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REPORT ON GEOPHYSICAL SURVEY

WELLAND BANK PIT II

Report number 96/10

Work commissioned by :

A P S
ARCHAEOLOGICAL
PROJECT
SERVICES

EL1 388 SL1 3438 34856 34923

SITE SUMMARY SHEET

96 / 10 Welland Bank Pit II

NGR: TF 184 081

Location, topography and geology

The site is situated southeast of Deeping St James, Lincolnshire, and just to the north of the River Welland. The area under investigation lies immediately to the southeast of the phase currently being extracted for gravel. The survey area occupied a level field from which the top 30 cm of soil had been stripped by machine. The underlying geology comprises sands and gravels.

Archaeology

The survey lies within an area of known archaeological sites. A previous geophysical survey immediately to the west of the current survey area (GSB 94/86) located numerous anomalies of potential archaeological interest. Ongoing archaeological excavations to the northwest of the survey area have located a complex of archaeological features including boundary ditches, pits, post holes and possible hearths. There is some evidence at the site for salt manufacturing.

Aims of Survey

A detailed gradiometer survey was carried out over the whole of a field approximately 4 ha in size. The aim of the survey was to locate any anomalies of possible archaeological interest. In particular, it was hoped that gradiometry might confirm the continuation of ditches revealed in excavations to the northwest. The geophysical survey forms part of a wider archaeological evaluation being undertaken by **Archaeological Project Services**.

Summary of Results *

A broad anomaly runs diagonally across the survey and appears to indicate a palaeochannel, although an archaeological origin cannot be ruled out. A concentration of pit type responses has been recorded in the southeast of the survey. While an archaeological origin is possible, the anomalies may be the product of naturally occurring magnetic gravels. In the northeast of the survey, several relatively strong pit type anomalies have been noted which appear archaeological in nature. There are very weak suggestions of linear anomalies in the vicinity, but an archaeological interpretation is tentative.

*** It is essential that this summary is read in conjunction with the detailed results of the survey.**

 For the use of APS

SURVEY RESULTS

96 / 10 Welland Bank Pit II

1. Survey Area

1.1 The location of the survey area is shown in Figure 1, at a scale of 1:2500.

1.2 The survey grid was set out and tied-in by **Geophysical Surveys of Bradford**. Details of the tie-in information have been lodged with the client. Pegs have been left *in situ* to facilitate relocation of the grid and have been noted on the tie-in sheet.

2. Display

2.1 A greyscale image of the entire data set and a summary interpretation are provided in Figures 2 and 3, respectively.

2.2 The data are also displayed as XY traces and dot density plots at a scale of 1:625. For ease of display the survey has been divided into two areas: A and B. Interpretation diagrams are provided at the same scale for each area.

2.3 The display formats referred to above are discussed in the *Technical Information* section, at the end of the text. A list of figures is provided at the start of the diagrams.

3. General Considerations - Complicating factors

3.1 The top 30 cm of soil had been stripped from the surface prior to survey in order to improve the likelihood of detecting weaker responses of possible archaeological interest. While this will have improved the resolution of the survey and resulted in excellent surveying conditions, the location of spoil heaps along the northern and eastern edges of the field restricted the area available for survey.

3.2 Gradiometry can be difficult on sites with alluvial cover and while stripping some of the soil will have assisted with interpretation of the results, the presence of magnetic gravels can still confuse interpretation of the results.

4. Results of Survey

4.1 The background level of responses varies across the site suggesting natural pedological variations that were expected due to the underlying sands and gravels.

4.2 A series of broad diffuse anomalies form a band which crosses the site diagonally and is aligned approximately east-west, with the responses being noticeably stronger in the southeast. While the nature of the responses suggests a natural origin, such as a palaeochannel, its orientation indicates a possible continuation of a ditch revealed by excavation. However, accurate plotting of the excavated feature will be needed to confirm this; the two features may simply be parallel. It is possible that the excavated feature does not extend into this area.

4.3 The assumed palaeochannel leads to a concentration of pit type anomalies in the southeast of the survey area. The suggestion of ditch like responses and the clearly defined 'edges' to this concentration of responses suggests that they are archaeological. However, a natural origin such as magnetic gravels cannot be excluded.

4.4 The increasing strength of anomalies from the northwest to the southeast could be due to several factors. If the anomalies are archaeological, it could indicate a concentration of features toward the southeast. Alternatively, it could be due to the nature of the magnetic gravels. Another possibility is an increasing thickness of overburden northwestward across the site.

4.5 Several pit type anomalies have been noted throughout the survey area. A concentration of relatively strong anomalies are visible in the northern corner of the survey and appear archaeological in nature. There are weak suggestions of associated linear anomalies but an archaeological interpretation is tentative.

4.6 Weaker pit type responses are apparent in the southwest of the survey. Their nature suggests that they are perhaps more likely to be natural. However, if there is a greater overburden in this area they could be originating from similar features to those seen in the northeast.

4.7 Throughout the survey area several isolated ferrous responses have been recorded. These are most likely to be due to modern ferrous debris near the surface or, possibly, small pockets of magnetic gravels. The most prominent of these responses are noted on the interpretation diagrams.

5. Conclusions

5.1 A band of anomalies runs diagonally across the survey and appears to indicate a palaeochannel, although an archaeological origin cannot be ruled out. A concentration of pit type responses has been recorded in the southeast of the survey and appears to be associated with the presumed palaeochannel. While an archaeological origin is possible, the anomalies may be the product of naturally occurring magnetic gravels.

5.2 In the northeast of the survey several relatively strong pit type anomalies have been noted which appear archaeological in nature. There are very weak suggestions of linear anomalies in the vicinity, but an archaeological interpretation is tentative.

5.3 While many of the anomalies suggest a natural origin, the known archaeological remains in the area suggest that some, if not all, of the responses may be of archaeological interest.

Project Co-ordinator: Dr S M Ovenden-Wilson
Project Assistants: Dr C Adam, N Lambert, J Nicholls and A Shields

Date of Survey: 22-23 & 29-30 January 1996
Date of Report: 1 February 1996

TECHNICAL INFORMATION

The following is a description of the equipment and display formats used in **GEOPHYSICAL SURVEYS OF BRADFORD** reports. It should be emphasised that whilst all of the display options are regularly used, the diagrams produced in the final reports are the most suitable to illustrate the data from each site. The choice of diagrams results from the experience and knowledge of the staff of **GEOPHYSICAL SURVEYS OF BRADFORD**.

All survey reports are prepared and submitted on the basis that whilst they are based on a thorough survey of the site, no responsibility is accepted for any errors or omissions.

Magnetic readings are logged at 0.5m intervals along one axis in 1m traverses giving 800 readings per 20m x 20m grid, unless otherwise stated. Resistance readings are logged at 1m intervals giving 400 readings per 20m x 20m grid. The data are then transferred to portable computers and stored on 3.5" floppy discs. Field plots are produced on a portable Hewlett Packard Thinkjet. Further processing is carried out back at base on computers linked to appropriate printers and plotters.

Instrumentation

(a) Fluxgate Gradiometer - Geoscan FM36

This instrument comprises of two fluxgates mounted vertically apart, at a distance of 500mm. The gradiometer is carried by hand, with the bottom sensor approximately 100-300mm from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is conventionally measured in nanoTesla (nT) or gamma. The fluxgate gradiometer suppresses any diurnal or regional effects. Generally features up to one metre deep may be detected by this method.

(b) Resistance Meter - Geoscan RM4 or RM15

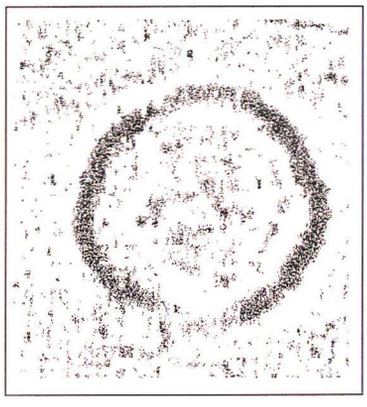
This measures the electrical resistance of the earth, using a system of four electrodes (two current and two potential.) Depending on the arrangement of these electrodes an exact measurement of a specific volume of earth may be acquired. This resistance value may then be used to calculate the earth resistivity. The "Twin Probe" arrangement involves the paring of electrodes (one current and one potential) with one pair remaining in a fixed position, whilst the other measures the resistance variations across a fixed grid. The resistance is measured in Ohms and the calculated resistivity is in Ohm-metres. The resistance method as used for area survey has a depth resolution of approximately 0.75m, although the nature of the overburden and underlying geology will cause variations in this generality. The technique can be adapted to sample greater depths of earth and can therefore be used to produce vertical "pseudo sections".

(c) Magnetic Susceptibility

Variations in the magnetic susceptibility of subsoils and topsoils occur naturally, but greater enhanced susceptibility can also be a product of increased human/anthropogenic activity. This phenomenon of susceptibility enhancement can therefore be used to provide information about the "level of archaeological activity" associated with a site. It can also be used in a predictive manner to ascertain the suitability of a site for a magnetic survey. The instrument employed for measuring this phenomenon is either a field coil or a laboratory based susceptibility bridge. For the latter 50g soil samples are collected in the field.

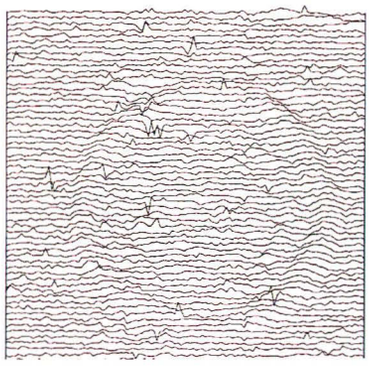
Display Options

The following is a description of the display options used. Unless specifically mentioned in the text, it may be assumed that no filtering or smoothing has been used to enhance the data. For any particular report a limited number of display modes may be used.



(a) Dot-Density

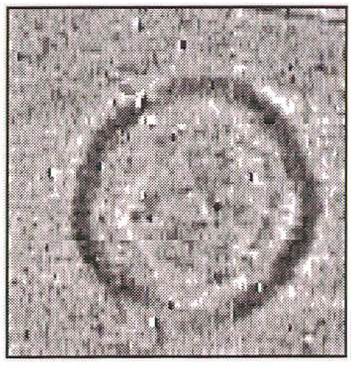
In this display, minimum and maximum cut-off levels are chosen. Any value that is below the minimum cut-off value will appear white, whilst any value above the maximum cut-off value will appear black. Any value that lies between these two cut-off levels will have a specified number of dots depending on the relative position between the two levels. The focus of the display may be changed using different levels and a contrast factor (C.F.). Usually the C.F. = 1, producing a linear scale between the cut-off levels. Assessing a lower than normal reading involves the use of an inverse plot, This plot simply reverses the minimum and maximum values, resulting in the lower values being presented by more dots. In either representation, each reading is allocated a unique area dependent on its position on the survey grid, within which numbers of dots are randomly placed. The main limitation of this display method is that multiple plots have to be produced in order to view the whole range of the data. It is also difficult to gauge the true strength of any anomaly without looking at the raw data values. This display is much favoured for producing plans of sites, where positioning of the anomalies and features is important.



(b) X-Y Plot

This involves a line representation of the data. Each successive row of data is equally incremented in the Y axis, to produce a stacked profile effect. This display may incorporate a hidden-line removal algorithm, which blocks out lines behind the major peaks and can aid interpretation. Advantages of this type of display are that it allows the full range of the data to be viewed and shows the shape of the indiviual anomalies. Results are produced on a flatbed plotter.

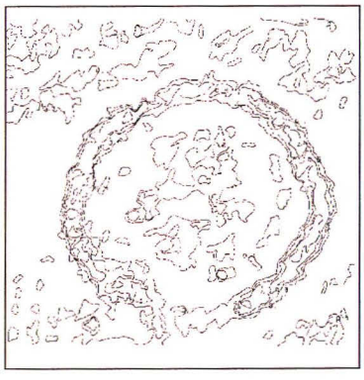
Display Options cont'd



(c) Grey-Scale

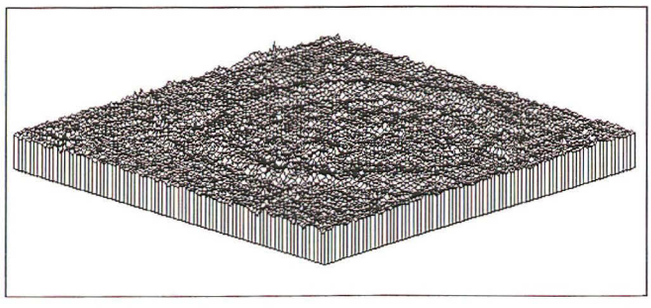
This format divides a given range of readings into a set number of classes. These classes have a predefined arrangement of dots or shade of grey, the intensity increasing with value. This gives an appearance of a toned or grey scale.

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. While colour plots can look impressive and can be used to highlight certain anomalies, grey-scales tend to be more informative.



(d) Contour

This display format is commonly used in cartographic displays. Data points of equal value are joined by a contour line. Closely packed contours indicate a sharp gradient. The contours therefore highlight an anomalous region. The range of contours and contour interval are selected manually and the display is then generated on the computer screen or plotted directly on a flat bed plotter / inkjet printer.

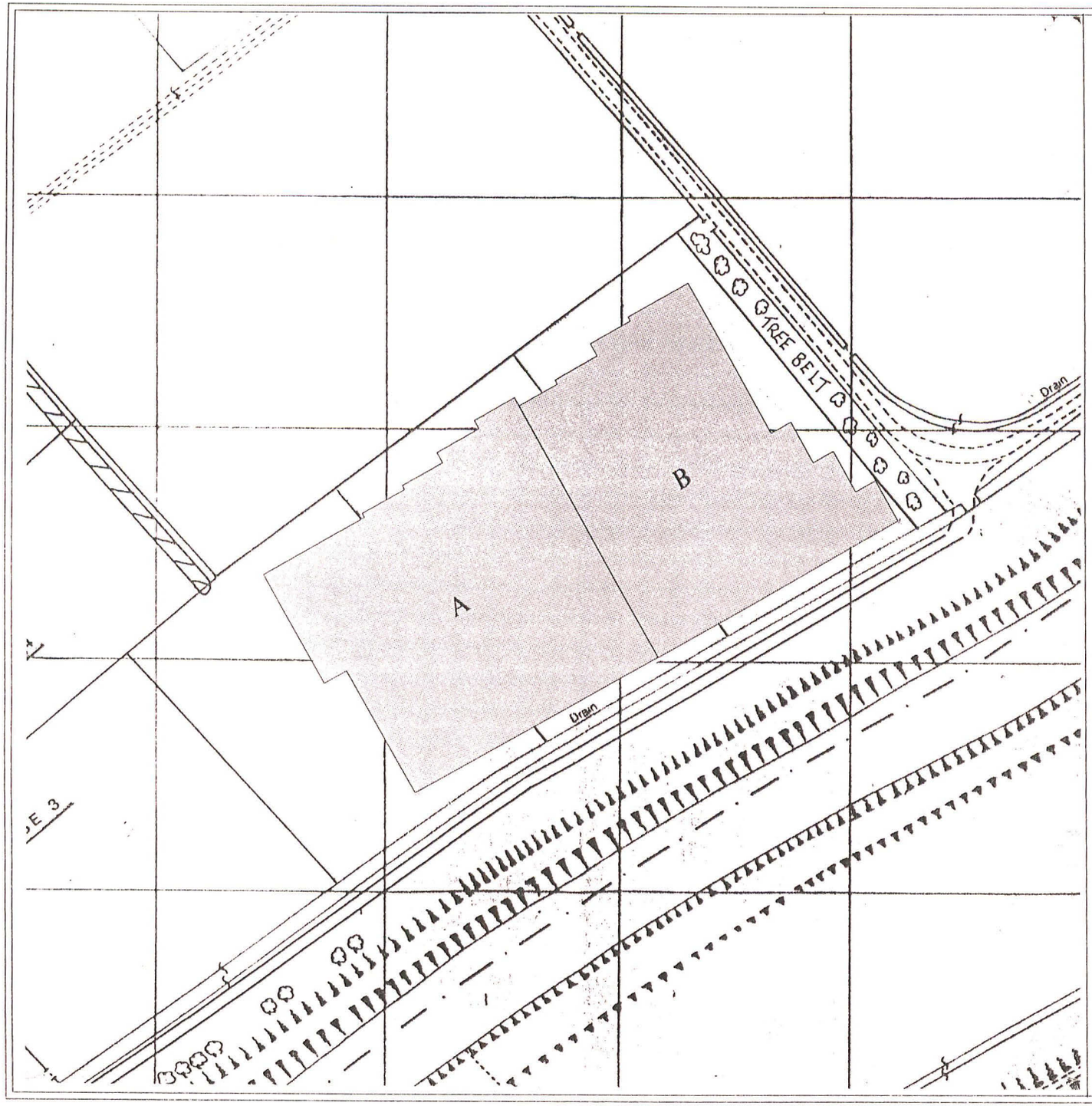


(e) 3-D Mesh

This display joins the data values in both the X and Y axis. The display may be changed by altering the horizontal viewing angle and the angle above the plane. The output may be either colour or black and white. A hidden line option is occasionally used (see (b) above).

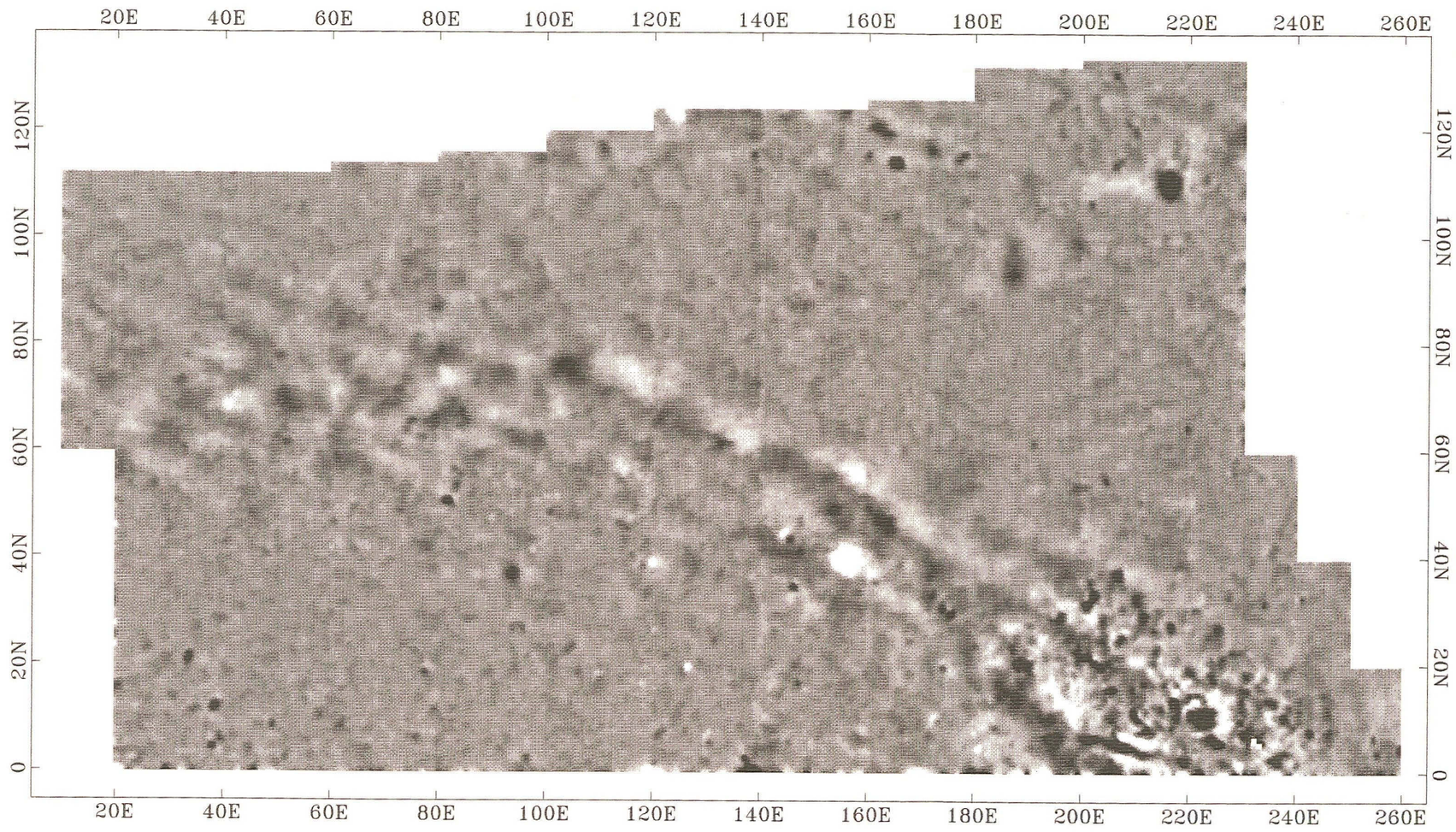
LIST OF FIGURES

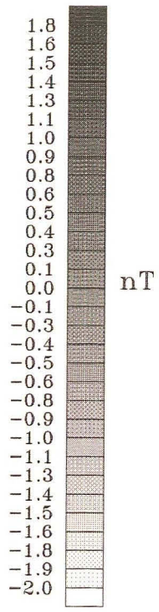
WELLAND BANK PIT
Location of Survey Area

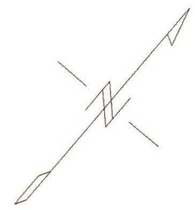


1:2500

Figure 1







Scale 1:1000

10 0 10 20 30 40 50 60

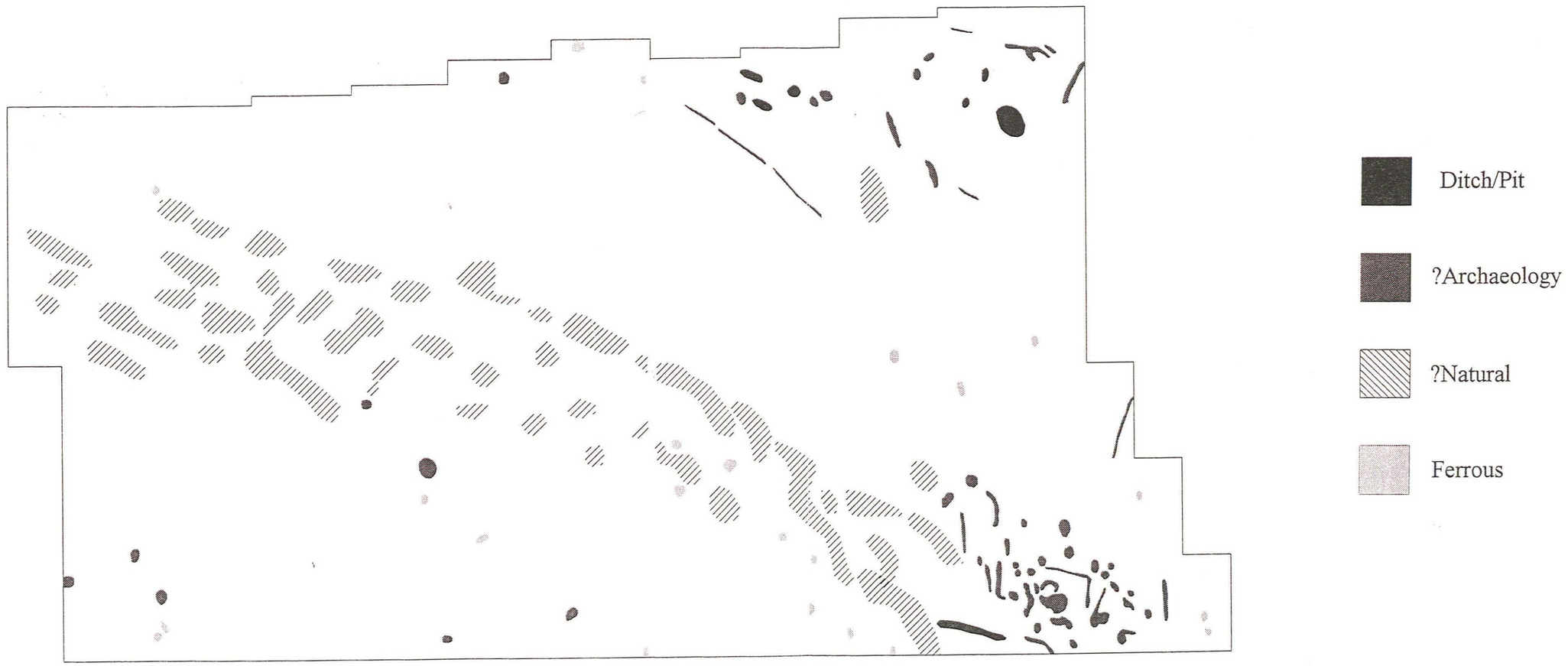
(metres)

WELLAND BANK PIT

Gradiometer Data

Figure 2

WELLAND BANK PIT
Summary Interpretation



Ditch/Pit

?Archaeology

?Natural

Ferrous

0 m 40

Figure 3

WELLAND BANK PIT
Area A

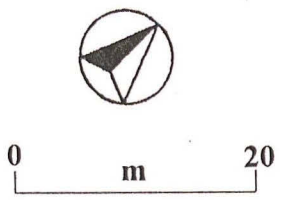
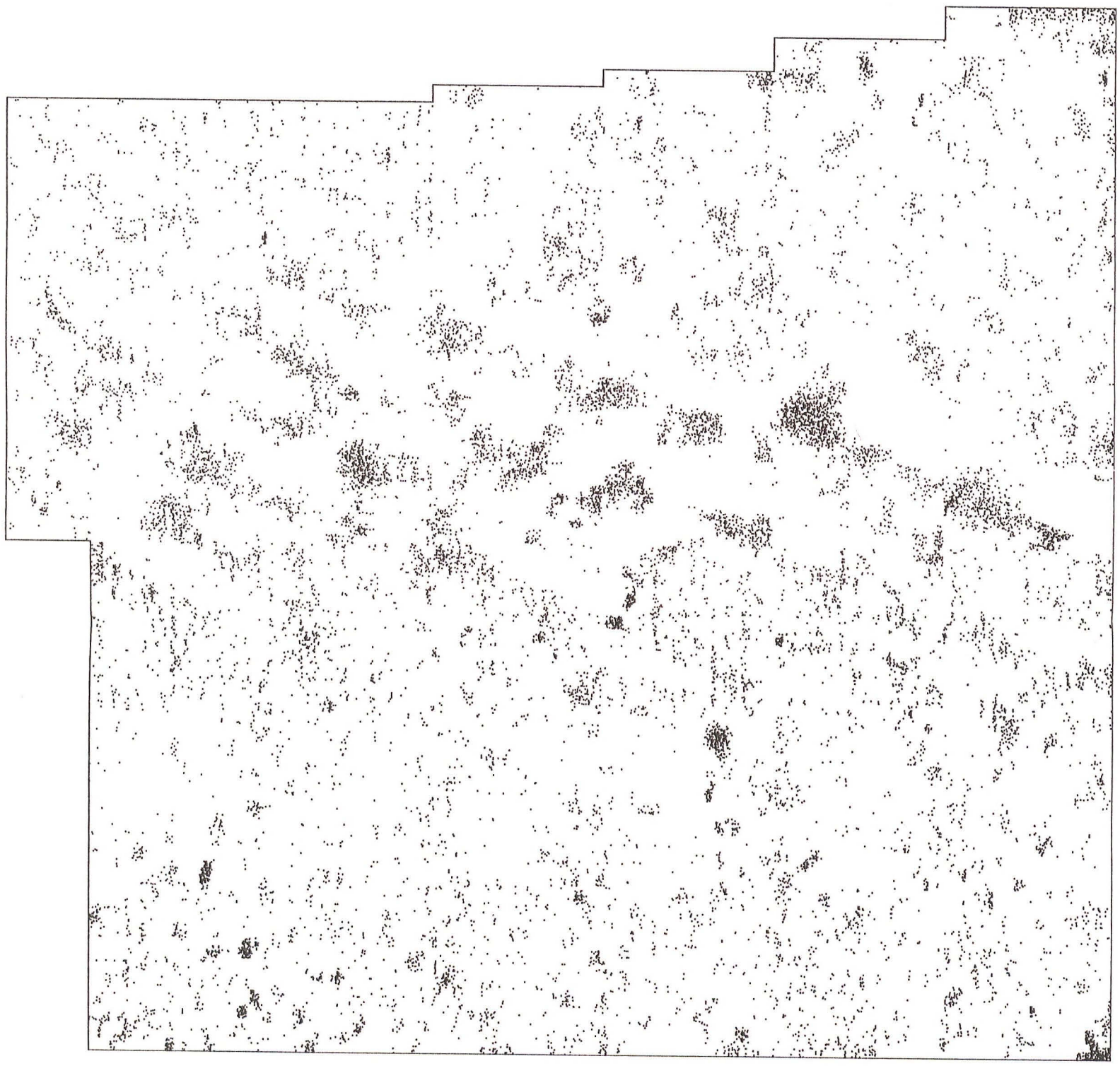


Figure A1

WELLAND BANK PIT
Area A



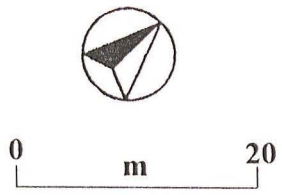


Figure A2

WELLAND BANK PIT
Area A

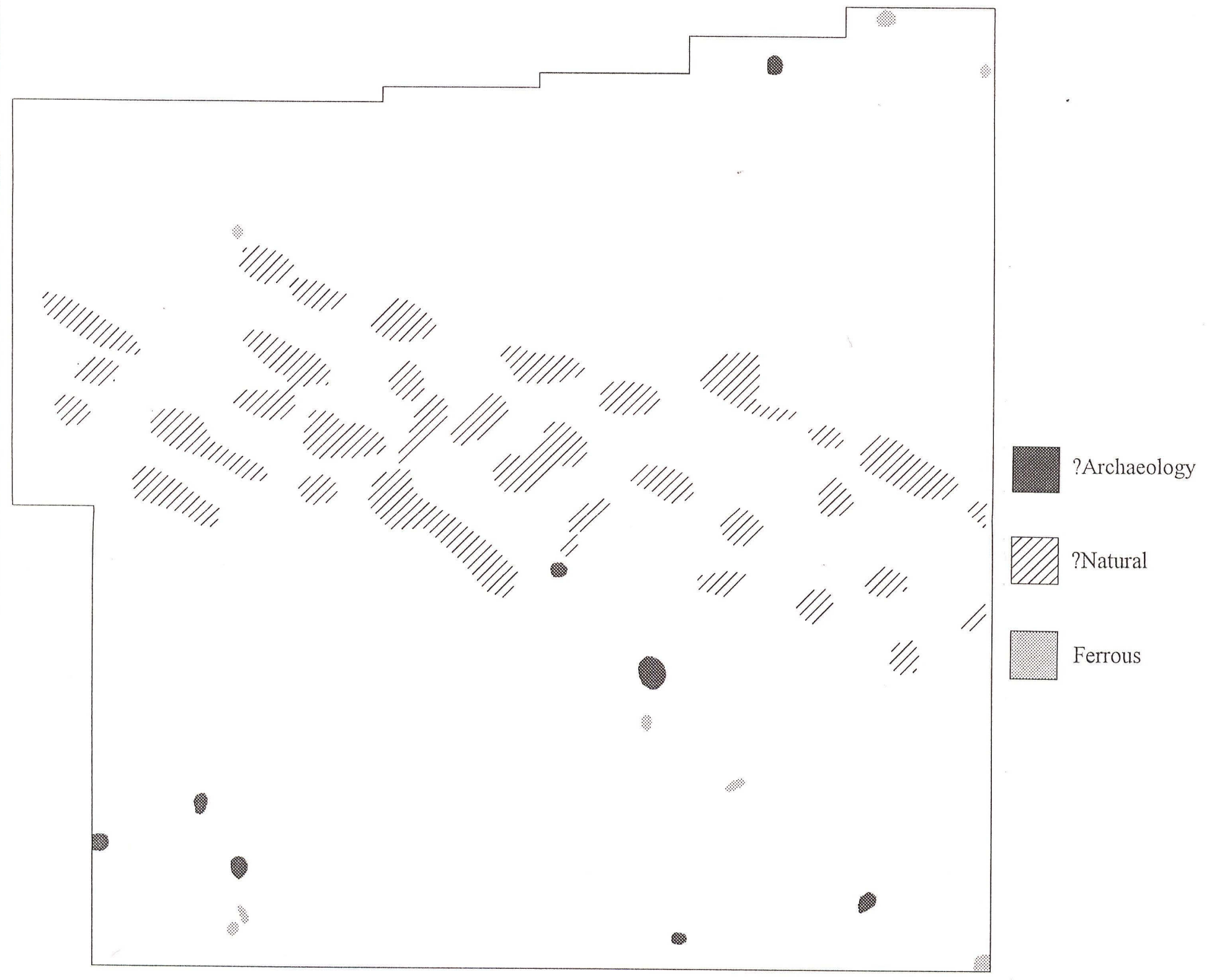


Figure A3

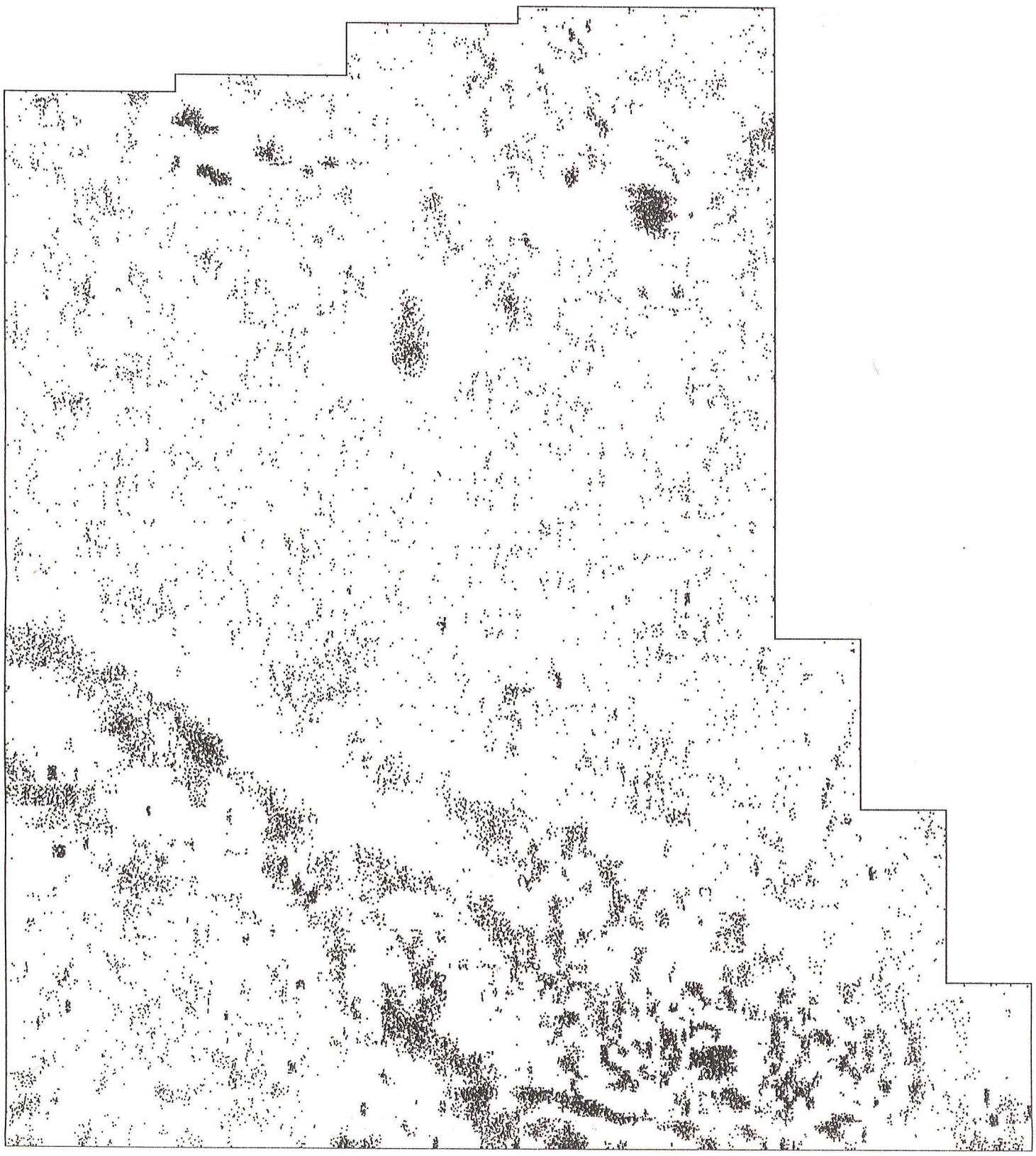
WELLAND BANK PIT
Area B

15 nT

0 m 20

Figure B1

WELLAND BANK PIT
Area B



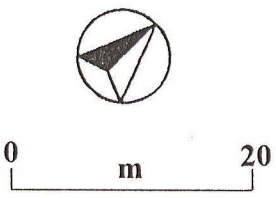


Figure B2

WELLAND BANK PIT
Area B

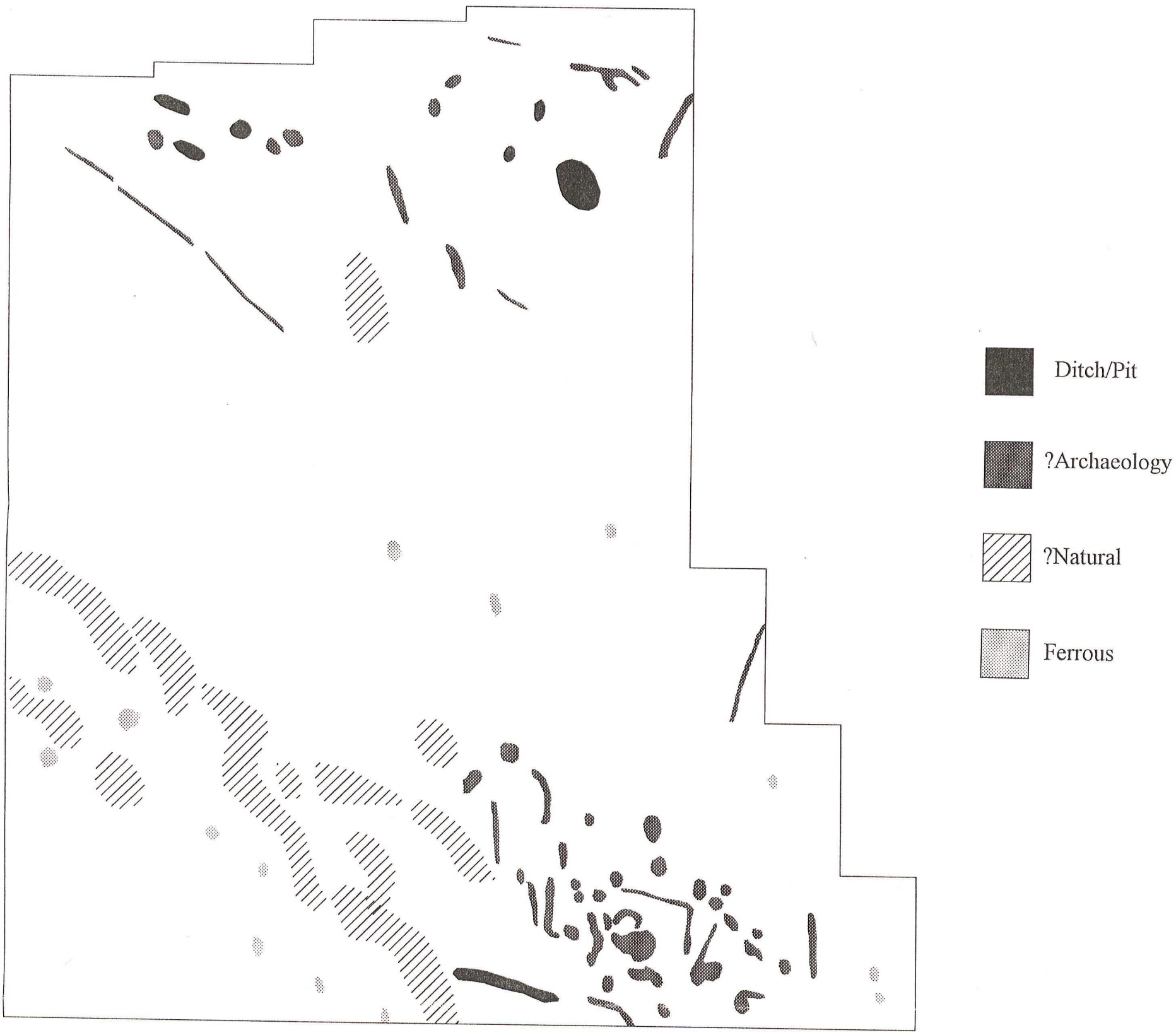


Figure B3