

**A former barn at Carew
Manor, Beddington
Excavations in 2015 and 2016**

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Carshalton & District History & Archaeology Society
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1. INTRODUCTION

This is the report on excavations carried out by the Carshalton and District History and Archaeology Society to investigate the site of an outbuilding in the service court of a former country house, now known as Carew Manor, Beddington. This is part of a programme of ongoing research into Carew Manor which has been reported in several of the Society's occasional papers.¹ One of these covers the history of the house and its owners.²

The excavations were part of the Society's contribution to a Heritage Lottery Fund bid for Beddington Park.

Thanks are due to the London Borough of Sutton, Bill Wyatt the parks manager and to everyone who took part in the excavation. Sutton Archive and Local Studies and Surrey History Centre were key sources of documentary information.

2. THE SERVICE COURT FOR CAREW MANOR

Carew Manor was a former country house which dates back to at least the late medieval period. The enclosure award map of 1820 shows a group of outbuildings forming a courtyard to the northwest of the house (figure 1). These consisted of:

- A dovecote in the centre of the area.
- Two small unidentified buildings to the north of the dovecote.
- A long north-south aligned range of buildings on east side of the area, which are now known as Beddington Park Cottages. They were surveyed in the 1980s and are the subject of a separate report.³
- A large east-west aligned building on the north side of the area.

There are no known earlier large-scale maps of the site so the history of area is problematic. The house dates back at least as far as the later middle ages. It was at its height in the 16th century when it was owned by Sir Nicholas Carew who was Master of the Horse, a Knight of the Garter and, for many years, one of Henry VIII's inner circle of courtiers. A man of Nicholas Carew's social standing would have probably owned a large multi-courtyard house with substantial out-buildings and stabling. Parts of the house date back to this time but there is no documentary for the layout of the outbuildings.⁴

There is much better documentation for the second half of the 16th century when the house belonged to Nicholas Carew's son Francis. The surviving sections of household accounts mention an Outer Court and a Great Court. It is not clear whether these were separate spaces or alternative names for same place. Both needed to have nettles cut and even if they were different the overall impression is of fairly informal areas surrounded by ancillary buildings. The accounts mention an:

Armoury	Dog house
Corn barn	Forge
Great barn	Hawk mew
Lyme barn	Lower loft by the stable
Brew house	Mint house
Milk house	Slaughter house

¹ Phillips 2013, Phillips 2015, Phillips and Burnett 2016 and Phillips 2015.

² Phillips and Burnett 2016 volume 1.

³ Phillips 2015.

⁴ Phillips and Burnett 2016 especially volume 1 p. 138-41.

Coal house
 Court gate
 Stable

Stable
 Wash house
 Wood house

Many of these buildings were probably around the outer court, but some may have been elsewhere. The stable is said to be in the Great Court and by a sluice in a water course. The wash and milk houses were also by a water course. The Great Barn was near the forge but there is nothing else to locate either building.⁵

In the early 18th century Nicholas Carew, 1st Baronet, modernised the house and re-landscaped the gardens and park. This involved the creation of a long canal-like west lake running out across the park on the axis of the house front. This was clearly intended to be seen from the house necessitating, the removal of any outer court which may have existed to the west of the house.

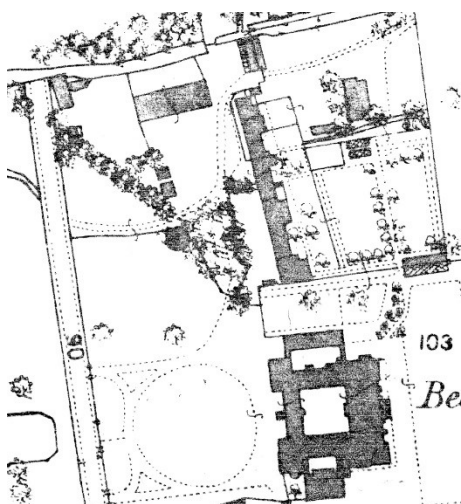
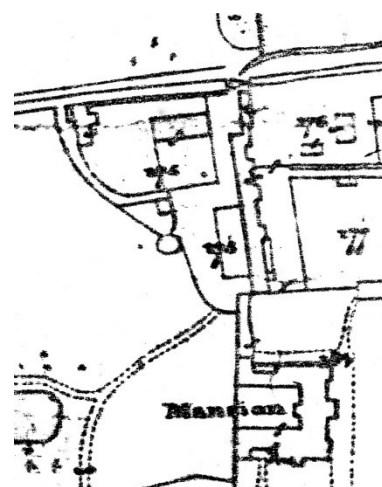


Figure 1. The outbuildings to the northwest of the house from the enclosure award map of 1820 (above left) and the tithe map of 1840 (above right) and the first 25 inch Ordnance Survey map of 1868 (left). Beddington Park Cottages are the long north-south aligned range. The suspected stable is shown on the 1820 map top centre. It had been partially demolished by 1840.

The Dovecote, which was in the centre of the 19th century court, is a scheduled ancient monument. It is very much in the style of the early 18th century and was almost certainly constructed by the 1st Baronet. There was a Tudor pigeon house which stood in Pigeon House Meadow, the location of which is unknown.

⁵ The references to the great barn are Surrey History Centre 281/4/22 f5r, f7r; 281/4/24 p. 1. For a discussion of the outer court in relation to the house and references to the other outbuildings see Phillips and Burnett 2016 volume 1 pages 138-142, 179-181 and 185-6.

A long range of buildings on the east side of the court are now known as Beddington Park Cottages. They were surveyed by the author and others in the 1980s before and during their conversion into houses. Most of the range was fairly recent but the north end contained a substantial part of a timber framed building. This had a crown post roof which went out of fashion in the mid-16th century. However, the carpenter's marks on the roof timbers were jumbled, suggesting that the building had been taken apart and reconstructed. This suggests that it could have been moved. The lower part of the timber work had mostly rotted and very little of the footings could be seen, so they did not provide any useful dating evidence.⁶ If the building was moved the obvious context would be the first Baronet's early-18th century remodelling of the landscape.

There is not much documentary evidence for the building which stood on the north side of the court in 1820. The maps suggest that in it had a length of about 64m and that the main part was about 12m wide. The cross-wing at the western end had an approximate length of 24m and a width of 6m. The western end of the building was demolished between 1820 and 1840 leaving the northern end of the cross wing and the east end of the main structure.

The Carew estate was sold in 1859 when the auctioneer's catalogue mentions:

... the Offices, which include a long brick and tile built range of Stabling, Coach-houses, and Three neat Cottages for Servants adjacent; Timber Yard at back, in which is a Carpenter's Shop and Deal Shed; also a Farm Yard with Barn, Cow Sheds, Granaries, Dog Kennels and Dove Cote.⁷

The stabling, coach-houses and cottages were in the east side range which became Beddington Park Cottages. The carpenters shop and deal shed lay east of Beddington Park Cottages while the dovecote can be equated with the surviving structure. The 1868 Ordnance Survey map shows a small range directly north of the Cottages which was probably the dog kennels. This leaves the farmyard with the barn, cow sheds and granaries unaccounted for and presumably in the north range.

The house and outbuildings were acquired by the Lambeth Female Orphanage Asylum in 1864. The remaining part of the northern range survived to be shown on the 1868 Ordnance Survey map. In 1874 the Orphanage carried out a series of repairs to the outbuildings. At that time 'the Committee directed that the old paling round the stable yard be cleared and that the roof of shed near the river at the northwest corner should be repaired'.⁸ In 1876 the outbuildings were sold to Canon Bridges and were incorporated in the park and subsequently let as a dairy farm.⁹ Bridges must have demolished the remaining part of the northern range as it is not shown on the 1896 Ordnance Survey map.

The site was acquired by the Council 1926. The general area was subsequently used as a tennis court. In the Second World War there were dig for victory allotments east of East Lodge but their exact boundary is not currently known.

In 1990 and 1991 some flood alleviation work was carried out which involved deepening the river channel immediately north of the excavated trench. This particular part of the work was not recorded but it is possible that the ground adjacent to the river was disturbed during the work.

⁶ Phillips 2015.

⁷ Carew Sale catalogue, 1859. Photocopy in Sutton Local Studies Collection.

⁸ Sutton Archives D 2/2/1 p. 127.

⁹ Phillips 2015. p. 78.

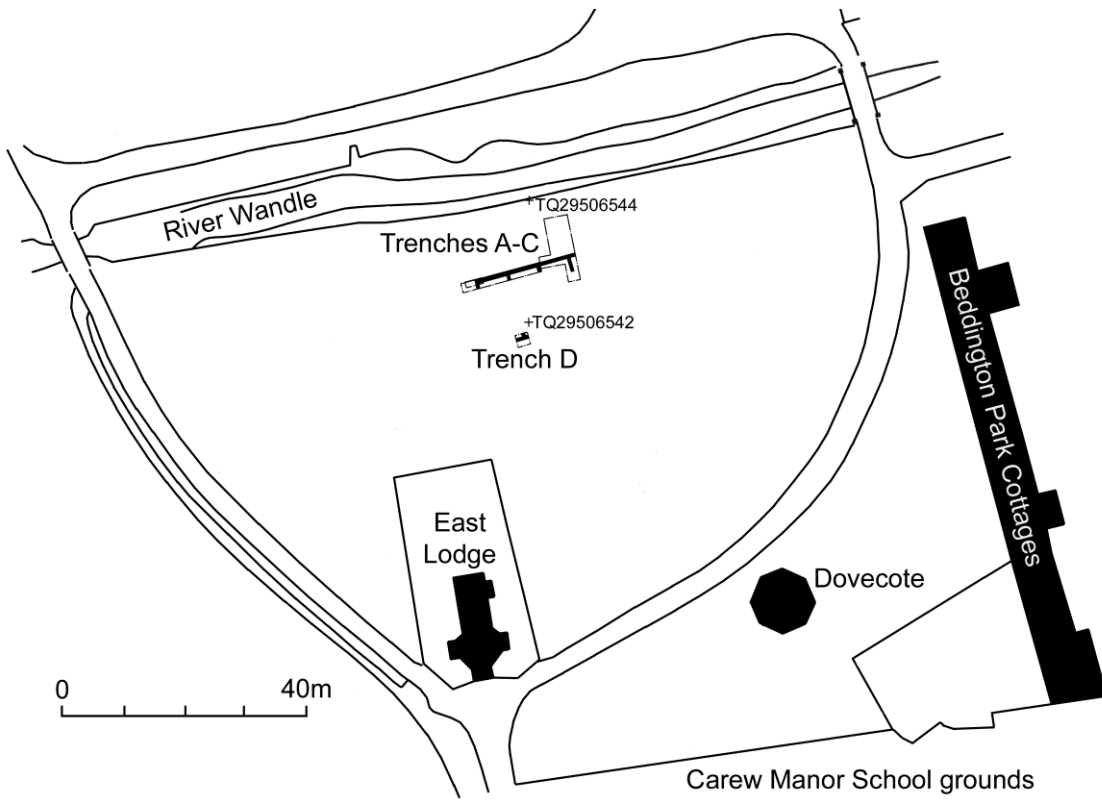


Figure 2. The location of the trenches.

Pre-1990 river bank

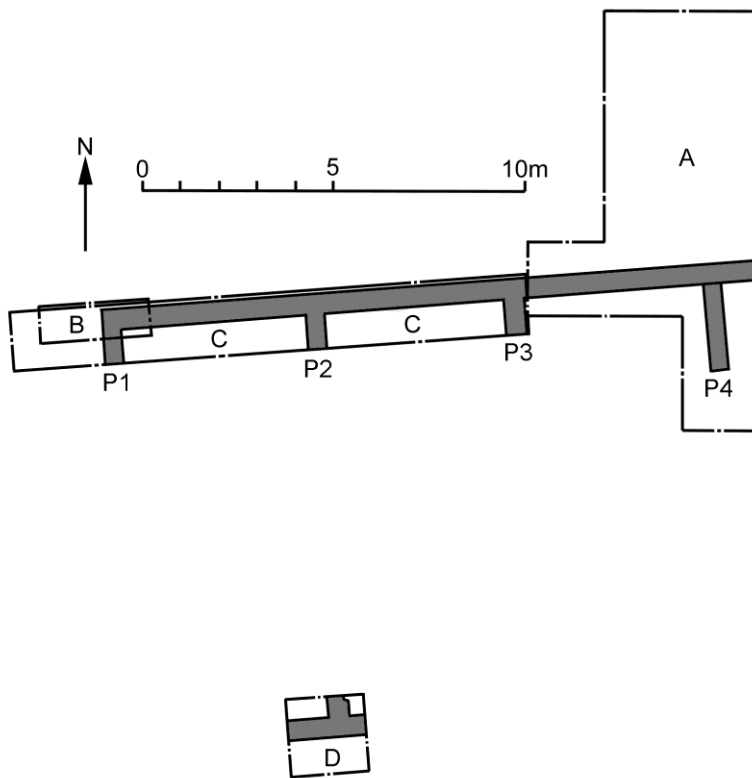


Figure 3. The BDD15 trenches and foundations (grey). There was no surviving floor.

3. THE EXCAVATION

The excavation was carried out in two campaigns: trenches A and B were excavated in 2015 and trenches C and D in 2016.

3.1 The stratigraphy of trench A

This trench was initially 8m north-south by 4m east-west. The northwest corner was 3.9m south of the river bank recorded on the current Ordnance Survey maps and 50m from the road-kerb on the west side of the bridge by the north end of Beddington Park Cottages (figure 2).

The trench was subsequently extended to expose more of a foundation. An area 3m north-south by 2m east-west was added to the east end of the south side and another area 2m by 2m was added to the south end of the west side as shown in figure 3. These are referred to as the south and west extensions.

The turf rested on layer [1] which consisted of soft dark brown top soil.¹⁰ At the south end of the trench the lower part of the deposit was fine silt. The layer contained many obviously modern finds.

Layer [1] rested on layers [2] and [3]. The material excavated as layer [2] occupied the southwest corner of the trench. The deposit extended into the southeastern part of the trench where it was excavated as layer [1]. Layer [2] consisted of rounded and sub-angular flint in a fairly loose matrix of medium brown soil. The flints were up to 15cm across but were mostly much smaller. There were a few scraps of ceramic building material and other finds including a piece of Bakelite and other modern items.

Layer [3] which occupied the northern end of the trench, consisted of rounded and sub-angular gravel in a sparse matrix of medium-brown soil with a little ceramic building material. It was very hard. It contained plastic and other modern items. Layers [2] and [3] were therefore very similar – the main difference being the degree of compaction.

Layer [2] rested on layer [4] which consisted of flint of mixed size and shape in hard medium brown soil with about 5% roof tile, mostly small pieces 2 to 3cm across.¹¹ The finds included modern pottery and glass, a piece of modern wall tile and the base of a shotgun cartridge. There were 131 pieces of bone including 28 front teeth from horses.

At the north end of the trench layer [3] was only partially excavated as work was limited to a section about 1m wide along the west side of the trench as shown in figure 4. Here layer [3] rested on layer [4]. This consisted of hard medium brown soil with flint of mixed size and shape mostly under 3cm. There was about 5% roof tile – mostly small pieces 2 to 3cm across.

The southern end of layer [4] covered a foundation [5] which ran roughly east to west across the trench (section 3.4). In the excavated areas to the north of the foundation layer [4] rested on layer [6] which consisted of flint mostly about 4 to 5cm across in a loose earth matrix. About 10% of the deposit consisted of broken peg tile. There was also a scatter of a chalk and few larger flint cobbles. There was little or no brick. The layer was similar to the overlying deposit although it contained more peg tile. The boundary between the two was not very distinct.

Layer [6] rested on [11] which consisted of flint cobbles mostly around 7 to 10cm across but up to 15cm in a loose matrix which was dark brown at the top but passed into clean gravel. The top had some appearance of a cobbled surface but it was uneven and a sondage on the north side of foundation [5] showed that the deposit was natural gravel. The upper part of the deposit

¹⁰ This deposit was excavated as [9] in the west extension and as [13] in the south extension.

¹¹ Layer [10] in the west extension was the same as layer [4].

contained a piece of modern corrugated window glass, a nail, two pieces of oyster shell and a little peg tile. These were probably contamination from the layer above.

There was an east-west aligned gulley in the top of layer [11]. It had a width of 1.46m and a depth of 0.15m. There was no silt or other distinctive fill and it may have a natural irregularity in the top of the gravel. A similar feature was seen in trench CD in the garden to the east of Carew Manor.¹²

There was a small cut [15] into the top of layer [11] towards the northwest corner of the trench (figure 4). The cut was more or less square with round corners although projecting flints made the sides somewhat irregular. It was about 20cm across and 17cm deep. It was filled by layer [14] which consisted of soft reddish to medium brown soil with flecks of mortar and ceramic building material and a few small pieces of brick.

The area to the south of foundation [5] was divided into two by a stub wall which projected from the main foundation. The area to the east of this, below layer [4] was occupied by [7] (figure 10).¹³ This consisted of flints of mixed size and shape in a sparse matrix of hard dark brown earth. There was a little chalk and occasional flint knapping flakes probably from a wall. There was no ceramic building material. Layer [7] rested on layer [12] which was very similar and may have been the same deposit. This rested on natural gravel at about 30.52m OD.

In the southwest corner of the trench layer [4] rested on layer [8] which was similar to [7]. The excavation of this area ended before the bottom of the deposit was reached.

Layer [7] contained a piece of Surrey white ware but otherwise none of the deposits south of [5] contained anything closely datable.

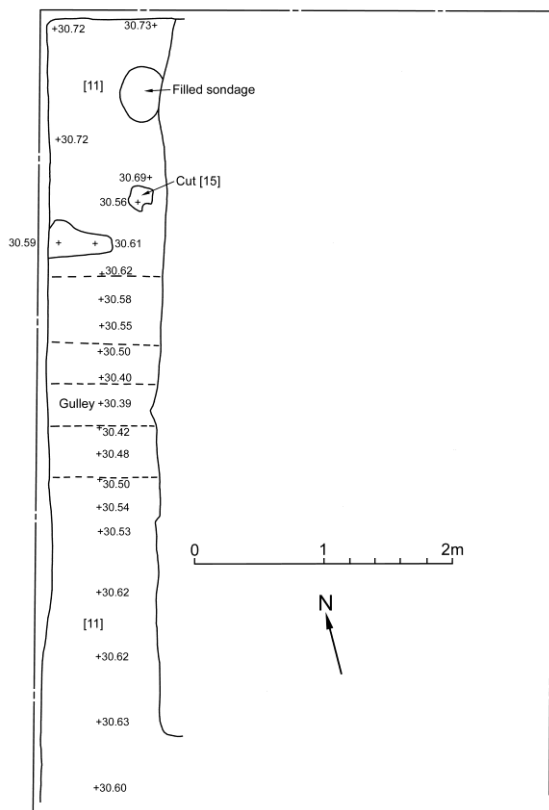


Figure 4. The section excavated along the west side of north end of the trench where the top of [11] was exposed.

¹² Phillips 2016 p. 28 and 31.

¹³ In the south extension this deposit was excavated as [18].



Figure 5. Trench A: the top of natural gravel layer [11] looking northeast.



Figure 6. Trench A: cut [15] in the top of layer [11]. Scale on the west side.



Figure 7. Trench A: west side of the trench with the top of layer [11] cut [15] in the foreground and the gully between the scales.



Figure 8. Trench A: west side of the trench with the gully in the top of layer [11]. Looking east.

3.2 The stratigraphy of trench B

Trench B was aligned on foundation [5] and was 10m west of the west extension of trench A. It was 4m east-west by 1m north-south and was dug to locate the northwest corner of the building.

The turf rested on layer [16] which consisted of medium greyish-brown top soil.

This rested on layer [17] which consisted of gravel of mixed shape up to 15cm in size in a matrix of hard greyish brown soil with some chalk.

This rested on layer [19] and, in the centre of the east end of the trench, on foundation [5] described in section 3.4.

Layer [19] consisted of flint in a matrix of hard greyish brown soil similar to [17].

When layer [19] was removed two layers were exposed. The first, layer [20] was to the north and west of foundation [5] and therefore outside the building. The other [23] was within the building to the south and east of the foundation.

Layer [20] consisted of broken peg tile in a matrix of brown soil. There was some flint and a little chalk, mostly flecks but some small pieces. Some of the tiles at the bottom of the layer appeared to have been broken in situ.

Layer [20] rested on layer [22] which consisted of flint of mixed size and shape up to 10cm in a hard dark blackish brown matrix. There was some brick and tile. Very little of the deposit was excavated and the bottom was not seen.

In the area south and east of the foundation layer [19] rested on layer [23]. This consisted of dark brownish-black silty sand with about 30% small flints and 10% larger ones. There were a few chalk flecks. The top of the deposit was flat and covered with flint pebbles.

The deposit rested on a flat mortared surface at 30.36m OD. This was not excavated.

3.3 The stratigraphy of trench C

Trench C was 13.5m east-west by 1.5m north-south and was aligned on the foundation [5]. It extended westwards from the west side of trench A and overlapped trench B so that the northwest corner of the foundation was exposed. The area west of foundation [5] was not excavated to the base of the top soil as it was partly the fill of trench B.

The grass grew in layer [101] which consisted of medium brown top soil with occasional flints and a few modern finds. This rested on layer [102] which consisted of gravel and chalk in a matrix of medium to dark-brown soil with some peg tile.

Layer [102] rested on foundation [5] which was aligned approximately east-west with three southward running projections as shown in figures 3 and 11 and described in (section 3.4) below.¹⁴ The western most projection (P1) appeared to be the end wall of the building while the centre and eastern ones marked internal divisions.

The deposits on the south side of the foundation between projections P1 and P2 were recorded as context [105]. They consisted of flint of mixed shape and size from 18cm down to pea gravel and grit, with enough soil to give it a medium-brown colour. The deposit was not excavated but was probably natural gravel.

The deposit south of the foundation between projections P2 and P3 was recorded as [104]. It was also of gravel which was up to 6cm across. It contained more soil than [105] but this may

¹⁴ This was excavated as context [103].

have been the result of slight under-digging. The deposit was not excavated.

Deposit [106] was exposed in a narrow strip between the foundation [5] and the north edge of the trench. It consisted of about 50% broken roof tile in a brown soil matrix. The tiles were at all sorts of angles, some flat, some on their edge resting against [5] and some at other angles (figure 9). The deposit was not excavated.



Figure 9. Trench C: the northeast corner showing the top of foundation [105] and the tile-rich deposit [103].

3.4 The northern foundation [5]

A foundation ran roughly east-west across the trenches A, B and C.¹⁵ It was first exposed in trench A where it was excavated as [5]. It was then found in trench B and excavated as [21] and then in C where it was excavated as [103]. In this report the whole structure is treated as [5]. It was exposed for a total length of 15.2m and had a width of about 0.5 to 0.6m.

The foundation consisted of chalk, flint and mortar bonded with very soft pale yellow-brown mortar. The core was rubble, but on the north side the flint had been struck and the chalk cut to make a more or less smooth surface. Only the lowest few centimetres of the foundation survived except at the northwest corner where there was a 5cm wide offset on the east side of the southward-running wall about 20cm below the surviving top. At this point the foundation extended downwards for at least another 10cm. In the centre of trench A the south side the foundation had been reduced to a few centimetres and some of the demolished material spread northwards over the top of layer [8].

¹⁵ The north side was at 82 degrees from magnetic north.

A sondage in trench A showed that the wall rested on natural gravel, which appeared to be the case elsewhere.

There were four projections (P1 to P4) running southward from the foundation in the positions shown in figures 3, 10 and 11. One, at the western end of the trenches, appeared to be the west wall of the building.¹⁶ It had a width above the offset of 0.53 to 0.56m. The outside corner had been damaged by a cut of uncertain date.

The second projection was 4.82m east of the inner face of the west wall and had a width of about 0.46m. It extended south for 0.68m and passed into the edge of trench C.

The third projection was 4.85m east of the second and had a width of about 0.5. It extended southwards for 0.69m and passed into the section.

The fourth projection was 4.8m east of the third and had a width of about 0.54m although the edges had been eroded. It extended south to end 2.2m from the main foundation.

There was a clear bonding break between the main foundation and the fourth projection (figures 10 and 19) but the others were integrated with the wall.

In the 2016 excavation, a rough more or less semi-circular cut [107] was found in the western end of the foundation. This was not detected in trench B in 2015. The fill, [108], consisted of chalk, mortar and ceramic building material in an earth matrix. The deposit above was excavated as layer [17] in trench B. The relationship between [108] and the deposits to the west of the foundation are uncertain although it is likely that [108] was the same layer as [20].

There was very little dating evidence for the structure as there was no excavation directly below it. A single piece of paving brick or very thick floor tile was embedded in the upper part of the main wall.¹⁷ This had a hard-red body 52mm thick. It appeared to be mortared into the wall. This probably dates from the 18th century although the material is not distinctive enough to be certain.

The only other dating evidence was a piece of glass bottle which was attached to a lump of the distinctive yellow-brown mortar used in the foundation.¹⁸ This was found in layer [108], the fill of a cut into the west end of the foundation and, judging by the mortar, had almost certainly been part of it. The bottle has a diameter of about 90mm. The vertical profile is slightly concave and the glass thickens from 3 to 8mm. The lack of strong vertical curvature shows that this cannot be from an onion or globular wine bottle so it must be of either mallet or cylindrical form. It is therefore unlikely to be earlier than about 1725 and more likely dates from the middle of the century.

¹⁶ First recorded in trench B as context [21].

¹⁷ Find <6>.

¹⁸ Find <103>.

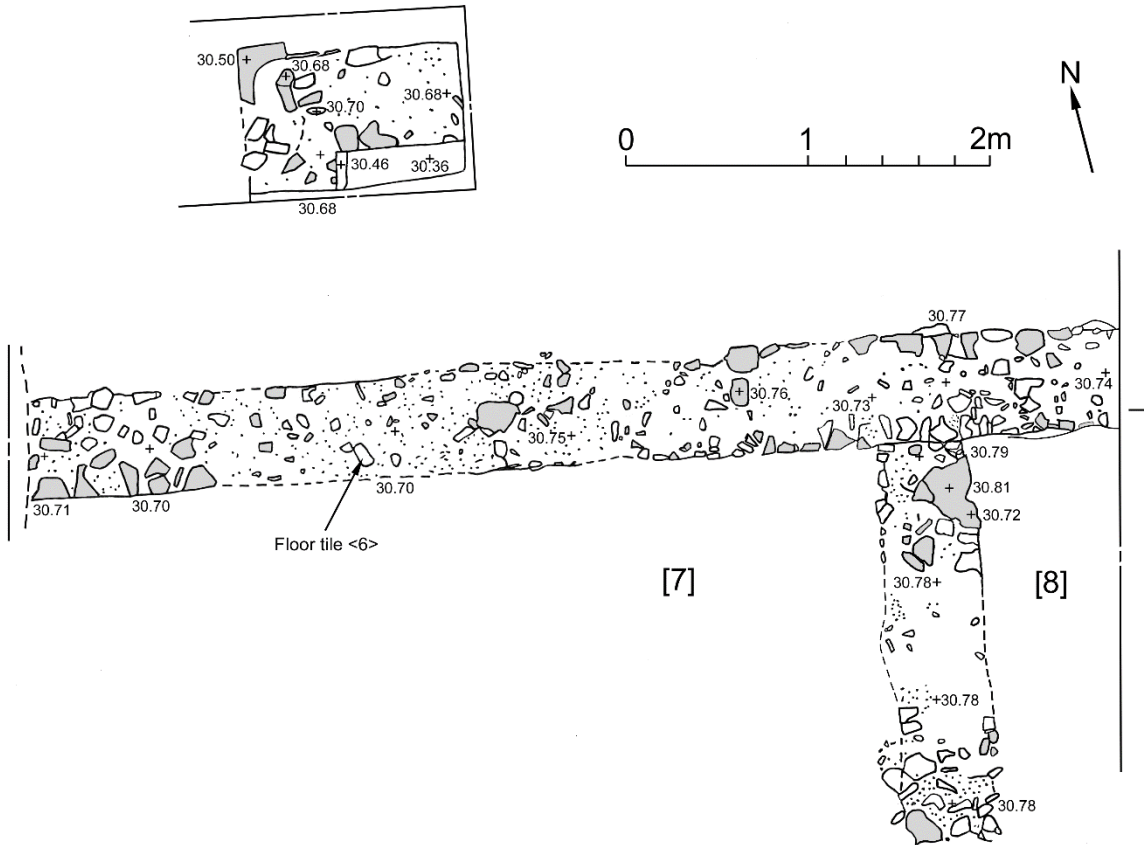


Figure 10. The top of foundation [5] in trench A (bottom) and trench B (top). The grey shaded areas are chalk.

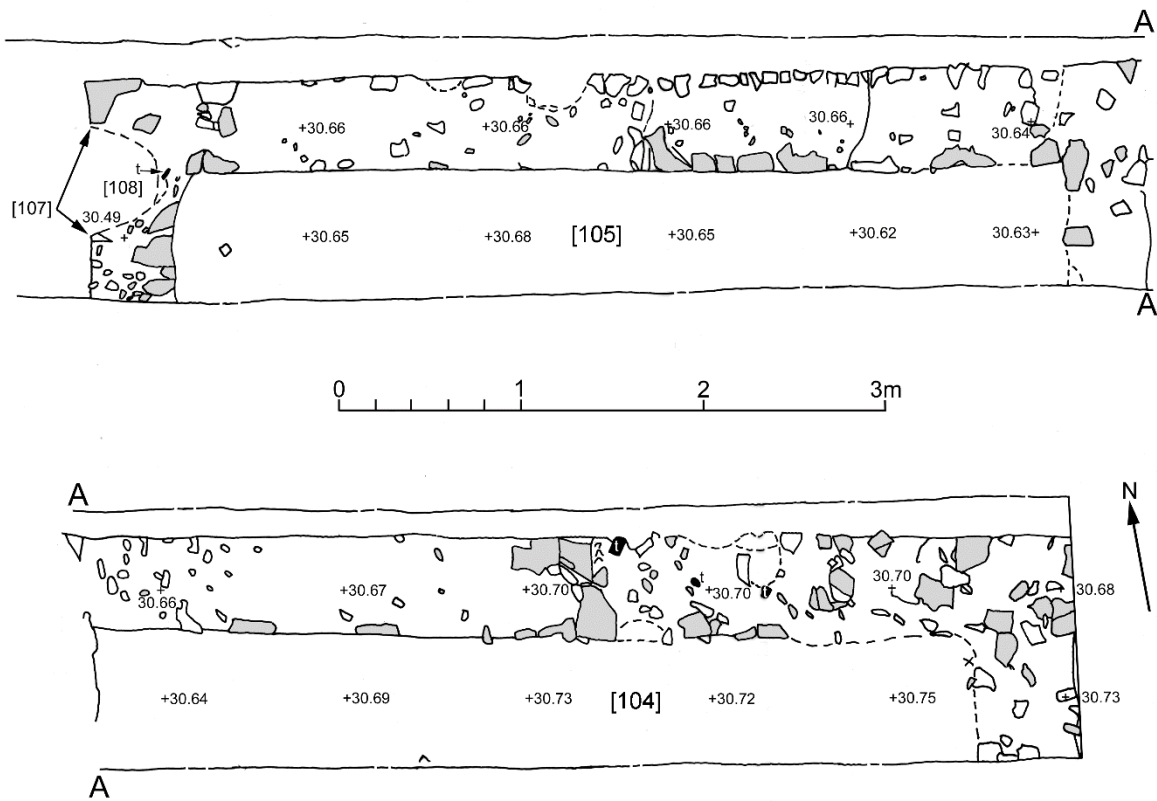


Figure 11. The tops of the foundation [5] in trench C. The grey shaded areas are chalk.



Figure 12. Trench B: the northwest corner of foundation [5]. North at the top.



Figure 13. Trench B: the northwest corner of foundation [5] looking east.



Figure 14. Trench C: foundation [5] looking east (left) and west (right).



Figure 15. Trench C: foundation [5] with projection P2 looking south.



Figure 16. Trench C: foundation [5] with projection P3. South at the top.



Figure 17. Trench A: foundation [5] looking east with projection P4 in the background.



Figure 18. Trench A: foundation [5] and projection P4 looking north.



Figure 19. Trench A: the junction between the main wall of foundation [5] (right) and projection P4 (left).



Figure 20. Trench A: foundation [5] with projection P4.



Figure 21. Trench A: paving brick <6> embedded in the top of foundation [5]. North at the top.



Figure 22. Trench A: detail of paving brick <6>.

3.5 The stratigraphy of trench D

Trench D was 2m square and was aligned parallel to trench C with a 9m gap between them as shown in figure 3.

The turf rested on layer [202] which consisted of mid-greyish brown soil. This rested on layer [203] which covered the whole area of the trench. It consisted of about 50% rounded, angular and sub-angular flint in a matrix of mid-greyish brown soil. The deposit contained modern finds.

The removal of layer [203] exposed foundation [208] which ran more or less east-west across the trench with a northward-running projection as shown in figure 24 and described in section 3.6.

The area to the north of the foundation and to the west of the projection was occupied by layer [204]. This consisted of rounded flint pebbles in a dark grey to black silt matrix. There were some chalk and mortar flecks and a few small pieces of chalk up to 4cm across. There were several knapped flint flakes. The lower part of the deposit was excavated as layer [211] the change of context being arbitrary to separate the finds from the upper and lower parts of the deposit. Excavation ended in this layer without the bottom being reached.

The area north of the foundation [208] and east of the projection was occupied by layer [207]. This consisted of rounded flint pebbles up to 7cm across in a matrix of dark grey to black sandy silt with small white flecks. This rested on layer [210] which was very similar. Excavation ended in the deposit at 30.41m OD.

The area south of foundation [208] was occupied by layers [205] and [206]. Layer [205] consisted of about 40% broken peg tile and a few scraps of chalk in a matrix of medium brown soil. Layer [206] consisted of a mixture of brown soil, crushed chalk and broken peg tile. In the south section the chalky deposit [206] overlay the peg tile deposit [205] but within the trench the boundary was often confused. Layer [205] also thickened to the north as it came closer to foundation [208] and in places touched [209] which underlay both. Layers [205] and [206] were therefore a single deposit consisting of mixture of dumped tile, chalk and soil.

Layer [209] underlay [205] and [206] and at least the south side of foundation [208]. It consisted of rounded and sub-angular gravel up to 10cm across in a matrix of very dark brown to black sandy silt. There was some peg tile and sharp struck flint flakes. Excavation ended in this layer at 30.45m OD except for a small sondage in the southeast corner which reached 30.21m OD without finding the bottom of the deposit.

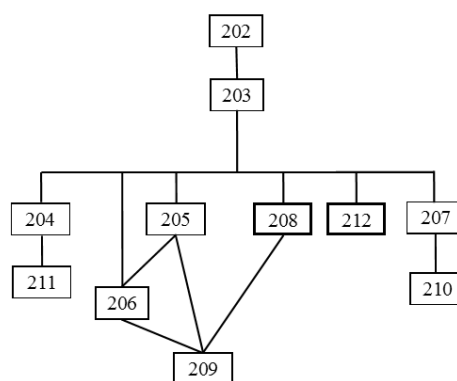


Figure 23. Matrix for trench D. Foundations in thick boxes.

3.6 The southern foundation [208] and [212]

Foundation [208] ran roughly east-west across trench D with a northward-running projection. The southern part of the projection was similar to the east-west foundation and was bonded into it but the northern end of it was made with a different mortar and was treated as context [212] as shown on figure 24.

Structure [208] was of flint and chalk bonded with pale yellow-brown chalk-spotted mortar. The chalk was up to 34cm across, the flint up to 18cm. The core was rubble but the flint and chalk in the face had been cut and struck. The main foundation was about 0.5m wide at the west end and 0.59m at the east. The northward projection was about 0.6m wide and extended inwards for about 0.325m. It then met context [212] in an irregular joint and this extended the projection to the northern edge of the trench where it passed into the section.

Structure [212] consisted of flint, chalk and a piece of soft red brick bonded with mortar that was slightly greyer and less yellow than that in [208]. The west side of this continued the line of the west side of [208] but the east side was set back by 21cm at the top and 12cm at the bottom. This was rough and may have been partly demolished.

The base of [208] was exposed on the south side where it appeared that a trench had been dug to the width of the foundation. Large flints had been rammed into the bottom of this. A layer of mortar had been placed on top and then the first course of roughly-faced chalk blocks with struck flints in the gaps between them.

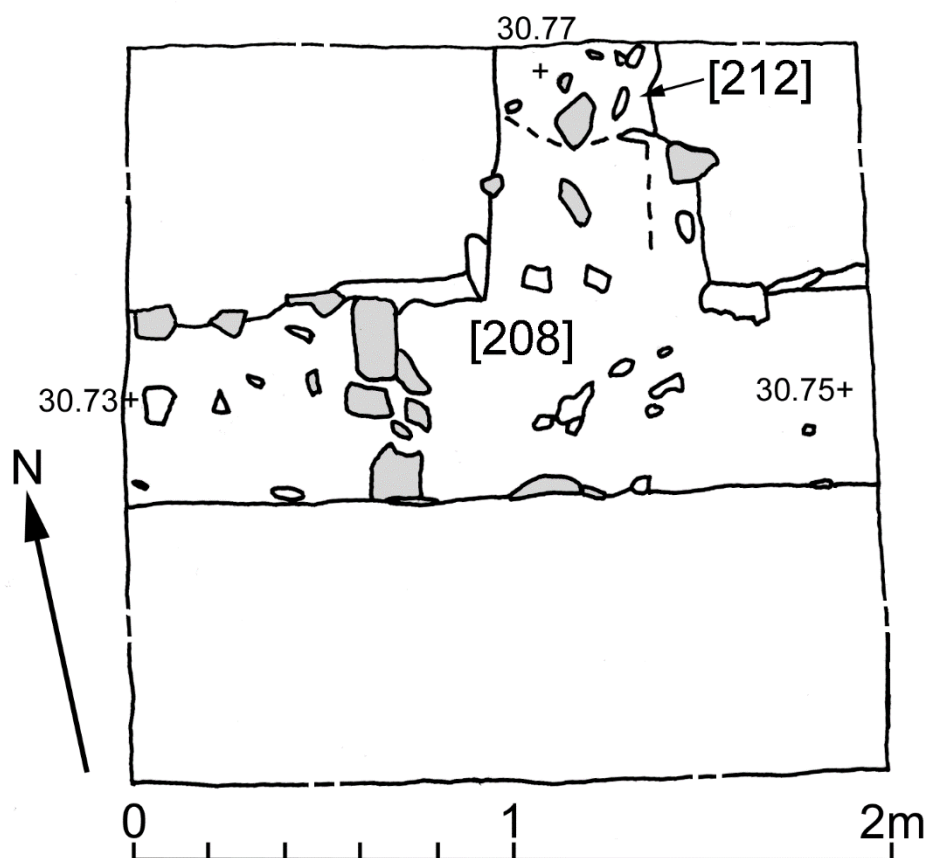


Figure 24. The foundations in trench D.



Figure 25. Trench D: foundation [208]. Looking north.



Figure 26. Trench D: foundation [208] in trench D with foundation [212] at the right hand or northern end of the projection. Looking west.



Figure 27. Trench D: the northward projection from foundation [208] with foundation [212] at the right-hand end. West at the top.



Figure 28. Trench D: the south side of foundation [208] looking west.

4. DISCUSSION

4.1 The building

The foundation [5] appears to relate to the north wall and northwest corner of the building shown on the enclosure award map of 1820 (figure 1). Foundation [208] is almost certainly the south wall. If so, the building had an external width of 11.56m and an internal width of 10.49m. On the north side the projections running inward from the north wall probably underpinned the principle trusses giving the lengths of three bays:

West wall	0.5	
Bay 1	4.85	
Truss 1	0.46	
Total		5.31
Bay 2	4.82	
Truss 2	0.53	
Total		5.35
Bay 3	4.8	
Truss 3	0.52	
Total		5.32
Average		5.32

The projection in trench D on the south side of the building was slightly west of the equivalent projection in trench C which may have been the result of a mistake in construction. The inner end of the trench D projection had been altered or repaired, as the mortar was different from the main foundation.

The average centre to centre bay length on the north side of the building was therefore around 5.32m. The 1820 enclosure award map and the more accurate 1868 Ordnance Survey map (figure 1) suggest that the building had a length of about 69m. A structure with 13 bays 5.32m long would have a total length of just under 70m once allowance is made for the extra end wall. It was common to have two or three bays between each wagon bay so that the crop did not have to be carried too far when it was unloaded. A likely arrangement for a 13 bay barn would be:

Two bays
Wagon bay
Three bays
Wagon bay
Three bays
Wagon bay
Two bays

Although there are precedents for a single-span timber roof of this width it is far more likely to have been aisled with the arcade posts resting on the inner end of sleeper beams on top of the inward projecting foundations.¹⁹ Projection P4 in trench A had a complete length of 2.2m suggesting that the nave was about 6.09m wide.

¹⁹ The tables in Margaret Wood. *The English Medieval House* 1965 p. 47-8 show that aisled halls had spans from the high 20s to as much as 67.5 feet (20.5m) at Westminster Hall. Spans of up to 45 feet (13.7m) were common. The rebuilt Westminster Hall was an exceptionally wide single span.

The dating evidence for the foundation was very limited. The best evidence was a piece of glass from a wine bottle which was not in the wall but was embedded in mortar which had clearly come from it.²⁰ The bottle was of cylindrical or mallet shape and therefore, unlikely to be earlier than about 1725 and more likely to be mid-18th century.

There was also a piece of red paving brick mortared into the top of the foundation in trench A. This was hard, 52mm thick, and looked more 18th century than Tudor.

The building could have been older than the foundation as timber-framed structures were sometimes taken apart and rebuilt in a different location. Most medieval timber work was fixed with wooden pegs, but iron nails and other fastenings became increasingly common from the 16th century.²¹ Very few nails were found which suggests that the timbers were pegged and that the timberwork was older than the foundations.

Why did the Carews need this huge building? The obvious possibilities are as a barn, a stable or a combination of both.

Stables usually had a first floor, which was used to store hay and other food and provide accommodation for the stable staff. They were generally narrower than a large barn, so they did not need to be aisled. Nicholas Carew KG who owned the house 1520-1539 was Henry VIII's Master of the Horse and one of the King's hunting and sporting companions. He entertained the King at Beddington and he might be expected to need a large stable. The stable at Kenilworth, built for John Dudley, Duke of Northumberland, in or shortly before 1553, has a length of 49m and a width of about 7m. It has a first floor and a single-span roof divided into eleven bays.²² The Royal Mews at Hampton Court were constructed in the mid-16th century and a barn was added in 1570. The stables were arranged around the courtyard are relatively narrow and un-aisled.²³

If a large aisled structure is not typical of a stable, it is of a barn. The building's size is similar to the barn at Harmondsworth, Middlesex, which was 58.52m long by 11.42m wide. This was divided into twelve bays including three wagon bays. Another very large barn at Manor Farm, Frindsbury, Kent, has a length of 64m and is divided into thirteen bays and two end outshuts.

Large barns were usually used to bring the harvest in and store it on the straw until it was threshed. This was usually done overwinter in the wagon bays and the grain was then taken to the granary to await use or sale. Wheat, barley, oats and beans were all handled in this way.

If the barn had 13 bays with three wagon bays the stackable floor area would be about 553m³.

The height of the stack is problematic but, if it is assumed that the nave was stacked to the top of the aisle posts and the aisles to the eaves the barn would have had a capacity of 3,556m³ or 125,603ft³ as detailed in section 6.

Cragg's *Hints to Young Valuers* published in 1901 gives figures for the measurement of straw and the yields of crops.²⁴ These would obviously reflect the then current farming practices incorporating the improvements which took place in the late 18th and 19th centuries but predating the major 20th century developments to seeds, fertilisers and chemical weed killers.

²⁰ Find <103> from trench C layer [108]. See p.11.

²¹ This can be seen in chapter 8 of Hewett 1980. Locally iron bolts were used for key joints in the early 16th century hall roof at Carew Manor, Beddington (Phillips and Burnett 2016 p. 43). Iron nails were used to join the timbers supporting the attic floor at Whitehall, which is thought to have been inserted about 1600. Numerous large iron nails were found in the excavation of the Oaks mansion house which was of mid-18th century and later date (Phillips and Williams 2014).

²² Thompson 1977 p. 24. Date from Goldring 2014 p. 167.

²³ Royal Commission of Historic Monuments. Middlesex. Page 48-9.

²⁴ Cragg 1901 p. 288.

The weight of a cubic foot of stacked straw varied according to the type of crop:

	Stacked straw (lbs/ft ³)	Barn capacity (lbs)
Wheat	4	502,414
Barley	3	376,810
Oats	3.5	439,612
Beans	2.5	314,009

Cragg also gives figures for the yield of straw per acre for a light, medium and heavy crop which can be used to calculate the area of crop need to fill the barn.²⁵ For a medium crop the figures are:

	Straw yield lbs/acre	Area of crop to fill barn (acres)
Wheat	3,360	149
Barley	2,240	168
Oats	3,360	130
Beans	2,800	112

These figures are obviously very approximate but it appears that the barn could hold about 130 to 160 acres of crops.

A study of the barn at Harmondsworth using medieval data suggests that the barn could service a much larger area of land. However, the surviving accounts from 1293-1451 suggest that the estate normally grew around 200 acres of cereals.²⁶ Farming methods probably changed significantly between the late middle ages and the mid-18th century and yields probably increased. Nonetheless, the estimated of 130 to 160 acres of crops for the Beddington barn may be on the low side.

A barn of this size would obviously be useful if the Carews were working a large home farm by direct labour. We do not know how the estate was worked in the 16th century but later most of the farmland seems to have been rented out. Two documents in Surrey History Centre list the property 'In S^r Nicholas Carews hands in Beddington when the settlement was made on Francis Carew w^h my Daughter given then in to me'.²⁷ This must refer to the marriage settlement of either the second Francis Carew (d. 1649) and his wife Susan Romney (d. 1687) or the third Francis (d. 1689) and his wife Ann Boteler (d. 1689). The handwriting favours the latter. Both documents are only partially legible, but it appears that the greater part of the Carew's Beddington lands were let for cash rents. This also appears to have been the case between 1702-3 and 1704-5 when there are a series of surviving accounts created by the trustees of the estate during the minority Nicholas Carew, later 1st Baronet.²⁸

Very little is known about the management of the estate in the mid-18th century. Nicholas Carew, 1st Baronet, died heavily in debt in 1727. His son was very young, so the estate passed into the hands of trustees. His widow Elizabeth married William Chetwynd and they probably managed the estate until the 2nd Baronet came of age about 1741. He turned out to be indolent spendthrift who died in 1762 heavily in debt. The estate then passed to Richard Gee of Orpington who seems to have allowed his brother William to live at Beddington. Richard died in 1816 and Beddington passed to William's wife Anne Paston Gee who died in 1828.²⁹ By that date the barn existed on the excavated site as it is shown on the 1820 map.

²⁵ Cragg 1901 p. 289.

²⁶ Impey 2017 p. 12-15.

²⁷ Surrey History Centre 2163/1/15 and 16. The quote is from the former.

²⁸ Minet Library VI/257.

²⁹ Phillips and Burnett 2016 p. 32-5.

The excavated foundation must have been created for one or other of these people. The 1st Baronet created a long canal-like west lake in the park on the axis of the house. This may have involved the clearance of an outer court on the west side of the house which would provide an obvious context for moving the barn. However, the lake existed by 1721, which is probably too early for the fragment of glass bottle that provides the main dating evidence.³⁰ The 1st Baronet died owing at least £10,000 and his wife and William Chetwynd may have tried to improve the management of the estate to increase income. At some point the northern part of the park was divided into fields which extended into the present park. The barn could have been built to house and process the crops from these fields. The fields are shown on Rocque's map of Surrey which dates from about 1760. If they were then fairly new they could have been created at the same time as the barn foundation, but there is no evidence for this: the fields could have been made in the 17th century.

The Carews owned the tithes of the sub-manor of Huscarls, a 200-acre property within Beddington. The Carews also received some tithes from the rest of Beddington parish as a result of leasing a house called the Portionary to the rector. This arrangement dated from at least 1601 and resulted in the Carews receiving a cash rent of 43s 4d a year and the tithe of the oats growing the parish, the tithe of the wheat and rye straw and seven quarters of wheat, four quarters of rye and thirty quarters of barley each year. This payment continued to the late 18th century.³¹ The Carews would have needed to store these tithes unless they were farmed out, but their volume is hard to define as we do not know what sort of crops were grown in early modern Beddington. However, the emphasis on oats and straw suggests the proceeds of the lease were intended to maintain animals.

The structure at Beddington is adjacent to the deer park. It was a common practice to overstock deer parks, so the animals had to be fed over the winter to keep them alive. If this was done at Beddington there would be a need for storage but the extent of this cannot currently be defined.

It is therefore difficult to understand the function of such a large barn.

The lack of nails on the site suggests that the barn was not new-built in the 18th century and that it may have been an older building moved to a new site. The timbers may have come from the great barn mentioned in the Carew household accounts for 1572-3 but, if so, it is not clear where the building had been or why it was moved in the mid-18th century.³²

4.2 Discussion of the stratigraphy

The deposits above the foundation in trench A (layers [1], [2] and [3]) consisted of soil and gravel with many modern finds including plastic. They had obviously been deposited or heavily disturbed in the recent past. In 1990-1 flood alleviation work was carried out on the river and the channel immediately north of the site was deepened. This was observed at the time, but nothing was noticed in the vicinity of the trench and no photographs were taken.³³ However, a substantial amount of gravel was dug out of the river bed and must have been dumped on the river bank before being moved elsewhere. The work was done by machine and the banks upstream were heavily churned and disrupted. It is likely that this happened on the site of the excavation and the layers [1] to [3] are the result of it. They may include material from the river bed as well as from the bank which existed prior to the work. Compaction by machinery may also explain why layer [3] in trench A was much harder than the later [2].

³⁰ John Evelyn diary 19 November 1721. BL Add MS 78,514 B. This John Evelyn was the grandson of the 17th century writer.

³¹ TNA C12/1543/14.

³² Surrey History Centre 281/4/22 f5r, f7r; 281/4/24 p. 1.

³³ The observations upstream are reported in Phillips 2016 p. 17-27.

These deposits overlay layer [4] which covered foundation [5] and layer [6] to the north of it. Layer [6] contained a large amount of broken peg tile. It seems likely that this related to the demolition of the building which, on the evidence of the maps (figure 1), took place in the mid-19th century. However, layer [4] contained many modern finds possibly from disturbance during the flood alleviation work. These were absent from layer [6] but there may have been some disturbance, as a piece of corrugated window glass was found in the top of the underlying gravel layer [11]. The latter was clearly natural and became clean with depth.

The foundation [5] rested on the top of the gravel and was presumably built into a trench excavated into the overlying deposits. To the north of the building these deposits must have been moved, as the demolition deposits rest on the top of the natural gravel. The same general sequence was probably present in trench C although the tile-rich layer [106] was not excavated so the underlying natural was not seen.

The deposits to the south of the foundation in trench D, and therefore outside the building, contained a large amount of peg tile and broken chalk which probably also rested on natural gravel.

In all three trenches the deposits within the building consisted of flints in a matrix of hard dark brown often sandy silt with a little chalk, although the deposit had probably been largely removed in trench C.³⁴ The flint flakes noted in trenches A and D probably related to the construction of the building.

The deposits below the foundation top within the building were therefore completely different from those outside. The deposits in the building contained very few finds and appeared to be older than or contemporary with the creation of the foundation. The deposits outside consisted largely of roof tile which probably related to the demolition of the building and the deposits which existed when the foundation was constructed had gone. It appears that the soil around the building was removed to around the top of the natural gravel and that the building was then demolished onto the excavated surface. It seems likely that the top soil was then put back to cover over the rubble. This seems an expensive way of disposing of the demolition debris. However, it would make sense if there was a desire to use the materials to raise the level of the ground on what would have been a damp riverside site. The present ground level drops to the southwest of the barn.

Trench A yielded 203 pieces of bone of which 53 (26%) were teeth and 34 (16.7%) were the front teeth of horses. Layer [4] produced 64% of the bone, 85% of the teeth and 82% of the horse teeth. Layer [4] rested on layer [6]. Both contained a large amount of peg tile which probably related to the demolition of the building in the mid-19th century as noted above. Layer [6] contained a moderate amount of bone but very few teeth. This suggest that the teeth related to activity on the site after the building had been demolished, the material having been introduced into the upper part of the deposit by disturbance. The flood alleviation work provides an obvious context for this disturbance and suggests that the teeth may have been dredged from the river. If this was so the teeth should also have been as common in layers [1] and [2] which consisted of disturbed deposits overlying layer [5]. The two contexts produced only 14 pieces of bone and 6 teeth which were most likely introduced to the deposit by the disturbance of the layer below. It appears that the concentration of horse teeth relates to activity on the site after the demolition of the building. The nature of the activity is however unclear.

³⁴ Layers [4], [7], [8] and [12] in trench A; layer [23] in trench B; layers [104] and [105] in trench C and layer [204], [208], [210] and [211] in trench D.

4.3 The river

The river Wandle flowed just north of the building in a channel shown on the 1820 enclosure award and all later maps. The river was deepened during flood alleviation work in 1990-1 but the original south bank and the adjacent channel bed were left in place and still survives. The northern edge of trench A was 3.9m from the pre-1990 river bank and the foundation [5] was about 10.5m from it.

The bottom of foundation [5] was at about 30.6m OD, which is about 0.3m above the adjacent pre-1990 river bed at 30.31m OD. The mortar surface seen in trench B in the corner of foundation [21] below layer [23] was at 30.365m OD. This may have been a construction surface rather than the original floor level. However, even if the floor was higher it seems perilously close to river level.

5. THE FINDS

Layer [1] was excavated as layers [1], [9] and [13] all of which are brought together as layer [1]. Layer [4] was excavated as layers [4] and [10] and the finds are again brought together as [4]. The same applied to layers [7] and [18].

Finds labels [24] are from layer [19].

5.1 Coins

Layer [1]

- Two pennies Elizabeth II dated 1974 and 1977.
- Sixpence George VI, 1944.
- Five new pence. Elizabeth II, 2009.

5.2 Pottery

Layer [1]

Roman

- Rim from bowl with grey-brown gritty fabric. 28g.
- Scrap of grey-brown pot. Possibly Roman. 1g.

Kingston

- Green-glazed wall sherd. 3g.

Stoneware

- Pale yellow body with mottled brown glaze. 10g. 18th or 19th century.
- Jug or mug handle attachment. Fine thin white body with bright orange-brown glaze. 10g.
- Handle with brown glaze. 5g. 19th century?

Tudor brown

- With olive-brown glaze. 5g.

Post-medieval redware.

- Base angle from large dish. 18g.
- Overburnt with dark brown glaze on interior. 2 pieces, 31g.

Staffordshire

- Base angle from straight-sided jar. Thick base (13mm). Pale brown body with uneven brown glaze. 23g.

Staffordshire combed ware

- Thin dark line on light background. 2g.

Staffordshire?

- Flake with pale brown body and yellow slightly green glaze. 1g.

Porcelain

- Cup rim decorated with roses. 2 pieces, 1g.

Soft paste 'porcelain'

- Cup rim with hand-painted blue and white decoration. 1g.

Transfer print

- Plate with blue – slightly mauve decoration. 4 joining pieces, 22g.
- Scrap with brown decoration. 1g.

Modern white china

- Jam jar rim. 3g
- Wall sherds. 2 pieces, 2g.
- White interior. Green exterior with relief decoration. 1g.
- Wall sherd. Ridges with pale tops and dark green groves with adjacent black and white decoration. 1g. (Joins sherds from [2] and [4]).
- Bottle wall sherd. White glaze both sides. 12g. (Joins piece from layer [4]).
- White wall sherd. 2g. 19th century?
- Rim sherd from white saucer with low relief decoration on the interior. 2 joining pieces, 16g.
- Cream rim sherd. 4g.
- Cup handle. 1g.

Unidentified.

- Unglazed redware. 4g.

Layer [2]

Roman

- Wall sherd. Fine grey body with pale core. 4g.

Post-medieval redware

- Pipkin foot with brown glazed interior. 26g.
- Wall sherd. Brown glaze on interior. 17g.
- Flower pot rim. 9g. 19th or 20th century.
- Flower pot rim. 9g.

Modern white china

- Wall sherd. Ridges with pale tops and dark green groves with adjacent black, white and brown decoration. 1g. (Joins sherds from [1] and [4]).
- White wall sherds. 2 pieces, 5g.

Unidentified

- Soft pale red groggy body. 4g

Layer [3]

Stoneware

- Rim of brown bottle with ridges on the interior. 5g. 19th or early 20th century.

Post-medieval redware

- Red body with pale yellow glaze over a white slip. 14g. 19th or 20th century.

Porcelain

- One side white, the other red. 1g.

Transfer print.

- Blue and white 'Chinese' decoration on one side, white the other. 2g.

Modern white china

- Wall sherds from pale grey bottle. 2 joining pieces, 34g.

Layer [4]

Border ware

- Red body with thick green glaze on both sides. Rib on the exterior. 2g.
- Rim or cordon. White body with yellow glaze. 4g.
- Bowl with orange brown glaze on the interior. 10g.

Stoneware

- Rounded rim sherd with mottled brown decoration. Possibly adjacent to spout. 6g.
- Bottle wall sherd. Grey with some golden-brown glaze on exterior. 8g.

Post-medieval redware

- Spotty brown glaze on one side, darkened surface on the other. 3g.
- Rim sherd. Glazed both sides. 12g.
- Interior has pale yellow glaze over a white slip. Two joining rim sherds with the glaze extending beyond the white slip onto the exterior. Wall sherd has a splash of glaze on the exterior. 3 pieces, 75g. (Rim sherd joins a piece from layer [6]).

Tin-glaze

- Pale blue glaze both sides. 5g
- Drug jar rim. Off white glaze both sides. 3g.

Porcelain

- Base of small white plate. 5 joining pieces. 15g.

Transfer print

<4> Grey blue floral decoration. 2g.

- Plate rim. Blue and white decoration. 2g
- Blue and white floral decoration on the interior. 2 pieces, 5g.

Staffordshire?

- Rim. Yellow body with yellow glaze decorated with white line on exterior. 2g.
- Base angle? Yellow body with yellow glaze both sides with scrap of blue on interior. 3g.

Modern china

- Rim sherd. Ridges with pale tops and dark green groves with black band around the rim. 4g. Two joining pieces which join sherds from [1] and [2].
- Cream glaze both sides. 7 pieces, 16g.
- Wall sherd with white – slightly blue – glaze both sides. 7g.
- Wall sherd with white glaze both sides. 2g.
- Rim and base angle from straight sided white jar. 2 pieces, 9g.
- Rim from a shallow white bowl. 2 pieces, 16g.
- Plate rim with thick and thin purple lines around the edge. 2 joining pieces, 6g.
- Bowl with cream glaze. 2 pieces, 31g.
- White cup. 7 joining pieces. 32g.
- Bottle wall sherd. White glaze both sides. 14g (joins piece from layer [1]).
- White glaze. From unidentified ornament or figure. 5g.
- Wall of cup with handle attachment. 5g.

Unknown

- Redware possibly overburnt peg tile. 5g.

Layer [6]

Post-medieval redware

- Rim sherd. Interior has pale yellow glaze over a white slip with glaze extending beyond the white slip onto the exterior. 7g. Joins a rim from layer [4]. 19th or early 20th century.

Layer [7]

Surrey white ware

- Wall sherd. Worn light green glaze with dark speckles. Kingston? 4g.

Layer [16]

Post-medieval redware

- Wall sherd from large bowl. Glazed interior. 63g.

Layer [19]

Tin-glaze

- Pale blue decoration both sides. Chamber pot? 6g.

Layer [101]

Post-medieval redware

- Part of wall, base angle and base of a large bowl glazed inside and out. 410g. 18th or 19th century.
- Rim, wall and base angle from a large shallow flower pot. Diameter 190mm. Height 63mm. 73g.
- Part of rim from large flower pot. 51g.

Stoneware

- Pale grey-brown stoneware with painted purple decoration on the base. 8g.
- Pale grey with clear glaze on the exterior. Probably the shoulder of a drink bottle. 11g. Late 19th or early 20th century.
- Stoneware with mottled brown exterior. 4g. Late 17th or 18th century.

Porcelain

- Rim with blue and white hand painted decoration on exterior. Plain interior. Gold rim. Tea cup? 1g.

Transfer print

- Blue and white rim sherd. 2g.
- Pale purple decoration on one side. 6g.

Modern.

- Tea pot? Two sherds with dark brown glaze on both sides. 17g.
- Buff body. Pale brown exterior. White interior. 2 pieces, 9g.
- Rim of white chamber pot. 12g.
- White china. 11g.

Uncertain.

- Buff body with clear glaze on both sides. 11g.

Layer [102]

Post-medieval redware.

- Base sherd from a large bowl. Glazed on the inside. 174g. 18th or 19th century.
- Wall sherd and scrap of base angle from large vessel. Glazed inside. 32g. 18th or 19th century.
- Base angle from large rectangular (?) dish. Clear glaze both sides. Reduced core. 44g.
- Flake with clear glaze on surviving side. 11g.
- Base sherd with glaze on one side. 55g.
- Bowl rim. Two ridges on the outside below rim. 11g.
- Rim with sparse iron glaze. 7g.

Modern

- Bowl sherd? Plain white both sides. 11g

- Three joining sherds from the side and rim of small deep bowl about 130mm diameter. Brown band around the rim and base with brown and white geometric (art deco?) decoration between them. 16g.
- Rim from large white vessel. 17g.
- Thick white rim. 19g.
- White body with white glaze both sides. 2g.
- White body with blue and black (?) striped decoration. Fire damaged. 3g.
- Rim and base angle from small dish. Pale brown body with clear glaze on the outside and white glaze on the inside. 12g.

Layer [203]

Stoneware

- White salt-glazed base angle. Diameter of base about 100mm. Sloping side. 14g. 18th century.

Modern

- White. 3 pieces, 7g.

Uncertain

- Base possibly from a bowl. Buff body with pale grey-brown glaze on the inside possibly intended to imitate stoneware. Body hard but not vitrified. Possibly about 1700. 14g.

5.3 Pipes

By Steve Morris

5.3.1 Bowls and special finds

Layer [1]

- <1> Bowl with spur. L19, 1690-1710. Bore 7/64in. 15g.
- <2> Bowl with forward raking spur marked but illegible. L26, 1760-1800. Bore 4/64. 10g.
 - Rim sherd decorated with a 'B' and part of a horn. Probably Grand Order of the Buffaloes. 1g.
 - Bowl rim. A scrap. 2g
 - Bowl, a scrap. 1g.

Layer [19]

- <5> Stem. Bore 5/64in. 1g.

Layer [102]

- <104> Bowl. Spur missing. L19, 1690-1710. No rouletting. Bore 6/64. 11g.

5.3.2 Stem

Layer	Bore (64th in)	Number	Weight (g)
[1]	4	11	18
[1]	5	5	8
[1]	6	2	4
[1]	7	2	18
[2]	6	1	2
[3]	4	1	2
[4]	5	2	8
[4]	6	1	3

Layer	Bore (64th in)	Number	Weight (g)
[4]	7	1	2
[19]	4	3	4
[101]	6	1	5
[102]	4	2	5
[102]	5	1	1

5.4 Glass

Layer [1]

- Green wine bottle. Patinated. 23g.
- Clear with white opaque surface on one side. Moulded in relief. 2 pieces, 5g. Lampshade?
- White glass frosted both sides. 4g.
- Clear glass. Uneven surface one side. 6mm thick. 5g. Modern.
- Neck of handmade bottle. Dark brown. No patination. 29g.
- Olive green bottle wall. No patination. 5g.
- Clear flat glass. 2 pieces, 13g. Modern.
- Flat clear corrugated one side. 2g. Modern.
- Green wine bottle wall. Heavily patinated. 12g.
- Brown bottle wall. Slight patination. 10g. Modern?
- Flat clear. 6g. Modern.

Layer [4]

- Clear corrugated clear bottle glass. 7 pieces, 34g. Modern.
- Neck of clear glass mineral water bottle. Late 19th or early 20th century. 26g.
- Green wine bottle. Heavily patinated. 3 pieces, 34g.
- Clear flat. 2 pieces, 13g. Modern.
- Clear bottle. 14g. Modern.
- Dark green bottle wall. No patination. 12g.
- Dark brown bottle wall. No patination. 3 pieces, 34g.
- Green patinated bottle wall. 4g.
- Green wine bottle. Heavily patinated. 10 pieces, 149g.
- Green bottle glass. Light patination. 2 pieces, 3g.
- Heavily patinated green wine bottle. 4 pieces, 72g.
- Olive-green wall sherd from bottle. No patination. 7g.

Layer [6]

- Curved green bottle with patination. 2 pieces, 3g.

Layer [11]

- Clear corrugated window glass. 2g.

Layer [17]

- Base of brown wine bottle with deep frog. Base sags out slightly. No patination. 202g.
- Heavily patinated bottle wall. 9g.
- Olive green bottle wall. 4g.
- Flat green glass. 1g.

Layer [19]

- Neck probably from a cylindrical wine bottle. Heavily patinated. 56g. Late 18th or early 19th century.
- Heavily patinated green wine bottle. 6 pieces, 85g.

Layer [20]

- Green bottle heavily patinated. 4g.

Layer [100]

<100> Glass waste? Light blue grey with fine parallel darker stripes. 6g.

Layer [102]

- Base of a pale green wine bottle with a deep frog. Diameter 76mm. 99g.
- Base angle from wine bottle. Sagging side at base. Frog. Heavily patinated. 39g.
- Base angle from wine bottle with deep frog. Heavily patinated. 26g
- Part of a thick frog. Heavily patinated. 51g.
- Wall just above base. Sagging side. Heavy patination. Diameter 70mm. 28g.
- Sagging wall sherd from hexagonal (?) or octagonal bottle. Heavily patinated. 13g.
- Sherd from neck of a dark green bottle with little patination. 43g.
- Base angle from a dark brownish wine bottle. Light patination. 46g.
- Base of large wine bottle. Diameter 110mm. Heavily patinated. 305g.
- Wall sherd. Heavily patinated. 39g.
- Wall sherd. Heavily patinated. 7g.
- Wine bottle rim with pointed band around the top. Heavily patinated. 6g.
- Wine bottle neck sherd with no patination. 3g.
- Flat window glass. 9g. Modern.

Layer [108]

<103> Wall sherd from a glass bottle attached to a mass of pale yellow-brown mortar similar to that used in foundation [103]. Glass heavily patinated. Bottle has a diameter of about 90mm. The vertical profile is slightly concave and the glass thickens from 3 to 8mm. The lack of vertical curvature shows that this cannot be from an onion or globular wine bottle: it must be of either mallet or cylindrical form. This means it is unlikely to be earlier than about 1725. Two joining pieces with earth on the fracture. 185g.

Layer [202]

- Clear bottle glass. 2 pieces, 38g. Modern.
- Clear glass with slight green tint. Indentation possibly for paper label. 4g. Modern.

Layer [203]

- Wine bottle wall. Heavily patinated. 2 pieces, 17g.
- Thick clear flat. 26g. Modern.
- Part of base angle from a dark brown wine bottle. 22g.

5.5 Floor tile and paving bricks

Layer [1]

- Red paving tile or brick. Surviving width 112mm, surviving thickness 48mm. 861g.
- Paving brick. Red body with some grog or clay lumps. 45mm thick. 887g.

Layer [5]

<6> Hard red body. Thickness 52mm. Smooth top probably worn with limescale (?) on it. Mortar on one fracture. 555g. Found embedded in the wall top.

Layer [19]

- Hard red body. 47mm. Hack mark on edge? Slightly worn top. 656g.
- Hard red body. 50mm thick. 497g.
- Paving brick. Hard red body. Width 113mm. Top heavily worn. Patches of dark brown glaze on one edge. 791g.
- Paving brick. Hard red body. Thickness 49mm. 2 pieces, 415 and 376g.

Layer [20]

- Red floor tile. No surviving complete dimensions. Surviving thickness 42mm. 758g.

Layer [101]

- Yellow paving brick. Fine hard body. Width 70mm. Height 33mm. 348g.
- Red paving tile. Thickness 43mm. Worn surface. Traces of mortar. 117g.
- Red paving tile. Thickness 50mm. 88g.

Layer [102]

- Paving brick or floor tile. 44mm thick. One edge bevelled. Smooth worn surface. 533g.
- Paving brick or floor tile. 44mm thick. Edge not bevelled. Smooth worn surface. 437g.
- Paving brick. Height 50mm. Width 117mm. Cut and then broken off 28mm from end. Mortar around top edge. 276g.
- Paving brick. Height 50mm, width 113mm. Hard red fabric. Worn surface. Traces of mortar on underside. 586g.

Layer [203]

- Paving tile. 43mm thick. Bevelled edge. Top smooth. 254g.

Unstratified (trench C)

- Paving brick. Hard red body. 50mm thick. Width 115mm. Top worn. Traces of mortar around top edge and on underside. One long edge bevelled but not the other. 981g.

5.6 Roof tile

Peg tile is only included if a full length or width survives, there is some unusual feature or 100% retention from the context.

Layer [4]

- Roof tile. Probably Roman. 100g.

Layer [6]

- <7> Soft body possibly river worn. 1 corner and 1 straight edge. The other edge tapers at about 45 degrees. The tile bends down about 65mm from the edge. About 14mm thick at the corner. 124g. (scale 5cm).



- Soft brick-red body. Maximum thickness 39mm. 11g. Possibly Roman. 72g.
- Peg tiles with complete widths of 152, 153, 153 and 154mm. 1,660g.
- Peg tile with the diagonal impression of the edge of a board (?) which left a wipe mark on the soft clay as it was removed. 61g.

Layer [8]

- Tile. 2 pieces, 13g.

Layer [11]

- Tile. 13 pieces, 98g.

Layer [22]

- Tile with large red grits and white (clay?) patches. 2 pieces, 51g.
- Tile. 2 pieces, 26g.

Layer [102]

- <106> Tile with four parallel marks in the surface. Thickness 15mm, No peg holes. 207g.



- Peg tile. Complete width 165mm. Thickness 11mm. No peg holes. 520g.
- Peg tile. Complete width 152mm. Thickness 12mm. 2 round peg holes. 371g.
- Peg tile. Complete width 152mm. Thickness 13mm. 1 square peg hole. 302g.
- Peg tile. Complete width 156mm. Thickness 12mm. No peg holes. 357g.
- Peg tile. Complete width 154mm. Thickness 14mm. 1 round peg hole. 374g.

Layer [203]

- Peg tile with surviving full width of 150mm. 13mm thick. 2 square peg holes. 421g.

Layer [204]

- Peg tile 15mm thick. ¼ of a peg hole. 22g.
- Peg tile. 9 pieces, 67g.
- Peg tile (?). 5 scraps. 10g.

Layer [209]

- <101> Roof tile. 3 pieces, 91g.
- <107> Tile with reduced core. Thickness 15-18mm. No peg holes. Wipe mark in one side. 73g.
- <108> Peg tile. One side smooth, the other cracked and uneven as if weathered while the clay was still soft. Fully oxidised. Thickness 12mm. No peg holes. 44g.
- <109> Peg tile reduced with oxidised surfaces. Thickness 19mm. No peg holes. Score mark on the surface. 25g.
- <110> Peg tile with two parallel indentations with shallow V-shaped cross section on the surface. Reduced core. Thickness 14mm, No peg holes. 86g.



Find <107>.



Find <108>.



Find <109>.



Find <110>.

Layer [209] continued:

Weight (g)	Thickness mm	Pegs	Notes
185	15	0	Two shallow parallel indentations on edge. Small holes. Core partly reduced.
67	13	1 ro	Scatter of flint temper. Partly reduced core.
47	14	0	Heavily overburnt with oxidised surface. Small holes.
32	-	0	Flake. Small holes.
52	15	.25 sq	Small holes
122	13	0	Thin scatter of flint and grog. A few holes. Reduced core with thin lighter red layer and a thin darker red layer on outside.
37	11	0	Scatter of flint and a few small hole.
38	12	.33 ro	Surface partly reduced. Some poor glaze from over-burning
61	17	.33 ro	Surface slightly flaked. Small holes. Parts of core slightly reduced.
64	14	0	Scatter of flint. Core partly reduced.
9	14	0	Grog. Corners rounded.
10	12	0	Scatter of flint. Possibly underfired. Rounded.
22	14	0	Clay laminated.
30	12	0	Worn uneven surface. A few small holes.
22	14	0	Reduced core. Mortar on the surface.
5	14	.5 ro	Peg hole 4mm from edge.
44	12	0	Reduced core, then oxidised, then partly oxidised exterior.
56	15	0	Reduced core, then oxidised, partly oxidised and oxidised exterior.

Weight (g)	Thickness mm	Pegs	Notes
78	11	0	Reduced core, then oxidised, partly oxidised and oxidised exterior.
33	16	0	Reduced core, then oxidised, partly oxidised and oxidised exterior. A few holes.
20	12	0	Reduced core, then oxidised, then partly reduced surface.
20	13	0	Reduced core, then oxidised, partly oxidised and oxidised exterior.
26	12	0	Reduced core, then oxidised then partly oxidised surface.
51	12	0	Oxidised. Small holes.
62	14	0	A few scraps of grog. Reduced core.
21	13	0	Red core with pale surfaces. Scatter of flint.
23	14	0	Red but with layers from slightly less oxidation. Flint.
28	13	0	Small holes. A little flint. Reduced core.
9	13	0	Reduced core.
9	13	0	
6	12	0	
7	12	0	Reduced core.
21	12	0	

6 flakes, 22g.

Layer [210]

- Peg tile 12 thick. Part of peg hole. 28g.
- Peg tile (1). Scrap, 4g.

Layer [211]

- Tile. 1 piece, 1g.

Pan tile:

Layer	Pieces	Weight (g)
[1]	3	1,019
[4]	2	418
[6]	1	103
[19]	1	121
[20]	1	186
[102]	2	160
[203]	3	674

5.7 Other building ceramics

Layer [1]

- Wall tile with dark green glaze. 18g. Modern.
- Salt-glazed drain pipe. 41g.

Layer [4]

- Wall tile with dark green glaze. 14g. Modern.
- White wall tile. 10g. Modern.

Layer [16]

- Firebrick. 141g.
- Stoneware drain pipe. 46g.

Layer [102]

- Heavily burnt brick rubble with patches of mortar on one side. 91g.

5.8 Stone

Layer [1]

- <9> Piece of soft ironstone with clear bedding laminations. Flat slightly concave side and curved back. Flat side has irregular groove 83mm long and up to 10mm wide and 8mm deep. Overall length 105mm, width 55mm, height 35mm. 206g. Appears to have been used for sharpening.
- End of a fine white hone stone. Rectangular section tapering from 42 by 27 to 32 16mm. Surviving length 106mm. 175g.
 - Purple slate. 27 pieces, 811g.
 - Grey slate. 1 piece, 6g.
 - Iron stone. 47g.
 - York stone or similar slab. Thickness 38mm. 95g
 - Rectangular block of stone with white spots in a grey matrix. Length 39mm, width 31mm, height 28mm. All edges chamfered. Circular hole in the top 21mm diameter and 16mm deep. Has a black deposit possibly Indian ink. Hole in the base 20mm diameter and 3mm deep. Small circular logo (?) on the top. Possibly moulded artificial stone in well. 65g.

Layer [2]

- Ironstone. Not magnetic. 78g.
- Ironstone. Magnetic. 46g.
- Hard dark grey stone. 71g.
- Reigate stone rubble. 7g.

Layer [4]

- Kent rag stone? Hard heavy grey stone with tar on most fractures. 74g.
- Ball-like flint with natural hole through the centre. 28g.
- Reigate stone. 1g.
- Reigate stone rubble. 582g.
- Flint flake. Sharp with mortar on the fractures. 36g.
- Purple slate. 11g.
- Sharp knapped flints with mortar probably from a wall. 8 pieces, 1,092g.

Layer [6]

- Reigate stone rubble. 125g.
- Burnt flint. 26g.
- Chalk rubble with rounded edges. 4 pieces, 921g.

Layer [8]

- Sharp flint flakes possibly from knapping for building work. 5 pieces, 69g.

Layer [16]

- Reigate stone rubble. 18g.

Layer [17]

- Reigate stone rubble. 3 pieces, 102g.

Layer [19]

- Reigate stone rubble. 2 pieces, 1,026 and 139g.
- Sharp flint probably knapped for wall. 697g.
- Knapped flint in chalky mortar. 216g.
- Heavy hard grey fossiliferous limestone. One edge worn smooth. Much lime scale on the surface. 5.5kg.
- Chalk. Corner of roughly shaped block, yellow lime scale on parts of the surfaces. 278g.

Layer [101]

<105> Fine soft white material, possibly chalk or stucco. One smooth irregular convex surface possibly from contact with flint. The other side concave, possibly a contact surface but with bubbles in it. The edges are fractures. Thin film of yellow lime scale on most of the surfaces and fractures. 87g.



- Burnt flint. 38g.

Layer [102]

- White oolitic limestone rubble 357g
- Shelly fossiliferous limestone. 184g.
- Reigate stone rubble. 2 pieces, 18g.
- Flint with roughly squared struck face. 301g.
- Reigate rubble. 34g.

Layer [203]

- Purple slate. 3 pieces. 178g.
- Hard dark grey metamorphic or volcanic rock. 217g.

Layer [204]

- Sharp flint flakes. 8 pieces, 339g.
- Reigate rubble. 313g.

Layer [209]

- Chalk. 5 angular pieces with slightly rounded corners. 77g.
- Sharp flint flakes. 17 pieces, 717g.

Unstratified trench B

- Portland stone. Wedge shaped One side and both ends are breaks. The 3 other sides are saw cuts ending in breaks. Surviving length 146mm. One end 64 by 81, the other 64 by 53mm. 1,210g.

5.9 Coal and cinder**Coal**

Layer	Pieces	Weight (g)
[1]	2	3
[17]	4	82
[19]	3	5

Cinder

Layer	Pieces	Weight (g)
[4]	1	19
[13]	2	147
[16]	1	2
[101]	1	20

5.10 Brick

Brick is only included where there was a full length, height or width ,some unusual feature or all finds were retained.

Layer [4]

- Hard red machine made brick> Frog with rounded sides on top with inscription
W?EEX B... / ESTATES
WOREX
WEBEX
Shallower frog with bevelled sides underneath. Two vertical channels on one long edge with dovetailed shape. There were probably originally 3. Height 65mm, width 108mm.

Layer [7]

- Scrap of ceramic building material probably brick. 1g.

Layer [19]

<8> Soft red brick with smooth finish. Height 64mm, width 105mm. Score marks on the top which have cut deeply into 1 edge. Mortar on bottom and the worn edge. 530g. (Scale 5cm).



Context	L	H		W	Fabric	Notes
[4]		57			SR	Rough. Tudor?
[4]		56			SR	Rough. Tudor?
[4]		60			SR	Smooth finish. Frog.
[4]		66			YS	Frog. Hack marks.
[9]				105	SR	
[9]				105	SR	
[9]		64			HR	
[13]		65			CR	Shallow frog
[17]		55			SR	Bottom rough. Doubtful full height.
[17]		60			SR	Bottom rough. Doubtful full height.
[17]		62			SR	Shallow frog.
[19]		55		108	SR	Smooth finish. Possibly a paver but very soft.
[19]		66		111	SR	
[19]		55			HR	Smooth finish. (paver?)
[19]		50			HR	Smooth finish (paver?)
[19]		64			CR	
[20]		64			CR	Shallow frog
[22]		52			SR	Smoothed finished. Might be a paver but very soft. Kept.
[203]		55		113	SR	Smooth surfaces. Probably not Tudor.

5.11 Bone

Context	Horse front teeth	Other teeth	Other bone	Totals	% HFT	% teeth
[1]	3	1	11	15	26.7%	20.0%
[2]	2	0	3	5	40.00%	40.00%
[3]	0	0	1	1		
[4]	28	17	86	131	34.4%	21.4%
[6]	1	1	47	49	2.04%	4.08%
[7]	0	0	2	2		
[8]	0	0	0	0		
[16]	2	2	4	8	25.00%	50.00%
[17]	2	0	42	44	4.55%	4.55%
[19]	1	2	10	13	7.69%	23.08%
[20]	0	0	1	1	10.71%	25.00%
[24]	0	0	10	10	7.93%	17.07%
[101]	3	4	21	28	10.71%	25.00%
[102]	13	15	136	164	7.93%	17.07%
[202]	0	0	2	2	0.00%	0.00%
[203]	3	3	58	64	4.69%	9.38%
[207]	0	0	1	1		
[209]	0	0	1	1		
C (2)	2	0	4	6	33.33%	33.33%
Totals	60	45	440	545	11.01%	19.27%

(1) 7 with butchery marks.

(2) Extension to west end of trench C in 2016

5.12 Shell

Oyster

Layer	Pieces	Weight (g)
[4]	2	6
[6]	17	164
[11]	2	8
[19]	1	31
[102]	6	70

5.13 Iron

Layer [1]

- Horse shoe. Width of shoe 105mm. Surviving length 77mm. Width of metal varies from 29 to 34mm. 2 to 3mm thick. 1 nail hole visible.
- Sheet iron. 3 scraps.
- Sheet iron rolled into rough tube. Length 90mm. Diameter about 13mm.
- Wire 1.5mm thick bent at close to 90 degrees. Total length 78mm.
- Bar 147mm long, diameter 6mm.

- Bar bent at a right angle and broken. Total length 66mm. Diameter 4mm.
- Round nails. Lengths 108mm and 76mm.
- Rectangular nails. Surviving lengths 40, 40, 38 and 48mm.
- Galvanised iron washer. 40mm diameter. Hole 11mm.
- Attachment to hold bucket handle. Galvanised. 2 rivets in place.
- Galvanised iron bucket handle with plates and rivets to fix to bucket wall. Bent.
- Galvanised iron bucket handle.
- Round iron wire. Diameter about 5mm.
- Square nail. Surviving length 58mm.
- Cast iron sheet 5mm thick. 2 scraps.
- Part of a cast iron bar. Width 50mm, thickness 11mm.
- Rust lump possibly a bent nail.
- Square nail. Surviving length 77mm.
- Round nails. Surviving lengths 128, 54 and 32mm.
- Square nail. Heavily corroded. Surviving lengths 52 and 57mm.
- Part of hook. Length around the curve 90mm.
- Iron tube. Length 28mm. Diameter about 14mm.
- Saddle-shaped piece of iron sheet with notches in the centre of the downward facing edges. Length 31mm, width 33mm, height 10mm.
- Flat cut nails. Surviving lengths 41, 80, 64, 45, 42 and 35mm.
- Fragments of rectangular nails. Surviving lengths 93, 78, 66, 56, 52, 47, 42, 38, 37, 34, 30, 29, 27, 27, 25, 22, 36, 54 and 17mm.

Layer [2]

- Round nail, complete, 130mm long.
- Screw with slotted head. Length 55mm. Modern.
- Square nails. Surviving lengths 65, 59, 45, 47 and 33mm.
- Round wire 50mm long.
- Flat-headed nail? Surviving length 42mm.
- Bomb splinter?
- Lump of rust.

Layer [3]

- Round nail, complete length 79mm.
- Oval nail, complete length 75mm.
- Square nails. Surviving lengths 70, 54 and 23mm.

Layer [4]

- Cast iron plate inscribed in relief '30 . 36' Metal bends out below the inscription and is broken. 3mm thick.
- Cast iron plate 7mm thick.
- Wire. 2 pieces.
- Part of small horse shoe.
- Rod 85mm long. 5mm thick
- Rod 49mm long. 6mm thick.
- Rod 51mm long. 3mm thick.
- Rod 40mm long. 3mm thick.
- Rod 147mm long. 5mm thick. Bent.
- Spike 51mm long by 17mm wide at the top, tapering to a point. Top turned over.
- Square nails with hammered heads. Surviving lengths 41, 51 and 56mm.

- Rectangular nails with hammered heads. Surviving lengths 40, 64 and 65mm.
- Rectangular nails. Surviving lengths 60, 46, 50, 32, 105 and 31mm.
- Rectangular nail bent probably when being extracted. Length 50mm.
- Square nail with very large flat head. Bent, probably while being extracted. Surviving length 63mm.
- Square nail with very small head. Surviving length 62mm.
- Square nails. Surviving lengths 56, 51, 85, 80, 81, 75, 62, 66, 57, 59, 39, 38, 70, 67, 58, 56, 47, 43, 40, 38, 36, 36, 32, 29, 26, 39, 45, 94, 108, 105, 80, 69, 66, 62, 60 and 38mm.
- Flat cut nail. Surviving length 56mm.
- Round wire nail. Surviving lengths 73 and 85mm.
- Iron strip 13mm wide.
- Hook length of metal 92mm, height to bend, 57mm.
- Scarp of curved cast iron possibly pipe.
- Curved iron bar section 6 by 7mm. Surviving length 152mm. Diameter of curve about 150mm.
- Part of a pen knife?
- Large or hoop with square top. Bar 7mm diameter. One side has a height of 375mm from top to point. The other side broken. Width of top 150mm.
- Piece of cast iron plate 2.5mm thick.

Layer [6]

- Bent iron wire or nail. 45mm long.
- Square nails. Surviving length 39, 30, 58, 57, 42, 44 and 41mm.

Layer [11]

- Nail. Square section. Surviving length 61mm.

Layer [16]

- Cast iron plate 2.5mm thick. One edge turns at right angles and is then broken.
- Square nails 48 and 91mm long.
- Flat split nail. Surviving length 27mm.

Layer [17]

- Large spike – flat T-shaped head. Surviving length 160mm.
- Square nail with point hammered over. Surviving length 68mm. Bent over at 52mm.
- Part of a horse shoe about 4mm thick. 1 nail in situ.

Layer [19]

- Square nail. Surviving length 63mm.
- Square nail with large head. Surviving length 49mm.

Layer [20]

- Nail? Surviving length 36mm.

Layer [101]

- Knife? Bone handle fitted to tang of broken iron blade.

Layer [102]

- Curved cast iron sheet. Possibly bomb casing.
- Nail with large head. Surviving length 44mm.

- Nail with round head and square shaft. Surviving lengths 49 and 82mm.
- Nail. Square section. Surviving length 55mm.
- Square cut nail. Length 54mm.
- Square nails. Surviving length 31 and 71mm.
- Rectangular nails. Surviving length 46 and 80mm.
- Square nails. Surviving lengths 77, 39, 56, 53, 55 65, 66 and 44mm.
- Scrap of wire about 90mm long.
- Scrap of rust.
- Cast iron plate about 5mm thick forming a corner. Possibly from a rain water hopper or tank.
- Round nail. Surviving length 103mm.

Layer [203]

- Square nails with surviving lengths of 30, 37, 42, 43, 48, 47, 55, 52, 51, 64, 62, 95 and 104mm.
- Bar about 10mm square. Length 80mm.

Layer [204]

- Nail. Shape uncertain. Surviving length 53mm.
- Key for small spring lock. Openwork handle. Length 60mm.
- Square nails. Surviving lengths 56 and 90mm.
- Round nails. Surviving lengths 64 and 79mm.

5.14 Non-ferrous metal

Layer [1]

- Lead tube. Oval, irregular about 6mm by 4mm. Length 84mm. 13g.
- Nail of silver coloured metal Rectangular. 34mm long. Round flat head. 1g.
- Lead washer. Diameter 16mm. Hole 6mm diameter. 3g.
- Brass eyelet from a tarpaulin. 6g.

Layer [2]

- Lead washer 16mm diameter with 6mm diameter hole. 4g.

Layer [4]

- Base of shotgun cartridge. Inscribed 'KYNOX No 12 BIRMINGHAM'. 4g.
- Non-ferrous sheet (zinc?). 0.5mm thick. 4 pieces, 16g.
- Aluminium sheet off cut. 2g.
- Lead dribble. 2g.

Layer [15]

<3> Part of a brooch. 2g. Late 19th or 20th century. (Scale 3cm).



Layer [16]

Scrap of aluminium sheet with a rivet and two rivet holes. Some edges torn. Probably from a flying bomb. 4g.

Layer [101]

<111> Alloy and iron object. Five hinged sections with knob in the centre. Possibly from an aircraft? Height 53mm, width 120mm as photographed. 203g.



Above and right: find <111>.



Layer [102]

Lead window came. 3 pieces, 28g.

6. CAPACITY OF THE BEDDINGTON BARN

Size (m)

External width	11.56
Internal width	10.49

Length (m)

W end wall	0.50	
Bay 1	4.85	
Truss 1	0.46	
Total		5.31

Bay 2	4.82	
Truss 2	0.53	
Total		5.35

Bay 3	4.80	
Truss 3	0.52	
Total		5.32
Average		5.32

The 19th century maps suggest that the barn was about 69m long
13 bays and an end wall would be 69.75

Internal length 68.74

It seems likely that the barn had 3 wagon bays:

2 bays

Wagon bay

3 bays

Wagon bay

3 bays

Wagon bay

2 bays

If so the stackable length would be 10 bays less 1 end wall 52.77

The total stackable area would be 553.52

However the nave could be stacked higher than the aisles

Projection P4 in trench A was 2.2m long so 2 aisles would be 4.40

So nave width is 6.09

Stackable area in aisles 232.17

Stackable height in aisles 4.80

Stackable area in nave 321.34

Stackable height in nave 7.60
 Storage volume (m3) 3556.68
 Storage volume (ft3) 125,603.50
 Assumes aisles stacked to the eaves and the nave to the top of the aisle posts
 Based on Harmondsworth

Crop volumes and acreages

Data from Cragg *Hints to Young Valuers*, 1901

Weight of 1ft³ stacked straw:

	lbs/ft ³	barn capacity (lbs)
Wheat	4	502,414
Barley	3	376,810
Oats	3.5	439,612
Beans	2.5	314,009

The area needed to yield this quantity of straw

I assume that the volume of the seed is too low to be significant

Medium crop

	Yield lbs/acre	Area needed (acres)
Wheat	3,360	149
Barley	2,240	168
Oats	3,360	130
Beans	2,800	112

Light crop

	Yield lbs/acre	Area needed (acres)
Wheat	1,960	256
Barley	1,400	269
Oats	1,960	224
Beans	1,960	160

The barn is more likely to be designed for a good crop than a poor one as the former needs the greatest space.

Cragg's medium figures seem a better approximation than his high ones as he was writing in 1901 after the agricultural improvements in the late 18th and 19th centuries.

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