Hatton to Silk Willoughby Proposed Gas Pipeline

ARCHAEOLOGICAL
FIELDWALKING
FIELD RECONNAISSANCE
AND
GEOPHYSICAL SURVEY

RUSKINGTON
AND
KIRKBY LA THORPE

prepared by

NETWORK ARCHAEOLOGY Ltd

for

Mouchel Consulting Ltd

on behalf of

Transco

network
ARCHAEOLOGY LTD

HATTON TO SILK WILLOUGHBY
PROPOSED GAS PIPELINE

ARCHAEOLOGICAL

FIELDWALKING, FIELD RECONNAISSANCE AND

GEOPHYSICAL SURVEY

RUSKINGTON & KIRKBY LA THORPE

VOLUME 1

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1 SUMMARY

1.1 This report presents the results of an archaeological fieldwalking, field reconnaissance and geophysical survey along two sections of the proposed BG Transco Plc natural gas *"Hatton to Silk Willoughby"* pipeline in Lincolnshire.

1.2 Section 1 consists of an approximately 1.7km length running between Fen Road, Ruskington (TF 10305133), and the A153 road to the south (TF 09624980).

1.3 Section 2 consists of an approximately 3.5km length running from the Evedon to Kirkby la Thorpe road crossing point (TF 09824687), to the Silk Willoughby A.G.I (TF 08444374).

1.4 The pipeline is currently scheduled for construction during spring and summer 2001. The construction easement will normally measure 42m.

1.5 Overall, the results of the field surveys agree with those of the archaeological desk-based assessment in that the potential for encountering extensive archaeological sites along the proposed sections is moderately high. This is despite the fact that no effective fieldwalking (50% and above visibility) was possible in Section 1 and only approximately 30% was suitable in Section 2.

1.6 The archaeological fieldwalking, field reconnaissance and geophysical surveys, together with the previous desk-based assessment, have identified a total of thirteen areas of increased archaeological potential associated within Section 1 and nineteen within Section 2.

1.7 *Section 1*
Having considered the combined results of all investigations to date, a new total of two Category C sites, four Category D sites, and seven Category E grade sites have been identified as being directly affected by this section of the proposed pipeline route (Table 1). The term 'site' is used to refer to any discrete area along the proposed pipeline route, with certain or potential archaeology.

Table 1: Summary of Sites Affected by the Proposed Pipeline

	A	B	C	D	E
SECTION 1	0	0	2	4	7
SECTION 2	0	0	5	8	6
Total	0	0	7	12	13

1.8 *Section 2*
Having considered the combined results of all investigations to date, a new total of five Category C, eight Category D, and six Category E grade sites have been identified as being directly affected by this section of the proposed pipeline route (Table 1).

1.9 Recommendations

Ideally all Category C sites identified as a result of these surveys should be avoided. Both these sections, however, have been subject to early investigation because of various engineering restrictions which make re-routing impracticable. All recommendations are, therefore, made on the basis that re-routing is not an option. If, however, this situation should alter, it would be necessary to carry out the same level of archaeological investigation into any previously unsurveyed areas.

Section 1 (Ruskington)
Specific recommendations for further investigation are summarised as follows:

- Both Category C sites (Sites 4 and 5) to be subject to early evaluation by trial trenching, followed by excavation or further mitigation.

- To reduce archaeological risks it is also recommended that three of the Category D sites (Sites 2, 3 and 6) are evaluated by trial trenching in advance of construction, and a provision made for further excavation and/or other mitigation if required.

- Detailed monitoring during construction, with provision for investigation of remaining category D and E sites.

- Permanent presence watching-brief during pipeline construction of the entire route, with provision for the recording of archaeological features and contingency for excavation of ***previously undetected*** sites.

Section 2 (Kirkby la Thorpe)
Specific recommendations for further investigation are summarised as follows:

- All of the Category C sites (Sites 2, 4, 5, 9 and 10) to be subject to early evaluation by trial trenching and a provision made for further excavation or other mitigation if required. In the cases of Sites 2, 4 and 10 there is a high possibility that topsoil stripping and excavation, preferably within a restricted easement, will then be recommended prior to construction.

- To reduce archaeological risks, it is recommended that one of the eight Category D sites (Site 8) is evaluated by trial trenching in advance of construction and a provision made for further excavation or other mitigation if required.

- Detailed monitoring during construction, with provision for investigation of remains encountered, of remaining category D and E sites.

- Permanent presence watching-brief during pipeline construction of the entire route, with provision for the recording of archaeological features and contingency for excavation of ***previously undetected*** sites.

2 INTRODUCTION

2.1 Background

BG Transco Plc is currently planning to construct a *c.* 39 km long pipeline to transport natural gas between the Hatton Compressor Station in Lincolnshire, TF 175 763, and the existing AGI at Silk Willoughby, Lincolnshire, TF 083 437 (Figure 1).

2.1.1 A staged approach has been adopted for the archaeological investigation of this pipeline (see Appendix 1). An Archaeological Desk-Based Assessment was completed by Network Archaeology Ltd (NAL) in December 1999. Two further re-routed sections were then reassessed in March 2000 and the results included as an addendum to the original report. This quantified and assessed the known and potential archaeological resource within a 1km-wide route corridor, and made recommendations for further investigation. The assessment forms the basis of the Archaeology and Heritage section of an Environmental Statement submitted to the DTI under *The Public Gas Transporter Pipe-line Works (Assessment of Environmental Effects) Regulations 1996,* which has been in effect since July 1999.

2.1.2 In March 2000, NAL was commissioned by Mouchel Consulting Ltd on behalf of BG Transco Plc, to conduct a (Stage 3) programme of Field Survey (archaeological fieldwalking, field reconnaissance and geophysical survey) along two sections of the proposed pipeline route (Figure 1). This report (Volume 1), presents the findings of these surveys and makes recommendations for further investigation and mitigation.

2.1.3 The Bartlett-Clarke Consultancy was commissioned by NAL to carry out the archaeogeophysical survey. The report on the geophysical survey forms Volume 2, with the findings summarised within the present report.

2.1.4 Route Sections 1 and 2 will be discussed separately.

2.2 Context of Pipeline Assessments

2.2.1 Linear developments such as pipelines provide an opportunity to examine a transect across a landscape and the evidence of past human activity preserved within it.

2.2.2 Potentially, pipelines can severely impact upon the archaeological resource. Close co-operation between archaeologist and engineer is essential to ensure that the impact on the archaeological resource is minimised.

2.2.3 Identification of archaeological sites at an early stage allows for forward planning of appropriate mitigation measures, such as route modifications, and site-specific investigations in advance of construction.

2.3 Scope of Assessment

2.3.1 The objectives are to:

- consider the cultural heritage implications of the proposed pipeline.
- assist BG Transco Plc in the selection of an archaeologically least-damaging pipeline route.

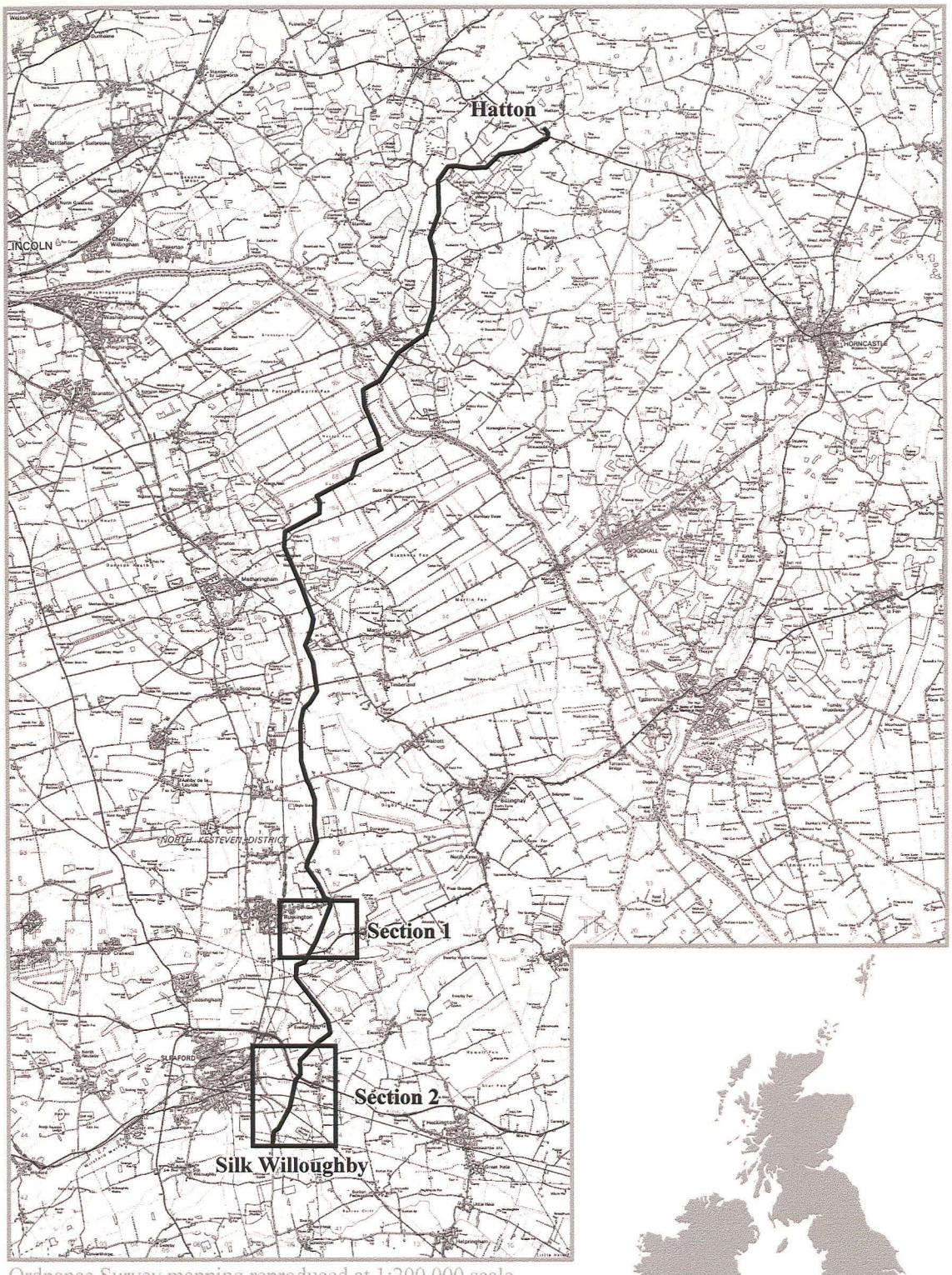

Figure 1: Location of the Pipeline, showing the areas covered by Section 1 and Section 2

- determine the presence or absence, extent, character, condition, quality and date of any sites of archaeological significance along the proposed pipeline route.
- assess the archaeological potential of the pipeline route.
- recommend mitigation measures: avoidance, minimisation of impact or evaluative fieldwork.

SECTION 1 (RUSKINGTON)

3 DESCRIPTION OF THE PIPELINE CORRIDOR

3.1 Location and Topography

3.1.1 The proposed pipeline runs south-west from Fen Road, continuing in this direction to the A153 (Figure 2). It crosses several substantial drainage ditches and a frequently used public footpath/bridle way. The land gently undulates between approximately 5m and 15m AOD.

3.2 Geology, Soils and Land Use

3.2.1 The surface geology and soils vary in this section. The northern half is dominated by heavy Boulder and Oxford clays and the southern half by lighter Sleaford sands and gravels.

3.2.2 The farmland along this stretch is exclusively arable and, at the time of the survey, given over almost entirely to cereal production.

4 SURVEY PROCEDURES

4.1 Establishment of the survey centreline

The survey was positioned in each field by reference to OS co-ordinates measured from the 1:2500 strip maps supplied by Mouchel, and located with a sub-1m accuracy GPS system. Ongoing route modifications were passed on to NAL and the Bartlett-Clarke Consultancy during the survey.

4.2 Fieldwalking Survey

Although all the fields were arable, none were entirely suitable for fieldwalking due either to the presence of unploughed stubble crop or advanced crop growth. Details of each field walked (including weather/light conditions, crop type, ground visibility, relief, walkers present) were recorded on pro-forma record sheets. These will form part of the project archive.

A spread of medieval tile fragments was observed in field 18/5, TF 0974 4997 (Site 5). The location was recorded and a representative sample taken.

4.3 Field Reconnaissance Survey

This was carried out simultaneously with the fieldwalking. It consisted of a visual inspection of the proposed pipeline route, in order to identify any extant earthworks, any significant soil or vegetative changes, present (and former) land use, visible geology, and general topographical variations. Observations were recorded on pro-forma record sheets and will form part of the project archive.

4.4 Geophysical Survey

The geophysical survey was carried out using magnetic susceptibility and continuously recorded magnetometer surveying. These methods were chosen as they provide a much more complete method of surveying a pipeline than the alternative of unrecorded magnetic

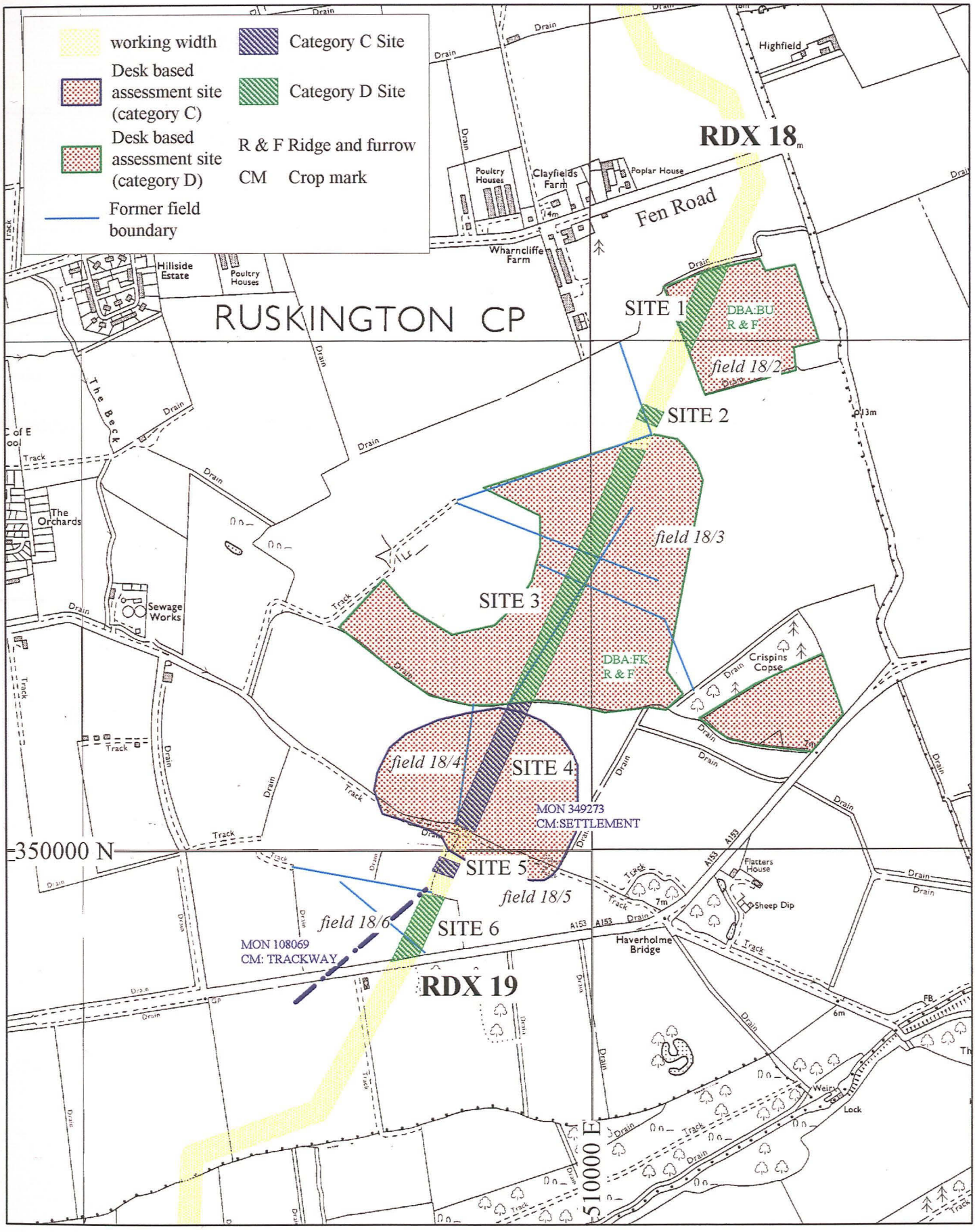

Figure 2: Site locations, Section 1

scanning. The detailed approach is also important to the specific project as the clay soils usually produce only comparatively weak magnetic anomalies, which are extremely difficult to detect by scanning alone.

The magnetometer survey was arranged as a 20m-wide strip along the entire length of Section 1. This provided a slightly less than 50% sample of the 42m wide working width. The magnetometer survey was carried out using Geoscan fluxgate magnetometers.

The susceptibility survey was based on readings taken at 12.5m intervals using Bartington MS2 susceptibility metres with the MS2D field probe.

Additional geophysical survey specification details and grid locations can be found in the separate geophysical survey report (Volume 2).

5 CRITERIA FOR GRADING SITES

Sites identified during the field survey have been graded on two criteria:

- Significance
- Impact

5.1 Significance

In order to provide an indication as to the level of constraint a site might place on the proposed pipeline, each has been categorised in accordance with the system used for the desk-based assessment (NAL 1999, Report 147, Section 7).

Table 2: Site category definitions

	A	B	C	D	E
Description	Legally protected site	Nationally or regionally important site, currently not legally protected	Locally important site, and/or site of uncertain character/date	Other site of uncertain character/date	Isolated find, modern feature
Examples	Scheduled Ancient Monuments and Listed Buildings	Burial sites, historic buildings, settlements e.g. villas, deserted Medieval villages.	Possible settlements, field systems, (e.g. well-preserved ridge & furrow), finds concentrations, former buildings, Roman roads, distinct magnetic anomalies	Ridge and furrow, minor magnetic anomaly clusters, dispersed finds scatters	Single find spots of various dates, inconclusive magnetic anomalies, modern field boundaries, drains & ponds
Mitigation	To be avoided	To be avoided	Avoidance normally recommended or mitigation implemented	Avoidance not recommended at this stage but in some circumstances mitigation applied	Avoidance not recommended at this stage

The inclusion of a site in a particular category often involved a degree of subjective judgement. The categories should not be taken as a statement of fact relating to the archaeological importance or value of a particular site. Categories are not fixed and there is every possibility that the classification of a site may change as a result of findings made during later stages of investigation.

5.2 Impact

5.2.1 The potential impact of the proposed pipeline on the archaeological resource will be:

- *Direct* - physical damage including compaction and/or partial or total removal of deposits

  - severance of archaeological features, in particular linear features

- *Indirect* - visual intrusion, affecting the aesthetic setting of sites or landscape features

  - disturbances caused by vibration, dewatering, change in hydrology, *etc.*

Much of the impact will occur during the construction phase of the proposed pipeline: topsoil stripping, soil storage, movement of heavy machinery, excavation of the pipe trench and easement reinstatement. All of these can have a permanent, damaging effect on the archaeological resource.

5.2.2 The level of impact will vary:

- *Severe (sev):* entire or almost entire destruction of deposits
- *Major (maj):* a high ratio of damage or destruction to deposits
- *Minor (min):* a low ratio of damage to surviving archaeological deposits
- *None (-):* no impact due to distance from the proposed pipeline easement, and/or construction technique
- *Uncertain (Unc):* e.g. because the quality and extent of deposits are unknown, or because construction techniques have not yet been decided.

5.2.3 Factors affecting the significance of impact include:

- the proportion of the site or feature affected
- the integrity of the site or feature; impacts may be reduced if there is pre-existing damage or disturbance of a site
- the nature, potential and heritage value of a site or feature.

6 RELIABILITY AND POTENTIAL LIMITATIONS OF DATA

6.1 The limitations of an archaeological impact assessment on the proposed pipeline include:

- the absence of field survey data for parts of the proposed route.
- the differential levels of "archaeological visibility" along the route. A field in ideal condition for field reconnaissance and geophysical survey may not be suitable for the recovery of finds.
- the lack of clarity surrounding the extent of some sites. This makes it difficult to provide a precise assessment of potential impact.
- the necessity of making subjective interpretations of the archaeological significance of field observations, finds scatters and geophysical anomalies. An absence of surface finds or magnetic anomalies could be a genuine absence, but equally could be the result of a well-preserved site, or poorly responsive geology respectively.

The development of mitigation strategies should take these points into consideration.

7 RESULTS

7.1 Fieldwalking Survey

7.1.1 Six fields were crossed by this section of the proposed pipeline route, with access available throughout. None were suitable for detailed artefact retrieval, due almost entirely to advanced crop growth (Appendix 2).

7.1.3 A sample of medieval roof tile fragments was recovered from the central area of field 18/5, TF 0974 4997 (Site 5). (Appendix 3 - No. 169).

7.2 Field Reconnaissance Survey

7.2.1 No surviving earthworks or significant crop/soil variations were observed.

7.3 Geophysical Survey

7.3.1 The entire length of Section 1 was available for survey. The survey alignment is offset part way across field 18/3 to bring it in to line with a revision of the route. The new line is followed in fields 18/5 and 18/6, but part of 18/4 had already been surveyed on the old line.

7.3.2 The geophysical survey produced results which corresponded with two category C sites (Sites 4 & 5), considered to have a moderately high archaeological potential, and three Category D sites (Sites 2, 3 & 6) with a lesser archaeological potential.

7.3.3 Fields 18/1-3 lie mainly on Boulder clay, and gave low susceptibility readings. Clay deposits are generally only moderately magnetically responsive, so it was crucial that both magnetometer and susceptibility surveys were executed, and their values viewed together. Furthermore, this moderate responsiveness means that many of the weaker readings could be more significant (and therefore have a higher archaeological potential) than the results might otherwise suggest.

7.3.4 It is possible on the weakly magnetic soils along the route that observed magnetic anomalies could be associated with other features which are not clearly detectable, and so the possibility that isolated or unsupported magnetic anomalies are archaeologically significant cannot be fully excluded.

7.3.5 Magnetic susceptibility values varied along the course of the proposed pipeline and in some cases correlated with magnetic anomalies, providing a higher degree of confidence in the interpretation of archaeological significance (Volume 2). Fields in which there are distinct correspondences between magnetometer and susceptibility findings include Sites 4,5 and 6.

7.4 Coincidence of sites found by desk-based assessment, fieldwalking, field reconnaissance and geophysical survey

7.4.1 Fieldwalking, field reconnaissance and geophysical survey are complementary prospecting techniques, the combined results of which can be crucial in interpreting the character of any site. For instance, a site with positive geophysical survey results and no coinciding finds could indicate either that the site is well-preserved, or that the site is prehistoric or Saxon, since pottery of these periods was produced in smaller quantities, and is usually less robust than other pottery. In contrast, a positive geophysical site rich in finds may indicate that the site is currently being truncated and the finds are being incorporated into the ploughsoil.

7.5 Areas with little or no apparent archaeological potential

Some of the proposed pipeline route crosses land with few or no known archaeological remains. Possible reasons for this include low levels of "archaeological visibility" along the route, and/or a genuine absence of archaeological remains at certain points along the pipeline route.

8 ASSESSMENT OF IMPACT AND RECOMMENDATIONS

8.1 General Impact and Recommendations

8.1.1 Sites Impacted by the Pipeline

The following mitigation measures are recommended for archaeological sites impacted by the proposed pipeline:

- **Avoidance**

Every effort should be made to avoid an impact upon significant archaeological remains.

- **Reduction of working width**

Unavoidable impacts should be minimised by reduction of the working width to the minimum practical level with adequate time and provision given to record subsequent archaeological deposits.

- **Evaluation** (Appendix 1 - Stage 4)

Significant archaeological constraints identified by the desk-based assessment and/or field surveys, and which are unavoidable, will require archaeological *evaluation* in advance of construction. Evaluation might involve machine-excavated trenches, hand-dug test-pits and/or hand auguring of specific sites within the proposed working width. The objectives are to confirm the presence or absence of archaeological deposits, to determine their character, extent, date and state of preservation, and to produce a report on the findings.

In certain areas of low/moderate archaeological potential it may be appropriate to carryout controlled topsoil stripping at the start of construction works in order to gain adequate time to follow further mitigation strategies if necessary.

- **Excavation** (Appendix 1 - Stage 5)

It may not be possible or desirable to avoid significant archaeological sites identified by an archaeological evaluation. *Excavation* of any such sites should take place in advance of construction. Excavation involves machine stripping of open areas within the proposed working width followed by archaeological investigation. The objectives are to obtain a full record of the archaeological remains prior to construction, and to produce a report on the findings.

8.1.2 Entire Route

The whole of the pipeline route should be subject to the following:

- **Watching Brief** (Appendix 1 - Stage 6)

A permanent-presence watching brief will be required during all ground disturbing activities of the construction phase of the project, to record unexpected discoveries, and known sites which did not merit investigation in advance of construction. The main phases of monitoring will be topsoil stripping, trench excavation and the opportunistic observation of the pre-construction drainage. The objectives are to obtain a thorough record of any archaeological remains found during construction, and to produce a report on the findings. Contingencies should allow for salvage excavation of significant, unexpected archaeological sites found during construction.

In addition to the pipeline easement, the sites used for associated engineering works should also be included in the watching brief: pipe storage areas, site compounds, road crossing easements and block valve sites.

8.1.3 Post-Construction Work

Following the watching brief, the following should be implemented:

- **Project Archive and Publication** (Appendix 1 - Stage 7)

A post-construction programme for dealing with all finds and records of investigated archaeological remains should be implemented, and, where appropriate, the drafting of articles or notes for publication.

8.1.4 Project Design

The above mitigation measures requiring archaeological investigation, if approved by BG Transco Plc, should form the basis of a project design produced by the archaeological contractor commissioned for each stage.

8.1.5 County Monitoring

The County Archaeologist should be invited to monitor the implementation of the archaeological project design, and should be informed of any significant archaeological sites found at each stage. Provision should be made for the County Archaeologist to monitor fieldwork in progress, and also to visit the construction site.

8.2 Site Specific Impacts and Recommendations

(*see Figure 2 for locations of Sites 1-6*)
Co-ordinates given are to generally locate the features, for exact information of the geophysical anomalies refer to Volume 2.

In the following site tables (3-4) the survey technique which has identified the greatest potential has been placed first.

8.2.1 Category C Sites

The following two Category C sites have a high archaeological potential. To minimise the archaeological risk it is recommended that both are evaluated at the earliest possible opportunity.

Table 3:
Summary of Desk-based Assessment, Fieldwalking, Field Reconnaissance and Geophysical Survey Results

Site No	Strip Map	Field No.	NGR	Description	Impact	Recommended Mitigation
4	36	18/4	TF 0977 5011	DBA: MON349273 cropmark settlement complex (*NAL, Rep. 147, pg. 23*) GEO: distinct linear features, possible pits & high susceptibility values *(Vol. 2, Figs 2 & 7, 18/4)* FR: nothing visible in field FW: not suitable for fieldwalking	D-Maj	Evaluation trenches to be excavated at earliest opportunity, leading to probable recommendation of advanced topsoil stripping and excavation in advance of construction, preferably within a restricted easement.
5	36	18/5	TF 0974 4997	FW: dense scatter of medieval tile GEO: slight increase in susceptibility readings & minor magnetic anomalies *(Vol. 2, Figs 2 & 7, 18/5)* DBA: hypothetical continuation of trackway cropmark DBA:MON 1080693 (*NAL, Rep. 147, pg. 25*) (see Site 6) FR: nothing visible in field	D-Unc	Evaluation trenches to be excavated at earliest opportunity, with provision for further excavation and/or other mitigation as required.

Site 4
Field 18/4 (TF 0977 5011)
DBA: Air photographs revealed cropmarks of an undated settlement complex, including several small enclosures and probable pits, within a possible major defensive boundary (DBA:MON 349273). The quality of the air photographs is poor and the area is generally confused with marks caused by background geology and drainage patterns (*NAL, Rep. 147, pg. 23*).
GEO: The magnetometer plot shows two distinct linear features which could be consistent with the presence of enclosures, and other smaller anomalies which could represent pits. These are not very concentrated across much of the field, although susceptibility values are high throughout. The likelihood that at least some archaeological features will be encountered in this field is therefore high *(Vol. 2, Figs 2 & 7, 18/4)*.
FR: Field reconnaissance detected no apparent earthworks in the field.
FW: Advanced crop growth prevented fieldwalking.
Impact: Direct, major.

Recommendations: Evaluation trenches to be excavated at earliest opportunity to allow for detailed assessment of remains i.e. type, significance, level of preservation, potential costs etc. Given the high probability of encountering significant archaeological deposits it is likely that advanced topsoil stripping and excavation will then be recommended, preferably within a restricted easement.

Site 5

Field 18/5 (TF 0974 4997)

FW: Fieldwalking identified a dense scatter of medieval, 13th - 16th C, roofing tile. Advanced crop growth, however, restricted artefact retrieval to a small sample from the centre of the plot (Appendix 3, No. 169).

GEO: The tile scatter corresponds to a slight increase in magnetic susceptibility readings, and very minor magnetic anomalies. A magnetometer survey will not necessarily respond to such small scale structural features as stone wall footings, post holes or foundation trenches, and it may therefore be the case that the remains of an isolated stone or timber farm building will not create any strong magnetic disturbances *(Vol. 2, Figs 2 & 7, 18/5)*.

DBA: The location of this scatter corresponds with the hypothetical continuation of a trackway cropmark visible to the south-west (MON 1080693, see Site 6 for details).

FR: Nothing visible within this field.

Impact: Direct, uncertain.

Recommendations: Evaluation trenches to be excavated at earliest opportunity, with provision for further excavation and/or other mitigation as required.

8.2.2 Category D sites

The following four Category D sites have a moderate archaeological potential. To minimise the archaeological risk it is recommended that three of the sites (Sites 2, 3 and 6) are evaluated prior to construction works.

Table 4 :
Summary of Desk-based Assessment, Fieldwalking, Field Reconnaissance and Geophysical Survey Results

Site No.	Strip Map	Field No.	NGR	Description	Impact	Recommended Mitigation
1	35	18/2	TF 1029 5102	DBA:BU ridge & furrow & field enclosure cropmarks - LCC AP 1971 (*NAL, Rep 147, pg. 28*) FR: nothing visible in field GEO: no significant results FW: not suitable for fieldwalking	D-Min	Detailed monitoring during construction watching brief, with provision for further excavation and/or other mitigation as required.
2	35/ 36	18/3 A	TF 1012 5083	GEO:magnetometer survey detected a group of features, including a linear anomaly, at the northern end of this field (*Vol. 2, Fig 7, 18/3A*) FR: nothing visible in field FW: not suitable for fieldwalking	Unc	Evaluation trench to be excavated in advance of construction, with provision for further excavation and/or other mitigation as required.

Site No.	Strip Map	Field No.	NGR	Description	Impact	Recommended Mitigation
3	35/ 36	18/3	TF 0998 5044	DBA:FK ridge & furrow & field enclosure cropmarks - AP 1975 (*NAL, Rep 147, pg. 28*) GEO: scattered magnetic anomalies but only one possible pit-like feature (*Vol.. 2, Fig 2, 18/3*) FR: nothing visible in field FW: not suitable for fieldwalking	D-Unc	Evaluation trench to be centred on pit-like anomaly in advance of construction, with provision for further excavation and/or other mitigation as required.
6	36	18/6	TF 0966 4985	GEO: raised susceptibility values & one pit-like anomaly (*Vol.. 2, Figs 2 & 7, 18/6*) DBA: MON1080693, cropmark of probable trackway to west of proposed route, undated (*NAL, Rep 147, pg. 25*) FR: nothing visible within field FW: not suitable for fieldwalking	D-Unc	Evaluation trenches to be excavated prior to construction, with provision for further excavation and/or other mitigation as required.

Site 1

Field 18/2 (TF 1029 5102)

DBA: The desk-based assessment identified an area of possible cropmark field enclosures and ridge and furrow cultivation (DBA:BU) (*NAL, Rep 147, pg. 28*).

GEO: No significant results were obtained.

FR: Nothing visible within this field.

FW: Not suitable for fieldwalking due to stubble cover.

Impact: Direct, minimum

Recommendations: Detailed monitoring during construction with appropriate excavation and recording of all archaeological deposits.

Site 2

Field 18/3A (TF 1012 5083)

GEO: A group of anomalies were identified which align with a ditch to the west, and could well represent a former field boundary. Route modifications made during the course of the survey mean these results now only cover the western edge of the currently proposed route. It appears likely, however, that these features continue to the east (*Vol.. 2, Fig 7, 18/3A*).

Impact: Uncertain

Recommendations: Given the generally poor responsiveness of Boulder clay geology it is possible that this relatively modest group of geophysical anomalies may be associated with more significant archaeological remains. It is, therefore, recommended that an evaluation trench is to be excavated in advance of construction, with provision for further excavation and/or other mitigation as required.

Site 3

Field 18/3 (TF 0998 5044)

DBA: The desk-based assessment identified an area of possible cropmark field enclosures and ridge and furrow cultivation covering approximately the southern two-thirds of this field (DBA:FK) (*NAL, Rep 147, pg. 28*).

GEO: Although there are a number of scattered magnetic anomalies which could represent bricks or iron, there is only one distinct pit-like anomaly towards the southern end (*Vol. 2, Fig 2, 18/3*).
Impact: Direct, uncertain
Recommendations: Once more, given the generally poor responsiveness of the underlying Boulder clay geology, it is possible that this single geophysical anomalies may be associated with more significant archaeological remains. It is, therefore, recommended that at least one evaluation trench is excavated over the pit-like anomaly in advance of construction, with provision for further excavation and/or other mitigation as required. The remainder of the area should be subject to detailed monitoring during construction with appropriate excavation and recording of all archaeological deposits.

Site 6
Field 18/6 (TF 0966 4985)
GEO: This field gave comparatively high magnetic susceptibility values and one possible pit-like anomaly (*Vol. 2, Figs 2 & 7, 18/6*).
DBA: Aerial photographs show a trackway cropmark defined by a pair of parallel ditches immediately to the north-west of the proposed pipeline. A possible third ditch is also visible near the centre. This cropmark is visible for a distance of approximately 350m and is of uncertain date (DBA:MON1080693) (*NAL, Rep. 147, pg. 25*).
FR: Nothing visible within this field.
FW: Not suitable for fieldwalking due to advanced crop growth.
Impact: Direct, uncertain
Recommendations: Given the proximity of significant cropmarks and the comparatively high susceptibility readings, it is recommended that at least one evaluation trench is excavated over the pit-like anomaly in advance of construction, with provision for further excavation and/or other mitigation as required. The remainder of the area should be subject to detailed monitoring during construction with appropriate excavation and recording of all archaeological deposits.

8.2.3 Category E Sites

Seven probable former field boundaries were noted as Category E sites in the desk-based assessment (*NAL, Rep. 147, Map 6*). These remain of low archaeological potential.
Recommendations: Detailed monitoring should take place during topsoil stripping, with provision for further excavation and/or other mitigation as required.

SECTION 2 (KIRKBY LA THORPE)

3 DESCRIPTION OF THE PIPELINE CORRIDOR

3.1 Location and Topography

3.1.1 This section of the proposed pipeline runs south-west from the Evedon Road road crossing to the Silk Willoughby AGI, a distance of approximately 3.8km (Figure 3). It crosses two major roads, the A17 and A1121, as well as two active railway lines. Several substantial drainage ditches and two public footpaths are also crossed. The land is low lying and of low relief, with ground elevations in the area of 10m AOD.

3.2 Geology, Soils and Land Use

3.2.1 The surface geology and, therefore, the soils in this section vary. The majority of the section is dominated by light Sleaford and Kellaway sands and gravels, although the northern and southernmost extremes consist of heavy Boulder and Oxford clays.

3.2.2 The farmland along this stretch is almost entirely arable but with some pasture to the north-west of Kirkby la Thorpe.

4 SURVEY PROCEDURES

4.1 Establishment of the Survey Centreline

See Section 1.

4.2 Fieldwalking Survey

Although the majority of the fields were arable, most were unsuitable for effective fieldwalking due to the presence of unploughed stubble crop, advanced crop growth or pasture. Only approximately 30% of the ground within this section had a fieldwalking visibility of at least 50%.

Fieldwalking was carried out by a team of archaeologists walking at 10m spacings within each field. Five traverses were walked, centred on the proposed pipeline. This gave a 40m-wide survey area. Details of each field walked (including weather/light conditions, crop type, ground visibility, relief, walkers present) were recorded on pro-forma record sheets. These will form part of the project archive.

Recovered artefacts from individual transects were given a unique alpha-numeric reference and were located using hand-tapes and marked on the 1:2500 strip maps.

All artefacts were collected unless of certain modern date.

4.3 Field Reconnaissance Survey

See Section 1.

Figure 3: Site locations, Section 2

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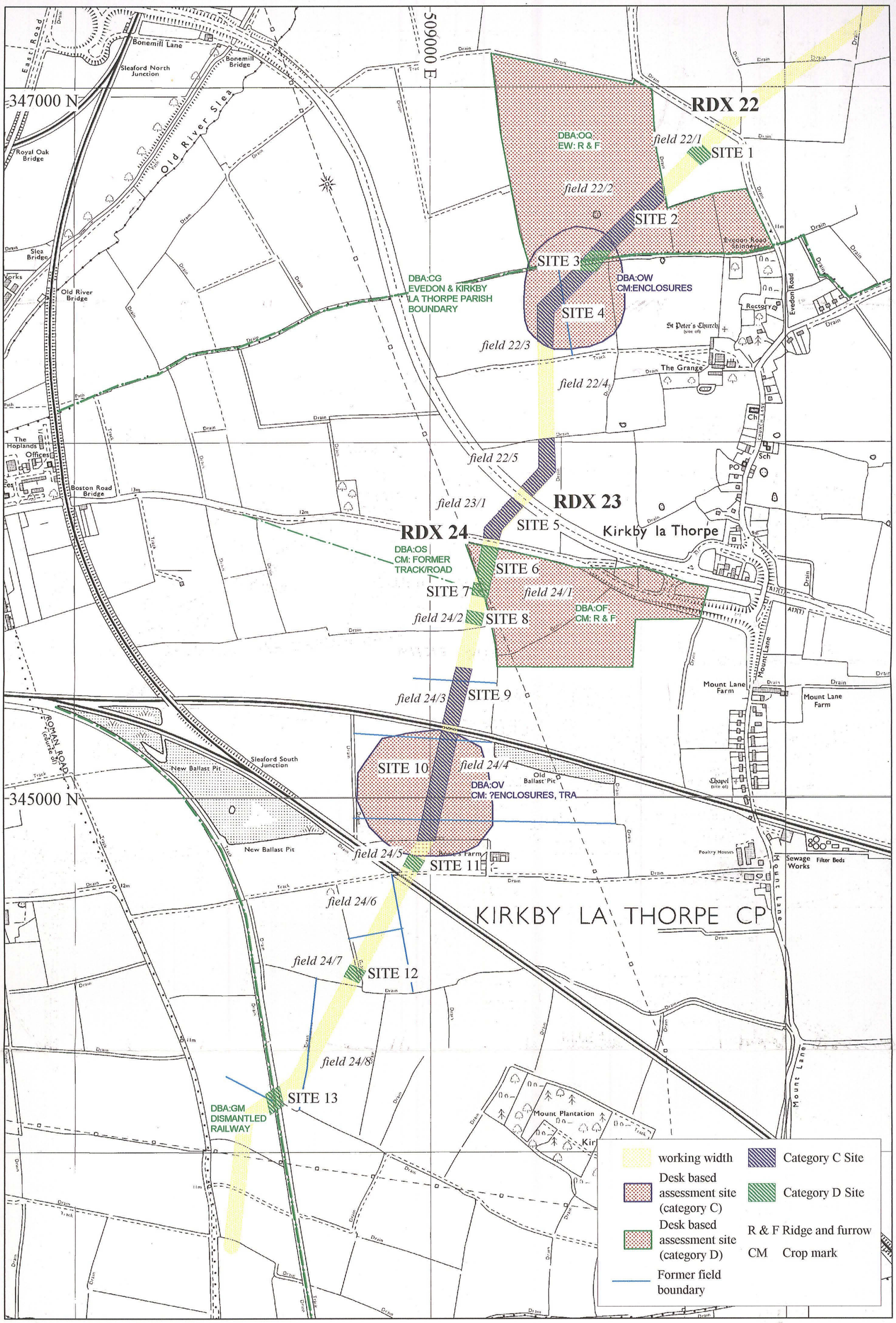


4.4 Geophysical Survey

See Section 1.

5 CRITERIA FOR GRADING SITES

See Section 1.

6 RELIABILITY AND POTENTIAL LIMITATIONS OF DATA

See Section 1.

7 RESULTS

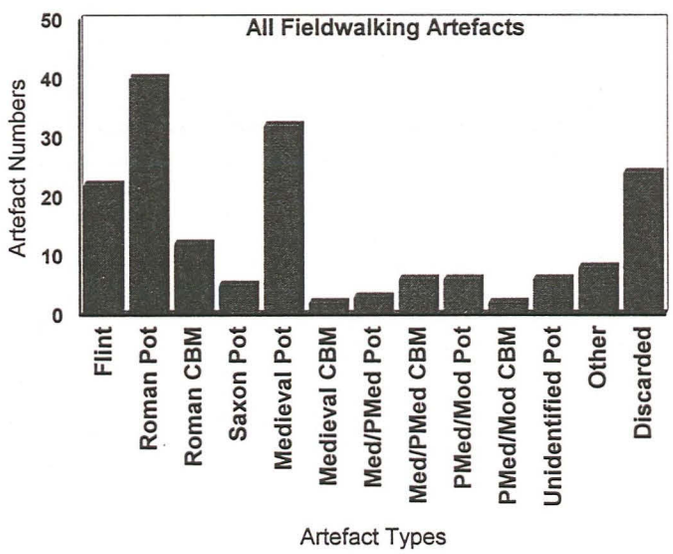
7.1 Fieldwalking Survey

7.1.1 Sixteen fields were crossed by this section of the proposed pipeline route, with access available throughout. Approximately 30% were suitable for detailed artefact retrieval i.e.. had a ground visibility of 50% or more (Appendix 2).

7.1.2 Many of the arable fields had only recently been ploughed and harrowed, therefore giving them little time to weather. Weathering by rain and frost will break down the lumps of soil and will make artefacts more easily recognisable and recoverable.

7.1.3 One hundred and sixty-eight artefacts were recovered, twenty-four of which were later discarded (Figure 4). The majority of these are Roman and medieval pottery sherds. There is a small, but significant, quantity of Saxon pottery.

Figure 4: Fieldwalked Artefacts, Section 2



7.1.4 One multi-period (Late Neolithic-Bronze Age/Roman/Saxon/Medieval), one Roman and one Medieval artefact scatter have been identified. These lie in fields 22/2 (Site 2), 23/1 (Site 5) and 24/5 (Site 11) respectively. These will be discussed below under their individual site numbers.

7.1.5 Occasional finds of mainly Roman and medieval pottery sherds occur throughout and are probably the result of past manuring practices and/or poor ground visibility.

7.1.6 A concentration of Post-Medieval pantile fragments was noted in field 24/7 (Site 12) but no sample was collected.

7.2 Field Reconnaissance Survey

7.2.1 No surviving earthworks or significant crop/soil variations were observed.

7.3 Geophysical Survey

7.3.1 The entire length of Section 2 was surveyed. The survey follows a revised route in field 22/3.

7.3.2 The geophysical survey produced results corresponding to all five Category C sites (Sites 2, 4, 5, 9 and 10)), considered to have a high archaeological potential, and four Category D sites (Sites 1, 8, 12 & 13) with a lesser archaeological potential.

7.3.3 Field 22/1 is on Boulder clay and gave low susceptibility readings. Clay deposits are generally only moderately magnetically responsive, so it was crucial that both magnetometer and susceptibility surveys were executed, and their values were viewed together. Furthermore, this moderate responsiveness means that many of the weaker readings could be more significant (and therefore have a higher archaeological potential) than the results might otherwise suggest.

7.3.4 It is possible on the weakly magnetic soils along the route that observed magnetic anomalies could be associated with other features which are not clearly detectable, and so the possibility that isolated or unsupported magnetic anomalies are archaeologically significant cannot be fully excluded.

7.3.5 Magnetic susceptibility values varied along the course of the proposed pipeline and in some cases correlated with magnetic anomalies, providing a higher degree of confidence in the interpretation of archaeological significance (Volume 2). Fields in which there are distinct correspondences between magnetometer and susceptibility findings include Sites 2, 4, 8, 9 and 10.

7.4 Coincidence of sites found by fieldwalking, field reconnaissance and geophysical survey

7.4.1 Fieldwalking, field reconnaissance and geophysical survey are complementary prospecting techniques, the combined results of which can be crucial in interpreting the character of any site. For instance, a site with positive geophysical survey results and no coinciding finds may indicate either that the site is well-preserved, or that the site is prehistoric or Saxon, since pottery of these periods was produced in smaller quantities, and is usually less robust than other pottery. In contrast, a positive geophysical site rich in finds may indicate that the site is currently being truncated and the finds are being incorporated into the ploughsoil.

7.4.2 Where fields were suitable for accurate fieldwalking (ground visibility of 50% and above) there was a high level of coincidence between sites marked by artefact scatters and those highlighted through geophysical survey anomolies (Sites 2, 5, 11 and 12). Unfortunately approximately 90% of this section was unsuitable for fieldwalking, so relatively few finds scatters were actually identified, as compared with the number of geophysical survey sites.

7.5 Areas with little or no apparent archaeological potential

Some of this proposed pipeline section crosses land with few or no known archaeological remains. Possible reasons for this include low levels of "archaeological visibility" along the route, and/or a genuine absence of archaeological remains at certain points along the pipeline route.

8 ASSESSMENT OF IMPACT AND RECOMMENDATIONS

8.1 General Impact and Recommendations

See Section 1

8.2 Site Specific Impacts and Recommendations

(*see Figure 3 for locations of Sites 1-13*), co-ordinates given are to generally locate the sites, for exact information of the geophysical anomalies refer to Volume 2. In the following site tables (5-6) the survey technique which has identified the greatest potential has been placed first.

8.2.1 Category C Sites

The following five Category C sites have a high archaeological potential. To minimise the archaeological risk it is recommended that all are evaluated at the earliest possible opportunity.

Table 5:
Summary of Desk-based Assessment, Fieldwalking, Field Reconnaissance and Geophysical Survey Results

Site No	Strip Map	Field No.	NGR	Description	Impact	Recommended Mitigation
2	41	22/2	TF 0955 4660	FW: Multi-period artefact scatter GEO: increased susceptibility readings, linear anomalies & possible pits (*Vol.. 2, Figs 3 & 8*) DBA:OQ ridge and furrow cropmarks, AP's 1947& 1966 (*NAL, Rep 147, Addendum pg. xv*) FR: nothing visible within field	D-Unc	Evaluation trenches to be excavated at earliest opportunity, leading to probable recommendation of advanced topsoil stripping and excavation in advance of construction, preferably within a restricted easement.
4	41/ 42	22/3	TF 0937 4642	DBA:OW undated rectilinear enclosure cropmarks, LCC AP 1971 (*NAL, Rep 147, Addendum pg. xiii*) GEO: increased susceptibility readings, linear anomalies & possible pits (*Vol. 2, Figs 3 & 8*) FR: nothing visible in field FW: not suitable for fieldwalking	D-Unc	Evaluation trenches to be excavated at earliest opportunity, leading to probable recommendation of advanced topsoil stripping and excavation in advance of construction, preferably within a restricted easement.
5	42	22/5 & 23/1	TF 0932 4583	FW: Romano-British pottery scatter GEO: distinct linear anomalies suggestive of field system & pit-like features (*Vol. 2, Figs 4 & 8*) FR: nothing visible in field	D-Unc	Evaluation trenches to be excavated at earliest opportunity, with provision for further excavation and/or other mitigation as required.
9	42/ 43	24/3	TF 0903 4505	DBA:MON 1049484 rectilinear enclosure cropmark (*NAL, Rep 147, Addendum pg. xiv*) GEO: high susceptibility readings & a linear anomaly (*Vol. 2, Figs 5 & 9*) FR: nothing visible in field FW: not suitable for fieldwalking	D-Unc	Evaluation trenches to be excavated at earliest opportunity, with provision for further excavation and/or other mitigation as required.

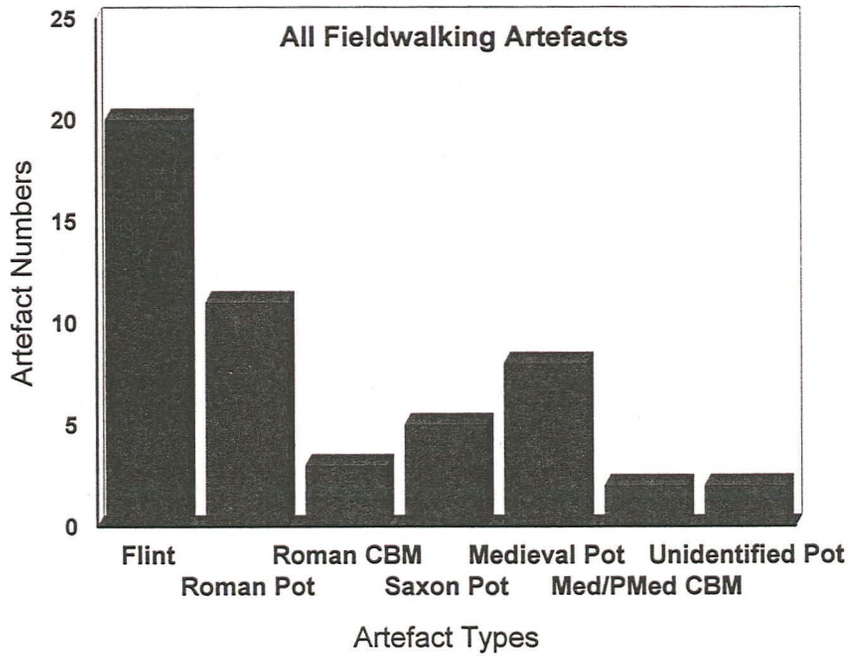
Site No	Strip Map	Field No.	NGR	Description	Impact	Recommended Mitigation
10	43	24/4	TF 0903 4505	DBA:OV cropmarks of ? enclosures/tracks, AP 1996 (*NAL, Rep 147, Addendum pg. xiii*) GEO: high susceptibility readings, increased magnetometer readings (*Vol. 2, Figs 5 & 9*) FR: nothing visible in field FW: not suitable for fieldwalking	D-Unc	Evaluation trenches to be excavated at earliest opportunity, leading to probable recommendation of advanced topsoil stripping and excavation in advance of construction, preferably within a restricted easement.

Site 2

Field 22/2 (TF 0955 4660)

FW: a multi-period artefact scatter was detected under ideal fieldwalking conditions (100% visibility). The finds are summarised in Figure 5 below and plotted alongside the geophysics results in Figure 6:

Figure 5 : Summary of Artefacts Recovered, Site 2



Flints- apart from two possible Mesolithic pieces, the entire flint assemblage was characteristic of the Late Neolithic/Bronze Age period and suggests a high level of activity in the area.

Roman Artefacts- the pottery consisted of everyday domestic wares, some of which were fairly abraded. These may be a by-product of manuring practices as much as an indication of direct occupation.

Saxon Pottery - although small in number these pottery sherds could be highly significant. Saxon pottery is relatively rarely and a small quantity found in these conditions can be disproportionate to the actual level of activity in the area. For example, a single Saxon pottery sherd found during fieldwalking to the east of Kirkby la Thorpe coincided with the location of a 7th C inhumation cemetery discovered during pipeline construction.

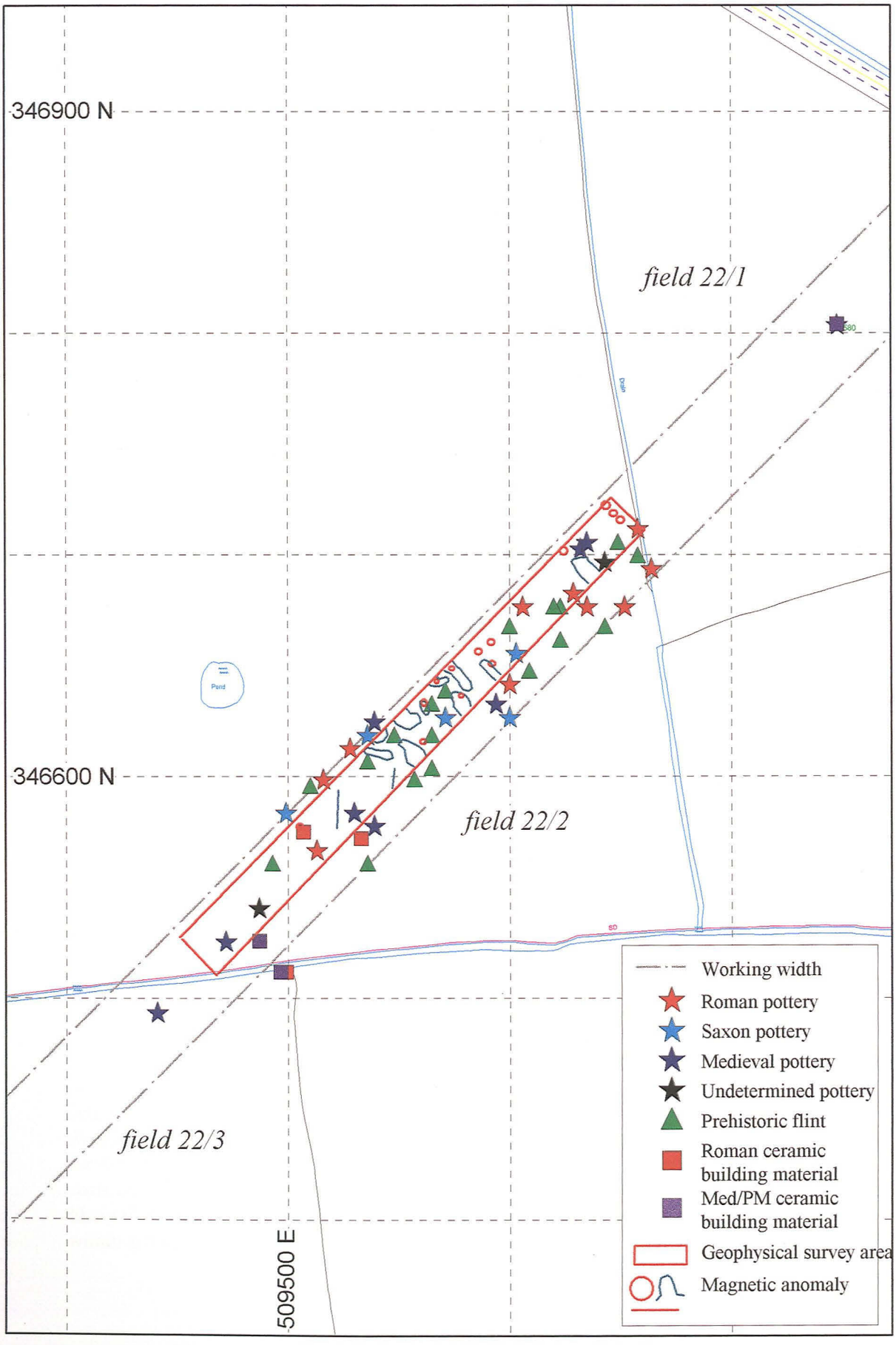


Figure 6: Site 2, Section 2, Geophysical and fieldwalking results

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Medieval Artefacts - these consisted primarily of locally produced domestic wares of the 13th-14th C, some of which were fairly abraded. These are more likely to be the result of manuring practices around the medieval village of Kirkby than an indication of direct occupation.
CBM - there was insufficient ceramic building material (brick & tile) to suggest the presence of buildings utilising these materials. It should be remembered, however, that substantial structures are often constructed using more perishable materials.
GEO: There was a very distinct increase in susceptibility readings in this field. The magnetometer findings are not, however, easy to interpret. The plot shows some linear and other features which could be ditches or ridge and furrow, perhaps with some pits, but there are also broad positive magnetic anomalies which are large enough to be natural (Figure 6). The geological map shows clay at this point, but broad variations in magnetic response are often seen when the depth of the topsoil varies above an uneven gravel subsoil. It could therefore be the case that there are both archaeological and natural contributions to the survey response in this field (*Vol.. 2, Fig 3 & 8*).
DBA: Aerial photographs from 1947 and 1966 show cropmark evidence of ridge and furrow cultivation. This is highly likely to be associated with agricultural activity around medieval Kirkby (*NAL, Rep 147, Addendum*).
FR: no upstanding earthworks or soil marks were visible in this field.
Impact: Direct, uncertain.
Recommendations: Evaluation trenches to be excavated at the earliest opportunity to allow for detailed assessment of remains i.e. type, significance, level of preservation, potential costs etc. Given the high probability of encountering significant archaeological deposits it is likely that advanced topsoil stripping and excavation will then be recommended, preferably within a restricted easement.

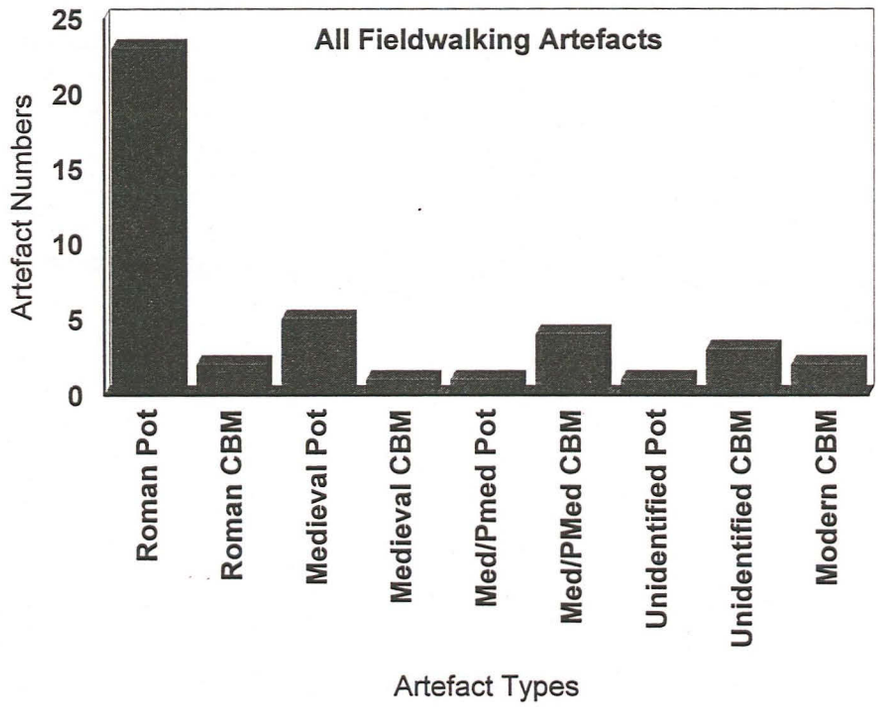
Site 4
Field 22/3 (TF 0937 4642)
DBA: Lincoln County Council aerial photographs (1971) show an indistinct cluster of small rectilinear enclosure cropmarks to the north-west of the village. No date is known but similarly size cropmarks can be seen immediately to the west of the site of St. Peter's church. The latter are thought to represent remains of medieval croft boundaries and a similar interpretation was therefore hypothesised for this site (*NAL, Rep 147, Addendum pg. xiii*).
GEO: Enhanced susceptibility readings are associated with ditch-like linear anomalies and possible pits. One large anomaly at the northern end of the field may be geological (*Vol. 2, Figs 3 & 8*).
FR: no upstanding earthworks were visible in this field.
FW: a mixture of unweathered arable and pasture meant that visibility was very poor in this field. However, one Late Neolithic/Bronze Age flint, one sherd of Roman pot and one sherd of medieval pot were recovered. Retrieval conditions were too poor, however, to draw any conclusions from this assemblage.
Impact: Direct, uncertain.
Recommendations: Evaluation trenches to be excavated at the earliest opportunity to allow for detailed assessment of remains i.e. type, significance, level of preservation, potential costs etc. Given the high probability of encountering significant archaeological deposits it is likely that advanced topsoil stripping and excavation will then be recommended, preferably within a restricted easement.

Site 5

Field 22/5 & 23/1 (TF 0932 4583)

FW: a significant scatter of principally Romano-British material was detected under moderate - good fieldwalking conditions (22/5 = *c.* 50% visibility, 23/5 = 50-75% visibility). The finds are summarised in Figure 7 below and plotted alongside the geophysics results in Figure 8:

Figure 7: Summary of Artefacts Recovered, Site 5



Roman Artefacts- the majority of the finds were recovered from field 23/1 where visibility was better. The pottery consisted of everyday domestic wares, although one fragment of high status Samian ware was collected. As well as the positively identified Roman CBM there were a number of 'unidentified' fragments which could be either Roman or Late Post-medieval. However, there was insufficient ceramic building material (brick & tile) to suggest the presence of buildings utilising these materials. Several oyster and mussel shells were also noted, suggesting dietry waste products.

As with Site 4, these artefacts may be a by-product of manuring practices - although in this case the possibility of more direct activity in the area seems more likely.

Medieval Artefacts - these consist primarily of locally produced domestic wares of the 13th C. These are more likely to be the result of manuring practices than an indication of direct occupation.

GEO: both fields produced distinct linear anomalies which could well indicate traces of a former field system. There may also be rather inconclusive pit-like features and a probable geological anomaly in field 23/1 (*Vol. 2, Figs 4 & 8*).

FR: no upstanding earthworks or distinctive soil marks were visible in this field.

Impact: Direct, uncertain.

Recommendations: Evaluation trenches to be excavated at earliest opportunity, with provision for further excavation and/or other mitigation as required.

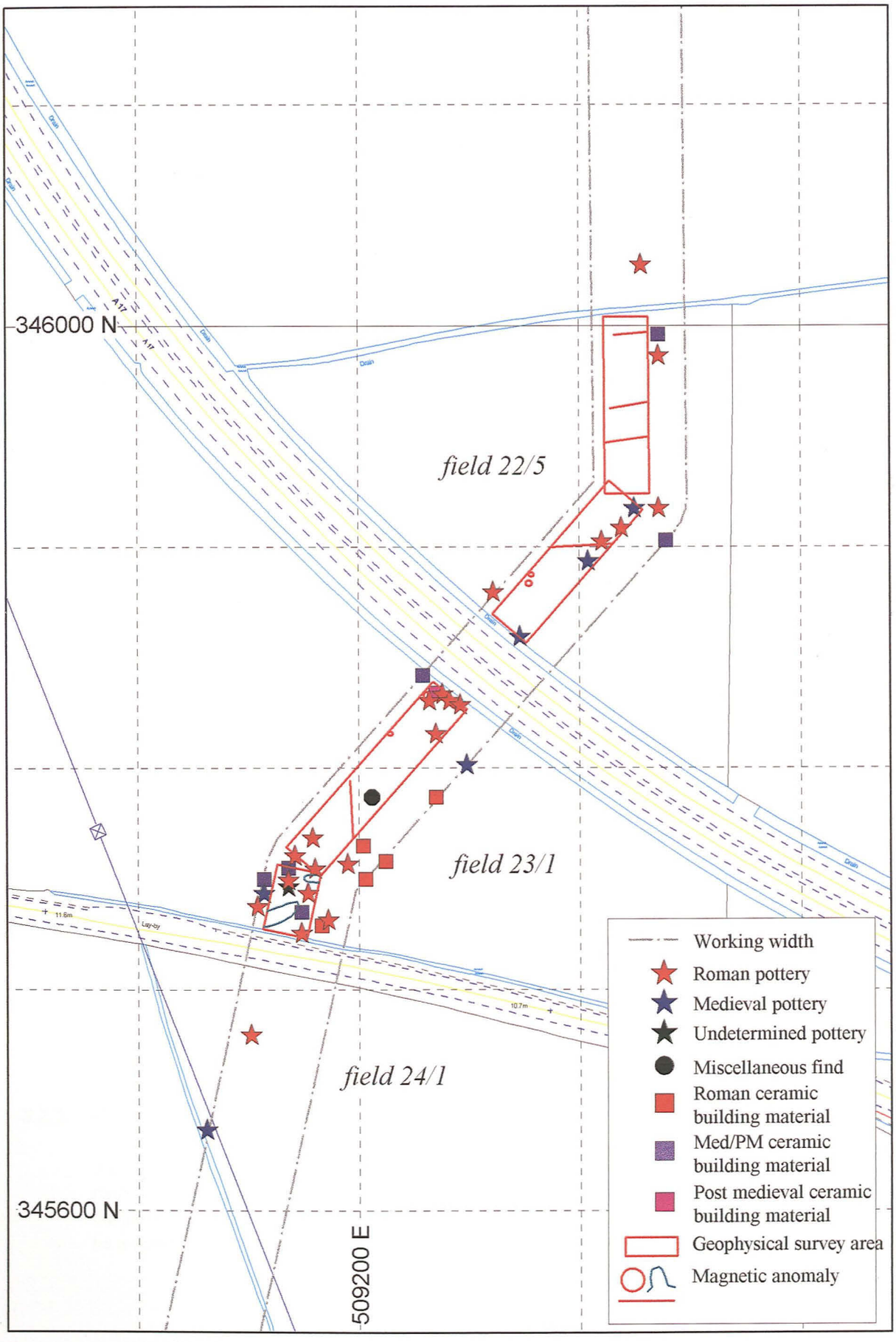


Figure 8: Site 5, Section 2, Geophysical and fieldwalking results

Site 9

Field 24/3 (TF 0908 4529)

DBA: Aerial photographs show cropmarks just to the east of the proposed pipeline route consisting of rectilinear enclosures and a possible hut circle (MON 1049484). Although they have yet to be investigated, they are believed to be associated with Iron Age/Romano-British activity (*NAL, Rep 147, Addendum pg. xiv*).

GEO: there are high susceptibility values in this field. A linear anomaly may relate to the nearby cropmarks, although it also aligns with a change in cultivation (*Vol. 2, Figs 5 & 9*).

FR: no upstanding earthworks were visible in this field.

FW: a mixture of crop, stubble and harrowed ground meant that visibility was poor in this field. However, one sherd of Roman pot and one fragment of Roman CBM were recovered, Retrieval conditions were too poor, however, to draw any conclusions from these finds.

Impact: Direct, uncertain

Recommendations: Evaluation trenches to be excavated at earliest opportunity, with provision for further excavation and/or other mitigation as required.

Site 10

Field 24/4 (TF 0903 4504)

DBA: Aerial photographs held at Swindon show a number of rectilinear enclosures and possible trackway cropmarks to the north-west of Bone's farm. Although undated there is a high possibility that this is a continuation of the extensive settlement cropmark complex to the north-west, MON 1049485, which is believed to be prehistoric/Romano-British in date (*NAL, Rep 147, Addendum pg. xiii*).

GEO: there are particularly high susceptibility readings in this field, together with a significant increase in magnetometer activity. Individual significant features are less easy to identify, perhaps in part because the field was ridged for potatoes at the time of the survey, but the variations in response seen here could well be archaeologically significant (*Vol. 2, Figs 5 & 9*).

FR: no upstanding earthworks or distinctive soil marks were visible in this field.

FW: although recently worked , a lack of weathering meant that visibility was poor in this field. However, one probable Late Neolithic/Bronze Age flint, four sherds of medieval pottery and an undated copper-alloy buckle were recovered. Retrieval conditions were too poor to draw any conclusions from this assemblage.

Impact: Direct, uncertain.

Recommendations: Evaluation trenches to be excavated at the earliest opportunity to allow for detailed assessment of remains i.e. type, significance, level of preservation, potential costs etc. Given the high probability of encountering significant archaeological deposits it is likely that advanced topsoil stripping and excavation will then be recommended, preferably within a restricted easement.

8.2.2 Category D Sites

The following eight category D sites have a lower archaeological potential. It is recommended that Site 8 be subject to evaluation whilst the remainder are closely monitored during the construction watching brief and any subsequent features recorded. There should be a contingency in place for additional excavation or other form of mitigation if required.

Table 6 :
Summary of Desk-Based Assessment, Fieldwalking, Reconnaissance and Geophysical Survey Results

Site No.	Strip Map	Field No.	NGR	Description	Impact	Recommended Mitigation
1	41	22/1	TF 0972 4677	GEO: ?? weak linear anomaly (*Vol.. 2, Fig 8, 22/1*) FR: nothing visible in field FW: not suitable for fieldwalking	D-Min	Detailed monitoring during construction watching brief, with provision for further excavation and/or other mitigation as required.
3	41	22/2 - 22/3	TF 1003 4657	DBA:CG Evedon & Kirkby la Thorpe parish boundary (*NAL, Rep. 147, pg. 29*) FR: mature hedgeline and ditch	D-Min	Detailed monitoring during construction watching brief, with provision for further excavation and/or other mitigation as required.
6	42	24/1	TF 0944 4554	DBA:OF ridge and furrow cropmarks, LCC AP 1971 (*NAL, Rep. 147, Addendum pg. xv*) FR: no clear field boundary with 24/2 and no surviving earthworks GEO: former field boundary with 24/2 visible as linear anomaly (*Vol.. 2, Fig 9, 24/1-2*) FW: not suitable for fieldwalking	D-Min	Detailed monitoring during construction watching brief, with provision for further excavation and/or other mitigation as required.
7	42	24/2	TF 0858 4576	DBA:OS cropmark of former trackway visible immediately west of proposed route, AP 1974 (*NAL, Rep. 147, Addendum pg. xv*) FR: nothing visible in field GEO: no significant results FW: not suitable for fieldwalking	Unc	Detailed monitoring during construction watching brief, with provision for further excavation and/or other mitigation as required.
8	42	24/2	TF 0912 4550	GEO: at least one pit-like anomaly adjacent to area of raised susceptibility readings (*Vol.. 2, Fig 4, 24/2*) FR: nothing visible in field FW: not suitable for fieldwalking	D-Unc	At least one evaluation trench to be centred on pit-like anomaly in advance of construction, with provision for further excavation and/or other mitigation as required.
11	43	24/5	TF 0896 4483	FW: slight medieval pottery scatter, possibly manuring GEO: no significant results FR: nothing visible in field	D-Unc	Detailed monitoring during construction watching brief, with provision for further excavation and/or other mitigation as required.
12	44	24/7	TF 0878 4449	FW: post-medieval pantile scatter GEO: small magnetic anomalies (*Vol.. 2, Fig 6, 24/7*) FR: nothing visible in field	D-Unc	Detailed monitoring during construction watching brief, with provision for further excavation and/or other mitigation as required.

Site No.	Strip Map	Field No.	NGR	Description	Impact	Recommended Mitigation
13	44	24/8 - 24/9	TF 0856 4411	DBA:GM disused railway (*NAL, Rep. 147, Addendum pg. xv*) GEO: high susceptibility readings (*Vol.. 2, Fig 6, 24/8*) FR: no apparent surviving earthworks	D-Min	Detailed monitoring during construction watching brief, with provision for further excavation and/or other mitigation as required.

8.2.3 Category E Sites

Six former field boundaries were noted as Category E sites in the desk-based assessment (*NAL*, Report 147, Addendum Map 7). These remain of low archaeological potential.
Recommendations: Detailed monitoring should take place during construction.

9 REPORT, FINDS AND ARCHIVE DEPOSITION

In addition to client copies, and when requested by the client, a copy of this report will be forwarded to the County Archaeologist for Lincolnshire for his comment. After completion of the construction phase of the project, a formal request will be made to the relevant landowners to consider donating the artefacts recovered from the fieldwork. Subject to landowner agreement, the Stages 1 - 5 finds and archive will be deposited in Lincoln Museum (Accession Number 2000.102).

10 STATEMENT OF INDEMNITY AND COPYRIGHT

Every effort has been made in the preparation and submission of this report to provide as complete an assessment as possible within the terms of the brief, and all statements and opinions are offered in good faith. Network Archaeology Ltd cannot accept responsibility for errors of fact or opinion resulting from data supplied by any third party, or for any loss or other consequences arising from decisions or actions made upon the basis of facts or opinions expressed in this report and any supplementary papers, howsoever such facts and opinions may have been derived, or as a result of unforeseen and undiscovered sites or artefacts.

11 ACKNOWLEDGEMENTS

Thanks are due firstly to Mouchel Consulting Ltd and BG Transco Plc who commissioned the archaeological fieldwork, in particular to Pat Rae, Lesley Lawrence and Alan Pye. Thanks to Alistair Bartlett of Bartlett-Clark Consultancy for undertaking the geophysical survey along the route and locating the auger-bore data. The landowners are also thanked for their co-operation.

12 REFERENCES

Network Archaeology Ltd, 1999. *Hatton to Silk Willoughby Archaeological Desk-Based Assessment. Report No. 147.*
Client report for Mouchel Consulting Ltd on behalf of BG Transco Plc.

Bartlett-Clark Consultancy, April 2000. *Hatton to Silk Willoughby, Lincolnshire Proposed Gas Pipeline: Report on Archaeogeophysical Survey 2000.*
Client report for Network Archaeology Ltd on behalf of Mouchel Consulting Ltd.

APPENDIX 1

APPENDIX 1: Archaeological Investigatory Stages

A staged programme of archaeological investigation, designed to integrate with each of our client's main phases of work:

TRANSCO'S PHASE OF WORK	CORRESPONDING ARCHAEOLOGICAL STAGES
feasibility assessment	***Stage 1*** ***feasibility study of route corridor option(s)*** - an appraisal of archaeological potential
conceptual design	***Stage 2*** ***desk-based assessment of route corridor*** - a thorough synthesis of available archaeological information
detailed design	***Stage 3*** ***field surveys of entire preferred pipeline route*** - field reconnaissance survey field walking geophysical survey (metal detector survey) (auger survey) ***Stage 4*** ***field evaluation of targeted areas along preferred pipeline route*** - machine-excavated trenches hand-dug test-pits ***Stage 5*** ***excavation*** - detailed excavation of those sites which it is not possible to avoid or desirable to preserve
construction	***Stage 6*** ***watching brief*** - permanent presence monitoring of all ground disturbing activities
post-construction	***Stage 7*** ***archive and publication*** - synthesis and dissemination of results, leading on from each of the stages outlined above

APPENDIX 1: Archaeological Investigatory Stages

Stage 1 Feasibility Study

An appraisal of archaeological potential

Stage 2 Desk-based Assessment

A thorough synthesis of available information.

Stage 3 Field Surveys

3a Field Reconnaissance Survey (rapid walkover)

This involves a visual inspection of the entire length of the proposed pipeline route in order to record the following:

- location and character of unrecorded earthworks
- the level of preservation of known earthworks (e.g. ridge-and-furrow)
- the occurrence of soil and vegetation changes which could indicate the presence of archaeological deposits
- land-use
- topographic variations
- visible geology
- health and Safety implications
- project specific requirements

3b Field walking

Field walking involves the systematic recovery of artefacts (pottery, tile, glass, slag, coins *etc.*) from the surface of ploughed fields. This exercise is intended to:

- determine the date and spatial extent of *known* sites on the proposed route which could not be avoided by route modifications.
- determine if any *known* sites lying close to the proposed route extend into it.
- locate, delimit and date previously *unknown* sites, lying in the course of the proposed route.

Field walking needs bare earth, ideally ploughed, harrowed and weathered. Late autumn and winter is the optimum time for this work.

3c Metal Detector Survey

Metal detecting can be carried out on all types of land. Ideally, detectorists with local experience are used. This exercise:

- complements field walking in arable areas.
- provides the only means of obtaining dating evidence in pasture, fen, moss and woodland areas.
- identifies and date sites that may not be archaeologically visible by field walking (e.g. accompanied burials, metal hoards, fair/trading sites)

3d Earthwork Survey

This work is undertaken to produce a topographic record of extant earthworks. These sites might be *known* earthworks identified by the Desk based Assessment, or previously *unknown* earthworks found during the Field Reconnaissance Survey. The sites may include settlement earthworks, agricultural earthworks (such as, ridge and furrow and lynchets), and field boundaries.

A total-station theodolite survey produces a close contour plot.

3e Auger Survey

The retrieval of subsurface soil samples can be used to determine the presence or absence, nature, extent and state of preservation of known or potential archaeological deposits. This may be appropriate in areas sealed by peat or alluvium, or on sensitive sites such as earthworks. Areas requiring auger survey can be identified during or shortly after the field reconnaissance and field walking surveys. This information can be crucial for determining areas suitable for geophysical survey.

3f Geophysical Survey

Geophysical survey can be used to:

- determine the character and spatial extent of *known* sites on the proposed route which can not be avoided by route modifications.
- determine if any *known* sites lying close to the proposed route extend into it.
- locate, delimit and determine the character of previously *unknown* sites lying in the course of the proposed route.

There are a number of available techniques, the most appropriate of which are *magnetometry*, *magnetic susceptibility* and *resistivity.*

Magnetometry

This technique detects local variations in the earth's magnetic field, resulting from anthropogenic changes to soil. These variations are often caused by the presence of buried archaeological deposits (e.g. ditches, pits, buildings, *etc.*). This survey technique uses hand-held equipment, usually a Geoscan FM 35 Fluxgate Gradiometer.

The instrument can be used to scan large areas before focusing on smaller areas for detailed gridded survey, usually at 1m transect separation. Scanning is often used in tandem with magnetic susceptibility (see below) to identify areas of potential for detailed survey.

Magnetometry is most suited to shallow archaeology up to *c.*1-1.5m below ground level. It can operate in all weathers and is not prone to seasonal effects. In general, boulder clay and alluvium tend to be poorly responsive, whilst other solid geologies and riverine gravels are relatively conducive to magnetometry, although local iron concentrations can sometimes give spurious results. It can also be affected by magnetic fields (e.g. pylons). This technique is quick and cost-effective.

Magnetic susceptibility
This technique records variations of magnetic susceptibility within topsoil and subsoil. Enhanced susceptibility is often a sign of past human activity. It differs from magnetic scanning in that it locates areas of *archaeological activity* rather than discrete *features*. Magnetic susceptibility is often used in tandem with magnetic scanning to identify areas of potential for detailed survey.

Resistivity
In this method, an electric current is passed through the ground between a pair of mobile electrodes. The current passes more easily through soil which has a lower resistance (e.g. ditch fills), but is impeded by buried walls and road surfaces, which have a higher resistance. Survey involves pushing a pair of electrodes into the ground along transects 1m apart. A Geoscan RM15 resistivity meter with twin electrode configuration is commonly applied. A new attachment called a 'multi-plexer', and a technique called 'resistivity profiling' allows readings to be taken from multiple levels at the same time.

Resistivity is most suited to shallow archaeology up to *c.*1m below ground level. The technique is slower than magnetometry and can be hampered by hard ground; ideally the probes need soft damp soil for good conductivity. Resistivity is affected by seasonal variability of groundwater. Saturated soils or soils with a high saline content are likely to produce poor results. Natural geological variations can also make interpretation difficult. This type of survey can show greater detail than magnetometry.

Stage 4 Field Evaluation

In some cases, where the results of field walking and/or geophysical survey are positive, and it is not possible or desirable to avoid a site, it may be necessary to undertake an evaluation in advance of construction. This might involve:

4a machine-excavated trenches
4b hand-dug test-pits

By using these techniques, it should be possible to confirm the presence or absence of archaeological deposits and to determine their character, extent, date and state of preservation. The choice of technique(s) will depend upon site-specific factors.

It may be desirable to undertake evaluation of certain category B or category C sites with high archaeological potential, even if the geophysical survey has failed to locate significant anomalies. Evaluation work is usually completed well in advance of pipeline construction.

Stage 5 Area Excavation

In occasional cases where the results of evaluation are positive, and it is not possible or desirable to avoid a site, area excavation may be the most appropriate course of action, in order to record a site prior to the construction of the pipeline. Precise excavation strategies for dealing with such archaeological remains will depend on

site-specific factors. It is usually preferable to preserve significant archaeological deposits (such as settlements and burials) *in-situ*, by modifying the course of the pipeline.

Stage 6 Watching Brief (during construction)

A permanent-presence watching brief should take place during the construction of the pipeline. As a minimum, this consists of archaeological monitoring of all topsoil stripping and pipeline trench excavations. Archaeological deposits identified are ideally preserved *in situ*, or can be recorded by excavation.

Stage 7 Post-Excavation (Archive, Report and Publication)

A post-excavation programme for dealing with all records of investigated archaeological remains and recovered artefacts usually follows each of the stages outlined above. This includes the collation and cataloguing of all site records, the processing, conservation and cataloguing of artefacts, the production of an archive report, and, where appropriate, the drafting of articles for publication.

APPENDIX 2

APPENDIX 2: Field Conditions

Section 1

Strip Map	Field Survey Plot No	NGR TF	Field Length (m)	Soil Type	Field use and Condition	Ground Visibility	Weather	Retrieval Conditions
35	18/1	1030 5126	200	clay loam	Arable, unploughed stubble	<25%	Overcast	V. poor
35	18/2	1022 5108	150	clay loam	Arable, unploughed stubble	<25%	Overcast	V. poor
35/36	18/3	1003 5068	680	clay and silty loams	Arable, fairly dense crop	<25%	Overcast	V. poor
36	18/4	0980 5017	290	silty loam	Arable, fairly dense crop	<25%	Bright sunshine	V. poor
36	18/5	0973 4999	135	silty loam	Arable, fairly dense crop	<25%	Bright sunshine	V. poor
36	18/6	0966 4985	140	silty loam	Arable, fairly dense crop	<25%	Bright sunshine	V. poor
Total			**1595m**					

Section 2

Strip Map	Field Survey Plot No	NGR TF	Field Length (m)	Soil Type	Field use and Condition	Ground Visibility	Weather	Retrieval Conditions
41	22/1	0975 4681	220	clay loam	? Set-aside, grass	<25%	Bright sunshine	V. poor
41	22/2	0955 4661	280	clay and sandy loams	Arable, harrowed, weathered	100%	Overcast/Bright sunshine	Good
41/42	22/3	0935 4640	290	sandy loam	Half arable, harrowed, not weathered / Half pasture	25-50% 0%	Overcast	Poor None
42	22/4	0933 4614	220	sandy loam	? Set-aside, grass	<25%	Overcast	V. poor
42	22/5	0933 4593	170	sandy loam	? Set-aside, patchy grass	c. 50%	Bright sunshine	Moderate
42	23/1	0921 4578	140	sandy loam	Arable, harrowed, weathered	>75%	Overcast/Bright sunshine	Good
42	24/1	0916 4566	120	sandy loam	Arable, ploughed stubble	25-50%	Bright sunshine	Poor
42	24/2	0913 4553	120	sandy loam	Arable, stubble	25-50%	Bright sunshine	Poor
42/43	24/3	0909 4534	270	sandy loam	Arable, mixed crop/stubble/harrowed & weathered	25-50%	Bright sunshine	Poor
43	24/4	0903 4506	310	sandy loam	Arable, harrowed, not weathered	25-50%	Bright sunshine	Poor
43	24/5	0896 4483	100	sandy loam	Arable, ploughed stubble	>75%	Bright sunshine	Good

APPENDIX 2: Field Conditions

Strip Map	Field Survey Plot No	NGR TF	Field Length (m)	Soil Type	Field use and Condition	Ground Visibility	Weather	Retrieval Conditions
43/44	24/6	0887 4466	280	silty loam	Arable, mixed crop/harrowed & weathered	<25 - 100%	Overcast	V. poor - good
44	24/7	0878 4450	45	clay loam	Arable, low crop	25-50%	Overcast	Poor
44	24/8	0869 4432	380	clay loam	? Set-aside, remnant crop	<25%	Overcast	V. poor
44	24/9	0848 4409	210	clay loam	Arable, mod crop	<25%	Overcast	V. poor
44	24/10	0846 4390	140	clay loam	Arable, harrowed & weathered	100%	Overcast	Good
Total			**3295m**					

APPENDIX 3

APPENDIX 3

No.	Plot	Map	Type	NGR TF	Date
1	24/10	44	pot	08435 43788	19th - 20th C
2	24/10	44	pot	08435 43794	13th C
3	24/10	44	pot	08424 43794	? L12th - 14th C
4	24/10	44	pot	08438 43808	unid.
5	24/10	44	pot	08429 43831	15th - 20th
6	24/10	44	pot	08444 43857	Roman
7	24/10	44	pot	08453 43863	13th C
8	24/10	44	pot	08455 43883	L15th - 16th C
9	24/10	44	fired clay	08449 43825	unid
10	24/10	44	pot	08450 43831	13th C
11	24/10	44	pot	08441 43837	18th - 19th C
12	24/10	44	pot	08446 43799	19th - 20th C
13	DISCARDED				
14	24/10	44	oyster shell	08473 43843	unid
15	24/6	43	CBM	08928 44744	Roman
16	24/6	43	pot	08913 44721	? 14th - 16th C
17	24/6	43	pot	08907 44709	13th - 15th C
18	24/6	43	CBM	08907 44709	Roman
19	DISCARDED				
20	24/6	43	pot	08893 44744	unid
21	24/6	43	pot	08902 44764	L 15th - M17th
22	DISCARDED				
23	24/5	43	pot	08980 44863	13th C
24	24/5	43	pot	08974 44854	13th - 14th C
25	DISCARDED				
26	24/5	43	pot	08957 44802	? 13th - 14th C
27	24/5	43	mussel shell	08968 44796	unid
28	24/5	43	oyster shell	08945 44799	unid
29	24/5	43	pot	08948 44825	Roman
30	DISCARDED				
31	24/5	43	CBM	08942 44840	Roman
32	24/5	43	pot	08962 44851	13th - 14th
33	24/5	43	sheep's tooth	08951 44857	unid
34	DISCARDED				
35	24/5	43	pot	08962 44874	? L13th - 15thC
36	24/5	43	pot	08962 44877	L13th - 15th C
37	24/5	43	pot	08973 44874	? 13th - 14th C
38	24/5	43	pot	08974 44877	?13th C
39	24/4	43	pot	08994 44906	L12th - 13th C
40	24/4	43	mussel shell	08994 44915	unid
41	24/4	43	pot	09000 44932	13th C
42	24/4	43	buckle	08994 44953	unid
43	24/4	43	pot	09052 45176	L13th -14th C
44	DISCARDED				
45	24/4	43	pot	09020 45132	? 13th
46	24/4	43	flint	09020 45124	?LN/BA
47	DISCARDED				
48	DISCARDED				
49	DISCARDED				
50	DISCARDED				

APPENDIX 3

No.	Plot	Map	Type	NGR TF	Date
51	DISCARDED				
52	DISCARDED				
53	24/3	43	CBM	09061 45254	Roman
54	24/3	43	pot	09102 45445	Roman
55	DISCARDED				
56	DISCARDED				
57	24/1	42	pot	09151 5680	Roman
58	24/1	42	pot	09131 5637	13th - 14th C
59	23/1	42	pot	09177 5744	Roman
60	23/1	42	pot	09180 5755	Roman
61	DISCARDED				
62	DISCARDED				
63	23/1	42	oyster shell	09206 45787	unid
64	DISCARDED				
65	23/1	42	CBM	09202 45765	Roman
66	23/1	42	pot	09195 45757	Roman
67	23/1	42	CBM	09183 45729	? Roman or LPMed
68	23/1	42	pot	09154 45738	13th C
69	23/1	42	pot	09154 45738	Roman
70	23/1	42	pot	09156 45740	Roman
71	23/1	42	pot	09156 45740	Roman
72	23/1	42	pot	09157 45744	13th C
73	23/1	42	CBM	09157 45750	13th - 18th C
74	23/1	42	pot	09168 45747	unid
75	23/1	42	pot	09168 45750	Roman
76	23/1	42	CBM	09168 45755	13th - 15th C
77	23/1	42	pot	09171 45761	Roman
78	23/1	42	pot	09179 45769	Roman
79	23/1	42	pot	09232 45831	Roman
80	23/1	42	pot	09238 45834	Roman
81	23/1	42	CBM	09235 45834	20th C
82	23/1	42	pot	09241 45831	Roman
83	23/1	42	CBM	09229 45842	13th - 16th C
84	23/1	42	pot	09246 45829	Roman
85	23/1	42	pot	09249 45802	13th - 15th C
86	23/1	42	pot	09235 45816	Roman
87	23/1	42	CBM	09235 45787	Roman
88	23/1	42	CBM	09212 45758	? Roman or Late Pmed
89	23/1	42	CBM	09203 45750	? Roman or Late Pmed
90	23/1	42	pot	09186 45732	Roman
91	23/1	42	CBM	09174 45735	13th - 16th C
92	23/1	42	pot	09174 45726	Roman
93	23/1	42	pot	09174 45726	Roman
94	22/1	41	CBM	09748 46804	13th - 15th C
95	22/1	41	pot	09748 46804	L14th - 16th C
96	22/2	41	pot	09658 46712	Roman
97	22/2	41	flint	09649 46706	LN/BA
98	22/2	41	pot	09629 46683	Roman
99	DISCARDED				
100	22/2	41	pot	09606 46677	Roman

APPENDIX 3

No.	Plot	Map	Type	NGR TF	Date
101	22/2	41	pot	09614 46672	13th - 14th C
102	22/2	41	flint	09600 46668	?LN/BA
103	22/2	41	flint	09571 46639	LN/EBA
104	22/2	41	flint	09565 46633	LN/BA
105	22/2	41	CBM	09499 46512	12th - 18th C
106	22/2	41	CBM	09499 46512	Roman
107	22/2	41	CBM	09487 46526	12th - 18th C
108	22/2	41	pot	09513 46567	? Roman
109	22/2	41	CBM	09533 46572	Roman
110	22/2	41	pot	09539 46578	L13th - 14th C
111	22/2	41	flint	09557 46599	?LN/BA
112	22/2	41	flint	09565 46604	?Meso
113	22/2	41	pot	09530 46584	13th - 15th C
114	22/2	41	flint	09565 46619	?LN/BA
115	22/2	41	pot	09571 46627	Saxon (5th - 8th C)
116	22/2	41	pot	09603 46656	Saxon
117	22/2	41	flint	09623 46677	preh.
118	22/2	41	flint	09620 46677	?LN/BA
119	22/2	41	pot	09643 46697	unid
120	22/2	41	flint	09658 46700	LN/BA
121	22/2	41	pot	09664 46694	Roman
122	22/2	41	pot	09652 46677	Roman
123	22/2	41	flint	09643 46668	LN/BA
124	22/2	41	pot	09635 46677	Roman
125	22/2	41	flint	09623 46662	LN/BA
126	22/2	41	flint	09609 46648	LN/BA
127	22/2	41	pot	09600 46642	Roman
128	22/2	41	pot	09594 46633	Roman
129	22/2	41	pot	09594 46633	13th - 14th C
130	22/2	41	pot	09600 46627	Saxon
131	22/2	41	flint	09548 46619	LN/BA
132	22/2	41	pot	09539 46625	13th - 14th C
133	22/2	41	pot	09536 46619	Saxon
134	22/2	41	pot	09528 46613	Roman
135	22/2	41	flint	09536 46607	?LN/BA
136	DISCARDED				
137	22/2	41	pot	09516 46599	Roman
138	22/2	41	flint	09510 46596	?Meso
139	22/2	41	pot	09499 46584	Saxon
140	22/2	41	CBM	09507 46575	Roman
141	22/2	41	flint	09493 46561	?LN/BA
142	22/2	41	flint	09493 46561	LN/BA
143	22/2	41	pot	09487 46541	unid
144	22/2	41	pot	09472 46526	L12th - 13th C
145	22/2	41	flint	09536 46561	?LN/BA
146	22/2	41	slag	09536 46561	unid
147	22/4	42	pot	09328 46028	? Roman
148	22/5	42	pot	09325 45918	L12th - 13th C
149	22/5	42	pot	09319 45909	Roman
150	22/5	42	pot	09310 45903	Roman

APPENDIX 3

No.	Plot	Map	Type	NGR TF	Date
151	22/5	42	pot	09310 45903	? Roman
152	22/5	42	pot	09304 45894	13th C
153	DISCARDED				
154	DISCARDED				
155	22/5	42	pot	9274 45858	13th - 16th C
156	DISCARDED				
157	22/5	42	pot	09336 45987	Roman
158	22/5	42	CBM	09336 45996	12th - 18th C
159	DISCARDED				
160	22/5	42	pot	09336 45918	Roman
161	22/5	42	pot	09261 45880	Roman
162	22/5	42	CBM	09339 45903	15th - 20th C
163	22/3	42	pot	09336 46274	Roman
164	22/3	42	flint	.09336 46274	LN/BA
165	22/3	42	pot	09441 46494	13th - 15th C
166	22/2	41	pot	09632 46703	13th C
167	22/2	41	pot	09635 46706	13th C
168	22/2	41	flint	09800 46810	LN/BA
169	18/5	36	CBM	0973 4999	13th - 16th C

FLINT	22
ROMAN POT	40
ROMAN CBM	12 (CERAMIC BUILDING MATERIAL)
SAXON POT	5
MEDIEVAL POT	32
MEDIEVAL CBM	2 + sample 169
MED/POST-MED POT	3
MED/POST-MED CBM	6
POST-MED/MODERN POT	6
POST-MED/MODERN CBM	2
UNIDENTIFIED POT	6
OTHER	8
DISCARDED	24
TOTAL	**169**