# A34 WOLVERCOTE VIADUCT REPLACEMENT, OXFORD, OXFORDSHIRE

NGR: SP 49021 10390

# ARCHAEOLOGICAL EXCAVATION POST EXCAVATION ASSESSMENT

#### October 2008

Report No. 610

#### **Quality Assurance**

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#### GLOSSARY OF ARCHAEOLOGICAL TERMS AND ABBREVIATIONS

Archaeology

For the purposes of this project archaeology is taken to mean the study of past human societies through their material remains from prehistoric times to the modern era. No rigid upper date limit has been set, but AD 1900 is used as a general cut-off point.

CBM

Ceramic Building Material.

Medieval

The period between the Norman Conquest (AD 1066) and c. AD 1500.

Natural

In archaeological terms this refers to the undisturbed natural geology of a site, in this case Triassic and Permian aged Lower Sandstone with Breccia and Conglomerate overlaid by terrace gravels and sands (Geological Survey of Great Britain 1974, Sheet 310).

NGR

National Grid Reference from the Ordnance Survey Grid.

OD

Ordnance Datum; used to express a given height above sea-level.

OS

Ordnance Survey.

Post-medieval

The period after c. AD 1500.

Prehistoric

The period prior to the Roman invasion of AD 43. Traditionally sub divided into; Palaeolithic - c. 500,000 BC to c. 12,000 BC; Mesolithic - c. 12,000 BC to c. 4,500 BC; Neolithic - c. 4,500 BC to c. 2,000 BC; Mesolithic - c. 2,000 BC; Mesolithic - c. 600 BC; Mesolithic - c. 600 BC; Mesolithic - c. 600 BC to Mesolithic - c. 600 BC; Mesolithic - c. 600 BC; Mesolithic - c. 600 BC; Mesolithic - c. 600 BC to Mesolithic - c. 600 BC; Mesolithic - c.

Roman

The period traditionally dated AD 43 to c. AD 410.

Romano-British

Term used to describe the fusion of indigenous Iron Age traditions with invasive Roman culture.

Saxon

The immediate post-Roman period traditionally dated from AD 410 to AD 1066.

#### **SUMMARY**

Between the 13<sup>th</sup> and 27<sup>th</sup> June 2008 Foundations Archaeology undertook an Archaeological Excavation on land at A34 Wolvercote Viaduct Replacement Scheme, Oxford, Oxfordshire (NGR: SP 49021 10390). Foundations Archaeology was appointed by Costain through Chris Blandford Associates to undertake the works. The project was directed on site by Diana King of Foundations.

Costain has been appointed by the Highways Agency under an ECI agreement to replace the existing Wolvercote Viaduct on the A34 Western Bypass as part of the Highways Agency maintenance programme. A condition of the Environmental Assessment Report (EAR) was a programme of archaeological assessment and recording prior to and during development of the site. The monitoring work revealed a discrete area of archaeological importance.

The archaeological excavations have indicated that the site lies within an area associated with Roman settlement. Due to the interleaving nature of the alluvial layers into which the archaeological features were cut, it is not possible to say where the centre of the settlement might have been, as many of the features could only be partly seen. It was agreed by all parties during a site visit that the depth of excavation required in this area would not be sufficient to expose all areas of archaeology in the caravan park, or all archaeological features within the defined excavation area. No further excavation was, therefore, undertaken.

The archaeological excavation revealed activity associated with a long-lived settlement spanning the Iron Age/early Roman period to the 4<sup>th</sup> century AD, with a possible break in occupation between the mid 2<sup>nd</sup> and mid 3<sup>rd</sup> centuries. Features, such as a possible enclosure, pits and areas of burning, attest to the presence of a Roman settlement. The low density of the features and the finds assemblage suggest a non-intensive, low-status, rural settlement.

This assessment document provides an overview of the results from the archaeological works and sets out the requirements to bring the site to publication.

#### 1 INTRODUCTION

- 1.1 This report presents the findings of an Archaeological Excavation undertaken by Foundations Archaeology between the 13<sup>th</sup> and 27<sup>th</sup> June 2008 on land at A34 Wolvercote Viaduct, Oxford, Oxfordshire (NGR: SP 49021 10390). The project was commissioned by Costain through Chris Blandford Associates and directed on site by Diana King of Foundations Archaeology.
- 1.2 Costain has been appointed by the Highways Agency under an ECI agreement to replace the existing Wolvercote Viaduct on the A34 Western Bypass as part of the Highways Agency maintenance programme. A condition of the Environmental Assessment Report (EAR) was a programme of archaeological assessment and recording prior to and during development of the site. The condition initially required an Archaeological Assessment of the proposed development area, undertaken by Chris Blandford Associates, which is relayed in detail in the Specification (Jacobs, 2008). A post-determination condition required archaeological evaluation of the proposed pier bases and a programme of archaeological monitoring and recording (watching brief) across all other areas of development (the results of which will appear in a separate report).
- 1.3 During the watching brief on the topsoil strip for the caravan site a discrete area of archaeological importance was revealed. It was subsequently agreed with Paul Smith, the county archaeologist for Oxfordshire County Council, in consultation with Costain, Alison MacDonald of Chris Blandford Associates, Kevin Beachus of Jacobs and Foundations Archaeology that the area of archaeological interest should be archaeologically excavated.
- 1.4 The archaeological work was undertaken in accordance with the principals of Planning Policy Guidance Note 16: Archaeology and Planning (DoE 1990) and the archaeological policies of Oxfordshire County Council. The archaeological excavation was undertaken in accordance with the Written Scheme of Investigation prepared by Foundations Archaeology (2008), agreed by Paul Smith, the county archaeologist for Oxfordshire County Council, and with IFA *Standards and Guidance on Archaeological Excavation* (1994, revised 2001).
- 1.5 This document provides an assessment of the evidence recovered during the archaeological excavation and a programme to bring the results to publication. This assessment now details the proposed publication format and content of the excavation report. This document conforms to the specification set out in Appendices 4 and 5 of The Management of Archaeological Projects (English Heritage, 1991).
- 1.6 In the following sections a summary of the results from the investigation is followed by an assessment of its stated aims and an overall assessment of the importance of the site is given. Finally each major category of finds is then similarly assessed in turn.

#### 2 SITE LOCATION

- 2.1 The site is situated on the northwest edge of Oxford, approximately 5km from the town centre, and is on the northern edge of the village of Wolvercote. The Wolvercote Viaduct lies within the part of the northern route of River Thames and the site encompasses some of its associated valleys and meadows.
- 2.2 In addition to the A34 bridge and slip roads, the A40 runs through the site, as does the Oxford to Birmingham Mainline Railway and the Oxford Canal. The remainder of the site predominantly consists of pasture, arable and meadow land.
- 2.3 The River Thames valley and the old course of the River Cherwell, now the Oxford Canal, run northwest-southeast under the viaduct. The majority of the site, therefore sits on alluvial deposits, dating to the Quaternary period. To the south of the site, under Lower Wolvercote, an outcrop of 1<sup>st</sup> floodplain gravel terrace deposits survive which derive from the development of the River Thames floodplain. To the north of the viaduct an outcrop of Oxford Clay exists. The floodplain, situated at the centre of the site, is flat and lies at approximately 60m AOD. The land rises to the northeast to approximately 70m AOD.
- 2.4 The excavation area comprised a parcel of land within the wider development area (Figure 2). It was situated on the northwest edge of the development area, to the northwest of the A34 and to the northeast of the A40. Area 22 was excavated within open pasture land and the ground rose gradually to the northeast.

#### 3 PROJECT AND ARCHAEOLOGICAL BACKGROUND

- 3.1 Costain has been appointed by the Highways Agency under an ECI agreement to replace the existing Wolvercote Viaduct on the A34 Western Bypass as part of the Highways Agency maintenance programme. The Environmental Assessment Report required the archaeological evaluation of the proposed pier bases and a programme of archaeological monitoring and recording (watching brief) across all other areas of development (the results of which will appear in a separate report). The watching brief on the temporary caravan site topsoil strip revealed a discrete area of archaeological importance. It was agreed by all parties that this area would be archaeologically excavated.
- 3.2 The site as a whole has been the subject of an archaeological assessment (Chris Blandford Associates, 2002), of which only a summary is presented below:
- 3.3 A number of palaeolithic implements have been recovered from the Wolvercote gravel terraces, which are known to have a high potential for

- Palaeolithic remains. Other Palaeolithic remains have been recovered from alluvial areas of the floodplain. No finds have previously been made within the study area from the Upper Palaeolithic or Mesolithic periods.
- 3.4 There is no evidence recorded in the study area from the Neolithic period, although a number of finds and features are known to the west. The Bronze Age is also not well represented, although a number of potential features have been identified in Port Meadow.
- 3.5 Potential Iron Age settlement activity is recorded near to the study area at Port Meadow and Wolvercote Common and Iron Age pottery has been recovered from just beyond the study area near the A40. The potential for the presence of Iron Age remains to occur within the study area is uncertain due to a lack of previous archaeological investigation.
- 3.6 It is possible that alluvial soils occur within the study area. These deposits have the potential to mask prehistoric features and provide exceptional preservation conditions. Fieldwork at Yarnton has reinforced the perception that floodplain areas offer enormous potential for the preservation of archaeological remains.
- 3.7 Possible Romano-British hut circles on the periphery of Port Meadow, a series of possible Romano-British ditches at Peartree Hill, along with Roman pottery from near the Wolvercote Viaduct and Peartree Interchange, suggest a moderate to high potential for Romano-British remains to be present within the study area. Where present, these remains may be of regional significance.
- 3.8 Records show that a settlement at Port Meadow was established by 1086. Saxon/Early Medieval archaeological evidence within the study area is limited to a Saxon ditch at the northeast.
- 3.9 Wolvercote is recorded in the Domesday Book as meadow and pasture lands of six furlongs long and three-and-a-half wide, which suggests a number of domesticates. The place name Wolvercote suggests an early date. It is known that by 1086 a total of 20 tenants were recorded.
- 3.10 Wolvercote was a separate manor in 1086 and remained independent for all but ecclesiastical purposes until the late 17<sup>th</sup> century. It is recorded that within the settlement of Wolvercote there was a farmstead or small settlement at Wyke o' Wycroft on the eastern edge of Port Meadow.
- 3.11 In 1139 John of St. John gave Godstow Abbey a mill at Wolvercote, which by 1541 was a double mill and fishery.
- 3.12 The nunnery at Godstow heavily influenced the Medieval development of Wolvercote. Lower Wolvercote developed around the nunnery mill and upper Wolvercote developed around the church of St. Peter, remains of which date to 13<sup>th</sup> 19<sup>th</sup> century. Possible Medieval agricultural land has been identified in

- Upper Wolvercote. Areas of ridge and furrow in the vicinity may indicate early field systems.
- 3.13 By the 17<sup>th</sup> century there were four mills at Wolvercote. In 1772 the Oxford Canal was constructed, which survives along its original line in the study area. During the 17<sup>th</sup> and 18<sup>th</sup> centuries a number of properties were erected along Godstow Road and within Upper Wolvercote.
- 3.14 Mixed farming dominated much of the 19<sup>th</sup> century. The 1887 1<sup>st</sup> Edition Ordnance Survey Map of the study area shows Lower and Upper Wolvercote as being relatively rural and small scale. Isolated farmsteads are located on the higher ground.
- 3.15 The early 20<sup>th</sup> century maps show a steady expansion and development of settlement, with the 1967-1968 Ordnance Survey map resembling the present settlement form.
- 3.16 The current study area therefore contained the potential for archaeological features and deposits

#### 4 AIMS

- 4.1 The general aims of the exercise were to gather high quality data from the direct observation of archaeological deposits in order to provide sufficient information to establish the location, date, character, extent, condition, significance and quality of any surviving archaeological remains in order to provide mitigation through preservation by record. The exercise also sought to clarify the nature and extent of existing disturbance and intrusions and to assess the degree of archaeological survival of buried deposits and surviving structures of archaeological significance.
- 4.2 These aims were to be achieved through pursuit of the following specific objectives:
  - i) to define and identify the nature of archaeological deposits on site, and date these where possible;
  - ii) to attempt to characterise the nature of the archaeological sequence and recover as much information as possible about the spatial patterning of features present on the site;
  - iii) to recover a well dated stratigraphic sequence which will attempt to determine the complexity of the horizontal and vertical stratigraphy present, and recover coherent artefact, ecofact and environmental samples, including an assessment of the environmental potential.

- iv) to disseminate the results through deposition of an ordered archive, the deposition of a detailed report at the Historic Environment Record and publication at a level of detail appropriate to the significance of he results.
- 4.3 An assessment of the success of these aims and avenues for additional research will be addressed in Section 9.

#### 5 METHODOLOGY

- 5.1 The defined excavation area was excavated in accordance with the Written Scheme of Investigation (Foundations, 2008).
- 5.2 The area had already been stripped of 0.30m of topsoil under watching brief conditions using a mechanical excavator fitted with a toothless grading bucket, working under the constant supervision of an experienced archaeologist. It was accepted by all parties that the depth of excavation undertaken would not be sufficient to expose all areas of archaeology in the caravan park or all the archaeological features within the defined excavation area. It was understood that no deeper excavation could be undertaken due to legal restrictions imposed on the construction methodology. It was further agreed that the unexposed archaeology would be protected if it remained *in-situ*.
- 5.3 Archaeological features and deposits that would be destroyed by the groundworks were subjected to appropriate levels of hand investigation. The site area was hand-cleaned and all excavation was thereafter conducted by hand. All spoil heaps were visually scanned for archaeological material.
- 5.4 Archaeological deposits and features were subjected to the following sampling levels. Where possible, sections were cut through all linear features at appropriate intervals and all intersections, overlaps and terminals were investigated to provide a minimum 20% sample. Where possible, a minimum 50% sample of all non-linear features was hand excavated. All spoil heaps were examined for finds.
- 5.5 Each excavation context was excavated, wherever possible, in such a way as to produce at least one representative cross-section of the deposit.
- 5.6 Decisions about the relative value of archaeological deposits and features were made in consultation with the County and City Archaeological Officers, Chris Blandford Associates and Jacobs UK Limited.
- 5.7 Palaeoenvironmental sampling of suitable deposits were undertaken in accordance with the Centre for Archaeology Guidelines *Environmental Archaeology: a guide to the theory and practice of methods from sampling and recording to post-excavation* (English Heritage 2002). Decisions regarding which contexts were suitable for environmental sampling were made on site in consultation with the County Archaeological Officer, Chris Blandford Associates and Jacobs UK Limited.

- 5.9 All artefactual and ecofactual remains, whether stratified or not, were collected, bagged and labelled. Artefacts were subjected to preliminary study on site in order to help date archaeological features and contexts. All artefactual and ecofactual evidence were treated in accordance with the Foundations Archaeology Technical Manual 4 (Finds Manual).
- 5.10 Provision was made within the tender for appropriate levels of artefact and ecofact conservation.
- 5.11 Following the excavation, the site was back-filled under the constant supervision of an experienced archaeologist. Subsequently, the area, as with the remainder of the caravan park, was covered with Terram and stoned to a depth of 0.30m. When the temporary caravan site is no longer needed, the stone and Terram will be removed and the area will be re-instated to a higher level than the original ground level. As part of this process Costain have undertaken to place up to one metre of soil over the area.

#### 5 STRATIGRAPHIC EVIDENCE

#### 5.1 General

- 5.1.1 For the purposes of excavation, the caravan park was known as Area 22. The natural deposits, which consisted of interleaving alluvial layers of mid orange plastic sand clay, were encountered at an average depth of 0.30m (60.00-62.50m OD) below the modern ground surface. The natural was sealed by topsoil/ploughsoil (2201), which comprised a dark grey brown firm, friable sand clay with a few sherds of late Post-medieval china wares.
- 5.1.2 The site has been divided into four phases within the Roman period which are based on artefactual and stratigraphic evidence. The phases are: Iron Age/Early Roman, 1<sup>st</sup> Century AD, 2<sup>nd</sup> Century AD and 4<sup>th</sup> Century AD. A degree of overlap exists between the first three phases and some features given to either of these may, in fact, actually belong to the other period.
- 5.1.3 There was no modern disturbance present within the excavated area. All features were truncated by Medieval ridge and furrow which was present across the caravan site area. These were aligned approximately northwest-southeast and were typically 3m in width, up to 0.30m in depth at the centre and spaced 5-7m apart.
- 5.1.4 All features were interleaved with the alluvial layers. The alluvial layers were not readily distinguishable from each other and could only been seen as separate events when shown in section, where they proved to be 0.2m-0.3m thick. As a result the features sometimes cut the alluvium and were sometimes overlaid by it, so many of the features did not show, or only partly showed, in plan.

#### 5.2 Iron Age/Early Roman

- 5.2.1 A total of four features from this earliest phase were present in the excavated area. The features comprised a pit [2209] and a possible pit [2221] and ditches [2227] and [2242]. A group of three further features, possible post-holes [2211], [2213] and [2240], probably also date to this period due to the stratigraphic relationship of [2211] and [2209].
- 5.2.2 Pit [2209] was a sub-oval, shallow feature measuring 1.46m in length, 0.50m in width and 0.12m in depth. It had 45° sloping sides, a wide, flattened base and was filled with (2210), a mid grey brown firm, compact, plastic sand clay with a few charcoal flecks and small flints. This feature contained 20 sherds of late-Iron Age/early Roman pottery and a fragment of sheep bone. The feature cut post-hole [2211].
- 5.2.3 Feature [2221] was a probable pit caught in section. It measured at least 0.30m in length, al least 0.81m in width and 0.63m in depth and had steeply sloping sides and a narrow, flattened base. It was filled with (2222), a dark grey green soft clay sand with frequent charcoal fleck inclusions. Finds from the feature comprised one sherd of late Iron-Age/early Roman pottery and a fragment of pig bone. The feature was cut by [2223], [2230] and [2236].
- 5.2.4 Ditch [2227] was a northwest-southeast aligned feature which was difficult to distinguish in plan. It measured at least 0.50m in length, 2.30m in width and at least 0.50m in depth. It had 45° sloping sides and a narrow, rounded base. It was primarily filled with (2228), a deposit comprising green plastic clay, 0.86m wide and 0.08m thick. Finds from this fill consisted of two sherds of late Iron Age-early Roman pottery. This fill was overlain by fill (2229), a brown orange friable clay sand, 2.30m in width and 0.19m thick. A fragment of cow bone and three sheep bones were present within this fill. Feature [2227] was re-cut by ditch [2230], cut by ditch [2233] and had an unknown relationship with [2221], although the dating from the two features suggested they were contemporary.
- 5.2.5 Feature [2242] was an east-west aligned ditch of which a portion could be distinguished in plan. It measured at least 12m in length, at least 2.2m in width and was at least 0.92m in depth. It had steeply sloping, near vertical sides and a flattened base which stepped down at the centre. It was primarily filled with (2243), a deposit which comprised light yellow orange compact, friable sand clay with rare charcoal fleck inclusions. Finds from this fill comprised one sherd of late Iron Age/early Roman date. Fill (2243) was overlain by (2244), an alluvial fill comprising mid brown orange hard, compact, friable sand clay with a few small stone and charcoal fleck inclusions. No finds were present within this fill. Ditch [2242] was re-cut by [2264] and was only visible in section 006 as it was entirely cut away by [2264] further to its west. It also cut alluvial layers (2247) and (2248).
- 5.2.6 Feature [2211] was a possible post-hole. It measured at least 0.43m in diameter and was 0.14m in depth. It was circular in plan and had 45° sloping sides and a

- rounded base. It was filled with (2212), a yellow clay with brown mottling which was firm, compact and plastic with a few charcoal flecks and small stones. No finds were present within the excavated section.
- 5.2.7 Feature [2213] was a possible post-hole measuring 0.46m in diameter and 0.20m in depth. It had near vertical sides and a flat base and was filled with (2214), a deposit visually identical to (2212). No finds were recovered from the excavated section.
- 5.2.8 Feature [2240] was a possible post-hole measuring 0.42m in length, 0.36m in width and 0.07m in depth. It had near vertical sides and a flat base and was filled with (2241), a deposit visually identical to (2212). No finds were recovered from the excavated section.

# 5.3 1st Century AD

- 5.3.1 A total of just two features were of 1st century date, ditches [2233] and [2230].
- 5.3.2 Feature [2233] was a northwest-southeast aligned ditch. It measured at least 13m in length, 1.38m in width and 0.79m in depth. It had steeply sloping sides and a rounded base. It was primarily filled with (2234), a light brown sand silt from which eight sherds of Iron Age/early Roman pottery sherds and one 1<sup>st</sup> century sherd were recovered in addition to a fragment of cow bone. This feature cut [2227].
- 5.3.3 Feature [2230] was a northwest-southeast aligned ditch re-cutting ditch [2227]. It measured at least 0.50m in length, at least 2.20m in width and 0.38m in depth and had gently sloping sides and a rounded base. It was primarily filled with (2231), a mid brown crumbly clay sand with frequent small stone inclusions. No artefactual evidence was present within this fill. Fill (2231) was overlain by (2232), a grey brown silt sand which contained eight sherds of Iron Age/early Roman pottery sherds and one 1<sup>st</sup> century sherd and three fragments of possible cow bone. Feature [2230] cut ditch [2227], possible pit [2221] and was cut by [2236].

# 5.4 2<sup>nd</sup> Century AD

- 5.4.1 At least four features can be attributed to this period, two ditches [2236] and [2264] and two pits [2223] and [2237]. A third linear feature [2260] may also belong to this period.
- 5.4.2 Feature [2223] was a slightly irregular, sub-circular pit measuring 1.50m in length, 4.40m in width and at least 0.50m in depth. It had vertical sides and a wide, uneven base. It was primarily filled with (2224), a grey sand clay with a few charcoal fleck inclusions. No artefactual evidence was present within this fill. Fill (2224) was overlain by (2225), an orange brown mottled, friable sand silt which contained two sherds of Iron Age/early Roman pottery and five sherds of 2<sup>nd</sup> century or later pottery and one fragment of possible sheep bone.

- 5.4.3 Feature [2236] was a possible re-cut of pit [2223], which was aligned northwest-southeast. It measured 2.18m in width and 0.44m in depth and had a steeply sloping southwest edge and a gently sloping, slightly stepped northeast edge and a narrow, rounded base. It was filled with (2226), a grey brown clay sand. Artefactual evidence from this feature comprised three sherds of Iron Age/early Roman pottery, and three sherds of late 1<sup>st</sup>-2<sup>nd</sup> century pottery, but was assigned to the 2<sup>nd</sup> century due to its relationship with [2223]. Feature [2236] cut [2221], [2223] and [2230].
- 5.4.4 Feature [2237] was a sub-oval pit with the long axis aligned northwest-southeast. It measured 2.10m in length, 1.80m in width and 0.60m in depth and had steeply sloping sides and a rounded base. It was primarily filled with (2238), a mid brown orange soft, friable clay sand, 0.41m thick, which did not contain any artefactual evidence. Fill (2238) was overlain by fill (2239), a mid orange brown soft friable sand clay with a few small stone inclusions, rare charcoal flecks and some root disturbance, 0.19m thick. This fill contained eight sherds of 2<sup>nd</sup> century+ pottery and 22 cow and sheep/goat bones.
- 5.4.5 Feature [2264] was a re-cut of ditch [2242]. It was approximately east-west aligned and measured at least 12m in length up to 2.20m in width and at least 0.94m in depth. It had partially stepped sides and a narrow, flat base. It was primarily filled with (2245)/(2254), an orange grey brown compact, plastic sand clay with a few small stone inclusions and occasional charcoal flecks, at least 2.20m in width and at least 0.70m thick. This fill produced six sherds of late Iron Age/early Roman pottery, and four sherds of 2<sup>nd</sup> century pottery and three sherds of  $2^{nd}/3^{rd}$  century pottery in addition to 12 sheep and cow bones. Fill (2245)/2254) was overlain by (2253), a light grey plastic sand clay with occasional small stone and charcoal fleck inclusions, up to 2.04m in width and up to 0.76m thick. Artefactual evidence from this fill comprised 28 sherds of late 1<sup>st</sup>/early 2<sup>nd</sup> century pottery and 28 animal bones including horse, cow and sheep. Ditch [2264] was finally back-filled in the late 4<sup>th</sup> century with fill (2246)/(2252)/(2255), which overlay (2253). This fill was a dark grey brown friable-plastic, soft sand clay with occasional small stone and charcoal fleck inclusions, up to 1.65m in width and up to 0.62m in depth. This fill contained ten sherds of Iron Age/early Roman pottery, 54 sherds of late 4<sup>th</sup> century pottery and 258 animal bones, including horse, cow, chicken and sheep/goat.
- 5.4.6 Feature [2260] was a north-south aligned ditch which measured at least 3.30m in length and 2.60m in width. This feature was not excavated but cleaning over its surface revealed 11 sherds of late 1<sup>st</sup>/early 2<sup>nd</sup> century pottery within fill (2261). Fill (2261) comprised a dark grey brown firm, friable-plastic sand clay with occasional small stone inclusions. Feature [2260] intersected with a small possible feature [2262], but their relationship remained unknown.

# 5.5 4<sup>th</sup> Century AD

5.5.1 This phase contained just one feature, ditch [2219], although the final back-fill of ditch [2264] also falls within this period (see paragraph 5.4.5). A second

- feature [2205] was dated by the pottery to this period, however, it clearly cut a medieval furrow and most likely related to tree root disturbance.
- 5.5.2 Feature [2219] was a narrow, northeast-southwest aligned ditch. It measured at least 14m in length, up to 1.10m in width and 0.33m in depth and had steeply sloping sides and a narrow, rounded base. It was filled with (2220), a dark grey brown with orange mottling firm, compact, plastic sand clay with a few small stone and pebble inclusions and rare charcoal flecks. Artefactual evidence from this feature comprised 62 sherds of 4<sup>th</sup> century pottery and 23 animal bones, including cow, sheep and sheep/goat.

#### 5.6 Undated

- 5.6.1 A total of five features remained undated, although it is very likely they belonged to the Roman period. The features comprised two possible hearths/burnt areas [2215] and [2256], two ditches [2249] and [2258] and a possible gully [2262].
- 5.6.2 Feature [2215] was a shallow sub-oval pit which could have represented a hearth or area of burning. It measured 0.80m in length, 0.63m in width and 0.08m in depth and had gently sloping edges and a rounded base. It was filled with (2216) which comprised bright pink, burnt clay with occasional charcoal flecks which was overlain by a layer of charcoal. The natural soil around the feature was partially burnt. No artefactual evidence was recovered from the feature.
- 5.6.3 Feature [2249] was a shallow, approximately north-south aligned ditch which intersected with ditch [2242/2264]. It measured at least 3.20m in length, 0.86m in width and 0.36m in depth and had steeply sloping sides and a flattened base. It was filled with (2250), a grey brown friable silt clay with occasional small stone and frequent charcoal fleck inclusions. No artefactual evidence was recovered from the excavated section.
- 5.6.4 Feature [2256] was an irregularly shaped area of burnt clay, charcoal and large, unshaped stones. It measured approximately 1.60m in diameter and was filled with (2257), a red pink clay with patches of charcoal and mid grey brown firm, plastic sand clay. This feature was not excavated.
- 5.6.5 Feature [2258] was a north-south aligned ditch measuring al least 6.10m in length and 1.10m in width. It was filled with (2259), a dark grey brown firm, friable-plastic sand clay with occasional small stone inclusions. This feature was not excavated, although six fragments of possible Roman pottery were recovered from the top of the fill.
- 5.6.6 Feature [2262] was a possible gully branching-off linear feature [2260]. It was east west aligned and measured at least 0.60m in length and 0.40m in width. It was filled with (2263), a dark grey brown firm, friable-plastic sand clay with occasional small stone inclusions. This feature was not excavated.

#### 6 DISCUSSION

- 6.1 The results of the excavations have indicated that the site lies close to the centre of a Roman settlement. Due to the interleaving nature of the alluvial layers into which the archaeological features were cut, it is not possible to say where the centre of the settlement might have been, as many of the features could only be partly seen.
- 6.2 The features revealed part of long-lived activity spanning the Iron Age/early Roman period to the 4<sup>th</sup> century AD, with a possible break in occupation between the mid 2<sup>nd</sup> and mid 3<sup>rd</sup> centuries. Features, including a possible enclosure, pits and areas of burning, suggest the presence of a Roman settlement.
- 6.3 Within the earliest, Iron Age/early Roman, phase were two large ditches which may have formed the northern corner of an enclosure. 'Inside' the possible enclosure were five shallow discreet features. Of these, three were possible post-holes; although they did not clearly indicate the presence of a structure. The shallow nature of the 'internal' features suggests that plough damage could have truncated other similar features and that the pattern is incomplete. It is further possible that the two large ditches represented not an enclosure, but land boundary demarcations or substantial drainage ditches.
- In the 1<sup>st</sup> century phase only two features were present. The north-south aligned ditch of the possible enclosure was re-cut in this period and a second, parallel ditch was constructed on its eastern side. The first two phases may have overlapped considerably, therefore the possible enclosure could still have been in use. The construction of a second ditch suggests consolidation of the enclosure. The lack of other features in this phase could be a false pattern as further features could be 'hidden' by alluvial layers, or, if shallow, could have been cut away due to ploughing or similar farming or land management activities.
- 6.5 In the third phase, the 2<sup>nd</sup> century, the east-west aligned ditch [2264] of the possible enclosure was re-cut, although the north-west aligned ditch did not appear to be re-opened. It is possible the activity area was expanded at this time as a large ditch further to the north was present, although this could also have indicated that the focus of activity had migrated northwards. Three discreet features were situated to the southeast of ditch [2264] which represented pits of unknown usage. The presence of these features suggested the area was still in use.
- 6.6 In the latest phase, the 4<sup>th</sup> century, only two features were present. The eastwest aligned ditch [2264] of the possible enclosure had been back-filled in this period and a single gully, possibly for drainage, was present on the southeast side of the area. No discreet features were present 'inside' or 'outside' the possible enclosure.

- 6.7 The pottery assemblage consisted predominantly of local Roman wares, mainly from Oxford and the Cotswolds, with only two regional imports and one continental import. Fragments of ceramic building material were limited to five fragments of a tegula and a fragment of Roman brick, both from the 4<sup>th</sup> century back-fill of ditch [2264]. The animal bone assemblage suggested consumption of animal products, not production or rearing.
- 6.8 The low density of the features and the finds assemblage suggest a non-intensive, low-status, rural settlement. It is likely further features were present beneath further alluvial layers, so the picture of the settlement may be far from complete.
- 6.9 Environmental samples were taken during the course of the excavations. These will be assessed and fully analysed where appropriate on the recommendation of Dr Rob Scaife acting as Environmental Coordinator in consultation with Jacobs UK Ltd. The results of any such work will be added as an appendix to the final report.

#### 7 NATURE OF THE RECORD

7.1 The stratigraphic archive for the site consists of the following elements:

Context Sheets
Record Sheets
Plans
Sections
Black & White photographs
Colour slides
Digital photographs

7.2 The following context types were represented:

Gullies
Pits
Postholes
Ditches
Areas of burning

7.3 The methodologies used to recover this evidence were set out in the Written Scheme of Investigation (Foundations, 2008). In summary the following excavation methods were utilised. A mechanical excavator was used to remove overburden onto the surface of archaeological deposits, thereafter an appropriate sample of selected deposits was removed by manual excavation. All contexts were recorded on a pro-forma context sheet and principal deposits were drawn in plan and section. These are available in the archive. Photographs were taken of all excavated features and sections.

7.4 Following the completion of the excavation an ordered, indexed, and internally consistent site archive was compiled in accordance with Appendix 3 of The Management of Archaeological Projects (English Heritage 1991).

#### 8 STATEMENT OF POTENTIAL

- Of the four specific aims set out in the Specification (Foundations, 2007; 4.2) 8.1 the following have been achieved:
  - Aim 1: To define and identify the nature of archaeological deposits on site, and date these where possible; this has been achieved. Activity associated with a low status, rural Roman settlement was identified on the site which spanned from the Iron Age/early Roman period to the 4<sup>th</sup> century AD. The limitations of the data, however, do not allow for a satisfactory assessment of extent of the settlement, or whether the excavated area contained the edge or the centre of a settlement.
  - Aim 2: To attempt to characterise the nature of the archaeological sequence and recover as much information as possible about the spatial patterning of features present on the site; this has been partly achieved. The current project has demonstrated that the Roman activity at the site lies near to a Roman settlement, which was in use from the Iron Age/early Roman period to 4<sup>th</sup> century AD. The same features were repeatedly re-used during this time period. The focus of settlement activity remains unknown. The presence of ridge and furrow features show that the area was cultivated in the Medieval period.
  - Aim 3: To recover a well dated stratigraphic sequence and recover coherent artefact, ecofact and environmental samples, including an assessment of the environmental potential; this has been achieved. Re-use and re-cutting of the features during the Roman period has resulted in a mixed pottery assemblage, with many sherds found residually. Later agricultural activity in the Medieval period and in the modern period may have caused contamination of the deposits. A number of features retain some palaeoenvironmental potential, but contamination may have rendered some of the features unsuitable.
- 8.2 The results of the fieldwork justified the implementation of the excavation programme and the site is clearly of sufficient quality to warrant publication as a detailed note in a local journal. The following section presents a considered policy for dissemination of the results, achieving;
  - i/the presentation of the results in a coherently synthesized and detailed format.

the deposition of an ordered and internally consistent archive with the Oxfordshire Museum Service under accession code OXCMS:2008.89.

# 9 PUBLICATION, PRESENTATION AND ARCHIVING

- 9.1 A final report shall be created, incorporating the results of any Palaeoenvironmental sampling required. No additional work has been recommended on the artefactual or ecofactual assemblages. Additional research will be carried out for this report in order to attempt to further the aims and objectives. On acceptance of the final report by the County Archaeologist of Oxfordshire County Council, a publication report will be prepared.
- 9.2 The report should comprise approximately 3 pages of text illustrated with appropriate plans, sections, finds drawings and photographs.
- 9.3 A full OASIS record, with attached report, will be created.
- 9.4 Additionally a full report of the excavations will be posted on the Internet at the Foundations Archaeology website (http://www.foundations.co.uk).
- 9.5 A microfilm copy of the project archive will be submitted to the National Monuments Record of English Heritage upon completion of the report.
- 9.6 The site archive and artefactual collection will be deposited with the Oxfordshire Museums Service.

#### 10 REFERENCES

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# 11 ACKNOWLEDGEMENTS

Foundations Archaeology would like to thank Costain, Kevin Beachus of Jacobs, Alison MacDonald of Chris Blandford Associates and Paul Smith of Oxfordshire County Council for their help in the successful completion of this project.

#### APPENDIX 1 – POTTERY ASSESSMENT

#### By Dr. Jane Timby

#### THE POTTERY

#### 1 Introduction

- 1.1 The archaeological work at Wolvercote Viaduct, Oxford, resulted in the recovery of 205 sherds, 2762 g dating to the later Iron Age-early Roman, Roman, late medieval and post-medieval periods. In addition a small quantity of ceramic building material and fired clay is also present.
- 1.2 The preservation of the assemblage was moderately good with an overall average sherd size of 13.5 g. Surface preservation however was less good with loss of colour-coats and other surface finishes.
- 1.3 Pottery was recovered from 22 contexts with some additional unstratified sherds. Half of these produced six or less sherds which have some ramifications with regard the confidence that can be placed on the dating.
- 1.4 For the purposes of the assessment the assemblage was scanned to assess its likely date range and quantified by sherd count and weight per context. The resulting data is summarised in Table 1. No details of the type or nature of the contexts or information regarding any stratigraphic relationships were available for this stage of the work.

#### 2 Later Iron Age-early Roman

- 2.2 A total of 86 sherds are present in fabrics typical of later Iron Age potting traditions but likely to continue to feature on rural sites throughout most of the 1<sup>st</sup> century AD, possibly into the 2<sup>nd</sup> century. These include sherds mainly from grog-tempered vessels accompanied by a few flint-tempered, calcareous and sandy wares.
- 2.3 Many of the vessels appear to be handmade, some possible wheelmade, closed forms. Of note is a flint-tempered base from (215) with a single extant post-firing perforation.
- 2.4 Some seven contexts, (209, 215, 2210, 2222, 2228, 2243, 2248), appear to exclusively contain this material but the presence of similar material alongside Roman wares proper from other contexts make it difficult to be certain whether these should be seen as pre-Roman or early Roman in date.

#### 3 Roman

- 3.2 In total some 108 sherds date to the Roman period, 53% of the assemblage by sherd count. Most of the pieces are products of the local Oxfordshire industry with examples of grey ware, colour-coated ware, white ware and white ware mortaria. Also present are sherds of grog-tempered storage jar.
- 3.3 The greywares are the most numerous and include examples of beakers and jars, one of the latter with crude barbotine blob of slip, possibly part of a barbotine dot pattern.
- 3.4 Regional imports are limited to two sherds of Dorset black burnished ware and three sherds of pink grog-tempered ware from the Midlands.
- 3.5 The Roman assemblage appears to span the later 1<sup>st</sup> century through to the mid 3<sup>rd</sup>-4<sup>th</sup> century. Earlier contexts include (212, 2232, 2234 and 2235). Contexts which appear to date from the 2<sup>nd</sup> century include 2220, 2225, 2245 and 2248 and perhaps from the later 2<sup>nd</sup>, context 205 which has a burnt mortarium flange, possible Young (177) type M10. The presence of Oxfordshire colour-coated wares from contexts 2206 and 2208 indicates a date after AD 240.
- 3.6 Of note is a post-firing cross on the underside of an Oxfordshire colour-coated bowl from 2208. Some of the storage jar sherds have a calcareous lining from holding water or other liquid.

#### 4 Late medieval-post-medieval

4.2 A small number of sherds, 11 in total, date to the later medieval or post-medieval period. This includes a single base probably from a Brill-Boarstall-type jug and other glazed sherds. Six pieces are from modern white or transfer decorated china dating to after the mid 19<sup>th</sup> century, five coming from the unstratified collection.

#### 5 Ceramic building material and fired clay

- 5.2 Some 11 fragments of fired clay and two pieces of ceramic building material are present in the assemblage studied. The latter appear to comprise a post-medieval roofing tile and a brick fragment of probable post-Roman date coming from context 2204 and the unstratified material.
- 5.3 The fired clay is very fragmentary and none of the pieces showed any diagnostic features indicative of possible function of use.

#### 6 Conclusions

6.2 The assemblage recovered from Wolvercote is chronologically quite diverse for such a small group of material but hints at non-intensive occupation dating from at least the 1<sup>st</sup> century AD through to the later Roman period. The earlier phase is

- marked by an admixture of native type wares and early Roman wares, the latter probably dating to after the Flavian period.
- 6.3 The lack of any continental imports and the low incidence of regional wares suggest a fairly low status rural settlement.
- 6.4 The post-Roman wares form a minor component to the assemblage and as such form a background scatter.
- 6.5 Apart from documenting its presence no further detailed work is recommended for this assemblage unless further work is undertaken at the site.

#### Reference

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	LIA-					CBM		
Context	ero	Roman	Pmed	Tot wt	Tot no	no.	Fclay	Date
2204	0	6	3	80	9	1	0	Pmed/Roman
2206	0	4	0	20	4	0	0	mid C3rd-C4th
2208	0	1	0	62	1	0	0	mid C3rd-C4th
2210	20	0	0	432	20	0	1	LIA-e Roman
2220	0	62	0	698	62	0	2	C4
2222	1	0	0	4	1	0	0	LIA-e Roman
2225	2	5	0	294	7	0	0	C2+
2226	3	3	0	107	6	0	0	late C1-C2
2228	2	0	0	17	2	0	0	LIA-e Roman
2232	8	1	0	147	9	0	0	e Roman C1 AD
2234	8	1	0	41	9	0	1	e Roman C1 AD
2235	3	7	0	47	10	0	1	e Roman C1 AD
2239	0	8	0	186	8	0	0	C2+
2243	1	0	0	1	1	0	0	LIA-e Roman
2245	6	4	0	108	10	0	0	C2
2246	10	38	0	461	48	5	2	late C4
2248	4	0	0	18	4	0	0	LIA-e Roman
2252	0	16	0	447	16	1	0	late C4
2253	0	28	0	224	28	0	0	late C1/eC2
2254	0	3	0	8	3	0	1	2nd/3rd
2259	0	6	0	3.5	6	0	0	?Roman
2261	0	11	0	104	11	0	0	late C1/eC2
Area 22 us	2	6	5	38	13	0	3	Pmed/Roman/LIA
Area 22A								
us	0	7	2	83	9	0	0	Pm/C4
<b>TOTAL</b>	70	217	10	3630.5	297	7	11	

APPENDIX 2 – ANIMAL BONE

Wolvercote Viaduct, Oxfordshire (WVO 08). Post-excavation assessment of animal bone.

Sylvia Warman

Introduction

A total of 479 bone fragments, from 443 bones, weighing 8.7kg were recovered. Within the assemblage

83 bones were identifiable to species and two mandibles and 49 epiphyses provide information on age-

at-death.

**Methods** 

The assessment conforms to the guidance on best practice described by English Heritage (2002). The

animal bone was rapidly scanned and the following recorded; number of bones, number of fragments,

weight of bones in grams, number of bones identifiable to species, fragmentation and preservation,

numbers of mandibles, epiphyses and whole bones, species and body parts identified, age and state

(including modifications such as butchery, burning, gnawing etc).

Results

The animal bone was recovered from 17 deposits, most are of Roman date. Three periods of activity

have been identified; Period 1 (Late Iron Age/Early Roman), Period 2 (1st-2nd century AD) and Period

3 (4th century AD). The results are presented by Period in Table 1.

The animal bone was well-preserved but the degree of fragmentation reduced the quantity of material

identified to species to less than 20% of the assemblage. Horse, cattle, sheep/goat pig and chicken

were identified. The remainder was too fragmented to identify fully and was classified by size as cow-

sized and sheep-sized. In terms of body parts present, cattle display the widest range with head, upper

and lower limb bones and feet identifiable. Both meat-bearing and non-meat bearing elements are

present. The range of body parts for horse is also wide, although the quantities are smaller. Sheep/goat

is represented by head and limb bones, whilst pig shows the most restricted range with skull, mandible

and loose teeth present. In terms of age-at-death, most of the animal bone was from adult or sub-adult

individuals. Deposit 2220 included a juvenile cattle radius (forelimb) shaft and deposit 2234 contained a

cattle molar which was so worn down that it is likely to have come from an aged individual. The

presence of the latter extends the range of age categories in the assemblage.

There was a high proportion of modern breakage (94% of the contexts examined). Both ancient

breakage and weathering were noted in 41% of the contexts that produced animal bone. Gnawing by

dogs and butchery were both noted in 35% of contexts that produced animal bone. Just one specimen,

from deposit 2246, exhibited possible pathological changes. This was cattle tarsal which had fused to a

neighbouring bone and showed signs of additional bone formation (extoses). These features could be

associated with trauma or infection.

Period 1 Late Iron Age/Early Roman

The deposits that produced animal bone from this period were fills from pits 2209 and 2221 which were

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located at the southern corner of the site. The only fully identified specimen was a pig mandible (lower

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jaw) which had been gnawed by dogs. Fill 2229 from linear 2227 produced; a cattle shoulder blade, cow-sized long-bone fragments which had been gnawed by dogs and sheep-sized long bone fragments.

Period 2 (1st-2nd century AD)

The animal bones from this period were mostly recovered from fills of linear features. Deposit 2232 which overlies 2229 in linear 2227 produced a cow-sized vertebra. Fills 2225 and 2226 of pit 2223 contained cow-sized and sheep-sized long bone fragments. Fills 2234 and 2235 are the primary and secondary fills of linear 2233. These produced cattle teeth, skull fragments and limb bones, a pig mandible and cow-sized and sheep-sized long bone fragments. Deposit 2245, the fill of linear 2264, contained a cattle metapodial, cow-sized ribs and sheep-sized long bone fragments. Deposit 2248 produced a substantial quantity of cattle bones including skull limb bones, metapodials and phalanges. A horse tooth and pelvis were also identified. The remainder of the material comprised cow-sized and sheep-sized fragments. Two fills 2253 and 2254 of linear 2242 produced animal bone. The species present were, horse and cattle. Cow-sized and sheep-sized long bone fragments were also present.

Period 3 (4th century AD)

Three deposits from this Period produced animal bone, all fills of linear features. Deposit 2220, the fill of linear 2219, contained cattle and sheep/goat teeth and limb bones, as well as cow-sized and sheep-sized long bone fragments. Deposit 2246, the upper fill of linear 2264, produced the largest quantity of animal on the site. The species present were; horse, cattle, sheep/goat and chicken. Numerous cow-sized and sheep-sized bone fragments were also present. One of the cattle bones, a tarsal, had additional bone growth (extoses). Deposit 2252, the upper fill of linear 2242, contained horse, cattle, sheep/goat, cow-sized and sheep-sized.

Undated

An alluvial layer 2218 contained a cattle radius, sheep skull fragments and cow-sized vertebra, rib and long-bone fragments. Deposit 2239 the fill of pit 2237, was located in the east of the site. Although this deposit is currently undated it is most likely to be Roman (King pers.com.). The animal bone recovered included cattle limb bones and metapodials and sheep skull and teeth.

**Discussion** 

The range of species is broadly consistent with that expected for a Roman assemblage in this region, although dog would be expected to be present as well. The dominance of cattle in assemblages has been taken as indication of military use/victualing (Dobney 2001, 36), but with such a small assemblage it is difficult to draw firm conclusions. The small quantity of pig within the assemblage is striking, a feature which has been observed previously in animal bone assemblages of Roman date (*ibid*, 36). The age structure of the assemblage is more consistent with consumption than production, with no evidence for stock-rearing. The complete long bones could be used to provide data on the size of the livestock. The publication record for Roman assemblages in this area is good and there is little to be gained from taking such a small assemblage to full analysis.

Recommendations

This assemblage is currently too small to warrant further work. Should further archaeological interventions occurring in the proximity produce additional animal bone, then the material assessed here

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could be studied in greater detail as part of a larger assemblage. A short summary of this assessment should be included in the publication.

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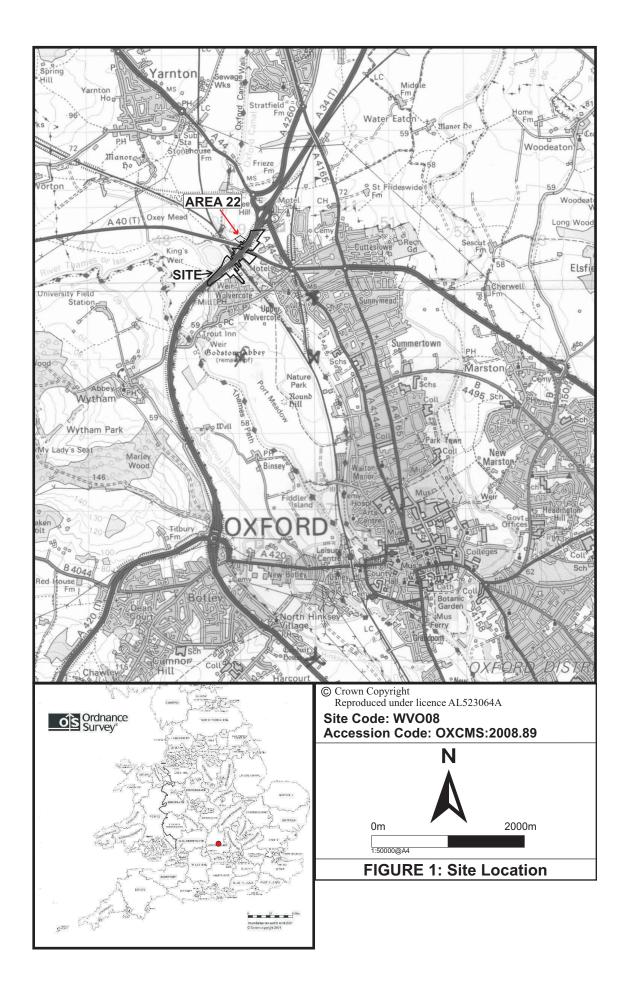
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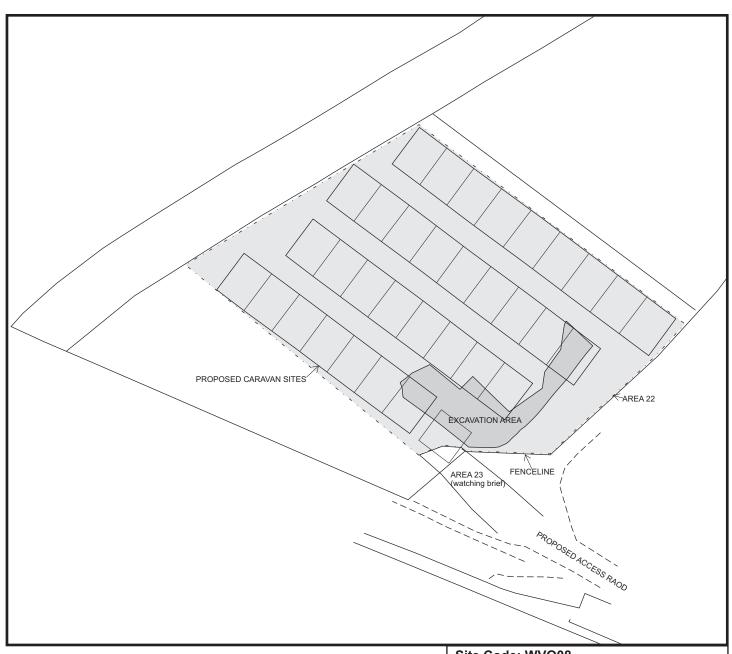
Table 1 Animal bone from Wolvercote Viaduct

Period	Fill of	context	Feature type	spot date	no of frags	no of bone s	weight	No of bones id	mandibles	epiphyses	Measurable Whole long bones	species/ part	state	age
1	2209	2210	Pit		2	1	4	0				SSZ(LB)	MB	
1	2221	2222	Pit		1	1	53	1	1			S(H)	GN MB	SA
1/2	2227	2229	Linear		4	2	146	1		1		B(UL) CSZ(LB) SSZ(LB)	MB BT GN	
2	2223	2225	Pit	2nd C	1	1	12	0				SSZ(LB)	AB MB	
2	2223	2226	Pit		3	3	9	0				CSZ(LB,FB) SSZ(LB)	MB	
2	2227	2232	Linear	Early roman	3	2	15	0				CSZ(V)	MB AB	
2	2233	2234	Linear	Early roman	1	1	9	1				B(H)	MB	0
2	2233	2235	Linear	Early roman	43	36	756	5	1	2		B(H,UL,LL) S(H) CSZ(UL,LB,FB,R) SSZ(LB)	MB WE GN AB	A, SA
2	2264	2245	Linear	2nd C	11	11	175	7		1		B(MP) CSZ(R) SSZ(LB)	GN MB	
2		2248	Deposit	2nd C	47	40	915	8		4	1	E(H,UL) B(H,UL,LL,MP,P) CSZ(V,R,LB) SSZ(LB,V)	BT AB MB	A, SA
2	2242	2253	Linear		28	22	543	5		4		E(MP) B(H,LL,MP,P) CSZ(UL,LB) SSZ(LB)	MB AB GN	Α
2	2242	2254	Linear		1	1	52	0		1		CSZ(UL)	AB	Α
3	2219	2220	Linear	2nd C	26	23	278	9		2		B(H,UL,LL,P) O/C(H,LL) CSZ(LB,V) SSZ(LB)	MB WE	A, J
3	2264	2246	Linear		195	192	3524	28		19	1	E(H,UL,SAC) B(H,UL,LL,MP) O/C(H,UL) CH(UL,LL) CSZ(UL,LL,LB,FB,R,V) SSZ(MP,LB,V)	MB BT GN AB PA	A, SA
3	2242	2252	Linear		67	66	1347	15		8		E(H,UL) B(H,UL,LL,MP,P) O/C(H,LL) CSZ(LB,R)	BT MB	A, SA
-		2218	Alluvial layer		22	20	266	3		2		B(LL) O/C(H) CSZ(V,LB,R)	MB BT	A, SA
-	2237	2239	Pit		24	22	638	6		5		B(LL,MP) O/C(H,HC) CSZ(V,R,LB)	BT MB WE	A ,SA
		Totals			479	443	8742	83	2	49	2			

## Key to codes used in table

Species; E = Equus caballus (horse), B = Bos taurus (cow), O/C Ovis/Capra (sheep/goat), S = Sus scrofa (pig), CH Gallus (Chicken), CSZ = cow-sized, SSZ = sheep-sized Parts; H = head, HC = horncore, V = vertebra, R = rib, UL = upper limb, LL = lower limb, MP metapodial, P = phalange, FB = flat bone, LB = long bone, F = fragment. Ageing data; epiphyses = simple count, mandibles = simple count State; WE = weathered, BT = butchery marks, BN = burnt, GN = gnawed, RT = root etching, MB = modern break, PA = pathology. Age; F/N = foetal/neonatal, I = infant, J = juvenile, SA = sub-adult, O = old adult.





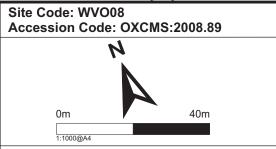


FIGURE 2: Study Area Location

