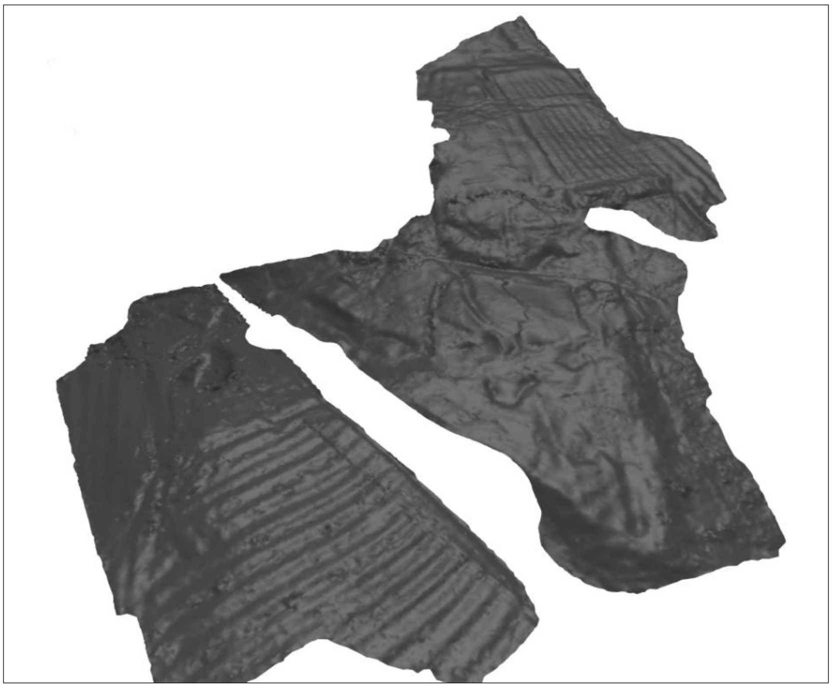
Land East of Coalville (Hugglescote)



Report on Earthwork/Topographic Recording

For Nexus Heritage

TPA Project Code: HGL1

Prepared by David Strange-Walker & Rachel Townsend
TPA Report code: 021/2014
February 2014

Trent & Peak Archaeology ©
Unit 1, Holly Lane
Chilwell
Nottingham
NG9 4AB
0115 8967400 (Tel.)
0115 925 9464 (Fax.)
tparchaeology.co.uk
trentpeak@yorkat.co.uk

Trent & Peak ARCHAEOLOGY

Client Name:	Nexus Heritage
Client Ref No.	-
Document Title:	Land East of Coalville (Hugglescote) - Report on Earthwork/Topographic Recording
Document Type:	Final Report
Issue/Version Number:	1
Grid Reference:	NGR 443483 312268
Planning Reference:	Not known
Site Code:	HGL
YAT Nominal Code:	4449/181
Report No.	021/2014

Issue Number	1
Prepared by **Date**	Dr. David Strange-Walker (Project Manager/Head of Geomatics) 28/02/2014
Approved by **Signed**	Dr. Howard Jones (Regional Director) 
Status	Final Report

Trent & Peak Archaeology is the Nottingham office of the York Archaeological Trust, a significant charity with annual turnover of over £6million. Trent & Peak Archaeology (TPA) was founded in Nottingham in 1967 and became part of YAT in 2011, formalising links that have existed between the two organisations for over 30 years. YAT's **Archaeology and Heritage** division undertakes a wide range of urban and rural archaeological consultancies, surveys, evaluations, assessments and excavations for commercial, academic and charitable clients. It can manage projects, provide professional advice and monitor archaeological works to ensure high quality, cost effective archaeology. Its staff have a considerable depth and variety of professional experience and an international reputation for research, development and maximising the public, educational and commercial benefits of archaeology. TPA and the Trust, through its offices in Glasgow, York, Sheffield and Nottingham, offer services throughout Britain and internationally.

York Archaeological Trust's **Attractions and Events** division runs major archaeological tourist attractions including the world-famous *Jorvik Viking Centre* and several large archaeological events including the *Jorvik Viking Festival* and *Yorkshire Medieval Festival*. This unique partnership bridges the gap between archaeological discovery and research, and public participation, educational outreach and inspiring presentation.

Trent & Peak Archaeology ©
Unit 1, Holly Lane
Chilwell
Nottingham
NG9 4AB
0115 8967400 (Tel.)
0115 925 9464 (Fax.)
tparchaeology.co.uk
trentpeak@yorkat.co.uk

Contents

Table of Figures

1. Executive Summary

Introduction

1.1 The area to the south of Hugglescote Grange, near Coalville, Leicestershire, (NGR 443483 312268) is rich in earthworks, which have been previously recorded as part of the *Medieval Earthworks of North-West Leicestershire* (Hartley 1984). It is suspected that these earthworks relate to the Grange of Garendon Abbey, now a pair of farms.

1.2 Trent & Peak Archaeology (part of the York Archaeological Trust) was contracted by Nexus Heritage to undertake a laser-scanned survey of these earthworks, and to produce contour plots and a terrain model from that survey data.

1.3 The geology of the site is Gunthorpe Member Mudstone outcropping at the surface across much of the site, with Oadby Member Diamicton overlying to the north and south and a band of Alluvial clay, silt, sand and gravel following the River Sence.

1.4 The area surveyed comprised almost 9ha of earthworks shown to the south and east of Hugglescote Grange in Hartley 1984.

1.5 The area was surveyed over four days in January 2014 by Rachel Townsend and Joe Groarke, and the project was managed by Dr David Strange-Walker.

1.6 The topographic survey broadly confirms the accuracy of the plan in Hartley 1984.

2. Site Methodology

2.1 The site was surveyed using a Leica HDS6100 phase-based terrestrial laser scanner, set to ‘high’ resolution. This produced a point cloud with a point spacing perpendicular to the scanner of 6.3mm at 10m from the scanner. An overall minimum resolution of 100mm (i.e. one measured 3D survey point in every 100mmx100mm square of ground) was targeted, but the nature of the collection process ensured that much denser data than this was be collected in many areas.

2.2 83 overlapping and intervisible survey stations provided coverage of all surveyable areas. These individual scan locations will be linked together by intervisible tilt-and-turn targets.

2.3 Survey control was provided by a survey-grade Leica Viva CS15/GS15 RTK-enabled GNSS (GPS) system.

2.4 No data was collected within the steep and wooded cut of the River Sence, running south-east to north-west across the site. This wooded channel also impeded visibility between the south-eastern and south-western fields.

2.5 Although the fields were generally free of long grass and scrub, there were rougher areas especially in the south-western field. The south-western field also contained areas of ground churned up by vehicle movements and with heaps of earth and rubble. These areas will result in lower-quality data.

2.6 The south-eastern and north-eastern fields contained fenced corrals for horses. When horses were present no surveying took place within these corrals. This restricted the positions available as survey stations.

2.7 Surveys will be processed, cleaned and linked in software to provide a single georeferenced point cloud for the survey area. This dataset will be processed further using a ground-finding algorithm to produce a simplified point cloud of ground points at a fixed 100mm spacing. This simplified point cloud will be used to produce final deliverable outputs.

3. Data processing methodology

3.1 The raw point clouds were registered together using the Leica Geosystems *Cyclone 8.1* point cloud processing software, and then registered to the Ordnance Survey grid. The resulting individual but registered point clouds were then unified to a single point cloud of 116 million points, with an overall point spacing in the region of 100mm.

3.2 The unified point cloud was cleaned within *Cyclone* to remove the majority of extraneous and unnecessary points, including trees, buildings, fences and horses. This dataset is referred to in the figures and discussion as '*rough*' data.

3.3 The unified point cloud was further processed in Leica Geosystems' *Cyclone II Topo* software package. A ground-finding algorithm was applied to the point cloud. This algorithm interpolates points at ground level based on the lowest points recorded by the laser scanner. It creates new points on a grid of fixed spacing at ground level, thus stripping out almost all unnecessary data. By its nature this process requires large amounts of time and computer power, so the resulting point cloud is simplified to a spacing of c. 1 point/m in the X and Y directions. This dataset is referred to in the figures and discussion as '*smooth*' data.

3.4 Both rough and smooth datasets were imported into the point cloud meshing software *3DReshaper*, and meshed to create surface models registered to the OS grid. Copies of the surface mesh were scaled in the Z axis to 3x their original heights, to enhance apparent height differences and topographic features.

3.5 All meshes were then viewed and presented in plan with an orthographic projection. A Minnaert topographic correction shader was applied to highlight topography, earthworks and surface imperfections.

3.6 The rough and smooth point clouds were also rendered orthographically using a plane shader, thus colouring points differently according to elevation.

4. Discussion

4.1 The study area was reasonably suitable for topographic survey by terrestrial lidar. The churned areas and heaps of earth in the south-western field and the occasional areas of longer grass and scrub have masked or blurred some areas. This has also resulted in occasional artefacts visible in the smooth data, created by the ground-finding algorithm.

4.2 As would be expected, the smooth data shows the main topographic features well and removes much of the noise created by impermanent and non-surface features. However the smooth data lacks the definition on smaller features such as the subcircular rings in the south-western field. The noise visible in the rough data makes this harder to interpret.

4.3 The 3x scaled meshes increase visual contrast strongly, particularly in the smooth data. This is perhaps the most visually clear of all the datasets, showing genuine earthworks plainly, but with a corresponding increase in the occasional data artefacts. Conversely the 3x scaled rough data is mostly confusing and unedifying: the accentuation of the noise reduces visual clarity severely.

4.4 The plane-shaded figures are something of a mixed bag. In the flatter north-eastern field the 1m shading band shows ridge-and-furrow quite effectively, and in the sloping south-western field the regular pattern of the ridge-and-furrow can be seen. Major earthwork features are also visible in the south-eastern and south-western fields but the overall effect is probably confusing rather than edifying. The 5m shading band is slightly clearer, appearing to show separate areas of ridge-and-furrow bounded by headlands in the north-eastern field and some topography in the south-eastern field. In general plane shading works well for large changes with a shading band covering the entire elevation change, although comparatively small features will not be visible in this scale, and for small changes on flat terrain. It is therefore unsurprising that this visualisation technique has not worked particularly well on the sloping terrain at Hugglescote.

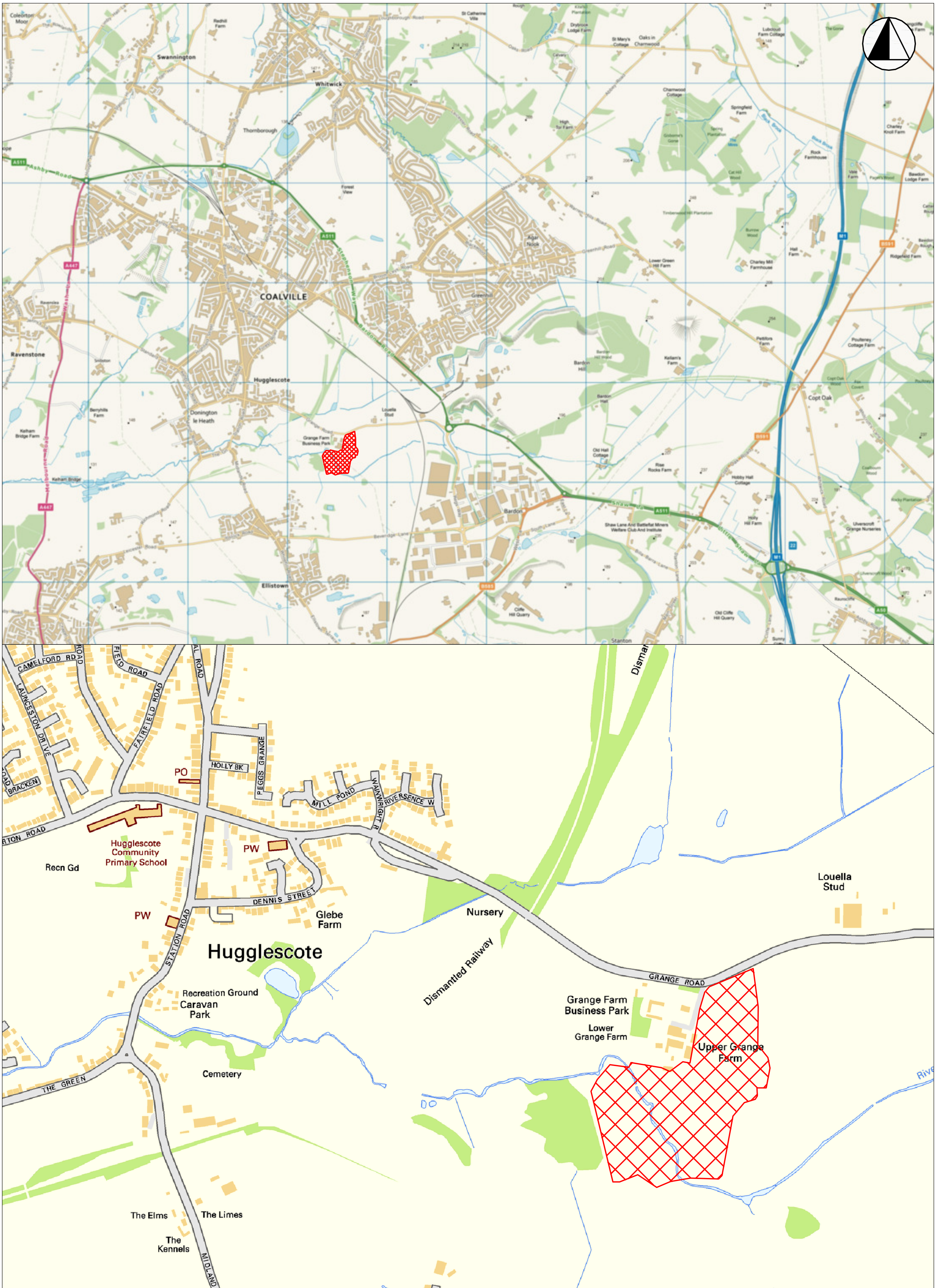
4.5 The contour plans suffer from much the same issues: because the contours across the site are so varied, only large changes are clear. Narrow contour bands are necessary to pick out small changes in terrain, but these rapidly become visually confusing over a large area.

4.6 The topographic survey was, on the whole, quite successful. Major ground features such as ridge-and-furrow are clearly visible in the meshes, and much smaller features that are not recorded in Hartley 1984 can also be seen. The topographic survey broadly confirms Hartley's earthwork plan as a correct summation of the earthworks.

5. Bibliography

Hartley, 1984. *The Medieval Earthworks of North-West Leicestershire*. Leicestershire Museums, Leicester

6. Figures

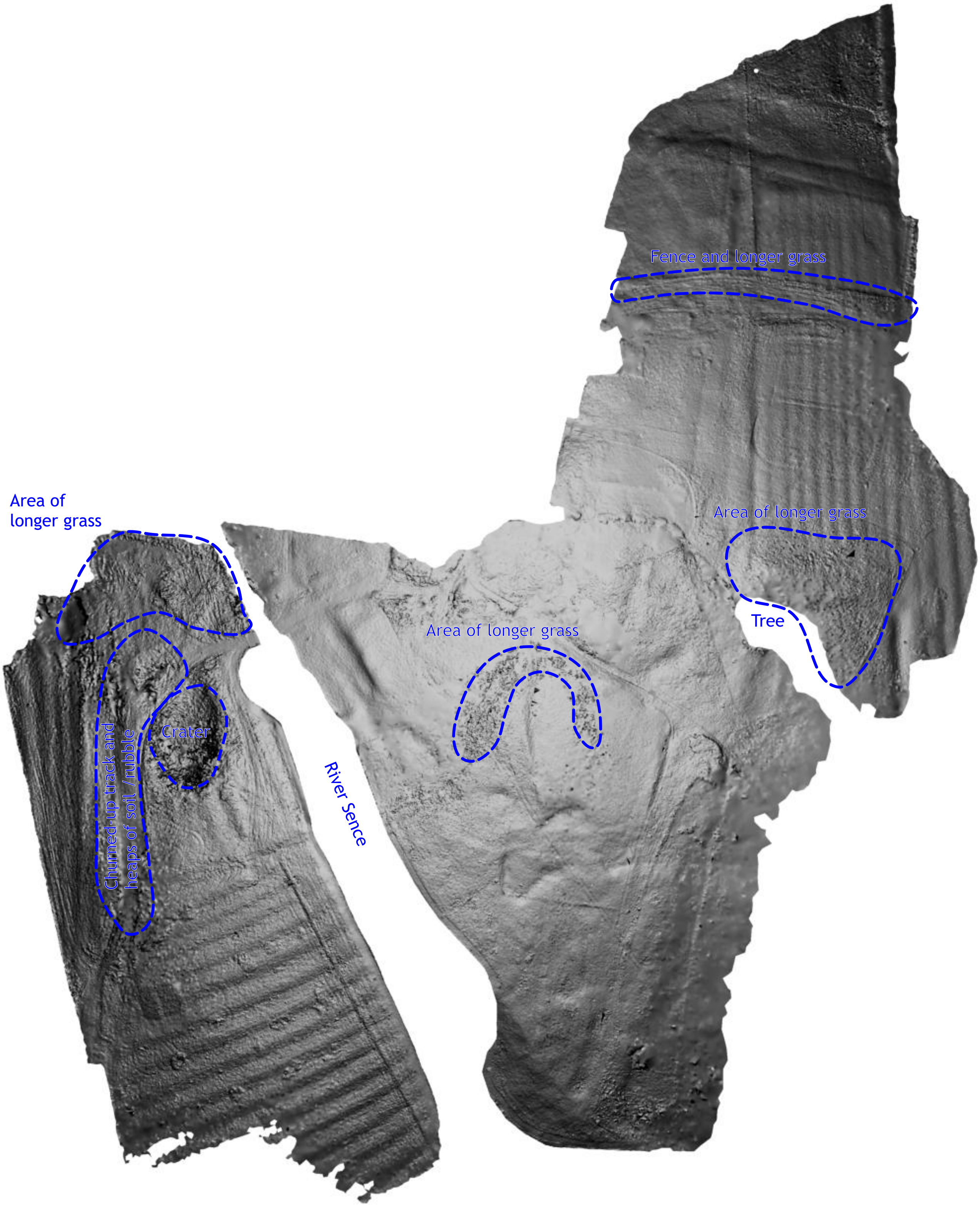


Trent & Peak Archaeology

HGL: Hugglescote Grange Leicestershire

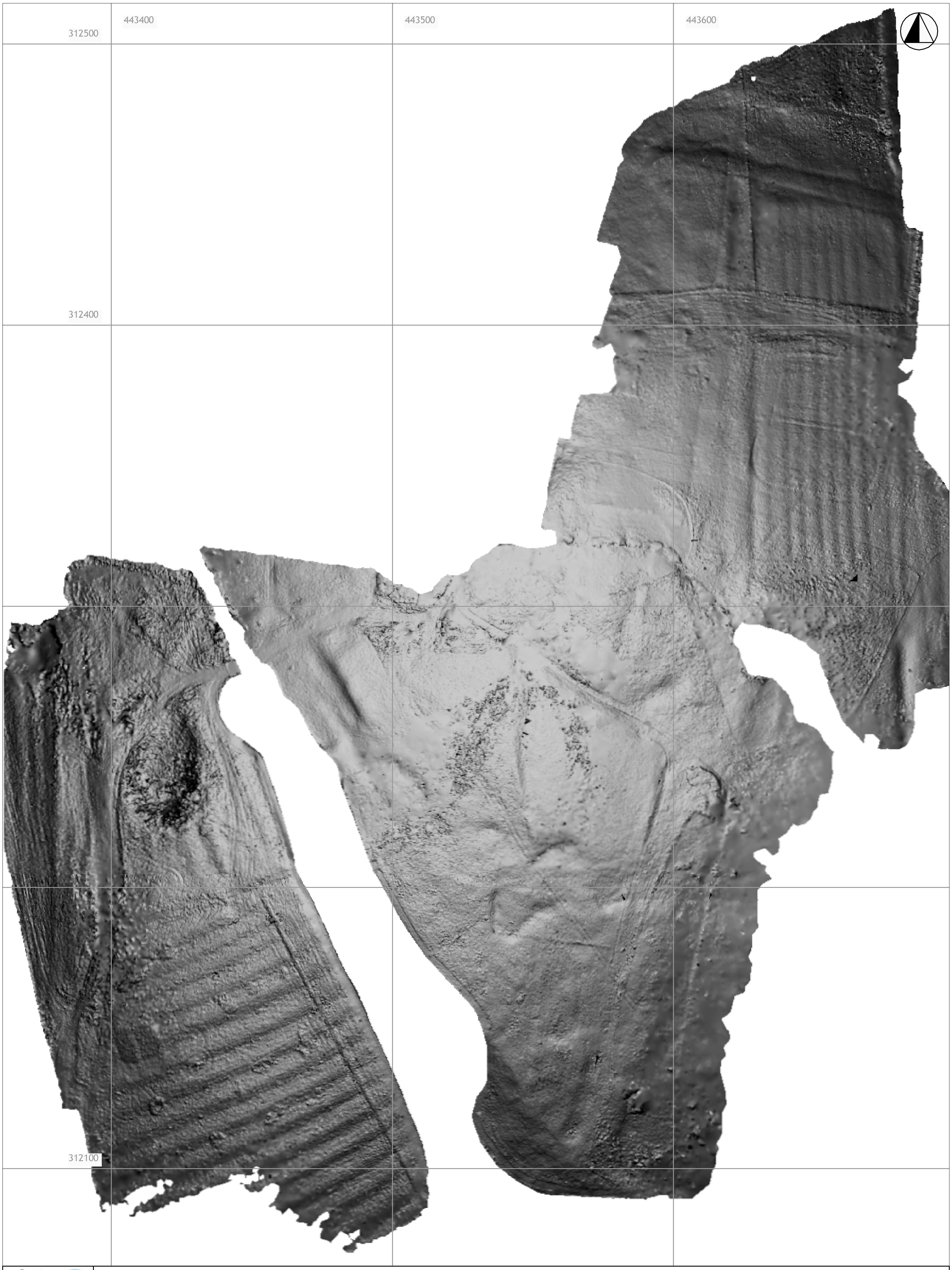
Fig. 1: Location of site

Scale 1:50000 / 1:10000 at A4 DSW/RT 28/02/2014

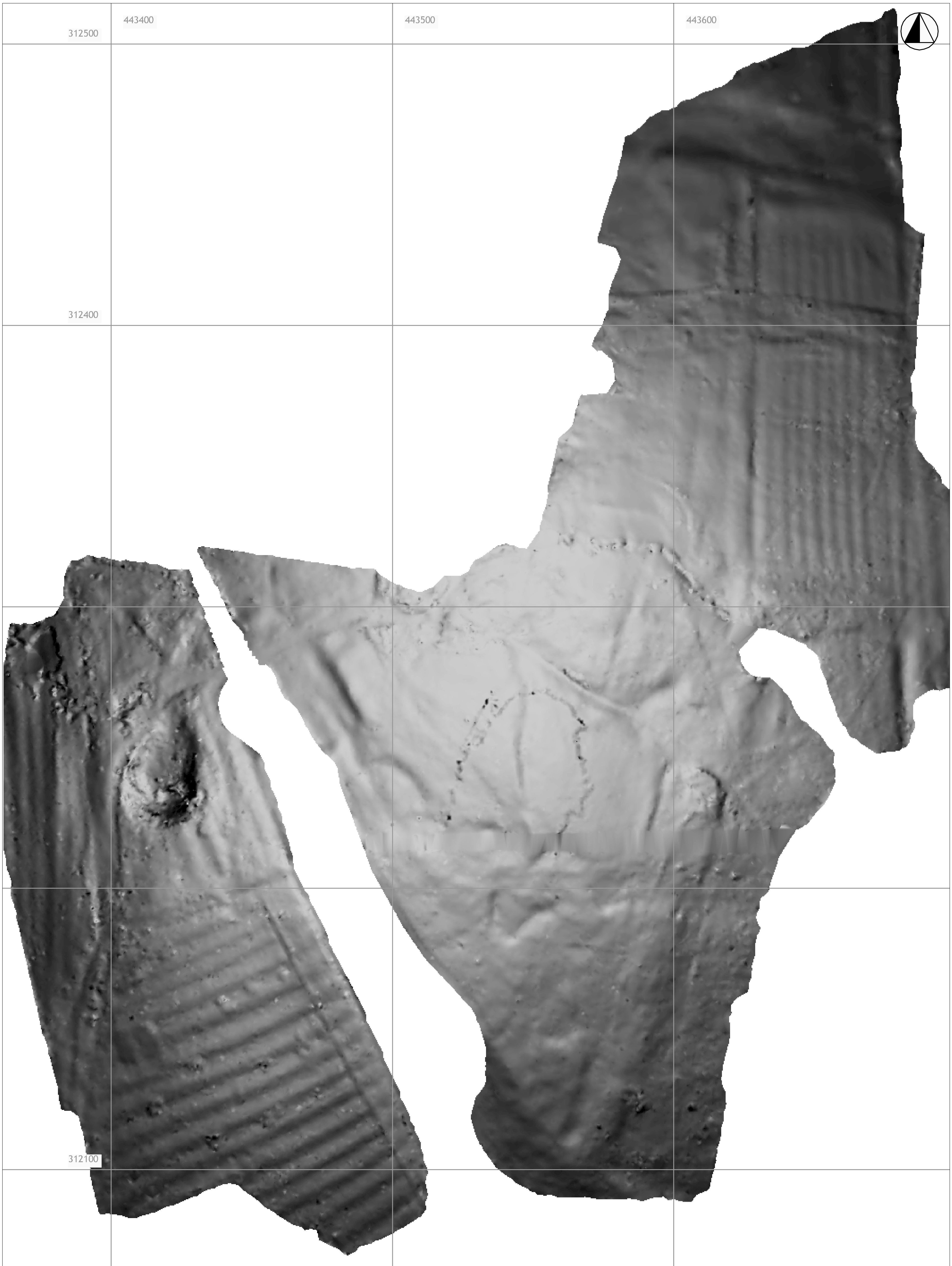


HGL: Hugglescote Grange, Leicestershire
Fig. 2: Notes & clarifications
Not to scale. DSW / RT 28/02 2014

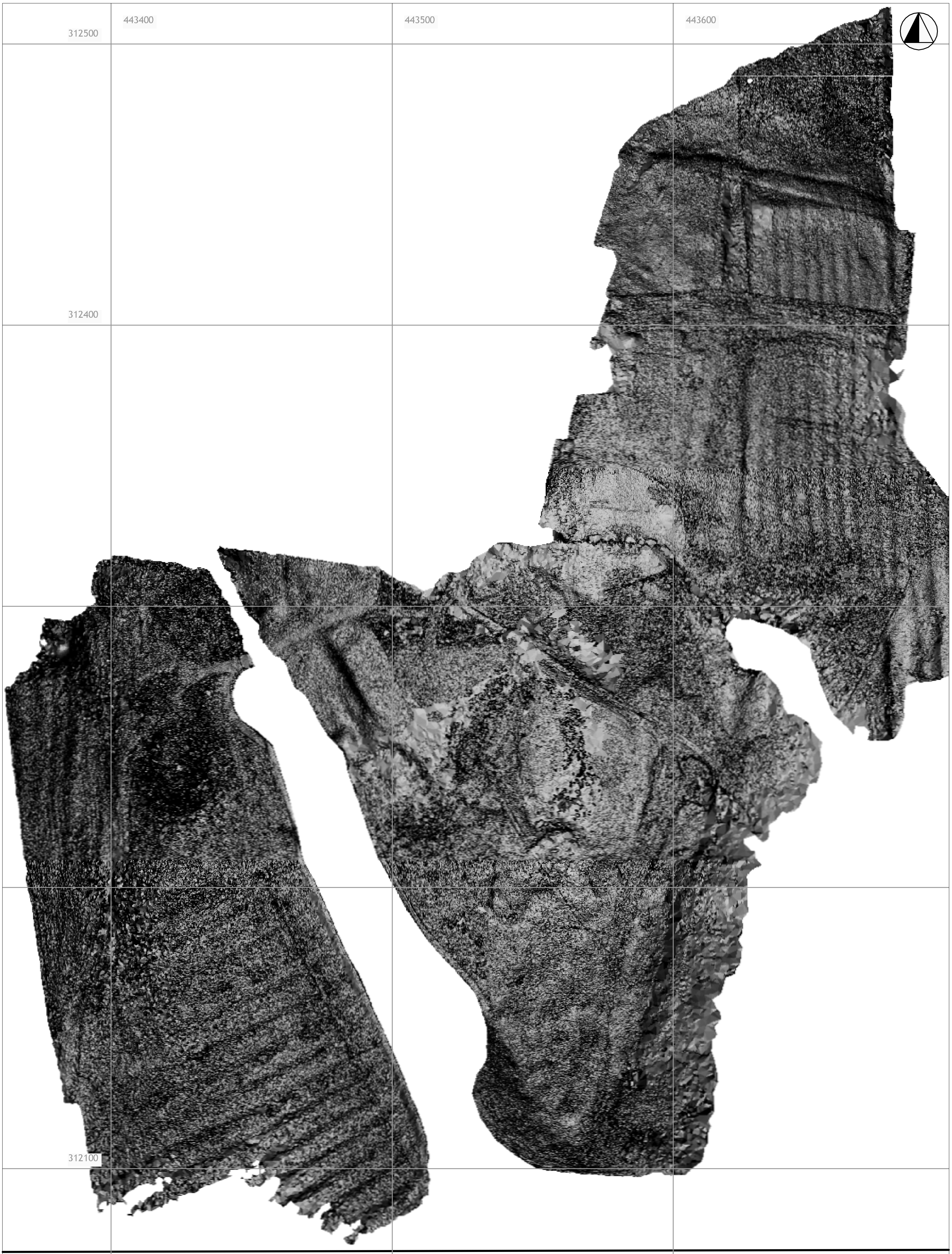
Trent & Peak
ARCHAEOLOGY



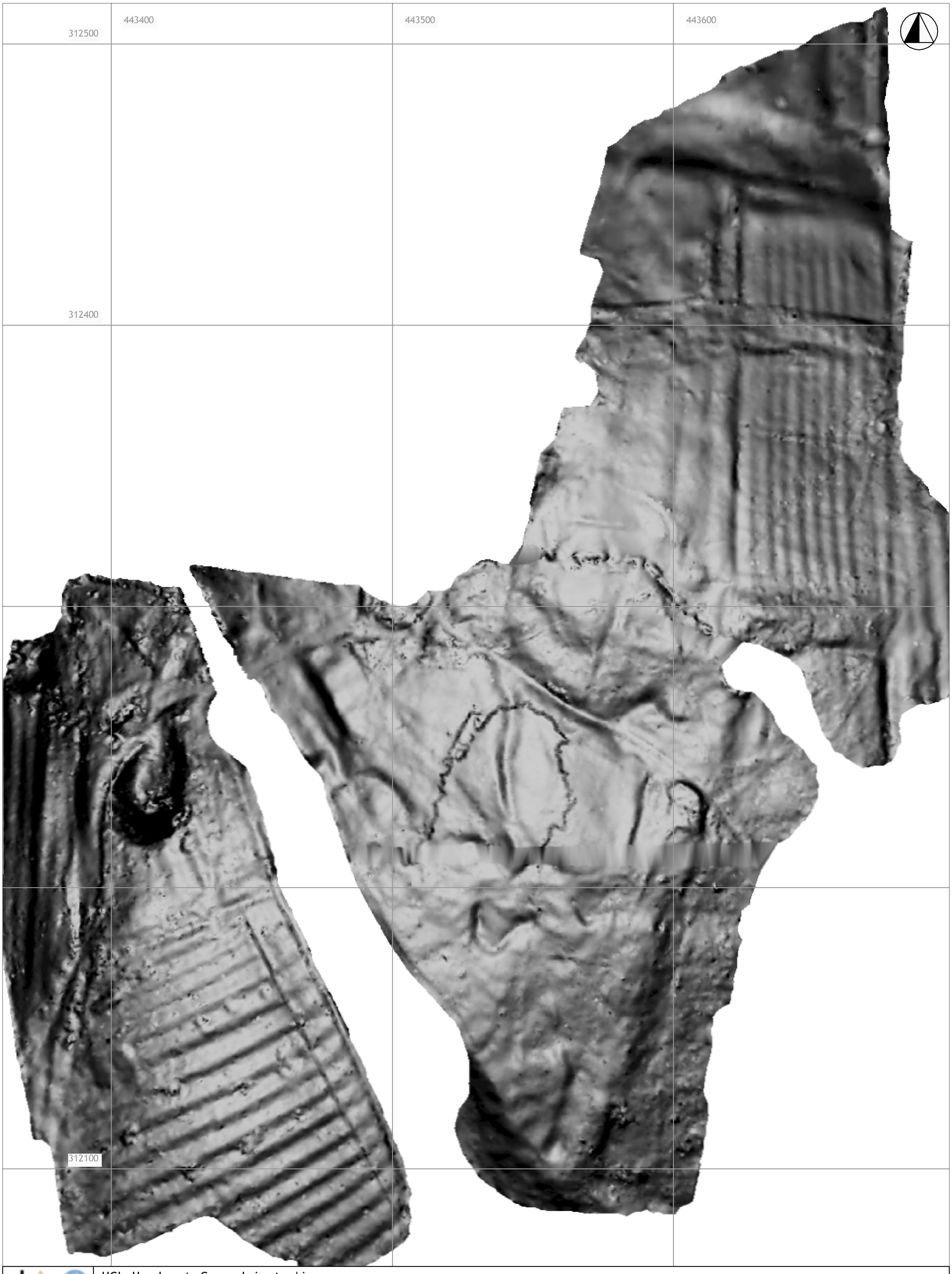
HGL: Hugglescote Grange Leicestershire
Fig. 3: Render of earthworks from laser scan data. 'Rough' data, cleaned but meshed directly from point cloud. Minnaert shaded, no height scaling
Scale 1:1250 at A3 DSW/RT 28/02/2014



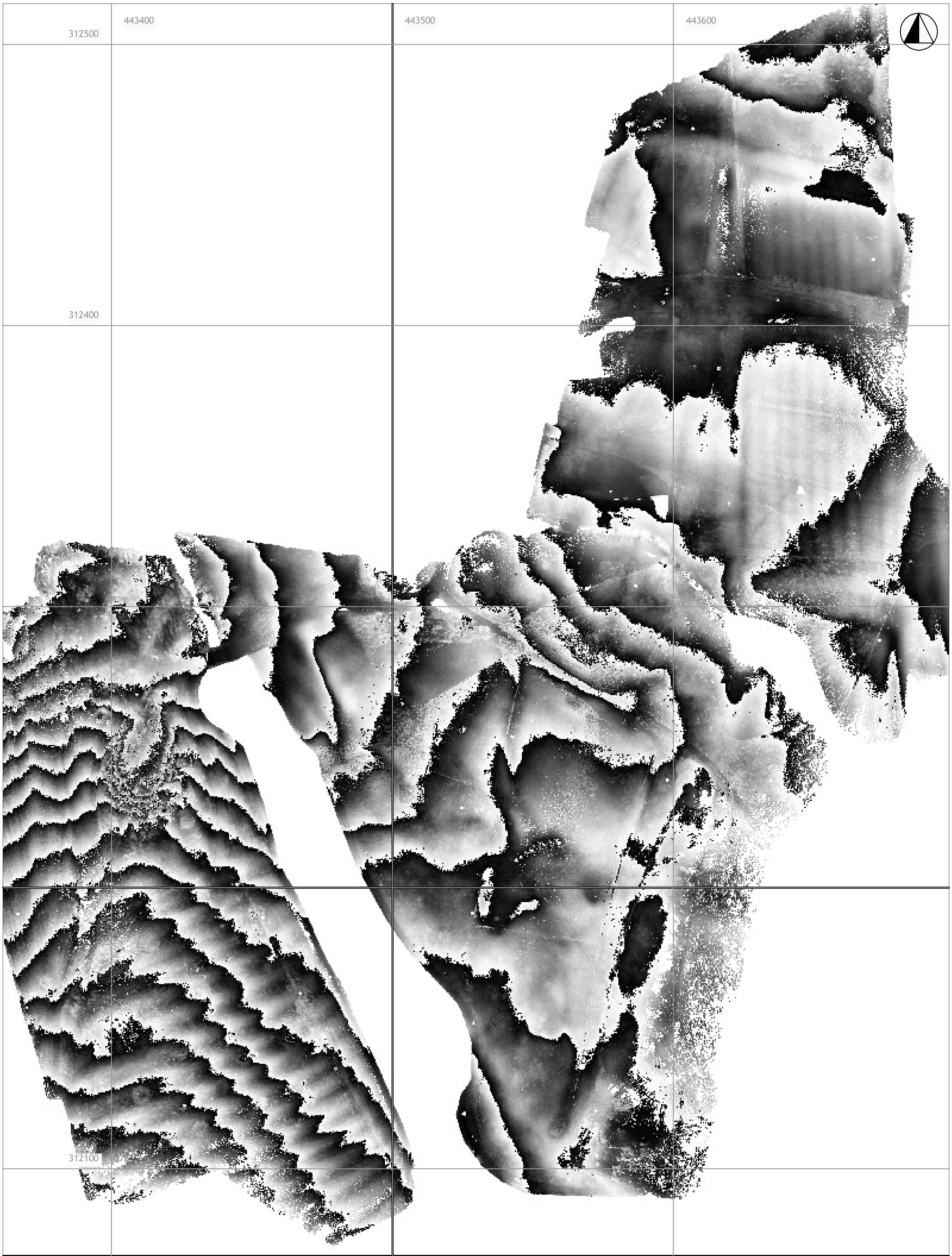
HGL: Hugglescote Grange Leicestershire
Fig. 4: Render of earthworks from laser scan data. 'Smooth' data, meshed following ground-finding algorithm. Minnaert shaded, no height scaling
Scale 1:1250 at A3 DSW/RT 28/02/2014



HGL: Hugglescote Grange Leicestershire
Fig. 5: Render of earthworks from laser scan data. 'Rough' data, cleaned but meshed directly from point cloud. Minnaert shaded, 3x height scaling
Scale c. 1:1250 at A3   DSW/RT 28/02/2014

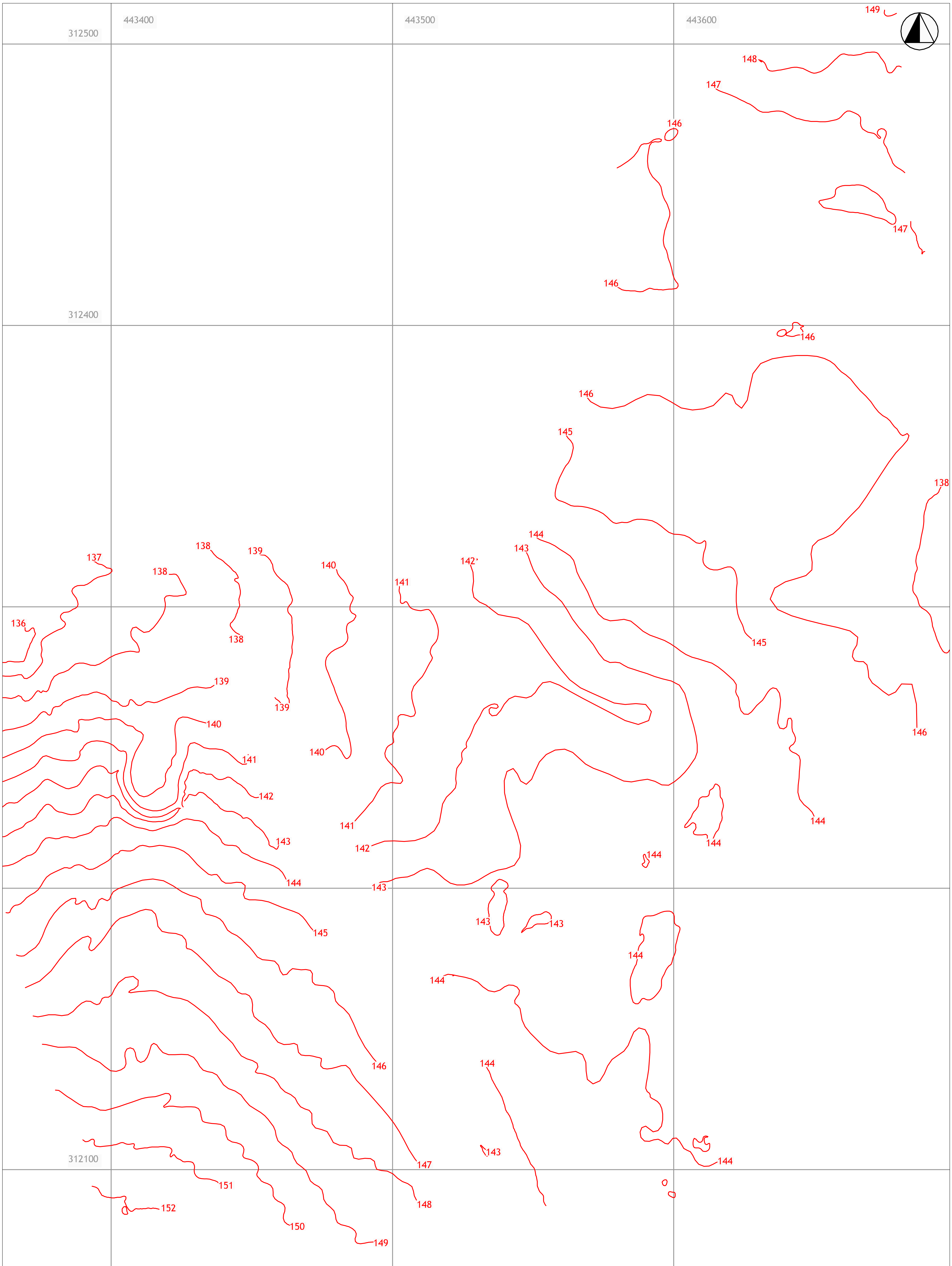


HGL: Hugglescote Grange Leicestershire
Fig. 6: Render of earthworks from laser scan data. 'Smooth' data, meshed following ground-finding algorithm. Minnaert shaded, 3x height scaling
Scale c. 1:1250 at A3   DSW/RT 28/02/2014

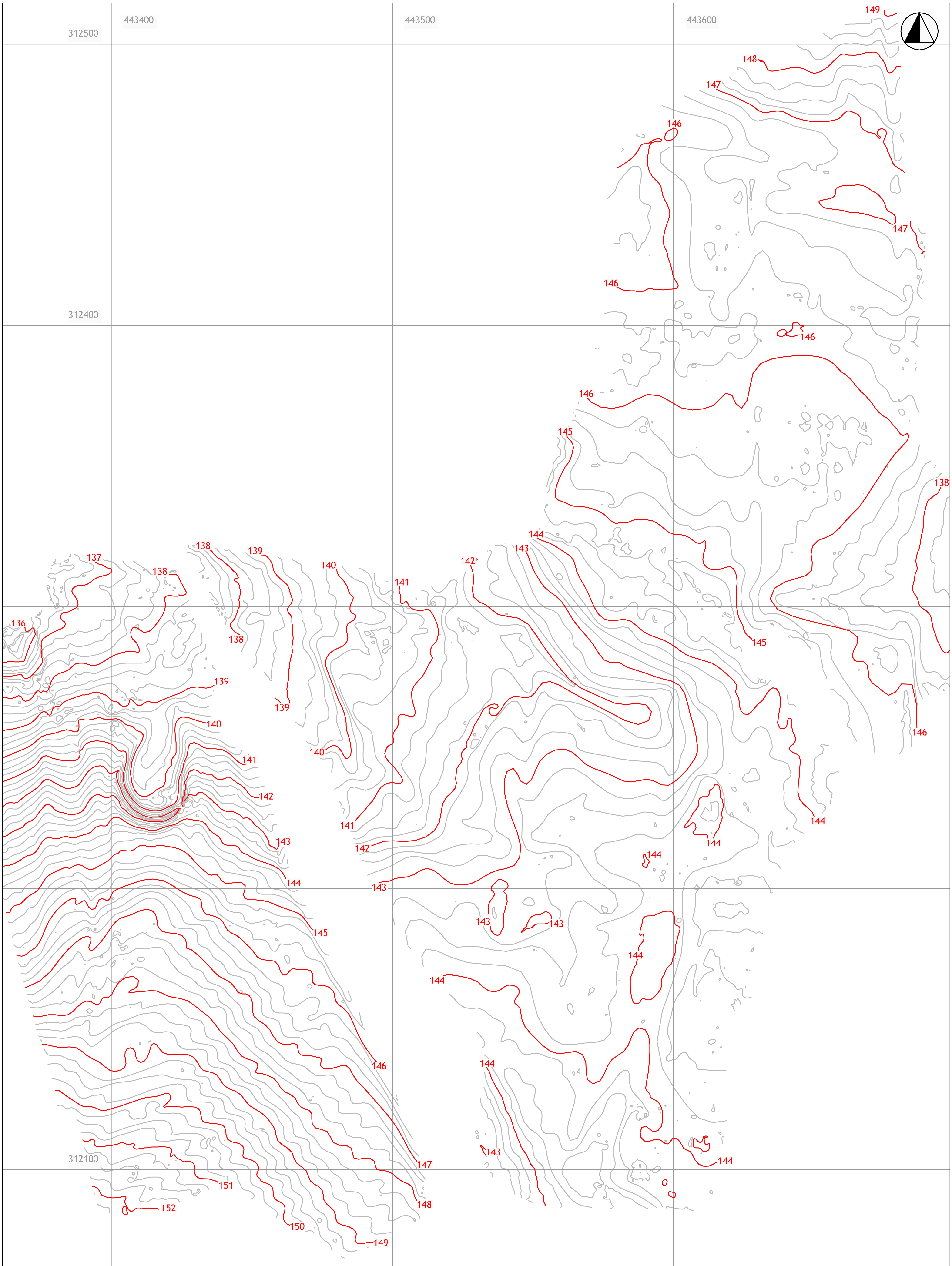


HGL: Hugglescote Grange Leicestershire
Fig. 7: Render of earthworks from laser scan data. 1m Plane shaded, showing elevation changes. Each band of black to white represents 1m increase in elevation.
Scale 1:1250 at A3 DSW/RT 28/02/2014

HGL: Hugglescote Grange Leicestershire
Fig. 8: Render of earthworks from laser scan data. 5m plane shaded, showing elevation changes. Each band of black to white represents 5m increase in elevation.
Scale 1:1250 at A3   DSW/RT 28/02/2014



HGL: Hugglescote Grange Leicestershire
Fig. 9: 1m contours, generated from smooth mesh data. Heights in m O.D.
Scale 1:1250 at A3 DSW/RT 28/02/2014



Trent & Peak Archaeology

HGL: Hugglescote Grange Leicestershire

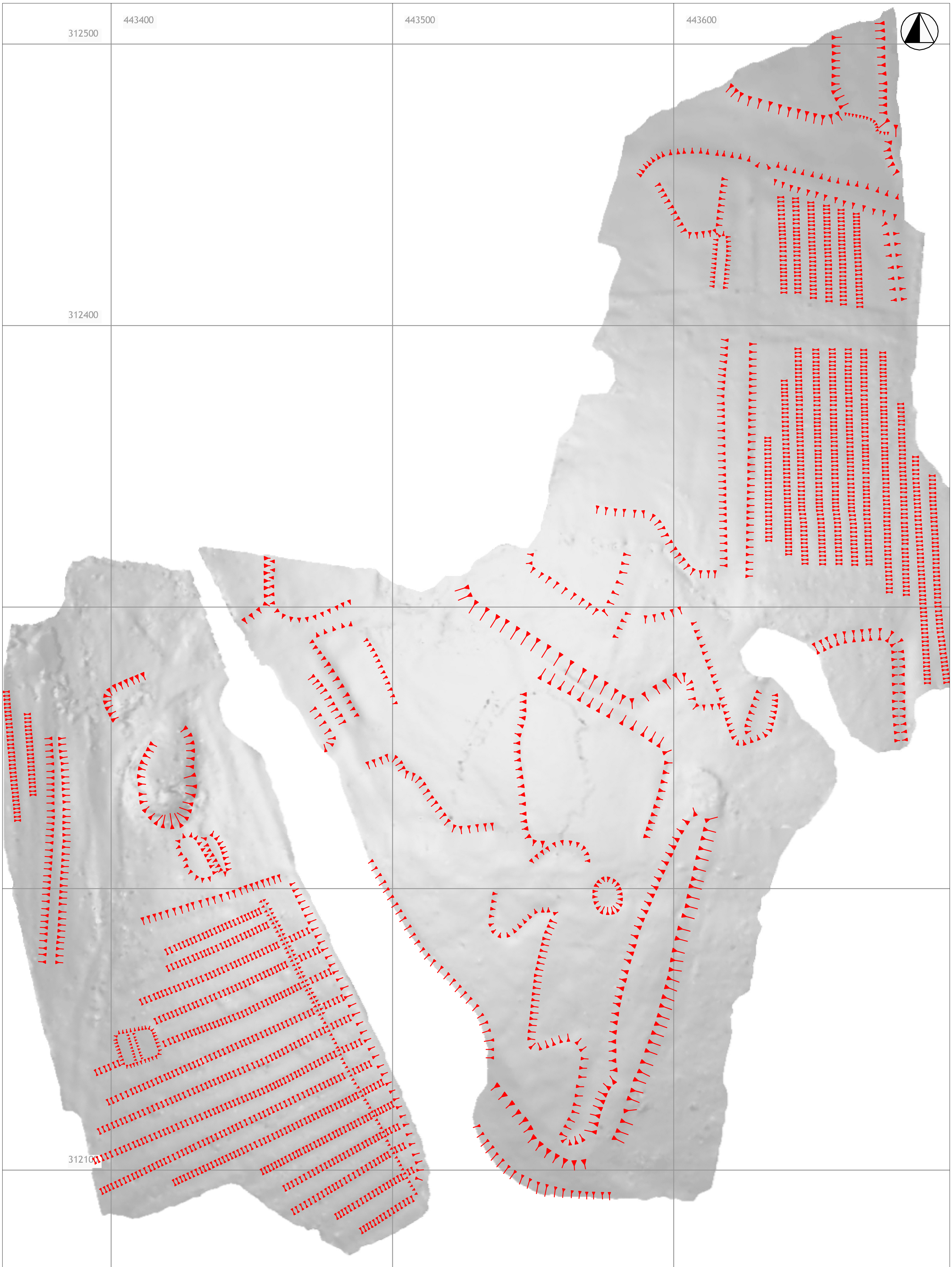
Fig. 10: 0.25m contours, generated from smooth mesh data.

Scale 1:1250 at A3 DSW/RT 28/02/2014

HGL: Hugglescote Grange, Leicestershire
Fig. 11: Perspective view of rough mesh, looking north.
Not to scale. DSW / RT 28/02/2014

Trent & Peak ARCHAEOLOGY

HGL: Hugglescote Grange, Leicestershire
Fig. 12: Perspective view of smooth mesh, looking north.
Not to scale. DSW / RT 28/02/2014



HGL: Hugglescote Grange Leicestershire
Fig. 13: Interpretative hachure plan of site
Scale 1:1250 at A3 DSW/RT 28/02/2014

Trent & Peak ARCHAEOLOGY