archenfield archaeology ltd
project ref AA_46/2

Brooklyn Ford, Bath Road, Worcester: archaeological monitoring and evaluation

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2003

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The authors would like to acknowledge the help and support of David Green of Neill Grinnall Homes for his help and co-operation.

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Cover Photograph: The excavation of trench 1 in progress

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Summary

In February 2003 Archenfield Archaeology conducted an archaeological evaluation of the former Brooklyn Ford Car dealership, Bath Road, Worcester on behalf of Neil Grinnall Homes and Spa Housing Association. A geoarchaeological study of cores taken from a borehole situated close to the line of Birmingham to Worcester Canal showed that the deposits consisted of an accumulation of alluvium overlying bedrock and overlain by a greater depth of made-ground. The lower levels were shown to have formed in waterlogged conditions, and samples may contain valuable pollen and plant remains that relate to the former course of the Frog Brook. Archaeological trial trenching showed that the site has been very disturbed by 19th and 20th century construction and demolition. Deep accumulations of made ground and a build up of layers of industrial dumping and the presence of back filled cellars were recorded. No evidence of occupation observed on either side of Bath Road was earlier than the later post medieval period.

1.0 Introduction

NGR SO 8518 5417
Worcester City Sites and Monuments Record ref. 94526 and 94527

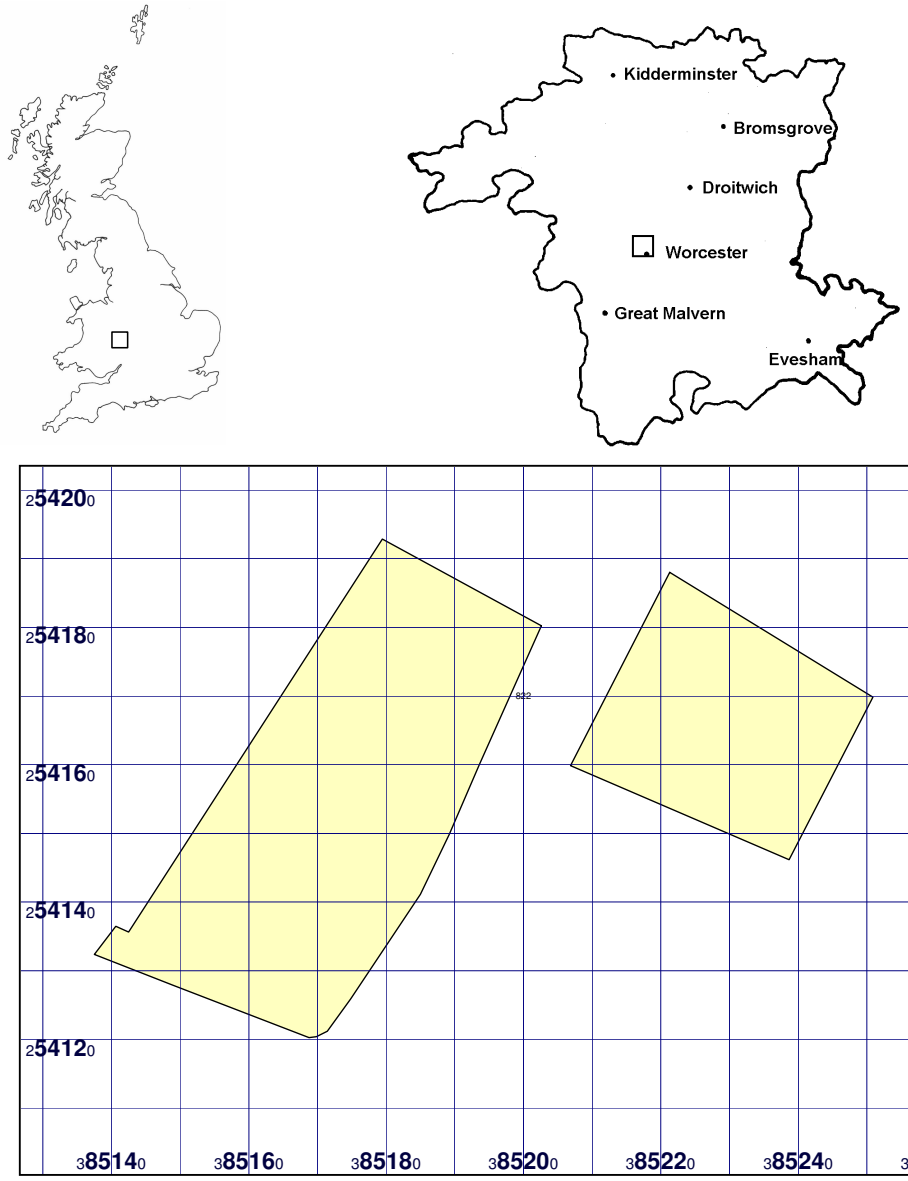


Figure 1: Location plan. Ordnance Survey superplan data reproduced under licence drawing ref 26105354

Neil Grinnall Homes and Spa housing Association (the clients) commissioned a programme of archaeological work in accordance with the brief issued by Worcester City Council Archaeology Service. This was issued in response to planning application P02L0070, for permission to construct a residential development comprising 55 units, car parking, landscaping and access. This document gives details of how the archaeological project was conducted, as stipulated in the brief. The programme of work detailed below was designed to meet the criteria laid out in 'General Standards and Practices Appropriate for Archaeological Fieldwork in Worcester City, Supplementary Planning guidance No.8: Archaeology and Development (Worcester City Council 1999)'.

2.0 Geological, historical and archaeological background

2.1 Geological background and land use

Worcester lies in the valley of the River Severn, just to the north of its confluence with the River Teme. The east bank of the Severn is a sand and gravel terrace. The site lies in the valley of a former tributary of the Severn, the Frog Brook, part of the former course of which is used by the Birmingham and Worcester Canal. Diglis Road runs along the foot of a scarp slope which rises from 15.93m OD to 29.30m OD at the summit on Bath Road.

The underlying geology of the site consists of beds of alluvial drift deposit over the Eldersfield mudstone formation[1]. A ground investigation conducted by Shire Geotechnical in September 2001 showed that in some places the ground level has been made up with deposits of ash, kiln wasters and building debris. On average the alluvial silts are not encountered until a depth of 3.5m below the present ground level. Some localised deposits were found to have elevated mercury levels present. Removal of these deposits was recommended by the geotechnical engineers.

The area of the site to the west of Bath Road was occupied by the Brooklyn Ford car sales and servicing centre. A series of buildings dating from the 1960's covers the entire area apart from some areas of hard standing on the Bath Street Frontage. The area to the east side of Bath Road is in use as an open area of hard standing.

2.2 Historical and archaeological background

Prehistoric activity in the area has been found in the form of artefacts recovered during river dredging; a Bronze Age sword was recovered during river dredging below Diglis in 1902 and a Bronze Age flint dagger found in dredged material dumped near Diglis docks in 1956.

The Roman settlement in Worcester seems to have been primarily industrial in character, with a highly developed iron smelting industry which was possibly already active at the time of the Roman occupation and appears to have continued until the eventual Roman withdrawal. The site lies approximately 350m from the apparent core of the early Roman settlement, which was first discovered when the castle motte was removed in 1833[2](Allies, 1840, p5).

Diglis first occurs in the records as the place name "Dudleg" in 1232. The Frog Brook is known to have occupied a course that took it south of the east side of the city towards its confluence with the River Severn some way below the Diglis Basin. The low lying nature of the land in this area, and the presence of underlying beds of marl make it likely that the Diglis area was a marsh in the early medieval period. Tracing the exact course of the Frog Brook has been made more difficult by the probable existence of multiple braided channels.

Evidence relating to the presence of a mill (Frog mill) in Severn Street in the 15th century also shows that the Frog Brook was dammed and diverted to provide water for a leat[3]. The Mill is known to have been in use in the 17th century, and was still occupied in 1678, but by *circa* 1660 the mill pond had silted up.

Little evidence of medieval occupation has been found in the area, probably due to the low-lying nature of the land and the extended use of the area as

[1] British Geological Survey 1:50000 geological map, Worcester Area, sheet 199
[2] The coins included those of Augustus, Tiberius, Vespasian, Adrian and Antoninus Pius
[3] St. Wulfstan's Hospital account Rolls 1482-3 and 1486-7

pastureland. Place name evidence suggests that the area was in use as pastureland in the 15th century. Diglis is referred to as "meadow called Dudley" in 1490 (Mawer and Stenton 1927, p.163). The meadows at Diglis formed part of the Bishop of Worcester's demesne in the medieval period, and the Prior of Worcester took a rent of £6 from the pastureland in 1535.

In 1815 the Birmingham and Worcester Canal was completed, with the Frog Brook being canalised. The Severn Navigation Weir and Lock, to the south west of Diglis Dock was constructed in 1844. The arrival of the canal meant that the area experienced rapid development, with industrial activity such as porcelain production and associated trades becoming established in the area.

A detailed report pertaining to the archaeological and historical background of the site at the former Brooklyn Ford garage is discussed in the desk-based assessment by Archenfield Archaeology (Sherlock, 2002).

3.0 Project aims and objectives

The aims of the project were: -

- To record the presence of sensitive archaeological material within all the trenches and in the spoil removed during the excavation, and to retrieve any potential dating evidence.
- To make a record of all finds and any environmental material recovered.
- To ensure that if any environmental evidence was preserved, that a sufficient sample be retained to allow for further analysis (normally at least a 10L sample was to be taken and stored in a thick gauge polythene bag, labelled both inside and outside with a permanent marker using a waterproof label).
- To ensure that the location and of the area excavated was accurately recorded on a suitably scaled plan.
- To record negative evidence and to consider its implications.
- To ensure that where important archaeological remains existed, plans for the preservation in-situ of such remains was discussed with the Worcester City Council Archaeologist and the client.
- To ensure that a recording strategy was adopted that allowed for the production of a stratigraphic record of the deposits encountered, and a record of the extent and depth of the excavations.

4.0 Methodology

4.1 Field methodology

The following methodology was employed: -

- A JCB using a toothless bucket was used to excavate the trenches.
- Suitably qualified archaeologists monitored all activity that involved disturbance of the ground surface.
- Initially a watching brief was maintained during the excavation of engineers trial pits on the site to the east of Bath Road. A watching brief of a borehole on the site to the west of Bath Road was maintained by the geoarchaeological specialists (Terra Nova). Two trenches (Trenches 1 and 2) were subsequently excavated on the site to the East of Bath road under archaeological supervision. Three more evaluation trenches were then excavated on the site to the west of Bath Road.
- An assessment of the archaeological significance of finds, structures and deposits was made and appropriate action taken.
- Structures and stratigraphic sequences observed were recorded on scaled drawings and the position of all work disturbing the ground, and any archaeological features, was located on them.
- The presence of artefacts was recorded with a description of type, quantity and original location.
- All descriptions of structures and deposits, photographic records and drawing numbers were recorded on the relevant data capture documents in accordance with Archenfield Archaeology's standard site recording procedures.
- Significant features were, where possible, photographed next to an appropriate scale rule, and a board displaying a unique context number. Each photographic exposure was recorded in the photographic log.
- Staff carrying out the monitoring of the groundwork followed the guidelines laid down in the Archenfield Archaeology Health and Safety Policy.
- Archenfield Archaeology conforms to the Institute of Field Archaeologists' Code of Conduct and code of Approved Practice for the Regulation of Contractual arrangements in Field Archaeology. All projects are, where applicable, carried out in accordance with IFA Standards and Guidance or Draft Standards and Guidance.

4.2 Processing methodology

- All retained artefacts and ecofacts were subjected to further analysis.
- All data were entered into a Microsoft ©Access relational database

5.0 Results

5.1 Stratigraphy

East side of Bath Road; monitoring of Geotechnical test pits and trial trenching

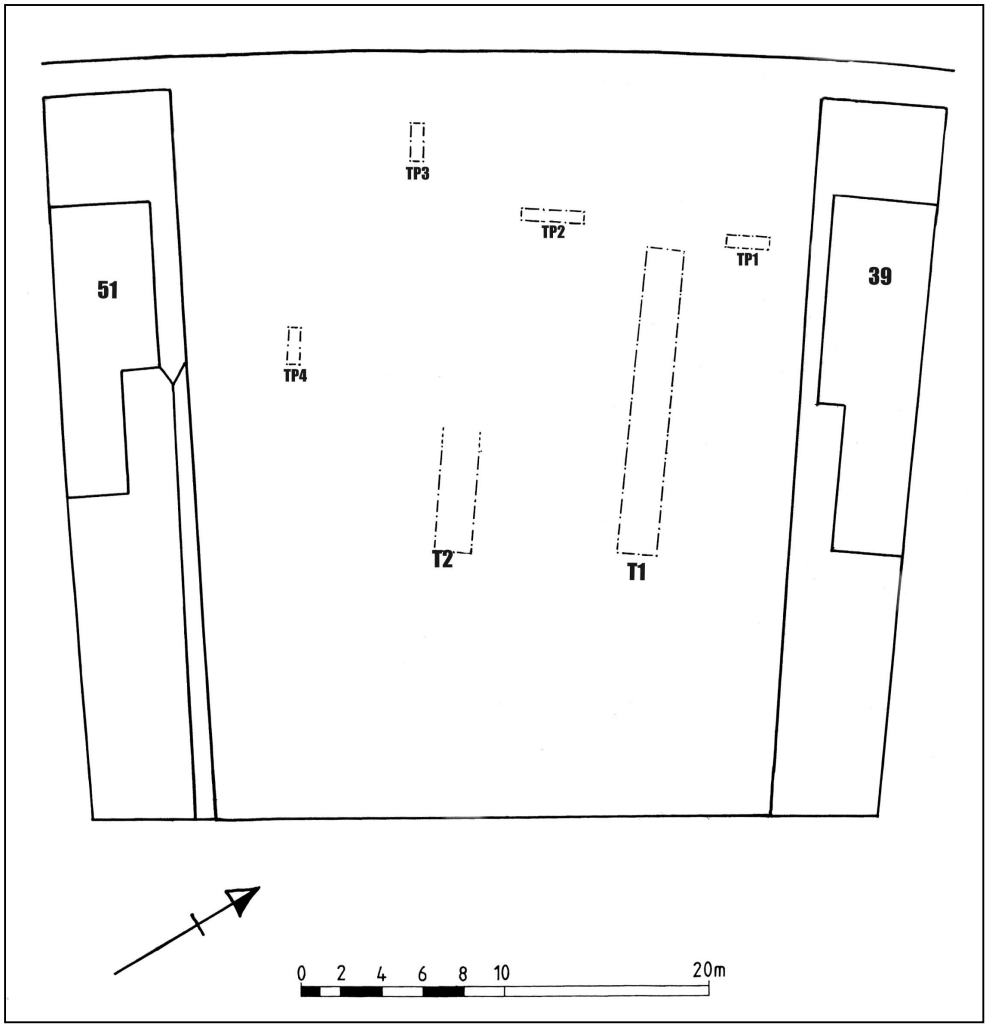


Figure 2: Site plan showing the location of trial pits (TP1-TP4) and evaluation trenches (T1 & T2) on the site on the east side of Bath Road

Initially four geotechnical test pits were monitored.

Test Pit 1 (TP1)

This was located 2 metres from the north-eastern site boundary and 8.7 metres from the line of Bath Road. The dimensions of the first test pit were 2 metres by 0.60 metres. The test pit was excavated to a depth of approximately 2.5 metres consisting of 0.40- 0.50 metres of hardcore, followed by 0.5 metres of extremely mixed dark soil consisting of charcoal, ash, coal and broken brick under which a layer of 0.20 metres thickness of humic matter was observed. This was followed by 1.0 metre of made ground full of ash, flecks of mortar and brick which overlay a cleaner, more clayey soil which was less contaminated at 2.0 metres in depth and

finally onto the top of the red marl at 2.5 metres. During the monitoring no archaeological features were observed.

Test Pit 2

This was situated 11.1 metres from the north-eastern site boundary and 7.9 metres from Bath Road. The dimensions were 3.0 metres by 0.6 metres. A step foundation built out of brick with stone and rubble within the make-up of it occurred just under the make-up of the tarmac and continued until the depth of 1.75 metres beneath the ground level. A similar dark humic mixed soil was encountered with a water strike occurring at the top of the trench. Beneath that a much greyer, crumbly textured silty soil mixed with a high concentration of charcoal, brick and oyster shell. Below this triassic lias with patches of greyer material, possibly alluvium, within it was observed at around 2.0 metres.

Test Pit 3

This was located 3.5 metres from Bath Road and 11.3 metres from the south-western perimeter of the site. The dimensions of this test pit were 2 metres by 0.6 metres. This test pit was different from the other three, since under the tarmac there was no actual hardcore, just ash, brick and mixed rubble. Immediately under this lay a backfill consisting of a loose natural red clayey material, which continued uninterrupted to the base of the pit. No inclusions of brick or pottery were observed. At 3.0 metres the water table was encountered and the pit was backfilled immediately. No archaeological features were encountered.

Test Pit 4

This was 13.4 metres from Bath Road and 5 metres from the south-western boundary of the site. The dimensions were 1.8 metres by 0.6 metres. Red scalping 0.20 metres thick overlaying very mixed made ground full of brick, ash and coal measuring 0.04 metres in thickness was observed. Under this, on the roadside of the trench a brick foundation along with concrete and mixed rubble foundations was encountered running directly across the trench. At the other end beneath the top layer of made ground was a much darker, nearly black layer of humic matter, full of charcoal and flecks of mortar was observed. Underlying this a cleaner mid-brown soil was recorded and at below 2.0 metres the top of red clay/ weathered rock lias was encountered. The pit was stopped at 2.5 metres.

Trench 1

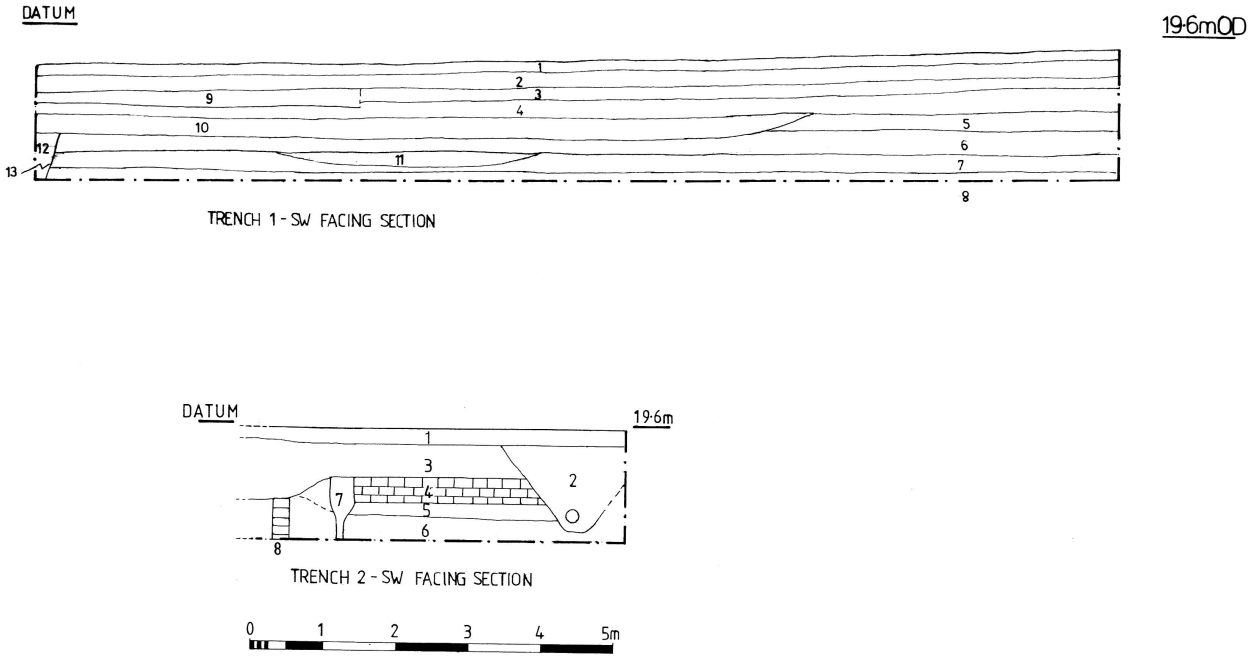


Figure 3: The south-west sections of trenches 1 (above) and 2 (below)

Trench 1 was aligned south-west to north-east and was located to the north-west end of the site. The trench measured 15 metres by 1.8 metres. The slope of the ground was 0.43 metres from the south-west to the north-east.

The surface was composed of tarmac and red scalpings (context 1) along the entire length of the trench and to a thickness of 0.15 metres. Directly below this along the length of the trench lay mid red-brown chippings (context 2) which was 0.25 metres thick. Neither context 1 or 2 contained any artefacts.

Context 3 comprised of dark greyish/ black humic silt 0.15 metres in depth and consisted of *circa* 50% rubble. Cut into this layer at the north-western end of the trench was context 9, which represented a demolition layer containing sand, ceramic building material (brick or tile) and mortar. Situated below this (context 4) was made up of reddish/ grey silty clay that contained traces of CBM (ceramic building material) and mortar, with lenses of burnt material, context 4 was 0.20 metres thick across the entire trench. Within context 4 there was a layer of CBM and burnt material (context 10) at the north-west end of the trench that produced pottery, glass and a corroded metal object. A layer of red/pink clay (context 5) was located below this along the length of the trench, consisting of *circa* 20% gravels, occasional lumps of ceramic building material and decaying grey mudstone 0.25 metres thick. No features or artefacts were encountered during this time. Below this context was a layer of reddish/ grey clay silt (context 6) that contained coal, charcoal and mortar which was 0.28 metres thick.

Cut into context 6 was a further layer (context 11) largely consisting of decayed lime mortar and red sandstone chippings. Context 11 produced a number of finds including mortar, corroded nails, pieces of stone floor tile, ceramic roof tiles, glass and pottery. Context 11 was situated at the north-western end of the trench and was 0.30 metres thick. It appeared that this context represented a spread of post

medieval building material, deposited in one episode, that was filling shallow depression approximately 2.5 metres wide. Abutting context 11 was context 7, which continued to the south-eastern end of the trench. Context 7 consisted of pale yellowish/ brown gritty silt which was 0.12 metres thick, that produced ceramics and a clay pipe stem. A post hole (context 14 [fill] and 15 [cut] was encountered within this context measuring 300 mm in diameter and was situated 4.45 meters from the south-eastern end of the trench, however, no artefacts were observed.

Context 7 merged with the horizon below (context 8) comprising of mid-pink clay silt. At the north-western end of the trench a pit was encountered (context 12 [fill]) and 13 [cut]). The pit produced a floor tile and a soil sample (no. 1) was also taken. The dimensions of the pit were observed in the northern and eastern sections of the trench. Excavation was stopped at approximately 1.5 metres (17.84 OD).

Trench 2

Trench 2 was situated 6 metres to the west of Trench 1, and was located on the same alignment, south-west to north-east. The trench measured 10 metres by 1.8 metres. The slope of the ground was 0.49 metres from the north-east to south-west.

The surface was composed of tarmac and red scalpings (context 1) along the entire length of the trench and to a thickness of 0.22 metres. At the southern end of the trench a cut for a sewer pipe was encountered 1.70 metres in from the south section wall (context 2). The thickness of the cut was measured to be 1.26 metres to the top of the pipeline. The cut was roughly triangular in shape. Abutting this (context 3) was a three-course wall, which began 1.2 metres from the southern section wall and measured 0.82 metres at the top and 1.05 metres at the bottom. On top of context 3 there was a demolition layer (context 4) consisting of burnt material and ceramic building material. The thickness of this layer was 0.44 metres. Below context 3 was a layer of concrete (context 5) with a thickness of 0.16 metres. Context 6 comprised of 0.20 metres of reddish/ brown clay silt and was located below context 5.

A toilet block was encountered 3 metres from the southern end of the trench (context 7) and was located within the concrete of context 5, measuring 0.70 metres in thickness. This formed the foundation of the toilet block, which the sewer pipe was serving.

A brick wall was observed 4.3 metres from the southern section wall, (context 8) with a thickness of 0.80 metres. Beyond this wall a deep cellar was encountered, with surviving wooden door posts as well as the remnants of a brick stairwell. The trench was backfilled with a mixture of building rubble, mortar which was very loose and began to collapse as soon as the trench was excavated. Trench 2 was subsequently abandoned. At the south-eastern end the trench was excavated to a depth of 1.64 metres (17.95 OD).

West side of Bath Road, trial trenching and borehole survey

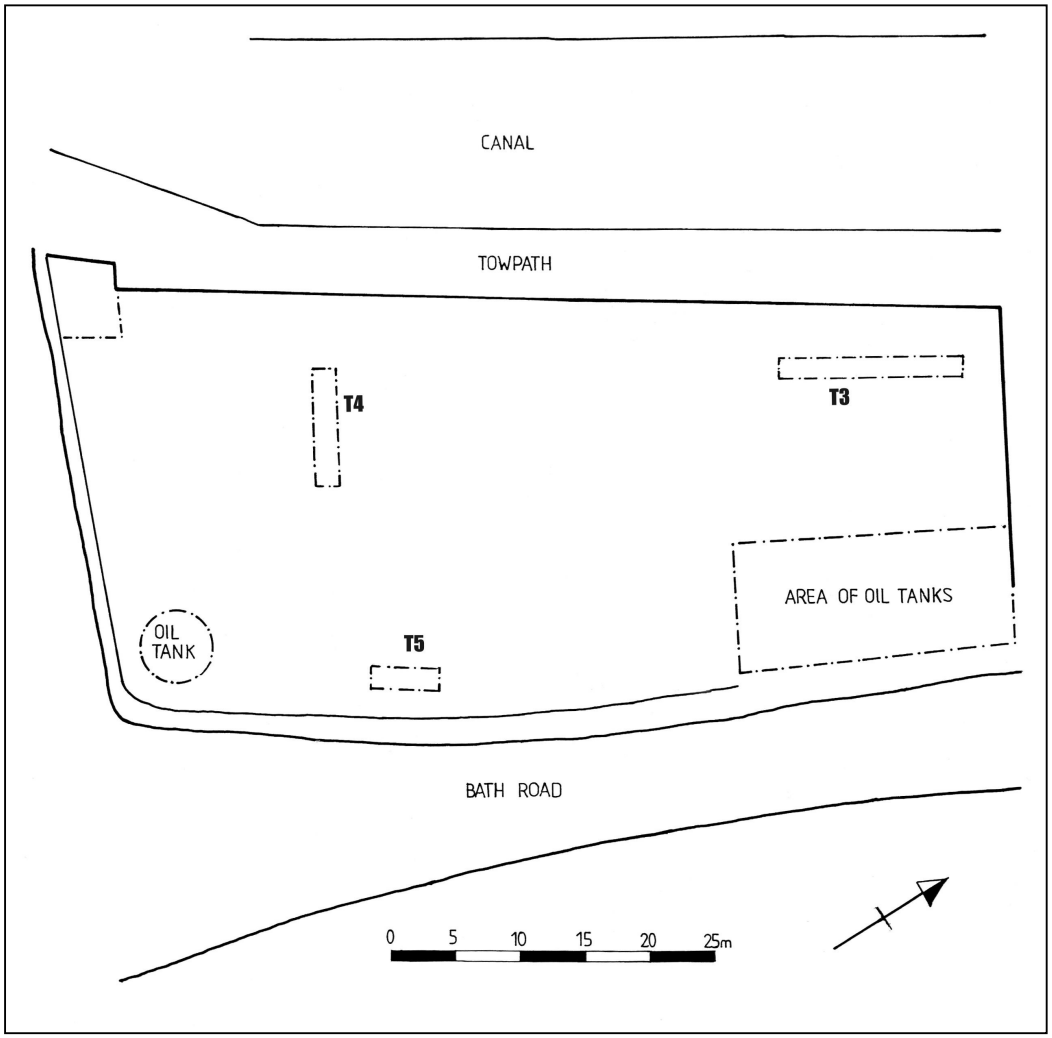


Figure 4: Site plan showing location of boreholes (BH1 & BH2) and trial trenches (T3-T5) located on the west side of Bath Road

Trench 3

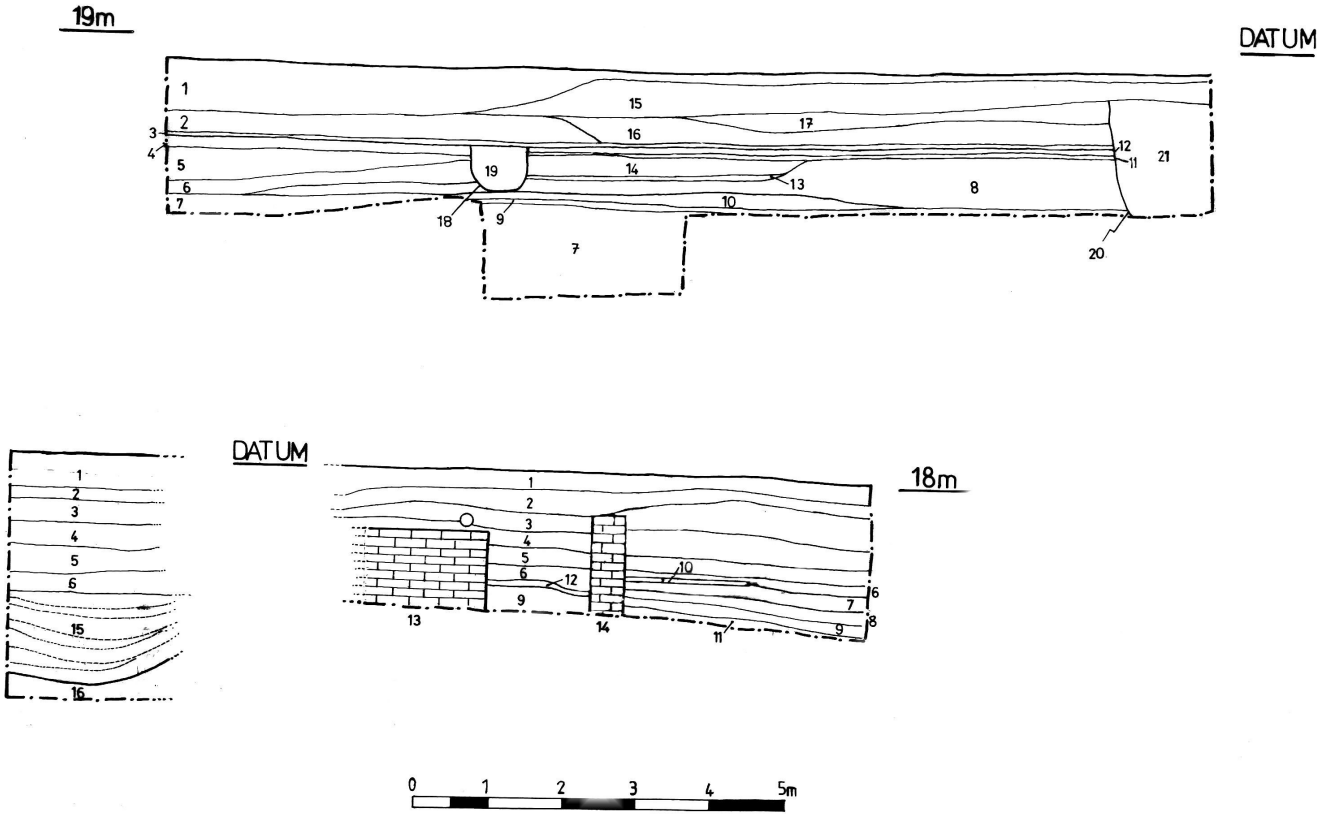


Figure 5: Top, trench 3, north-west facing section, bottom left trench 4 south eastern end of the north-east section and bottom right trench 4 south-west section

Trench 3 was aligned north-east south west parallel to the canal and was 15 metres by 2 metres. Due to the extremely loose and unstable nature of the overburden, some of which had only been very recently deposited following demolition of the garage buildings, the trench was excavated to a depth of 2 metres (17.13 OD) and then stepped down to a depth of 3 metres (16.67 OD) in the central portion of the trench. This was done to allow the lower undisturbed layers to be properly examined.

A very loose, mixed layer (1) consisting of material deposited as a result of Post-Medieval pottery manufacture dumping within a matrix of dark blackish-brown gritty/sandy –coal/burnt material, including moderate flecks and fragments of CBM and occasional lumps of slag. This lay partially over a dark grey-brown gritty humic silt layer (2), which had occasional inclusions of small rounded pebbles and flecks and fragments of CBM and mortar. Layer 1 also overlay a band of pinkish-red gravelly silt plus occasional flecks and fragments of CBM and mortar (15). This in turn overlay a loose layer (17) consisting of CBM, slate and mortar, which was over a layer of dark grey-brown gritty humic silt (16) which contained frequent flecks and fragments of CBM, slate and mortar, and occasional slag.

Two thin, highly compacted layers appeared to extend across the entire length of the trench; layer 3, which consisted of a mixture of pinkish-red silty clay, cinders/ash and building rubble and immediately below this layer 4 (coal dust plus occasional mortar flecks). Layer 4 lay over layer 5 (pinkish-red gravelly-silt plus moderate flecks of coal, CBM and mortar), layer 14 (CBM and slate fragments within matrix of mortar) and layer 8 (pinkish-red gravelly silt plus occasional flecks

of CBM and mortar). On closer examination layer 4 was cut by a pit, 18, which had a very loose fill consisting of mid brown humic silt and frequent fragments of degraded metal, plus (post-med) pottery and miscellaneous rubbish. Extending across the remainder of the trench at this level were layers 12 (mixture of CBM, mortar slate, coal, charcoal and slag) and 11(coal dust plus *circa* 20% CBM, mortar and slate). At the northern end of the trench a large pit (20) was evident, which cut layers 17, 16, 12, and 8. This feature was at least 1.4 metres wide and 1.6 metres deep. The base of this feature was not excavated. Pit 20 contained context 21, a fill comprising loose sandy silt plus frequent fragments of CBM, slate and mortar, and moderate flecks and fragments of coal/charcoal, metal and pottery of later post medieval date. At about 2 metres along the whole of the trench a layer of alluvial silt (context 7 mid grey-brown humic silt plus occasional fragment of charcoal and CBM/pot) was present. This became progressively freer of contamination and appeared to be free of all inclusions of charcoal, pot or other material below a depth of 3 metres.

None of the material recovered from this trench appears to be earlier than nineteenth century in origin. The presence of large amounts of pottery kiln waste and layers of compacted coal dust and slag reflect what is known from contemporary cartographic evidence about the use of the site from that period (Sherlock 2002).

Trench 4

Trench 4 was aligned east-west and was 15 metres by 2 metres. As with trench 3 the top 300 mm was formed by a very loose layer (1) of recent building demolition debris mixed with pottery manufacturing waste within matrix of dark brown gritty silt and coal/charcoal. This overlay a compact layer (2) of pinkish-red gravelly silt with occasional fragments of coal and CBM. A well defined layer of compacted dark brown/black gravelly humic silt plus moderate flecks of CBM (3) was over a layer of indurated dark brown gravelly silt plus abundant slag (4). Two brick features were found in a relatively good condition, one having 17 courses (13, aligned north east/south-west and running back into the section) and a brick wall (14) with at least twelve courses extant. 14 ran at a right angle to the trench. 13 and 14 are co-axial, and seemingly related. These two features possibly formed the outside perimeter of a building. Wall 14 was aligned roughly east-west and was visible in the western section of the trench.

Plate 1: The brick surface (8) in trench 4

Immediately to the west of feature 13 a laid surface consisting of stone flags (10) laid on a bed of crushed brick, sand and ash (11) extending across the width of the trench was encountered. The flags were approximately 0.5 metres by 0.8 metres and had accretions of very compacted coal dust adhering to their upper surface. Beneath the flags and the make up layer associated with them, a well-preserved brick surface (8) was found that extended across the entire width of the trench (see plate 1). These were laid in a mortar matrix and lay directly over a layer consisting of red clay.

At the eastern end of trench 4, visible only in the north-eastern section, identical layers of dumped material alternated but were found to have well defined layers of sawdust (15) with interleaving layers of grey alluvial material. This continued down to a depth of approximately 3 metres. Beneath this lay a bed of cohesive mid grey-brown humic silt, with occasional charcoal flecks (16). The decayed remains of timber planking was visible within the alternating sawdust/ clay fill of this feature, and these may have formed the lining of a structure, possibly a sawpit.

The features encountered in this trench are also consistent with the pattern of use that might be expected from the cartographic evidence which shows that coal merchants, a carpenter and a timber yard were operating in the area from the 1840s.

Trench 5

Trench 5 was positioned as close as possible to the street frontage of the site, running parallel to Bath Road. The ground across the front portion of the site had been greatly disturbed by the removal of buried fuel tanks and the removal of contaminated ground. This fact, coupled with the presence of live services in the area meant that it was only possible to excavate trench 5 to a total length of 5 metres long and 1.8 metres wide. Trench 5 was excavated to a depth of 1.5 metres (16.99 OD).

Beneath the demolition debris (1), which covered the whole site, lay a make-up layer consisting of pinkish-red gravelly clay with silt (2) which in turn overlay a reddish grey clay with silt subsoil (3). No archaeological features or deposits were seen.

5.2 The geoarchaeological survey

By David Jordan, Terra Nova

Summary

Deposits studied at a site on Bath Road, Diglis, Worcester were found to consist of an accumulation of alluvium overlying bedrock and overlain by a greater depth of made-ground. The lower alluvium was probably deposited gradually in stable, wet conditions and may preserve pollen and other evidence by which the environmental history of the valley floor might be reconstructed. It is unlikely, however, that the sequence of environmental development could be dated since the deposits do not contain material on which dating could be reliably carried out.

Aims of the study

This study aimed to clarify the origins of deposits recovered from a site at Bath Road, Diglis, Worcester and assess their potential to provide geoarchaeological and palaeoenvironmental evidence in response to a brief issued by Worcester City Museum Archaeology Section (Brief 02/37).

Background

The deposits of the Frog Brook valley, in which the site lies, may be of archaeological and palaeoenvironmental significance both in themselves and in the evidence that they might preserve. The valley lies close to the centre of the historic town and, in accumulating sediments from its catchment and from the river Severn, may have also accumulated human occupation debris representing urban development.

We do not have accurate maps which show the location of the site in relation to the topography of the valley before it was greatly altered by 19th century development. The geological 1:50000 map (BGS, 1993) and modern topography, however, suggest that the site sits near the middle of the former valley and may overlie deep alluvium. The geological map shows alluvial deposits overlying rocks of the Triassic Eldersfield Mudstone Formation.

The Frog Brook is thought to have developed as a Late Devensian river channel. It has been used as part of the city defences and, later, as the town ditch. The valley is known to have been prone to flooding as water from the River Severn ponded headwards during floods from pinchpoints downstream at Callow End and Cliffey Wood (Morris, 1974). Thus the Frog Brook basin deposits might record the changing flood regime of the river Severn at Worcester through the Holocene as well as that of the Frog Brook itself.

These backwater alluvia have the potential to preserve excellent sedimentary evidence in an environment dominated by slow water movement and minimal erosion. This also means that there is the potential for the survival of well contexted archaeological and environmental evidence in the alluvium and former ground surfaces of the Frog Brook valley, through waterlogging and accumulation.

Previous studies of the Frog Brook alluvia (Terra Nova 2000, 2002) have not encountered deep deposits and the potential for a sedimentary record incorporating archaeological evidence is yet to be realised.

The natural soils

The natural soils of the site have not been mapped but those of nearby valleys, similar to that of the Frog Brook, are Pelo-alluvial gleys of the Compton series. These are mottled soils of moderately good drainage which are periodically waterlogged by a fluctuating ground water table (SSEW, 1986).

Method

The site had undergone a geotechnical borehole and test-pit investigation, before our own fieldwork, the results of which suggested the presence of deep artificial deposits (made ground) which posed problems of investigation and of site safety. The test pits and bores suggested that the north and eastern side of the site did not overlie Holocene alluvium. A bore at the north-east corner (WS2) identified sand and gravel at 0.6m which might have been redeposited material overlying alluvium but, from pits and borehole records nearby, appeared suggest more likely to be a natural, Devensian terrace deposit. Test pit SG2 on the north-west corner of the site identified blue grey sandy clay at 1.7 m which may have been natural alluvium as may that identified at 3.9m by pit SG3. Bore WS1 identified alluvium at 3.7m and, from SPT data it is inferred that the Mudstone bedrock lay at about 5 m.

We were significantly hampered, in analysing the geotechnical data, by the lack of absolute heights OD for the tops of the pits and bores which made it difficult to relate the records to each other and to the surrounding area. The varying deposit records and depths of made ground may indicate, however, that some soil (potentially including alluvium) may have been removed from the site and, subsequently, replaced with mixed make-up layers during the development of the area. It seemed possible, therefore, that the site did not contain any continuous alluvial deposits and that any, apparently natural, sequence of deposits should be interpreted with care.

We originally planned an attempt to recover samples from any buried alluvium using a narrow percussion window corer in two locations in the south western part of the site where the existing records suggest that we have the greatest chance of success.

We found, however, that the deep excavations that this would have required were made impossible by the dangerously loose, deep made ground. Deposits being recovered by a much larger diameter shell-and-auger percussion borehole in the south-western corner of the site showed that a single, deep sequence of intact deposits might be recovered in this way using U100 core sample tubes. The core being carried out at the time recovered good evidence that there was, indeed, a sequence of alluvial deposits beneath the made-ground.

We therefore changed our plans and carried out a further shell-and-auger core which recovered a complete sequence of intact samples in 10cm diameter plastic tubes from 2.5 to bedrock at 7.4 metres below the ground surface.

We observed the excavation of trial pits to the east of Bath Road. These showed that the bedrock there is much shallower and that mudstone, probably disturbed by periglacial mixing and solifluction, lies at only 2 metres from the modern ground surfaces and shallows rapidly uphill to the east. The rock and periglacial deposits are here overlain by a deep, natural soil profile which appeared to be formed in natural colluvium. Above and cut into this was a sequence of apparently natural archaeological deposits and more recent dumps of debris. The buried soil and artificial deposits above showed signs of prolonged waterlogging due to impeded drainage and the rise of groundwater in the valley bottom. This was much less pronounced, however, than in the deposits from the boreholes to the west, closer to the centre of the valley and the course of the former Brook itself.

Observations

The deposits recovered as intact U100 tube samples were examined in the laboratory. They consisted of a sequence of mostly clayey deposits from the base of the industrial-debris made ground to the late Devensian gravel deposits at about 7 metres. It was striking that this sequence differed considerably from that which we originally observed only 1 metre to the west.

We observed nine well-defined strata, which are described in the Appendix using criteria adapted from Avery (1980) and Jones et al. (1999). The sequence broadly consists of :

1 Bedrock, with a disturbed upper surface, overlain by 0.75m of gravel and sandy deposits. The gravel and sand were moderately well sorted and appear to have been deposited from fast-moving water, most probably under late Devensian conditions

2 0.75m of mid-grey clay, sandy at the base and increasingly tinged blue towards the top. There were abundant fine former root pores within this deposit, concentrated towards the upper surface, and filled with darker and apparently more organic fine matter within a reduced matrix. There was, however, no trace of the former ground surface from which the roots and the dark, fine matter had descended.

3 1.2 metres of clayey deposits, a strong red-brown and slightly stony at the base becoming mid-grey towards the top. This deposit also had abundant former root pores descending from above its upper surface, containing a reduced blue-grey clay.

4 2.0 metres of mid-grey clay containing small fragments of ceramics becoming larger and more abundant towards the surface. This deposit also contained a few small fragments of wood as well as ash and charcoal which became dominant, mixed with red-brown clay, at the surface.

Above this was a further 2.5 metres of dark, ashy, stony made-ground to the modern surface.

These four zones of deposit appear to have formed in quite separate phases of deposition and represent different periods of change and stability in the Frog Brook valley.

Deposit 1 represents the decay and mixing of the bedrock surface under Devensian periglacial conditions, followed by alluviation from energetic stream-flow, most probably in the late Devensian or very early Holocene.

The clayey deposit 2 above appears to be entirely natural and represents gradual alluvial accretion in a low-energy, slow-flowing stream environment during the Holocene. The upper surface of this deposit has been truncated but it is very difficult to estimate how much has been lost. No surface, from which soil development has taken place, survives and the remaining deposits appear to represent only the lower part of a soil profile into which deep roots have penetrated. Thus at least 50cm or so is likely to be missing. It is possible, however, that even more has been removed since the deposit is likely to have accumulated gradually over a long period of time and the root pores found within it may have formed from surfaces which were subsequently buried by further accumulation. In such deposit former periods of stability may be represented by an increase in root density but further alluviation may still have added a considerable depth of deposit above.

The lower part of deposit 3 consists of largely unaltered material derived from the bedrock surface and is unlikely to have been deposited naturally, unless by a slump from the slope above – though in this case we might expect to find some more organic soil matter mixed into the deposit, which is not the case. The deposit is very slightly sorted, suggesting that it was deposited in moving water, and the increasingly grey clay above probably represents gradual accumulation of further stream alluvium and the reworking of the material beneath over a long period. There must have been sufficient periods of stability on the valley floor for further rooting to develop and, therefore, for a soil profile to form. This profile, however, appears also to have been truncated before the overlying deposits accumulated.

Deposit 4 is unstructured and consists of a mixture of clay and occupation debris which appears to have been deposited in a few, brief episodes. There is little evidence of subsequent reworking and it appears more likely that the deposit became sealed by further, overlying deposits which prevented the development of a soil profile.

The made-ground above is of entirely artificial origin and consist largely of industrial debris unaltered by further weathering.

Magnetic susceptibility measurements made on the cores support these conclusions. Deposits 1 and 2 and the lower part of deposit 3 show only low values with a maximum of 10 SI at the top of deposit 2 – a normal value for a natural material with some soil formation given the mineralogy of the deposit parent material. The upper part of deposit 3 and the whole of deposit 4 show higher values rising to more than 200 SI at the top of deposit 4. This is what we would expect of deposits derived in part from industrial and occupation debris and also shows the gradual increase in the proportion of debris which makes up the deposits towards the surface as well as the abrupt change in mineralogy and deposit source at each successive boundary.

Discussion and conclusions

Of these deposits only 1 and 2 are likely to have accumulated naturally and to contain palaeoenvironmental evidence which may be used to create a reliable understanding of the development of the valley floor. All the strata above are probably derived from elsewhere and deposited by human activity. They do contain evidence for some gradual accumulation and reworking under natural conditions but this will have taken place within derived material and it will probably not be possible to separate that environmental evidence which is genuinely informative from that which is derived and thus misleading.

The lower deposits, 1 and 2, can give us some useful palaeoenvironmental information. We note, in particular, that deposit 2 represents gradual alluvial accumulation under waterlogged conditions and that pollen and other evidence may survive within it. The mineral matter of the deposit, however, does not preserve any useful evidence of the sedimentary regime since the deposit accumulated gradually and has been heavily reworked by roots and soil fauna. Thus individual episodes of flooding and the development of the river regime is not represented stratigraphically. The deposits appear to have remained waterlogged for almost all of the time since they accumulated since they show no sign of soil structure formation, drying cracks or the movement of sesquioxides to form mottles.

To sum up – the Mudstone bedrock is weathered and appears to have been broken-up and disturbed, most probably under Devensian periglacial conditions. Gravel and then sand were deposited from flowing water in the later Devensian and the stream flow gradually reduced as vegetation stabilised in the early

Holocene. It is likely that the stream rationalised into a single, stable channel during the Mesolithic and that the site had a wet soil subject to regular inundation from the river Severn and from the Frog Brook itself. We found no peat but it is possible that peat beds developed under very wet conditions nearby. We cannot say for certain when the overlying layers were deposited on the site although we can guess at the activity which they represent. Historic maps suggest that the site was only developed in the post-Medieval period and it is therefore likely that deposit 2 represents alluvium which accumulated continuously from the beginning of the Holocene to this time. We lack, however, any material from deposits 1 and 2 which is suitable for radiocarbon or other forms of physical dating and it may therefore be impossible to assess when deposition occurred.

Further evaluation of pollen and diatoms is likely to be worthwhile but no reliable plant macroscopic remains, mollusc or insect remains were noted in the deposit despite careful preparation.

The Location of the borehole

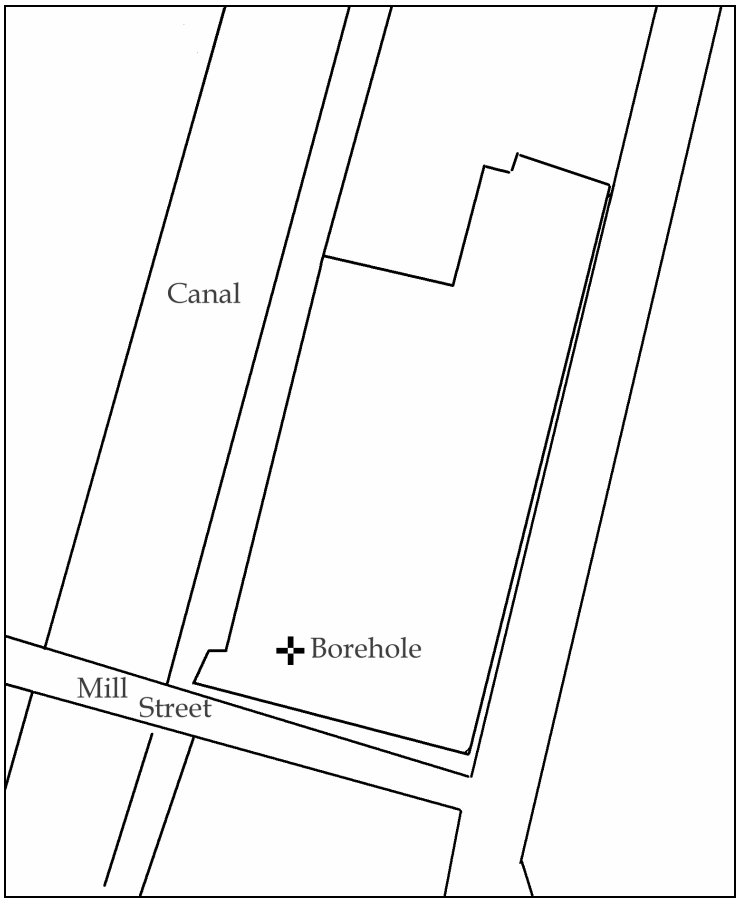


Figure 6: Plan showing the location of the borehole.

5.3 Pottery

A total of 32 sherds were recovered from the two trenches, of which all were recovered from stratified contexts. The overwhelming bulk of the material was of the later post medieval period, consisting of pearl wares, transfer printed blue and white wares. One sherd of 17th century slipware was also recovered from context 7 (Trench 1). The small size of the assemblage makes a more detailed study of the assemblage unlikely to yield much further information.

5.4 Environmental evidence

As all the excavated features were post-medieval, no processing of soil samples has yet been undertaken. However, a sample of the bottom fill, 12, of pit 13 (trench 1) was retained and forms part of the archive.

6.0 Conclusions

The archaeological evaluation and the geoarchaeological study largely confirm the cartographic and documentary evidence. The site is known to be in a low lying area that once formed the valley of the Frog Brook. The geoarchaeological samples show that the alluvial deposits present at depth below the heavily disturbed upper layers do consist of alluvial material that was probably deposited as a natural result of the development of the valley floor. They represent a complete sequence of gradual accumulation from the Holocene until the development of the canal and site for industrial and trade purposes. These deposits were formed under waterlogged conditions and the survival of valuable diatom, pollen and plant macro fossil evidence within them was shown to be high. The possible presence of beds of peat in other areas of the site that were not examined should also be noted. It was not possible to recover samples from the lower alluvial levels with sufficient quantities of datable material to allow a radio carbon 14 dating of this sequence to be made.

The monitoring of the engineers trial pits and the archaeological evaluation showed that much of the site (on both sides of Bath Road) has been disturbed by development in the nineteenth and early twentieth centuries. Much of the upper ground levels to the west side of Bath Road were shown to have been made up of dumped material, kiln and ash waste from the pottery industry, demolition rubble and layers of compressed coal and ash and other industrial material. Features relating to the use of the site as coal and timber yards were identified.

The lack of any evidence of any prehistoric, Roman or medieval occupation of the site may be as a result of the widespread disturbance, but probably reflects the cartographic evidence which points to the area having remained in use solely as pasture land until after the canal was completed. No evidence of Civil War defensive works was found. On the east side of Bath Road some evidence relating to the occupation of the site in the seventeenth to eighteenth centuries was preserved in the form of a pit and a spread of mortar and other material from a demolished building, close to the line of Bath Road.

7.0 Archive deposition

The primary project archive, consisting of the excavated material and any original paper records, will be prepared and stored in accordance with the guidelines laid down in the Institute of Field Archaeologists' guidelines for the preparation and storage of archives. The primary archive will be stored with Worcester City Museum.

A copy of the digital archive, stored on CD and consisting of context, artefact and ecofact data, together with the site plan and selected photographs, will accompany the primary archive.

The client, in consultation with the project manager, will make provision for the deposition of all finds from the excavation with the Worcester City Museum. On completion of the fieldwork and the processing, collation, recording and analysis of the finds from the excavation all finds will be handed over to the museum staff, along with the project archive. Arrangements will be made with the museum for the transfer of title.

8.0 Publication and dissemination proposals

Paper copies of this report will be lodged with the Archaeological Adviser to Worcester City Council Archaeological Service, Worcester City Sites and Monuments Record and Worcester City Library.

CDs of this report, together with the supporting archival material will be available from Archenfield Archaeology.

Archenfield Archaeology will retain the complete photographic record, including the negatives.

Appendices

Appendix 1: notes relating to the geoarchaeology survey

A note on the identification of environmental evidence.

This report is the result of a geoarchaeological study of the mineral and organic deposits and soils. In the course of examining the deposits pollen, diatoms, and other forms of environmental evidence are occasionally found and recorded. However, the samples have not been prepared specifically for the recovery of these materials and no attempt at species identification has been made. This report is not intended to be, and should not be used as, a substitute for full pollen, diatom and other environmental assessments made by suitably qualified specialists. The aim of this report is rather to comment on the nature of the deposits themselves and as contexts for the survival of archaeological and environmental information, to provide relevant information to the other specialists.

The Meaning of Magnetic Susceptibility

Magnetic susceptibility[4] (χ is a measure of the degree to which a material will become magnetised in the presence of an external magnetic field. The magnetic susceptibility of many natural soils increases slightly towards the surface. This is the Le Borgne effect (Le Borgne, 1955) and is probably caused by slight changes in magnetic mineralogy caused by the greater availability of oxygen at the surface.

Burnt soil material, domestic debris and ceramics typically have high magnetic susceptibilities. Ferrous metals have susceptibilities which are even higher. The degree to which an archaeological or natural deposit is contaminated with these materials can be determined by measuring its susceptibility, either in the field, using a small, portable detector, or under more controlled conditions in the laboratory.

Laboratory instruments also allow us to calculate the frequency dependence (fd) of the susceptibility. This is a measure of the percentage difference between the susceptibility of a sample to magnetic fields which are alternated at two different frequencies, 0.465 and 4.65 KHz – known as low frequency (lf) and high frequency (hf) respectively. Samples containing magnetic minerals of different types show different χ_{fd} values – although the interpretation of these differences is, as yet, a matter of debate.

It is thought that very fine magnetic particles, derived from burning and soil formation, alter the magnetic susceptibility of samples in a way which alters with the frequency of the inducing field.

Simple studies of the relationship between particle size, particle type and susceptibility can often help us to understand how the magnetic properties of archaeological deposits arise. Such studies are easily achieved during excavation projects and may prove a valuable part of future excavation practice, especially on urban sites.

4 The use of magnetic susceptibility measurements is discussed in Walden, J., Oldfield, F., and Smith, J. (1999) Environmental magnetism: a practical guide. Quaternary Research Association, technical guide no. 6, London, pp.243.

Appendix 2: Geoarchaeological sample descriptions

Sample code ***1.1*** **Type** *pit sample core sample* **Depth** *7.2m+*
Depth of LB ***Not seen***

Colour: ***1*** *red brown yellow grey blue pink* ***2*** *v.light light medium dark v.dark* ***3*** *weak strong*

Texture: clay silty clay sandy clay clay loam silty clay loam sandy clay loam loam silt loam sand loam loamy sand sand

Struct: **1** Gran AB sAB Prism Platy Aped / F M L / strong weak **2** Gran AB sAB Prism Platy Aped / F M L / strong weak

Wetness dry moist wet very wet

Organic matter: non-humic slight mod-humic very-humic organic **Inclusions:** none or type: _____

Redoximorphism: *none mottles concretions depletions* ***Sedimentary Structure****: none or type:* ***Rock strata***

Stones: none few common abundant **Lower boundary** not seen **or** diffuse gradual clear abrupt sharp

Other comments _____

Sample code ***2.1*** **Type** *pit sample core sample* **Depth** *6.7*
Depth of LB ***7.2***

Colour: ***1*** *red brown yellow grey blue pink* ***2*** *v.light light medium dark v.dark* ***3*** *weak strong*

Texture: clay silty clay sandy clay clay loam silty clay loam sandy clay loam loam silt loam sand loam loamy sand sand

Struct: **1** Gran AB sAB Prism Platy Aped / F M L / strong weak **2** Gran AB sAB Prism Platy Aped / F M L / strong weak

Wetness dry moist wet very wet

Organic matter: non-humic slight mod-humic very-humic organic **Inclusions:** none or type: Abundant gravel

Redoximorphism: *none mottles concretions depletions* ***Sedimentary Structure****: none or type:* *Slightly horizontal*

Stones: none few common abundant **Lower boundary** not seen **or** diffuse gradual clear abrupt sharp

Other comments _____

Sample code ***2.2*** **Type** *pit sample core sample* **Depth** *6.45*
Depth of LB *6.7*

Colour: ***1*** *red brown yellow grey blue pink* ***2*** *v.light light medium dark v.dark* ***3*** *weak strong*

Texture: clay silty clay sandy clay clay loam silty clay loam sandy clay loam loam silt loam sand loam loamy sand sand
Struct: **1** Gran AB sAB Prism Platy Aped / F M L / strong weak **2** Gran AB sAB Prism Platy Aped / F M L / strong weak

Wetness dry moist wet very wet
Organic matter: non-humic slight mod-humic very-humic organic **Inclusions:** none or type: _____

Redoximorphism: *none mottles concretions depletions* ***Sedimentary Structure****: none or type:* *Slightly horizontal*

Stones: none few common abundant **Lower boundary** not seen **or** diffuse gradual clear abrupt sharp

Other comments

Sample code ***2.3*** ***Type*** *pit sample core sample* ***Depth*** *5.7*
Depth of LB *6.45*

Colour: ***1*** *red brown yellow grey blue pink* ***2*** *v.light light medium dark v.dark* ***3*** *weak strong*

Texture: clay silty clay sandy clay clay loam silty clay loam sandy clay loam loam silt loam sand loam loamy sand sand

Struct: **1** Gran AB sAB Prism Platy Aped / F M L / strong weak **2** Gran AB sAB Prism Platy Aped / F M L / strong weak

Wetness dry moist wet very wet

Organic matter: non-humic slight mod-humic very-humic organic **Inclusions:** none or type: occasional organic flecks

Redoximorphism: *none mottles concretions depletions* ***Sedimentary Structure****: none or type: slightly horizontal*

Stones: none few common abundant **Lower boundary** not seen **or** diffuse gradual clear abrupt sharp

Other comments

Sample code ***3.1*** ***Type*** *pit sample core sample* ***Depth*** *4.9*
Depth of LB *5.7*

Colour: ***1*** *red brown yellow grey blue pink* ***2*** *v.light light medium dark v.dark* ***3*** *weak strong*

Texture: clay silty clay sandy clay clay loam silty clay loam sandy clay loam loam silt loam sand loam loamy sand sand

Struct: **1** Gran AB sAB Prism Platy Aped / F M L / strong weak **2** Gran AB sAB Prism Platy Aped / F M L / strong weak

Wetness dry moist wet very wet

Organic matter: non-humic slight mod-humic very-humic organic **Inclusions:** none or type:

Redoximorphism: *none mottles concretions depletions* ***Sedimentary Structure****: none or type: slightly horizontal*

Stones: none few common abundant **Lower boundary** not seen **or** diffuse gradual clear abrupt sharp

Other comments

Sample code ***3.2*** ***Type*** *pit sample core sample* ***Depth*** *4.5*
Depth of LB *4.9*

Colour: ***1*** *red brown yellow grey blue pink* ***2*** *v.light light medium dark v.dark* ***3*** *weak strong*

Texture: clay silty clay sandy clay clay loam silty clay loam sandy clay loam loam silt loam sand loam loamy sand sand

Struct: **1** Gran AB sAB Prism Platy Aped / F M L / strong weak **2** Gran AB sAB Prism Platy Aped / F M L / strong weak

Wetness dry moist wet very wet

Organic matter: non-humic slight mod-humic very-humic organic **Inclusions:** none or type: peaty and thin humified organic lenses

Redoximorphism: *none mottles concretions depletions* ***Sedimentary Structure****: none or type: slightly horizontal structure*

Stones: none few common abundant **Lower boundary** not seen **or** diffuse gradual clear abrupt sharp
Other comments **abundant roots**

Sample code ***4.1*** ***Type*** *pit sample core sample* ***Depth*** *3.7*
Depth of LB *4.5*

Colour: ***1*** *red brown yellow grey blue pink* ***2*** *v.light light medium dark v.dark* ***3*** *weak strong*

Texture: clay silty clay sandy clay clay loam silty clay loam sandy clay loam loam silt loam sand loam loamy sand sand

Struct: **1** Gran AB sAB Prism Platy Aped / F M L / strong weak **2** Gran AB sAB Prism Platy Aped / F M L / strong weak

Wetness dry moist wet very wet

Organic matter: non-humic slight mod-humic very-humic organic **Inclusions:** none or type: twiggy and peaty organic fragments
Redoximorphism: *none mottles concretions depletions* ***Sedimentary Structure****: none or type:*

Stones: none few common abundant **Lower boundary** not seen **or** diffuse gradual clear abrupt sharp

Other comments

Sample code ***4.2*** ***Type*** *pit sample core sample* ***Depth*** *2.60*
Depth of LB *3.70*

Colour: ***1*** *red brown yellow grey blue pink* ***2*** *v.light light medium dark v.dark* ***3*** *weak strong*

Texture: clay silty clay sandy clay clay loam silty clay loam sandy clay loam loam silt loam sand loam loamy sand sand

Struct: **1** Gran AB sAB Prism Platy Aped / F M L / strong weak **2** Gran AB sAB Prism Platy Aped / F M L / strong weak
Wetness dry moist wet very wet

Organic matter: non-humic slight mod-humic very-humic organic **Inclusions:** none or type: brick and industrial debris
Redoximorphism: *none mottles concretions depletions* ***Sedimentary Structure****: none or type:*

Stones: none few common abundant **Lower boundary** not seen **or** diffuse gradual clear abrupt sharp
Other comments

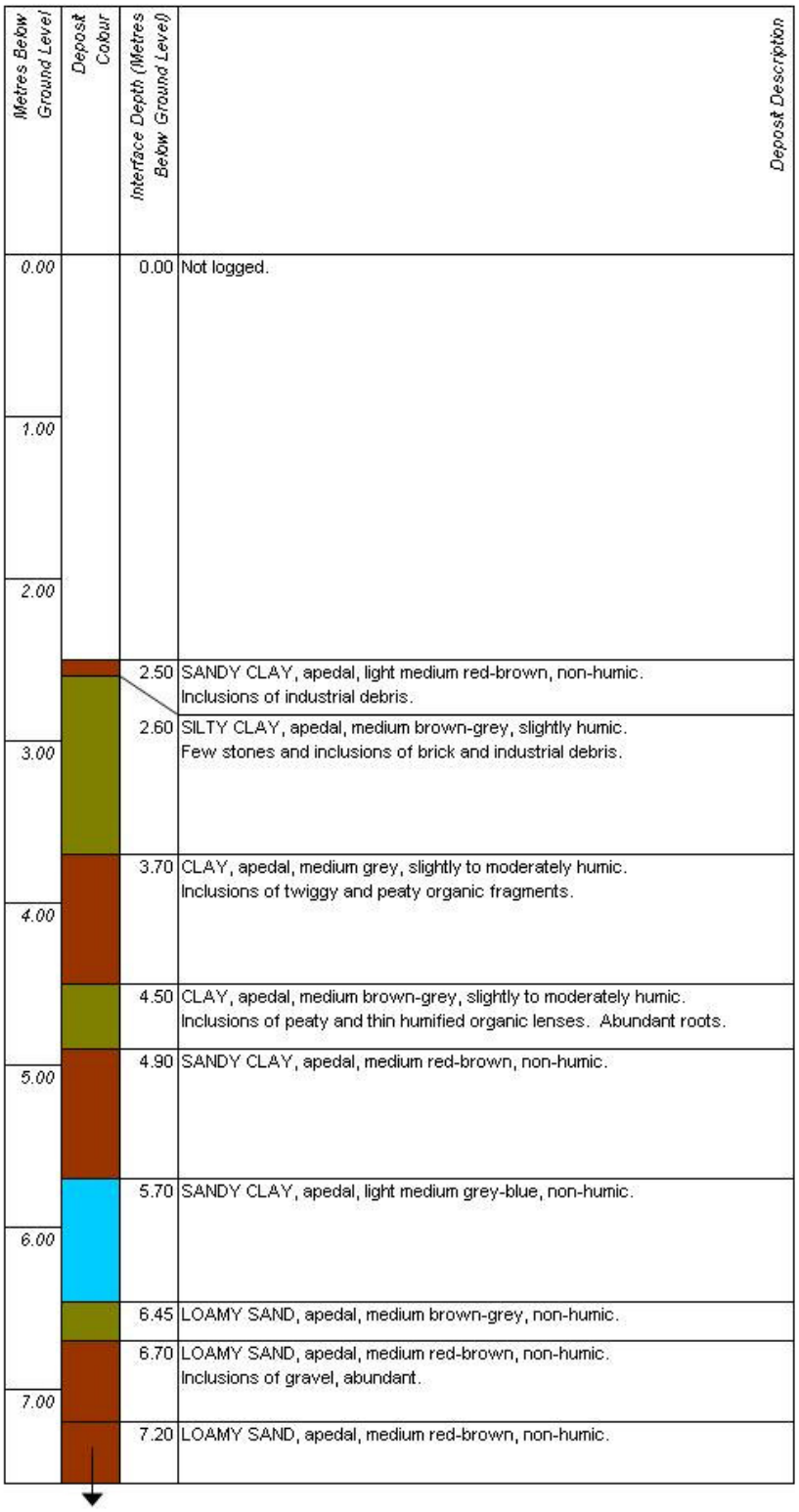
Sample code ***4.3*** ***Type*** *pit sample core sample* ***Depth*** *2.50*
Depth of LB *2.60*

Colour: ***1*** *red brown yellow grey blue pink* ***2*** *v.light light medium dark v.dark* ***3*** *weak strong*

Texture: clay silty clay sandy clay clay loam silty clay loam sandy clay loam loam silt loam sand loam loamy sand sand

Struct: **1** Gran AB sAB Prism Platy Aped / F M L / strong weak **2** Gran AB sAB Prism Platy Aped / F M L / strong weak
Wetness dry moist wet very wet
Organic matter: non-humic slight mod-humic very-humic organic
Inclusions: none or type: industrial debris
Redoximorphism: **none mottles concretions depletions** Sedimentary Structure**: none or type:**
Stones: none few common abundant **Lower boundary** not seen **or** diffuse gradual clear abrupt sharp

Appendix 3: Borehole Log



Metres Below Ground Level	Deposit Colour	Interface Depth (Metres Below Ground Level)	Deposit Description
0.00		0.00	Not logged.
1.00			
2.00			
		2.50	SANDY CLAY, apedal, light medium red-brown, non-humic. Inclusions of industrial debris.
		2.60	SILTY CLAY, apedal, medium brown-grey, slightly humic. Few stones and inclusions of brick and industrial debris.
3.00			
		3.70	CLAY, apedal, medium grey, slightly to moderately humic. Inclusions of twiggy and peaty organic fragments.
4.00			
		4.50	CLAY, apedal, medium brown-grey, slightly to moderately humic. Inclusions of peaty and thin humified organic lenses. Abundant roots.
		4.90	SANDY CLAY, apedal, medium red-brown, non-humic.
5.00			
		5.70	SANDY CLAY, apedal, light medium grey-blue, non-humic.
6.00			
		6.45	LOAMY SAND, apedal, medium brown-grey, non-humic.
		6.70	LOAMY SAND, apedal, medium red-brown, non-humic. Inclusions of gravel, abundant.
7.00			
		7.20	LOAMY SAND, apedal, medium red-brown, non-humic.

Figure 7: The borehole log

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Cartographic material

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Plan showing the fortifications of Worcester	1651
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Young	Plan of Worcester, 1779
Nash's	Plan of Worcester, 1781
Young	Plan of Worcester, 1790
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