THE NORBURY MILL SURVEY, 1983-84: THE DEVELOPMENT OF AN EARLY SEVENTEENTH CENTURY WATER MILL

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INTRODUCTION

Norbury Mill lies to the west of the village of Norbury, south of the river Dove (SK12034222) (Fig. 1). It is constructed of sandstone ashlars, with moulded and glazed windows, parapeted coped gables, an external plinth, and segmental-arched doorways. The structure is four bays long and two storeys high, with an attic storey in the roof over the central bays (Figs 2, 3). On the ground floor, at each end (Bays 1 and 4), wheel-houses contain the watercourses and two water-wheels which drove machinery in the central bays (2 and 3). On the first floor, at the southern end (Bay 4), is a small chamber entered by means of external steps. The stone-floor is located in Bays 2 and 3, with a bin-floor in the attic above. Associated with the mill are a malt kiln, constructed of ashlar, and a brick-built mill house.

THE SURVEY

The survey of the mill building was carried out during the winter of 1983-4, with the aid of a labour force from Nottingham Inter-Community Enterprises, under the supervision of M. Hills. The machinery was recorded by I. H. Mitchell, K. Reedman and M. W. Sissons of the Industrial Archaeology Section of the Derbyshire Archaeological Society. The survey archive of site records and photographs has been deposited with Derbyshire County Council Sites and Monuments Record. For the compilation of this report, MS provided the archive drawings and text on the machinery, CD wrote the remainder of the text, and MH prepared archive drawings of the building.

Following the removal of the collapsed remains of an early-twentieth century lean-to structure on the west side of the mill, a ground plan was prepared and external elevations of the building were drawn and photographed (Figs 4, 5). On account of the instability of the structure no detailed survey of the interior, or of the late-nineteenth century workshop, could be attempted, but the principal features were recorded by measured sketch.

Chronology

Analysis of the structure revealed four principal phases of construction, each utilising distinct types of building material. It is, however, uncertain whether Phases 2-4 represent discrete phases of construction, or piecemeal work over a protracted period: working mills require constant

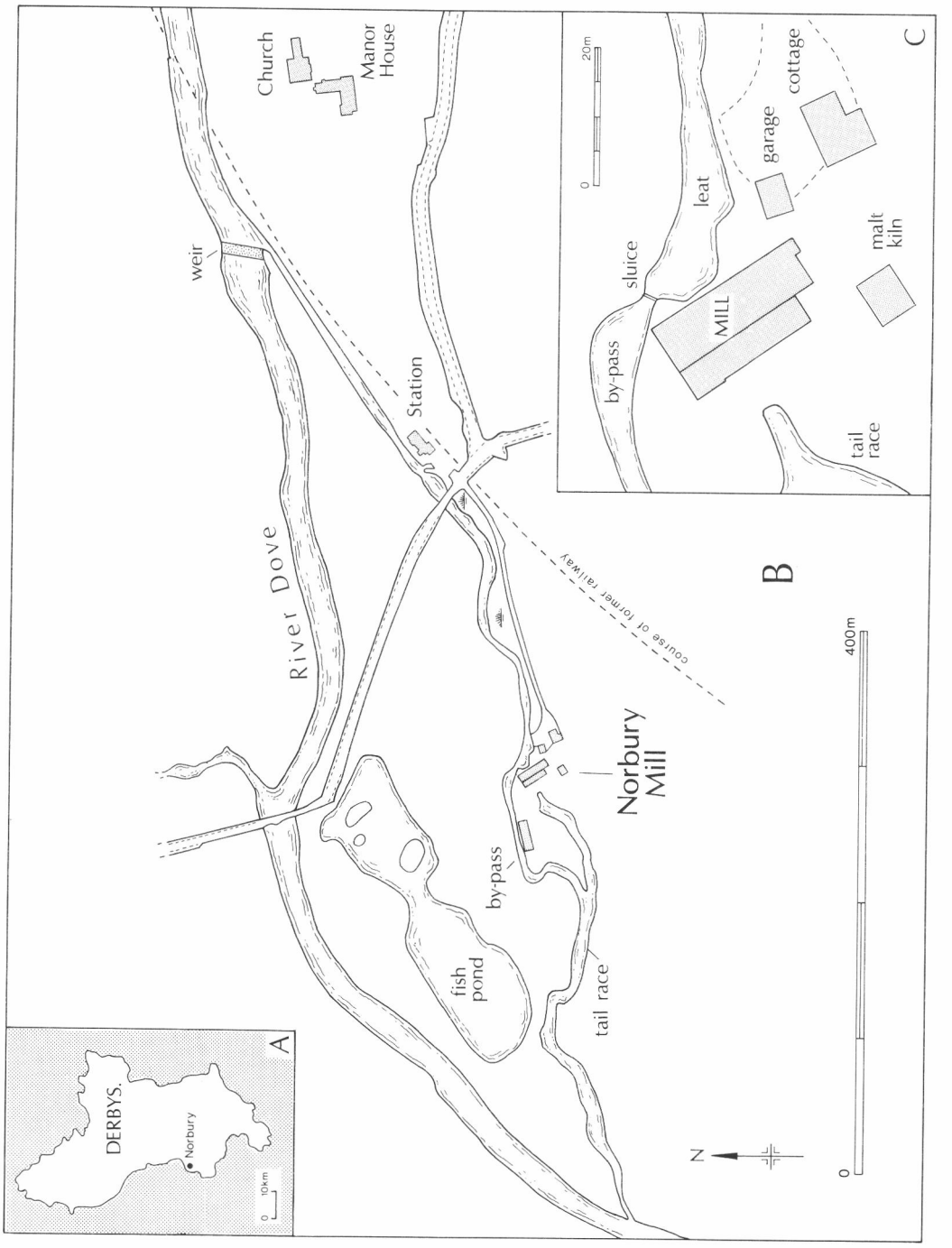

Fig.1 Norbury Mill: location.

maintenance. The dates ascribed to the phases are, therefore, tentative; Phase 1 rests on stylistic evidence, and Phases 2-4 are dated by the materials employed.

Phase 1 Early-seventeenth century: construction of the mill in sandstone ashlars, with timber framed internal partitions. A sub-phase or change during construction is indicated by the enlargement of first floor windows at the north and south ends of the building to form doors, and the addition of an external stair and dog-kennel.

Phase 2 Eighteenth century: a thorough overhaul of the building to counteract the effects of settlement and decay, including the construction of external buttresses by the main doorway on the east side, replacement of the internal partitions with brick walls, reconstruction of the watercourses, and re-roofing. Additional machinery, including a further set of mill-stones and a crusher, was inserted. The phase is characterised by the use of a narrow red brick, and an irregular staffordshire-blue roof tile.

Phase 3 Late-nineteenth century: repair of the east wall in gritstone, and piecemeal internal repairs in red brick; a larger window, roof lights and a loading bay were also inserted. A workshop was constructed at the north end of the mill. The mill was primarily used to drive saws.

Phase 4 Early-twentieth century. A lean-to structure, roofed with corrugated iron, was constructed on the west side of the mill; additional window openings were formed and there were internal repairs using concrete. The mill also drove a dynamo.

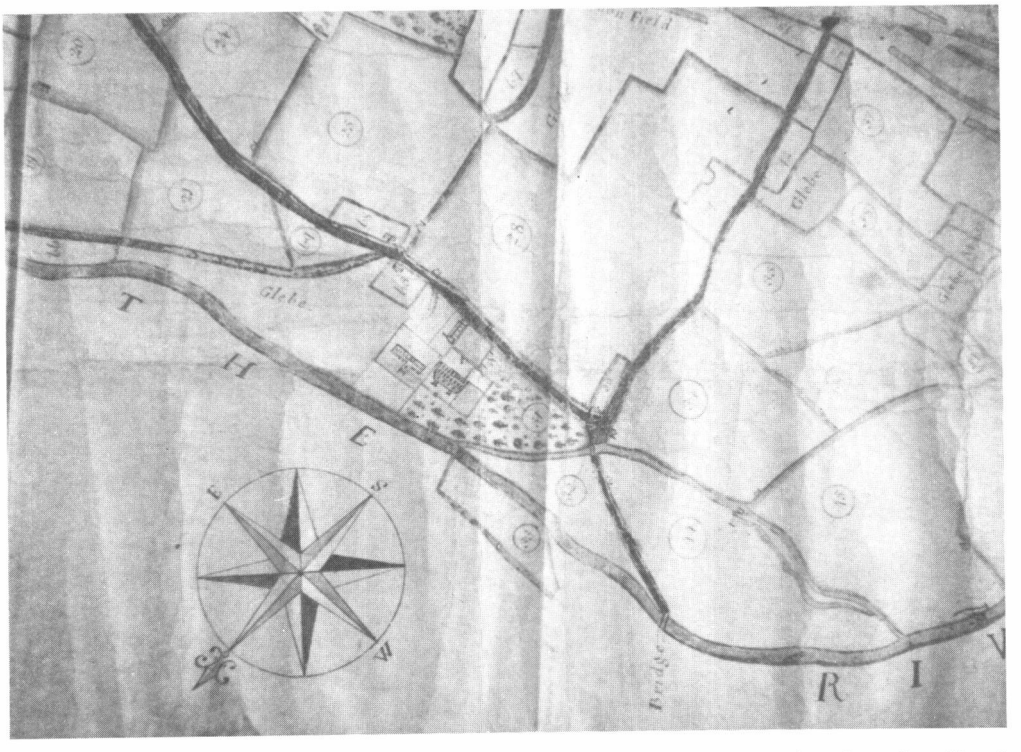

Plate 1 Norbury Mill: detail of estate map of 1753, showing the manor house and gardens, the mill and malthouse (D641/M/1/4).

Structural Development

Location and water supply

Justice Fitzherbert, Lord of the Manor of Norbury, recommended the construction of water mills for the improvement of estates and discussed their siting in the *Boke of Surveyinge* (1538):

> The lord of the manor may set upon the great rivers corn mills ... commonly these mills be not set upon the streams of the great rivers, but a great part of the water is conveyed out of the great stream by a mill-fleume, made with mans hands, to a certain place where wise men think the mill was most convenient. (Bennet and Elton, 1900: 190)

Norbury Mill is fed from the Dove by a leat, over 400 metres long, and in part man-made, which is depicted on, and was therefore constructed prior to, a map of 1753 (D/641/M/1/4) (Fig. 1; Pl. 1). The leat leaves the river above an artificial weir, north-west of the village church, in a regular cutting, some 180 metres long, which skirted the former gardens of the manor house. Below Norbury Mill bridge the leat widens, becomes less regular, and is now bounded by a marsh — all that remains of the mill pool depicted on the plan of 1753. The west end of the mill pool is formed by the mill building. At the front (east side) of the mill, the flow is divided by a pointed cut-water, of which only slight traces remain, into two channels, which pass through the mill at its north and south ends. Excess water was originally diverted around the southern side of the mill (D641/M/1/5). The present by-pass course, carrying water around the northern end of the mill, was established in the nineteenth century. Immediately in front of the mill the leats have been filled in. Behind the mill the two channels, although formerly open, now run below ground, emerging some 10 metres to the west. They were covered (in Phase 3) with large timbers, probably railway sleepers, which are now collapsing. Behind the mill the two channels merge, join the by-pass course, and then flow westwards in an irregular course to the river Dove. The irregularity of the tail race indicates that it was not deliberately constructed, but utilises a former river course, whose eastern end above the mill formed the mill pond. This postulated subsidiary or relict channel, formed by a natural meander in the course of the river Dove, could have served in much the same way as an artificial leat, being easily controlled and protecting the mill from the destructive forces of the main river in spate.

Plan (Figs 2-5; Plates 2-6)

The mill is a long low building, measuring 21 x 7.5 metres, its long axis orientated approximately north-south. The building is four bays long and two storeys high, with an attic in the roof over the central bays. On the ground floor, the northern bay (Bay 1) and the southern bay (Bay 4) form the wheel-houses, containing the watercourses and the surviving water-wheels. The wheel-houses have external doorways in the northern and southern ends of the buildings respectively, and internal doorways, to Bays 2 and 3, on their eastern sides. The central bays, 2 and 3, form a single chamber, with a thoroughfare between opposed doors in the long (eastern and western) sides of the building. This chamber contained the principal machinery driven by the water-wheels. Only the machinery on the southern side remains. The first floor, a wooden floor resting upon joists, formerly extended throughout the building, but this survives only at the southern end. Bay 4 contains a fireplace, and may therefore have been a dwelling or office, entered from external steps at the south end. Bays 2 and 3 contained the stone-floor where the grain was ground; the surviving area of floor in Bay 3 is essentially an access platform around the hurst-frame. Above Bays 2 and 3 was the attic bin-floor. The bin-floor survives only in Bay 3, reached by a wooden ladder from the first floor. It comprises a small access platform with a large, plank-lined hopper to the south, which fed grain to the stones below. Upward-opening trap doors to the north of the hurst-frame and hopper allowed grain to be raised, by means of a sack hoist, from

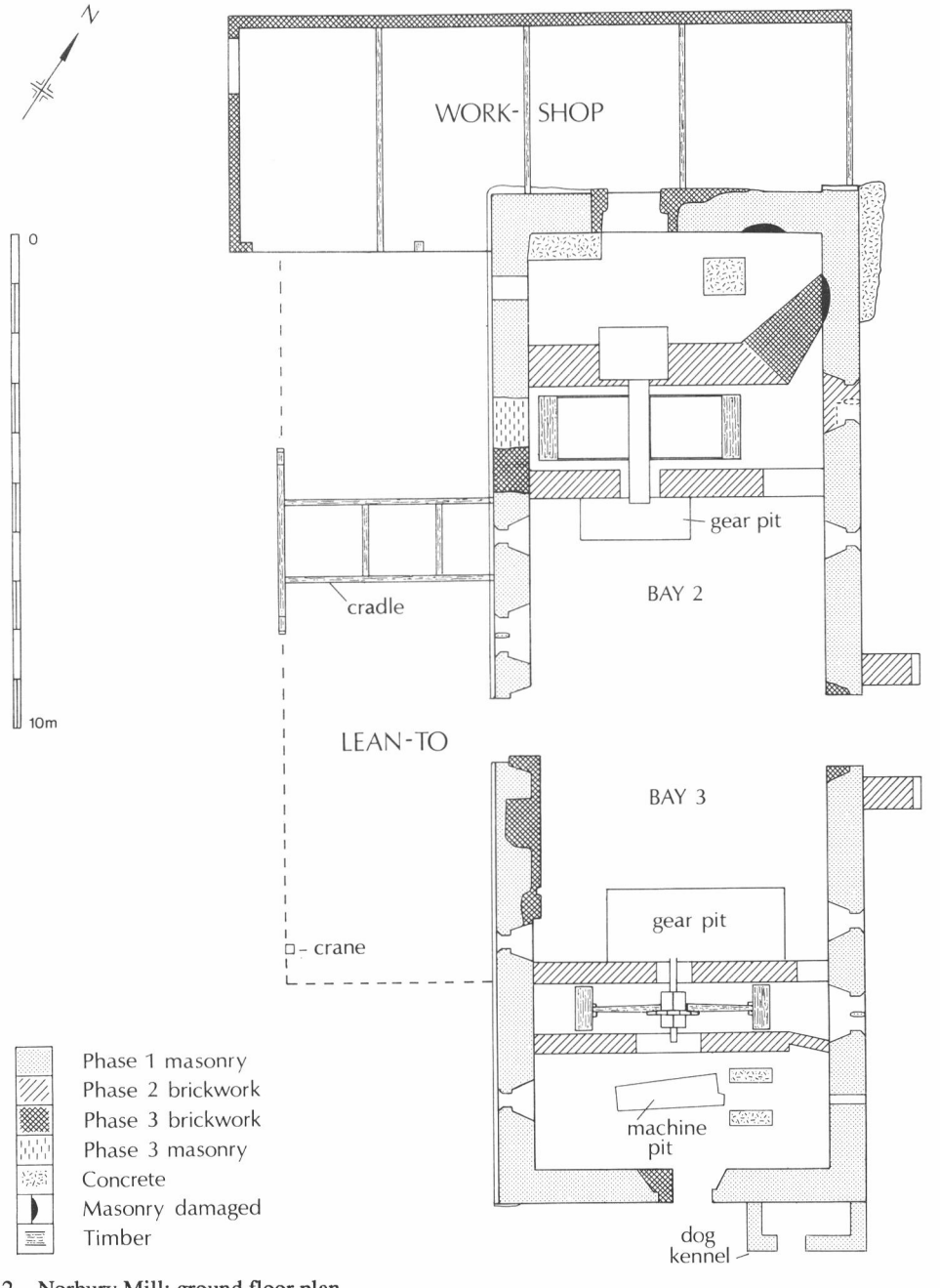

Fig.2 Norbury Mill: ground floor plan.

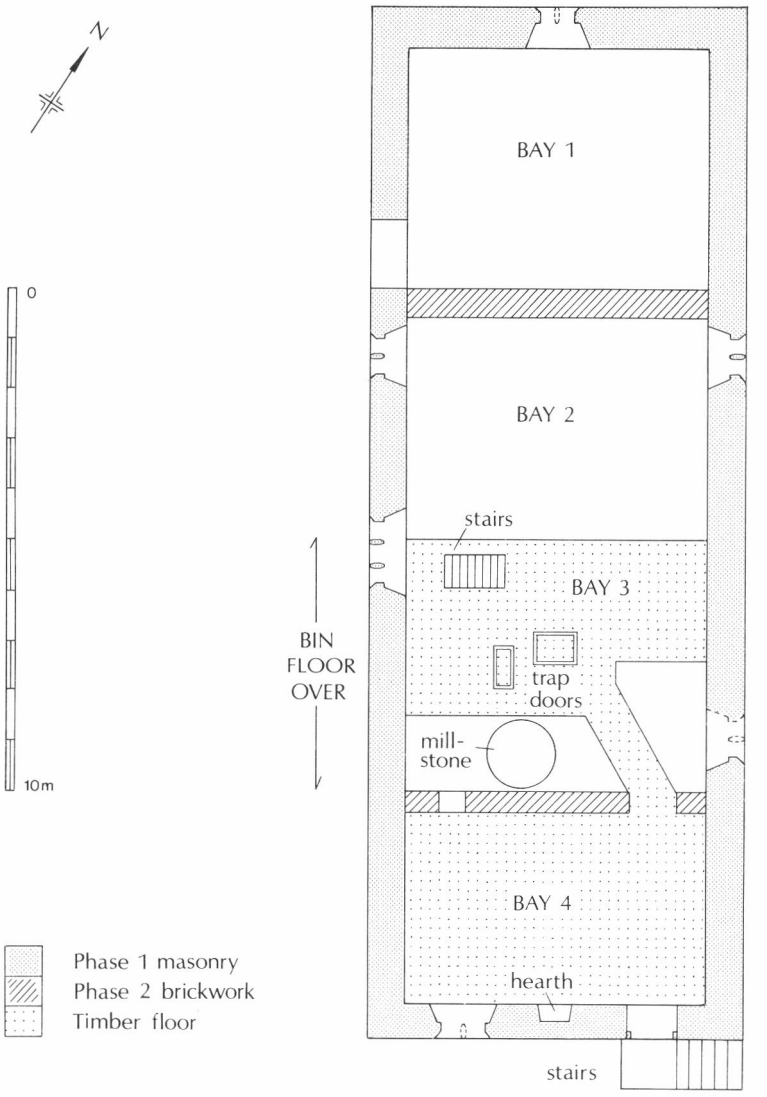

Fig.3 Norbury Mill: first floor plan.

the ground floor to the attic bin-floor. It is probable that there was a similar stone- and bin-floor in Bay 2. The present form of the stone-floor and bin-floor in Bay 3 dates from the final phases (3-4) of occupation, but a broadly similar arrangment may be assumed in earlier phases.

Construction: Phase 1

The Phase I walls, 0.66 metre thick, are constructed of high quality, finely-jointed ashlars of deep red Hollington sandstone; the core and internal face is of coursed rubble. Approximately 0.7 metre above ground level, a plain-chamfered plinth extended around the building; areas of the plinth have been dressed off in the course of later alterations. A shallow buttress, rising to first floor level, interrupts the plinth on the west side of Bay 3. At the gable ends, the low parapets,

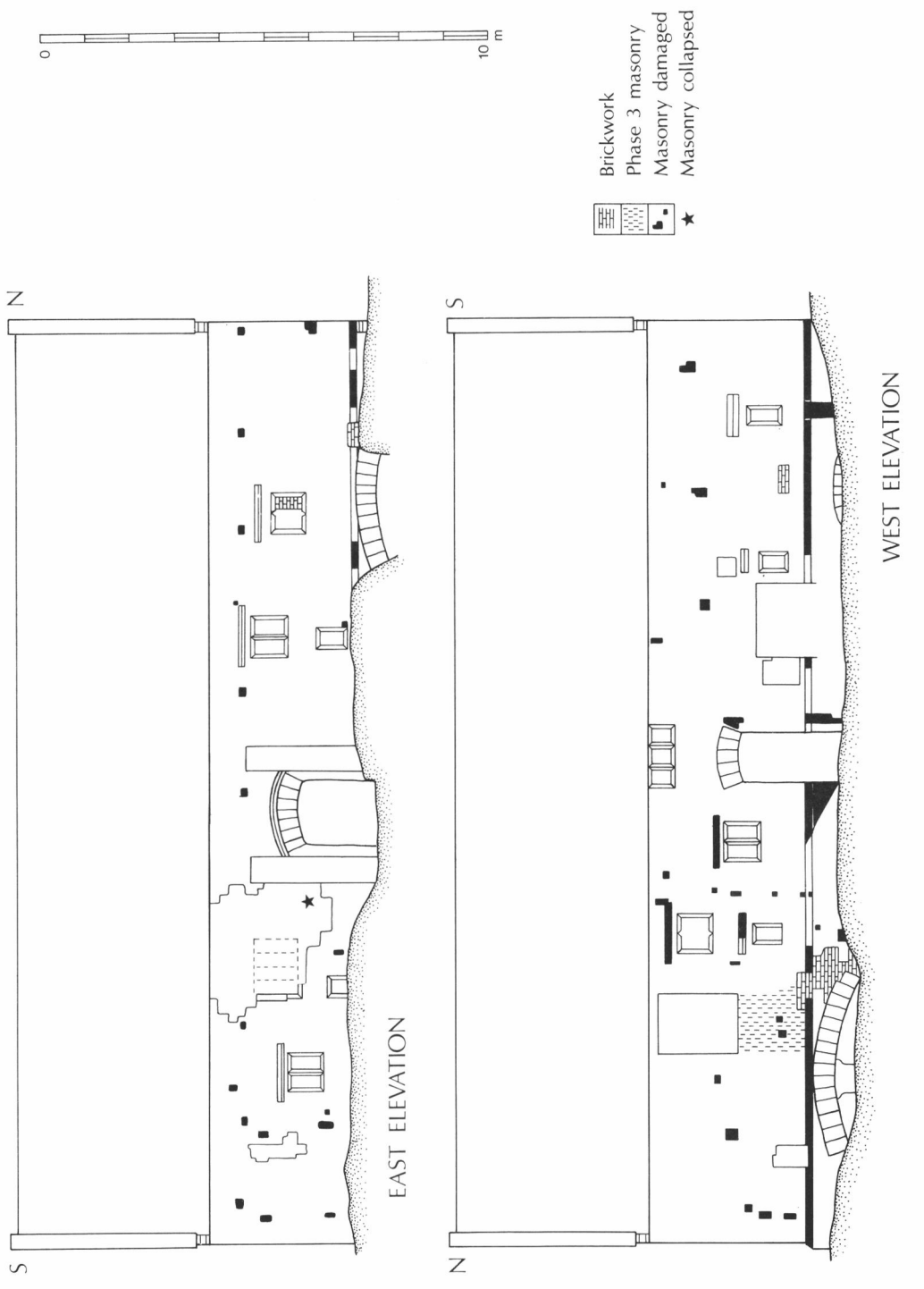

Fig.4 Norbury Mill: east and west elevations.

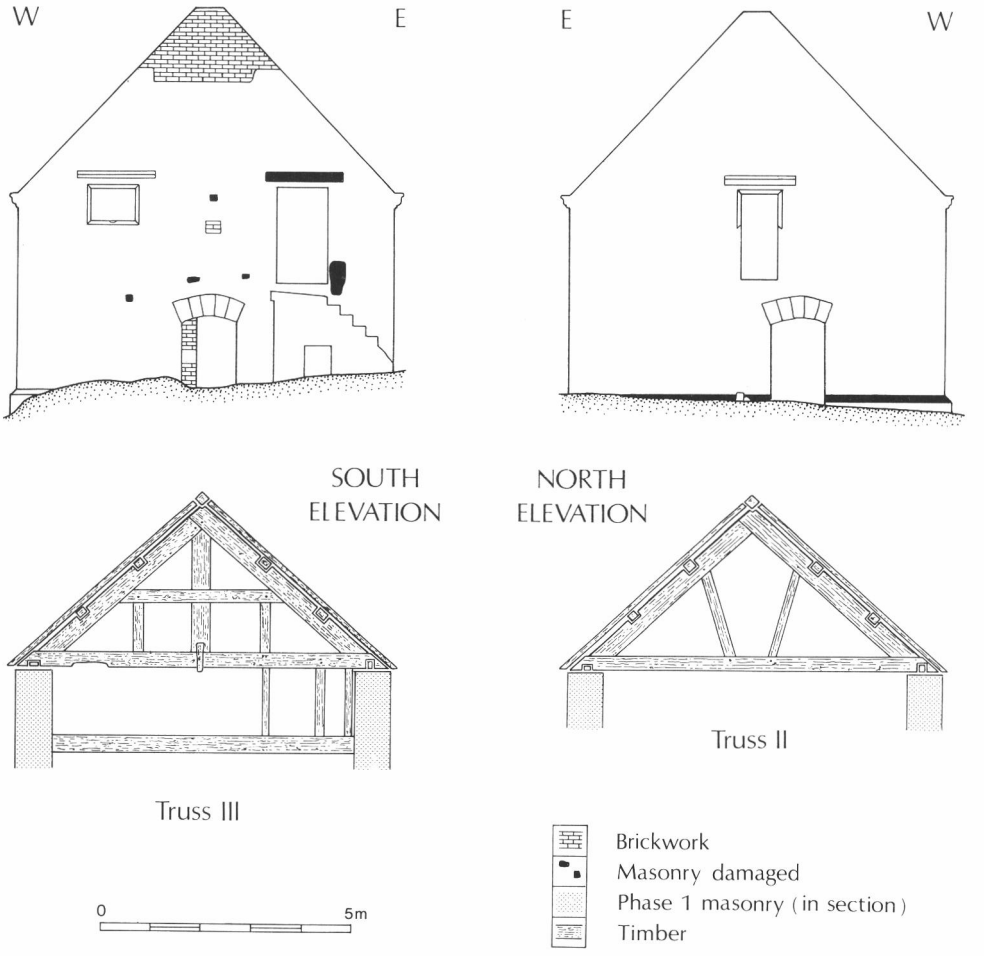

Fig.5 Norbury Mill: north and south elevations; internal partition and roof trusses II and III.

resting upon kneelers, carried a chamfered coping, of which little now remains. The watercourses at the northern and southern ends enter and leave the building below segmental-headed arches of plain voussoirs; the southern watercourse is largely buried. A row of joist holes on the east side of the mill suggests the existence of a lean-to structure, providing a covered walk-way around the building. The building is lit by small rectangular windows with recessed surrounds, consisting of either single lights, or two and three lights separated by thick octagonal chamfered stone mullions. On the exterior, above each window, was a heavy projecting chamfered dripmould; several have been dressed-off in the course of later alteration. On the interior, the windows are splayed and set below a flat, timber lintel. Several retain vertical iron glazing bars. A photograph of the front (eastern) elevation of the mill, taken about 1895 (DRO) (Pl. 6), shows the lights glazed with small, diamond panes, but only fragments of lead cames now remain. The arrangement of the windows was determined principally by the location of machinery and working processes within the building.

The ground floor doorways, on the northern, southern and eastern sides, have external

Plate 2 Norbury Mill: west elevation. (Note the collapsed crane and saw cradle.)

Plate 3 Norbury Mill: south elevation.

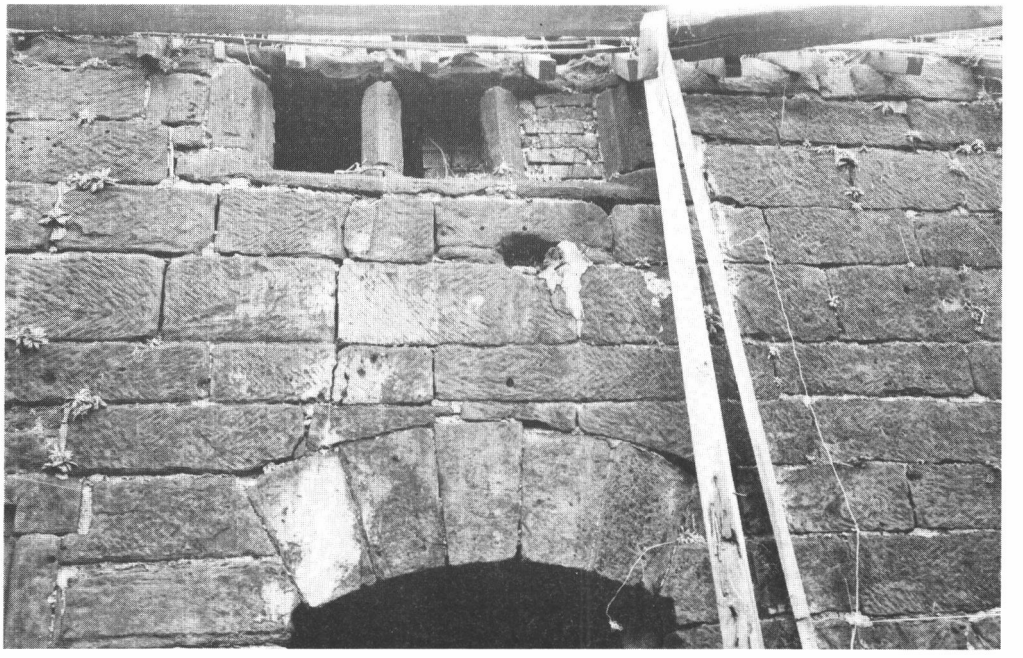

Plate 4 Norbury Mill: west elevation — detail. (Note the head of the west door and the common rafters trenched into the head of the wall and the first floor window.)

Plate 5 Norbury Mill: east door.

Plate 6 Norbury Mill: east elevation *c.* 1885.

segmental-arched heads of plain voussoirs, with a flat timber lintel on the interior. The doorway on the east front of the building is wider and has a heavy projecting keel-shaped drip-mould. Such features clearly distinguish it as the 'main' doorway, but this may be an architectural conceit rather than a true indication of function, since it could be approached only by crossing the mill leat. The door, of oak planks studded with iron nails and hung from iron strap hinges, has eighteenth century inscriptions, and may be an original feature.

The mill was originally sub-divided by timber framed partitions, which extended from the ground floor to the roof and closed off the end bays, 1 and 4, from the central area; doorways on the eastern side gave access to the wheel-houses. During Phase 2 these partitions were largely replaced, except in Bay 4, where studs rise from the first floor to the tie beam of Truss III, into which they are pegged and morticed. The sides of the studs contain a rebate, to accept an infill of short horizontal timbers or flagstones.

The northern wheel-house, Bay 1 on the ground floor, contained a large watercourse, 4.0 metres wide. The eastern side is lit by a two-light window above the watercourse and sluice. There may have been a single light in the western side, but this area was rebuilt in Phase 3. The southern wheel-house, Bay 4 on the ground floor, contains a narrow watercourse, 1.0 metre wide. The eastern side is lit by a two-light window above the watercourse and sluice; on the western side there is a single light. On the ground floor, Bay 2 is lit on the eastern side by a two-light window, with a single light below, and on the western side by one single and one two-light

window. Bay 3 was lit on the eastern side by a two-light window, with a single light below; on the west, close to the buttress, there is a single light.

On the first floor, Bay 4 contains a fireplace with a stone mantel, supported upon chamfered corbels, and with a re-used millstone for the hearth. It is lit by a two-light window in the south wall, on the west side of the fireplace. A similar window, to the east of the fireplace, was possibly enlarged to create the surviving external doorway. The doorway is approached by a flight of stone steps, wide and low to facilitate the carriage of heavy sacks. The stair base incorporates a dog kennel. Although of identical construction, the stair is not bonded into the main fabric, and could therefore be an early addition. An internal doorway at the west side of Bay 4, its head cut out of the tie beam of Truss III, gave access to Bay 3. The provision of a fireplace and at least one large window suggests that the chamber in Bay 4 was a dwelling, perhaps the miller's house. Bay 1 on the first floor was lit by a two-light window in the north gable, subsequently extended to form a doorway. There is no evidence of an external stair, and the 'doorway' is probably best interpreted as a loading bay. The stone-floor, Bays 2 and 3 on the first floor, is lit by a three-light window, immediately below the eaves in the centre of the west wall, and (formerly) a two-light window at first floor level at the northern end. The eastern side of the stone-floor has no windows, but a formerly railed opening in the floor of bay 3 admits light from the ground floor window below and there may have been a similar arrangement in Bay 2.

Despite the Phase 2 overhaul, and piecemeal replacement of decayed common rafters and sections of wall-plate and ridge-piece, the roof largely retains its original form. It has three trusses, or pairs of principal rafters, which are tenoned into slightly cambered, chamfered tie beams. The tie beams are halved onto the wall plates. The principal rafters support a heavy ridge piece, into which the common rafters are tenoned and pegged. The common rafters, at *c.* 0.42 metre centres, are carried upon the backs of staggered, trenched purlins, and may originally have rested upon the wall plates. Truss III has a short straight collar, halved and pegged to the principal rafters. Short posts, morticed and pegged at each end, rise from the tie beam to the collar. A central post, also morticed and pegged at each end, rises from the tie beam to the collar, where it is halved and pegged, and thence to the apex of the principal rafters. On the south side, an attached, chamfered and tapered corbel of uncertain purpose, conceals the junction of the central post and tie beam. Truss I, largely concealed by boarding, appears to be of similar construction. Trusses I and III, extensions of the partitions subdividing the mill, were perhaps intended to withstand the considerable lateral pressures of both the roof and the grain, contained in the adjacent hoppers on the bin-floor. Truss II, unless it was made of re-used timber, appears originally to have been of queen-post construction, but raking-struts now extend from the tie beam to the principal rafters. Slightly curved windbraces, intended to give lateral stability, rise from the purlins to the principal rafters of Truss II. The original roof covering was probably of thatch, which is consistent with the low parapet and kneelers.

Renovation: Phase 2

This phase, characterised by the use of a narrow red brick (230 x 65 x 110 mm), included re-roofing with an irregular, staffordshire-blue tile, and a thorough overhaul of the building to counteract the effects of settlement and decay. The capacity of the mill was extended by the fitting of an additional set of stones in Bay 4, and its range of operations was widened by insertion of a second water-wheel and a crushing mill at its northern end.

On the eastern side, external buttresses of brick, faced with stone, were constructed either side of the main doorway. The partition separating Bays 1 and 4 from Bays 2 and 3 was replaced at ground level by a brick wall. At first floor level the timber framing was retained, and infilled with

brick. The internal doorway on the west side of the first floor chamber was replaced by the present opening at the east. On the ground floor, the southern watercourse and gear pit were lined with brickwork. The drive between them was carried through the partition wall in a rectangular opening, with a flat timber lintel. A further wall was constructed to the south, partially enclosing the wheel and providing additional support for the first floor. An opening in the wall allowed an additional drive to be taken from the wheel. This powered a set of stones, now completely removed, which were installed on the first floor in Bay 4 and fed from a timber grain-spout, passing down through the partition wall from the bin-floor.

At the northern end of the building, the postulated timber framed partition was replaced by a brick wall, extending from the ground floor to the tie beam of Truss I; the attic space above remained boarded. There was no access from the stone-floor to the northern first floor chamber, which may have been reserved for some quite separate use. The northern watercourse and gear pit were lined with brick, and the drive between them, as at the south end, taken through the partition wall in a rectangular opening, set below a timber lintle. The northern watercourse was divided, by a brick wall, into two channels. A stone pillar, at the end of the dividing wall, supported the western arch over the watercourse. The subdivided, northern watercourse may have contained either a single narrow wheel with an overflow course to the north or, more probably, two narrow wheels: the southern wheel would have driven machinery in Bay 2, the northern wheel, machinery in Bay 1, on the ground or first floor. In the north-east corner of Bay 1, the internal walls were carefully dressed back, from the ground to the underside of the first floor, to contain an additional piece of machinery, probably a crushing mill. The dressing back of the walls cannot be closely dated, but the labour involved suggests a demand for additional space in Bay 1, that is unlikely in the succeeding phases. The separation of the first floor chamber of Bay 1 suggests that the crushing mill, fed with raw material brought in through the loading bay at the north end, was intended to process different material (such as marl, flint or lime) from the rest of the mill.

The thatch was replaced with irregular, staffordshire-blue tiles. To accommodate the new roofing material and to counter the effects of settlement, the tops of the walls were altered. In places brick was used to repair and raise the upper courses of the walls; elsewhere common rafters were trenched in to the ashlars of the wall top.

The sawmill: Phases 3-4

In Phase 3 a sawmill was established on the west side, and a workshop constructed at the northern end of the mill. A loading bay was formed on the west side of Bay 1, which was partially rebuilt with gritstone ashlars. At various points within the building, patches of brickwork (brick size 235 x 75 x 110 mm) were inserted to strengthen and support the structure. Areas of the roof were re-covered with regular, machine-pressed, staffordshire-blue tiles; and lighting was improved by the insertion of glass roof lights and a large window on the east side. The machinery at the northern end was re-modelled. Phase 4, characterised by the introduction of new materials — concrete and corrugated iron — was essentially a continuation of Phase 3. A lean-to was constructed on the west side, unembellished window openings formed, and a dynamo inserted, driven from the the southern water-wheel.

The workshop is largely a lean-to structure, measuring 13.5 x 4.0 metres. Its eastern end is open, and its north side rests on timber posts carried on a low brick wall. Where the workshop extends beyond the mill, to the west, the wall plate supports a king-post truss and is carried on an earth-fast post. The western gable end is constructed of brick, and the roof is covered with regular, machine-pressed, staffordshire-blue tiles. A drive from the mill's northern water-wheel

was led to the workshop. The tail races were covered with large timbers, probably railway sleepers. A timber cradle was constructed to support a saw, powered from the northern pit gear by a drive taken through the wall. A crane was driven off the southern pit gear, by a drive taken through the wall.

In Bay 1, the northern water-wheel was removed. The channel was filled in, the rear closed with a brick wall containing an iron drain plate; and the sluice was re-formed with a sloping side, to direct all the flow to the remaining water-wheel. The western wall, over the watercourse, was repaired with gritstone ashlars. Following the construction of the workshop, the loading bay on the first floor at the northern end of the mill could no longer be used, and so was replaced by a rectangular opening, with a pegged timber frame in the west wall. A hoist in the apex of the roof of Bay 1 may be associated with this later loading bay. In Bay 2, a beam was inserted beside the tie beam of Truss I to support two large beams, parallel to the main axis of the building, passing through the partition wall. These two beams were subsequently sawn off, but probably extended north and south to support machinery in Bays 1 and 2. The two-light window over the pit gear on the east side of Bay 3 was replaced by a large rectangular window, now collapsed, with a pegged timber frame and three timber mullions.

In Phase 4 the cradle was enclosed within a lean-to structure, with a corrugated iron roof. At the southern end of the mill, the opening in the partition wall for the drive between the southern water-wheel and pit gear, was crudely enlarged, probably when a new axle was inserted. Further drives were taken out to the west side, cutting through the base of a Phase 1 window. Three unembellished openings were made to provide further light. Timber frames were inserted in the door and window of the first floor chamber, and an internal window formed in the partition wall. On the ground floor, an irregular slot was opened in the east wall to light the wheel-house. Beside the southern water-wheel, a concrete-lined pit was constructed, and several concrete bases. The presence of electrical switch gear suggests that a dynamo was driven off the southern wheel. Elsewhere in the building and to the north, beyond the workshop, there are several concrete machine-bases. Concrete was also used to repair the fabric of the building and its watercourses. Subsequently, the northern machinery, with the exception of the wheel, was removed. The grist-mill at the southern end of the building may have remained in use longer, but the loss of part of the southern wheel indicates that components of the southern machinery were also deliberately removed.

Machinery (Figs 6, 7)

The surviving machinery comprises: at the southern end of the mill, a pair of stones, hurst-frame, corn bin and pit gear in Bay 3, driven by a water-wheel in Bay 4; and at the northern end, a water-wheel in Bay 1. To the west, outside the main building, is a wooden cradle, to support a saw bench, and a crane for moving large timbers. The crane comprises a single round pillar and a re-used wheel-shaft, on which are mounted the top boom, the inclined boom and an iron windlass and gearing. The surviving mill-machinery, together with slight traces of earlier equipment, are described in more detail below.

The southern machinery

The southern wheel, a low breast-shot wheel, overall diameter 4.2 metres, is contained within a pit, 1.0 metre wide, with part of a sluice remaining on the eastern side (Fig. 6). The wheel (1) is made up of a sectional cast-iron rim, attached to a single cast-iron hub by six wooden spokes, 75 x 185 mm in section. Only the lower three of the original six rim sections survive. Cast-iron boxes, integral with the rim, carry the two starts for each of the 24 floats; each float is 920 mm

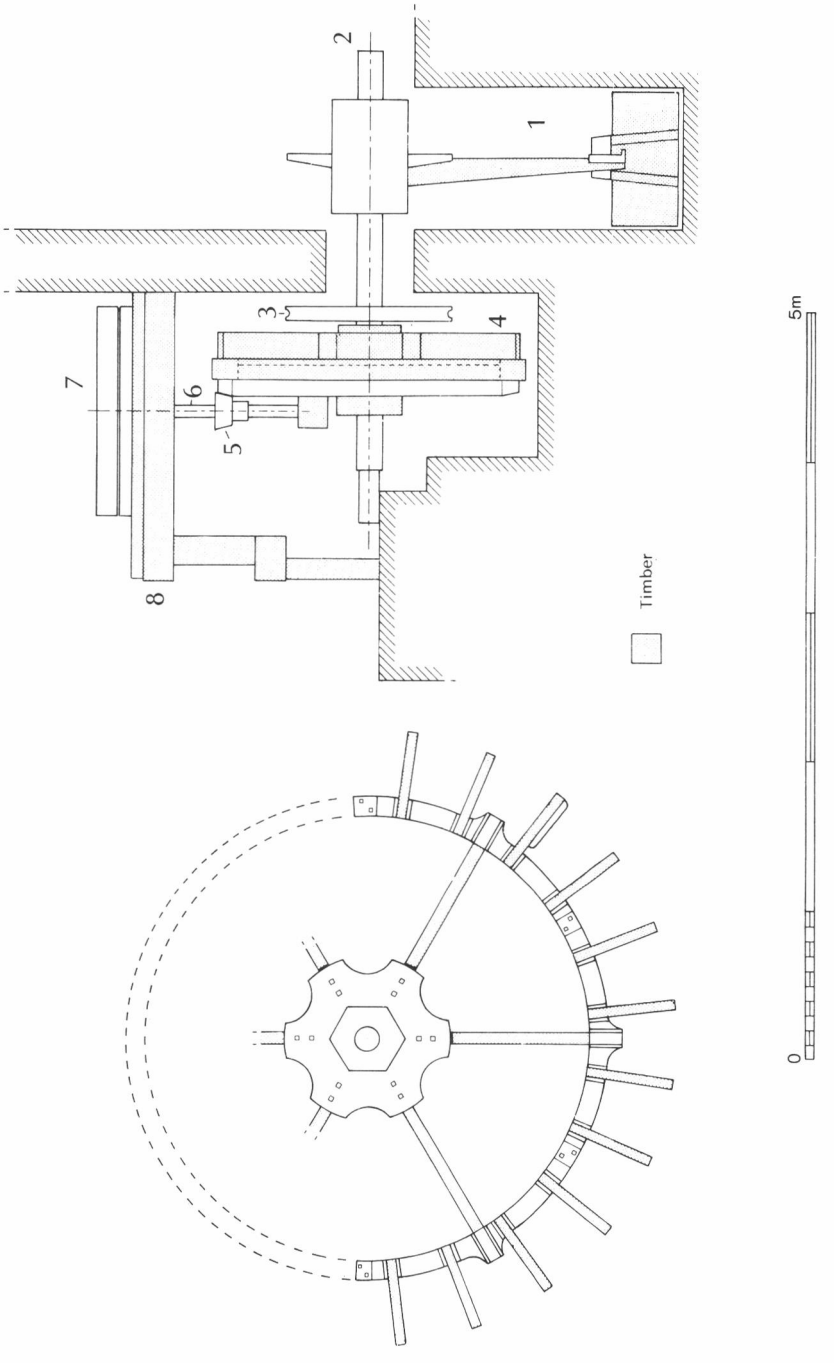

Fig.6 Norbury Mill: southern machinery.

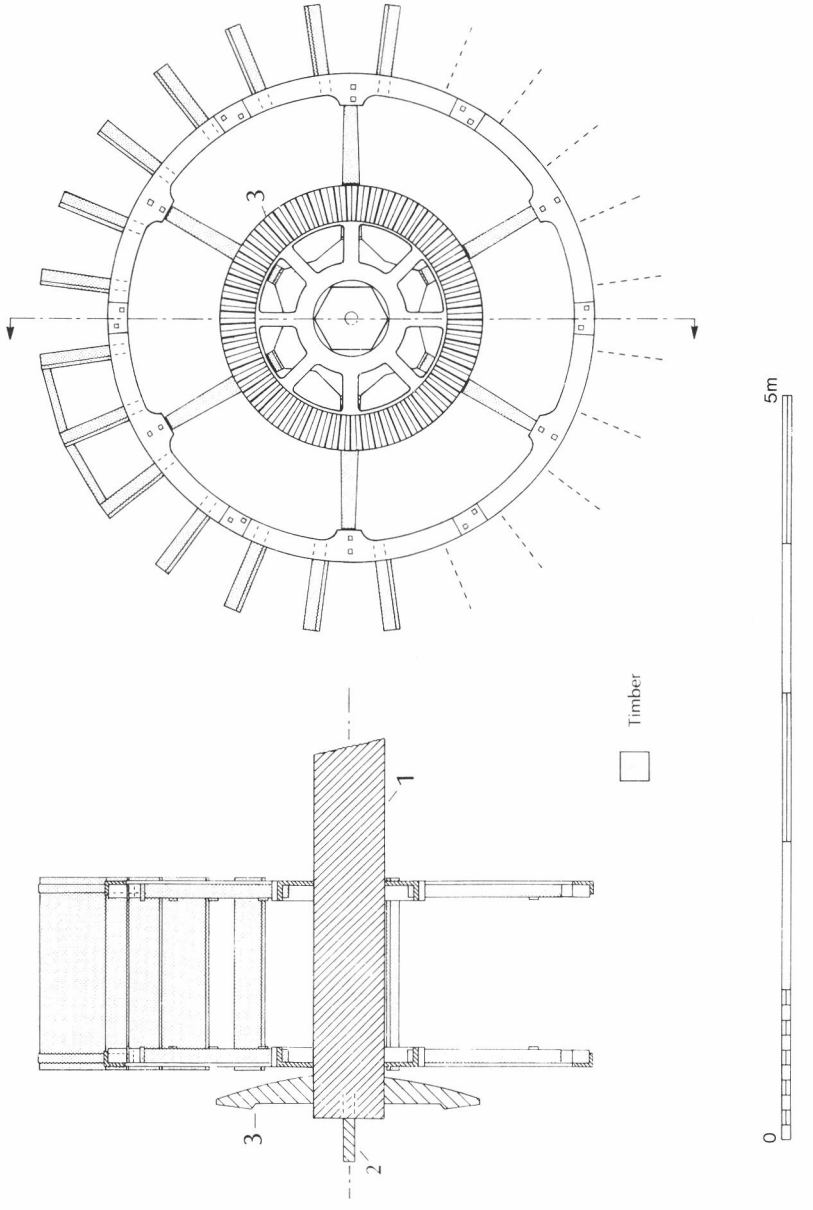

Fig.7 Norbury Mill: northern machinery.

wide and 250 mm deep. The wheel hub is mounted upon a hexagonal iron wheel-shaft (2), 440 mm wide across the flats, which passes through the partition wall into Bay 3. The opening in the partition wall has been enlarged, probably when the wheel-shaft was inserted. The opening is rough and irregular, a characteristic of the workmanship of Phase 4. Two drives are carried by this shaft: one to a sack-hoist (3) and the other to the pit-wheel (4).

The wooden rim of the pit-wheel, 2.1 metres in diameter, is carried upon eight clasp arms, which fit around a square wooden block, 440 x 440 mm, mounted upon a hexagonal iron shaft. This blocking-out of the iron shaft indicates that the pit-wheel was originally constructed to fit a shaft of larger diameter, probably of timber. Bolted to the rim of the pit-wheel is an iron gear ring, with 120 teeth. This gearing engages with a single bevelled cast-iron stone-nut (5), 250 mm in diameter, with 16 teeth. The stone-nut is keyed onto an iron stone-spindle (6), which passes up through the bed stone to drive the runner stone of a pair of stones, each 1.4 metres in diameter (7). Each stone is formed of two pieces of millstone grit, held together by iron bands. The stones are set in a hurst-frame (8), 1.5 metres above the ground floor. Tentering, or adjustment of the stones, was effected by a heavy screw, now missing, on the end of the cross beam carrying the stone-spindle. The meal-spout, to remove ground material from below the stones, is also missing. The hopper, grain-spout and feed-shoe, to carry material down to the stones from the grain bin in the attic space of Bay 3, have likewise been removed. At first floor level, in Bay 4, a wooden grain-spout passes through the partition wall. This spout fed grain from the bin in Bay 3 to a set of stones, now entirely removed, in the first floor chamber in Bay 4. This arrangement, powered from the southern water-wheel below, pre-dates the surviving stones in Bay 3.

Located directly above the stones in Bay 3 is the sack-hoist. This comprises a short wooden winding-drum or windlass, on an iron shaft, formerly powered by a rope-drive from a pulley on the wheel-shaft. The sack windlass was engaged by raising the end of the drumshaft, using a lever above the western side of the hurst-frame. This action tensioned the rope-drive, causing the windlass to rotate, and so to raise the hoist rope. The hoist rope passed up from the windlass, through the bin floor above, to a pulley fixed to a roof purlin. From here it passed around a further pulley in the apex of the roof, and travelled the full length of Bay 3, on the underside of the ridge, to a third pulley in the roof apex, at the junction of Bays 2 and 3, whence it ran directly down to the ground floor. This arrangement is an extension and replacement of an earlier system which raised sacks through the two upward-opening trap doors in Bay 3. The present sack-hoist perhaps post-dates the removal of machinery in Bay 2.

The ground floor, adjacent to the water-wheel in Bay 3, contains several reinforced-concrete foundations and derelict electrical switch gear. The latter, in particular, suggests the installation of a dynamo, driven by a belt from a now broken extension of the wheel-shaft.

The northern machinery (Bays 3 and 4)

The machinery at the northern end of the building was driven by the larger leat. In Phase 1, this large course probably drove a single wheel, up to 4.0 metres wide. In Phase 2, it was subdivided to accommodate either a single wheel and by-pass course or, more probably, two wheels. The present low breast-shot water-wheel occupies a pit constructed in Phase 3. The wheel, 4.15 metres in overall diameter, carried 24 floats, each 460 mm deep and 1.34 metres wide (Fig. 7). On the lower part of the wheel the floats have been washed away. The starts for the floats are fixed into cast-iron boxes, attached to the inside of the 'L'-section rims. The two iron rims, 1.1 metres apart and each formed of six cast segments, are carried on 12 wooden spokes, 100 mm, tapering to 75 mm, wide. The spokes are socketed into a cast-iron hub, carried on a heavy timber wheel-shaft, 500 mm in diameter. The wheel-shaft has broken, allowing the wheel to list. Originally the shaft extended through the partition wall to a pit in Bay 2, which formerly contained a pit-wheel. The pit-wheel, and all other machinery in Bay 2 (probably comprising an upright shaft and spur-wheel, carrying the drive to one or more pairs of stones, together with the hurst, floors and grain bin) have been removed. On the northern side of the water-wheel, a cast-iron gear wheel, 1.73 metres in diameter, with 64 teeth, is attached to the shaft (3). This drive,

unconnected with the milling machinery in Bay 2, powered a crushing mill in the north-east corner of Bay 1. A broken iron shaft-extension powered the workshop and sawmill machinery, via plummer block bases in the north and west walls of Bay 1.

Discussion

The continued operation of the mill necessitated constant maintenance and minor repairs to the machinery, with more extensive rebuilding at regular intervals. In comparatively remote rural mills, lack of demand and insufficient capital inhibited the rapid adoption of technological advances, and new methods and materials, hence re-use and adaptation of machinery was the normal practice. Comparatively old methods and items of machinery could remain in operation long after they had been superseded elswhere. In the absence of a published analysis of local mill machinery, the introduction of cast-iron and the use of hybrid, cast-iron and wooden, wheels cannot be closely dated. The machinery at Norbury must therefore be broadly ascribed to the nineteenth century.

Evidence of mill wrights' work at Norbury, which may be connected with extensive reconstructions of the machinery, is provided by a series of inscriptions on the main east door and its lintel. 'WB 1736', and below it '1748', suggest two pieces of work by the same man. 'TO 1793' indicates further repair in the later eighteenth century. A phase of nineteenth century reconstruction is commemorated by 'SM 1833'. While it is probable that elements of early machinery remain at Norbury, it must be stressed that the surviving machinery is only part of that utilised in the relatively recent final phases of use. The present arrangement of the southern machinery replaces that employed in Phase 2, and is driven by a cast-iron shaft of probably nineteenth century date, inserted in Phase 4. The driving of the stones directly from the pit-wheel is a technologically primitive method, used since the Roman and Anglo-Saxon periods. However, in the final phases, 3 and 4, sawing, rather than milling, may have been the chief activity at the mill. Therefore, this comparatively primitive arrangement of the southern milling machinery probably arose from a reduced requirement, and need not represent an intact survival of early machinery.

Associated structures

Associated with the mill are two structures: a contemporary stone malt kiln to the south-west; and a brick cottage to the south-east (Fig. 1). A stone wall to the north of the cottage, now incorporated into a modern garage, may be part of a third structure. None of the structures was surveyed, but since they formed part of the mill establishment they are briefly described below.

The mill cottage

The cottage has been extended in the twentieth century, but incorporates an earlier, two-storey dwelling. The brick of the earliest phase is identical to that employed in the Phase 2 alteration of the mill. The cottage is identified with a 'small, neat, brick and tiled, dwelling house' recorded in 1809 (D/641/M/5). This accommodation may have replaced the miller's house in the first floor chamber at the southern end of the mill.

The malt kiln (Plate 7)

The malt kiln comprises a rectangular, two-storey structure, aligned east-west and built of coursed rubble with ashlar dressings. The ground floor has flat lintled, opposed doorways in the centres of the long sides. The first floor chamber, originally with a timber floor resting on joists, is lit by two, two-light windows, with chamfered mullions and moulded surrounds. The roof has parapeted, coped gables, resting on stone kneelers, and is now covered with staffordshire-blue

Plate 7 Norbury Mill: south elevation of the malt house.

tiles, but may originally have been thatched. The internal walls on the ground floor have been altered, but appear to have thickened and sloped to form a heating chamber at the west end, with a moveable screen or 'hair' at first floor level for drying the malt. The constructional details of the structure are similar to the mill and it is probably contemporary. Alterations to the kiln, using brick identical to that employed in Phase 2 work in the mill, suggest it was then converted to form an outhouse or barn. The malt kiln is not recorded in the estate valuation of 1809 (D/641/M/5), and may already have been disused. Until the development of large urban commercial maltings in the nineteenth century, malt kilns were a common feature of estates. In general they are simple functional structures, often inserted into redundant buildings. The quality of the Norbury malt kiln complements the adjacent mill.

DISCUSSION

A mill is recorded at Norbury in 1086 (Morgan, 1978: 6), but it is not certain that it remained in use throughout the later medieval period, when many mills in Derbyshire were abandoned. A mill was working at Norbury in the early sixteenth century, when the will of John Fitzherbert (d.1531) disposed of "all such stuff at the mylne as the mylner deyly occupieth" (Cox, 1885: 239). No other mill site has been identified within the parish, and it is probable that the present location, an optimum natural mill site, would have been used long before the surviving building was constructed. While it may have been expedient for the present mill to utilise an established site, no continuity of occupation can be demonstrated.

An inscription on the main door ('WB 1736') provides a reliable *terminus ante quem* for the existence of the mill. However, in the absence of any further direct documentary or epigraphic

evidence a precise dating of its construction can be obtained only through stylistic studies. The dateable features of the first phase of construction comprise: windows with flat drip-moulds and thick, chamfered mullions, and the segmental-arched heads to the doorways and watercourses. Such features, termed "mediaeval or sub-mediaeval" (Brunskill, 1971: 116-119) or even "Tudor", "continued to an astonishingly late date" on Derbyshire manor houses (Pevsner, 1953: 26) and were employed, with only little variation, on minor domestic, rural and industrial vernacular buildings into the nineteenth century. Used at Carnfield Hall and Denby Old Hall in the late sixteenth century, these features predominate in the seventeenth century, with examples at Makeney Old Hall and Alfreton House. In the late seventeenth and early eighteenth century they were employed at Newton Old Hall and Chiverton House (Craven and Stanley, 1982; 1984). It might be expected that the features of an agricultural/industrial building would derive from, and therefore be later than, their earliest domestic use. However, unlike the majority of mill buildings, where the structure is a utilitarian cover for machinery and grain, Norbury Mill, constructed of ashlars, with moulded and glazed windows, coped, parapeted gables, plinth, and segmental-arched doorways and watercourses, has considerable architectural pretension. It is likely to reflect new, or at the very least contemporary, fashions in building. The absence of symmetry and the lack of any classical features suggest an early seventeenth century date for its construction. The modifications, comprising the addition of an external staircase and door at the south end and the enlargement of a first floor window at the north end, cannot be closely dated.

The construction of Norbury Mill and malt kiln represents a considerable capital investment; the quality of the building, far exceeding the commercial requirements of an entrepreneur, suggests a wealthy and exacting owner. In the absence of any direct evidence, the construction of the mill may therefore be attributed to the Fitzherbert family, lords of the manor of Norbury, who had sufficient wealth, access to timber and stone, and controlled the water supplies. The quality of the building would reflect the status of the Fitzherberts, and its embellished appearance derive from its location, close to their principal residence. The seventeenth century date of the present building precludes any direct connection with the author of the *Boke of Husbandrye* and *The Boke of Surveyinge*. In the later sixteenth century the devotion of the family to Roman Catholicism, leading to fine and imprisonment, initiated its financial decline, exacerbated in the seventeenth century by subsequent legal wrangles and adherence to the royalist cause. The Fitzherberts of Norbury became extinct, and in 1648 the estates passed to the Fitzherberts of Swinnerton, Staffordshire. Norbury ceased to be a principal residence, and the manor house and an estate were leased to the family of Maskery (Cox, 1885; Meredith, 1970: 33-4). There was building at Norbury in 1682; the reconstruction of the manor house as a smaller residence is ascribed to the inception of the Maskery tenancy (Cox, 1885: 255-6). However, this activity cannot have included the construction of the mill which, on stylistic grounds, must have been significantly earlier. Despite reduced fortunes, the resources of the Fitzherberts of Norbury remained considerable, and the construction of a mill could have represented an attractive investment for them, with capital recovered in as little as five to six years and the subsequent annual return up to four times greater than an equivalent investment in land (Petchey and Giggins, 1983: 85).

Largely intact seventeenth century mills are rare; the best known are Worsborough, Barnsley (Shorland-Ball, 1978) and Rossett, Clywd. As far as Norbury Mill is concerned, the lack of contemporary structures precludes detailed discussion of the plan. However, the apportioning of the first floor chamber at the southern end, Bay 4, to domestic use is comparable with such provision at Worsborough (Shorland-Ball, 1978: 243); and timber-framed partitions, also

recorded at Worsborough (Shorland-Ball, 1978: 243), may have been intended to absorb the vibration of the working machinery. The buttressing of the rear of Bay 3 to counteract vibration and settlement is likewise comparable with a nineteenth century addition to the Worsborough mill (Shorland-Ball, 1978: 244).

The expense of constructing two water-wheels may have been off-set by the resulting greater capacity of the mill. This large working capacity presupposes a demand, which appears greater than could be sustained by a small settlement, in one of the least populous areas of Derbyshire (Riden, 1978) and, moreover, in a region where pastoral, rather than arable, regimes were predominant (Fussel, 1951: 9). The Fitzherberts may still have been able to compel their tenants, possibly including those on manors adjacent to Norbury, to grind at their mill. The return may also have been increased by the malt kiln, and by limited merchant milling. It is also possible that semi-industrial plant, such as the crushing mill first evidenced in Phase 2, was installed in Phase 1: clay, lime, or marl might have been processed. (It should be noted that in the eighteenth century the nearby mill at Rocester, Staffordshire, supplied ground calcined flint to the Potteries (Meredith, 1964).) There is, however, no evidence that the potential of Norbury Mill was exploited to its full, since only three pairs of stones are recorded in 1809 (D641/M/1/5). In purely economic terms, therefore, the provision of two water-wheels may be an over-ambitious investment, and is perhaps better seen as complementing a structure whose fabric exceeds mere function.

During the eighteenth century (Phase 2) the mill cottage was constructed and the mill overhauled. There may have been piecemeal repair of the mill, but the re-building of the watercourses, gear pits, and internal partitions, the buttressing of the main door and the re-covering of the roof, appear to be a concerted programme to counteract settlement and general decay. The materials, a narrow red brick and irregular staffordshire-blue tiles, were used over a considerable period of time in the eighteenth and early nineteenth centuries, and do not allow the work to be closely dated: a mid- to late-eighteenth century date seems most likely for this renovation of the mill, now already over a century old. At the same time, perhaps, the capacity of the mill was increased with the provision of an additional set of stones in Bay 4; the separation of the first-floor chamber in Bay 1, and the insertion of a second, northern, water-wheel and crushing mill further extended its range. Work on the machinery in 1736, 1748 and 1793 is attested by millwrights' inscriptions. An estate valuation of 1809 records "an undershot water grist mill, working three pairs of stones, excellent mill dam, well supplied with water by the River Dove, and a small, neat, brick and tiled, dwelling house, underlet by the tenant to Mr Lygo" (D641/M/1/5). There is no evidence of tenancy prior to the nineteenth century, although it is probable that the mill was leased for fixed periods, with the tenant responsible for the day-to-day maintenance. A millwright's inscription, 'SM 1833', may refer to the repair of machinery on the inception of a new tenancy. A memorandum of 1832 records an agreement, made between Richard Sutton Ford, on behalf of Thomas Fitzherbert, esquire, and Thomas Maskery of Norbury Hall, gentleman, to let on a yearly tenancy, at an annual rent of £70, the messuage, outbuildings and water corn mill, called Norbury Mill, together with six acres of land, including the river or mill stream. The agreement was to have effect when possession was obtained from the then tenant, Richard Clarke (D641/5/E(L)4). The Maskery family were the largest farmers in the parish in 1832, and resided at the Hall until 1881. The Fitzherbert estate was then sold to Samuel William Clowes, but the Maskery family retained the tenancy for some further time.

From the mid-nineteenth century the occupants of the mill are recorded in trade directories. In 1846 John Pakeman was miller, although he is recorded elsewhere as a miller and farmer

(Bagshaw, 1846: 324). He was still there in 1857, described as farmer and miller (White, 1857: 226), but in 1860 he is listed only as a miller (Harrison *et al.*, 1860: 221). In 1881, William Pakeman, "farmer and miller" is recorded (Kelly, 1881: 221). The designation of these tenants as 'farmer and miller' suggests that the mill did not then provide full time employment. Unable to compete with technologically superior roller-mills, driven by reliable power sources and conveniently located for the milling of imported wheat, the rural mill was throughout England largely reduced to meeting local demand, mainly for animal feed. In the face of this decline, it was not uncommon for mills to be put to other uses. In 1895 William Thorley, a farmer, builder, quarry proprietor and contractor of Snelston (where he was also the tenant of Sides Mill), was to be found at Norbury Mill (Bulmer, 1895: 443-5). Given the national decline in rural milling, and the local predominance of dairying and stock raising, it is unlikely that both Sides Mill and Norbury Mill continued, under a single tenant, as grist-mills. Indeed, by 1899 William Thorley appears at Norbury as a "builder and contractor" (Kelly, 1899: 319). Although a small grist-mill was retained at the southern end of the building, to supply local requirements for animal feed, Thorley's business activities underlie the conversion to a sawmill (Phase 3). A large window and roof lights were inserted; the mill was partially re-roofed; a workshop was constructed at the north end; and the northern machinery was altered to serve a saw and a crushing mill: quantities of white dust, adhering to the water-wheel in Bay 1, indicate that the crusher was used for grinding mortar. A high quality of craftsmanship is evident in the masonry, the brickwork, and the carpentry of the workshop and framed openings. A photograph (Pl. 6) taken *c.* 1885, showing the east front of the mill prior to the insertion of the wooden window frame in Bay 3, provides a *terminus post quem* for Phase 3, which accords well with the later nineteenth or early twentieth century date indicated by the building materials: a regular, machine-pressed staffordshire-blue tile and red brick. The scale of this venture may relate to the proximity of rail transport, and the establishment of Isaac Smith, "coach builder, wheelwright, general and shoeing smith, coal merchant, building material dealer and supplier of all manner of colliery, wheelwrights' and builders' timber", at Norbury Station. By 1908 William Thorley had left Sides Mill, but remained at Norbury (Kelly, 1908: 349), to be succeeded by his son, William Thorley Junior, also a builder, who stayed there until 1928. In Phase 4, a lean-to structure with a corrugated iron roof was constructed on the west side of the mill, a new door and windows inserted at the south end, and concrete used for repairs. In the southern wheel-house an irregular slot was opened to provide further light, and a dynamo inserted. Corrugated iron and concrete are unlikely to have been used before the 1920s. From 1932 the mill was occupied by Arthur William Wheldon, carpenter to L. A. Clowes, and served as an estate carpenters' workshop (Kelly, 1932: 382). The southern mill was used to provide electricity until the Second World War. At the time of writing the future of this rare, early seventeenth century structure remains uncertain.

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