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**ARCHAEOLOGICAL INVESTIGATION
AT MEADOW LANE,
NORTH HYKEHAM,
LINCOLNSHIRE,
(NHM04)**



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**ARCHAEOLOGICAL INVESTIGATION
AT MEADOW LANE,
NORTH HYKEHAM,
LINCOLNSHIRE,
(NHM04)**

**Work Undertaken For
WESTLEIGH DEVELOPMENTS LTD**

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ARCHAEOLOGICAL PROJECT SERVICES



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**Archaeological Investigation at North Hykeham, Meadow Lane
(NHM04)
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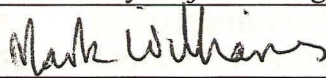
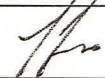
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Table of Contents

List of Figures

List of Plates

1.	SUMMARY	1
2.	INTRODUCTION.....	1
2.1	DEFINITION OF AN ARCHAEOLOGICAL EXCAVATION.....	1
2.2	PLANNING BACKGROUND.....	1
2.3	TOPOGRAPHY AND GEOLOGY.....	1
2.4	ARCHAEOLOGICAL SETTING	2
3.	AIMS	2
4.	METHODS	2
5.	RESULTS	3
5.1	NATURAL DEPOSITS	3
5.2	ROMAN DEPOSITS.....	3
5.3	MEDIEVAL DEPOSITS	5
5.4	POST-MEDIEVAL DEPOSITS	5
5.5	MODERN DEPOSITS	5
5.6	UNDATED DEPOSITS	5
6.	DISCUSSION	6
7.	CONCLUSION	9
8.	PERSONNEL	9
9.	ACKNOWLEDGEMENTS	9
10.	BIBLIOGRAPHY	10
11.	ABBREVIATIONS.....	10

Appendices

1. Specification
2. Contexts and Stratigraphic matrix
3.
 - a) Roman Pottery
 - b) Cremated bone and Faunal remains
 - c) Late Medieval/ Post Medieval ceramics
 - d) Post Medieval CBM assesment
4. Environmental
5. Archaeomagnetic dating
6. Glossary

7. The Archive

List of Figures

- Figure 1 General location plan
- Figure 2 a) Site location
b) Recent Archaeological investigation near Meadow Lane
- Figure 3 Site Layout
- Figure 4 Archaeology
- Figure 5 Sections
- Figure 6 Plans
- Figure 7 Kiln floor surface (046)

List of Plates

- Plate 1 General view of site facing south
- Plate 2 Site during stripping facing north
- Plate 3 Section 5 through water channel
- Plate 4 Section 4 Roman ditch [011]
- Plate 5 Section 13 Roman ditches [015], [017], [019] & [021]
- Plate 6 Section 11 Roman ditch [027]
- Plate 7 Section 12 Roman ditches [034], [036], [038] and [040]
- Plate 8 Section 10 Plough Furrow [026]
- Plate 9 Kiln floor surface (046)
- Plate 10 Archaeomagnetic dating of post medieval kiln
- Plate 11 'Puddling' over [033]
- Plate 12 Post-medieval pit [033] after overnight rain

SUMMARY

Plate 13 Roman pit [017] containing cremated bone.

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1. SUMMARY

An archaeological investigation was undertaken on land at Meadow Lane, North Hykeham, Lincolnshire. The investigation involved a strip, map and sample of archaeological deposits within the development site. In addition, a previously discovered kiln, believed to be Post-Medieval, was partially re-excavated in order to obtain a sample for archaeomagnetic dating.

The development site is in an archaeologically sensitive area, located on the southeast boundary of the present town of North Hykeham. Previous investigations within the area revealed Romano-British activity including metalworking and pottery production.

The excavation revealed a low level of late Roman activity located in the southeast area of the site. Post-medieval activity including a possible clay extraction pit and the floor surface of a second kiln, were found in the north and eastern areas of the site.

2. INTRODUCTION

2.1 Definition of an Archaeological Excavation

'...a programme of controlled, intrusive fieldwork with defined research objectives which examines, records and interprets archaeological deposits, features and structures and, as appropriate, retrieves artefacts, ecofacts and other remains within a specified area or site on land, inter-tidal zone or underwater.' IFA 1995 (revised 2001)

2.2 Planning Background

A programme of geophysical survey and trial trenching has been undertaken at the development site (PCA 2002) and revealed a well preserved kiln believed to be post-

medieval in date. Only two similar kilns have been investigated within Lincolnshire. A low level of Romano-British activity was also identified within the area.

A planning application (N/43/0512/04) for construction of 23 dwellings has been submitted to North Kesteven District Council. Permission has been granted subject to a programme of archaeological works.

Archaeological Project Services (APS) was commissioned by Westleigh Developments Ltd to undertake the subsequent archaeological investigation between the 17th of January and the 1st of February 2005.

2.3 Topography and Geology

North Hykeham lies to the southwest of Lincoln in the administrative district of North Kesteven, Lincolnshire (Fig 1). The development site lies on the southeast of North Hykeham located to the north of Meadow Lane, which runs approximately west to east from North Hykeham towards Waddington (Fig 2a & 2b.).

An established residential estate forms the west and north boundaries for the site. The southern boundary is defined by a recently developed residential area and road access from Meadow lane via Sharps Walk. To the east lies a recently cleaned out drainage dyke and open fields (Fig 3). The site was formerly a paddock and was grassed at the time of the excavation, sloping gently from northwest to southeast at c. 8.5m OD.

The local soils consist of fine loamy drift over clayey typically stagnogley soils of the Wickham series across the western part of the site. The underlying Lower Lias Clay was formed in the Jurassic and Cretaceous periods with superficial loamy drift being deposited by the proto River Trent as it flowed from Lincoln to Newark

(Hodge *et al* 1984, 351). The eastern part of the site however is composed of alluvial deposits of sand and gravel (British Geological Survey 1973) deposited by the pre-canalised River Witham (North Hykeham Pump Drain) that now runs approximately 200m to the east of the site.

2.4 Archaeological Setting

North Hykeham is located on the southwest margins of the city of Lincoln. There have been no prehistoric settlements found within the development area, however, several Neolithic artefacts have been recovered from this region, including two polished stone axes, a perforated axe hammer and a leaf shaped arrowhead. A small quantity of Iron Age pottery has also been recovered in an evaluation in an adjacent field (JSAC 1999 Fig. 2b).

Lincoln was a substantial Roman settlement (*Lindum*) with access to two major roads, Ermine Street ran from London to the Humber estuary and the Fosse Way forming a route to Exeter and the South West. The present area of North Hykeham is situated between these two Roman Roads, with the development site approximately 2km east of the Fosse Way and 4km west of Ermine Street.

Sand and gravel quarrying in the 1930s to the west of the site exposed a late 1st/ early 2nd century AD 'rustic ware' pottery kiln. An evaluation and subsequent excavation immediately south west of the site exposed three principal phases of Romano-British activity dated from the 2nd to late 4th century AD, including evidence for metalworking. More recently a programme of geophysical survey and trial trenching was undertaken within the development area and revealed a low level of Romano-British activity dating to the late 1st to mid 2nd century AD (PCA 2002).

In 1086, North Hykeham appeared in the Domesday Book as *Northhica* under the ownership of Baldwin the Fleming and

Count Alan (Morgan & Thorne 1986). The name North Hykeham itself is probably a mixture of Old English, '*hica*' being a type of bird and '*ham*' meaning farmstead, literally the farmstead where a particular bird can be found (Cameron 1998). Numerous isolated find spots, including coins of Henry VI (1421-1471) and Henry VII (1485-1509) indicate a low level of medieval activity.

An unexpected discovery during trial trenching within the development area was a well preserved tile and possible brick kiln believed to be post-medieval (16th-18th century) (PCA 2002) sealed beneath topsoil. Several undated pits and ditches were also picked up in trial trenching and may be associated with clay preparation and tile production on the site.

The first edition OS map shows the development site as being within an enclosed field system in 1886 away from the main settlement of North Hykeham. No kilns, clay pits or structures within the development area are noted on this map.

3. AIMS

The aim of this investigation was to recover as much information as possible on the origins, date, development, phasing, spatial organisation, character, function, status, significance and nature of social, economic and industrial activities on the site.

In particular the date, extent and character of archaeological remains present on the site was investigated, with emphasis on identifying and understanding any features associated with the post-medieval kiln.

4. METHODS

A mechanical excavator removed recent deposits with a toothless ditching bucket under constant archaeological supervision

until an archaeological horizon or natural geology was reached. A bund of material was left *in situ* around the known kiln area, comprising approximately 7 by 8m in plan.

Following site stripping, areas were hand cleaned where necessary and a pre-excavation plan made of the entire site using an EDM. After further consultation with the North Kesteven Heritage Officer, four additional trenches were dug by mechanical excavator through areas of 'puddled' subsoil until undisturbed geology or archaeological deposits were reached. A representative sample of exposed features throughout the site was hand excavated to date and characterise the archaeological remains.

Archaeological features were recorded on APS pro-forma context record sheets, using a single context method whereby each individual unit of archaeological stratigraphy was given a unique number. Plans of features were drawn at 1:20 whilst sections were drawn at 1:10. An ongoing photographic record was compiled throughout the investigation. Artefacts recovered during the archaeological investigation were bagged and labelled for later analysis by appropriate specialists. Environmental samples were also taken from archaeologically significant deposits and sent for further analysis.

As part of the agreed archaeological strategy, the previously exposed western side of the known kiln was re-excavated and archaeomagnetic dating undertaken on the kiln structure. Following sampling, the kiln was re-covered with engineering membrane and backfilled.

5. RESULTS

Following post-excavation analysis six phases were identified;

Phase 1	Natural Deposits
Phase 2	Roman Deposits

Phase 3	Medieval deposits
Phase 4	Post-medieval deposits
Phase 5	Modern Deposits
Phase 6	Undated Deposits

Archaeological contexts are listed below and described. The numbers in brackets are the context numbers assigned in the field.

5.1 Natural Deposits

The underlying geology is composed of yellow clays (003) on the west and north of the site with brownish red sandy silts (004) forming the southern and eastern areas of the site. Two natural water channels were present in the south-eastern area of the site overlain by a layer of alluvium (005). Channel [008] meanders across the eastern side of the site and is filled with a fine, sterile, silty sand (009) (Fig. 5 Section 2). This channel is also clearly cut in plan by Roman gully [011]. The second channel [013] is found against the southern edge of the site and again is filled with a fine, sterile, silty sand (014) (Fig 5 Sections 3, 5 & Plate 3).

Both of these channels are likely pre-Roman channels from within the River Witham's flood plain. Finally deposit (043) a thick blue clay, was found to underlie the Post-medieval pit [033] and represents a layer of natural clay below (003) (Fig 5 Section 15). A petrological sample of (043) was taken for further study as a potential clay source for the tile produced on site.

5.2 Roman Deposits

The Roman activity is largely focused against the eastern side of the southern half of the site. A layer of alluvium (005) overlies the extreme east and south of the site where the natural ground level drops. This alluvium sealed all the Roman deposits which were in turn cut through natural silts (004).

Gully [011] traversed the site from west to east cutting natural clay (003) at the western side of the site and silts (004) at the eastern side. Feature [011] also clearly cuts natural channel [008] in plan (Fig 4). Gully [011] measured 0.63m by 0.27m deep with concave sides (Fig 5 Section 4, Fig 6 Plan 6 & Plate 4). This feature was filled with a silty sand deposit (012) containing sherds of 4th C AD pottery (Appendix 3).

Three distinct linear features [015], [019] and [021] were located against the eastern side of the site aligned north-south (Fig 4). All three linears were cut into natural silts (004) and sealed by a layer of alluvium (005). Ditch [021] was the earliest linear measuring 1.2m wide by 0.5m wide with concave sides sloping at approximately 45 degrees. Linear [021] was filled by silty sand (022) and while it contained no dating evidence, is clearly cut by [019] (securely dated to the Roman period). Ditch [019] appeared to be a recut along the alignment of [021], truncating its western side. This feature measured 0.8m wide by 0.54m deep with a similar profile in cross section to [019]. Ditch [019] was filled by a sandy silt deposit (020), which contained Romano-British pottery and CBM (Fig 5 Section 6, Fig 6 Plan 3, Plate 5 & Appendix 3a).

A narrow Roman gully [015] recuts along the length of [019] and measured 0.5m by 0.18m deep with moderately sloping concave sides. Gully [015] was filled by a silty sand deposit (016), similar in character to (020) and (022). This feature extends south for 6m beyond Section 6 where it ended in a rounded terminus. The terminus [058] shows a similar profile to [015] and contains a comparable fill to (016), recorded in section as (057) (Fig 5 Section 21 & Fig 6 Plan 8).

A small circular pit [017] was cut into the top of deposit (022) within ditch [021]. The alluvial layer (005) also seals this pit. The pit measured 0.70m by 0.18m and is

filled by a silty sand deposit (018) containing cremated human bone and charcoal (Appendix 3b). The cremation is heavily fragmented with no associated containing vessel. A single sherd of abraded Nene Valley fineware dated to the mid 3rd to 4th century AD was recovered from the deposit (Appendix 3a).

A second Roman linear [027] traverses the site from west to east approximately 7.5m north of [011]. As with [011], this feature was cut into natural clay (003) to the west of the site and natural silts to the east. Ditch [027] measured 1.5m by 0.45m deep, with moderately sloping concave sides (Fig 5 Section 11, Fig 6 Plan 5 & Plate 6). A silty clay deposit (028) fills [027] and contains pottery dated to the later Roman period (Appendix 3a). A recent trial trench (PCA 2002, Trench 4) truncates ditch [027] 10m from the east side of the site.

On the east side of the trial trench four distinct linear features [034], [036], [038] and [040] are aligned west to east and clearly cutting ditches [019] and [021] as well as gully [015]. These features are all cut into natural silts (004) and were sealed by alluvium (005). The only ditch to continue beyond the trial trench to the west was [036] which has a comparable profile to [027]. The remaining features may be sealed beneath the kiln area to the northwest, with only the most southerly of the ditches being visible in plan (Fig 4).

Ditch [034] was the earliest of these features measuring 1.1m by 0.52m deep with a gently sloping southern side and truncated by ditch [036] along its northern side. Ditch [034] was filled with a sandy silt deposit (035) consistent with the other Roman features in the southeast of the site. Ditch [036] truncates the southern side of [034] and measures 2.2m by 0.55m deep with moderately sloping concave sides. A silty sand deposit (037) similar to (035) fills [036] and contains a small amount of Roman pottery (Appendix 3a). Deposit

(037) is truncated by the Roman recut [038] that follows the alignment of [036].

The recut [038] measured 1m by 0.48m with a similar profile in cross section to [036]. A silty sand deposit typical of the ditch fills found on site fills [038] and contains Romano-British pottery. This feature was itself recut by a gully [040] that follows the same east-west alignment.

The gully [040] recuts along the length of [038] and measures 0.7m by 0.22m with a concave base and sides. A sandy silt deposit (041) containing Romano-British pottery fills [040] (Fig 5 Section 12, Fig 6 Plan 4 & Plate 7).

5.3 Medieval Deposits

Two linear features are located in the northern area of the site. Both features resemble the remains of medieval ridge and furrow style ploughing (Fig 4). Furrow [026] measures 1.6m wide by 0.15m deep and was filled by (027) a deposit derived from subsoil (Fig 5 Section 10, Fig 6 Plan 2 & Plate 8). Furrow [044] was located 2.7m to the south of [026] and measured 1.5m by 0.1m deep and was filled by (045) a similar deposit to (027).

5.4 Post-Medieval Deposits

The post medieval deposits were located to north of the preserved kiln area. The remains of a kiln floor surface (046) are located against the east side of the site approximately 18m northeast of the preserved kiln (Fig 4, Fig 7 & Plate 9). The floor surface measured 3 by 5m and includes a patch of preserved rake out material (056) swept out of the stoke holes from when the kiln was in use. There is no structure left of the kiln, however a small rubble patch (055) just to the south of the floor surface may represent a dump of the unusable material when the kiln was dismantled. The rubble (055) measures 1.2 by 0.5m by 0.02m thick, and composed of fractured brick and tile.

At the north west of the site a large rectangular pit [033] has been cut into the natural blue clays (043). The pit measured 3.6m east west by 5.6m north south by 0.6m deep with near vertical sides and a flat base (Fig 5 Section 15, Fig 6 Plan 1, Plates 11 & 12). The pit was filled with a layer of redeposited clay (042) measuring 0.2m in thickness. A silty clay deposit (032) 0.46m thick overlay (042) and contained post-medieval CBM (Appendix 3d), possibly representing wasters. The pit [033] was sealed by deposit (031), redeposited blue grey clay 0.3m thick and expanding up to 9m north south by 7m east west. A layer of disturbed natural yellow grey clays (030) measuring 0.18m in thickness seals this deposit. A layer of subsoil (029) seals (030) and overlies the whole pit area (Fig 4, Fig 5 Section 14, Plates 11 & 12).

5.5 Modern Deposits

A linear 20th century field drain [049] and [053] aligned approximately north-south is located to the western side of the site. The drain measures 0.25m by 0.13m deep and was backfilled with a grey brown silty clay (050) and (054). A layer of 'puddled' subsoil (047) and (051) measuring 0.24m in thickness seals the field drain and was overlain by topsoil (Fig 5 Sections 18, 19 & Fig 4). The topsoil is composed of loamy dark grey silt clay measuring 0.3m thick and overlying the entire site (Fig 20).

5.6 Undated Deposits

Undated deposits include the disturbed natural clays found under 'puddled' subsoil across the west of the site. Deposits (048) and (052) represent natural yellow clay lying in a shallow hollow and measure 0.1m in thicknesses. Both deposits were cut through by the modern field drains [049] and [053], and were sealed below (047) and (051) respectively.

A layer of alluvium (005) stretches approximately 5.5m west from the eastern

edge of site and 5.5m north from the southern edge of the site. The alluvium sealed all the Roman features in the southeast area of the site to a maximum depth of 0.25m, and was sealed in turn by the subsoil (002) (Fig 5, Section 20).

The subsoil (002) underlying topsoil (001) is silt rich sand measuring 0.4m and probably incorporating a large volume of river silts from the pre-canalised River Witham (Fig 5, Section 20).

6. DISCUSSION

Low levels of Roman features were revealed at Meadow Lane, North Hykeham. The deposits are mainly found in the south and east of the site where there is a greater depth of overlying material to preserve the remains. The western side of the site has a 0.3m thick layer of topsoil overlying the natural clays, compared to a maximum thickness of 0.8m combined topsoil, subsoil and alluvium preserving the material on the eastern side.

There are two main Roman boundaries defined across the development site. The earlier north south boundary is formed by ditch [021], recut first by [019] and finally by the shallower gully [015].

The second, later boundary aligned east west, is represented by ditch [034]. As with the north-south boundary, ditch [034] is recut by a later ditch [036] recorded as [027] west of the trial trench. Two more episodes of recutting occur along this alignment [038] and [040].

The two ditch alignments suggest they are boundaries on the periphery of a Romano-British settlement located further south of the development site. Several phases of recutting of the boundaries would suggest a moderately long period of Roman habitation within the area, not unexpected given the span of occupation (2nd to 4th

century AD) found to the south west of the site in previous investigations.

The frequent recuts may also be a product of the location of the ditches within the site geology. All of the recuts are found in the eastern half of the site dug into old river silts (004) rather than the impermeable yellow clay (003) found to the west. The silt rich fills of the ditches within this area, suggest a close proximity to the River Witham and its flood plain in the Roman Period. With a higher risk of flooding and seasonal inundations of flood deposited silts, boundary ditches would need more frequent maintenance. The presence of a layer of alluvium (005) sealing the Roman deposits across the eastern side of the site further indicates the proximity of the River Witham's flood plain before canalisation.

A deposit of cremated human bone was located within a discrete pit [017] cut into the upper fills of the earliest north-south ditch [021]. There was no sign of an obvious cremation vessel, with a single sherd of 3-4th C fineware providing the only ceramic dating evidence.

This suggests that burial practices on the site may be simple cremations and discrete deposits, in this case in a silted up ditch near the river margins. Cremations are not uncommon within the Roman period, and are often found without a containing vessel (*pers.comm* J.Kitch). Disposal of bodily remains near and within water sources has been suggested as a major practice in pre-Christian Britain. Prehistoric burials are relatively rare in comparison to the believed population size, suggesting only select elements of burial practice are being recorded. Certainly the well documented Arras chariot burials and warrior inhumations of the Iron Age would seem to be significant burials and beyond the norm. It is likely that less demonstrative burial practice was utilised by the bulk of the population.

Given the Iron Age adoption of water based rituals, notably in the placed deposits of metalwork in rivers, it is conceivable that cremated bodies may have been given a similar treatment, placed near or within bodies of water. A Romanised Lincolnshire may have therefore continued these water-associated cremation practices for the general populace. This may be particularly relevant at North Hykeham, with the settlement bordering a major river.

The pottery recovered during excavation has been dated to the 3rd to 4th C AD, contrasting with earlier material of predominantly 2nd C revealed in the 2002 evaluation. This suggests a period of extended occupation of the site with earlier Roman deposits present beyond the stripped area. The largely 4th C material revealed within the development site may indicate a continuation of the settlement revealed to the southwest (Appendix 3a). In addition, 17 of the 81 recovered sherds are derived from either alluvium sealing Roman deposits or subsoil/topsoil. It is certainly possible that some of the later Roman material is in fact intrusive from the settlement to the southwest, particularly given the possibility of episodic flooding suggested within the eastern area of the site. Later Roman material may have been transported by river flooding, incorporating abraded material within the upper fills of abandoned, earlier ditches.

A small quantity of medieval and post-medieval pot sherds were recovered from top and subsoil (Appendix 3c). These are considered to be residual in nature.

There is a moderate level of post-medieval activity within the development site all related to tile and possibly brick production (Appendix 3 c & d). After the Roman period, tile production was largely abandoned until a renaissance in the early medieval period. The use of roof tiles became so important within medieval

cities that an Ordinance was passed in 1212 prohibiting the use of thatch in London (PCA 2002). By 1468 the tilers of London petitioned for guild status and recommended quality control of products. The failing quality of medieval tile was addressed by an Act of Parliament in 1477 regulating the preparation and production of tiles to minimum standards (McCarthy & Brooks 1988).

Post medieval tile making continued under these 15th century regulations, though there is little physical evidence remaining for kilns within Lincolnshire. The Boston tile industry continued into the post-medieval period, but despite references to tile production in Lincoln, only a 15th-16th century kiln at St Marks has been located to date (Field 1984). The presence of two post-medieval kilns at North Hykeham is therefore of considerable interest.

In addition to the kiln uncovered during trial trenching, a second kiln floor surface was located 18m to the northeast. The preserved floor surface represents heated and partially vitrified soil caused by the high temperatures found within the kiln during firing. The heated surface appears to define three flues or stoke holes suggesting a four-walled kiln similar to that found in trial trenching. There is no standing structural material, possibly indicating the kiln was robbed of reusable bricks at the end of its firing. It is feasible that the best condition building material was reused within the construction of the kiln discovered during trial trenching. A similar sized post-medieval kiln at Danbury, Essex was found to have had the good quality external bricks robbed out, leaving only the superheated lining material (Drury 1975).

Two phases of kiln activity are present within the development site. As part of the archaeological strategy, the potential and evidence for clay extraction and preparation was also investigated. The raw materials for good brick and tile

production include soft plastic clay easily moulded and sandy clay to add tempering (PCA 2002). A nearby water source is also essential for the mixing process.

Meadow Lane, North Hykeham has the potential for a good clay extraction site, possessing soft plastic clay on the western side of the site and a source of sandy clay along the margin between (003) and (004). The River Witham now only 200m from site would have been a valuable resource of water and a method of transport to potential markets at Lincoln.

The rectangular pit [033] located in the north west of the development site could be an extraction pit, being dug deep into the natural clays. The volume of clay removed however would not be great, comprising approximately 12 cubic metres of material. This would appear to confirm that small-scale tile production was occurring at Meadow Lane, probably on a seasonal part time basis. An alternative use for the pit could be as a mixing tank for the excavated, weathered clays and water, churned until the right consistency for moulding was reached. This was the favoured method of mixing clay by the Staffordshire potters in the late 17th century, steeping clay in a square pit until due consistency was reached (McCarthy & Brooks *ibid*).

After the pit had gone out of use, it was partially backfilled with (042). Backfilling of extraction pits was good practice as potters and tilers could be prosecuted for leaving open dangerous pits. Post-medieval potters in Verwood were frequently brought before Cranbourne court for failing to backfill extraction pits (McCarthy & Brooks *ibid*). The 'puddling' deposits overlying the rectangular pit suggest an irregular pond formed after the pit was abandoned. The partially exposed pit would collect both rainwater and a rising water table forming a natural pool after a short time exposed in poor weather (Plate 12).

There is no direct physical evidence for storage facilities associated with the kilns. After preparation of the clays, tiles would have been formed on pallet boards and left to dry to the 'leather hard' stage. This activity would be best carried out in a workhouse structure where tiles could be stacked for drying. No associated structure exists at Meadow lane, however a post medieval kiln site at Bulmer, Essex revealed the remains of an open walled shed sitting on a foundation of brick and tile wasters (Drury *ibid*). Any structure with such shallow foundations at Meadow lane would probably have been destroyed by 19th and 20th century agriculture.

The volume of clay extracted and low level of tile wasters found across the development site suggest that tile production was local, small scale and seasonal. Post medieval tile production was common as a part time occupation. The will of Samuel Moody a brick and tile maker at Danbury in the late 17th century, reflects a self-sufficient farmstead with tile making only a seasonal addition to the family's income (Drury *ibid*).

Tile production would fit easily into a pastoral farmer's time when the raw materials were close at hand. The 1477 Act of Parliament stipulates that raw clay had to be quarried before the beginning of November and left to weather, before mixing with water before February and firing after March (McCarthy & Brooks *ibid*). The optimum time for tile production would then fill the winter months when farming traditionally slows down, providing an extra income over the coming year.

Archaeomagnetic dating of the preserved kiln has provided a last firing date of between 1480 and 1530 AD, with a best estimate of 1505 AD. This suggests the kiln was constructed during the late medieval period being last used within the same generation as the 1477 Act of

Parliament coming into force. The CBM analysed from the 2002 evaluation gave a broad date range for the kiln of 16th-18th century. When the archaeomagnetic date is taken into consideration, the CBM must either have been produced in the early 16th century or is unrelated to the preserved kiln.

It is possible that as CBM typologies are fairly undiagnostic during the later medieval and post-medieval periods, that much of the material analysed from the 2002 evaluation was actually closer to 15th and 16th century in date.

Subsequent analysis of the CBM recovered from North Hykeham (Appendix 3d) confirmed the local production of brick, floor and flat roof tiles in the 15th and 16th Century AD. Petrological study of the brick and tile suggests that shaley clay of the Grantham formation was used as the source material. It is likely that Grantham formation clays were deposited as till during glacial movement, leaving exposed outcrops within the North Hykeham area.

7. CONCLUSION

An archaeological investigation was undertaken on land at Meadow Lane, North Hykeham, Lincolnshire. The development site was deemed to be archaeologically sensitive with previous trial trenching having encountered a low level of Romano-British material and a well preserved kiln believed to be Post-Medieval. The investigation involved a strip, map and sample of archaeological deposits. Additionally the known kiln was partially re-excavated in order to obtain a sample for archaeomagnetic dating.

The investigation revealed low levels of late Roman deposits found mainly within the southeast area of the development site. The low concentration and location of deposits would suggest the development site is placed on the outer periphery of a

Roman settlement with the core further southwest of the site.

Moderate levels of Post-medieval deposits were found within the north and east of the development site including a possible clay extraction pit and the heated floor surface of a second kiln. No other structures were associated with the kiln activity. There is sound evidence for small-scale tile preparation and production taking place at North Hykeham during the late 15th-16th centuries AD probably as a seasonal activity to bolster the income of pastoral farming.

8. PERSONNEL

Project Coordinator: Mark Williams
 Site Supervisor: Michael Wood
 Site Staff: Neil Parker, Jim Robertson & Richard Lawrence
 Survey: Mark Dymond
 Environmental Analyst: Val Fryer
 Finds Processing: Denise Buckley
 Finds Analysts: Jennifer Kitch, B J Precious, Alan Vince & Jane Young
 Archaeomagnetic dating: Vassil Karloukovski & Mark Hounslow
 Photographic Reproduction: Sue Unsworth
 CAD Illustration: Michael Wood
 Post-excavation Analyst: Michael Wood

9. ACKNOWLEDGEMENTS

APS would like to acknowledge the assistance of Westleigh Developments Ltd for commissioning this programme of work and supplying plant throughout the investigation. Dr Mark Hounslow of Lancaster University undertook archaeomagnetic sampling on site. Mark Dymond provided survey support throughout and Joanna Hambly kindly provided further reference material on Post-Medieval kilns. Mark Williams coordinated the project and edited this report in conjunction with Tom Lane.

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10. ABBREVIATIONS

APS Archaeological Project Services

CBM Ceramic Building Material (brick, tile etc.)
 EDM Electronic Distance Measure
 IFA Institute of Field Archaeologists
 OD Ordnance Datum (Height above sea level)
 OS Ordnance Survey

Figure 1: Site Location

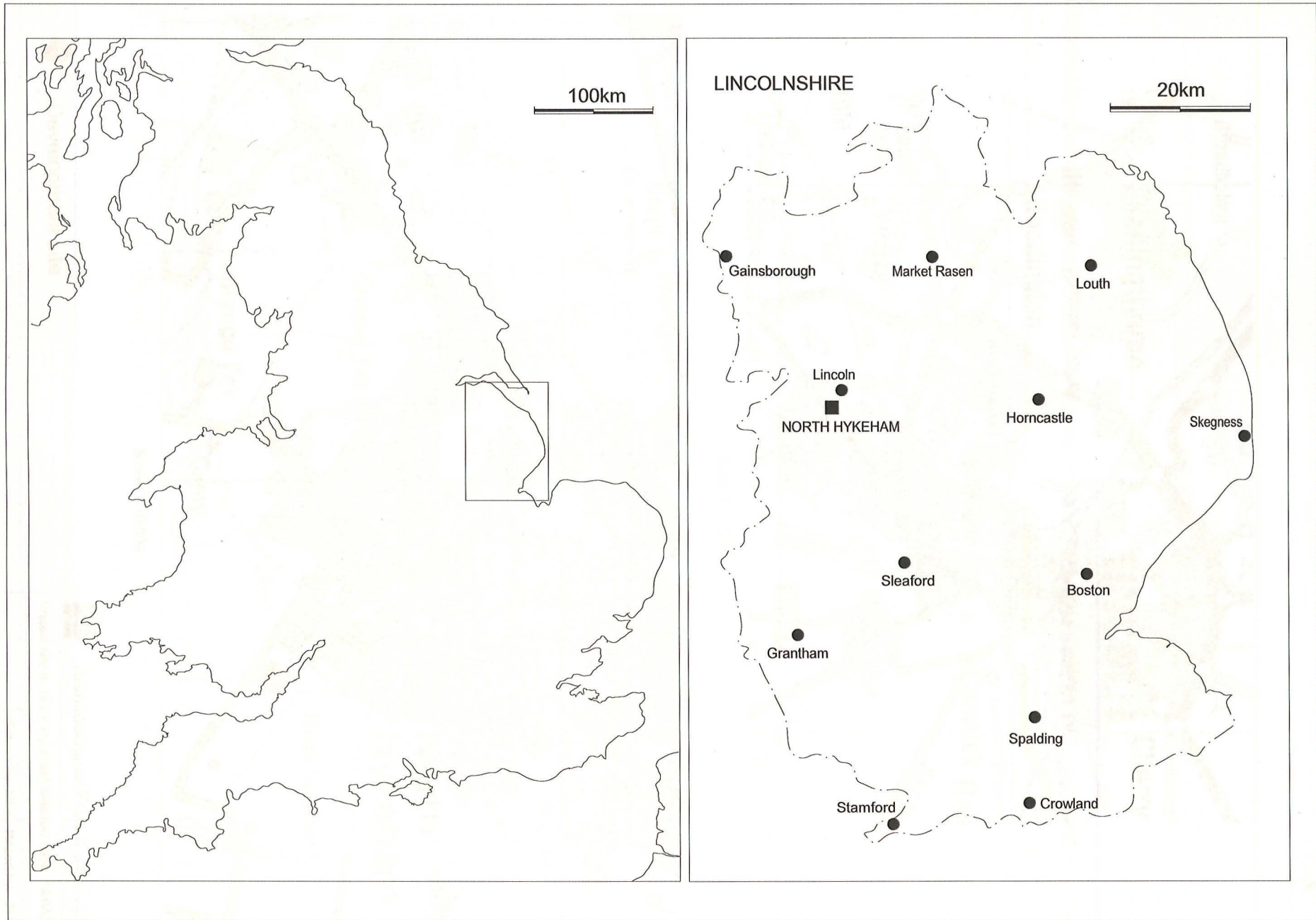
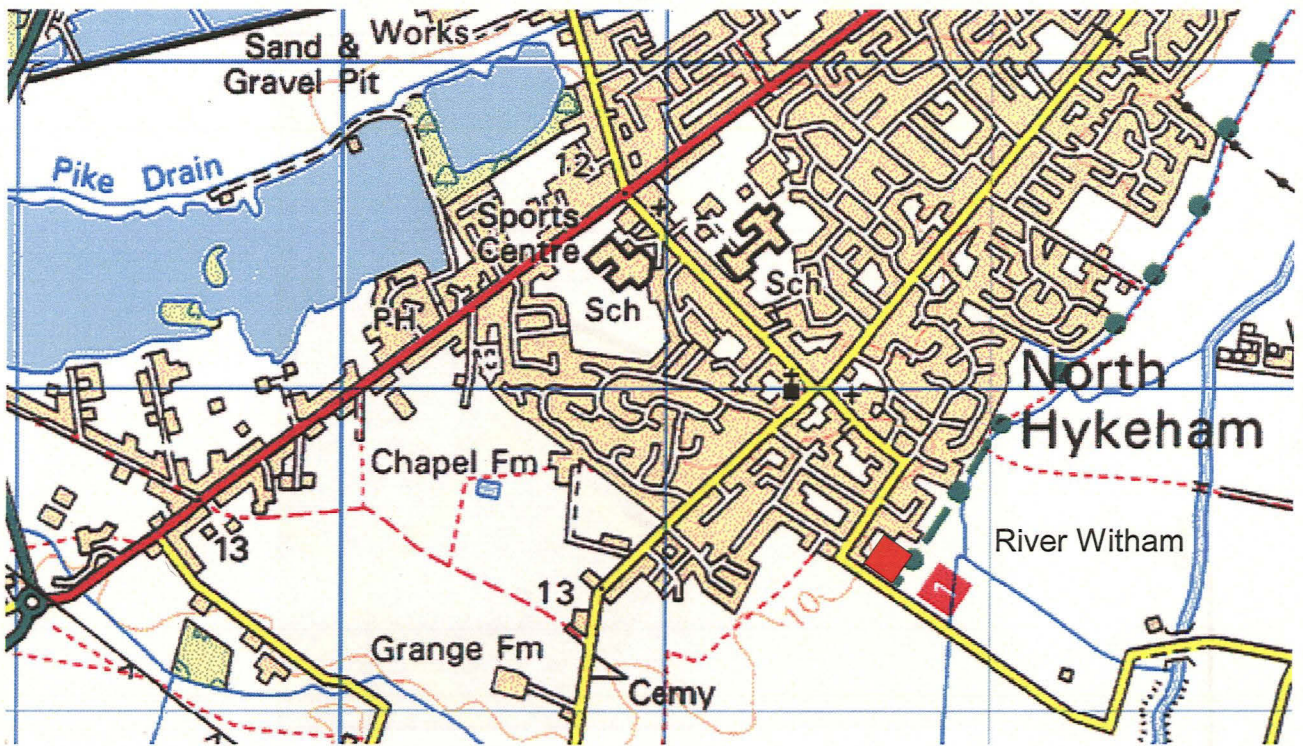


Figure 1: General Location Plan



Scale 1:25,000



Scale 1:10,000



Development site



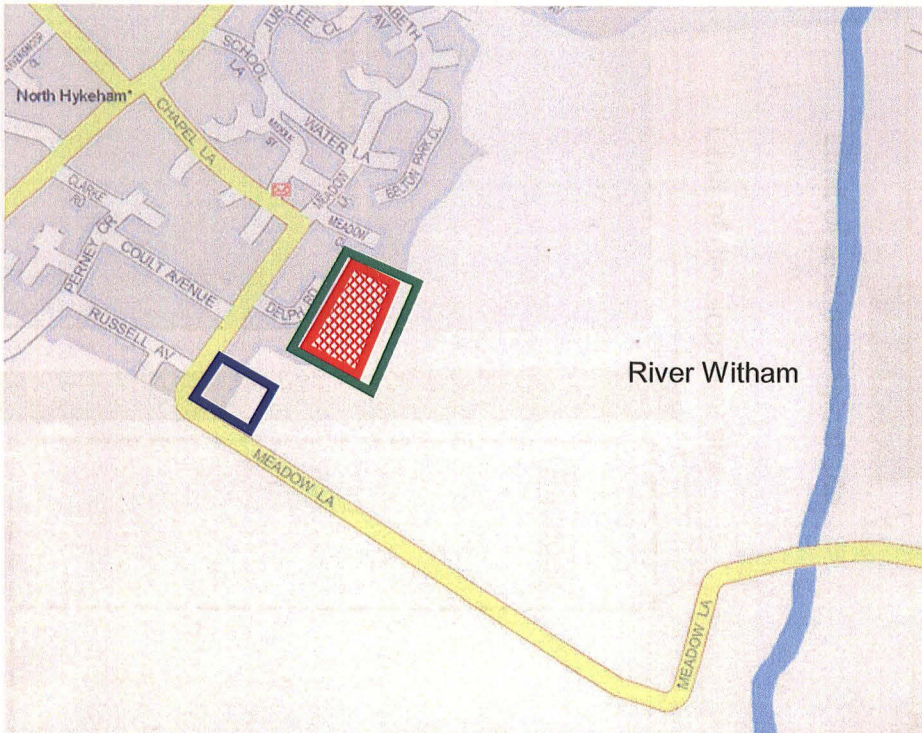
Archaeological Project Services

Project Name: North Hykeham Meadow Lane NHM04

Drawn by: MW

Report No: 31/05

Figure 2a Site Location



-  JSAC Evaluation 1999
-  PCA Evaluation 2002
-  APS Investigation 2004




	Archaeological Project Services	
Project Name: North Hykeham Meadow Lane NHM04		
Scale 1:10000	Drawn by: MW	Report No: 31/05

Figure 2b. Recent Archaeological investigation near Meadow Lane

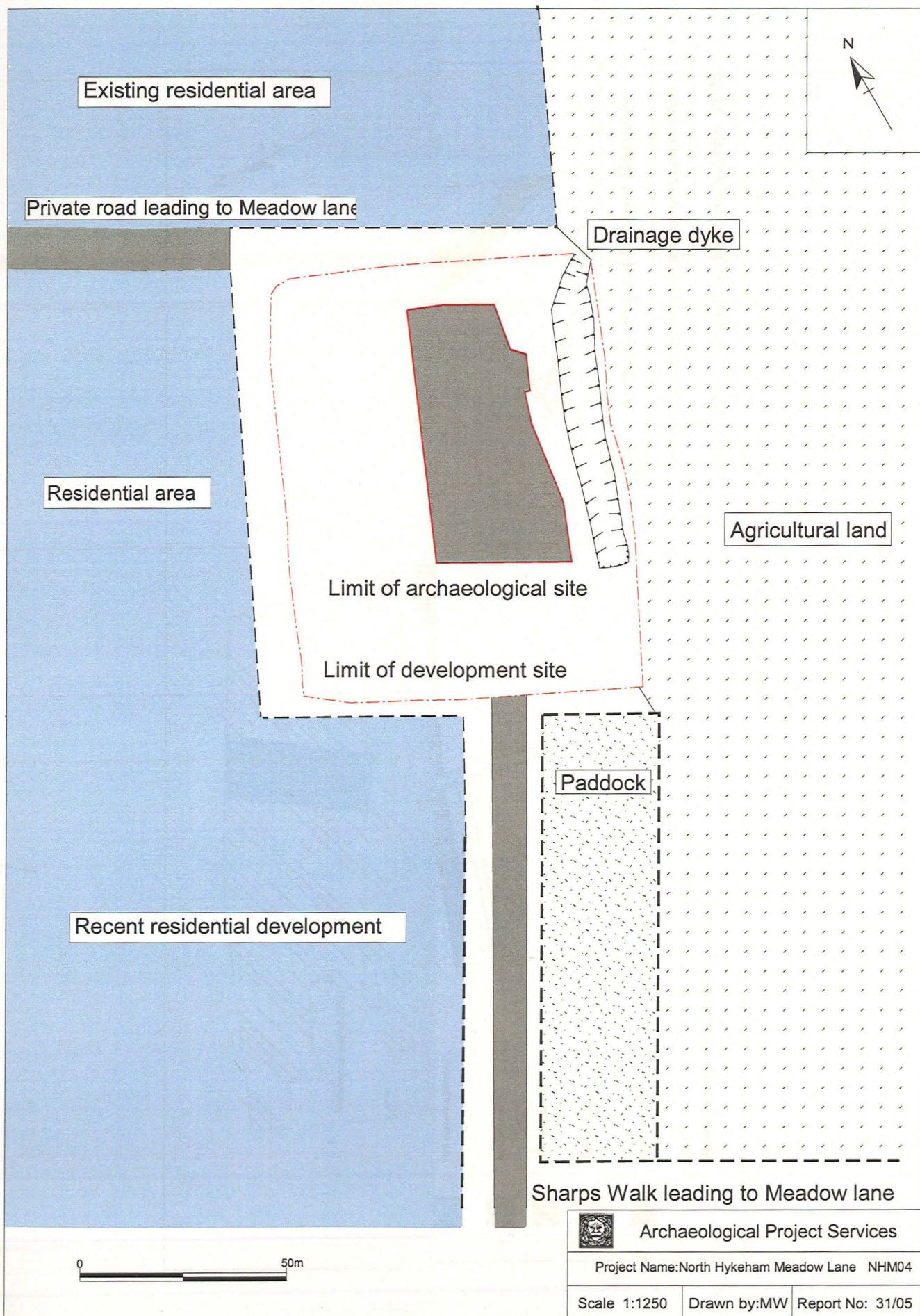


Figure 3 Site Location

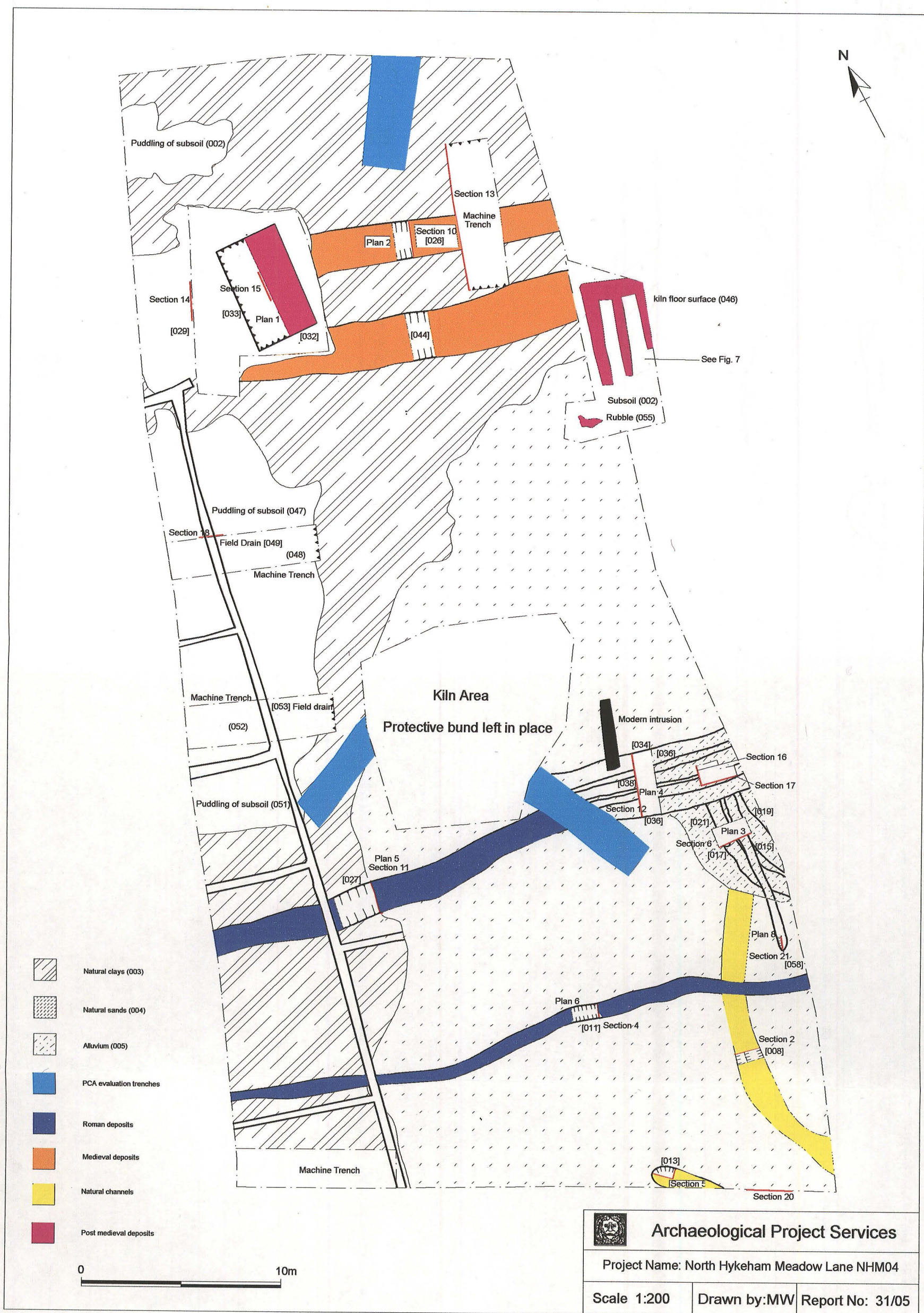
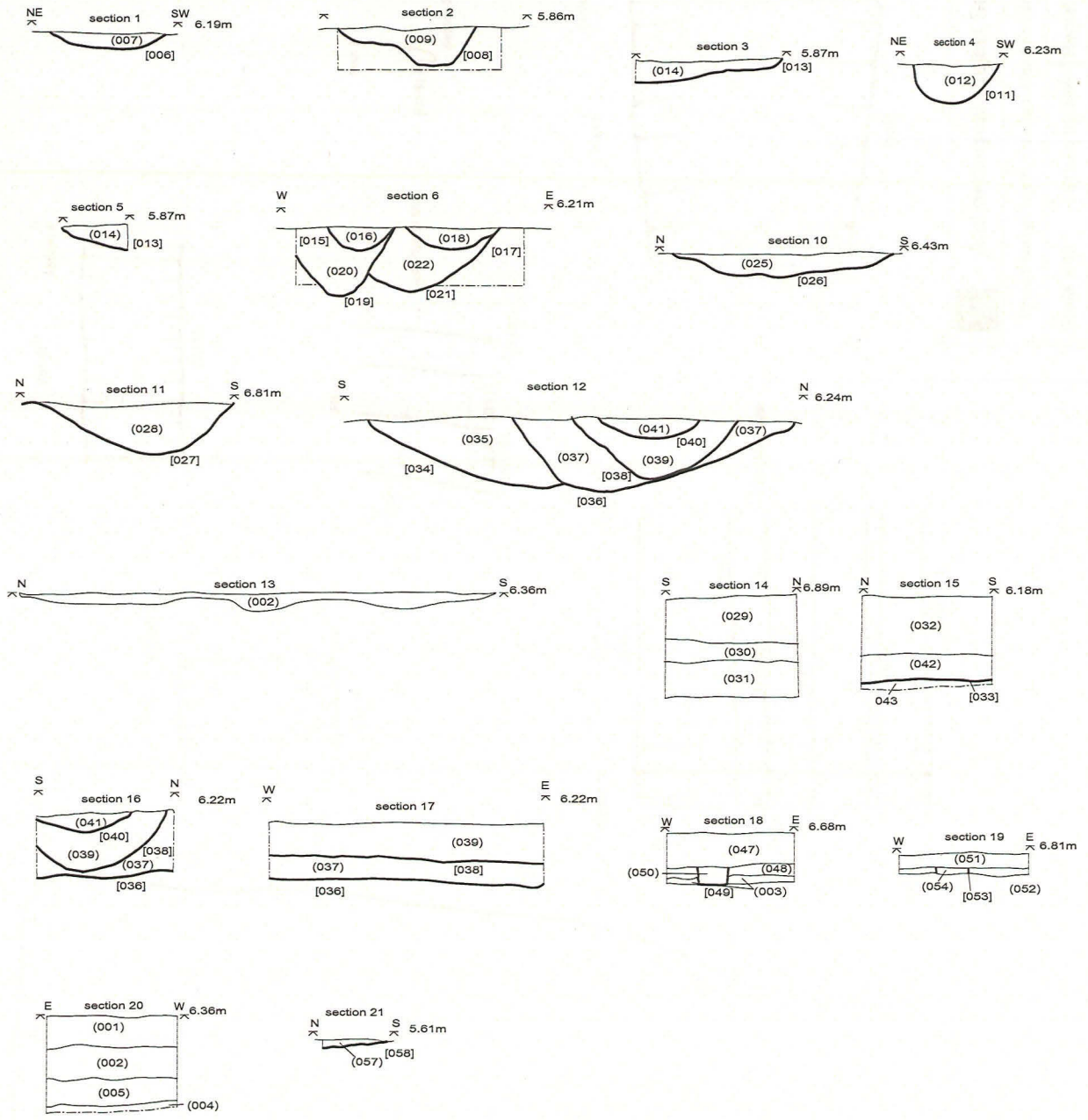


Figure 4 Archaeology




 Archaeological Project Services		
Project Name: North Hykeham Meadow Lane NHM04		
Scale 1:50	Drawn by: MW	Report No: 31/05

Figure 5 sections

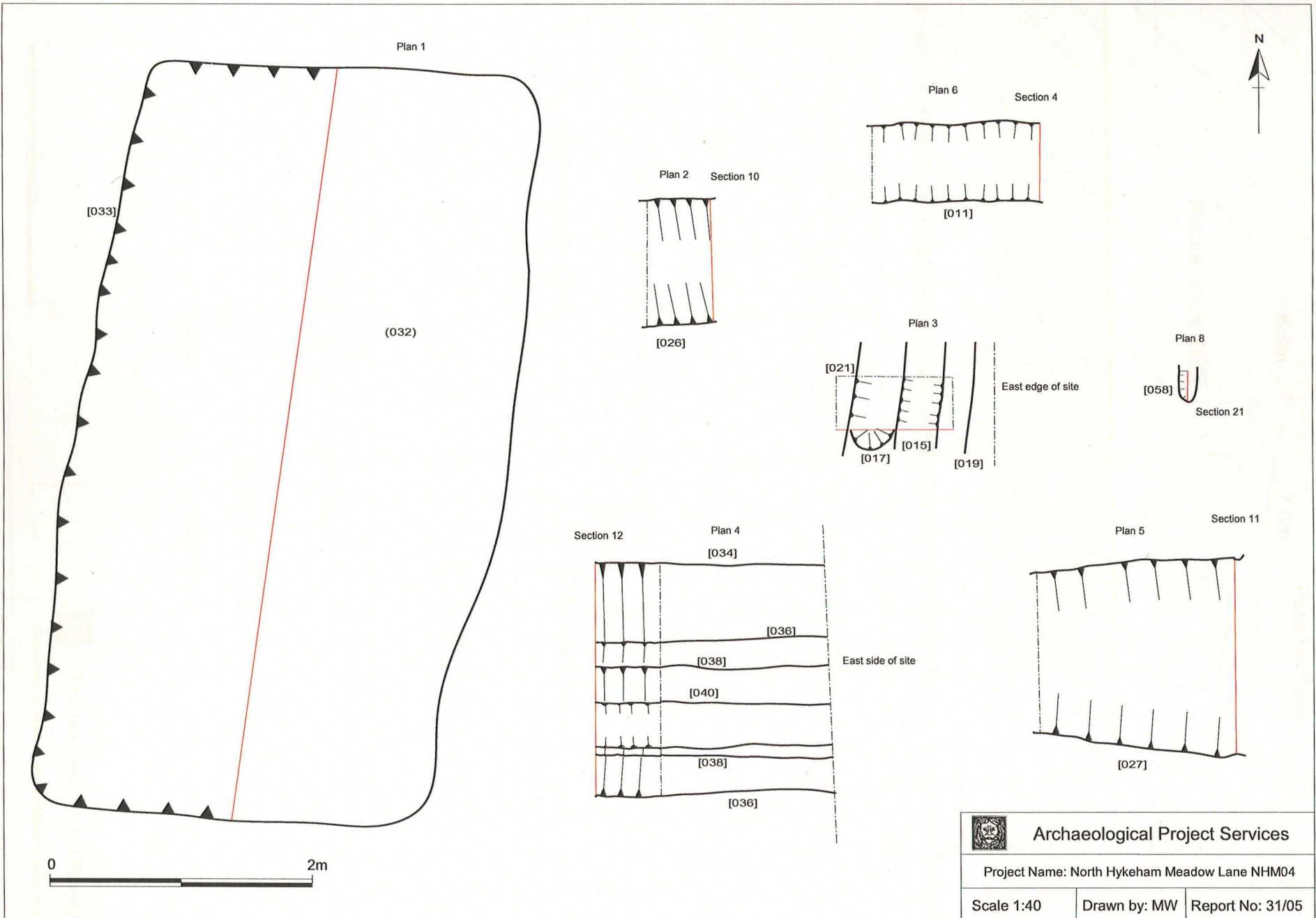



Figure 6 plans

 Archaeological Project Services		
Project Name: North Hykeham Meadow Lane NHM04		
Scale 1:40	Drawn by: MW	Report No: 31/05

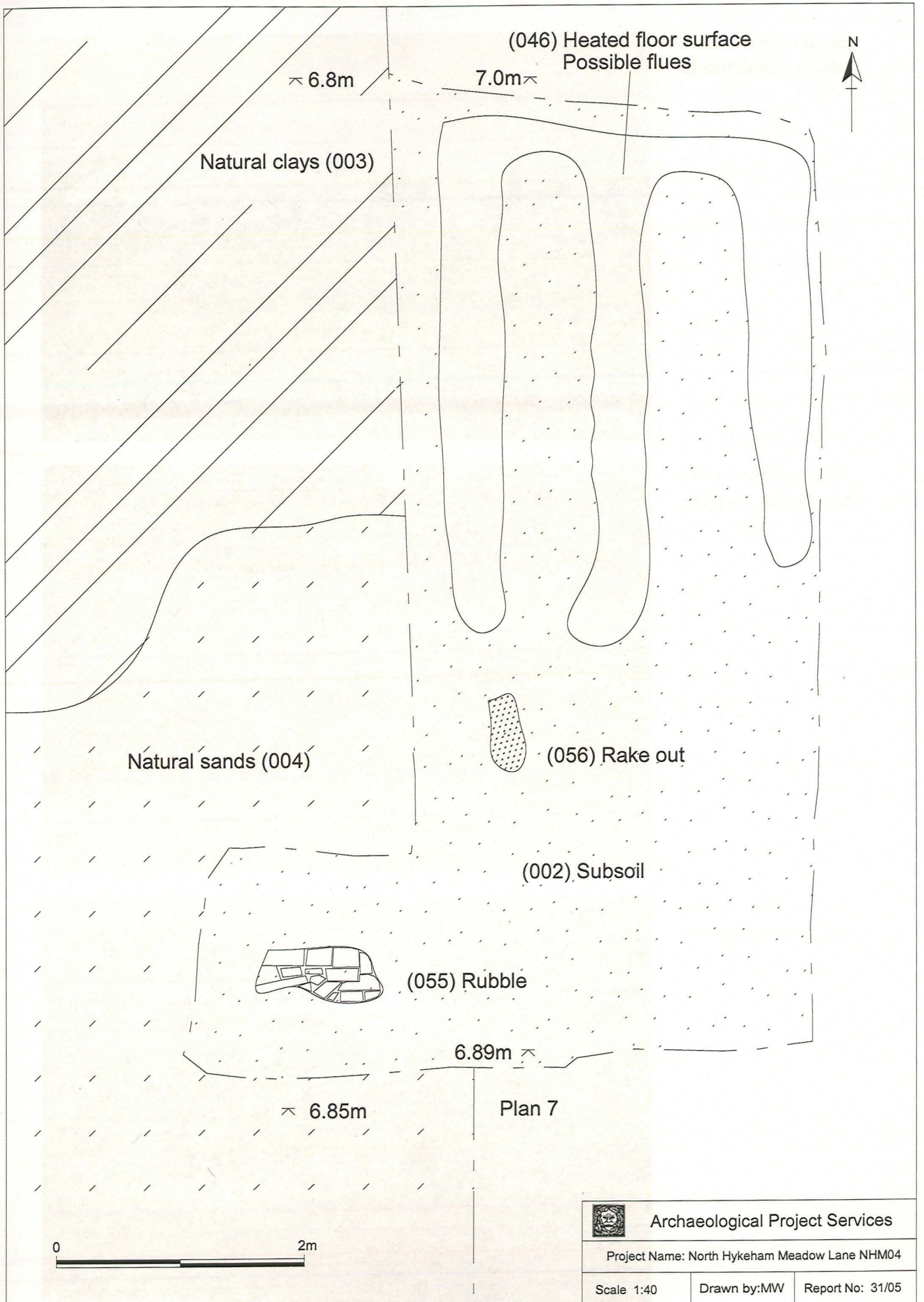


Figure 7 Kiln floor surface



Plate 1 General view
of site facing south



Plate 2 Site during
stripping facing north



Plate 3 Section 5
through water channel



Plate 4 Section 4
Roman ditch [011]



Plate 5 Section 13
Roman ditches [015]
[017] [019] [021]



Plate 6 Section 11
Roman ditch [027]

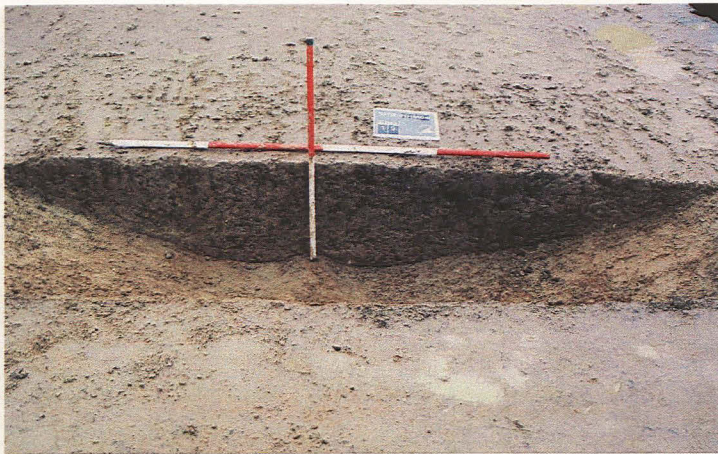


Plate 7 Section 12
Roman ditches [034]
[036] [038] [040]



Plate 8 Section 10
Plough Furrow [026]



Plate 9 Floor surface
(046)



Plate 10 Archaeomagnetic dating of
Post-medieval kiln



Plate 11
 'Puddling'
 over [033]



Plate 12 Post-med
 pit [033] after
 overnight rain



Plate 13 Roman pit
 [017] containing
 cremated bone

APPENDIX 1

**SPECIFICATION FOR
ARCHAEOLOGICAL PRESERVATION,
INVESTIGATION AND DATING
AT MEADOW LANE,
NORTH HYKEHAM,
LINCOLNSHIRE**

**PREPARED FOR
WESTLEIGH DEVELOPMENTS LTD**

**BY
ARCHAEOLOGICAL PROJECT SERVICES
Institute of Field Archaeologists'
Registered Archaeological Organisation No: 21**

NOVEMBER 2004

TABLE OF CONTENTS

1	SUMMARY	1
2	INTRODUCTION	1
3	SITE LOCATION	1
4	PLANNING BACKGROUND	1
5	SOILS AND TOPOGRAPHY	1
6	ARCHAEOLOGICAL AND HISTORICAL BACKGROUND	2
7	AIMS AND OBJECTIVES	2
8	SITE OPERATIONS	3
9	POST-EXCAVATION AND REPORT	4
10	ARCHIVE	5
11	REPORT DEPOSITION	6
12	PUBLICATION	6
13	CURATORIAL MONITORING	6
14	VARIATIONS TO THE PROPOSED SCHEME OF WORKS	6
15	STAFF TO BE USED DURING THE PROJECT	6
16	PROGRAMME OF WORKS	7
17	INSURANCES	7
18	COPYRIGHT	7
19	BIBLIOGRAPHY	8

1 SUMMARY

- 1.1 *This document comprises a specification for archaeological investigation of land at Meadow Lane, North Hykeham, Lincolnshire.*
- 1.2 *A programme of geophysical survey and trial trenching has been carried out within the proposed development and revealed a very well preserved post medieval (16th/18th century) tile (and possibly brick) kiln of which only two similar kilns have been investigated in Lincolnshire. A low level of Romano-British activity was also identified within the area..*
- 1.3 *A planning application has been made for residential development of the area. Permission has been granted subject to a condition for a programme of archaeological work that will involve archaeomagnetic dating of the kiln structure, scientific analysis of the tile and brick fabric and topsoil stripping and archaeological mapping, sample excavation and recording of the remains revealed.*
- 1.4 *On completion of the fieldwork a report will be prepared detailing the results of the investigation. The report will consist of a text describing and interpreting the archaeological deposits located. The text will be supported by illustrations and photographs.*

2 INTRODUCTION

- 2.1 This document comprises a specification for a programme of archaeological work at Meadow Lane, North Hykeham, Lincolnshire.
- 2.2 The document contains the following parts:
 - 2.2.1 Overview
 - 2.2.2 The archaeological and natural setting
 - 2.2.3 Stages of work and methodologies to be used
 - 2.2.4 List of specialists
 - 2.2.5 Programme of works and staffing structure of the project

3 SITE LOCATION

- 3.1 North Hykeham is in the administrative district of North Kesteven, on the south-western periphery of Lincoln. The proposed development area covers an area of approximately 0.7Ha and is located on the south side of Meadow Lane, at national grid reference SK 9472 6548.

4 PLANNING BACKGROUND

- 4.1 A full planning application (N/43/0512/04) for the construction of 23 dwellings has been submitted to North Kesteven District Council. Permission has been granted, subject to a condition for a programme of archaeological works. A brief for archaeological works was produced by the Heritage Officer, North Kesteven District Council.

5 SOILS AND TOPOGRAPHY

- 5.1 The site was formerly a paddock, and is still grassed. It slopes gently from north-west to south-east

at c. 8.5m OD

- 5.2 The local geology consists of Lower Lias Clay, although the eastern part of the site is made up of alluvial deposits of sand and gravel (British Geological Survey, 1973), deposited by the pre canalised River Witham, (North Hykeham Pump Drain), which now runs approximately 200m east of the current site.

6 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

- 6.1 Numerous prehistoric artefacts have been recovered from the area, including two Neolithic polished stone axes, a perforated axe hammer, and a leaf shaped arrowhead. A small quantity of Iron Age pottery was recovered during an evaluation in an adjacent field and a late 1st / early 2nd century AD pottery kiln and associated pottery was exposed during gravel extraction works.
- 6.2 An archaeological excavation approximately 200m north west of the proposed development site exposed three principal phases of Romano British activity, including evidence of metal working, from the 2nd to late 4th century AD.
- 6.3 In 1086, North Hykeham appears in the Domesday Book as Northhica, under the ownership of Baldwin the Fleming and Count Alan (Morgan and Thome, 1986). Numerous isolated findspots, including coins of Henry VI (1421 1471) and Henry VII (1485 1509), indicate a low level of activity through the medieval period.
- 6.4 A programme of geophysical survey and trial trenching has been carried out within the proposed development area (Pre Construct Archaeology 2002).
- 6.5 The purpose of the archaeological evaluation was to determine whether Romano British settlement identified in the western adjacent field continued into the currently proposed development area. Only a low level of Romano British activity was identified, suggesting that this area was on the periphery of the nearby settlement.
- 6.6 An unexpected discovery, however, was a very well preserved Post-medieval (16th / 18th century) tile (and possibly brick) kiln. The kiln structure survives to at least 4 brick courses high and the evaluation indicated that it was largely undisturbed. The kiln structure lies beneath just 300mm of topsoil.
- 6.7 Although they are frequently referred to in historical documentation, only two Post-medieval brick and tile kilns have been investigated in Lincolnshire. The excellent condition of this one makes it rare and important, particularly the potential contribution it can make to the study of post medieval industry and buildings in the immediate locality. It is likely that the products of this kiln, located as it is on the bank of the river Witham, were used in Lincoln in the 16th to 18th centuries.

7 AIMS AND OBJECTIVES

- 7.1 The aim of the work will be to recover as much information as possible on the origins, date, development, phasing, spatial organisation, character, function, status, significance and nature of social, economic and industrial activities on the site.
- 7.2 The objectives of the work will be to:
- 7.2.1 Determine the date of the archaeological remains present on the site.
- 7.2.2 Determine the extent and spatial arrangement of archaeological remains present within

the site.

- 7.2.3 Establish the character of archaeological remains present within the site.
- 7.2.4 Determine the extent to which surrounding archaeological remains extend into the site.
- 7.2.5 Identify the way in which the archaeological remains identified fit into the pattern of occupation and land-use in the surrounding landscape.
- 7.2.6 Identify any archaeological features that may be associated with the kiln.

8 SITE OPERATIONS

8.1 General Considerations

- 8.1.1 All work will be undertaken following statutory Health and Safety requirements in operation at the time of the investigation. A Risk Assessment will be prepared prior to the investigation, and updated throughout its duration.
- 8.1.2 The work will be undertaken according to the relevant codes of practice issued by the Institute of Field Archaeologists (IFA). Archaeological Project Services is an IFA registered archaeological organisation (no. 21) managed by a Member (MIFA) of the institute.
- 8.1.3 All work will be carried out in accordance with *Standards for Field Archaeology in the East of England, 2003*.
- 8.1.4 Any artefacts found during the investigation and thought to be 'treasure', as defined by the Treasure Act 1996, will be removed from site to a secure store and the discovery promptly reported to the appropriate coroner's office.

8.2 Methodology

- 8.2.1 Recent deposits will be removed by mechanical excavator with a toothless ditching bucket under archaeological supervision. Previous investigations have indicated that archaeological remains of possibly Romano-British and later date are identified beneath topsoil and subsoil and is expected that the area stripping will be to the base of subsoil/top of natural across the area.
- 8.2.2 Following the site stripping areas will be cleaned if necessary and a pre-excavation plan made of the entire investigation site.
- 8.2.3 A representative sample of exposed features will be hand-excavated. This will include: the excavation of structures, post trenches or other structural slots; half-sectioning of postholes and pits; cross-sectioning of linear features, where not forming parts of structures. All burials (excluding animal interments of potentially post-medieval-recent date) will be fully excavated.
- 8.2.4 Archaeological features will be recorded on APS pro-forma context record sheets. The system used is the single context method by which individual archaeological units of stratigraphy are assigned a unique record number and are individually described and drawn. All context and site numbering used will be compatible with the Norfolk Sites and Monuments Record.

8.2.5 Plans of features will be drawn at a scale of 1:20 and sections at a scale of 1:10. Should

individual features merit it, they will be drawn at more appropriate scales.

- 8.2.5 Throughout the duration of the investigation a photographic record consisting of black and white prints (reproduced as contact sheets) and colour slides or prints will be compiled. The photographic record will consist of:
- the site before the commencement of field operations
 - the site during the investigation to show specific stages of work, and the layout of the archaeology within the area.
 - individual features and, where appropriate, their sections.
 - groups of features where their relationship is important.
 - the site on completion of fieldwork
- 8.2.6 Should human remains be located they will be left *in situ* and only removed if absolutely necessary. If removal of human remains proves necessary then the appropriate Home Office licence will be obtained and the coroner and police informed, as appropriate. Consideration will be given at all times to ensure that no offence is caused to any interested parties.
- 8.2.7 Archaeomagnetic dating of the kiln will be undertaken on the previously exposed western half of the kiln. Following sampling, the kiln will be re-covered with engineering membrane and backfilled.
- 8.2.8 Finds collected during the fieldwork will be bagged and labelled according to the individual deposit from which they were recovered, ready for later washing and analysis. All finds work will be carried out to accepted professional standards and the Institute of Field Archaeologists *Guidelines for Finds Work* (1992).
- 8.2.9 Conservation of artefacts will be carried out by Lincoln City and County Museum. The resources available for conservation is dependent on the quantity and type of artefacts recovered from the site.
- 8.2.10 The location of the site recording grid will be established by an EDM survey and accurately related to the Ordnance Survey grid and to suitably mapped local features.
- 8.2.11 During the investigations, all exposed surfaces, excavation horizons, and spoil, will be regularly and repeatedly metal-detected to ensure optimum recovery of artefacts. Any identified artefacts will be excavated from its parent context in normal stratigraphic sequence.

9 POST-EXCAVATION AND REPORT

9.1 Stage 1

- 9.1.1 On completion of site operations, the records and schedules produced during the investigation will be checked and ordered to ensure that they form a uniform sequence constituting a level II archive. A stratigraphic matrix of the archaeological deposits and features present on the site will be prepared. All photographic material will be catalogued: the colour slides will be labelled and mounted on appropriate hangers and the black and white contact prints will be labelled, in both cases the labelling will refer to schedules identifying the subject/s photographed
-

9.1.2 All finds recovered during the investigation will be washed, marked, bagged and labelled according to the individual deposit from which they were recovered. Any finds requiring specialist treatment and conservation will be sent to the Conservation Laboratory at the City and County Museum, Lincoln.

9.2 Stage 2

9.2.1 Detailed examination of the stratigraphic matrix to enable the determination of the various phases of activity on the site.

9.2.2 Finds will be sent to specialists for identification and dating.

9.2.3 The fabric of the tiles and bricks previously recovered and those likely to be revealed during this investigation will be analysed scientifically and the material used in a County Type Series. Furthermore, if any areas of raw material extraction or by-product are located samples will be taken for analysis.

9.3 Stage 3

9.3.1 On completion of stage 2, a report detailing the findings of the investigation will be prepared. This will consist of:

9.3.1.1 A non-technical summary of the findings of the investigation.

9.3.1.2 A description of the archaeological setting of the site.

9.3.1.3 Description of the topography and geology of the area

9.3.1.4 Description of the methodologies used during the investigation and discussion of their effectiveness in the light of the results.

9.3.1.5 Text describing the findings of the excavation.

9.3.1.6 Plans of the trenches showing the archaeological features exposed. If a sequence of archaeological deposits is encountered, separate plans for each phase will be produced.

9.3.1.7 Sections of the archaeological features.

9.3.1.8 Interpretation of the archaeological features exposed and their context within the surrounding landscape.

9.3.1.9 Specialist reports on the finds from the site.

9.3.1.10 Appropriate photographs of the site and specific or grouped/associated archaeological features.

9.3.1.11 A consideration of the significance of the archaeological remains encountered, in local, regional and national terms.

10 ARCHIVE

10.1 The documentation, finds, photographs and other records and materials generated during the

evaluation will be sorted and ordered into the format acceptable to the City and County Museum, Lincoln. This sorting will be undertaken according to the document titled Conditions for the Acceptance of Project Archives for long term storage and curation.

11 REPORT DEPOSITION

- 11.1 Copies of the evaluation report will be sent to: the client, Westleigh Developments Ltd; the North Kesteven Heritage Officer; North Kesteven District Council Planning Department; and the Lincolnshire County Sites and Monuments Record.

12 PUBLICATION

- 12.1 A report of the findings of the investigation will be submitted for inclusion in the journal *Lincolnshire History and Archaeology*. Notes or articles describing the results of the investigation will also be submitted for publication in the appropriate national journals: *Post-medieval Archaeology*, *Medieval Archaeology* and *Journal of the Medieval Settlement Research Group* for medieval and later remains, and *Britannia* for discoveries of Roman date.

13 CURATORIAL MONITORING

- 13.1 Curatorial responsibility for the project lies with North Kesteven Heritage Officer. As much written notice as possible, ideally at least seven days, will be given to the archaeological curator prior to the commencement of the project to enable them to make appropriate monitoring arrangements.
- 13.2 It is envisaged that there will be a site meeting with the curator immediately upon completion of the stripping/cleaning to discuss the extent of investigation required by archaeological excavation.

14 VARIATIONS TO THE PROPOSED SCHEME OF WORKS

- 14.1 Variations to the scheme of works will only be made following written confirmation of acceptability from the archaeological curator.
- 14.2 Should the archaeological curator require any additional investigation beyond the scope of the brief for works, or this specification, then the cost and duration of those supplementary examinations will be negotiated between the client and the contractor.

15 STAFF TO BE USED DURING THE PROJECT

- 15.1 The work will be directed by Tom Lane MIFA, Senior Archaeologist, Archaeological Project Services. The on-site works will be supervised by an Archaeological Supervisor with knowledge of archaeological investigations of this type. Archaeological excavation will be carried out by Archaeological Technicians, experienced in projects of this type.
- 15.2 The following organisations/persons will, in principal and if necessary, be used as subcontractors to provide the relevant specialist work and reports in respect of any objects or material recovered during the investigation that require their expert knowledge and input. Engagement of any particular specialist subcontractor is also dependent on their availability and ability to meet programming requirements.

Task	Body to be undertaking the work
Conservation	Conservation Laboratory, City and County Museum,

Lincoln.

Pottery Analysis	Prehistoric: Dr C Allen, Oxford Archaeology; or Dr D Knight, Trent and Peak Archaeological Unit Anglo-Saxon and later: P Blinkhorn or D Hall, independent archaeologists
Other Artefacts	J Cowgill, independent specialist (formerly City of Lincoln Archaeology Unit)
Human Remains Analysis	R Gowland, independent specialist
Animal Remains Analysis	Environmental Archaeology Consultancy
Environmental Analysis	Environmental Archaeology Consultancy
Soil Assessment	Dr Charly French, independent specialist
Pollen Assessment	Pat Wiltshire, independent specialist
Radiocarbon dating	Beta Analytic Inc., Florida, USA
Dendrochronology dating	University of Sheffield Dendrochronology Laboratory

16 PROGRAMME OF WORKS

16.1 The duration of the site works is difficult to determine as it is to a large extent reliant on the speed of stripping and spoil removal, and also depending on the quantity and complexity of archaeological remains encountered. Post-excavation work is likewise dependent on the quantity and complexity of archaeological remains encountered.

17 INSURANCES

17.1 Archaeological Project Services, as part of the Heritage Trust of Lincolnshire, maintains Employers Liability insurance to £10,000,000. Additionally, the company maintains Public and Products Liability insurances, each with indemnity of £5,000,000. Copies of insurance documentation can be supplied on request.

18 COPYRIGHT

18.1 Archaeological Project Services shall retain full copyright of any commissioned reports under the *Copyright, Designs and Patents Act 1988* with all rights reserved; excepting that it hereby provides an exclusive licence to the client for the use of such documents by the client in all matters directly relating to the project as described in the Project Specification.

18.2 Licence will also be given to the archaeological curators to use the documentary archive for educational, public and research purposes.

18.3 In the case of non-satisfactory settlement of account then copyright will remain fully and exclusively with Archaeological Project Services. In these circumstances it will be an infringement under the *Copyright, Designs and Patents Act 1988* for the client to pass any report, partial report, or copy of same, to any third party. Reports submitted in good faith by Archaeological Project Services to any Planning Authority or archaeological curator will be removed from said Planning

Authority and/or archaeological curator. The Planning Authority and/or archaeological curator will be notified by Archaeological Project Services that the use of any such information previously supplied constitutes an infringement under the *Copyright, Designs and Patents Act 1988* and may result in legal action.

- 18.4 The author of any report or specialist contribution to a report shall retain intellectual copyright of their work and may make use of their work for educational or research purposes or for further publication.

19 BIBLIOGRAPHY

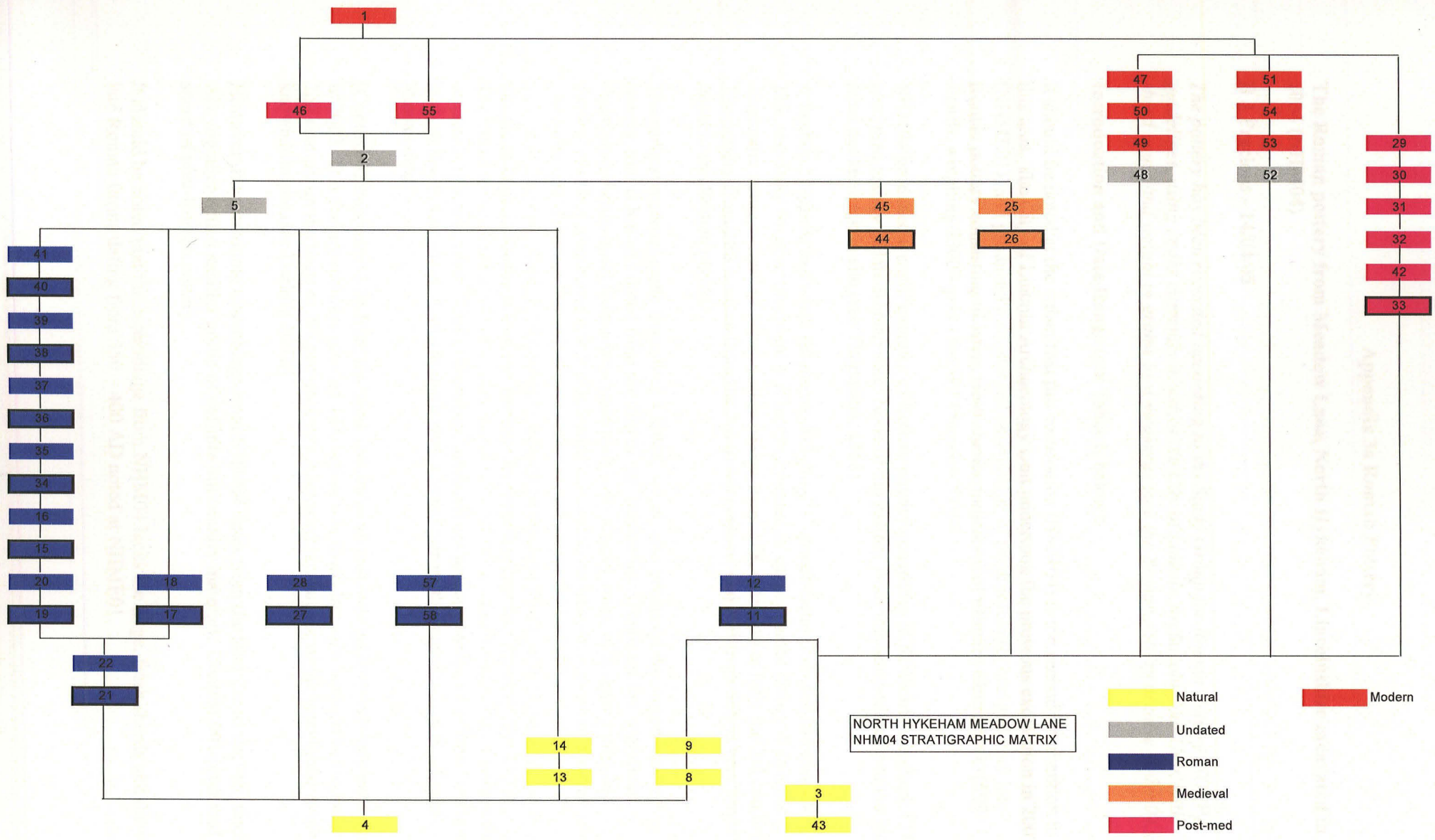
Pre-Construct Archaeology (Lincoln), *Archaeological Evaluation Report; Meadow Lane, North Hykeham, Lincolnshire*, Unpublished PCA report .

Specification: Version 1, 17th November 2004

APPENDIX 2 CONTEXTS AND MATRIX

Context	Description	Interpretation	Thickness	Phase
001	Dark grey brown silty clay	Topsoil	0.3m	Modern
002	Mid brown silty sand	Subsoil	0.4m	Undated
003	Yellow clay	Natural	-	Natural
004	Brownish red silty sand	Natural	-	Natural
005	Blue Grey silty sand	Alluvium	0.25m	Undated
006	Linear gully	Same as [040]	-	Roman
007	Mid brownish grey silty sand	Same as (041)	-	Roman
008	Linear channel	Natural water channel	0.28m	Natural
009	Light grey silty sand	Fill of [008]	0.28m	Natural
010	Same as 004	Natural	-	Natural
011	Linear gully	RB gully	0.27m	Roman
012	Mid brownish grey silty sand	Fill of [011]	0.27m	Roman
013	Linear channel	Natural water channel	0.2m	Natural
014	Light grey silty sand	Fill of [013]	0.2m	Natural
015	Linear ditch	RB ditch	0.18m	Roman
016	Dark greyish brown silty sand	Fill of [015]	0.18m	Roman
017	Circular pit	RB Pit	0.18m	Roman
018	Dark greyish brown silty sand	Fill of [017]	0.18m	Roman
019	Linear ditch	RB ditch	0.54m	Roman
020	Mid greyish brown silty sand	Fill of [019]	0.54m	Roman
021	Linear ditch	RB ditch	0.5m	Roman
022	Light greyish brown silty sand	Fill of [021]	0.5m	Roman
023	Same as 033	Same as 033	-	Post-Med
024	Same as 032	Same as 032	-	Post-Med
025	Greyish brown silty sand	Fill of [026]	0.15m	Medieval
026	Linear	Medieval plough furrow	0.15m	Medieval
027	Linear ditch	RB ditch	0.45m	Roman
028	Light greyish brown silty clay	Fill of [027]	0.45m	Roman
029	Greyish brown silty clay	Subsoil overlying (030)	0.38m	Undated
030	Yellowish grey clay	Clay overlying (031)	0.18m	Post-Med
031	Blue grey clay	Clay overlying (032)	0.3m	Post-Med
032	Grey brown silty clay	Upper fill of [033]	0.46m	Post-Med
033	Square pit	Post med clay extraction pit	0.66m	Post-Med
034	Linear ditch	RB ditch	0.52m	Roman
035	Light greyish brown silty sand	Fill of [034]	0.52m	Roman
036	Linear ditch	RB ditch	0.55m	Roman
037	Greyish brown silty sand	Fill of [036]	0.55m	Roman
038	Linear ditch	RB ditch	0.48m	Roman
039	Dark greyish brown silty sand	Fill of [038]	0.48m	Roman
040	Linear gully	RB gully	0.22m	Roman
041	Dark bluish grey silty sand	Fill of [040]	0.22m	Roman
042	Yellow grey clay	Lower fill of [033]	0.2m	Post-Med
043	Blue yellow clay	Natural clay below [033]	0.1m	Natural
044	Linear	Medieval plough furrow	0.1m	Medieval
045	Grey brown silty clay	Fill of [044]	0.1m	Medieval
046	Heated natural silts	Heated floor surface	0.01m	Post-Med
047	Greyish brown silty clay	Subsoil collected in hollow	0.24m	Modern
048	Yellowish grey clay	Disturbed natural clays	0.1m	Undated
049	Linear	20 th C field drain	0.13m	Modern
050	Grey brown silty clay	Backfill for [049]	0.13m	Modern
051	Same as (047)	Same as (047)	0.24m	Modern
052	Same as (048)	Same as (048)	0.1m	Undated
053	Same as (049)	Same as (049)	0.13m	Modern
054	Same as (050)	Same as (050)	0.13m	Modern
055	Brick fragments	Rubble adjacent to (046)	0.15m	Post-Med

056	Mid brown silt & charcoal	Rake out associated with (046)	0.02m	Post-Med
057	Grey brown silty clay	Fill of [058]	0.06m	Roman
058	Rounded terminus	RB gulley	0.06m	Roman



Appendix 3a Roman Pottery

The Roman pottery from Meadow Lane, North Hykeham, Lincolnshire excavated in 2004 (NHM04)

B J Precious - 14/04/05

The pottery has been recorded according to the Study Group for Roman Pottery (SGRP) guidelines, using codes currently in use at the City of Lincoln Archaeological Unit, with sherd count and weight in grams as a measures (see the Roman pottery archive – nhm04.xls).

Introduction and Date Range (see Table 1, below)

It should be noted at the outset that this excavation (NHM04) is the second intervention in this area. The City of Lincoln Archaeology Unit undertook the previous excavation in 2001 (NHME01), and produced a substantial assemblage of predominantly late and very late Roman pottery consisting of large, fresh sherds, indicative of primary depositions, (599 sherds, weighing 23009 gms - see B J Precious 2001).

NHM04 produced a small quantity of Roman pottery consisting of 82 sherds weighing 1155 gms, also mainly of late Roman date. None of the pottery from this site conforms to the wares from the known kiln site (see Thompson, 1958).

A further 28 sherds and small fragments weighing 67 grams came from soil samples (**20S**, **22S**, and **56S**). Most of this pottery is too fragmented to supply useful dating. The most diagnostic being a sherd of Nene Valley beaker from **22S**, dating to at least the 3rd century. The pottery from **20S** is dates from the 3rd to 4th century, and that from **56S** is very broadly dated to the Roman period.

The earliest material came from ditch fill **028**, which also produced the largest amount of pottery, and is broadly dated from the 2nd to the 3rd century. There are few significant diagnostic sherds, apart from a wide-mouthed bowl in grey ware, of at least a mid-2nd century date but continuing into the 3rd, and the curved rim of a jar or bowl in a cream fabric. The latter could date from the 2nd to at least the 3rd century. The bulk of this context consists of two smashed and rather abraded jars or beakers. There are no rims or decoration but the moulded footring one of the vessels (32 sherds) indicates a date into the 2nd century. The other pot (9 sherds) has a plain but narrow base with obvious string marks where it was removed from the wheel. This is normally, although not prescriptively, a feature of vessels of mid- to late Roman date. A single sherd with a red slip from this context may be of post-Roman date.

[Context **028** appears to be from the same feature as an east-west gully previously excavated in 2002. This feature includes context **133**, which was dated from the later 1st to the early 2nd century on the basis of the presence of a rusticated jar, but not of the type found at the known kiln site, see Darling 2002.]

However, the remaining assemblage from NHM04 dates from the later 3rd to the 4th century AD, together with a smaller group of definite 4th century material. Context **001** produced a sherd of post-Roman pottery.

It should be noted that the assemblage from NHM04 lacks the large, fresh sherds and the very late Roman forms dating from 350 – 400 AD noted at NHME01.

Table 1: NHM04 - Date range of the Roman pottery

Date range	Context sherds grams sherd/weight			
				t
4C/POSTRO	1	3	81	27
4C	2	3	98	32.7
4C	5	3	96	32
4C	7	4	57	14.3
4C	12	5	98	19.6
M3-4C	18	1	4	4
4C?	20	2	33	16.5
2-3C/POSTRO?	28	51	383	7.6
3-4C	32	1	15	15
4C	39	5	90	18
L3-4C	47	2	168	84
L3-4C	51	2	32	16
TOTAL		82	1155	14.3

Condition

There is a moderate incidence of abrasion, and a high amount of staining noted in this assemblage. The staining appears to be the result of iron pan leaching into or encrusting the pottery.

There are no obvious sherd links, and the average sherd/weight falls within a moderate range (14.3 grams). Contexts **001**, **002** and **047** produced the highest sherd weights indicating that there was little disturbance of the material; in contrast Context **028** produced one of the lowest ratios of 7.6 grams suggesting that this group was more heavily disturbed.

Statement of Potential (see Tables 2 and 3, below)

The assemblage from NHM04 provides useful additional evidence of late Roman occupation to the exceptional assemblage excavated in 2001 (NHME01), which together with the presence of Roman building material at that site may be indicative of a nearby villa.

Table 2: NHM04 - The Roman fabrics by percentage of sherd count and weight.

Fabric	code	sherds %	grams %
Cream ware	CR	1 1.23%	7 0.61%
Grey ware	GREY	72 87.65%	1000 86.57%
Swanpool mortaria	MOSP	1 1.23%	50 4.33%
Medieval pottery	MPOT?	1 1.23%	1 0.09%
Nene Valley colour-coat	NVCC	1 1.23%	4 0.35%
Oxidised ware	OX	2 2.47%	8 0.69%
Swanpool oxidised	SPOX?	1 1.23%	4 0.35%
Vesicular ware	VESIC	3 3.70%	81 7.02%
	TOTAL	82 100.00%	1155 100.00%

Almost three quarters of the pottery from NHM04 consists of grey wares (GREY), some are similar in fabric and form to the products of the Swanpool kilns in Lincoln. In addition there is a notable amount of a distinctive reduced fabric containing large rounded pebbles of quartz (GREY) that is consistent with the geology of the valley bottom of the Hykeham area (pers comm Dr A G Vince). It should be noted that although similar, it is different to the late Roman coarse tempered fabric of the Swanpool kilns (LCOA).

The Swanpool kilns clearly supplied some of the pottery to the site including a mortarium (MOSP), but also possible oxidised vessels (SPOX?). The latter may belong to a group of unsourced oxidised wares that are very similar to the fabrics of the Swanpool kilns (OX).

There are only two examples of finer tablewares in Nene Valley colour-coated ware. One is a very abraded, single body sherd from a hemispherical bowl (18), and the other an equally abraded sherd from a beaker (22S). The rim of a jar or bowl in a Cream fabric may also originate from these kilns. There is no pottery imported from the Continent, which reflects the later date of much of this assemblage. However, this virtual lack of finewares could also suggest a lower status site.

Table 3: NHM04 - The Roman forms by function, and percentage of sherd count and weight.

Form	code	sherds	%	gms	%
Undiagnostic		2	2.44%	5	0.43%
Everted-rim beaker	BKEV	1	1.22%	5	0.43%
Jar or beaker	JBK	10	12.20%	43	3.72%
Open form	OPEN?	1	1.22%	41	3.55%
Wide-mouth bowl	BWM	4	4.88%	76	6.58%
Wide-mouth bowl	BWM?	1	1.22%	18	1.56%
Closed form	CLSD	11	13.41%	171	14.81%
Cooking pot	CP?	1	1.22%	18	1.56%
Jar	J	39	47.56%	266	23.03%
Curve-rim jar	JCUR	1	1.22%	43	3.72%
Huntcliff jar variant	JHUNV?	1	1.22%	34	2.94%
Curve-rim jar or bowl	JBCUR	2	2.44%	11	0.95%
Large jar or bowl	JBL	6	7.32%	247	21.39%
Storage jar	JS	1	1.22%	127	11.00%
Wall-sided mortarium	MWS?	1	1.22%	50	4.33%
	TOTAL	82	100.00%	1155	100.00%

There is a small, but important group with a coarse fabric with a vesicular surface indicating that some inclusions have leached out, probably during firing (VESIC). One vessel form in this fabric is very similar to the distinctive, late Roman Huntcliff jar (normally in a calcite-gritted fabric), but with an incipient groove on the interior suggesting that it is an earlier variant.

The forms present are indicative of the function of the assemblage. There is a very small amount of drinking vessels, but no flagons or amphorae. The bulk of the group consists of kitchen to table pottery including wide-mouth bowls and, more predominantly, jars of undiagnostic types. At least two vessels were used solely in the kitchen – a cooking pot (CP), and a proto-Huntcliff jar (JHUNV). The latter is unusual as the internal lid-seating that characterises these vessels is very faint. A probable wall-sided mortarium used for food preparation, and a sherd from a large storage jar was also likely to have been confined to the kitchen.

Further Work

The pottery is in stable condition, and should be retained for further study.

References

- Darling, M. J. 2002 Report 100 on Pottery from Meadow Lane, North Hykeham, MLNH02, for Pre-Construct Archaeology
- Precious, B. J. 2001 The Roman pottery from Meadow Lane, North Hykeham, Lincolnshire (NHME01) for Cit of Lincoln Archaeological Unit
- Thompson, F.H. 1958 A Romano-British pottery kiln at North Hykeham, Lincolnshire; with an Appendix on the typology, dating and distribution of 'Rustic' ware in Great Britain, *Antiq J*, 38, 15-51.

Appendix 3b Cremated bone and faunal remains

North Hykeham, Meadow Lane (NHM 04)

Cremated Bone by Jennifer Kitch

Introduction

Two deposits of cremated human bone were recovered from sieved environmental bulk samples taken during the archaeological preservation, investigation and dating works undertaken by Archaeological Project Services at Meadow Lane, North Hykeham, Lincolnshire.

Context

Cremation (018) Sample No. 1, 271 fragments (105g)

The cremated remains were recovered from a dark grey silty sand deposit, within a shallow circular pit [017] cut into the upper fills of a Romano-British linear ditch [021].

Cremation (022) Sample No. 9, 68 fragments (19g)

The remains were recovered from the light grey/brown silty sand fill of the Romano-British ditch [021].

The two cremation assemblages were recovered from two physically stratified deposits. It is possible that the remains are from the same deposit; disturbed by later activity.

Condition

The bone is highly fired and is fully calcified, having a fairly uniform white colouration with some mid grey colouration remaining towards the centre of the cortical bone (Shipman et al 1984: 313).

The remains are highly fragmentary. The maximum fragment size for both deposits is 24mm.

Results

Tables 1 and 2 below summarises the identifiable bone from the cremation deposits.

Table 1, Cremation (018) summary

Context	Sample	Taxon	Skeletal Element	No. Frags	Weight (g)
18	1	Human	Cranial Vault	16	9
18	1	Human	Second Phalanx	1	0.3
18	1	Human	Unidentified	107	25.2
18	1	Human	Long Bone	60	42.3
18	1	Human	Unidentified	13	8.4
18	1	Human	Unidentified	73	19.7
18	1	Human	Vertebral articular facet	1	0.1
				271	105

Table 2, Cremation (022) summary

Context	Sample	Taxon	Skeletal Element	No. Frags	Weight (g)
22	9	Human	Cranial Vault	8	4.6
22	9	Human	Long Bone	3	4.5
22	9	Human	Ulna	2	0.9
22	9	Human	Unidentified	55	9
				68	19

A minimum of one individual is represented within each of the cremation deposits. If the remains were considered to be from the same deposit, no evidence for multiple individuals was noted.

No age or sex indicators were present within the represented skeletal elements. The robust size of the present bone would suggest an adult individual. No evidence of trauma or pathology was noted.

Discussion

The cremation deposits are small and only represent a small percentage of a single skeleton. As there is no evidence for a bustrum (in situ cremation), then it is assumed that the remains were removed from the pyre ashes by hand for burial. Several fragments of mineralised charcoal and bone conglomeration were present within both of the deposits that may be a residue from the pyre fuel. Several fragments of clinker were recovered from cremation (018).

The limited size of the cremation may be limited by collection bias, or only collected as a 'token' for burial. However, as the cremation deposits were uncontained, then truncation and plough damage cannot be ruled out.

References:

Shipman, P., Foster, G, & Schoeninger, M., 1984 Burnt Bones and Teeth: an Experimental Study of Color, Morphology, Crystal Structure and Shrinkage. *Journal of Archaeological Science* Vol. 11, 307-325

Other Bone

A total of 18 (11.6g) fragments of animal bone were recovered from environmental bulk samples, 2, 6,7 and 8. In addition 3 (3.5g) fragments of a large mammal long bone were retrieved as bulk finds. The condition of the bone is poor, allowing for little in the form of identification. None of the remains were identifiable beyond size category. Two fragments were calcified, indicated high temperatures or prolonged burning. Little further information can be gained, save the presence of the bone within the assemblage.

Appendix

Table 3, Animal Bone from the sieved assemblages

Context	Sample	Taxon	Element	No. Frags	Weight (g)	Condition	Notes
20	8	Large Mammal	Skull	5	5.1	5	
12	2	Large Mammal	Long Bone	2	1.3	5	
12	2	Unidentified	Unidentified	9	4.5	5	
28	-	Large Mammal	Long Bone	3	3.5	5	
35	6	Medium Mammal	Long Bone	1	0.5	4	Burnt white
16	7	Unidentified	Unidentified	1	0.2	4	Burnt white

Table 4, Other inclusions from the cremation deposits

Context	Sample	Description	No. Frags	Weight (g)
18	1	Clinker	7	2
18	1	Mineralised Charcoal and bone conglomeration	35	28.6
22	9	Mineralised Charcoal and bone conglomeration	12	10.9

Appendix 3 c Late Medieval and Post-Medieval Ceramics

Pottery Archive NHM04

Jane Young

context	cname	full name	form type	sherds	vessels	weight	part	description	date
01	BL	Black-glazed wares	jug/large drinking vessel	2	1	45	BS	waster;cracked during firing;? ID or vitrified PMLOC;black/green fabric	late 16th to 18th
01	BL	Black-glazed wares	jug/large drinking vessel	1	1	90	base	vitrified;cracked during firing	17th to 18th
01	TOYII	Toynton Late Medieval ware	large jug	1	1	114	rim with	very abraded;grooved oval strap	mid 15th to mid 16th
01	LSW3	14th to 15th century Lincoln Glazed Ware	jug	1	1	16	BS	abraded;? ID	14th to 15th
51	STMO	Staffordshire/Bristol mottled-glazed	cup	1	1	4	BS		late 17th to 18th

Ceramic Building Archive NHM04

Jane Young

context	cname	fabric	sub type	frags	weight	ref no	description
01	PNR	NH1		1	260		spalled;corner;OX/R/OX
01	RID	NH1;fine		1	32		? ID
01	PNR	NH1 + common shale		3	167		abraded;light firing;look medieval type
01	NIB	NH1	nib 3A	1	63		very abraded;glassy edge;very odd
01	PNR	NH1		1	122		corner;OX/R/OX
01	PNR	NH1		2	95		
01	PNR	NH1		1	98		abraded
01	PNR	NH1		6	239		different tiles;very abraded
01	PNR	NH1		3	44		abraded;light firing;look medieval type
02	PNR	NH1		1	105		corner
02	PNR	NH1		1	14		
02	PNR	NH1 + shale		1	207	DR2	light firing;very unusual;large pre-fired hole 23mm & one small prefired hole 9mm in corner next to a part drilled hole;light
02	BRK	NH1		1	74		? Or FLOOR;low fired
05	PNR	NH1		1	5		very abraded
05	PNR	NH1		1	30		very abraded
20	RBRK	semi vitrified		1	208		
20	RBRK	comm fe		1	119		very abraded;55mm thick

context	cname	fabric	sub type	frags	weight	ref no	description
26	PNR	NH1		1	73		very abraded;corner
28	PNR	NH1		1	16		very abraded;corner
28	PNR	poor L1 ? + common shale		1	104		very abraded;common shale in fabric;thick tile
28	PNR	NH1		1	166		hard fired;thick
29	PNR	NH1		1	326		off corner;abraded;Fabric Type sherd
29	PNR	NH1		1	53		
29	NIB	NH1		1	294		right corner;tool marks;abraded
31	NIB	NH1	applied bar	2	20		right corner;same tile
31	PNR	NH1		2	1189		OX/R/OX;width 182mm;hard fired;cracked during firing
31	NIB	NH1	nib type 7u	3	505		left corner;Nib Type series;Fabric Type series
31	FLOOR	NH1		1	1318		corner;abraded;43mm
31	BRK	NH1		1	1631		handmade;possible fingering marks on top surface;186x105x50mm;3/4 brick;struck upper surface;light upper surface;sanded base & sides
31	PNR	NH1		1	64		very abraded;corner
31	PNR	NH1		1	401		edge;very abraded
31	PNR	NH1		1	207		abraded
31	PNR	NH1		1	163		peg/drill hole or large inclusion hole;very abraded
31	PNR	NH1		1	166		very abraded
32	PNR	NH1		1	149		corner;very abraded;fe panning
32	PNR	NH1		1	109		very abraded;fe panning
32	PNR	NH1		1	46		corner;very abraded
32	NIB	NH1	applied bar	1	209		right corner
37	PNR	NH1		1	24		very abraded

context	cname	fabric	sub type	frags	weight	ref no	description
46	BRK	NH1		3	56		very abraded;? Or FLOOR
46	PNR	NH1		1	19		abraded
46	MISC	NH1		6	17		various scraps
47	NIB	NH1		1	168		
47	PNR	NH1		1	34		flake
47	PNR	poor L1 ?		1	40		very abraded;medieval
47	PNR	NH1		3	288		same tile;corner
47	NIB	NH1		1	174		left corner;cracked during firing;waster;worm casts ?
47	PNR	NH1		1	404		abraded;corner
47	FLOOR	NH1		1	1962		sanded base & sides;very slightly chamfered;221x43-45mm
47	NIB	NH1	pulled & folded nib;7v ?	1	718		cracked during firing
47	BRK	NH1		1	59		? Or FLOOR;large pebble voids
47	PNR	NH1		1	379		low fired;very abraded;corner
47	NIB	NH1	applied central nib	1	267		right corner;cracked during firing
47	FLOOR	NH1		1	701		corner;blown in kiln;semi vitrified;41mm thick
47	FLOOR	NH1		1	824		? Or BRK;large pebbles;semi vitrified;50mm thick
47	BRK	NH1 + very large pebbles		1	707		53mm thick; ? Or BRK
47	PNR	NH1		1	262		poss same tile as nib;corner;cracked during firing
51	NIB	NH1	nib type 7v	1	470		left corner;153x14mm;type tile
51	PNR	NH1		1	64		cracked during firing
51	PNR	NH1		1	138		
51	PNR	NH1		1	48		thick tile

context	cname	fabric	sub type	frags	weight	ref no	description
51	PNR	NH1		1	98		corner;thick tile
51	PNR	NH1		1	332		corner;large pebble inclusions;thick tile
51	NIB	NH1	nib type 7v	1	498		right corner
51	PNR	NH1		1	13		flake
51	FLOOR	NH1		1	589		corner;slightly chamfered edges;sanded base & sides;50mm thick
51	FLOOR	NH1		1	99		42mm thick
51	FLOOR	NH1		1	74		52mm thick
51	PNR	NH1		1	17		
55	NIB	NH1	nib type 7u	2	508	DR1	same tile;2 corners162mm width 16mm thickness;Nib Type Series
55	BRK	NH1		1	211		sanded base & worm casts ?
55	BRK	NH1		1	51		? Or floor;vitrified surface
55	BRK	NH1		1	84		? Or floor;part vitrified surface
55	BRK	NH1		1	499		handmade;sanded edges & base;stacking mark;115x58mm

Appendix 3 d Post Medieval CBM Assessment

Characterisation Studies of Post-medieval Ceramic Building Material from Meadow Lane, North Hykeham, Lincolnshire**Alan Vince**

Waste from archaeological investigations on the site of a post-medieval ceramic building material production site at North Hykeham, Lincolnshire, was assessed by Jane Young for APS Ltd. As part of this assessment, she recommended analysis of the products and fired clay used on the site in order to investigate several related questions:

Are the various ceramic types found on the site all likely to have been made there?

Can we say anything about the choice of raw materials used?

Can we establish which preparation methods were employed?

Are there any diagnostic features to the fabric which might serve to identify products found on other sites?

Methodology

Table 1

TSNO	Sitecode	Context	class	cname	Form	subfabric	Action
V3177	mlnh02	413	FCLAY	FCLAY	KILN		ICPS;TS
V3187	mlnh02	412	CBM	PMTIL	FLOOR		ICPS;TS
V3188	mlnh02	413	FCLAY	FCLAY	KILN		ICPS
V3189	mlnh02	413	FCLAY	FCLAY	KILN		ICPS
V3190	mlnh02	413	FCLAY	FCLAY	KILN		ICPS
V3191	mlnh02	413	FCLAY	FCLAY	KILN		ICPS
V3192	mlnh02	413	FCLAY	FCLAY	KILN		ICPS
V3193	mlnh02	413	FCLAY	FCLAY	KILN		ICPS
V3171	nhm04	51	CBM	PMTIL	NIB	NH1	ICPS;DR
V3172	nhm04	31	CBM	PMTIL	NIB	NH1	ICPS
V3173	nhm04	02	CBM	PMTIL	PNR	NH1 + shale	TS;ICPS;DR
V3174	nhm04	29	CBM	PMTIL	PNR	NH1	ICPS
V3175	nhm04	55	CBM	PMTIL	NIB	NH1	ICPS;DR
V3176	nhm04	47	CBM	PMTIL	NIB	NH1	ICPS
V3178	nhm04	47	CBM	PMTIL	FLOOR	NH1	TS;ICPS
V3179	nhm04	47	CBM	PMTIL	BRK	NH1	ICPS
V3180	nhm04	47	CBM	PMTIL	FLOOR	NH1	ICPS
V3181	nhm04	31	CBM	PMTIL	BRK	NH1	TS;ICPS

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<http://www.avac.uklinux.net/potcat/pdfs/avac2005137.pdf>

V3182	nhm04	31	CBM	PMTIL	BRK	NH1	ICPS
V3183	nhm04	55	CBM	PMTIL	BRK	NH1	ICPS
V3184	nhm04	51	CBM	PMTIL	FLOOR	NH1	ICPS
V3185	nhm04	47	CBM	PMTIL	BRK	NH1 + very large pebbles	TS;ICPS
V3186	nhm04	55	CBM	PMTIL	BRK	NH1	ICPS
V3194	nhm04	47	CBM	PMTIL	NIB	NH1	TS;ICPS
V3195	nhm04	01	CBM	PMTIL	RID	NH1;fine	TS;ICPS
V3196	nhm04	31	CBM	PMTIL	NIB	NH1	ICPS
V3197	nhm04	32	CBM	PMTIL	NIB	NH1	ICPS

The waste was found in two excavations, with site codes MLNH02 and NHM04. Twenty-seven objects were sampled (Table 1). The former site produced a large unglazed floor tile (1 sample, V3187) and a collection of fired clay (samples V3177, V3188-93). The latter is interpreted as being part of the superstructure of a kiln. The latter site produced fragments of nibbed flat roof tile (samples V3171-76, V3194, V3197), bricks (samples V3179, V3181-83, V3185-86), unglazed large floor tiles (samples V3178, V3180, V3184) and a possible fragment of ridge tile (sample V3195).

Each sample was sub-sampled for Inductively-Coupled Plasma Spectroscopy, carried out under the supervision of Dr J N Walsh, Royal Holloway College, London and a sample of each object type was thin sectioned. The sections were prepared by Steve Caldwell, University of Manchester, and stained using Dickson's method (Dickson 1965) in order to distinguish the various carbonates which might be present (ferroan and non-ferroan calcite and dolomite).

Ceramic Petrology

Nine thin sections were prepared. Each was examined semi-quantitatively, noting the presence/absence and rough frequency of each inclusion type. The same range of inclusions was found in each section although there was considerable variation in texture as a result of the poor mixing of the clay.

The following inclusion types were noted:

Quartz. Sparse to abundant sub-rounded and rounded grains up to 0.4mm across. Some are clearly well-rounded grains which have cracked and then been subject to further rounding. The grains are mainly monocrystalline and unstrained but include strained, polycrystalline grains. Well-rounded grains with a high sphericity, up to 1.5mm across are also present but sparse.

Clay pellets. Moderate to abundant rounded fragments of clay were present, up to 2.0mm across. These grains vary from a very light brown to dark brown in plain polarised light and in

several cases show distinct laminations. Black staining is also common. These fragments are similar in colour and texture to the groundmass and are therefore relict clay, fragments of the parent clay. The laminations indicate that the parent clay is a weathered shale or mudstone. The black staining is probably the result of iron or manganese concretion.

Chert. Sparse rounded fragments up to 0.4mm across.

Sandstone. Sparse rounded fragments of fine-grained sandstone (and coarse siltstone) up to 0.4mm across.

Opaques. Sparse angular and subangular fragments up to 2.0mm across.

Ferruginous sandstone. Sparse angular fragments with an opaque matrix and subangular quartz grains up to 0.2mm across.

The groundmass consists of poorly mixed lenses of optically anisotropic baked clay varying in colour and quartz silt content.. Some lenses contain abundant inclusions of quartz, with minor chert and sandstone, as described above, whilst others contain no inclusions greater than c.0.1mm across. Some of the lighter-coloured lenses are more birefringent than the more common red-firing ones.

In two of the sections the core of the sample was reduced, isotropic and any iron-rich inclusions had vitrified (VC3178 and V3194).

Chemical Analysis

The frequency of a range of elements were measured by ICPS. These included major elements, measured as percent oxides (Appendix 1) and minor and trace elements, measured as parts per million (Appendix 2).

Although silica was not measured directly by ICPS, it could be estimated by subtracting the sum of all measured oxides from 100%. The mean and standard deviations of these estimates are shown in Fig 1, which shows that the bricks and kiln fabric have a higher silica content than the flat roof tiles, the floor tiles and the ridge tile.

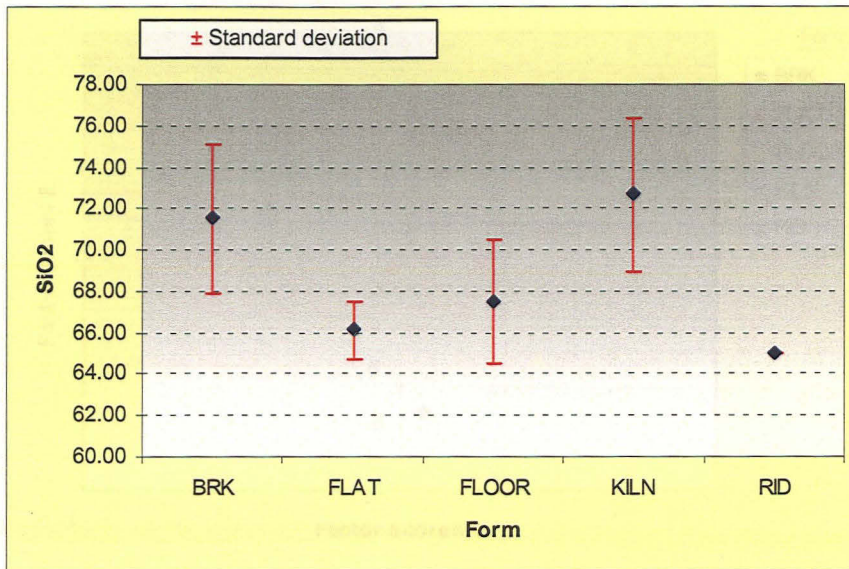


Figure 1

Since high silica content depresses the values of other measured elements, the values of all measured elements were normalised to Aluminium and the resulting dataset was then analysed using factor analysis (). Six factors were found and the variations and similarities in the sample compositions were explored by examining plots of Factor 1 versus Factor 2, Factor 3 versus Factor 4 and Factor 5 versus Factor 6.

Differences were found between the samples from the 2002 site and those from the 2004 site, but these seem to be due to the fact that the 2002 samples were mainly of kiln fabric. Otherwise, the principal variations were between different object types.

The plot of F1 against F2 indicate that the kiln fabric samples have negative F1 scores whereas those of the other types have a wider range of F1 scores (Fig 2). The ridge tile sample has a higher F2 score than the remainder. The negative F1 scores could be due to lower Rare Earth Element values or higher Potassium and Sodium values. Potassium and Sodium is likely to have been present in rare feldspar grains, present in the quartzose sand. The high F2 score of the ridge tile sample seems to be a consequence of high values for two Rare Earth elements (Lanthanum and Neodymium), Scandium, Chromium, Titanium, Potassium and Magnesium.

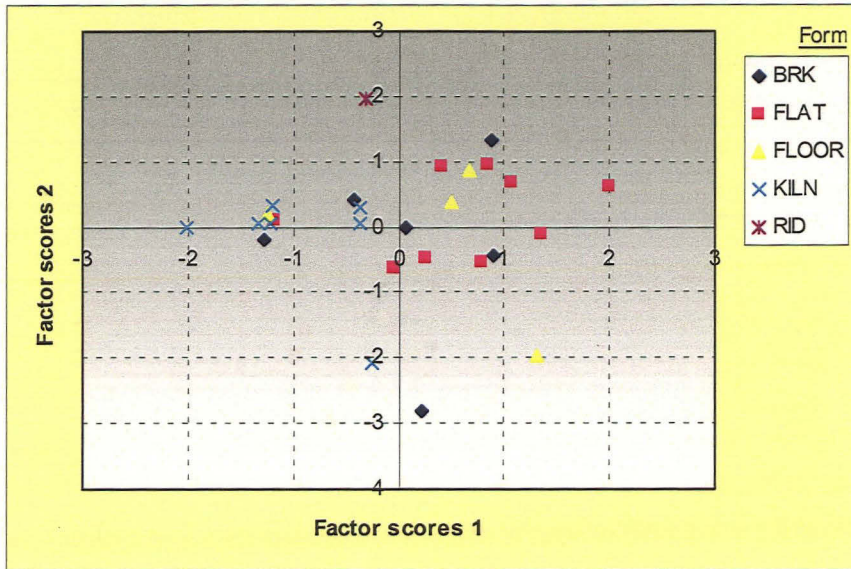


Figure 2

The same pattern is seen in the plot of F3 against F4 (Fig 3). In this case, the difference in composition of the ridge tile and the remainder is clearer than in Fig 1.

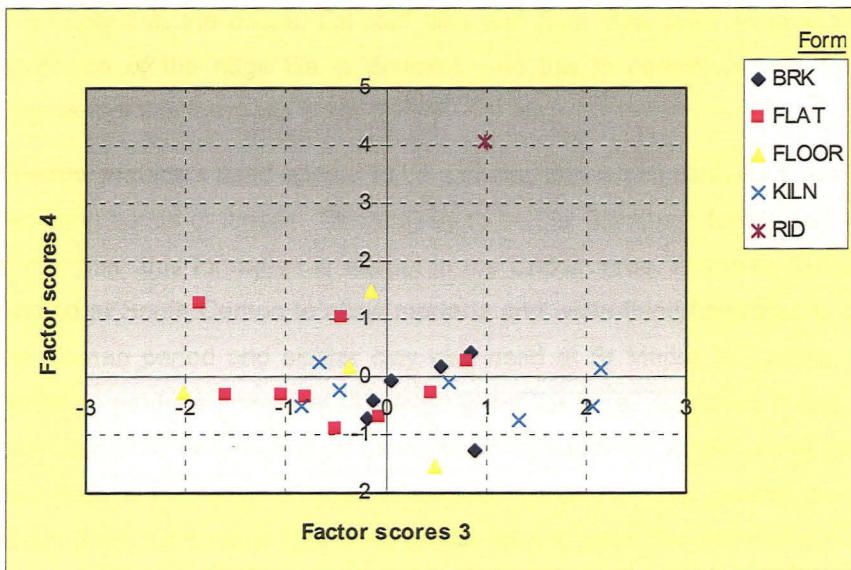
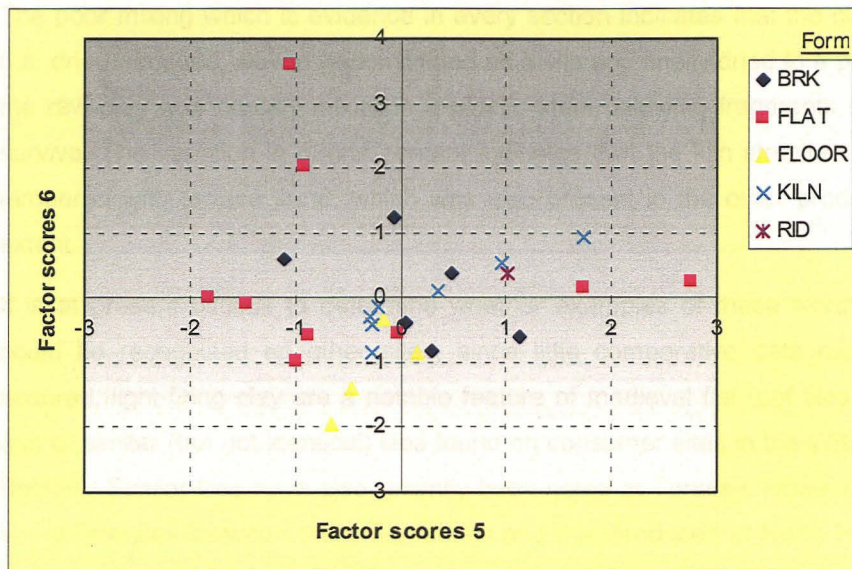


Figure 3

The plot of F5 against F6 scores does not differentiate the ridge tile from the remainder, but does reveal that the various object types form overlapping clusters (Fig 4). The floor tiles have a lower F6 mean than the remainder, perhaps due to a lower iron content, whilst the bricks and kiln fabric samples have mean F5 and F6 scores centring on zero. The flat roof tiles may form two clusters, one with high F5 scores and the other with low F5 scores. The reality of these groups cannot be proven given the small number of samples taken.



Discussion

The petrological and chemical analyses provide some answer to the found questions posed at the start of the analysis.

It is likely that the bricks, flat roof tiles and floor tiles were all produced at the site. The attribution of the ridge tile is doubtful, and this is consistent with the fact that only one fragment of this form was present.

The raw materials used appear to be a shaley clay which contains a mixture of light-firing and red-firing bands or lenses. This is likely to be the Grantham formation (1980), although Kent states that this formation is absent in the Lincoln area. However, sufficient light-firing clays existed at South Carlton to allow mortaria and white-firing finewares to be produced there in the Roman period and similar clay was used at St Marks, in Lincoln, in the late medieval period to produce finewares (although given the small quantities made, the clay might have been imported from a clay pit to the north or south of Lincoln. However, it is clear that this clay does not outcrop at North Hykeham, where the solid geology consists of Lower Lias, which does not contain light-firing bands, having been deposited under marine conditions. It is likely that the clay source used was obtained locally, however, and this suggests that the clay used was a till, derived from an exposure of the Grantham formation to the north of Lincoln. The large fragments of opaque ironstone and ferruginous sandstone are likely to come from the Northampton sand, which underlies the Grantham formation.

The quartzose sand noted in all the sections is typical of that found in Trent valley sands and is mainly derived from Triassic deposits, the larger grains being likely to come from the Sherwood Sandstone (aka Bunter sandstone). The sand varies considerably in texture and the finer fraction is often found in the windblown cover sands overlying the Jurassic limestones on the Lincoln Edge, but in this case the grains include larger grains absent from the cover sands and the most likely source is a terrace sand in the Trent valley.

The poor mixing which is evidence in every section indicates that the clay was not levigated (i.e. dried, crushed, sieved, reconstituted as a slip and finally dried to a plastic state). Instead, the raw clay was crudely mixed in a plastic state, allowing fragments of the parent clay to survive. The variation in quartz content indicates that the kiln structure and the bricks were tempered with terrace sand, which was also present in the other products, but to a lesser extent.

It is at present difficult to determine whether examples of these North Hykeham products could be recognised on other sites, since little comparative data exists. Lenses of fine-textured, light-firing clay are a notable feature of medieval flat roof tiles produced in Lincoln and of similar (but not identical) tiles found on consumer sites in the Witham valley, including Boston. Similar tiles have also recently been noted at Torksey. However, whether there are any differences between these tile fabrics and that produced at North Hykeham and Lincoln cannot be determined until comparative samples are available.

Conclusions

The products of the ceramic building material industry at North Hykeham include bricks, floor tiles and flat roof tiles. They may not include ridge tiles, since the one example from the site has differences in chemical composition, although its fabric as seen in thin section is identical to North Hykeham products. Thin section and chemical analysis also shows that quartzose sand from a local terrace sand was added to all the products, but was added in larger quantities to the bricks and kiln furniture. The chemical analysis further suggests that the floor tiles may have slight differences in composition from the flat roof tiles, despite similar quantities of sand temper, and that these may indicate that the floor tiles were produced at one time, from the same batch of clay, whereas there may be two distinct groups of flat roof tiles. However, these differences are small and would need to be confirmed by analysis of a larger sample of tiles.

The fabric used at North Hykeham contains pellets and lenses of light-firing clay, derived in this case from the Grantham Formation. Such light-firing clays are limited in their outcrop in Lincolnshire to the Grantham Formation (which underlies the Lincolnshire Limestone, along the scarp slope of the Lincoln Edge) and the Upper Estuarine Beds which overlies the Lincolnshire Limestone (i.e. on the dip slope of the Jurassic scarp). Their presence at North Hykeham is postulated here to be due to the use of a glacial till (or perhaps Quaternary head, formed by slumping of deposits from the scarp) and extends the potential source area for such light-firing clays.

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Nature, 205, 587.

Fitch (2001) Winstat for Microsoft (r) Excel. Fitch, Robert K. 2001.

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 London, HMSO.

Appendix 1. ICPS Data for Major Elements (measured as percent oxides)

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V3171	21.59	5.93	1.42	0.83	0.26	2.62	0.92	0.1	0.071
V3172	19.21	6.48	0.92	0.88	0.24	2.34	0.81	0.4	0.05
V3173	20.84	5.33	1.28	0.46	0.21	2.83	0.83	0.17	0.018
V3174	19.13	10.8	0.95	1.11	0.2	2.13	0.79	0.22	0.085
V3175	21.76	6.93	1	0.85	0.19	2.46	0.93	0.11	0.065
V3176	21.06	7.14	1.38	0.78	0.23	2.63	0.86	0.11	0.048
V3177	18.56	5.65	1.01	0.31	0.22	2.34	0.75	0.09	0.02
V3178	20.53	6.77	1.26	0.53	0.25	2.5	0.77	0.1	0.046
V3179	16.62	5.49	0.94	0.36	0.22	2.27	0.62	0.08	0.019
V3180	19.93	6.85	1.21	0.54	0.23	2.44	0.82	0.11	0.064
V3181	18.04	6.61	1.13	0.65	0.24	2.35	0.74	0.18	0.051
V3182	17.59	7.74	0.76	0.64	0.22	2.1	0.72	0.09	0.04
V3183	14.27	5.35	0.53	0.3	0.19	1.91	0.59	0.09	0.039
V3184	22.46	8.1	1.33	0.46	0.23	2.46	0.9	0.1	0.033
V3185	17	6	0.93	0.27	0.21	2.19	0.67	0.08	0.023
V3186	20.48	6.67	1.38	1.3	0.24	2.65	0.84	0.17	0.096
V3187	18.2748	5.87	0.81	0.57	0.2	2.08	0.79	0.09	0.094
V3188	18.4	6.75	1.06	0.35	0.33	2.65	0.74	0.12	0.032
V3189	20.53	6.74	1.16	0.34	0.27	2.59	0.81	0.09	0.017
V3190	14.44	4.85	0.78	0.26	0.21	2.01	0.57	0.08	0.033
V3191	15.38	5.12	0.83	0.25	0.22	2.04	0.59	0.08	0.035
V3192	14.52	5.08	0.52	0.3	0.19	1.86	0.59	0.08	0.053
V3193	17.99	5.83	0.98	0.32	0.22	2.19	0.73	0.08	0.032
V3194	22.5	6.58	1.46	0.7	0.24	2.64	0.93	0.09	0.069
V3195	20.2	8.12	1.75	0.62	0.24	2.96	0.91	0.12	0.046
V3196	22.16	6.48	1.21	1.02	0.24	2.59	0.95	0.15	0.07
V3197	18.77	9.58	0.93	1.07	0.21	2.29	0.73	0.18	0.087

Appendix 2 ICPS Data for Minor and Trace elements (measured as parts per million)

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V3171	376	132	32	162	80	18	114	208	25	95	44	100	46	9	1	5	3	77	104	25
V3172	351	112	28	105	71	16	117	191	23	87	35	75	37	6	1	5	3	63	82	20
V3173	343	125	25	174	47	18	90	109	19	77	37	69	39	6	1	4	2	46	85	17
V3174	339	106	30	119	92	16	86	224	27	78	42	82	44	5	1	5	3	36	148	25
V3175	433	127	31	148	76	19	75	212	24	92	41	78	43	6	1	5	3	31	105	19
V3176	409	131	32	173	83	17	115	238	22	58	43	84	45	7	1	5	3	53	105	21
V3177	340	111	24	112	44	15	78	154	17	65	36	61	37	4	1	3	2	50	81	14
V3178	390	124	28	160	72	17	101	225	24	70	44	75	46	8	2	5	3	74	105	25
V3179	336	98	23	122	44	14	80	174	17	53	33	58	34	4	1	3	2	67	79	17
V3180	356	126	30	149	71	17	96	219	23	75	39	83	41	5	1	4	3	45	104	22
V3181	349	114	24	122	59	15	94	162	20	77	34	67	35	5	1	4	3	50	93	16
V3182	365	112	28	117	62	15	77	181	23	77	34	63	36	5	1	4	3	45	107	19
V3183	355	89	25	80	45	12	49	143	18	73	18	48	20	4	1	3	2	42	75	14
V3184	351	141	31	158	61	19	97	228	18	65	41	68	42	6	1	4	3	46	112	17
V3185	322	104	24	118	40	14	76	167	14	54	30	55	31	4	1	3	2	54	77	15
V3186	347	130	29	155	78	17	122	219	21	60	43	79	45	9	1	5	3	45	107	24
V3187	442	113	51	152	73	16	68	171	22	85	29	69	31	6	1	4	3	46	108	19
V3188	328	113	23	96	42	15	79	193	16	61	36	61	37	3	1	3	2	65	98	17
V3189	342	125	23	82	46	17	84	219	14	61	36	61	37	5	1	3	2	49	97	16
V3190	322	91	21	86	34	12	69	96	13	54	29	54	30	6	1	3	2	51	68	16
V3191	319	95	22	97	37	13	69	136	14	56	29	59	30	6	1	3	2	72	76	15

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<http://www.postex.demon.co.uk/index.html>

A copy of this report is archived online at <http://www.avac.uklinux.net/potcat/pdfs/avac2005137.pdf>

V3192	371	86	22	108	38	12	54	129	14	65	22	50	24	5	1	3	2	43	66	13
V3193	327	79	24	93	41	15	76	133	16	66	35	59	36	5	1	3	2	47	79	16
V3194	396	106	32	185	87	19	113	252	27	82	48	92	50	8	2	5	3	59	111	27
V3195	361	129	33	97	63	19	89	132	21	75	46	83	47	6	1	4	3	38	99	21
V3196	370	134	30	130	96	18	123	245	24	92	38	76	40	6	1	5	3	34	102	30
V3197	431	105	28	130	83	16	91	213	23	75	37	71	39	6	1	4	3	47	116	27

Appendix 4 Environmental

AN ASSESSMENT OF THE CHARRED PLANT MACROFOSSILS AND OTHER REMAINS FROM MEADOW LANE, NORTH HYKEHAM, LINCOLN (NHM 04).

Val Fryer, Church Farm, Sisland, Loddon, Norwich, Norfolk, NR14 6EF
July 2005

Introduction

Excavations at Meadow Lane, North Hykeham were undertaken by Archaeological Project Services in January/February 2005. The work revealed features of Romano-British and post-Medieval date including pits, gullies, ditches and other discrete deposits. Samples for the extraction of the plant macrofossil assemblages were taken from across the excavated area, and eight were submitted for assessment.

Methods

The samples (or sub-samples thereof) were processed by manual water flotation/washover, and the flots were collected in a 500 micron mesh sieve. The dried flots were scanned under a binocular microscope at magnifications up to x 16, and the plant macrofossils and other remains noted are listed on Table 1. Nomenclature within the table follows Stace (1997). All plant remains were charred. Modern contaminants including fibrous roots, seeds and fungal sclerotia were present throughout.

The non-floating residues were collected in a 1mm mesh sieve and sorted when dry. All artefacts/ecofacts were removed for further specialist analysis.

Results of assessment

With the exception of charcoal fragments and pieces of heather (*Ericaceae*) stem, plant macrofossils were exceedingly rare, with poorly preserved cereal grains occurring in only two samples (2 and 8). Charcoal was moderately abundant in the assemblages from samples 1, 2 and 9 from the Romano-British deposits, and formed the principal component of sample 5, which was taken from post-Medieval charred layer [056]. Heather stem fragments also occurred in both the Romano-British and post-Medieval features.

All eight assemblages contained a moderate to high density of mineralised soil concretions, all of which were probably derived from the solution of naturally occurring minerals. The black porous and tarry residues and the vitreous concretions noted within a number of the samples appeared to be indicative of very high temperatures of combustion, although the exact nature of this burning was not understood at the time of writing. Burnt bone fragments were abundant in sample 1 from the fill of a Romano-British pit, but it was not clear whether this material represented a cremation or a small deposit of burnt refuse, as there was no ancillary evidence to support either interpretation.

Conclusions and recommendations for further work

In summary, plant macrofossils are particularly rare within these assemblages and, as a result, little can be deduced about the local environment during either the Romano-British or post-Medieval periods. However, most of the assemblages studied appear to be derived from material which was burnt at a very high temperature. The nature of the material from sample 1 has been discussed above, and it is considered most likely that the remaining assemblages are derived from fuel waste. However, it is not clear whether this material is associated with sample 1, or indicative of the deposition of domestic or industrial refuse. The occurrence of heather stem fragments may possibly be of note, as these were a favoured fuel for both domestic ovens and light industrial processes, as they attained a high temperature very quickly and maintained their heat throughout combustion.

As so little material was recovered from the assemblages, no further analysis is required. However, a written summary of this assessment should be included within the site archive.

Reference

Stace, C., 1997 *New Flora of the British Isles*. Second edition. Cambridge University Press

Key to Table

x = 1 – 5 specimens xx = 5 – 20 specimens xxx = 20+ specimens b = burnt ss = sub-sample

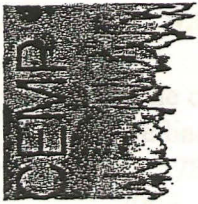
Sample No.	1	2	4	6	7	8	9	5
Context No.	O18	O12	OO7	O35	O16	O20	O22	O56
Feature type	Pit	Gully	Gully	Ditch	Deposit	Ditch	Ditch	Deposit
Date	RB	RB	RB	RB	RB	RB	RB	Pmed
Cereals								
<i>Hordeum</i> sp. (grain)						x		
Cereal indet. (grain frag.)		x						
Other plant macrofossils								
Charcoal <2mm	xx	xx	x	x	x	x	xx	xxx
Charcoal >2mm	xx						xx	xxx
Charred root/stem	x					x		xx
Ericaceae indet. (stem)			xcf	x	x	x		xx
Other materials								
Black porous 'cokey' material	xx	x	xx		x			x
Black tarry material			x	x		x		
Bone	xxxb	x	x			x		
Burnt/fired clay								x
Burnt soil concretions	xx							
Mineralised soil concretions	xx	xxx	xx	xx	xxx	xx	xx	xxx
Small coal frags.			x	x	x	x		x
Vitrified material	xx	x	x				xx	
Sample volume (litres)	20ss	18	10ss	20	20	20	10ss	10
Volume of flot (litres)	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
% flot sorted	100%	100%	100%	100%	100%	100%	100%	50%

Table 1. Charred plant macrofossils and other remains from Meadow Lane, North Hykeham, Lincoln.

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01 JUL 2005

Appendix 5 Archaeomagnetic Dating



Report on the archaeomagnetic dating of a brick-built kiln, Meadow Lane, North Hykeham, Lincolnshire

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June. 30th, 2005.

Report for Archaeological Project Services

Summary

A multi-entranced late medieval brick-built kiln at North Hykeham south of Lincoln (grid ref. SK945655) has been dated using archaeomagnetic techniques. Nine brick samples were collected from the kiln, some from the apparent footings of the kiln and some from the well preserved walls. Only four of these provided useful archaeomagnetic directions, these all being from the walls of the kiln. The remaining samples, mainly from the eastern end, were probably not fired *in situ*. The specimens from the wall samples provided a mean direction (variation corrected) of declination = 8.5° , inclination = 68.3° , $\alpha_{95} = 2.9^\circ$, $K = 103$. This produces a direction corrected to Meriden of declination = 8.4° , inclination = 67.7° , $\alpha_{95} = 2.9^\circ$. This direction and its confidence interval, when compared to the UK master curve of Clark et al. (1988), suggests that with an approximate 95% probability, the date of the last major heating of the kiln was between AD 1480 to AD 1530.

1. Sample collection and preparation

Nine oriented pieces of bricks were collected for archaeomagnetic dating from a late mediaeval kiln at North Hykeham south of Lincoln (grid ref. SK 945655, Latitude 53.1785° , Longitude -0.5862°), Lincolnshire. These were collected on the 28th January 2005.

The kiln was oriented roughly NNE-SSW, with two firing chambers, with entrances at the southern end (Fig. 1). The samples were collected from the short upstanding walls (samples NH4, NH6, NH7, NH8, NH9), and also what appeared to be the footings of the structure adjacent to the walls (NH1, NH2, NH3 and NH5). These later samples were below a reddened clay mantle, which appeared to be the floor of the kiln. This was not sampled, since there was a possibility it represented in part collapsed material.

All samples were oriented using a flat area on the surface of the bricks, using an orientation staff. Onto this flat surface a reference direction was determined with respect to magnetic north (using a magnetic compass), and its dip direction was determined to an accuracy of 1 degree.

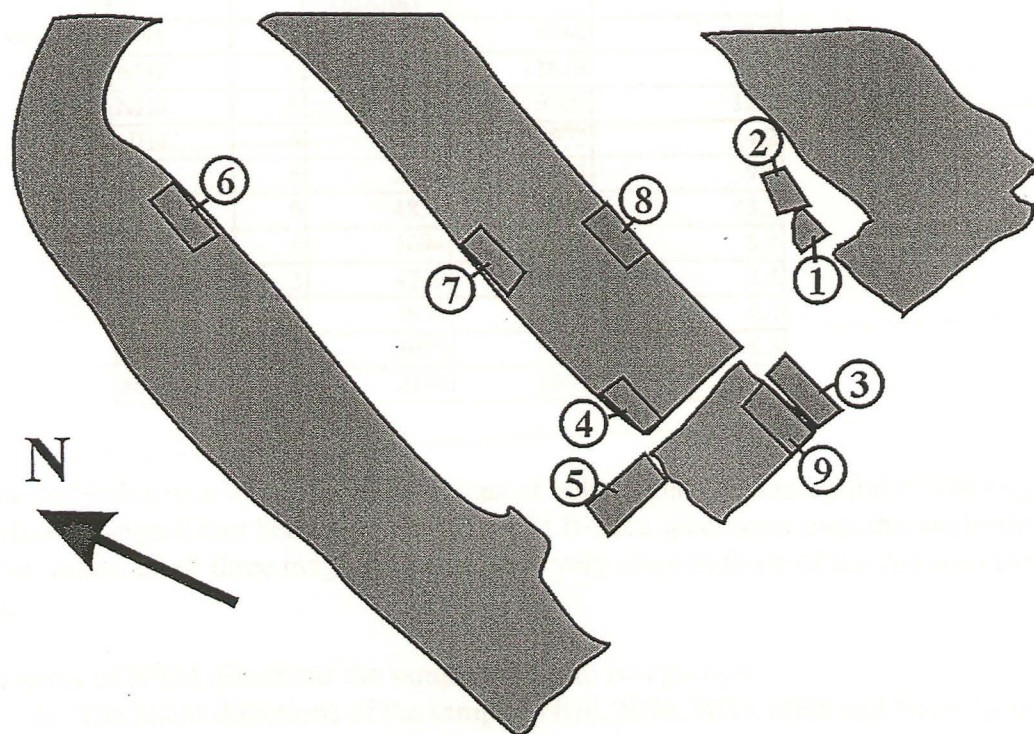


Fig. 1. Schematic diagram showing the locations of the sampled bricks, NH1 to NH9.

In the laboratory sodium silicate solution was applied to the sides of the monoliths in order to consolidate them for sub-sampling. The periphery of many of the bricks were rather soft when dried. Samples which were from the walls were divided into slice 'A' (close to the former firing surface), and slices 'B', 'C' and 'D' farther inside the brick and away from the external fired surface. Six to eleven 2.2 x 2.2 x 2.2 cm cubic

specimens were cut from each sample in the laboratory using a diamond saw. Six of the best preserved and intact specimens from each sample were used in the laboratory analysis.

2. Archaeomagnetic procedures and results

The direction and strength of natural magnetization of the specimens were measured at the CEMP, Lancaster University, using a Minispin spinner magnetometer. The low-field magnetic susceptibility (χ_{LF}), was measured on a Bartington MS2 susceptibility meter.

Table 1 lists the mean sample values of the Natural Remanent Magnetisation (NRM), the χ_{LF} , and the Koenigsberger factor (Q_{NRM}). The Koenigsberger factor is the ratio between the NRM and the induced magnetisation in a 0.5 Oe field (i.e. approximately earth's magnetic field intensity). Values larger than 1 indicate the net *in situ* magnetisation is dominated by a permanent remanence.

Table 1. Average volume specific magnetic parameters for the Meadow Lane kiln. N_s = number of specimens used in determining the mean. The -A and -B suffix on the samples indicate the sub-slices of the sample.

Sample	N_s	NRM intensity, (mA/m)	χ_{LF} , ($\times 10^{-6}$ SI)	Q_{NRM}
NH1	6	3771	6766	13.9
NH2	6	4714	11619	11.8
NH3	6	3054	6704	12.3
NH4	6	6624	12972	14.2
NH5	6	5364	15523	9.8
NH6	6	4836	9095	13.3
NH7	6	3694	9647	8.8
NH8-A	3	4739	14127	8.4
NH8-B	3	5915	15755	9.4
NH9-A	5	2033	9610	5.3
NH9-B	2	2144	9971	5.0

The collection as a whole has high values of NRM intensity, susceptibility and Q_{NRM} , indicating significant heating in the past. The B-slice specimens from the wall-bricks have values of all three magnetic parameters very close to those of the A-slice (Table 1).

In terms of NRM directions the samples fall into two groups.

- 1) The NRM directions of the samples NH4, NH6, NH7, NH8 and NH9, form a relatively tight cluster with declinations around 16° and inclinations of $\sim 60^\circ$ (Fig. 2 a). Specimen directions from samples show a similar degree of scatter as all the samples together as a whole.
- 2) Samples NH1, NH2, NH3 and NH5 on the other hand have anomalous directions (Fig. 2 b). At the intra-sample level, the specimen directions are again relatively well clustered, but the clusters are of anomalous direction. As their high NRM intensity, susceptibility and Q_{NRM} values are similar to those of the first group, the bricks they come from have been heated to similar

temperatures and probably possess a thermoremanent magnetisation of similar quality. The wide deviations of their NRM directions are probably due to the fact that they were not fired *in situ*. Hence, their final resting place probably came about during later robbing/destruction/collapse of the kiln.

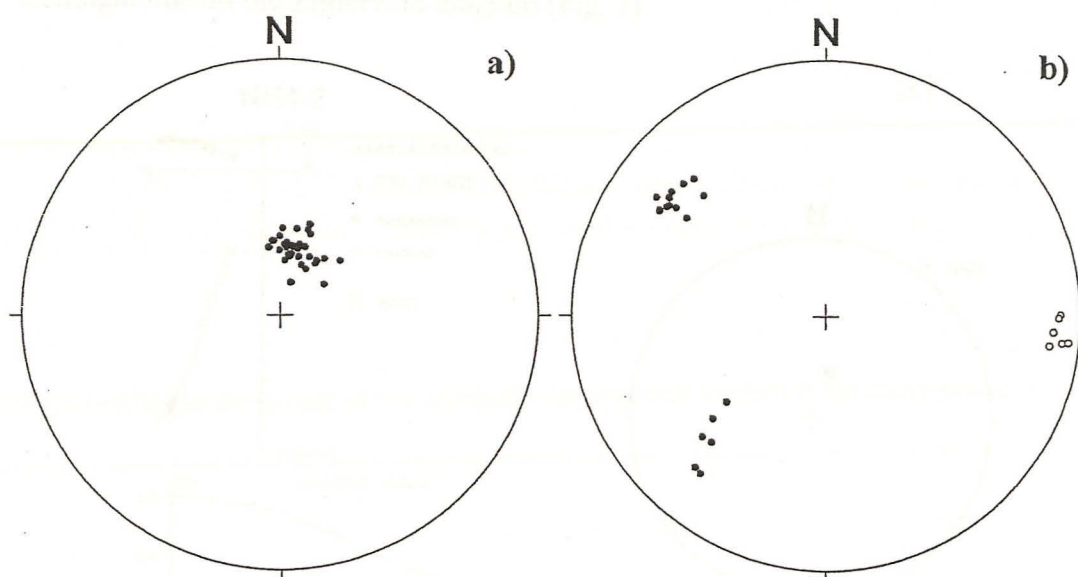


Fig 2. a) Stereoplot of the NRM directions from samples NH4, NH6, NH7, NH8 and NH9, and b) from samples NH1, NH2, NH3 and NH5.

In order to elucidate the nature of the NRM of the bricks, two more specimens, from the innermost D-slice of the wall brick sample NH8 were also measured. This slice was some 8 cm inside the brick, away from the fired surface. Table 2 shows that there is little difference between the NRM directions of the specimens from the A, B and D slices. This indicates that the heat in the kiln was considerable and had managed to reach slice D and reset its remanent magnetisation. The approximately 50% drop in the NRM intensity and susceptibility of the D-slice specimens (Table 2) is probably due to it being farther away from the fired surface.

Table 2. Direction and volume specific parameters of NRM for the A-, B- and D-slice specimens from sample NH8 of the Meadow Lane kiln.

Specimen	D	I	NRM intensity, (mA/m)	χ_{LF} , ($\times 10^{-3}$ SI)
NH8-A1	10.5	70.0	4023	12733
NH8-A2	11.0	67.7	5237	14308
NH8-A3	18.2	79.0	4960	15342
NH8-B1	5.5	72.4	5549	16417
NH8-B2	15.5	66.5	7134	16983
NH8-B3	3.9	67.3	5063	13867
NH8-D2	12.0	67.9	2989	7025
NH8-D3	11.7	64.0	3363	5142

Five pilot specimens (one from each sample) were progressively demagnetised with alternating magnetic fields (AF) in eight steps up to 50 mT, using a Molspin AF

demagnetizer. The NRM of most specimens contained only very minor overprints (i.e. probably field and laboratory viscous magnetisations), which were removed in demagnetisation fields of 10-15 mT (Fig. 3 a, b). Demagnetisation in fields higher than 15 mT revealed a directionally stable, medium to high coercivity magnetisation component- the Characteristic Remanent Magnetization (ChRM) which is evident by a straight line on the Zijderveld diagram (Fig. 3).

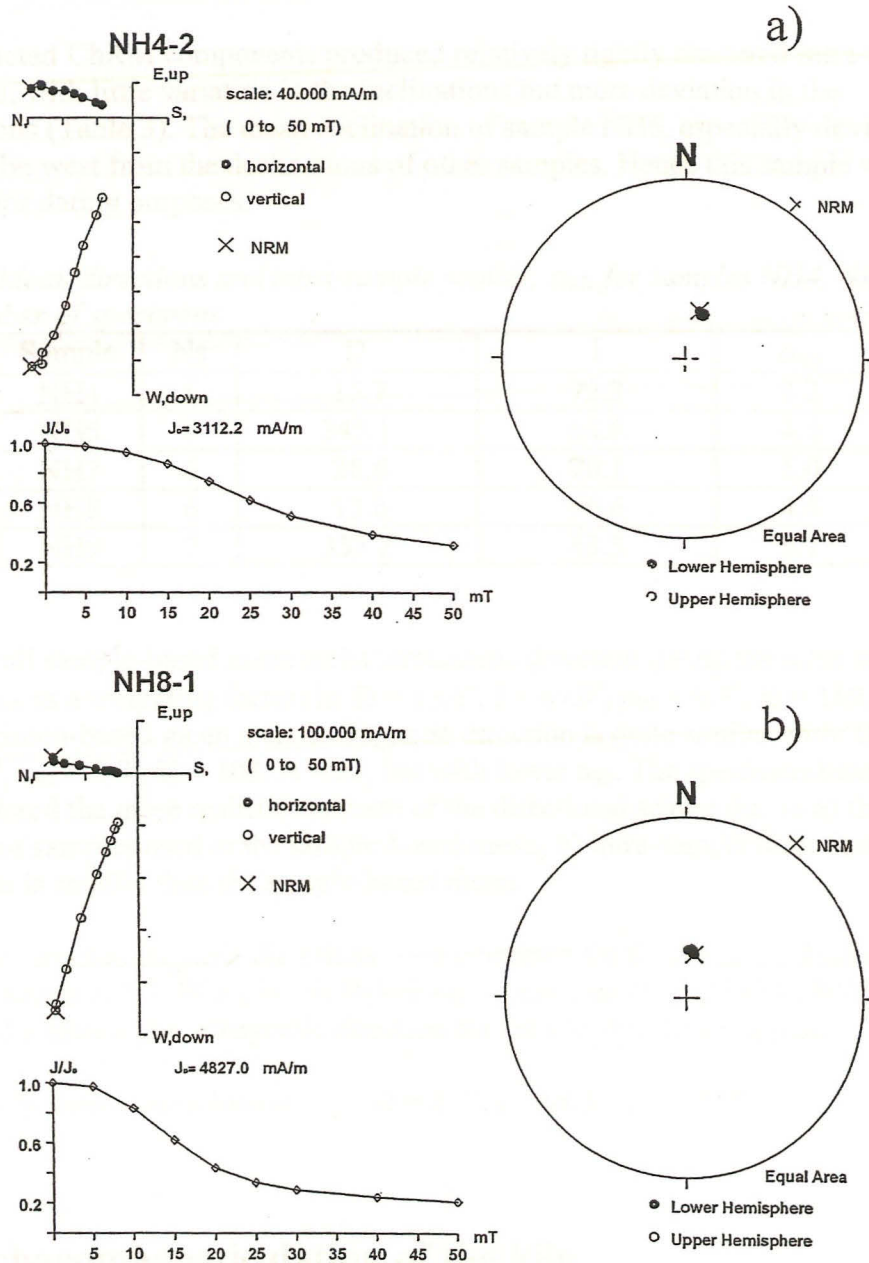


Fig. 3. Typical AF-demagnetization characteristics of brick specimens: (a) from the western chamber (NH4-2), and (b) from the eastern chamber (NH8-1).

The ChRM directions of most specimens were very stable, with median destruction fields (MDF) between 20 to 30 mT. Only sample NH9 had a lower MDF of about 10 mT. Between 20 and 35% of the NRM was left after demagnetisation at 50 mT (Fig. 3), reflecting the presence of considerable antiferromagnetic minerals (haematite) or high-coercivity ferrimagnetic (fine-grained magnetite) minerals.

Twenty-six more specimens in total from samples NH4, NH6, NH7, NH8 and NH9 were demagnetised using three magnetic field steps between 15 to 40 mT. The ChRM direction of each specimen was calculated using principal component analysis based on the least-squares fitting technique of Kirschvink (1980). The specimens' ChRM directions, together with the NRM intensity, χ_{LF} , and Q_{NRM} values, are listed in the Appendix.

The extracted ChRM components produced relatively tightly clustered intra-sample directions, with little variation in the inclinations but more deviation in the declinations (Table 3). The mean declination of sample NH6, especially deviated towards the west from the declinations of other samples. Hence this sample was rejected for dating purposes.

Table 3. Mean directions and intra-sample scatter, α_{95} , for samples NH4, NH6-9. N_s = number of specimens.

Sample	N_s	D	I	α_{95}
NH4	6	15.7	72.3	3.2
NH6	6	345.1	68.8	4.5
NH7	6	28.6	70.1	5.0
NH8	6	13.6	66.6	4.5
NH9	7	357.2	63.3	5.7

The overall sample-based mean archaeomagnetic direction (using the intra-sample scatter α_{95} as a weighting factor) is: $D = 13.4^\circ$, $I = 69.0^\circ$, $\alpha_{95} = 6.7^\circ$, $K = 169$, $N = 4$. The specimen-based mean archaeomagnetic direction is quite similar with: $D = 11.8^\circ$, $I = 68.3^\circ$, $\alpha_{95} = 2.9^\circ$, $K = 103$, $N = 25$, but with lower α_{95} . The specimen-based mean is considered the more realistic estimate of the directional scatter due to a) the small number of samples used in the sample-based mean; b) intra-sample directional scatter is smaller than the sample-based mean.

The mean archaeomagnetic directions were corrected for the magnetic declination of the site, which is 3.3° W for North Hykeham for the year 2005 (NASA, 2005). This produced a final archaeomagnetic direction for the Meadow Lane kiln of:

$$(\text{specimen-based mean}) \quad D = 8.5^\circ, I = 68.3^\circ, \alpha_{95} = 2.9^\circ.$$

3. Archaeomagnetic dating of the kiln

The mean directional results were converted via the pole method of Noel and Batt (1990) in order to compare it to the revised British master curve of Clark et al. (1988). This corrects the direction to Meriden ($\phi = 52.43^\circ$ N, $\lambda = 1.62^\circ$ W).

Converted to Meriden data:

$$(\text{specimen-based mean}) \quad D = 8.4^\circ, I = 67.7^\circ, \alpha_{95} = 2.9^\circ.$$

When plotted on the UK master curve of Clark et al. (1988), the specimen-based mean direction gives a best estimate age of last heating of AD 1505, with a 95 % confidence interval for the date of AD 1480-1530 (Fig. 4).

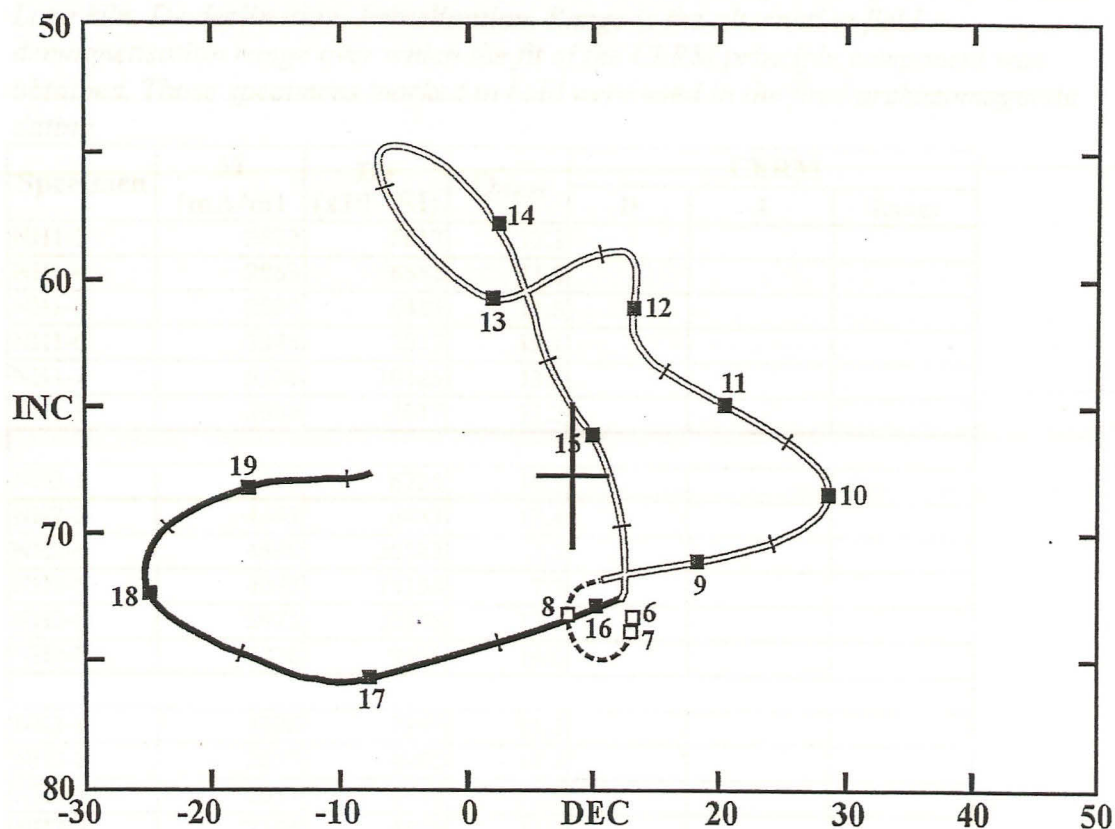


Fig. 4. Comparison between the UK master curve for AD 600 - 1975 of Clark et al. (1988) and the converted to Meriden specimen-based mean ChRM direction of the Meadow Lane kiln with its error interval (black cross) based on the Fisher 95% confidence cone.

References:

- Clark, A.J., Tarling, D.H., Noel, M., 1988, Developments in archaeomagnetic dating in Britain, *J. Archaeol. Sci.* **15** (6): 645-667.
- Kirschvink, J., 1980, The least-squares line and plane and the analysis of the palaeomagnetic data, *Geophys. J. R. astr. Soc.*, **62**, 699-718.
- NASA, 2005. IGRF Geomagnetic Field Model.
<http://nssdc.gsfc.nasa.gov/space/model/models/igrf.html> [12/5/05]
- Noel, M., Batt, C.M., 1990. A method for correcting geographically separated remanence directions for the purpose of archaeomagnetic dating, *Geophys. J. Int.*, **102**, 753-756,

Appendix

Volume-specific NRM intensity (M), magnetic susceptibility (χ_{LF}), Koenigsburger ratio (Q_{NRM}) and ChRM directional results for each measured specimen from the Meadow Lane kiln. D =declination, I =inclination. Range is the alternating field demagnetisation range over which the fit of the ChRM principle component was obtained. Those specimens marked in bold were used in the final archaeomagnetic dating.

Specimen	M (mA/m)	χ_{LF} ($\times 10^{-6}$ SI)	Q_{NRM}	ChRM		
				D	I	Range
NH1-3	3822	5617	17.1			
NH1-4	2863	6542	11.0			
NH1-5	2987	6483	11.6			
NH1-6	5345	7017	19.1			
NH1-7	5526	10325	13.5			
NH1-8	2084	4617	11.3			
NH2-1	3826	6725	14.3			
NH2-2	4443	6433	17.4			
NH2-4	4696	20583	5.7			
NH2-5	4072	14150	7.2			
NH2-6	5975	12375	12.1			
NH2-7	5276	9450	14.0			
NH3-1	3308	7367	11.3			
NH3-2	2817	4908	14.4			
NH3-3	2091	4158	12.6			
NH3-4	2196	4508	12.2			
NH3-6	4384	13325	8.3			
NH3-8	3533	5958	14.9			
NH4-2	2594	4042	16.1	19.6	69.1	15-50 mT
NH4-3	5163	8492	15.3	5.3	69.4	15-40 mT
NH4-4	8788	12058	18.3	23.9	69.4	15-40 mT
NH4-5	7497	12075	15.6	15.7	74.3	15-40 mT
NH4-6	6503	14767	11.1	11.4	75.9	15-40 mT
NH4-7	9206	26400	8.8	17.1	75.4	15-40 mT
NH5-1	5248	18533	7.1			
NH5-3	5370	17367	7.8			
NH5-5	6859	10525	16.4			
NH5-7	5968	9650	15.5			
NH5-10	4284	18342	5.9			
NH5-11	4459	18725	6.0			
NH6-1	2678	6358	10.6	351.6	62.2	15-50 mT
NH6-2	4633	10900	10.7	341.5	68.9	15-40 mT
NH6-3	3966	9650	10.3	338.8	64.9	15-40 mT
NH6-4	3153	8417	9.4	340.0	74.5	15-40 mT
NH6-5	6607	7942	20.9	337.2	71.6	15-40 mT
NH6-6	7983	11308	17.7	359.1	69.7	15-40 mT

NH7-1	619	4667	3.3	42.0	73.4	15-50 mT
NH7-2	2434	6600	9.3	20.6	66.8	15-40 mT
NH7-4	7691	15942	12.1	28.1	70.4	15-40 mT
NH7-7	3332	8992	9.3	31.4	72.0	15-40 mT
NH7-8	4864	12217	10.0	7.2	73.2	15-40 mT
NH7-10	3226	9467	8.6	38.8	62.4	15-40 mT
NH8-A1	4023	12733	7.9	10.6	67.2	15-50 mT
NH8-A2	5237	14308	9.2	18.1	61.7	15-40 mT
NH8-A3	4960	15342	8.1	26.1	75.5	15-40 mT
NH8-B1	5549	16417	8.5	7.7	66.8	15-40 mT
NH8-B2	7134	16983	10.6	14.2	62.6	15-40 mT
NH8-B3	5063	13867	9.2	8.9	65.5	15-40 mT
NH9-A1	2316	9267	6.3	356.9	63.3	10-40 mT
NH9-A3	2171	10392	5.2	333.5	67.6	10-25 mT
NH9-A4	2410	11950	5.1	337.7	64.3	10-25 mT
NH9-A7	1594	8033	5.0	13.3	58.6	10-25 mT
NH9-A8	2234	10217	5.5	4.6	66.4	10-20 mT
NH9-B2	1393	7083	4.9	359.3	57.3	10-20 mT
NH9-B3	2119	10333	5.2	7.3	61.1	10-20 mT

Appendix 6

GLOSSARY

Alluvium	Deposits laid down by water. Marine alluvium is deposited by the sea, and fresh water alluvium is laid down by rivers and in lakes.
Anglo-Saxon	Pertaining to the period when Britain was occupied by peoples from northern Germany, Denmark and adjacent areas. The period dates from approximately AD 450-1066.
Context	An archaeological context represents a distinct archaeological event or process. For example, the action of digging a pit creates a context (the cut) as does the process of its subsequent backfill (the fill). Each context encountered during an archaeological investigation is allocated a unique number by the archaeologist and a record sheet detailing the description and interpretation of the context (the context sheet) is created and placed in the site archive. Context numbers are identified within the report text by brackets, e.g. [004].
Cut	A cut refers to the physical action of digging a posthole, pit, ditch, foundation trench, etc. Once the fills of these features are removed during an archaeological investigation the original 'cut' is therefore exposed and subsequently recorded.
Domesday Survey	A survey of property ownership in England compiled on the instruction of William I for taxation purposes in 1086 AD.
Fill	Once a feature has been dug it begins to silt up (either slowly or rapidly) or it can be back-filled manually. The soil(s) that become contained by the 'cut' are referred to as its fill(s).
Geophysical Survey	Essentially non-invasive methods of examining below the ground surface by measuring deviations in the physical properties and characteristics of the earth. Techniques include magnetometry and resistivity survey.
Iron Age	A period characterised by the introduction of Iron into the country for tools, between 800 BC and AD 50.
Layer	A layer is a term used to describe an accumulation of soil or other material that is not contained within a cut.
Medieval	The Middle Ages, dating from approximately AD 1066-1500.
Natural	Undisturbed deposit(s) of soil or rock which have accumulated without the influence of human activity
Neolithic	The 'New Stone Age' period, part of the prehistoric era, dating from approximately 4500 - 2250 BC.
Old English	The language used by the Saxon (q.v.) occupants of Britain.
Post hole	The hole cut to take a timber post, usually in an upright position. The hole may have been dug larger than the post and contain soil or stones to support the post. Alternatively, the posthole may have been formed through the process of driving the post into the ground.
Post-medieval	The period following the Middle Ages, dating from approximately AD 1500-1800.

Prehistoric	The period of human history prior to the introduction of writing. In Britain the prehistoric period lasts from the first evidence of human occupation about 500,000 BC, until the Roman invasion in the middle of the 1st century AD.
Ridge and Furrow	The remains of arable cultivation consisting of raised rounded strips separated by furrows. It is characteristic of open field agriculture.
Romano-British	Pertaining to the period dating from AD 43-410 when the Romans occupied Britain.
Saxon	Pertaining to the period dating from AD 410-1066 when England was largely settled by tribes from northern Germany
Till	A deposit formed after the retreat of a glacier. Also known as boulder clay, this material is generally unsorted and can comprise of rock flour to boulders to rocks of quite substantial size.
Transformed	Soil deposits that have been changed. The agencies of such changes include natural processes, such as fluctuating water tables, worm or root action, and human activities such as gardening or agriculture. This transformation process serves to homogenise soil, erasing evidence of layering or features.

Appendix 7 The Archive

The archive consists of:

12	Daily record sheets
58	Context records
3	Context record sheets
1	Section record sheets
1	Plan record sheets
1	Environmental sample record sheet
10	Environmental sample records
14	Sheets containing scale drawings (plans and sections)
2	Photographic record sheets
1	Box of finds

All primary records and finds are currently kept at:

Archaeological Project Services
The Old School
Cameron Street
Heckington
Sleaford
Lincolnshire
NG34 9RW

The ultimate destination of the project archive is:

Lincolnshire City and County Museum
12 Friars Lane
Lincoln
LN2 1HQ

The archive will be deposited in accordance with the document titled *Conditions for the Acceptance of Project Archives*, produced by the Lincolnshire City and County Museum.

Lincolnshire City and County Museum Accession Number: 2004.256

Archaeological Project Services Site Code: NHM04

The discussion and comments provided in this report are based on the archaeology revealed during the site investigations. Other archaeological finds and features may exist on the development site but away from the areas exposed during the course of this fieldwork. *Archaeological Project Services* cannot confirm that those areas unexposed are free from archaeology nor that any archaeology present there is of a similar character to that revealed during the current investigation.

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