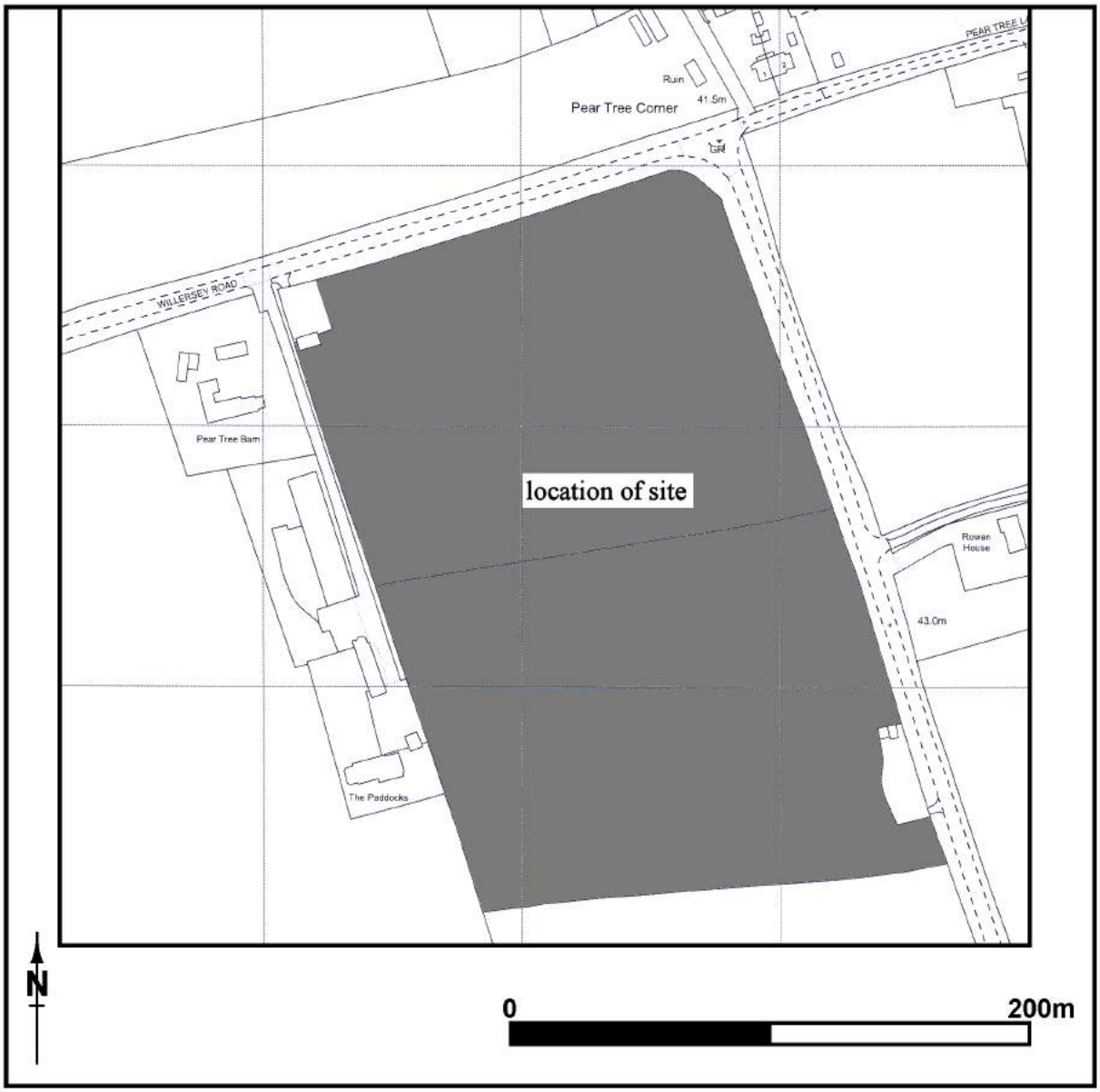


Fig 1: Location of site

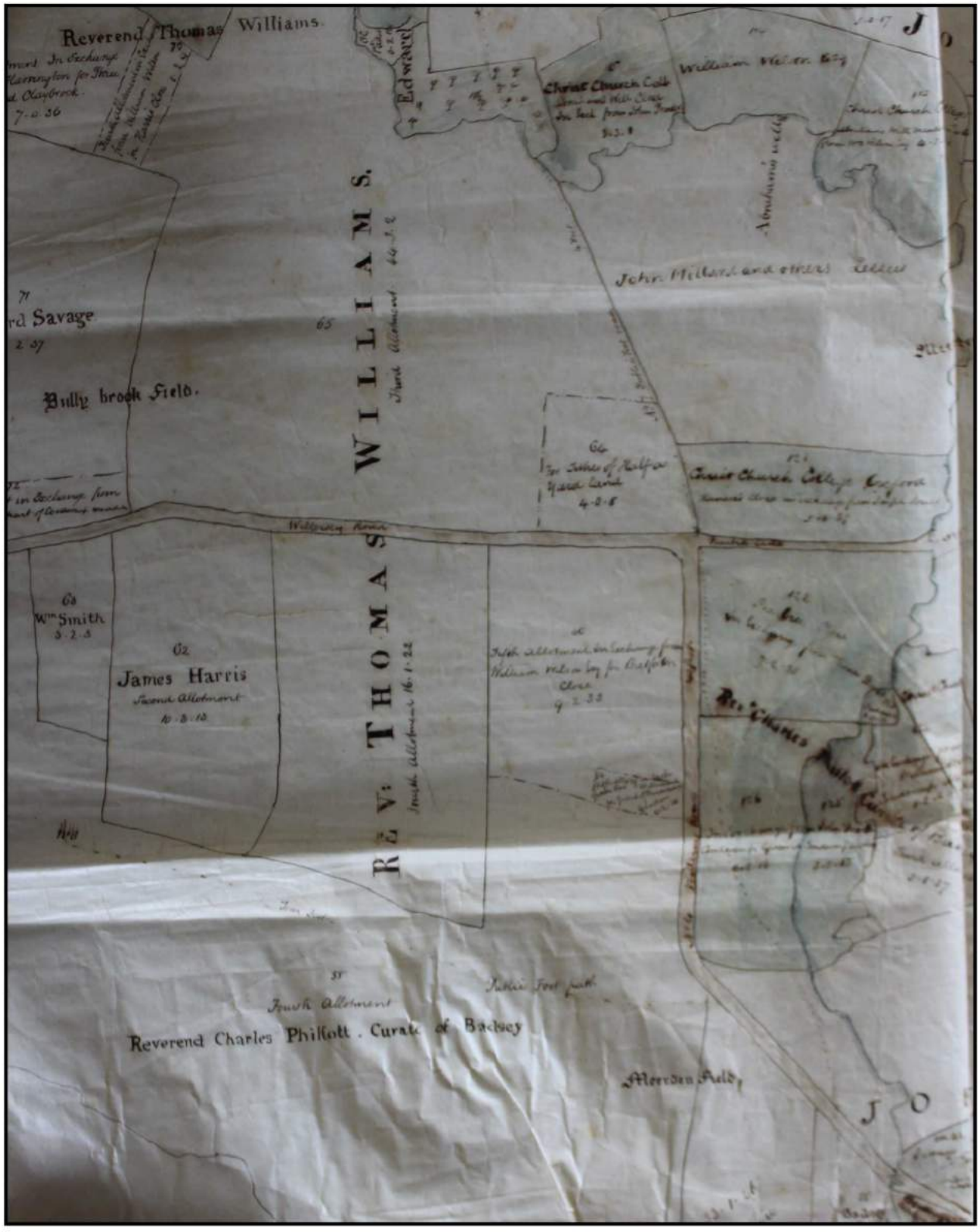
arable

common

N

0 200m

Fig 2.1: Transcription of the 1812 enclosure map of Badsey - land use according to Worcestershire HER



not to scale

The area of the project was allotted to the Reverend Charles Phillpott, Curate of Badsey: 'land in Meerden Field' and was in use as 'common'

Fig 2.2: 1812 enclosure map showing allotment of land parcels

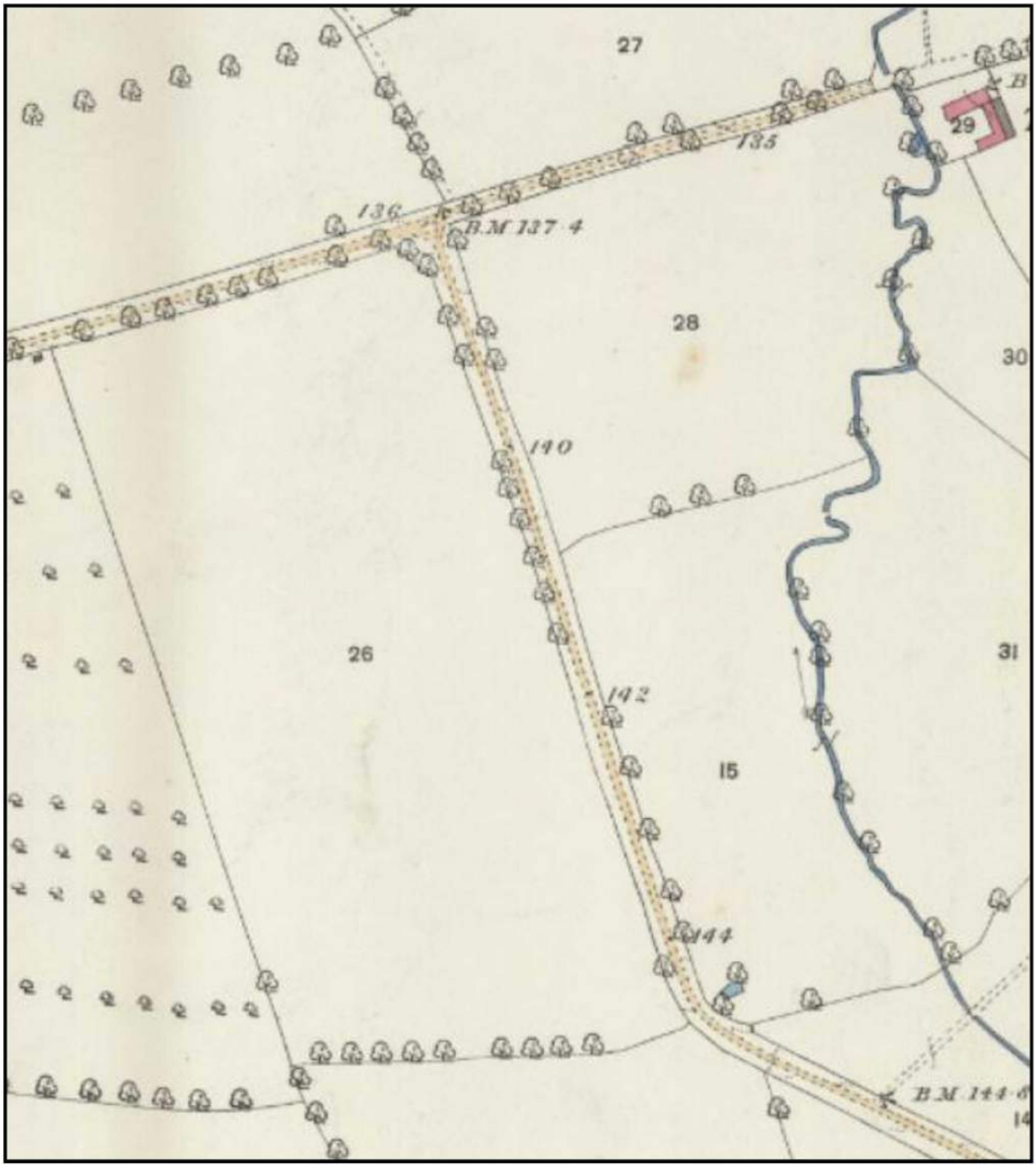


Fig 2.3: Ordnance Survey map of 1885

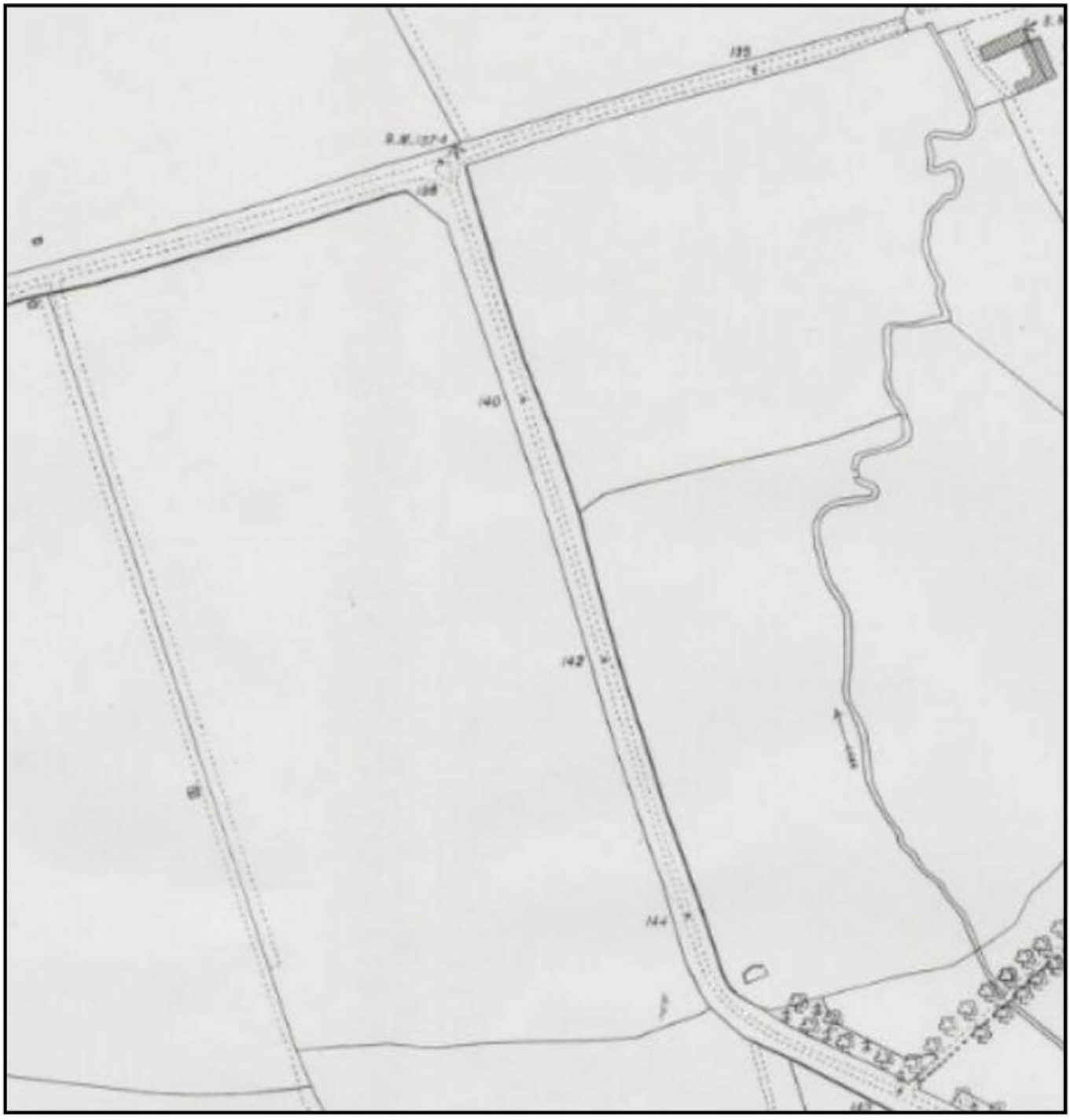


Fig 2.4: Ordnance Survey map of 1902

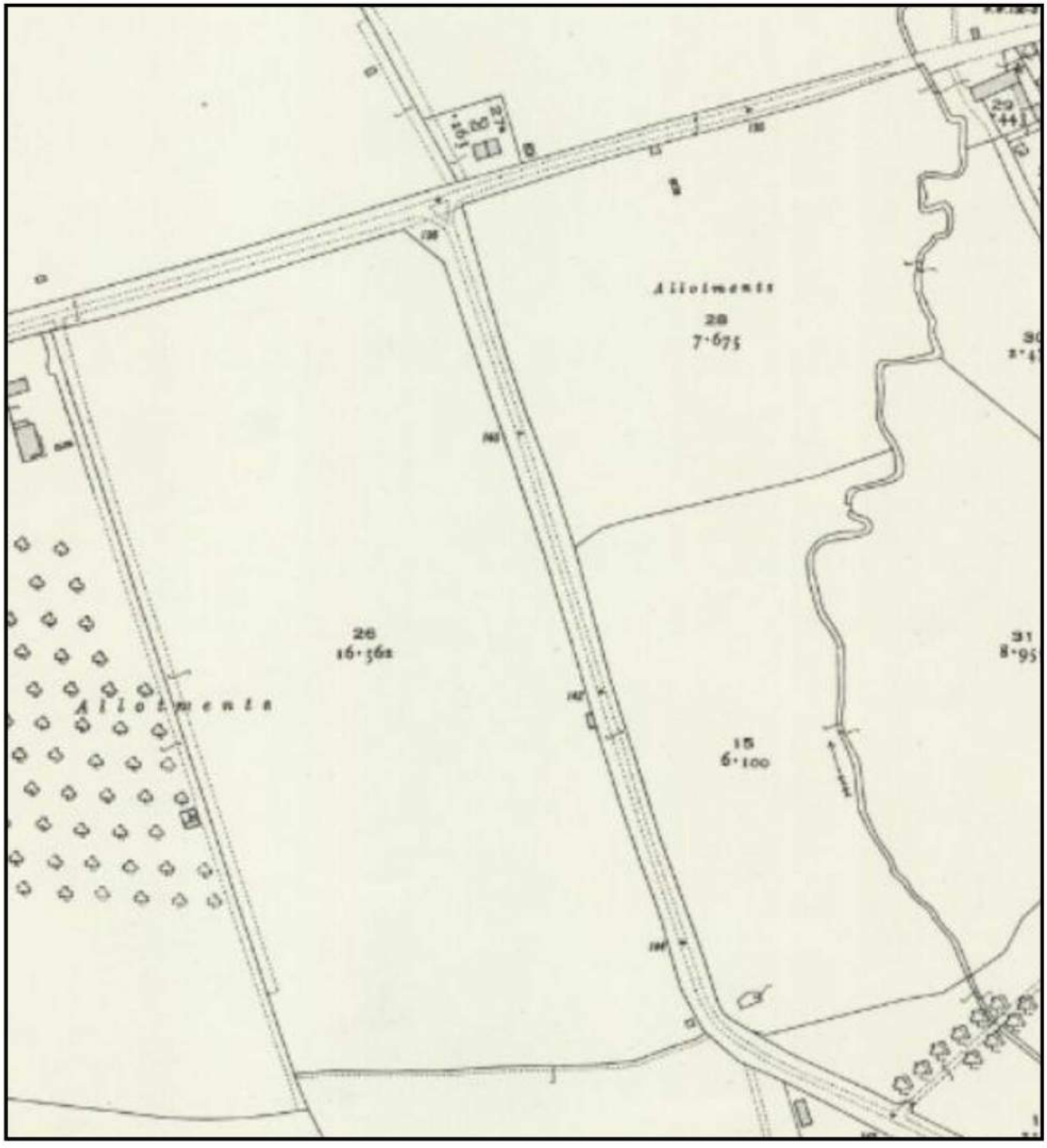


Fig 2.5: Ordnance Survey map of 1923

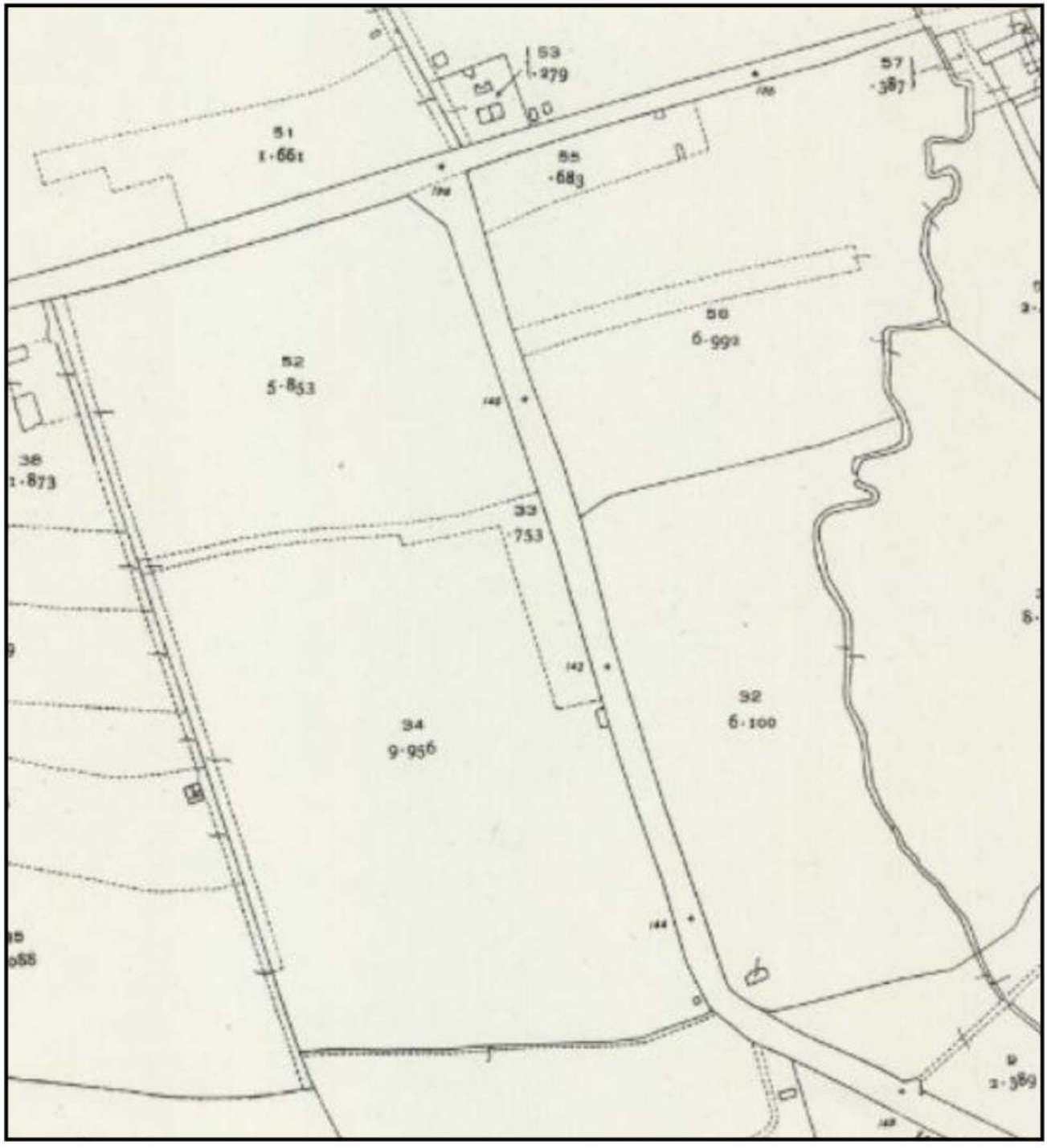


Fig 2.6: Ordnance Survey map of 1946

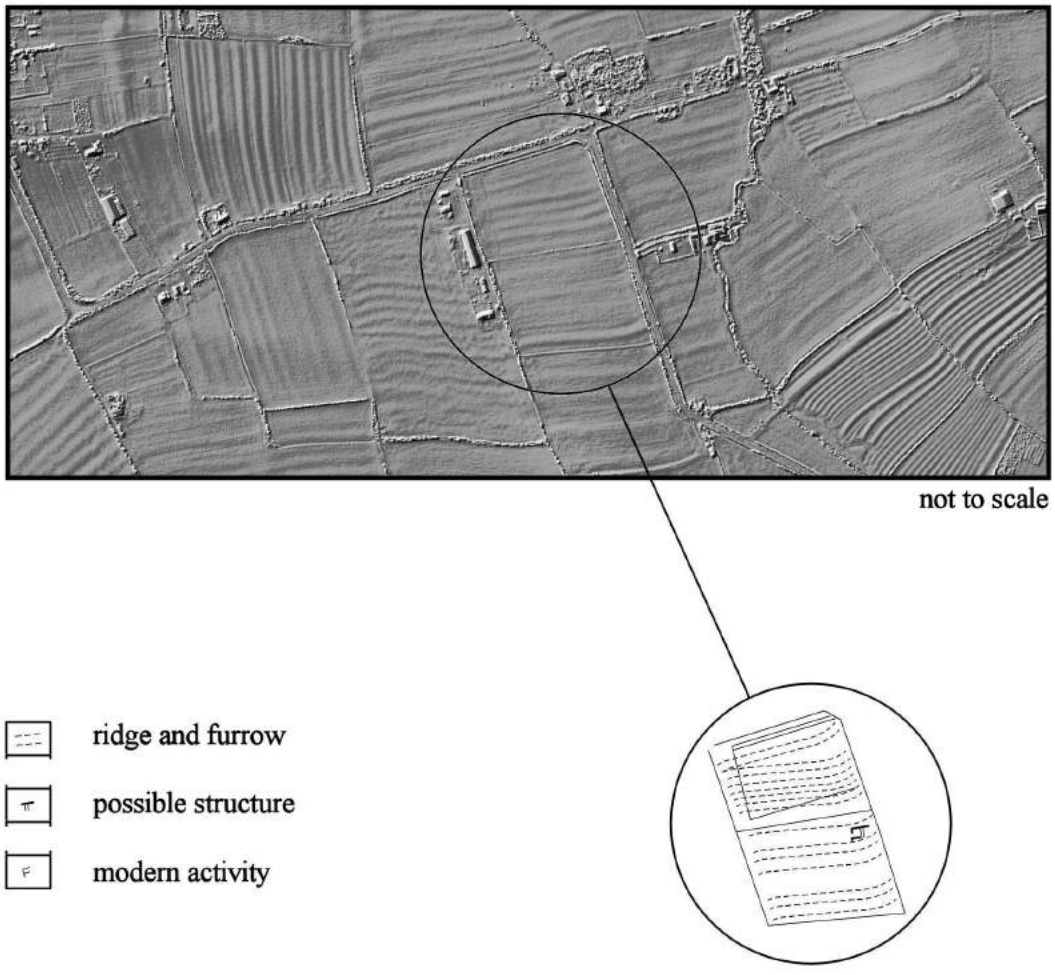


Fig 3.1: LIDAR survey with preliminary interpretation

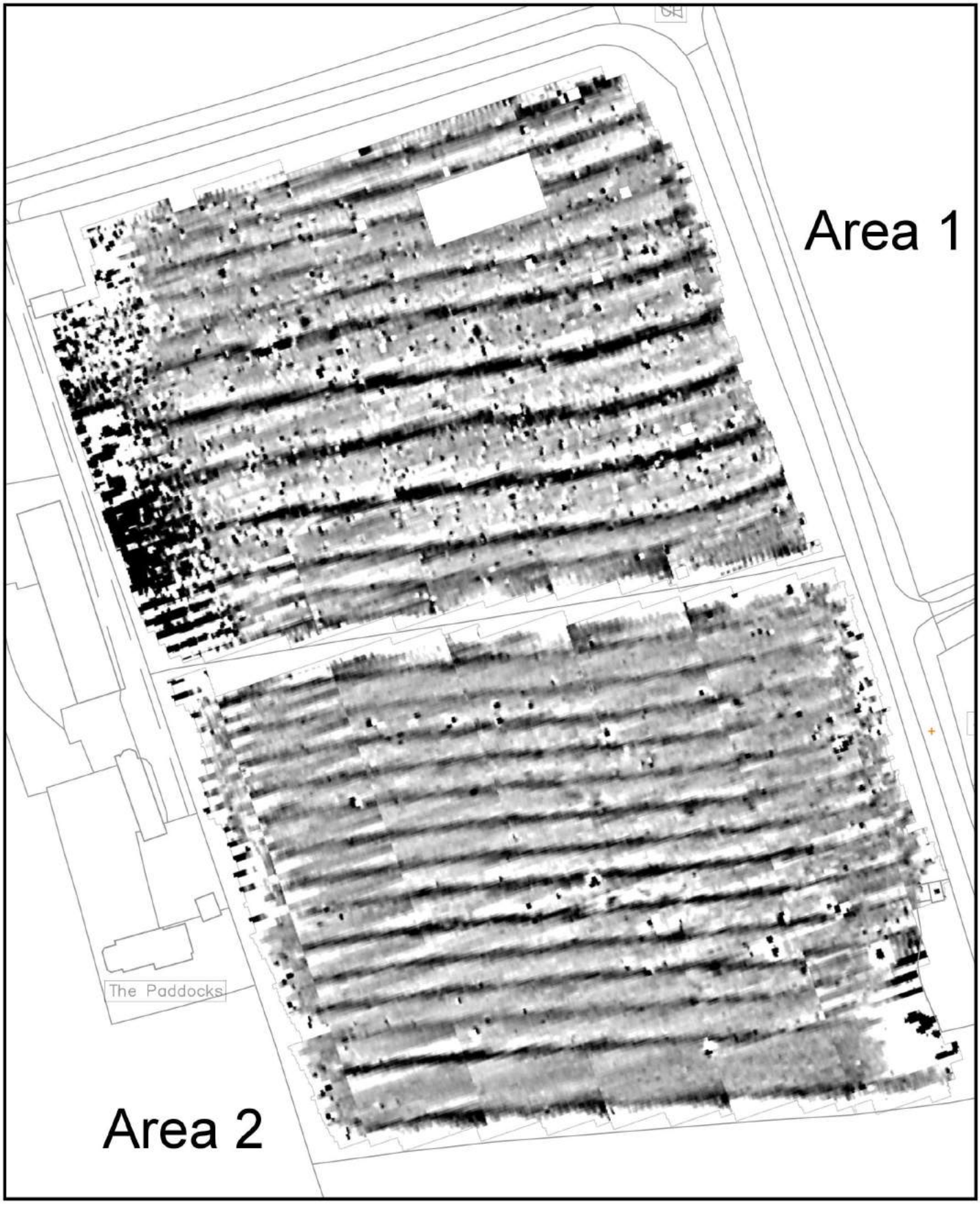


Fig 3.2: SUMO Survey - magnetometry survey

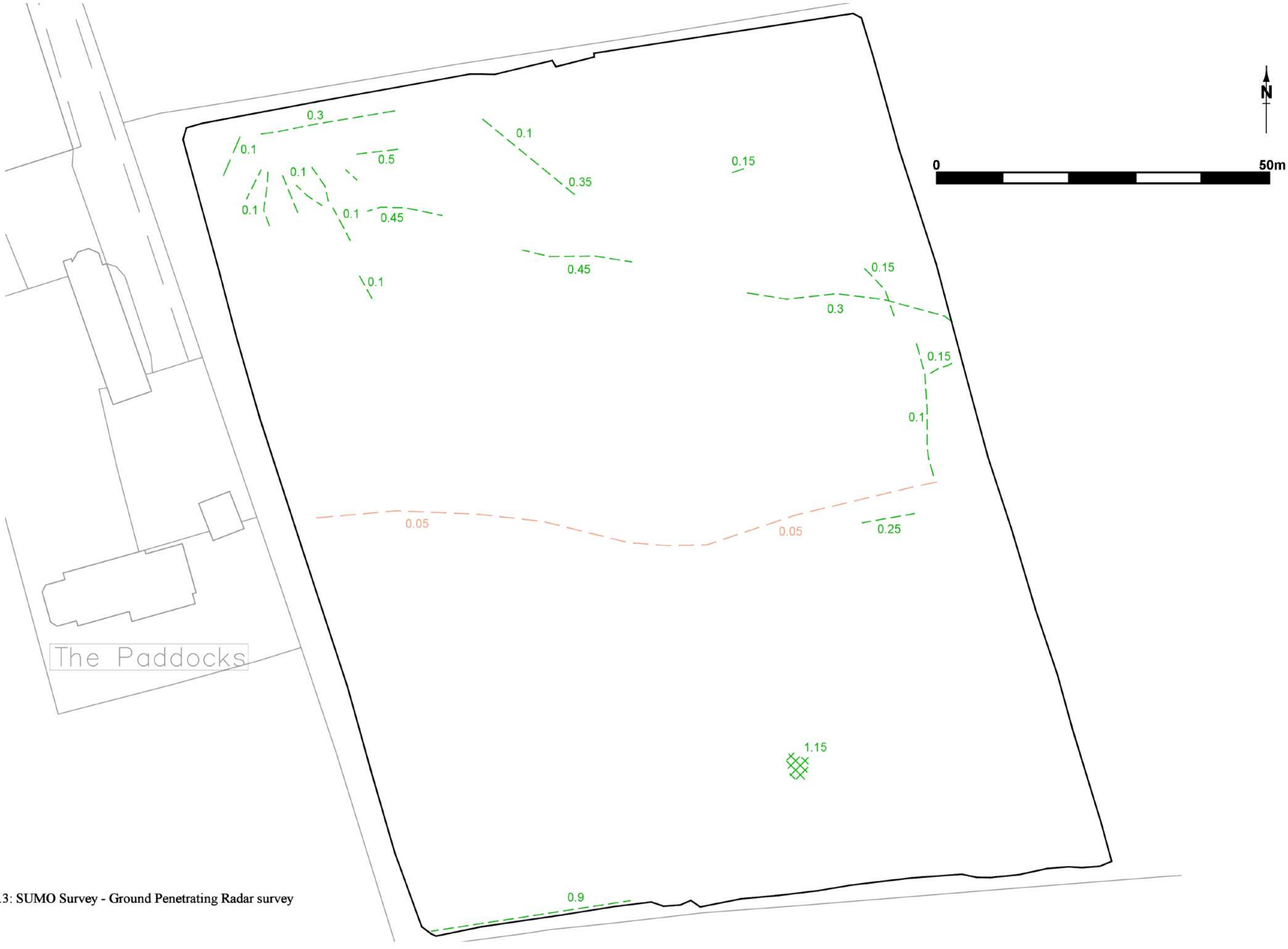
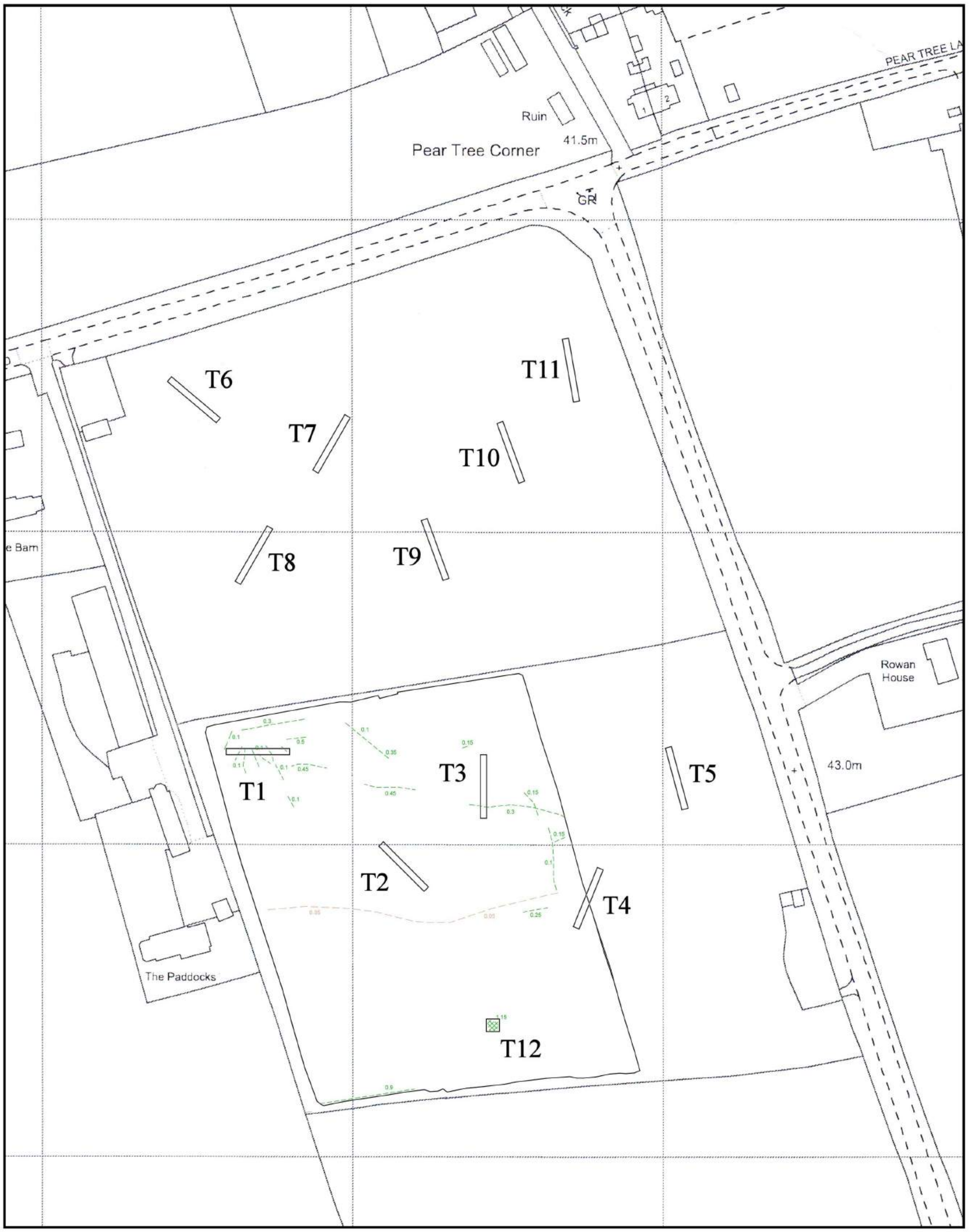


Fig 3.3: SUMO Survey - Ground Penetrating Radar survey



Trenches positioned according to a suggested layout in an email exchange between Aidan Smyth of Wychavon District Council and Councillor Mike Tennant of Badsey and Aldington Parish Council. One additional trench, about 3m square, has been located over the discrete feature in the southern part of the site.

20m trench

3m square trench

N

0 100m

Fig 3.4: Trench plan

Trench 1

Trench 2

Trench 3

Trench 4

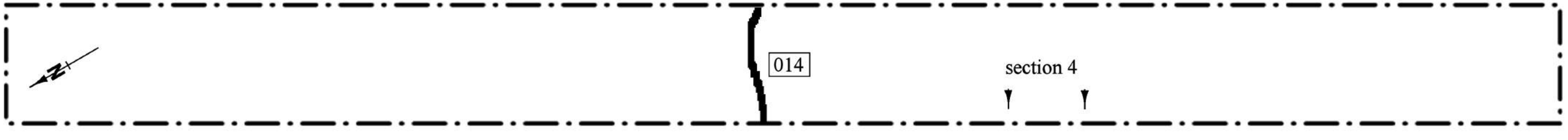


Fig 4.1: Trenches 1 to 4

0 5.0m

Trench 6

Trench 7

Trench 8

Trench 9

Fig 4.2: Trenches 6 to 9

Trench 10

034

section 9

Trench 12

section 10

N

0 5.0m

Fig 4.3: Trenches 10 and 12

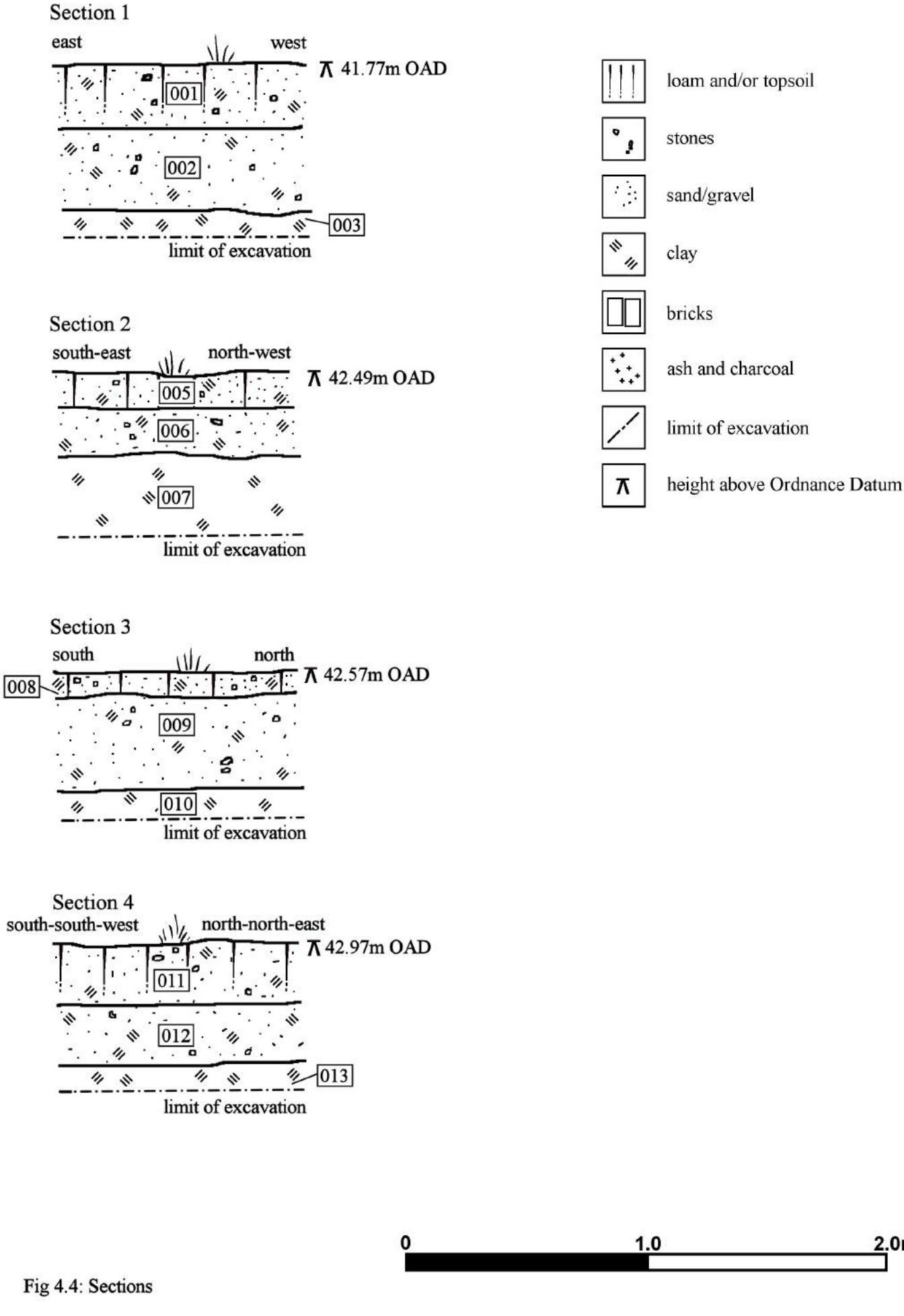


Fig 4.4: Sections

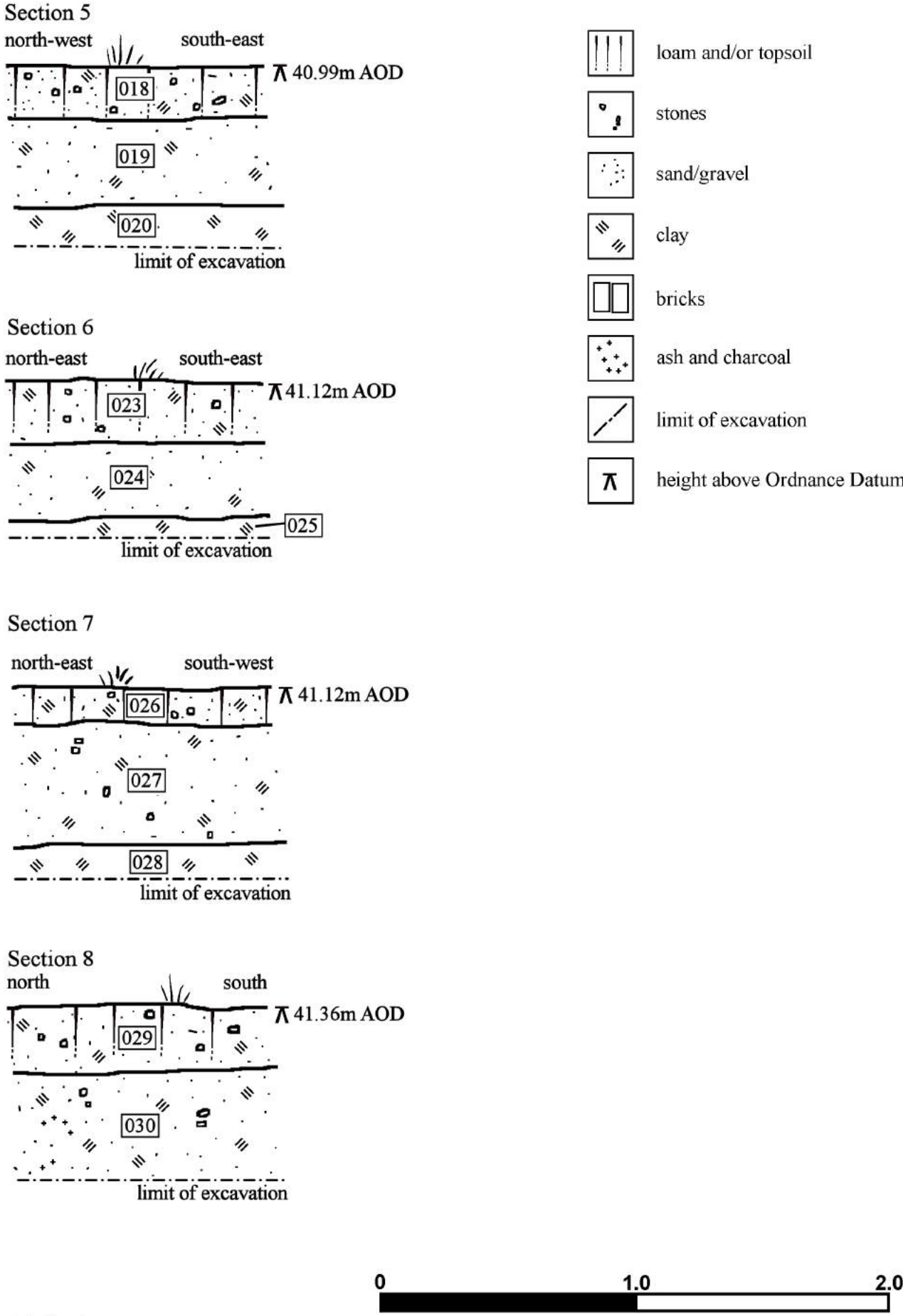
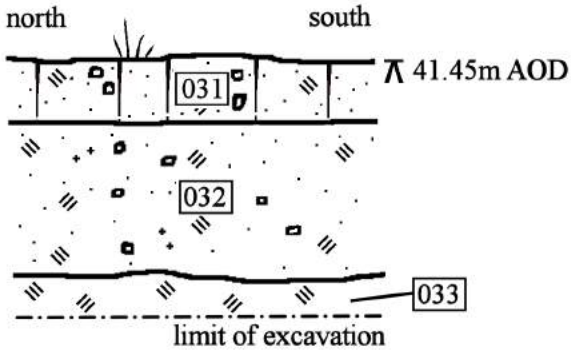
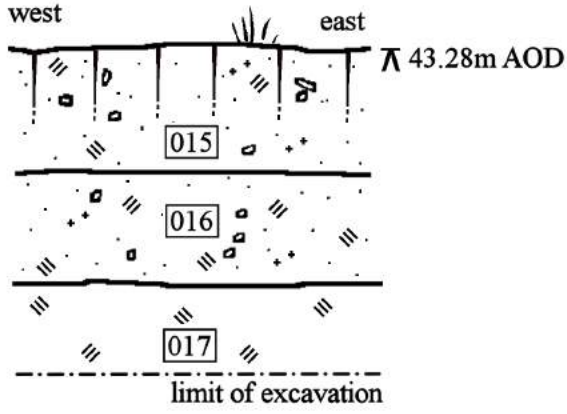


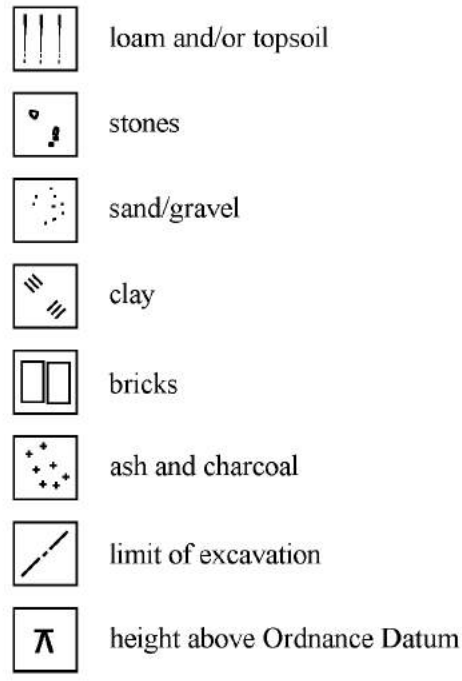
Fig 4.5: Sections

Section 9



Section 10





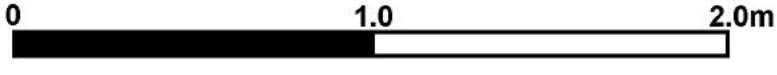


Fig 4.6: Sections

Fig 5: Trench 1

Fig 6: Trench 2

Fig 7: Trench 3

Fig 8: Trench 4

Fig 9: Trench 4, context 014

Fig 10: Trench 6

Fig 11: Trench 6, context 021

Fig 12: Trench 6, context 022

Fig 13: Trench 7

Fig 14: Trench 8

Fig 15: Trench 9

Fig 16: Trench 10

Fig 17: Trench 10, context 034

Fig 18: Trench 12

Fig 19: Social distancing

Fig 20: Excavation of Trench 6

Fig 21: Example of land drain from Trench 6, context 021

Fig 22: Example of land drain from Trench 6, context 021

Fig 23: Trench 1, context 002; finds

Fig 24: Trench 2, context 006; finds

Fig 25: Trench 8, context 026; finds

Fig 26: Trench 10, context 032; finds

Appendix 1: List of the contexts

Context number	Trench number	Description	Interpretation
001	1	Dark grey brown sandy clay loam with occasional small rounded stones	Topsoil
002	1	Light reddy brown sandy clay with occasional small rounded stones	Subsoil
003	1	Mid green grey tenacious clay	Natural subsoil
004	1	Ceramic pipe	Land drain
005	2	Dark grey brown sandy clay loam with occasional small rounded stones	Topsoil
006	2	Light reddy brown sandy clay with occasional small rounded stones	Subsoil
007	2	Mid green grey tenacious clay	Natural subsoil
008	3	Dark grey brown sandy clay loam with occasional small rounded stones	Topsoil
009	3	Light reddy brown sandy clay with occasional small rounded stones	Subsoil
010	3	Mid green grey tenacious clay	Natural subsoil
011	4	Dark grey brown sandy clay loam with occasional small rounded stones	Topsoil
012	4	Light reddy brown sandy clay with occasional small rounded stones	Subsoil
013	4	Mid green grey tenacious clay	Natural subsoil
014	4	Blue plastic pipe	Water pipe
015	12	Dark grey brown sandy clay loam with occasional small rounded stones	Topsoil
016	12	Light reddy brown sandy clay with occasional small rounded stones	Subsoil
017	12	Mid green grey tenacious clay	Natural subsoil
018	6	Dark grey brown sandy clay loam with occasional small rounded stones	Topsoil
019	6	Light orange brown sandy clay with common small rounded stones	Subsoil
020	6	Orange grey tenacious clay	Natural subsoil
021	6	Ceramic pipe	Land drain
022	6	Ceramic pipe	Land drain
023	7	Dark grey brown sandy clay loam with occasional small rounded stones	Topsoil
024	7	Light orange brown sandy clay with common small rounded stones	Subsoil
025	7	Orange grey tenacious clay	Natural subsoil
026	8	Dark grey brown sandy clay loam with occasional small rounded stones	Topsoil
027	8	Light orange brown sandy clay with common small rounded stones	Subsoil
028	8	Orange grey tenacious clay	Natural subsoil
029	9	Dark grey brown sandy clay loam with occasional small rounded stones	Topsoil
030	9	Light orange brown sandy clay with common small rounded stones	Subsoil
031	10	Dark grey brown sandy clay loam with occasional small rounded stones	Topsoil
032	10	Light orange brown sandy clay with common small rounded stones	Subsoil
033	10	Orange grey tenacious clay	Natural subsoil
034	10	Blue lias formation and Charmouth mudstone	Natural bedrock

Appendix 2: Finds report

Artefactual analysis by Laura Griffin

The finds work reported here conforms to the following guidance: for finds work by CIfA (2014), for pottery analysis by PCRG/SGRP/MPRG (2016), for archive creation by AAF (2011), and for museum deposition by SMA (1993).

Aims

- To identify, sort, spot date, and quantify all artefacts;
- To describe the range of artefacts present;
- To preliminarily assess the significance of the artefacts.

Method of analysis

All hand-retrieved finds were examined. They were identified, quantified and dated to period. All information was recorded All information was recorded on Microsoft Access for 365, with tables generated using Microsoft Excel.

The pottery was examined under x20 magnification and referenced as appropriate by fabric type and form according to the fabric reference series maintained by Worcestershire Archaeology (Hurst and Rees 1992 and www.worcestershireceramics.org).

Results

The discussion below is a summary of the finds and of their associated location or contexts by period. Where possible, dates have been allocated and the importance of individual finds commented upon as necessary.

The assemblage recovered from the site totalled 11 finds weighing 312g (see Table 1). All material came from topsoil and subsoil (contexts 002, 006, 026 and 032). Level of preservation was fair, with finds displaying moderate levels of surface abrasion. Material dated to the Roman and modern periods.

period	material class	object specific type	total	weight (g)
Roman	ceramic	pot	1	12
modern	ceramic	pot	1	42
modern	ceramic	drain	8	251
modern	glass	vessel	1	7

Table 1: Quantification of the artefactual assemblage

Summary artefactual evidence by period

All material has been dated and grouped and quantified (Tables 1 and 3). Pottery sherds were datable by fabric type to their general period or production span (Table 2).

period		fabric name	total	weight (g)

	fabric number			
Roman	12	Oxidised Severn Valley ware	1	12
modern	81.4	Miscellaneous late stoneware	1	42

Table 2: Quantification of the pottery by fabric type

Roman

A single sherd of locally produced oxidised Severn Valley ware was recovered from Trench 8 (context 026). The sherd could be identified as the rim of a narrow-mouthed everted rim jar (*cf.*Webster 1976, no.1) and dated mid 1st-4th century.

Modern

Material of modern date formed the bulk of the assemblage and consisted of eight fragments of ceramic land drain (contexts 002 and 006), one sherd of pottery (context 032) and a piece of glass handle (context 006).

The pottery was of a highly fired stoneware (fabric 81.4), with an olive-green glaze, possibly from a large jar or jug form. Stoneware vessels of this type are commonly identified in assemblages of mid 19th-mid 20th century date.

The glass handle was pale green in colour and of a barley twist design, with two clear moulding seams running down the length. It is most likely Victorian in date.

context	material class	object specific type	total	weight (g)	start date	end date	finds TPQ
002	ceramic	drain	4	150			modern
006	ceramic	drain	4	101			20th century
006	glass	vessel	1	7	M19C	E20C	
026	ceramic	pot	1	12	M1C	4C	Roman
032	ceramic	pot	1	42	M19C	M20C	mid 20th century

Table 3: Summary of context dating based on artefacts

Recommendations

No further work required

Bibliography

AAF 2011 *Archaeological archives: a guide to the best practice in the creation, compilation, transfer and curation*. Available at http://www.archaeologyuk.org/archives/

CIfA 2014 *Standard and guidance for the collection, documentation, conservation and research of archaeological materials*. Available at http://www.archaeologists.net/codes/ifa

Hurst, J D, and Rees, H, 1992 Pottery fabrics; a multi-period series for the County of Hereford and Worcester, in Woodiwiss, S G (ed), *Iron Age and Roman salt production and the medieval town of Droitwich*, CBA Res Rep, **81**, 200-9

PCRG/SGRP/MPRG, 2016 *A standard for pottery studies in archaeology*

SMA 1993 *Selection, retention and dispersal of archaeological collections*. Available at http://www.swfed.org.uk/wp-content/uploads/2015/05/selectionretentiondispersalofcollections1-SMA.pdf

Webster, P V, 1976 Severn Valley Ware: a preliminary study, *Trans Bristol Gloucestershire Archaeol Soc,* **94**, 18-46

Summary of data for Worcestershire HER

WSM 72807 (event HER number)

WRB 21

Artefacts

period - note 1	material class	object specific type	count	weight	start date	end date	specialist report? (note 2)	key assemblage? (note 3)
Roman	ceramic	pot	1	12	M1C	4C	N	N
modern	ceramic	pot	1	42	M19C	L20C	N	N
modern	ceramic	drain	8	251	19C	20C	N	N
modern	glass	vessel	1	7	M19C	E20C	N	N

Notes

1) In some cases the date will be "Undated". In most cases, especially if there is not a specialist report, the information entered in the Date field will be a general period such as Neolithic, Roman, medieval etc (see below for a list of periods used in the Worcestershire HER). Very broad date ranges such as late Medieval to Post-medieval are acceptable for artefacts which can be hard to date for example roof tiles. If you have more specific dates, such as 13th to 14th century, please use these instead. Specific date ranges which cross general period boundaries can also be used, for example 15th to 17th century.

period	from	to
Palaeolithic	500000 BC	10001 BC
Mesolithic	10000 BC	4001 BC
Neolithic	4000 BC	2351 BC
Bronze Age	2350 BC	801 BC
Iron Age	800 BC	42 AD
Roman	43	409

Post-Roman	410	1065
Medieval	1066	1539
Post-medieval	1540	1900
Modern	1901	2050

period specific	from	to
Lower Paleolithic	500000 BC	150001
Middle Palaeolithic	150000	40001
Upper Palaeolithic	40000	10001
Early Mesolithic	10000	7001
Late Mesolithic	7000	4001
Early Neolithic	4000	3501
Middle Neolithic	3500	2701
Late Neolithic	2700	2351
Early Bronze Age	2350	1601
Middle Bronze Age	1600	1001
Late Bronze Age	1000	801
Early Iron Age	800	401
Middle Iron Age	400	101
Late Iron Age	100 BC	42 AD
Roman 1st century AD	43	100
2nd century	101	200
3rd century	201	300
4th century	301	400
Roman 5th century	401	410
Post roman	411	849
Pre conquest	850	1065
Late 11th century	1066	1100
12th century	1101	1200
13th century	1201	1300
14th century	1301	1400
15th century	1401	1500
16th century	1501	1600
17th century	1601	1700
18th century	1701	1800
19th century	1801	1900
20th century	1901	2000
21st century	2001	

2. Not all evaluations of small excavation assemblages have specialist reports on all classes of objects. An identification (eg clay pipe) and a quantification is not a specialist report. A short discussion or a more detailed record identifying types and dates is a specialist report. This field is designed to point researchers to reports where they will find out more than merely the presence or absence of material of a particular type and date.

3. This field should be used with care. It is designed to point researchers to reports where they will be able to locate the most important assemblages for any given material for any given date.

Appendix 3: Geophysics report

GEOPHYSICAL SURVEY REPORT

Willersey Road, Badsey, Worcestershire

Client

Martin J Cook

Survey Report

01069

Date

January 2021

Survey Report 01069: Willersey Road, Badsey, Worcestershire

Survey dates	7, 9-11 December 2020
Field co-ordinator	Simon Lobel BSc Richard Fleming
Field Team	Oliver Thomas Liam Brice-Bateman BA Stephen Weston BA
Report Date	7 January 2021
CAD Illustrations	Rebecca Fradgley BSc Magdalena Udyrysz-Krawec MSc
Report Author	Rebecca Fradgley BSc
Project Manager	Simon Haddrell BEng AMBCS PCIfA
Report approved	Dr John Gater BSc DSc(Hon) MCIfA FSA

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geophysics@sumoservices.com

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Figure 05	1:600	GPR Survey - Timeslice at 0.20m depth
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Figure 07	1:600	GPR Survey - Timeslice at 0.60m depth
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Figure 12	NTS	2017 Google Earth Image and GPR Timeslice showing modern path

2. SURVEY TECHNIQUE

Detailed magnetic survey (magnetometry) and Ground Penetrating Radar (GPR) were chosen as the most efficient and effective methods of locating the type of archaeological anomalies which might be expected at this site.

Magnetometer: Bartington Grad 601-2 Traverse Interval 1.0m Sample Interval 0.25m

GPR:	Mala Mira	Traverse Interval 0.08m	Sample Interval 0.08m

3 SUMMARY OF RESULTS

3.1 Magnetometer and Ground Penetrating Radar (GPR) surveys conducted over land off Willersey Road, Badsey, Worcestershire identified no definite archaeological anomalies. Evidence for former ridge and furrow is seen across the whole of the survey area in the magnetometer results, while linear trends and a small discrete response of uncertain origin, plus a modern pathway, are visible in the GPR data.

4 INTRODUCTION

4.1 **SUMO Geophysics Ltd** were commissioned to undertake a geophysical survey of an area outlined for the creation of a new cemetery. This survey forms part of an archaeological investigation being undertaken by **Martin J Cook**.

4.2 Site details

NGR / Postcode	SP 079 419 / WR11 7JT
Location	The survey area is located to the south-east of the village of Badsey, to the east of Evesham, Worcestershire. Willersey Road forms the northern and eastern boundaries of the site, with agricultural land to the south and farm buildings to the west.
HER	Worcestershire
District	Wychavon
Parish	Badsey CP
Topography	Mostly level
Current Land Use	Grassland / pasture
Geology (BGS 2020)	Solid: Blue Lias Formation and Charmouth Mudstone Formation (undifferentiated) - mudstone. Superficial: none recorded.
Soils (CU 2020)	Soilscape 9: lime-rich loamy and clayey soils with impeded drainage.
Archaeology (WHER 2020)	Worcestershire Historic Environment Record (HER) identifies nine heritage assets within a 500m radius of the site. The postulated Roman Road from Hinton on the Green to Ryknild Street (WSM30628) lies immediately north of the site, following the course of Willersey Road and Pear Tree Lane. Ridge and furrow earthworks (WSM70184; WSM34471; WSM70183) are recorded on land to the north-west and south-east of the area, with the remaining records associated with 19th century barns and outbuildings.
Survey Methods	Magnetometer survey (fluxgate gradiometer)
Study Area	Magnetometer: *c.*4.7 ha GPR: *c.*1.3 ha

4.3 **Aims and Objectives**

To locate and characterise any anomalies of possible archaeological interest within the study area.

5 RESULTS

5.1 *Magnetometer*

5.1.1 *Probable / Possible Archaeology*

No magnetic responses have been recorded that could be interpreted as being of archaeological interest.

5.1.2 *Agricultural – Ridge and Furrow*

Widely spaced, slightly curved, parallel linear anomalies are present across both survey areas. They are indicative of former ridge and furrow cultivation and could have medieval or post-medieval origins.

5.1.3 *Ferrous / Magnetic Disturbance*

Ferrous responses close to boundaries are due to adjacent fences and gates. Small scale ferrous anomalies ("iron spikes") are present throughout the data and are characteristic of small pieces of ferrous debris (or brick / tile) in the topsoil; they are commonly assigned a modern origin. Only the most prominent of these are highlighted on the interpretation diagram. An area of magnetic disturbance, also of modern origin, has been identified along the western edge of Area 1.

5.2 *GPR*

Uncertain Origin

A number of tentative linear trends have been detected, predominantly in the northern part of the survey area. The majority of the responses are relatively shallow (c. 0.1m - 0.3m in depth) suggesting that they are most likely to have a modern explanation; however, their exact origin is unknown.

A single discrete reflection has been identified at a depth of 1.15m in the south of the site. While an archaeological explanation cannot be ruled out, especially given the known features of interest in the vicinity of the site, there are no such responses in the magnetic data; as a consequence a natural origin is perhaps more likely.

Modern path

A curving linear anomaly has been detected at a depth of 0.05m and corresponds with the location of a modern path, visible on Google Earth imagery (Fig. 11).

6 DATA APPRAISAL & CONFIDENCE ASSESSMENT

6.1 Historic England guidelines (EH 2008) Table 4 states that the typical magnetic response on the local soils / geology is variable. The results from this survey indicate the presence of former ridge and furrow and there is no *a priori* reason to suggest that the technique would not have detected archaeological features, should they be present.

6.2 The GPR data across the survey areas displays a moderate contrast between linear responses and that of the background, indicating that the underlying ground is conducive to a GPR survey. A depth penetration of up to 1.6 metres was achieved by the Mala Mira system, and a number of anomalies of uncertain origin were detected, indicating the GPR survey was effective.

7 CONCLUSION

7.1 The survey off Willersey Road, Badsey has not identified any features of definite archaeological interest, nor any obvious obstructions in the area outlined for the proposed cemetery. The magnetic data reveal evidence for ridge and furrow cultivation across the site, while the GPR data have identified numerous linear trends of uncertain origin. The latter are thought most likely to be modern, given their shallow depth, while a small discrete feature at a depth of *c.*1m is possibly natural, although an archaeological origin cannot be ruled out entirely. The line of a modern pathway has also been detected in the GPR results and it coincides with a feature in the same location on Google Earth imagery.

8 REFERENCES

BGS 2020 British Geological Survey, Geology of Britain viewer [accessed 06/01/2021] *website*: (http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps)

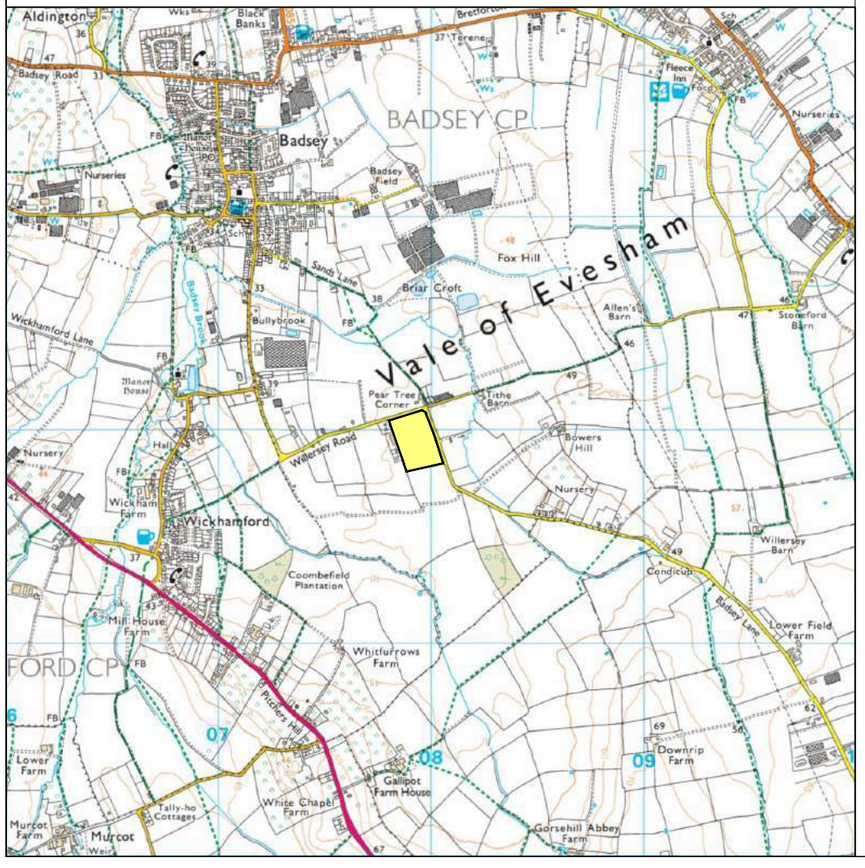
CIfA 2014 *Standard and Guidance for Archaeological Geophysical Survey.* Amended 2016. CIfA Guidance note. Chartered Institute for Archaeologists, Reading http://www.archaeologists.net/sites/default/files/CIfAS%26GGeophysics_2.pdf

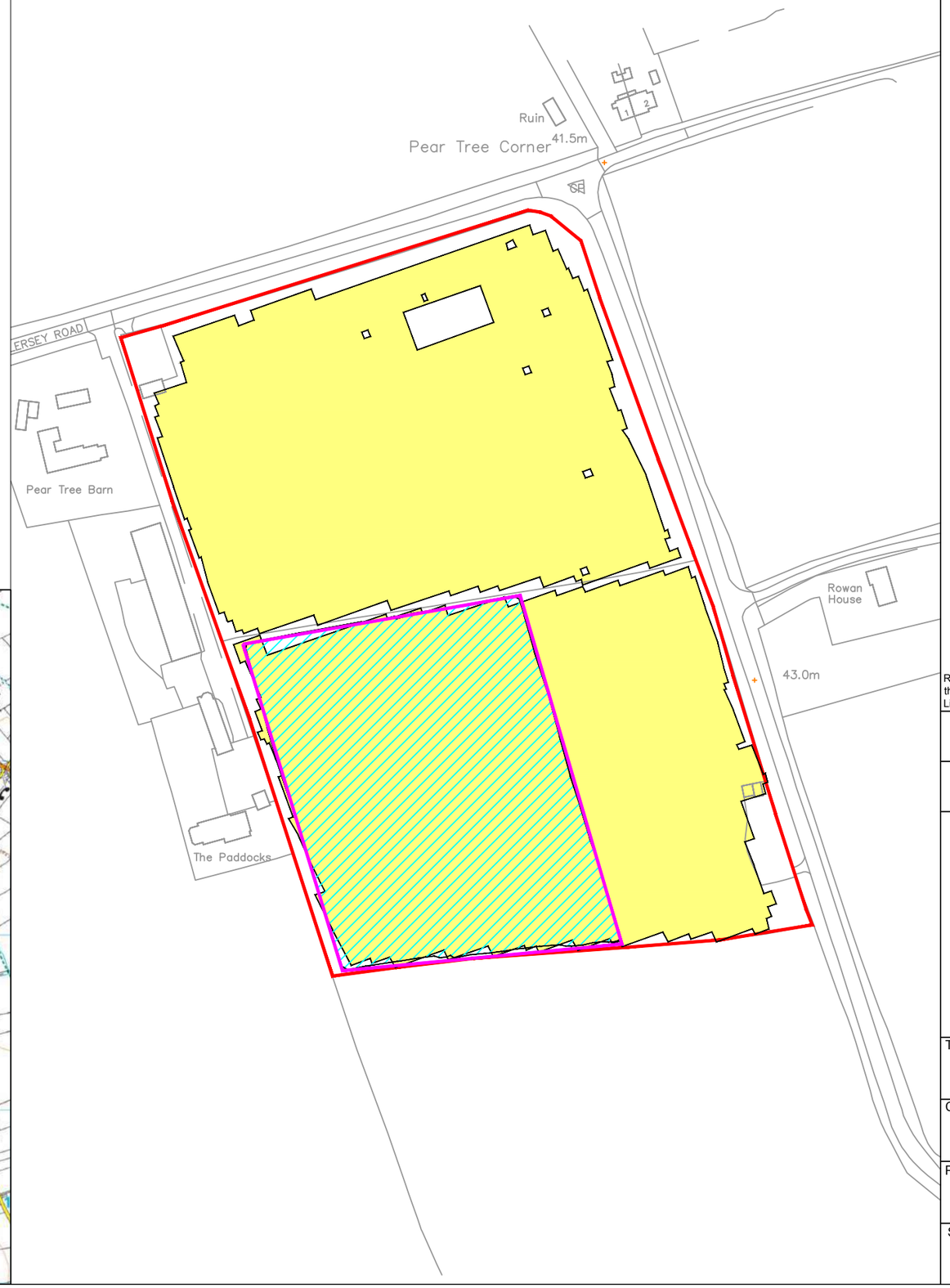
CU 2020 The Soils Guide. Available: www.landis.org.uk. Cranfield University, UK. [accessed 06/01/2021] *website: http://mapapps2.bgs.ac.uk/ukso/home.html*

EAC 2016 *EAC Guidelines for the Use of Geophysics in Archaeology,* European Archaeological Council, Guidelines 2.

EH 2008 *Geophysical Survey in Archaeological Field Evaluation.* English Heritage, Swindon https://content.historicengland.org.uk/images-books/publications/geophysical-survey-in-archaeological-field-evaluation/geophysics-guidelines.pdf/

WHER 2020 Worcestershire Historic Environment Record [accessed 06/01/2021] *website:* www.heritagegateway.org.uk





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	Magnetometer Survey Areas
	GPR Survey Area

N

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title: Site Location

Client: Martin J Cook

Project: 01069 - Willersey Road, Badsey, Worcestershire

Scale: NOT TO SCALE

Fig No: 01

Pear Tree Corner 41.5m

WILLERSEY ROAD

Pear Tree Barn

Area 1

Rowan House

43.0m

The Paddocks

Area 2

N

+2nT

-1nT

sumo Survey

GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Magnetometer Survey - Greyscale Plots

Client:
Martin J Cook

Project:
01069 - Willersey Road, Badsey, Worcestershire

Scale:
0 metres 62.5
1:1250 @ A3

Fig No:
02

N

KEY

	Agriculture (ridge and furrow)
	Magnetic disturbance
	Ferrous

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Magnetometer Survey - Interpretation

Client:
Martin J Cook

Project:
01069 - Willersey Road, Badsey, Worcestershire

Scale:
0 metres 62.5
1:1250 @ A3

Fig No:
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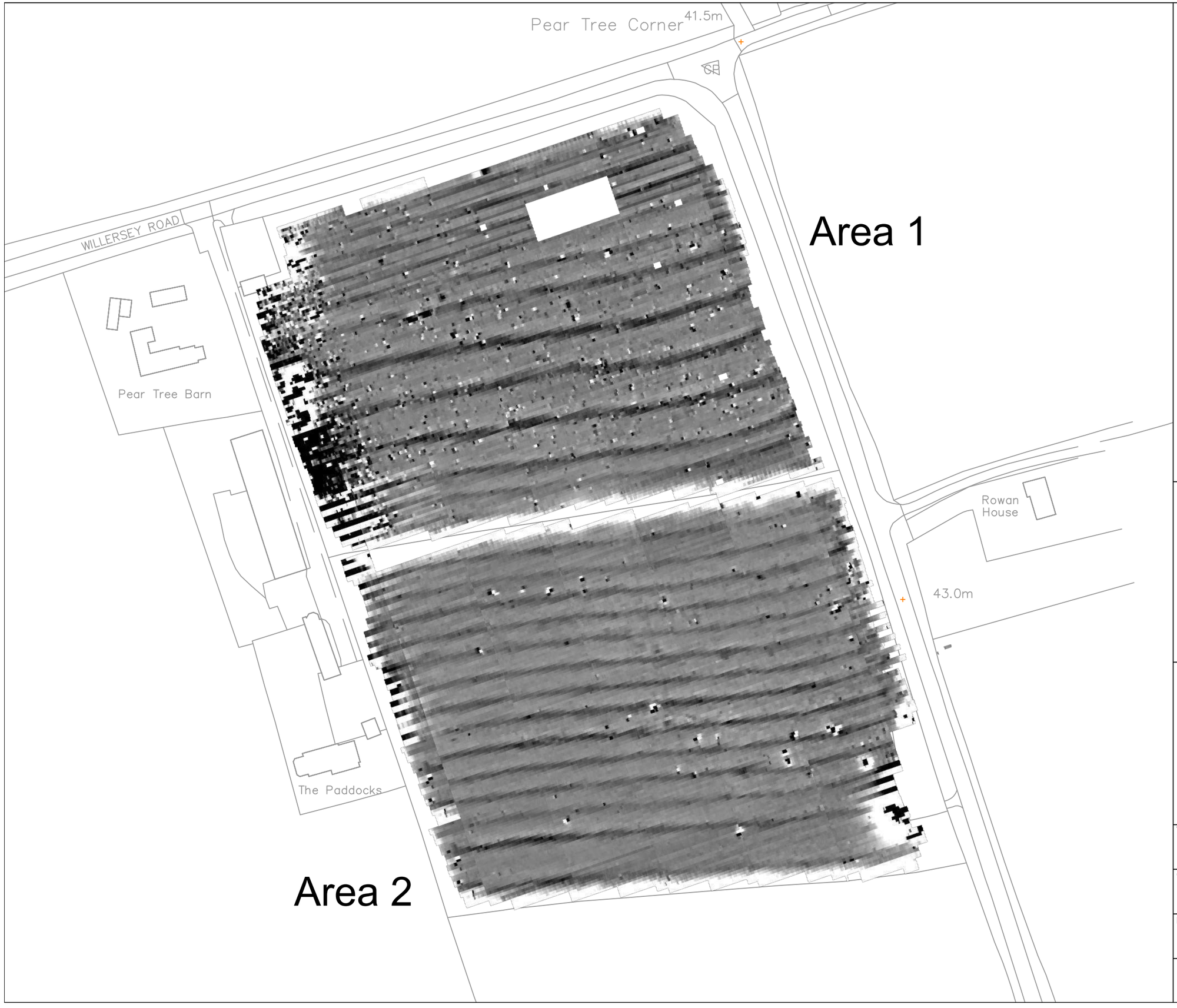


N

+5nT

-5nT

sumo Survey

GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

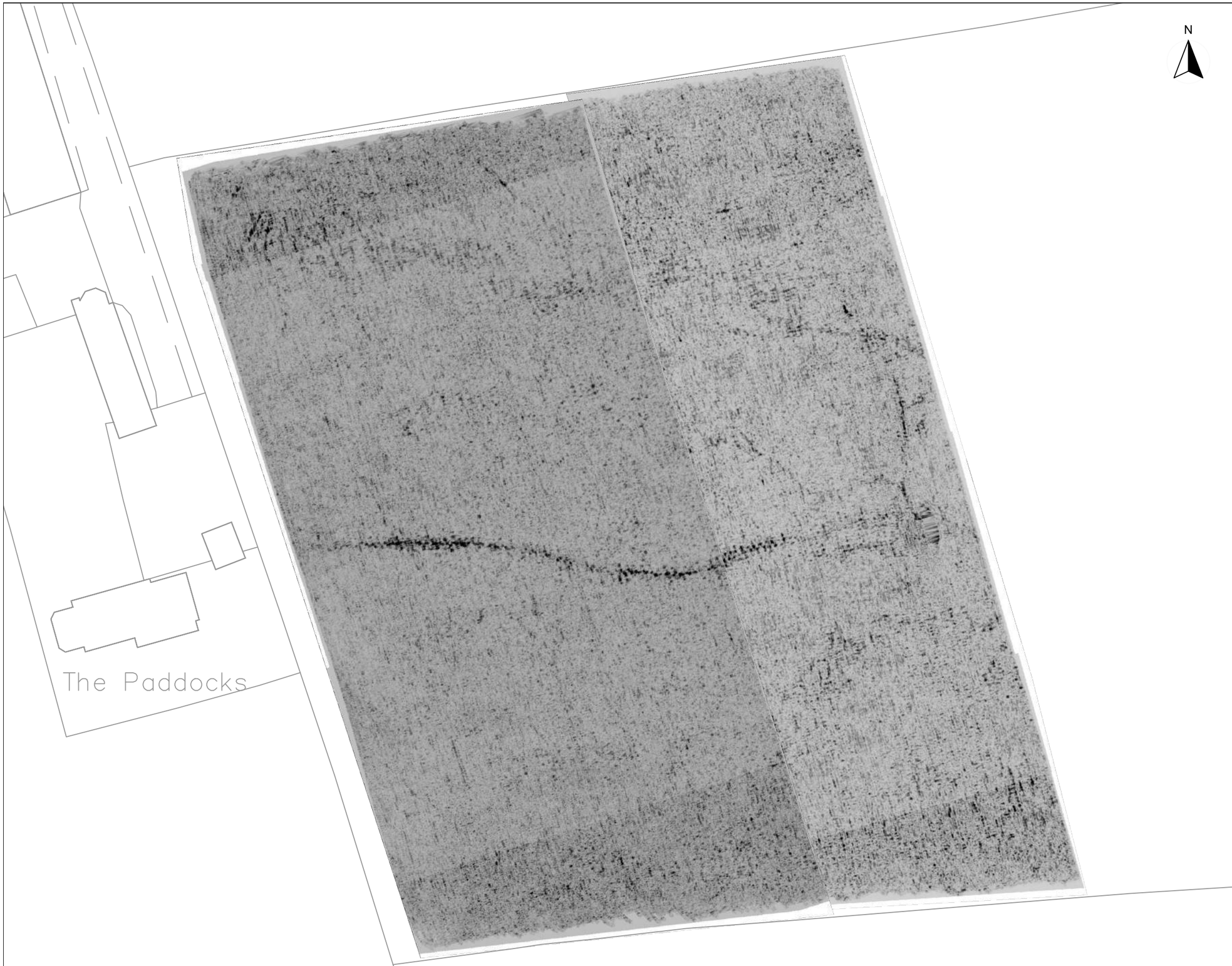
Title:
Minimally Processed Data - Greyscale Plot

Client:
Martin J Cook

Project:
01069 - Willersey Road, Badsey, Worcestershire

Scale:
0 metres xx
1:XXXX @ A3

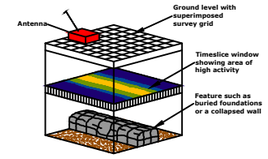
Fig No:
04



Timeslice at 0.20m depth

TIMESLICE PLOTS

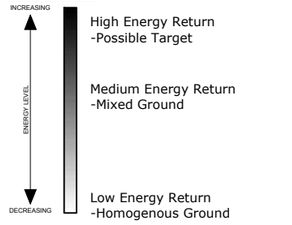
In addition to a manual abstraction from the radargrams, a computer analysis was carried out. The radar data is interrogated for areas of high activity and the results presented in a plan format known as timeslice plots. In this way it is easy to see if the high activity areas form recognisable patterns.



The GPR data is compiled to create a 3D file. This 3D file can be manipulated to view the data from any angle and at any depth within range. The data was then modelled to produce activity plots at various depths. As the radar is actually measuring the time for each of the reflections found, these are called "time slice windows". Plots for various time slices have been included in the report. Calculations, based on an average velocity, have been made to show the equivalent depth into the ground. The data was sampled between different time intervals effectively producing plans at different depths into the ground.

The weaker reflections in the time slice windows are shown as white and light grey. The stronger reflections are represented by dark grey and black.

Colour Scale for Timeslice 'Activity' Plots and Simplified Key



sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
GPR Survey - Timeslice at 0.20m depth

Client:
Martin J Cook

Project:
01069 - Willersey Road, Badsey, Worcestershire

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Fig No:
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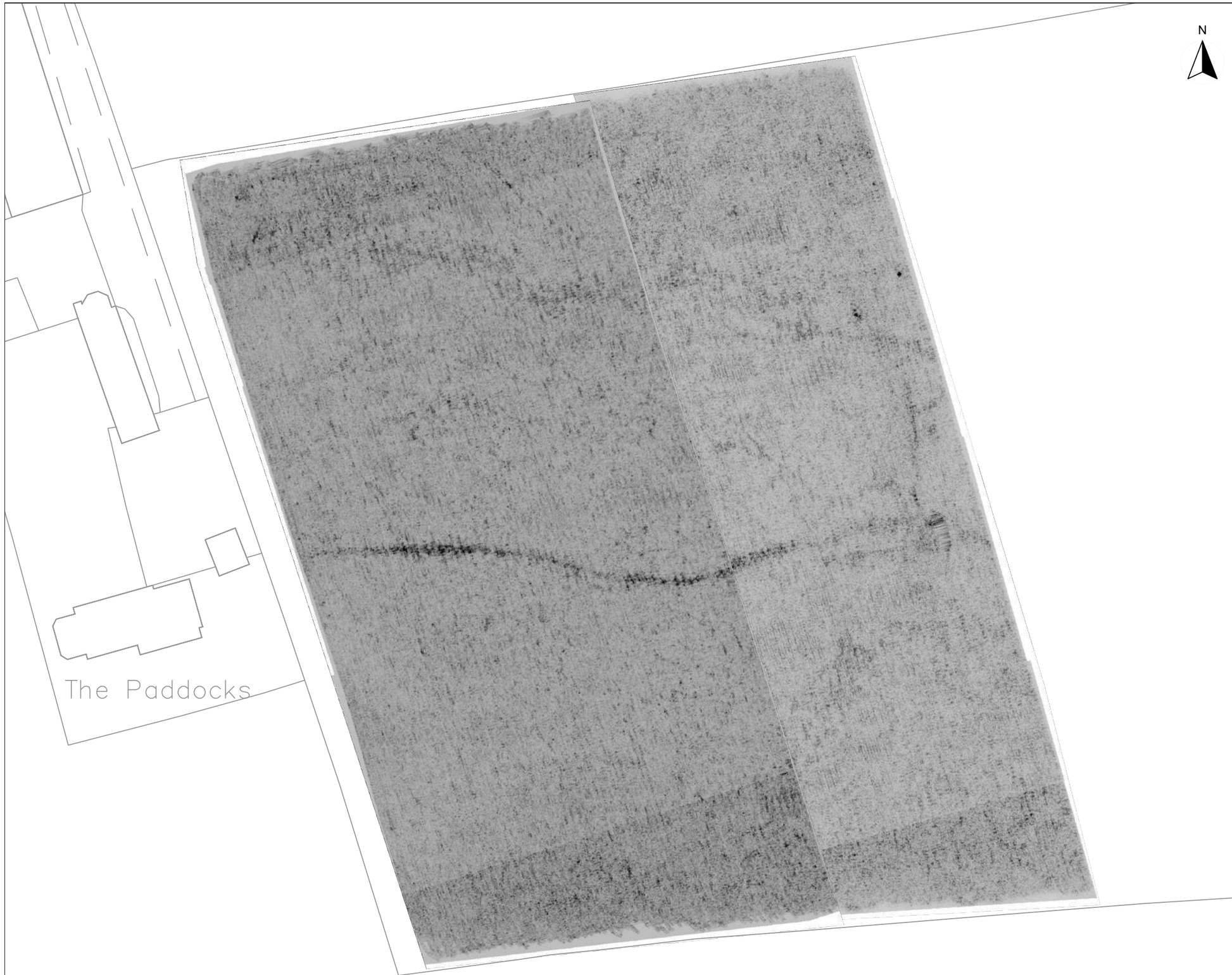
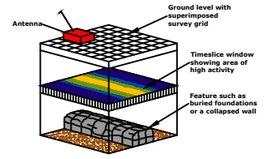


Timeslice at 0.40m depth

TIMESLICE PLOTS

In addition to a manual abstraction from the radargrams, a computer analysis was carried out. The radar data is interrogated for areas of high activity and the results presented in a plan format known as timeslice plots. In this way it is easy to see if the high activity areas form recognisable patterns.



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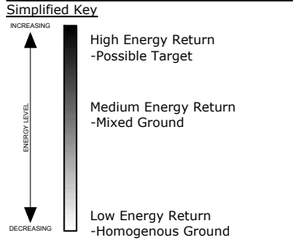
Colour Scale for Timeslice 'Activity' Plots and Simplified Key



sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
GPR Survey - Timeslice at 0.40m depth

Client:
Martin J Cook

Project:
01069 - Willersey Road, Badsey, Worcestershire

Scale:
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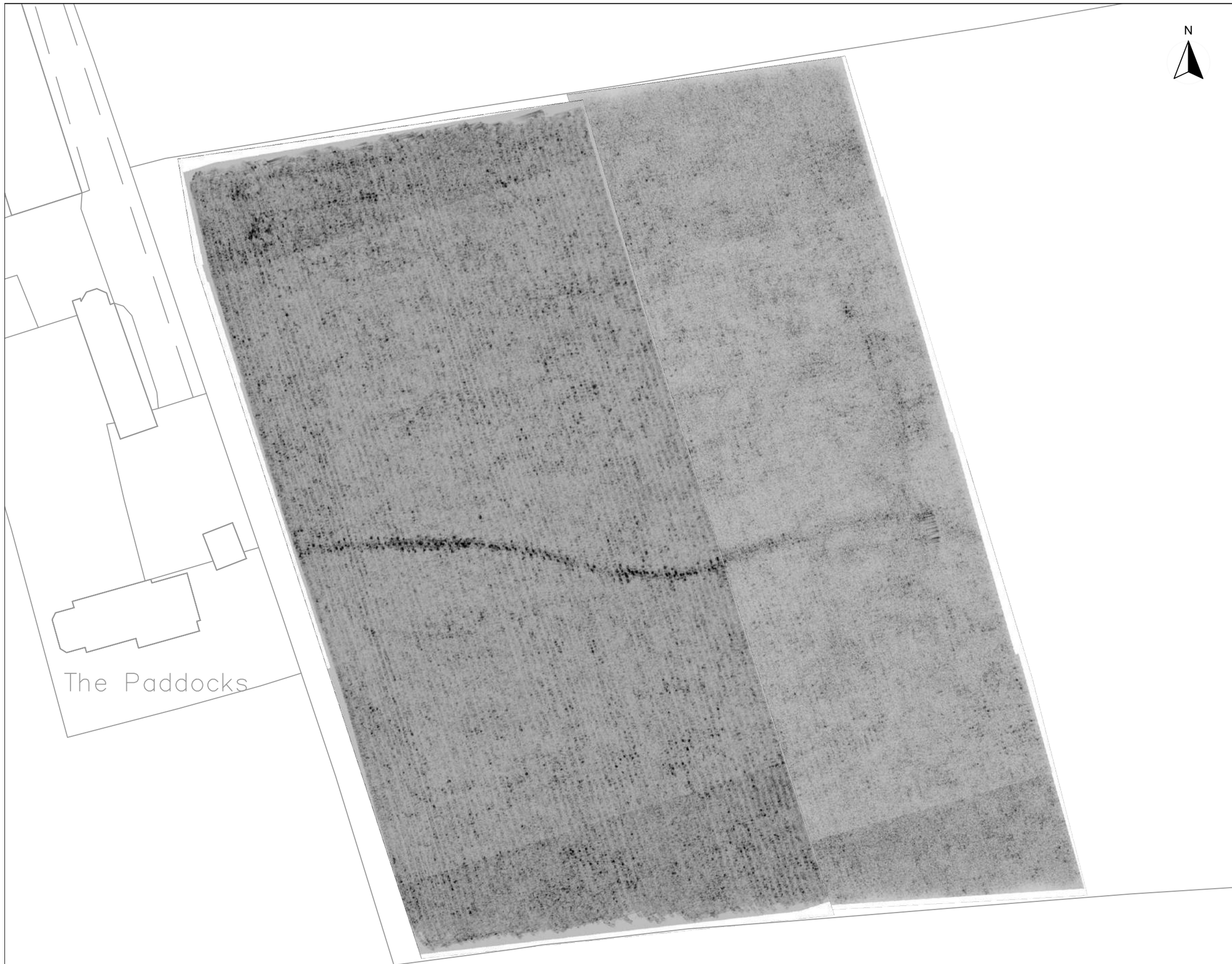
1:600 @ A3

Fig No:
06



Timeslice at 0.60m depth

TIMESLICE PLOTS

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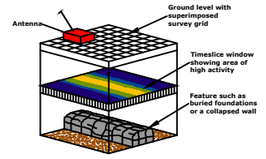

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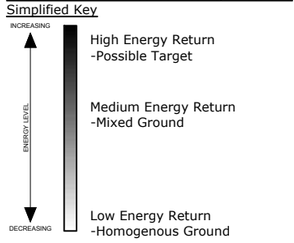
Colour Scale for Timeslice 'Activity' Plots and Simplified Key



sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
GPR Survey - Timeslice at 0.60m depth

Client:
Martin J Cook

Project:
01069 - Willersey Road, Badsey, Worcestershire

Scale:
0 metres 30
1:600 @ A3

Fig No:
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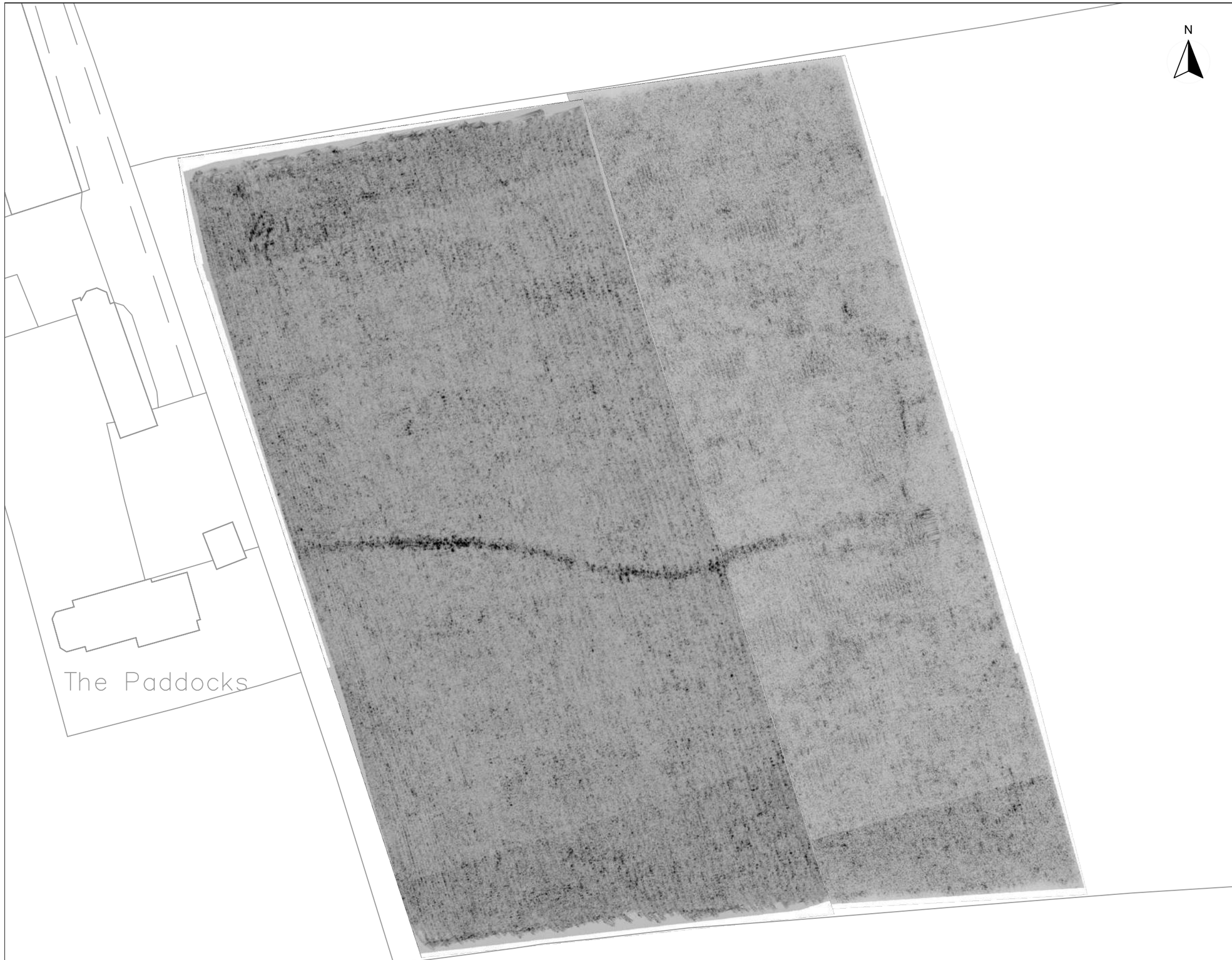
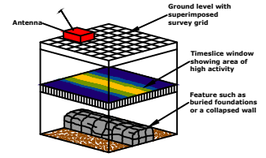


Timeslice at 0.80m depth

TIMESLICE PLOTS

In addition to a manual abstraction from the radargrams, a computer analysis was carried out. The radar data is interrogated for areas of high activity and the results presented in a plan format known as timeslice plots. In this way it is easy to see if the high activity areas form recognisable patterns.



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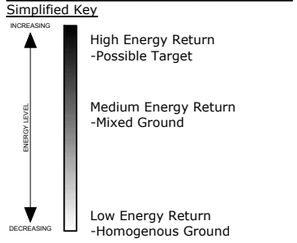
Colour Scale for Timeslice 'Activity' Plots and Simplified Key



sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

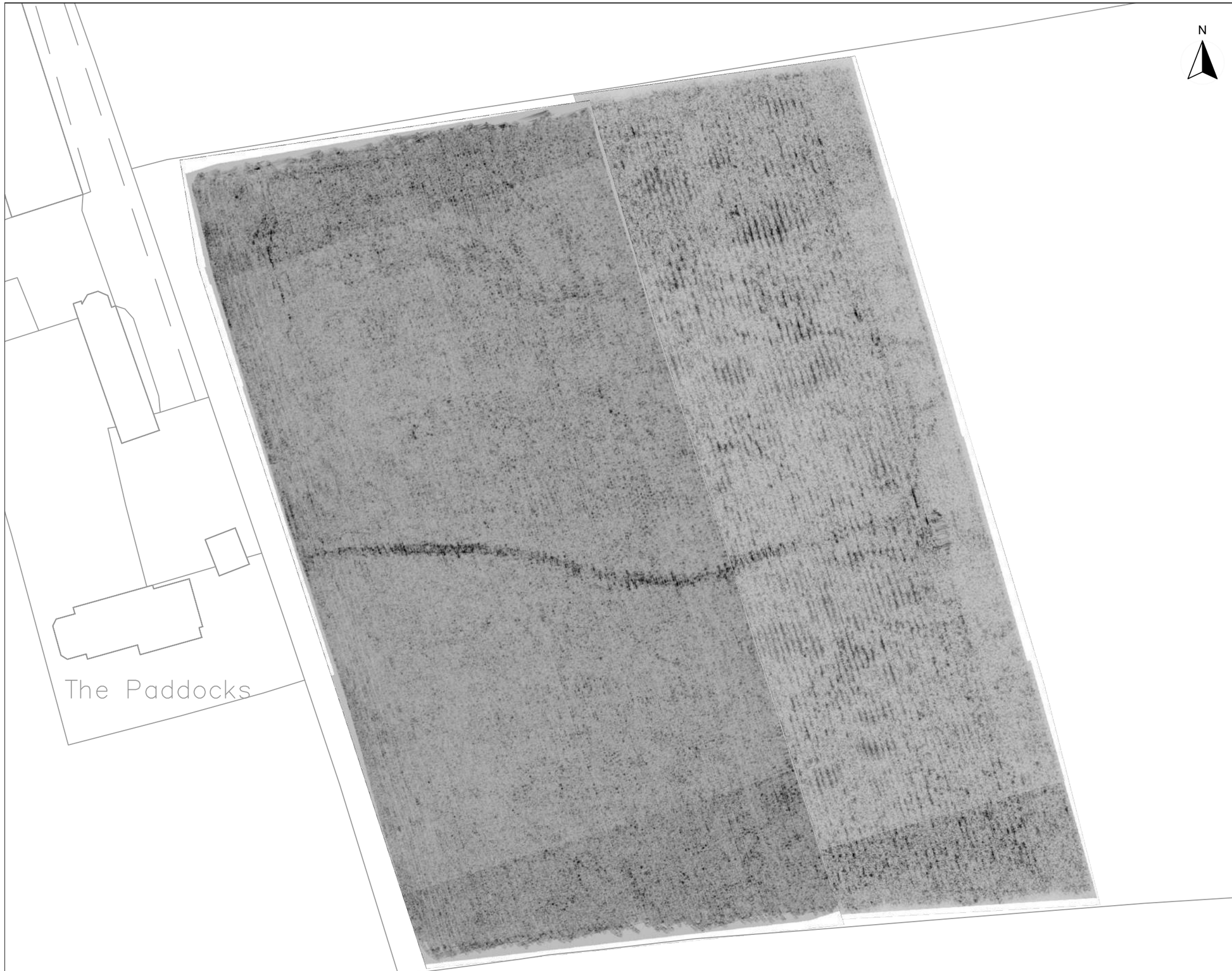
Title:
GPR Survey - Timeslice at 0.80m depth

Client:
Martin J Cook

Project:
01069 - Willersey Road, Badsey, Worcestershire

Scale:
0 metres 30
1:600 @ A3

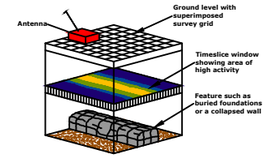
Fig No:
08



Timeslice at 1.00m depth

TIMESLICE PLOTS

In addition to a manual abstraction from the radargrams, a computer analysis was carried out. The radar data is interrogated for areas of high activity and the results presented in a plan format known as timeslice plots. In this way it is easy to see if the high activity areas form recognisable patterns.



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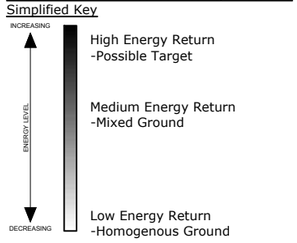
Colour Scale for Timeslice 'Activity' Plots and Simplified Key



sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

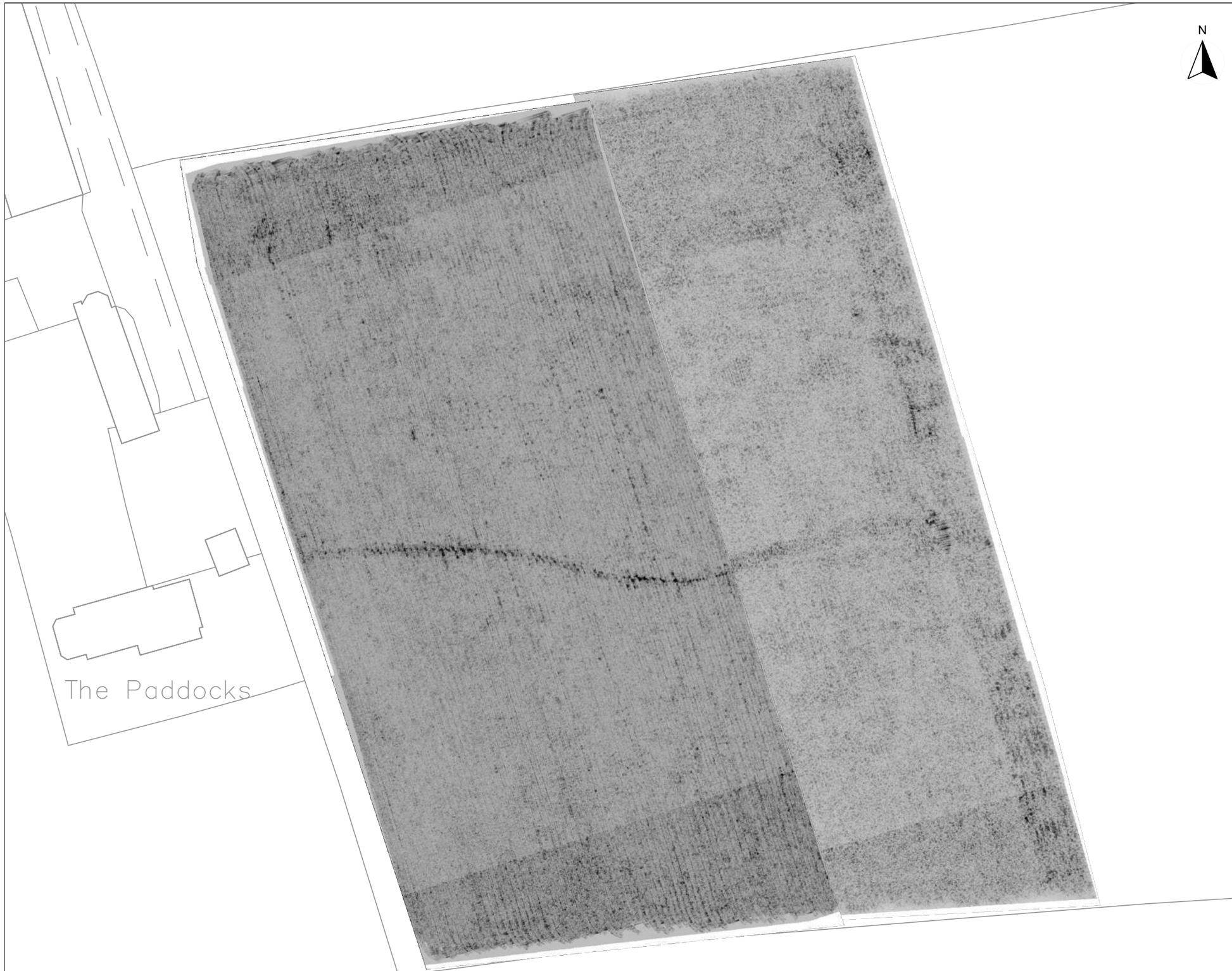
Title:
GPR Survey - Timeslice at 1.00m depth

Client:
Martin J Cook

Project:
01069 - Willersey Road, Badsey, Worcestershire

Scale:
0 metres 30
1:600 @ A3

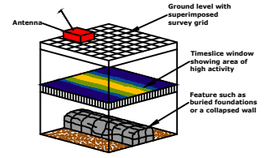
Fig No:
09



Timeslice at 1.00m depth

TIMESLICE PLOTS

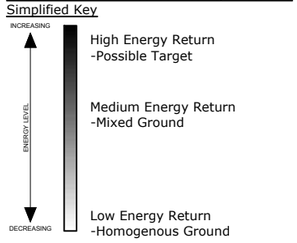
In addition to a manual abstraction from the radargrams, a computer analysis was carried out. The radar data is interrogated for areas of high activity and the results presented in a plan format known as timeslice plots. In this way it is easy to see if the high activity areas form recognisable patterns.



The GPR data is compiled to create a 3D file. This 3D file can be manipulated to view the data from any angle and at any depth within range. The data was then modelled to produce activity plots at various depths. As the radar is actually measuring the time for each of the reflections found, these are called "time slice windows". Plots for various time slices have been included in the report. Calculations, based on an average velocity, have been made to show the equivalent depth into the ground. The data was sampled between different time intervals effectively producing plans at different depths into the ground.

The weaker reflections in the time slice windows are shown as white and light grey. The stronger reflections are represented by dark grey and black.

Colour Scale for Timeslice 'Activity' Plots and Simplified Key



sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

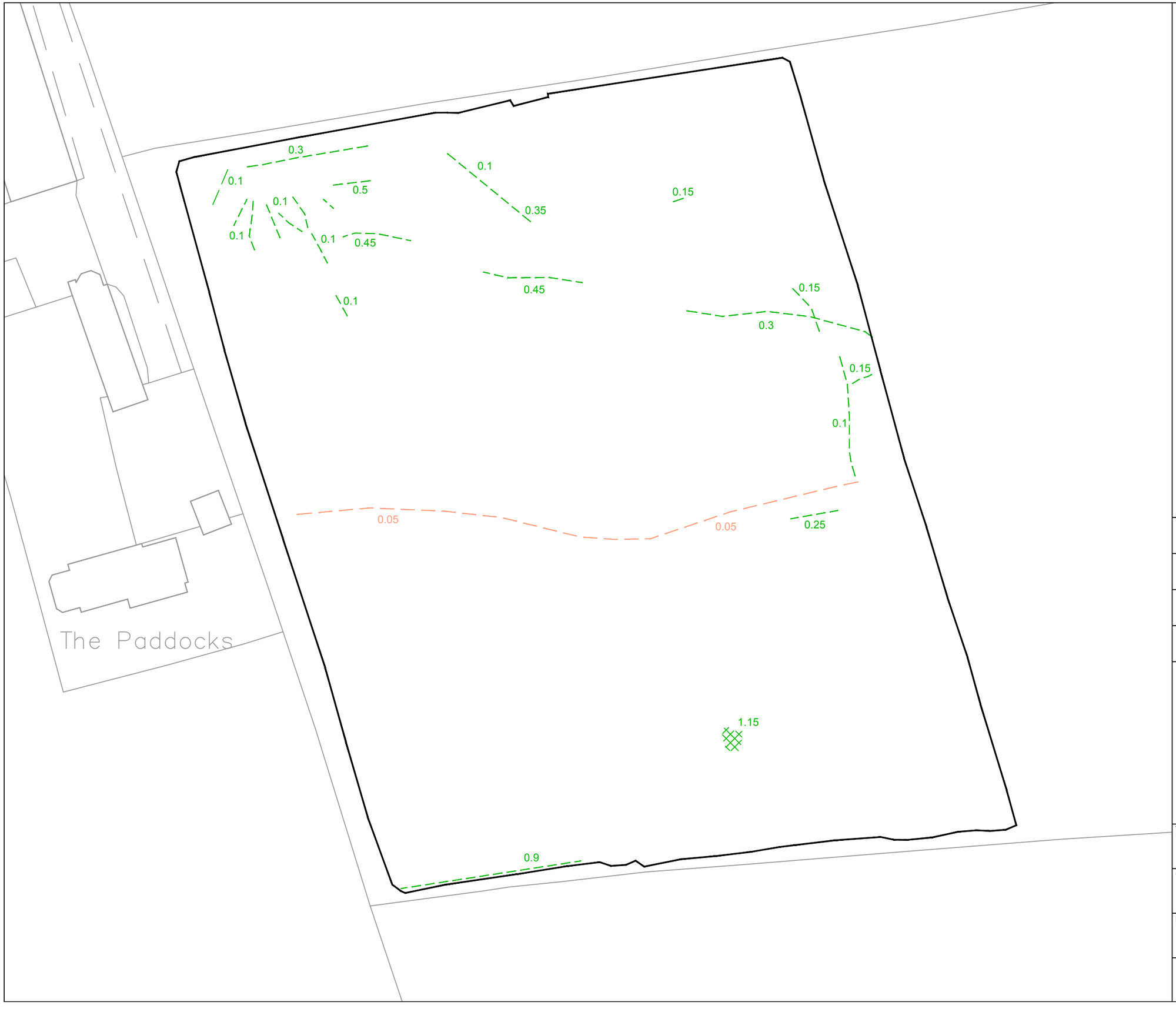
Title:
GPR Survey - Timeslice at 1.60m depth

Client:
Martin J Cook

Project:
01069 - Willersey Road, Badsey, Worcestershire

Scale:
0 metres 30
1:600 @ A3

Fig No:
10



KEY

	Uncertain Origin (linear / discrete)
	Modern path
0.35	Depth to the top of the feature (in m)

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
GPR Survey - Plan Interpretation

Client:
Martin J Cook

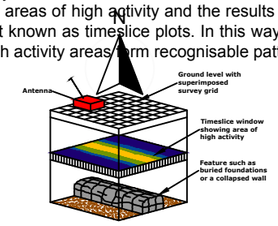
Project:
01069 - Willersey Road, Badsey, Worcestershire

Scale:
0 metres 30
1:600 @ A3

Fig No:
11

TIMESLICE PLOTS

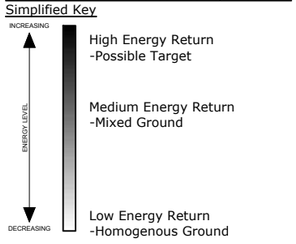
In addition to a manual abstraction from the radargrams, a computer analysis was carried out. The radar data is interrogated for areas of high activity and the results presented in a plan format known as timeslice plots. In this way it is easy to see if the high activity areas form recognisable patterns.



The GPR data is compiled to create a 3D file. This 3D file can be manipulated to view the data from any angle and at any depth within range. The data was then modelled to produce activity plots at various depths. As the radar is actually measuring the time for each of the reflections found, these are called "time slice windows". Plots for various time slices have been included in the report. Calculations, based on an average velocity, have been made to show the equivalent depth into the ground. The data was sampled between different time intervals effectively producing plans at different depths into the ground.

The weaker reflections in the time slice windows are shown as white and light grey. The stronger reflections are represented by dark grey and black.

Colour Scale for Timeslice 'Activity' Plots and Simplified Key



sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
2017 Google Earth Image and GPR Timeslice showing modern path

Client:
Martin J Cook

Project:
01069 - Willersey Road, Badsey, Worcestershire

Scale:
NOT TO SCALE

Fig No:
12

Appendix A - Technical Information: Magnetometer Survey Method, Processing and Presentation

Standards & Guidance

This report and all fieldwork have been conducted in accordance with the latest guidance documents issued by Historic England (EH 2008) (then English Heritage), the Chartered Institute for Archaeologists (CIfA 2014) and the European Archaeological Council (EAC 2016).

Grid Positioning

For hand held gradiometers the location of the survey grids has been plotted together with the referencing information. Grids were set out using a Trimble R8 Real Time Kinematic (RTK) VRS Now GNSS GPS system.

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to a far greater accuracy than a standard GPS unit. A standard GPS suffers from errors created by satellite orbit errors, clock errors and atmospheric interference, resulting in an accuracy of 5m-10m. An RTK system uses a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier it measured, and the mobile units compare their own phase measurements with those they received from the base station. This results in an accuracy of around 0.01m.

Technique	Instrument	Traverse Interval	Sample Interval
Magnetometer	Bartington Grad 601-2	1m	0.25m

Instrumentation: Bartington *Grad* 601-2

Bartington instruments operate in a gradiometer configuration which comprises fluxgate sensors mounted vertically, set 1.0m apart. The fluxgate gradiometer suppresses any diurnal or regional effects. The instruments are carried, or cart mounted, with the bottom sensor approximately 0.1-0.3m from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is measured in nanoTesla (nT). The sensitivity of the instrument can be adjusted; for most archaeological surveys the most sensitive range (0.1nT) is used. Generally, features up to 1m deep may be detected by this method, though strongly magnetic objects may be visible at greater depths. The Bartington instrument can collect two lines of data per traverse with gradiometer units mounted laterally with a separation of 1.0m. The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each site survey, data is transferred to the office for processing and presentation.

Data Processing

Zero Mean Traverse	This process sets the background mean of each traverse within each grid to zero. The operation removes striping effects and edge discontinuities over the whole of the data set.
Step Correction (De-stagger)	When gradiometer data are collected in 'zig-zag' fashion, stepping errors can sometimes arise. These occur because of a slight difference in the speed of walking on the forward and reverse traverses. The result is a staggered effect in the data, which is particularly noticeable on linear anomalies. This process corrects these errors.

Display

Greyscale/ Colourscale Plot	This format divides a given range of readings into a set number of classes. Each class is represented by a specific shade of grey, the intensity increasing with value. All values above the given range are allocated the same shade (maximum intensity); similarly, all values below the given range are represented by the minimum intensity shade. Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. The assigned range (plotting levels) can be adjusted to emphasise different anomalies in the data-set.

Presentation of results and interpretation

The presentation of the results includes a ‘minimally processed data’ and a ‘processed data’ greyscale plot. Magnetic anomalies are identified, interpreted and plotted onto the ‘Interpretation’ drawings.

When interpreting the results, several factors are taken into consideration, including the nature of archaeological features being investigated and the local conditions at the site (geology, pedology, topography etc.). Anomalies are categorised by their potential origin. Where responses can be related to other existing evidence, the anomalies will be given specific categories, such as: Abbey Wall or Roman Road. Where the interpretation is based largely on the geophysical data, levels of confidence are implied, for example: Probable, or Possible Archaeology. The former is used for a confident interpretation, based on anomaly definition and/or other corroborative data such as cropmarks. Poor anomaly definition, a lack of clear patterns to the responses and an absence of other supporting data reduces confidence, hence the classification Possible.

Interpretation Categories

In certain circumstances (usually when there is corroborative evidence from desk-based or excavation data) very specific interpretations can be assigned to magnetic anomalies (for example, *Roman Road, Wall,* etc.) and where appropriate, such interpretations will be applied. The list below outlines the generic categories commonly used in the interpretation of the results.

Archaeology / Probable Archaeology	This term is used when the form, nature and pattern of the responses are clearly or very probably archaeological and /or if corroborative evidence is available. These anomalies, whilst considered anthropogenic, could be of any age.
Possible Archaeology	These anomalies exhibit either weak signal strength and / or poor definition, or form incomplete archaeological patterns, thereby reducing the level of confidence in the interpretation. Although the archaeological interpretation is favoured, they may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.
Industrial / Burnt-Fired	Strong magnetic anomalies that, due to their shape and form or the context in which they are found, suggest the presence of kilns, ovens, corn dryers, metal-working areas or hearths. It should be noted that in many instances modern ferrous material can produce similar magnetic anomalies.
Former Field Boundary (probable & possible)	Anomalies that correspond to former boundaries indicated on historic mapping, or which are clearly a continuation of existing land divisions. Possible denotes less confidence where the anomaly may not be shown on historic mapping but nevertheless the anomaly displays all the characteristics of a field boundary.
Ridge & Furrow	Parallel linear anomalies whose broad spacing suggests ridge and furrow cultivation. In some cases, the response may be the result of more recent agricultural activity.
Agriculture (ploughing)	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.
Land Drain	Weakly magnetic linear anomalies, quite often appearing in series forming parallel and herringbone patterns. Smaller drains may lead and empty into larger diameter pipes, which in turn usually lead to local streams and ponds. These are indicative of clay fired land drains.
Natural	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions.
Magnetic Disturbance	Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present.
Service	Magnetically strong anomalies, usually forming linear features are indicative of ferrous pipes/cables. Sometimes other materials (e.g. pvc) or the fill of the trench can cause weaker magnetic responses which can be identified from their uniform linearity.
Ferrous	This type of response is associated with ferrous material and may result from small items in the topsoil, larger buried objects such as pipes, or above ground features such as fence lines or pylons. Ferrous responses are usually regarded as modern. Individual burnt stones, fired bricks or igneous rocks can produce responses similar to ferrous material.
Uncertain Origin	Anomalies which stand out from the background magnetic variation, yet whose form and lack of patterning gives little clue as to their origin. Often the characteristics and distribution of the responses straddle the categories of *Possible Archaeology* / *Natural* or (in the case of linear responses) *Possible Archaeology* / *Agriculture*; occasionally they are simply of an unusual form.

Where appropriate some anomalies will be further classified according to their form (positive or negative) and relative strength and coherence (trend: weak and poorly defined).

Appendix B - Technical Information: Magnetic Theory

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock. Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.1 nanoTeslas (nT) in an overall field strength of 48,000 (nT), can be accurately detected.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremanent* material.

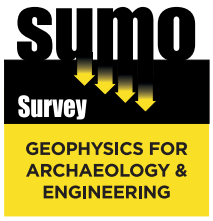
Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremanence is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremanent archaeological features can include hearths and kilns; material such as brick and tile may be magnetised through the same process.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried feature. The difference between the two sensors will relate to the strength of a magnetic field created by this feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity and disturbance from modern services.



- Archaeological
- Geophysical
- Laser Scanning
- Measured Building
- Topographic
- Utility Mapping

SUMO Services Ltd, incorporated under the laws of England and Wales,
Company Registration No.4275993.
Registered Office Unit 8 Hayward Business Centre, New Lane, Havant, Hampshire, PO9 2NL

Appendix 4: Extract from the level book

Date 15 April 2021 Levels

From Spot height Pear Tree Corner

Taken for Willersey Road Badsey

To trenches and sections

BACK SIGHT	INTERMEDIATE	FORE SIGHT	COLLIMATION OR H.P.C.	REDUCED LEVEL	DISTANCE	REMARKS
1.523			43.023	41.5		Spot height Pear Tree Corner
1.205		1.571	42.657	41.452		T10 & CP1
	1.298			41.359		T9
	1.540			41.117		T7
	1.540			41.117		T8
2.130		1.671	43.116	40.986		T6 & CP2
	1.348			41.768		T1
	0.630			42.486		T2
1.836		0.549	44.403	42.567		T3 & CP3
	1.437			42.966		T4
	1.122			43.281		T12

Appendix 5: OASIS form

OASIS DATA COLLECTION FORM: England

Printable version

OASIS ID: martinco1-421007

Project details

Project name	The Paddocks, Willersey Road, Badsey
Short description of the project	Evaluation at The Paddocks, Willersey Road, Badsey
Project dates	Start: 07-12-2020 End: 14-04-2021
Previous/future work	No / Not known
Any associated project reference codes	WSM 72810 - HER event no.
Any associated project reference codes	WSM 72807 - HER event no.
Type of project	Field evaluation
Site status	Local Authority Designated Archaeological Area
Site status	Local Authority Designated Archaeological Area
Site status	Local Authority Designated Archaeological Area
Current Land use	Grassland Heathland 4 - Regularly improved
Current Land use	Grassland Heathland 4 - Regularly improved
Current Land use	Grassland Heathland 4 - Regularly improved
Monument type	NONE None
Significant Finds	POTTERY Modern
Significant Finds	POTTERY Roman
Methods & techniques	"Targeted Trenches","Documentary Search","Geophysical Survey"
Development type	Cemetery
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Pre-application
Solid geology (other)	Blue Lias Formation
Drift geology	Unknown
Techniques	Ground penetrating radar
Techniques	Magnetometry

Project location

Country	England
Site location	WORCESTERSHIRE WYCHAVON BADSEY The Paddocks, Willersey Lane, Badsey
Postcode	WR11 7HD
Study area	4.7 Hectares
Site coordinates	SP 079 419 52.074990632655 -1.884720631612 52 04 29 N 001 53 04 W Point
Height OD / Depth	Min: 0m Max: 0m

Project creators

Name of Organisation	Martin Cook BA MCIfA
Project brief originator	Local Authority Archaeologist and/or Planning Authority/advisory body
Project design originator	Martin Cook BA MCIfA
Project director/manager	Martin Cook BA MCIfA
Project supervisor	Martin Cook BA MCIfA
Type of sponsor/funding body	Developer

Project archives

Physical Archive recipient	Worcestershire County Museum
Physical Contents	"Ceramics"
Digital Archive recipient	ADS
Digital Contents	"none"
Digital Media available	"Images raster / digital photography","Survey","Text"
Paper Archive recipient	Worcestershire County Museum
Paper Contents	"Ceramics"
Paper Media available	"Report"

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Archaeological evaluation at The Paddocks, Willersey Road, Badsey, Evesham, WR11 7HD
Author(s)/Editor(s)	Cook, M.
Date	2021
Issuer or publisher	Martin Cook MCIfA
Place of issue or publication	Walton-on-the-Naze
Description	A4 blue card cover with transparent front cover

Entered by	Martin Cook (office@martinjcook.com)
Entered on	6 May 2021

OASIS:

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