GEOPHYSICAL SURVEYS AT HEALAUGH MANOR, NEAR TADCASTER, NORTH YORKSHIRE

A programme of research carried out on behalf of

Northern Archaeological Associates

by

GeoQuest Associates

INTRODUCTION

Healaugh Manor Farm, near Tadcaster in North Yorkshire, is located on the site of an Augustinian priory of 13th century date. Following the dissolution in 1540, the priory buildings were converted into a manor house and it is thought that the surviving moat was excavated at around the same time. Landscaping of the area within the moated enclosure was carried out in the eighteenth century and has resulted in the landforms that are visible today.

This report presents the results of geomagnetic and electrical resistivity surveys of areas surrounding the Manor and associated farm buildings (Figure 1). The work was undertaken on behalf of Northern Archaeological Associates (NAA) according to instructions supplied by Mr P. Abramson of NAA. The aim of the investigation was to map subsoil features which might relate to the former Healaugh Priory, in order to develop an archaeological mitigation strategy prior to possible redevelopment of the farm buildings.

LANDUSE, TOPOGRAPHY AND GEOLOGY

Areas 1, 2 and 3 are predominantly level and had been largely cleared of debris and scrub prior to the surveys. Areas 4, 5 and 6 comprise level lawns and flowerbeds.

Information provided by the Geological Survey shows that the solid geology of the region consists of Permian and Triassic sandstones. There are no rock outcrops in the study area.

THE GEOPHYSICAL SURVEY

Choice of Technique

The primary aim of the geophysical surveys was to map any subsoil features that might be of archaeological interest, particularly with regard to remains that may have comprised part of Healaugh Priory. Previous geophysical research has shown that in the majority of cases a significant magnetic susceptibility contrast exists between the undisturbed subsoil and stone features such as foundations and tracks, as well as between the subsoil and the fill of cut features such as ditches and pits. Similarly, research has also shown that there is usually a significant contrast in electrical resistivity between undisturbed and stone/refilled features, caused by the relative differences in water content between deposits. The proximity of buildings adjacent to several of the survey areas has prohibited the use of magnetic surveying since the resulting data would be adversely affected by electromagnetic fields deriving from the fabric and services of these structures. Thus in Areas 1, 2 and 6 only the technique of electrical

resistivity mapping has been applied. In Areas 3a, 4 and 5, which are of particular archaeological interest, it was considered appropriate to employ both geomagnetic and resistivity methods. The largest area 3b was investigated using only the technique of geomagnetic survey (Figure 1).

Field Methods

Measurements of vertical geomagnetic field gradient were taken over a regular grid using a Geoscan FM36 fluxgate gradiometer with ST1 sample trigger. A zig-zag traverse scheme was employed and data were logged in units of 20 x 20m at 1.0 x 0.5m intervals. Appendix A provides further information about the techniques employed.

Measurements of soil electrical resistivity were made over identical grids using a Geoscan RM15 resistivity meter with 0.5m spacing of the mobile electrodes. A zig-zag traverse scheme was employed and data were again logged in units of 20 x 20m at 1.0 x 0.5m intervals. Appendix B provides further information about this technique.

Data were downloaded on site into a Sharp PC3000 portable graphics computer for storage and verification. These data were subsequently transferred to a laboratory computer for processing, interpretation and archiving.

Data Processing

The GeoQuest **InSite®** Windows program was used to process the geophysical data and produce a continuous tone grey-scale images of the resistivity and geomagnetic data at a scale of 1:500. These results are shown in Figures 2 and 3 on a plan digitised from a 1:1250 map supplied by NAA. A convention is used that shows positive magnetic and resistivity anomalies as dark grey and negative anomalies as light grey.

The following basic processing steps were applied to the data:

Removal of Random 'Spikes' present in the data due to small ferrous objects (magnetic data) or poor electrode contact on stones on or near the ground surface (resistivity data). This process replaces spikes with the mean of near-neighbours.

Removal of Striping Artifacts in the geomagnetic data caused by alternating changes in level between zig-zag traverses.

Correction for Drift in magnetometer calibration with time.

Adjustment of Grid Mean Values to achieve an optimum match along the lines of contact between data grids (both data sets).

Interpolation of the data, using a bilinear function, to generate a regular mesh of values at 0.25 x 0.25m intervals (both data sets).

Printing of the processed data on a Hewlett Packard HP650C Designjet plotter with 256 grey shades and 600 dpi resolution. A sigmoid function was used to map the data to printed grey tones since this provides a measure of contrast equalisation.

Figures 2 and 3 include a palette bars which relate the grey scale intensities to anomaly values in nano Tesla per metre and ohms, respectively. Note that the regularly spaced blank areas seen in the resistivity survey of Figure 3 correspond to the location of pillar bases. Appendix C provides more information about the data processing and itemises the algorithms that were applied to produce Figures 2 and 3.

DISCUSSION OF RESULTS

Key to Figures

Significant anomalies in both the resistivity and geomagnetic data have been detected and are summarised on a 1:750 geophysical interpretation plan in Figure 4 using coded colours and patterns. An archaeological interpretation is given in Figure 5. The types of anomalies which have been distinguished are as follows:

1 **Green**: Significant regions of anomalously high magnetic field gradient which could be associated with high susceptibility soil-filled structures such as pits and ditches.

2 **Blue**: Significant regions of anomalously low magnetic field gradient which may indicate materials with low susceptibility, such as stone structures, paths or cavities.

3 **Red**: Strong dipolar anomalies (paired positive-negative) whose most probable sources, in this context, are near-surface iron objects, brick and tile debris. Such anomalies have been ignored in the subsequent archaeological interpretation.

4 **Brown**: Areas where the subsoil electrical resistivity is anomalously high. These areas might provide a further indication for the presence of stone structures such as paths or wall footings.

5 **Orange**: This colour is used to indicate areas where the survey has detected an unusually low electrical resistivity. These regions may signify the presence of ditches or pits filled with relatively moist soil.

Discussion

Area 1 Here the resistivity survey has detected a complex pattern of anomalies largely characterised by an increase in resistivity towards the NE. Since no clear geometric pattern is visible in the data it seems likely that the anomalies reflect random spreads of demolition rubble. No geomagnetic survey was made of this area.

rubble may mask other features.

Area 2 This small area was explored using only the resistivity survey method which has again detected a confused pattern of diffuse anomalies thought to reflect a random spread of demolition rubble.

Area 3a Both resistivity and geomagnetic surveys were made of this area which is thought to mark the position of the Priory nave and chancel. Of particular interest is the presence of a rectilinear pattern of high resistivity anomalies with a similar alignment to the present Manor and buildings. It seems possible that this set of anomalies may represent wall footings for the demolished nave and chancel. This feature is not seen in the geomagnetic data which unfortunately are dominated by dipolar anomalies arising from ferrous litter.

Area 3b This was the largest contiguous area examined by geophysical survey (Figure 2). The geomagnetic data suggest that the subsoil is largely devoid of significant anomalies with the possible exception of a deposit of high susceptibility material (stone or tile?) near the NE margin of the survey area. Resistivity survey was not made in Area 3b.

Area 4 Both resistivity and geomagnetic surveys were made of this small area. Of archaeological interest is a pattern of distinct geophysical lineations, seen in each data set, which are co-oriented with the manor house and buildings. The sign of the anomalies are consistent with the presence of stone wall footings or drains. These features must be shallow as indicated by the narrow width of the anomalies (<2m).

Area 5 Geomagnetic and resistivity survey of this area (possible cloister site) was carried out in a contiguous block with Area 4. The majority of detected anomalies are weak and diffuse, suggesting that the subsoil contains quantities of random demolition rubble and ferrous debris. However, the presence of both magnetic and resistivity lineations points to a possible wall footing or drain beneath the central part of this area with an E-W orientation. No other features of archaeological interest were detected.

Area 6 Weak, high resistivity lineations that have been detected in this area may also warrant further investigation as being of possible archaeological interest. However, it is evident from the resistivity data that the subsoil is probably contaminated by stone rubble.

CONCLUSIONS

The results of this research are summarised below:

1 Geomagnetic and resistivity surveys have been carried out over six areas at Healough Manor, near Tadcaster in North Yorkshire, prior to possible redevelopment of the farm buildings.

2 The area was found to contain spreads of demolition rubble in the subsoil together with significant concentrations of ferrous litter in an area immediately north of the Manor house.

3 The geophysical surveys has provided evidence that wall footings, drains or other stone features are present in an area thought to have been the site of the nave and chancel. Similar features have been detected in the conjectured cloister area, west of the Manor house.

CREDITS

Survey: D.N. Hale, D. Thompson
Report: M. Noel, D.N. Hale
Graphics: C. Martinez
Date: 12th May 1997

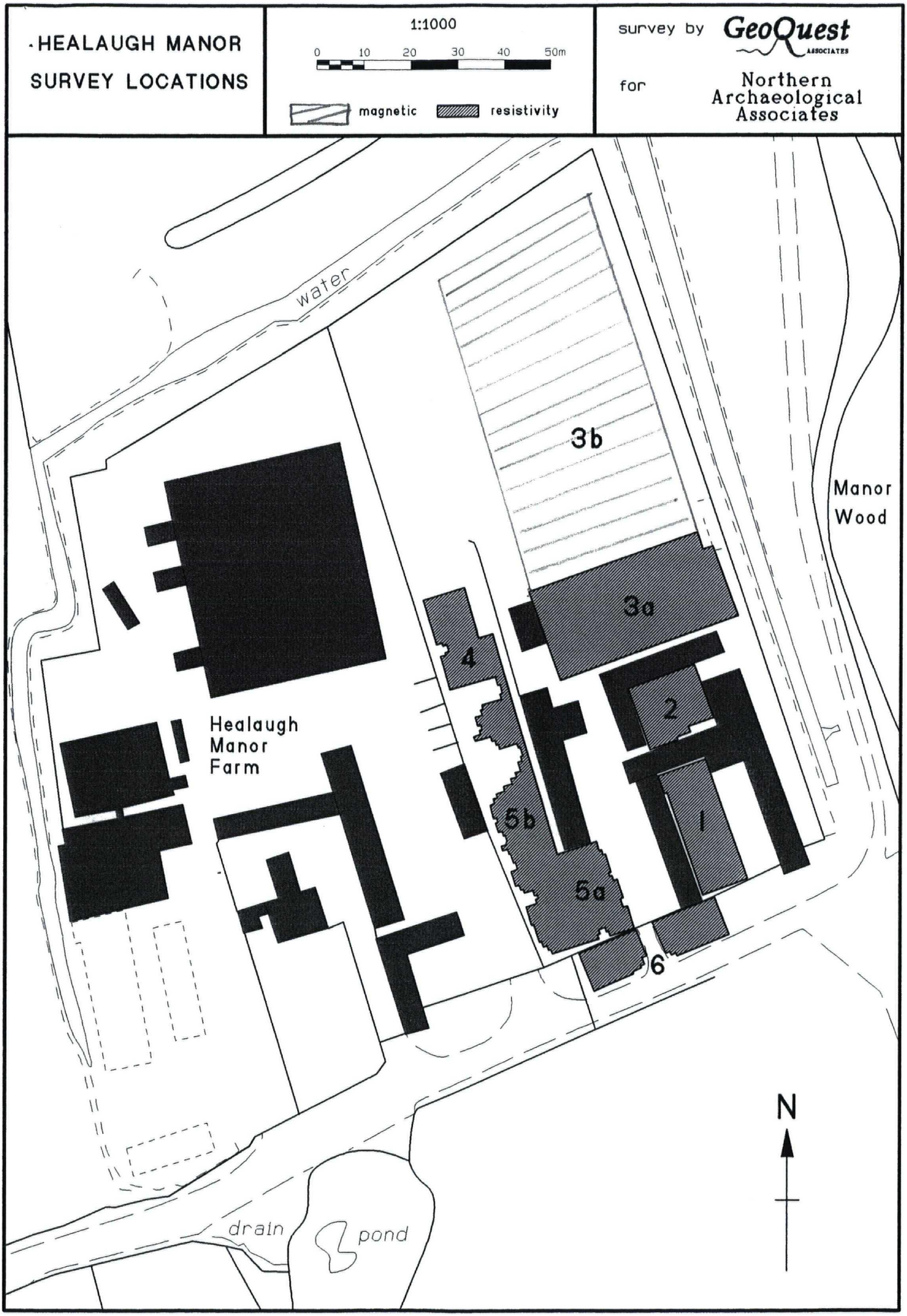

HEALAUGH MANOR
SURVEY LOCATIONS
1:1000
0 10 20 30 40 50m
magnetic
resistivity
survey by GeoQuest ASSOCIATES
for Northern Archaeological Associates
water
3b
Manor
Wood
3a
4
2
Healaugh
Manor
Farm
6b
1
5a
6
N
drain
pond

FIGURE 1

HEALAUGH MANOR
RESULTS OF
MAGNETIC SURVEY

1:500

0 10 20 30 40 50m

survey by GeoQuest ASSOCIATES

for Northern Archaeological Associates

N

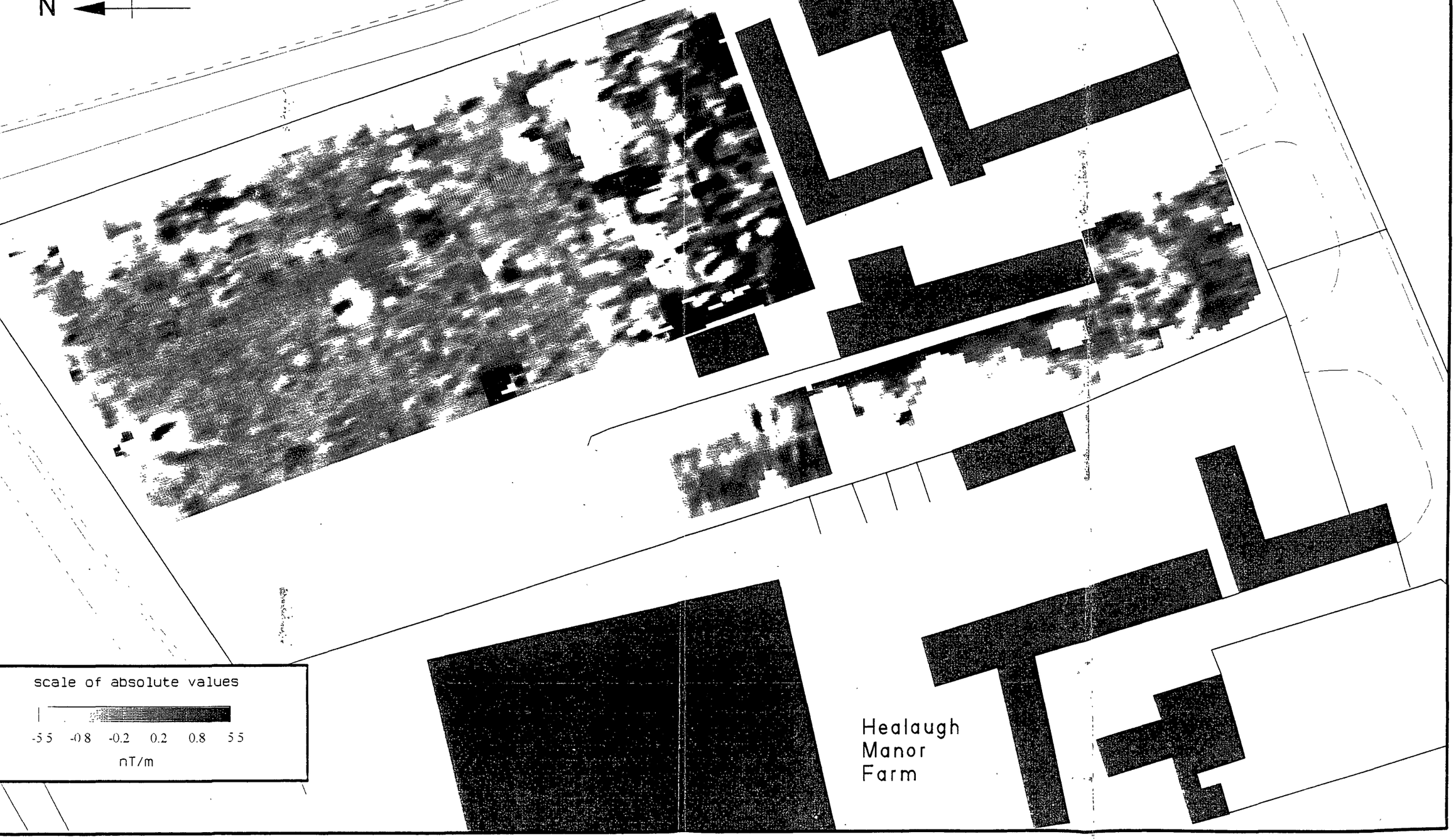


FIGURE 2
Results of Magnetic Survey

HEALAUGH MANOR
RESULTS OF
RESISTIVITY SURVEY

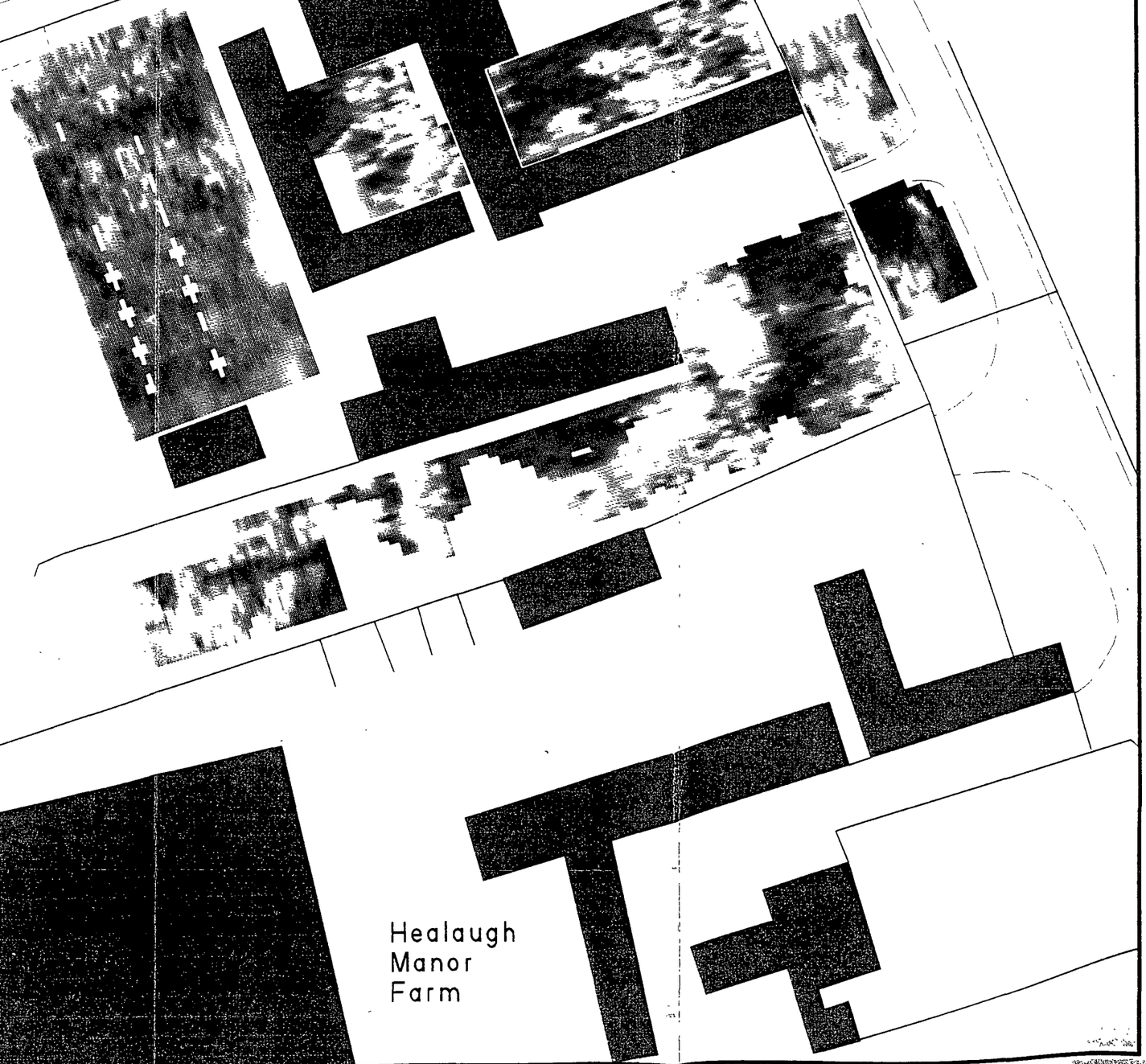
1:500

10 20 30 40 50m

survey by GeoQuest ASSOCIATES

for Northern Archaeological Associates

N



Healaugh
Manor
Farm

scale of absolute values

-21.5 -3.0 -0.9 0 9 3 1 21.5

Ohm

FIGURE 3
Results of Resistivity Survey

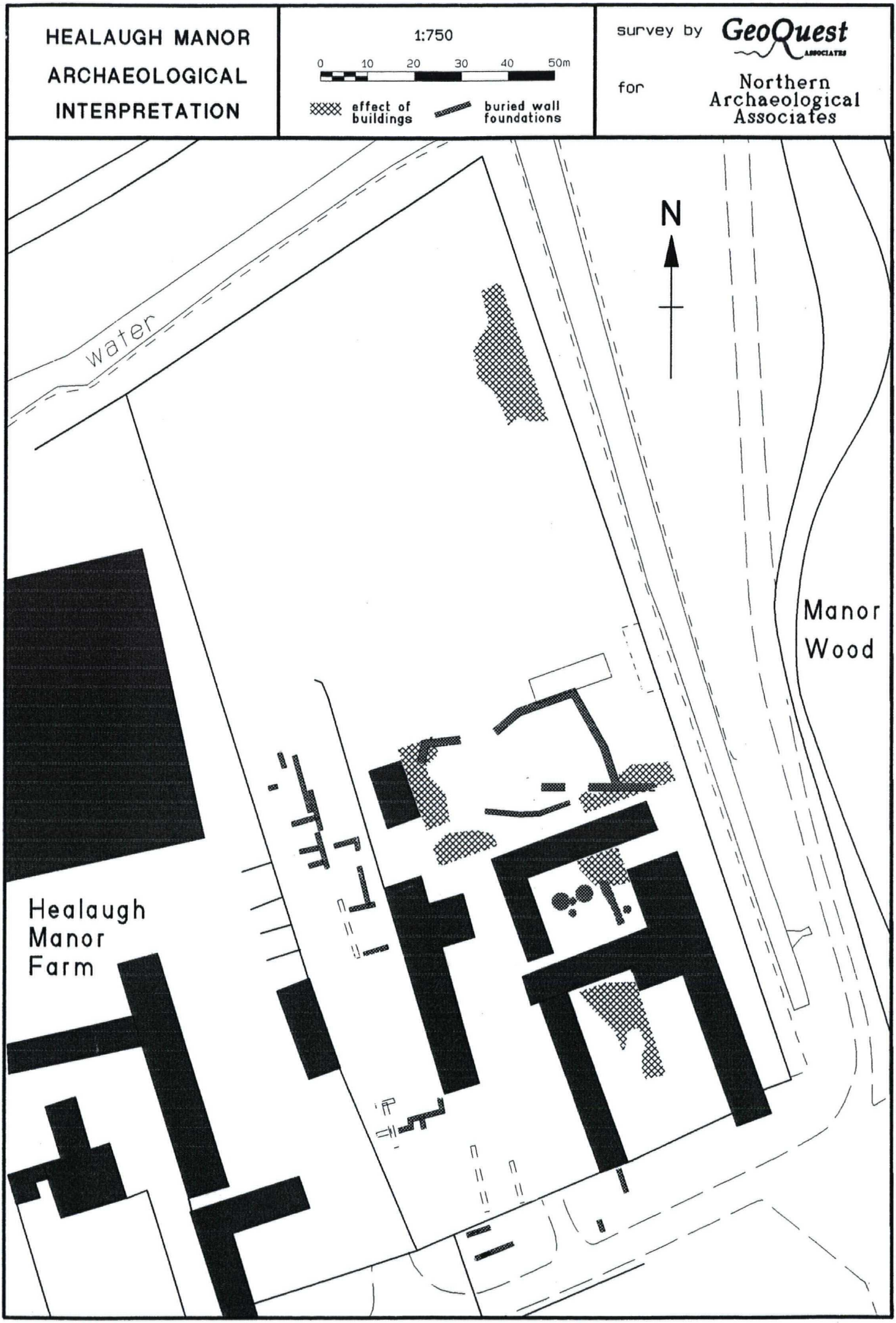

HEALAUGH MANOR
ARCHAEOLOGICAL
INTERPRETATION
1:750
0 10 20 30 40 50m
effect of buildings
buried wall foundations
survey by GeoQuest ASSOCIATES
for Northern Archaeological Associates
N
water
Manor Wood
Healaugh Manor Farm

FIGURE 5