

LAVERSTOKE MILL WHITCHURCH, HAMPSHIRE

HISTORIC BUILDINGS REPORT

Geraint Franklin



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Research Department Report Series 13-2010

**LAVERSTOKE MILL
WHITCHURCH, HAMPSHIRE**

HISTORIC BUILDINGS REPORT

Geraint Franklin

NGR: SU49217 48669

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ISSN 1749-8775

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Research and illustrations by Geraint Franklin
Photography by Geraint Franklin except where otherwise credited.

ARCHIVE LOCATION

National Monument Records Centre, Great Western Village,
Kemble Drive, Swindon SN2 2GZ. Telephone: 01793 414600.

DATE OF SURVEY AND RESEARCH

November 2005 – May 2006, updated 2010.

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Frontispiece: Counting paper in the salle, Building 2 (Undated, c.1950s photograph, supplied by Nick Pearson).

Front cover image: View across the mill race at Laverstoke towards Buildings 5 (the 1854 wheel house) and 1 (the 1881 Glazing house). (Photograph: Jon Clarke; DP098879).

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SUMMARY

Laverstoke Mill is a large, multi-phase paper mill near Whitchurch, north Hampshire. It operated as a paper mill between 1719 and 1963, when Laverstoke was the principal mill of the Portal family, who from 1724 held the sole contract for the manufacture of Bank of England banknote paper. Hand-made rag paper constituted the majority of the output at Laverstoke until the 1950s, although various papermaking machines were installed from the mid-19th century, notably by Bryan Donkin.

The complex comprises around forty closely-grouped buildings with an exceptional landscape setting which includes Laverstoke Park, the mill pond and the River Test. The principal mill buildings are low-rise, red brick structures of mid-19th to mid-20th century date, with metal-framed windows and ashlar, flint or vitrified brick detailing. They remained in reasonably good condition at the time of the 2006 survey, although papermaking machinery has long been removed.

Laverstoke Mill lies within the Laverstoke and Freefolk Conservation Area and contains three grade II-listed buildings: Mill House, Mill Cottages, and the Glazing House. The significance of Laverstoke Mill lies in the architectural interest of the buildings and its historical association with the Bank of England. It was one of the largest and foremost hand-made paper mills in Britain.

ACKNOWLEDGEMENTS

The following are gratefully acknowledged for their help during the preparation of this report: Andrew Barber of Basingstoke and Deane Borough Council; Graham Steaggles, Barry Jones, Susie Barson and Jon Clarke of English Heritage; Jonathan Edis and Jon Lowe of **CGMS**; Brett Harbutt of Thames Water; Nick Pearson; G.R. White and Bryan Hennem. The revised report has benefited considerably from Alan Crocker's research on the Bryan Donkin installation of the 1850s. Mike Williams of English Heritage and Alan Crocker made detailed comments on the text, which was edited by Joanna Smith. Derek Kendall, Jon Clarke and Andrew Barber kindly supplied many of the photographs.

The assistance of the staff of the National Monuments Record and Hampshire Record Office is gratefully acknowledged. Appendices 4-13 are reproduced from Edis and Lowe (2005) by the kind permission of **CGMS** and the authors. Appendix 15 is based on a figure supplied by **CGMS**. Photographs are by Geraint Franklin, except where credited. Where possible all efforts have been made to establish the correct copyright holders of the material reproduced in the report. Unless otherwise cited, images are © English Heritage or © Crown copyright **NMR**.

Lastly, thanks are due to the following ex-employees and local residents who contributed valuable information about Laverstoke Mill: Dave Baker, J. Barker, Mabel Beattie, Frank Bentley, Margaret Chatterton, Gill Conlon, Ron Cousins, R.J. Eastman, Mrs Gilbert, Hector Goldsack, Doreen Harvey, Patrick Hurley, P. Phillimore, Graham Rampton, Neville Richards, Irene Tungate, G.R. White and Dennis Wormsley.

INTRODUCTION

In 2005 a report was commissioned from Architectural Investigation by Graham Steaggles, Historic Areas Advisor, English Heritage Southeastern Region and Andrew Barber, Conservation Officer, Basingstoke and Deane Borough Council to inform a re-listing assessment prior to the redevelopment of Laverstoke Mill. The in-house report was issued in 2006. The opportunities to integrate new research by Alan Crocker on machinery installed by Bryan Donkin, and comments received too late for inclusion in the 2006 report have prompted the revision of the preliminary report. At the time of revision (2010), the revised planning application for Laverstoke Mill is being determined. It is hoped that this report will help to inform the ongoing management of change at this important site.

The report draws on the large Portal archive at the Hampshire Record Office (hereafter abbreviated **HRO**). The Portal's publications on Laverstoke Mill have also been consulted.¹ The most recent assessment of the site is by **CGMS**.² In addition, several former Portals employees have contributed their recollections of Laverstoke, and they are credited individually in the text. Buildings are identified by function if known (eg. Glazing house) and by a numbering system devised by Portals and used in the **CGMS** report (Appendix 15).

Some explanation of process is essential if industrial buildings are to be understood in their functional context. Technical terms relating to papermaking processes and plant are *italicised*: here the reader is referred to Appendix I, an outline of the manufacturing processes of hand-made paper at Laverstoke. Additionally, a glossary of terms can be found at www.baph.org.uk or Shorter (1993). The workings of the Fourdrinier and cylinder mould machines, used at Laverstoke from 1885 and 1917 respectively, are summarised at www.surrencystudios.com/Paper%20Manufacturing.htm and in endnote 143.

Preliminary sections of the report examine the landscape setting and historical development of Laverstoke Mill. The main section comprises detailed descriptions of the principal buildings grouped in chronological order. A comparative section sets out the regional context of Laverstoke, before summarising nationally significant paper mills, including those associated with the Bank of England. The report concludes with a summary of the architectural and historical significance of the site. It is hoped that these will form the strands of a research agenda that will inform and structure the future study of the site.

HISTORICAL DEVELOPMENT

The predominantly 19th-century character of Laverstoke Mill is belied by its long history of water-milling. Prior to its acquisition by Henry Portal in 1718, it was a corn mill, and was included in the sale of Laverstoke manor to Thomas Hussey in 1637.³ It is possible that one or both of the two Laverstoke mills recorded in the Domesday book was located on the present mill site.

Henry Portal (c.1690-1747) was a French Huguenot who fled persecution after the revocation of the Edict of Nantes, arriving at Southampton in c.1706.⁴ He found there an influential community of Huguenot émigrés including the White Paper Makers' Company of England, with whom he became involved, working in a paper mill at South Stoneham, near Southampton in c.1710.⁵ In 1712 Portal set up a small paper mill at Bere, Whitchurch, Hampshire (two miles from Laverstoke).

By 1718, Portal was in a position to expand his business, and obtained the lease of the neighbouring mill at Laverstoke 'in consideration of a new Mill to be built by Henry Portal [...] at the yearly rent of £5 payable half yearly [...] and also one reame of fine foolscap paper neatly cut'.⁶ The mill was rebuilt in 1719 (fig. 1) and is depicted in a parish map of the 1750s by Isaac Taylor (Appendix 4).

The Bank of England had been established in 1694 in the City of London and first issued banknotes in that year; they were initially manufactured by Rice Watkins at Sutton Mills in Berkshire.⁷ Watkins introduced simple watermarks as an anti-counterfeiting measures in 1697 following a number of well publicised forgeries. Watermarks were necessary because banknotes were entirely hand-written until 1725.

As a result of the close relationship between Portals and the Bank of England, key phases at Laverstoke were initiated by developments in printing technology or contracts for new products, denominations or issues. The Bank's introduction of partially-printed notes in 1725 may have prompted them to seek a new contract for a specific grade or quality of paper for the new presses. In December 1724, Henry Portal was awarded the contract for producing watermarked banknote paper for the Bank of England. Personal connections may have played a part: the then-governor of the Bank of England, Sir Gilbert Heathcote, was from a Huguenot family, and it was his uncle, Sir William Heathcote, who granted the Bere mill lease to Portal in 1712.

Backed by the security of this contract, Henry continued to invest in the Laverstoke site: in 1724 the mill was insured for £300, and in 1730 this had risen to £1,200.⁸ From



Figure 1: 1719 datestone reset on Building 1 (photograph: Derek Kendall; DP017538).

the mid 18th century onwards, notes for the Bank of England were manufactured at Laverstoke.⁹ From 1725 to 1818, a Bank of England employee, the 'Bank officer' was resident on site, from 1785 in a cottage built opposite the mill by Joseph Portal.

In the mid-18th century, Portal became an increasingly influential figure in the county and beyond: he purchased the Laverstoke estate in 1759, and became the High Sheriff of the County in 1763. In 1798, he rebuilt the manorial seat, Laverstoke House, to the designs of Joseph Bonomi.

From 1818 to 1919 the Bank of England imposed restrictions on Portal's production of security paper for third parties, such as, private banks, foreign banks, and ordinary commercial paper (known as 'trade papers'). Portal's could only enter into contracts with third parties with the Bank's express consent. This restriction continued even when orders were scarce or ceased entirely in 1821, 1838/9 and 1841, and must have limited the expansion of the mill complex and investment in new plant. The layout of the mill prior to the 1854 rebuild is shown in a series of plans of c.1848 (Appendices 5-7).

The 1850s saw a series of reforms at Laverstoke, again linked to changes in note production at the Bank of England. The Bank Charter Act 1844 began the process which gave the Bank of England a monopoly on banknote issue. Firstly, Portal gained control over the production of the *moulds* on which individual sheets were formed. Previously, moulds were manufactured and stored at the Bank of England, and the mould-maker regularly travelled between London and Laverstoke. In 1852, the Bank's representative was installed in a new mould office at Laverstoke and the Bank paid Portals £200 per year to maintain and store the moulds.¹⁰

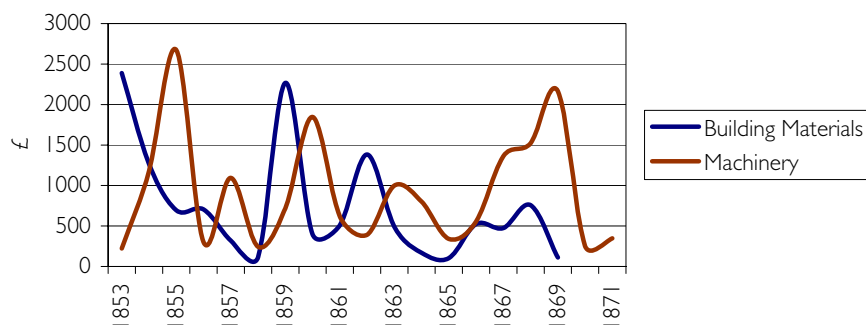
At around this time the rebuilding of Laverstoke mill was first considered. In 1852, the lake was dredged to raise the head of water. At the same time Wyndham Portal started to research new machinery for paper mills, including that manufactured by Bryan Donkin of Bermondsey and John Hall Jr of Dartford, where Donkin was trained.¹² It is likely that the rebuilding was driven by developments in printing at the Bank of England, which issued a new series of fully printed notes in January 1855.¹³ The architect for the 1854 installation, and probably for a second phase of c.1860 was Thomas Hellyer of Ryde on the Isle of Wight (1811-1894). Laverstoke represented a departure from the churches that formed the majority of his design output. As works drew to a close, the *London Illustrated News* reported,

"The new buildings in which the unique machinery is placed were erected under the superintendence of Mr. Hellyer, architect, of the Isle of Wight; and while very great care appears to have been taken to provide every convenience and possible desideratum as regards light, ventilation and comfort for the workmen, Mr Hellyer has, at the same time, succeeded in giving to the whole an appearance of beauty and chasteness, which is but seldom to be found in works of a similar character".¹⁴

In 1853, Bryan Donkin & Co of Bermondsey was commissioned to manufacture and install plant including paper machines and a water turbine.¹⁵ Bryan Donkin (1768–1855) was an instrumental figure in the early mechanisation of papermaking. The Laverstoke installation was probably supervised by his sons John (1802–1854) or Bryan (1809–1893).¹⁶ The mill was rebuilt over the following two years, and the paper-making

processes, until then largely pre-industrial in character, were reconfigured. The new machinery included a water-turbine, a ten horse-power steam boiler, and *drying* and *sizing* machines, although, crucially, the paper continued to be handmade.¹⁷ Recent research shows that Portals did not find Donkin's paper machines entirely satisfactory and by 1860 were using other engineering manufacturers and processes closer to traditional hand-made paper production.¹⁸

The outlay on buildings and machinery was considerable, and Portal imposed a price rise to cover the costs (graph 1).¹⁹ Further expansion at Laverstoke was driven primarily by the acquisition of new contracts. In 1860, new buildings and machinery were erected for the newly-formed Government of India.²⁰ This was a highly significant and long-running contract, as the Paper Currency Act of 1861 gave the Government the monopoly of note issue in India. An average of 25 to 35 bricklayers were employed at Laverstoke during the period March to September 1860. The accounts ledger reveals that most of the machinery for this phase was manufactured by Easton & Amos.²¹ The new plant included new counting machines, which were admired by Bank of England personnel on their visit of that year.²²



Graph 1: Laverstoke Mill: fixed capital expenditure, 1853-1871. Source: HRO:132M98/C616.

Early deliveries to the Bank were made by 'water carriage' to London and the first deliveries of paper by rail were made in 1853.²³ From the mid-19th century until c.1914, horse and cart was the dominant mode of transport. In 1919, a delivery lorry was purchased.²⁴ In 1862 and 1867 security measures were increased after a number of well-publicised thefts of banknote paper from Laverstoke. From 1862 a police constable from the Hampshire Constabulary was installed at the gatehouse.²⁵ There was a further security scare in 1885 following bomb threats from an Irish republican group, the 'vendetta brotherhood and freedom for Ireland'. This was after Portals commenced the manufacture of Irish banknote paper.²⁶ The tightening of security caused changes in working practice and may have prompted the addition of new secure storage facilities.

The Portals took an active interest in researching contemporary developments in banknote paper-making, and in 1877 Wyndham Portal visited banknote paper mills in France and America.²⁷ In 1885, a Fourdrinier papermaking machine was ordered from G.&W. Bertram & Co. of Edinburgh for the manufacture of Postal Order forms and rupees.²⁸ The associated machine house was Building 27. The introduction of machine-made paper at Laverstoke was controversial enough for the *Paper Trade Review* to comment:



Figure 2: 1880 photograph, captioned 'Laverstoke Old Brigade'. Wyndham Portal at centre. Note the horse and cart in the background (photograph supplied by Nick Pearson).

'The fact that the famous Laverstoke Mills should put in a machine, is an indication of the times. Its reputation as a vat mill is unassailable. We believe, however, that the recent issue of Postal Notes has led to this new departure. Doubtless other Government Security Papers are also required'.²⁹

In addition to the main contract with the Bank of England, Laverstoke manufactured Indian banknote paper under contract with the India office; the Banks of Scotland and Ireland (from 1884 and 1885 respectively; and Postal Orders and Old Age Pension forms under contract with the Postmaster general (from 1881 and 1908 respectively).

In 1919 the Bank of England lifted its restrictions on Portals manufacturing papers for other countries (although the Bank retained 'first claim' on Portals.³⁰ Although the volume of orders increased rapidly in response to this, further extension of Laverstoke was 'not thought to be a viable proposition', perhaps due to the lack of additional space for expansion.³¹

By the early 20th century, the Portals regarded Laverstoke as old fashioned and inefficient in comparison to other mills. In a report of 1920, Sir William Portal commented 'economy is a difficult word to introduce into Laverstoke Mills'.³² Instead, a new mill was built at Overton from 1920-22.³³ Overton increasingly



Figure 3: Early-20th century brass check, used as proof of identity or as a temporary stock receipt (scan by Bryan Hennem).



Figure 4: Visit of King George V to Laverstoke in 1923. Note Building 20 background left (photograph supplied by Nick Pearson).

became the focus of expansion and investment in papermaking technology, and still manufactures banknote paper today.

In addition to the mills at Laverstoke, Bere and Overton, Portals acquired additional mills in the early 20th century: Bramshot Mill, Liphook, Hampshire (1906); Turkey Mill, Keighley, Yorkshire (1917); Stowford Mill, Ivybridge, Devonshire (1924); a 50% interest in Cartier Pietro Miliani, Fabriano, Italy (1928); and Chartham & Roughway mills, Kent (1930). Many of these were described as 'overflow mills': they were purchased to help fulfil individual manufacturing contracts. This implies that the existing facilities at Laverstoke and Overton could not cope with this new level of demand.



Figure 5: Watermarked paper made at the Portal exhibition stand at the Festival of Britain (supplied by G.R.White).

Following a reassessment of their business in 1930, Portals sold their interests in trade papers to Wiggins Teape, in order to concentrate on banknote and security paper. For the remainder of the 20th century, Portals continued to rationalise and mechanise production. Laverstoke increasingly specialised in research and design in the fields of engineering, manufacture and security. From 1934, Portals commenced experiments into incorporating metallic security threads into their paper; these may

have been conducted at Laverstoke. This feature was implemented into £1 and 10/- notes in 1940.³⁴

In 1951, Portals demonstrated hand-made paper techniques at the Festival of Britain (fig 5).³⁵ This proved to be something of a swansong, as the production of handmade paper ceased in 1953, and the following year the cylinder mould paper machines (see page 41) were transferred from Laverstoke to Overton, where, by the late 20th century, the Portals had fully rationalised production techniques and had developed their own system of banknote papermaking.³⁶

During the second half of the 20th century, Portals lost orders as many countries, many of them newly-independent, developed their own paper mills. Portals reacted to this by diversifying into non-papermaking ventures. From 1957 to 1972 a chemical research laboratory and research engineering department was installed at Laverstoke.³⁷

Experiments were conducted at Laverstoke into the use of papermaking equipment for other functions, and in the commercial applications of recycled waste pulp.³⁸ Papermaking at the Mill ceased in 1963, and the administration offices and mould office transferred to Overton in 1966.³⁹ In 1972, the Laverstoke site was taken over by Patterson Candy, a subsidiary company of the Portals, and converted for the manufacture of water treatment equipment, which continued until 2005. The premises are still vacant at the time of writing (2010).

SETTING OF THE MILL COMPLEX

Laverstoke Mill is a large, multi-phase paper mill complex of c.1.25ha (3 ac.) on the river Test in Hampshire. It comprises some 21 principal buildings, considered individually on the following pages, in addition to numerous minor and ancillary structures. The setting of the Laverstoke Mill complex derives from the contrast between the 'openness' of the surrounding estate landscape, and the dense, enclosed and compact grain of the mill complex. The landscape setting of the Mill complex is of exceptionally high quality. It is surrounded by Laverstoke Park and bounded by the Test and the tranquil mill pond. These qualities are recognised by the inclusion of Laverstoke Mill in the Laverstoke and Freefolk Conservation Area, designated in 1990.⁴⁰



Figure 6: A Laverstoke Mill 'streetscape' (photograph: Derek Kendall; DP017476).

The diverse and irregular layout of the complex is characteristic of a rural industrial site developed over an extended period of time. It derives from a combination of the



Figure 7: View of the site from the west (photograph: Andrew Barber, B&DBC).



Figure 8: 1994 aerial photograph of Laverstoke Mill from the north east. The lake is visible at the bottom of the photograph. Buildings discussed in this report are numbered (NMR15154 ; © Crown copyright. NMR).

constrained site, which is bounded by the river, lake and the road, and the cumulative effect of piecemeal building. Whilst this quality is evident from the plan (Appendix 15), the complex must be experienced at first hand to appreciate its varied massing, density, permeability, enclosure and silhouette. The spaces between buildings, which range from narrow alleyways to irregular courtyard-like spaces, are a crucial element in the setting of individual structures. Setting is an important element in understanding and evaluating buildings at Laverstoke. The mid-19th-century buildings which form the core of the complex were themselves designed with abutting elements in mind: their setting derives from a dense, cheek-by-jowl relationship with their neighbours. In the second half of the 20th century, development sometimes sprawled beyond the historic core of the site (such as the structures to the north of buildings 9 and 11, and the group east of Mill House), resulting in lower-density areas of generic envelopes.

BUILDING DESCRIPTIONS

The building descriptions are presented in approximately chronological order, and related buildings are grouped together. They should be read in conjunction with the site plan (Appendix 15).

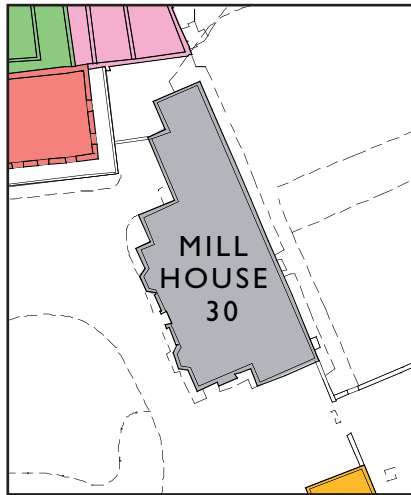


Figure 9: Building 30.

Building 30 (Mill house) is a grade II-listed, late-18th century manager's house with 19th-century additions and alterations. Mill House is not considered in detail here as it lies outside the proposed development area and it was not possible to gain access.

Mill house is of two storeys with a half-hipped tile roof. It is red brick in Flemish bond with rubbed and gauged flat arches and dentilled eaves of moulded brick. The principal (west) elevation is of three symmetrical bays, the pedimented central bay breaking forward. The door architrave has a moulded cornice, narrow pilaster strips terminating in consoles, reeded frieze, architrave, flush-panelled reveals, and decorative fanlight. The wide flanking bays, with their canted bay windows of ashlar, may

represent an early-19th century remodelling of the house. Various later 19th-century additions adjoin to the north and east. Although Mill House is presently in separate ownership, the building's historical association with the mill is nevertheless strong.



Figure 10: Mill House, west elevation (photograph: Andrew Barber, B&DBC).

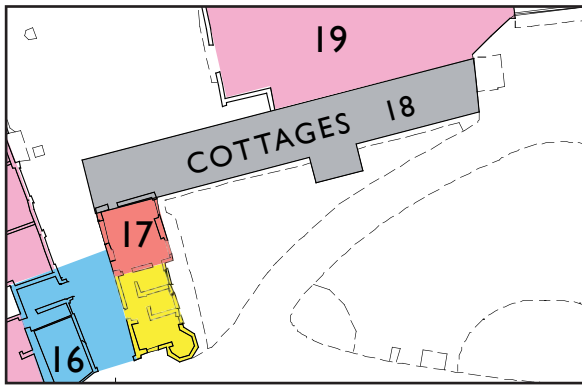


Figure 11: Building 18.

Building 18 (Mill cottages) are grade II-listed workers' cottages. The octagonal ashlar plaque on the north elevation reads 'Built by John Portal Esq., 1842'. The narrow, two-storeyed terrace accommodates five cottages of a single room-depth. The principal façade to the north is faced with knapped and course flint work with red brick dressings, and there is a hipped slate roof. The windows are paired lancets with thick, unmoulded ashlar jambs, simple brick hoodmoulds and intersecting iron glazing bars in the Gothick style.

It is thought that the south-facing elevation was formerly blind.⁴¹ The openings and the porch are modern and relate to the building's late 20th-century conversion to offices. The eastern end was partially rebuilt in brick in the late-20th century. Building 17 abuts the southwestern angle and 19 obscures the eastern portion of the north façade, (although a map of c.1848 suggests this may originally been abutted by mill buildings).

These cottages were built by John Portal as subsidised, low-rent housing for his workers at Laverstoke. A picturesque group in a semi-rural setting, they can be compared to early 18th-century estate-workers cottages as examples of Victorian philanthropy. The houses predate the large model communities of the 1850s and 1860s such as Copley, Halifax of c.1850, Saltaire of 1853 and Ackroyden of 1861, although the tenement blocks at New Lanark, Scotland date from the 1790s and railway companies were building small terraces similar to Mill Cottages in the 1840s at Crewe, Swindon and Wolverton. The cottages also predate early humanitarian groups such as the Society for Improving the Dwellings of the Labouring Classes (established in 1845).



Figure 12 (above): Datestone, Mill Cottages (photograph: Andrew Barber, B&DBC).

Figure 13 (left): Mill Cottages, North elevation (DP098880)



Figure 14: 1880 photograph, original caption 'Male servants at Laverstoke.' (photograph supplied by Nick Pearson). Most of the workers are wearing paper hats.

Portals' attitude to their workers could also be described as paternalistic but controlling, and this is borne out by Mill Cottages. The south elevation, originally blind, can be explained as a desire to confine the occupants' prospects: they could only view their work-place. At the same time, the cottages are overlooked by the manager's house, and access to the world outside the mill could only be gained via the gatehouse.

It was increasingly realised amongst mill-owners that the location of workers' housing within the confines of a site was a means of exercising social control over the workforce. Cooke Taylor wrote in 1840 that this arrangement '[affords] employers opportunities of coming frequently into personal communication with their workpeople and exercising a healthy control over their domestic habits and private morals.'⁴² Portals continued to provide workers' cottages, and the influence of the mill can be seen throughout the wider village, in a common style and quality of philanthropic housing of various dates, including later examples, such as Manor Cottages, Freefolk, the grade II-listed cottages of 1939 by E.T. Mort for agricultural workers on Lord Portal's estate, c.1km (1000 yds) from Laverstoke Mill.

The Mill Cottages belong to a well-documented building type: the estate-workers cottage. It is their location within an enclosed, high-security industrial complex of the mid-19th century, which is unusual and of special interest. Their setting has been compromised by abutting buildings 17 and 19, and their character and appearance (particularly that of the south elevation) compromised through conversion to offices in the late 20th century.

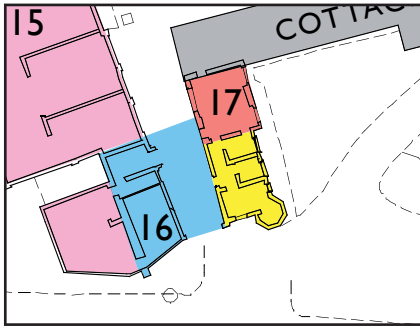


Figure 15 Building 16/17.



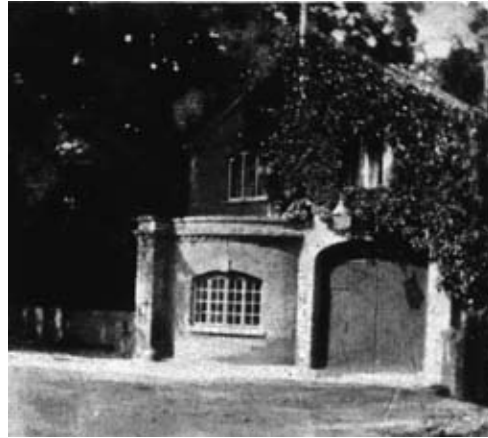
Figure 16: Building 16, heraldic plaque (photograph: Derek Kendall; DP017542).

Building 16/17 (the Gatehouse) dates from the early 19th century, with late 19th century alterations and additions. In 1868, the gatehouse was heightened and re-modelled; prior to that it was a simple pitched-roof structure (figs. 17&19). It is a three-storey building of orange brick with a mixture of vitrified and yellow-brick dressings, including long and short quoins. To the west is a two storey, single-bay catslide extension.

The casement windows of the gatehouse have polychromatic segmental heads and ashlar keystones. The ground floor incorporates a large four-centred carriage arch. The first floor has a single central casement window and the second floor two smaller openings. Also at second floor level is an ashlar plaque bearing the Portal arms (fig. 16) and a square, early-20th-century clock.

Before 1863, the rags that were the raw material for bank note papermaking were unloaded and sorted at the gatehouse.⁴³ From 1862 until 1918, the ground-floor room to the west of the entrance archway was the office of resident PC of the Hampshire Constabulary, who oversaw security on the site. Residential accommodation was provided at first floor level.⁴⁴ From 1918 onwards, Portal's

own commissionaires (security department) occupied the building, with the exception of part of the upper floor, which in the mid-20th century became a telephone exchange and WC. Building 17 (the 'consultation room') was built between 1894 and 1910 and was used as a meeting room in the mid-20th century.⁴⁵ To the east and west are 20th-century additions.



Figures 17&18 (top and bottom left): 'As is' and 'proposed' sketches of the gatehouse by William Portal, 1868 (supplied by Nick Pearson).

Figure 19 (top right): Undated, pre-1868 postcard of Building 16 prior to alterations. (supplied by Mrs Irene Tungate).

Figure 20 (bottom right): Building 16, south elevation in 2006. (photograph: Derek Kendall; DP017543).

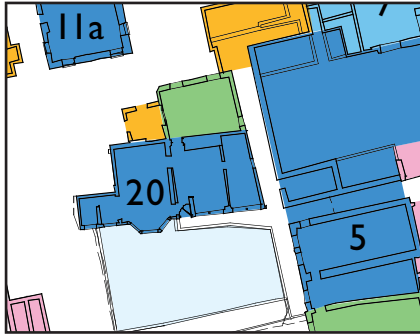


Figure 21: Building 20.

Building 20 (Manager's offices) is an asymmetric, two-storeyed block of 1857.⁴⁶ It comprises a double-gabled range of four bays, a two-bay section originally incorporating a ground floor recess and a two-bay gabled range to the east. It is built of Flemish bond with headers of vitrified brick, a detail not observed elsewhere at Laverstoke Mill. The central gable contains a clock and a ground floor bay window. The original fenestration, which partially survives, consists of iron-framed casements with flat-headed rubbed and gauged brick arches.

The irregular south elevation expresses the interior use of space much more clearly than the contemporary mill buildings, which are on the whole regular and symmetric. The picturesque, domestic quality of the irregularly sized gables is tempered by the inclusion of an exposed iron lintel under which was formerly a two-bay recess (see fig. 4). These characteristics are not shared with the 1854-60 mill buildings attributed to Thomas Hellyer. Later additions include the bay window, alterations to the southeast corner and partial mid-20th-century refenestration. First floor access to Building 5 (east-west wing) was inserted in the mid-20th century via a corbelled-out circulation lobby.

The room lit by the bay window is the grandest, and retains features such as architraves and cornice. This may originally have been the manager's offices. By the mid-20th century it was the chairman's office, the adjoining room the managing director's office, and the smaller room to the east, his secretary's office. The rooms above may have contained residential accommodation for visitors etc; these later became secretarial and finance offices.⁴⁷ The Mill offices overlook the river Test, the courtyard, Mill cottages and the Gatehouse to the south, enabling the manager to survey the principal entrance of the mills and the workers' housing.



Figure 22: Mill offices, south elevation (photograph: Andrew Barber, B&DBC).



Figure 23 Building 5: south wing

Building 5: south wing (Wheel house) is one of the group of 1854 buildings designed by Thomas Hellyer to house machinery designed by Bryan Donkin & Co. It is one of the earliest turbine houses in England and, although the turbine no longer survives, the remaining machine house contains associated fittings and is of intrinsic architectural merit. Only the southern part of Building 5 is considered here. The principal (west) elevation of this block is of orange brick with three semi-circular headed windows at first-floor level with rubbed and gauged voussoirs, and an oculus over. The covered way abutting the east elevation is an inter-war rebuild on the footprint of an earlier passage.

The central room, located directly over the mill tail, was the wheel house. This contains fittings for a water turbine, installed by Bryan Donkin in 1854 at a cost of £575.⁴⁸ The wheel-house contains a cast-iron fish-bellied beam with a bearing on the underside for a vertical drive-shaft which was driven by the turbine below, a second beam which supported bearings for a horizontal shaft and a pulley mechanism which may have raised and lowered the turbine wheels. There is also a sluice-gate system for directing water onto the turbine. The paddle and control wheel for this still functions.

The turbine itself was located beneath the wheel house floor. It was 'motionless' by 1895, although it remained an auxiliary power source into the 20th century.⁴⁹ It was probably removed in the mid-20th century, although intrusive investigation may reveal surviving elements and fixtures.⁵⁰ Prior to 1854, a waterwheel was been located in the same position, as indicated by Appendix 6.

The turbine is described in the 1919 inventory: 'One water turbine with about 20 buckets, having



Figure 24: Building 5 (south wing): west elevation (photograph: Jon Clarke; DP098881).



Figure 25: Building 5 (south wing). Wheel house interior: detail showing control wheel for sluice gate (DP098882).

bevel gear, to operate the outside buckets from the beater house floor [above] and double bevel gear to operate [sluice] gate. One second set of gear for operating the inside buckets from the Turbine House floor'.⁵¹ This was probably a vertical shaft, axial flow turbine with a horizontal wheel, of the Fontaine type.⁵² This type was suited to small heads of water such as the head of about six feet at Laverstoke.⁵³ The *Illustrated London News* reported that the Laverstoke turbine featured 'a beautiful contrivance rendered necessary here by the constantly varying level of the water at the tail of the mill'.⁵⁴ This was probably a lifting and lowering mechanism.

The inventory goes on to describe the machinery in the wheel house: 'Vertical shaft, with one pair of bevel wheels, the wheel having mortise teeth driving to the glazing room [Building I to the south] with belt pulley. One pulley to drive [Donkin] washing engine [on first floor]. One pulley to drive beating engine [on first floor]. Extension of turbine shaft, with one pair of wheels, the wheel having mortise teeth, the horizontal shaft having coupling, two wall brackets and [pulley] blocks and one pair of spur wheels driving the water pump, one having mortise teeth.'⁵⁵

The Fromant turbine was developed by Fromant of Chartres, France and patented in 1840. A simpler version was installed at the Ballincollig gunpowder works, County Cork, in 1854.⁵⁶ Turbine technology was slow to be adopted in England, because cheap steam-power was readily available. Donkin & Co exhibited a turbine of this type at the 1862 Great Exhibition in London. If this interpretation is correct, then it is likely that the Laverstoke example was the first Fontaine turbine installation in the United Kingdom.⁵⁷

A beater house was located above the turbine on the first floor. In 1919 this contained 'one old beater; one washing engine by Bryan Donkin, new washing engine by Bertrams'.⁵⁸ At some later point it was converted to a pay office.⁵⁹

Although the Wheelhouse was rebuilt in 1854, the present layout shares many similarities with that shown on a c.1848 plan (see Appendix 6). The rebuild retains the footprint and position of former openings and it seems that many areas such as the *salle*, vat room and wheel house enjoyed continuity of function.

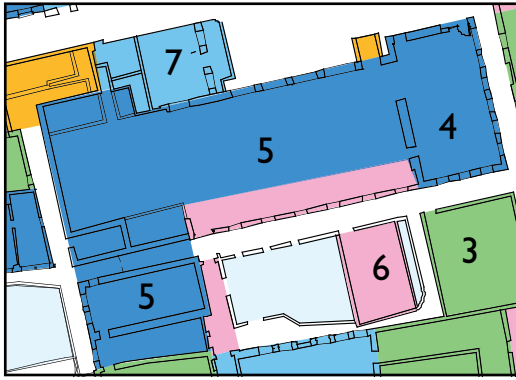


Figure 26: Building 5: east-west wing

Building 5: east-west wing is a paper mill of 1854 by Thomas Hellyer with Bryan Donkin & Co as consulting engineers. It was historically known as 'A Mill'.⁶⁰ The south wing is dealt with separately on account of its differing function (see page 19). The structure comprises a long, single storey, east-west aligned block with a cross-wing to the west. The building was originally of six bays, with a south door on the easternmost bay.⁶¹ The present eastern cross-wing (Building 4) is a later but associated addition of c.1860. The 1854

Paper Mill shared some similarities with that shown on a c.1848 plan (see Appendix 6). In particular, the vats were housed in the same area as they were in the pre-1854 building,

Building 5 has been extensively altered in the 20th century. External walls from the primary phase survive only where they have been preserved by abutting buildings, such as in the western cross wing. The triple openings shown in the 1854 *Illustrated London News* illustration (fig. 28) – which are duplicated on the north elevation of Building 4 – are blocked. The original external gable wall of Building 5 also survives. The north wall is shown as blind in the 1854 view, perhaps anticipating later additions of the 1860s to the north (a paper store, labelled 7 on the 1931 fire insurance plan).⁶² Following the subsequent clearance of these buildings in the 1970s, the north wall was rebuilt incorporating large metal-framed windows with concrete surrounds.⁶³ The south wall was removed



Figure 27: Building 5, (east-west wing), view to the west. (photograph: Jon Clarke, DP098883).

between 1910 and 1931 to enable an aisle-like extension to the south. The roof covering is modern also.

The most significant surviving element of the structures are the roof trusses, although these are reset and now rest on internal responds (I-beams with concrete plinths), and they show evidence of a certain amount of repair. They take the form of Polonceau trusses, an innovative design patented by Camille Polonceau in 1837. They consist of two inverted king post trusses tied together, combining timber principal rafters, cast-iron struts and wrought-iron tie rods.⁶⁴ Polonceau trusses were employed in the contemporary Building 9 and later buildings (Building 27 of 1885; Building 11 extension of 1907) where all-iron and all-steel versions were developed. This particular truss was so prevalent at Laverstoke because it fulfils two of the crucial requirements for machine houses: they could span large distances economically, and provide extra headroom compared to standard king or queen post forms. It is interesting to note that this structure originated in France, like many of the innovations introduced to Laverstoke.

The building housed machinery, manufactured by Bryan Donkin and Co, for *couching*, *drying* and *sizing* hand-made banknote paper. The original arrangement can be seen in the 1854 engraving (fig. 28), which shows the north east junction of the main block and the cross wing. At the western cross wing, *mould*-made sheets were *couched* onto an moving web of felt and passed around steam-heated drying cylinders. The notes were then passed through a bath of *size* and dried again using a further set of cylinders.⁶⁵

The 1854 illustration shows that power transmission was carried under floor level. The large belt wheel was probably driven by shafting from the turbine to the south. The

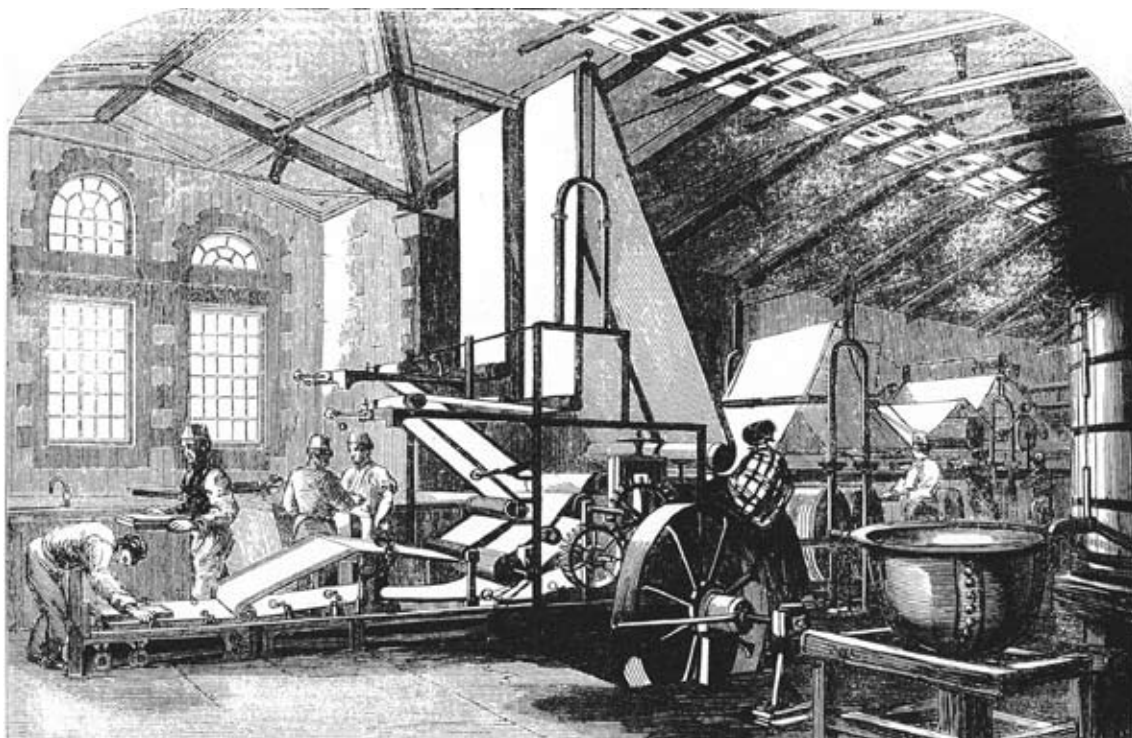


Figure 28: Building 5 (east-west wing). 1854 Illustrated London News illustration of papermaking machinery. The view is to the north east.

process bears a similarity to the press and drier sections of the Fourdrinier process as developed by Brian Donkin, but crucially permitted the use of *hand-moulds*. As a whole the process represents a partial mechanisation of hand-made papermaking.

The east end of the building may have housed the mould office after its relocation from the Bank of England between 1856 to 1860. Wyndham Portal's memorandum of 12 February 1856 states 'The Mould Office will be removed into the east end of the new building immediately.'⁶⁶

By 1919, 'A mill' contained four cast-iron *stuff chests*, eight lead-lined *vats* with agitators, *strainers* and eight waterleaf *drying machines*, 'three of an old type (by Bryan Donkin), one by Wallis and Stevens and four by Bertrams Ltd'.⁶⁷ The Donkin drying machine was probably removed in the 1920s or 30s.⁶⁸ A former Laverstoke employee recalls an arrangement of four vats, driers and a *press* in the mid 20th century, used to manufacture handmade trade paper.⁶⁹ The vats were supplied with pulp produced in Building 9 via pipes. A papermaking machine was installed in the 1960s for a short period.⁷⁰ The building was most recently used as an test room for mechanical trials.⁷¹



Figure 29: A century on, vatman and coucher still at work in Building 5, although Donkin's machine is gone (undated c.1950s photograph supplied by Nick Pearson).



Figure 30: Building 9

at ground-floor level is a blocked carriage opening, flanked by windows; above, a large semicircular-headed window with an oculus lighting the clerestory. The windows are metal framed with concrete lintels and cast-iron sills, probably early-20th-century replacements. The interior of the southwestern portion is open to the roof, exposing iron Polonceau trusses of essentially identical type to the firmly-dated Building 5, another indicator of a c.1854 date.

Building 9 is a paper mill of c.1854 and attributed to the architect Thomas Hellyer. It has additions of the mid-19th century (perhaps 1860) and 20th century to the north and east. It is a handmade paper mill associated with the manufacture of Bank of England note paper. It was formerly known as 'B Mill'.⁷²

The earliest element is the north-south orientated, single-storey block to the south west (fig. 31). This is a tall, red-orange brick structure with dark red and vitrified brick dressings. The symmetrical south elevation expresses the full-length gabled louvre. At



Figure 31: c.1854 element of Building 9, south elevation (photograph: Andrew Barber, B&DBC).

The eastern extension is later, probably of the 1860s (it is present on the 1872 Ordnance Survey map). The first floor, known as 'B mill top' projects beyond the ground floor, spanning the walkway on inserted steel lintels to join Building 7 (fig. 6).⁷³ At ground floor level the extension and the earlier western building form a single open plan area. One explanation for this is that the introduction of new machinery required a larger floor area. The party wall above is carried on two cast-iron columns which support a fish-bellied, north-south spine beam and two transverse tie beams, all of wrought iron (fig. 32). They support rolled-iron joists, a technique introduced in the 1850s. All this would have presented a considerable engineering challenge, and it is possible that this work relates to 'four girders' fabricated by Henry

Grissell in 1860.⁷⁴ It is unusual to see the fish-bellied form in anything other than cast iron. Fish-bellied beams can also be seen in the Wheel-house.

By the early 20th century, handmade trade paper was being manufactured here. In 1919, the southern part of the ground floor housed six *stuff chests* and seven *strainers*, and the northern part seven lead-lined *vats* and a ten horsepower electric motor, with a shaft and belt pulley arrangement to power the first floor. The Mill also housed two hydraulic *baling presses* 'of an older type [than those of Building 11] with wrought iron piping, and seven *waterleaf drying machines* similar to C Mill [Building 11] but of an older type, chiefly made at Basingstoke in 1862'.⁷⁵ It is likely that this represents a *terminus ante quem* for the completion of the extension.

The first floor of the eastern wing contained the principal beater and breaker machines for the whole mill. In 1919, there were two lead-lined Hollander beaters with 10'x5'4" troughs. These were 'of the old type' and were manufactured by George and William Bertram of Edinburgh.⁷⁶

From the 1920s onwards, *half-stuff* was supplied to Laverstoke by lorry from the Portal mills at Overton and Ivybridge.⁷⁷ It was transported to the first floor of the east wing of Building 9 by a lift, located on the underside of the projecting first floor. After being passed through *beater* and *breaker* machines, the resulting stuff was piped down into the ground-floor *stuff chests*. By the mid-20th century and possibly earlier, this floor was supplying stuff to the mills in buildings 14, 5, and 11, via a network of pipes that ran between the buildings.⁷⁸ The paper was produced in the north end of the building. The south western part of Building 9 was converted to a steam boiler house in the mid-1960s.⁷⁹



Figure 32 Building 9: fish-bellied beams (DP098884).



Figure 33: c.1854 element of Building 9, south internal elevation. Note the Polonceau trusses (photograph: Andrew Barber, B&DBC).

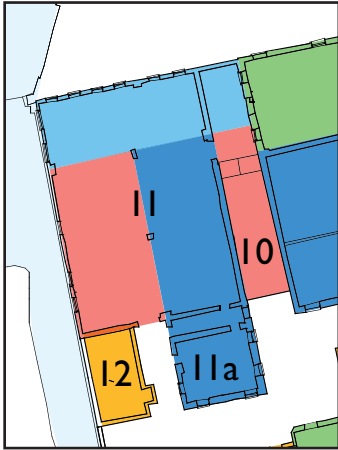


Figure 34: Buildings 11 and 11a.

Buildings 11 and 11a are a paper mill is of c.1860 attributed to the architect Thomas Hellyer. It has late 19th century and 1907 additions to the north and west respectively. It is a rare example of a handmade paper mill and *mould* office associated with the manufacture of Bank of England bank notes. It was historically known as 'C Mill'.⁸⁰

The principle three storey, north-south aligned block is approximately contemporary with Building 4 (c.1860), on the evidence of its vitrified brick, red brick and ashlar dressings and eaves treatment. The metal-framed windows with their concrete lintels and cast-iron sills are probably early-20th century replacements.

The east-west extension to the north was erected between 1872 and 1894 on the basis of map evidence. It has an east-west aligned pitched-roof. The polychromatic detailing of the east gable end is based on the 1850s wing. The outward-facing north elevation, by contrast, omits such niceties: the irregular disposition of openings presumably reflects functional requirements.

The 1907 addition to the south west incorporates vitrified dressings, an oculus and datestone. Like the c.1854 element of Building 9, on which it is seemingly based, it has a full-length louvered clerestory. The roof has glazed sections and is supported by a slender, all-steel Polonceau truss (see page 22).



Figure 35: Building 11 interior, looking south west (photograph: Jon Clarke; DP098885).

By the early 20th century, this particular mill produced five pound notes and high-denomination (£1000) treasury bonds. The ground floor of the 1907 building was the *vat* room, and in 1919 contained six cylindrical cast-iron *stuff chests* of 8' diameter with agitators, seven flat *strainers*, and seven lead-lined timber *vats*.⁸¹ The ground floor of the c.1860 building contained seven single-cylinder waterleaf *drying machines*.⁸² A well was located to the south of Building 11a. In the mid-20th century this was converted into a catch pit, into which condensed water from the steam-traps would run. This water, which had been softened, was pumped back to the boiler.⁸³

In the early 20th century, and possibly from 1860, the first and second floors of the three-storey structure comprised the mould office.⁸⁴ Here, both hand-moulds and mould covers for the new cylinder machines were made. Watermarks, including elaborate *chiaroscuro* watermarks, were also designed and manufactured.⁸⁵ It is possible that these were the 'new buildings for mould office and Indian government' noted in a Portals memorandum.⁸⁶ A press room was located in the north-eastern part of the first floor, which in 1919 contained two hydraulic *baling presses*.⁸⁷

When the mould office was relocated to the first floor of Building 14 around 1956.⁸⁸ Building 11 was converted into an experimental engineering workshop, and 11a into an office. The upper storeys became a drawing office and electronic laboratory.⁸⁹



Figure 36: Building 11, south elevation (photograph: Derek Kendall; DP017461).

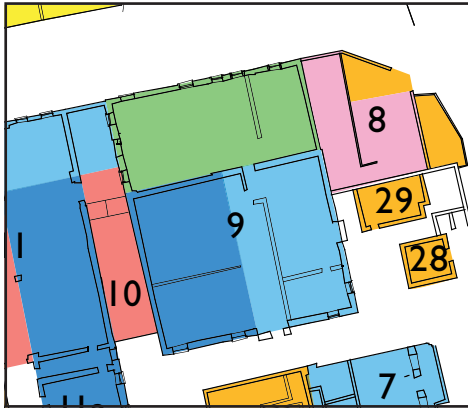


Figure 37: Building 10

Building 10 is a narrow, single-storey infill structure between Buildings 9 and 11, erected between 1894 and 1910. It contained washing plant for *couch* felts, including two ‘Surgar’ washing machines and a centrifugal extractor.⁹⁰ After 1917, the cylinder moulds from Building 14 were stored and repaired here.⁹¹ From the late 1950s it was a mess room.⁹²



Figure 38: Building 10, south elevation (DP098886).

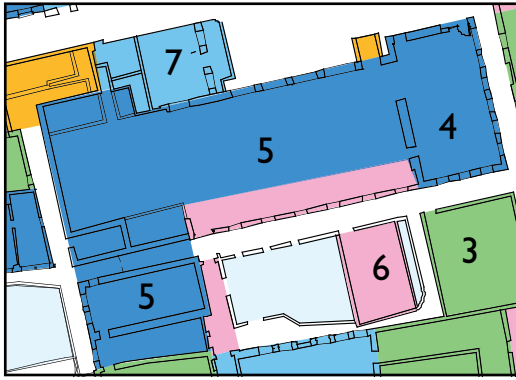


Figure 39: Building 4.

Building 4 (the Size house) is of c.1860 and attributed to Thomas Hellyer, although with 20th-century alterations. It abuts the single storey Building 5 (east-west wing), forming its eastern cross wing. Stylistically, it resembles the buildings of Hellyer's mid-1850s rebuild. For example, the ashlar kneelers and eaves treatment is present. The east elevation is of highly-glazed vitrified bricks with red-brick dressings; an identical treatment to the north-south wing of Building 11 (see fig. 36).

The north elevation is a late-20th-century rebuild below eaves level, although three semi-circular window heads with orange rubbed and gauged brick voussoirs are preserved in the gable. The fenestration is similar in appearance to the north elevation of the western cross-wing of the adjoining Building 5 (see fig. 28), no doubt reflecting a desire to make the group as symmetrical as possible.

This was the *sizing* house for the Building 5 paper mill and originally housed sizing machines installed by Donkin & Co.⁹³ The ground floor housed a gelatine size plant, where animal hide, hooves or bones were boiled down, and the resulting size stored in wood-lined size tanks.⁹⁴ The first floor was known as the 'book room' and was used as a stationery store in the early 20th century.⁹⁵

The Size house is not shown on a survey of July 1860 (see Appendix 8), but was probably under construction, as a contemporary note makes reference to the erection of the 'East end of mills building'.⁹⁶ The new building



Figure 40: Building 4: north elevation (DP098887).

was probably associated with the manufacture of Indian rupees which commenced in 1860 and involved 'new buildings and machinery'.⁹⁷



Figure 41: Building 4: south elevation. Building 5 abuts 4 to the left and beyond is Building 21 (DP098888).

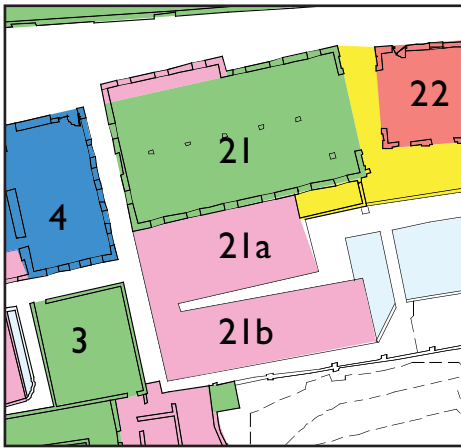


Figure 42: Building 21

Building 21 (the Size house) was built some time between 1872 and 1894. It is a two storeyed brick building of six recessed bays, articulated by pilasters flush with the eaves plane. Metal-framed windows with central casement elements, concrete lintels and cast-iron sills. The additions to the north west and the late-20th-century infill between 21 & 22 are not of interest.

In the early-20th century, this was the main sizing house for handmade papers. It was probably a replacement for the older and smaller Building 4. In 1919 it contained four gelatine sizing machines for 54-inch paper and six lead-lined sizing tubs.⁹⁸ The first floor was a drying loft.⁹⁹

The two galvanised corrugated-iron structures to the south (labelled on fig. 12 as 21a and b) were built between 1910 and 1931. They may correspond with a *vat* room known as 'A Mill extension', installed in January 1915 and referred to in the chief engineer's reports.¹⁰⁰ In the mid-20th century, the corrugated iron-clad **Building 21a** contained drying machines and **21b** to the south was known as the 'pilot hall', and used for experimental engineering work.¹⁰¹



Figure 43: Building 21, south elevation (photograph: Derek Kendall; (DP017533)).

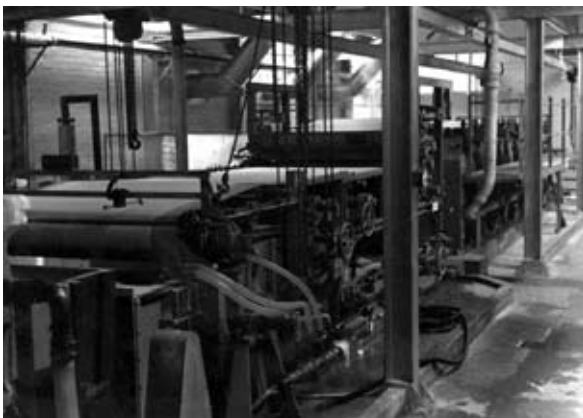


Figure 44: Undated, c.1950s photograph of the gelatine sizing machine on the ground floor of Building 21. (Photograph supplied by Nick Pearson).



Figure 45: Undated, c.1950s photograph of the drying loft on the first floor of Building 21. (Photograph supplied by Nick Pearson).

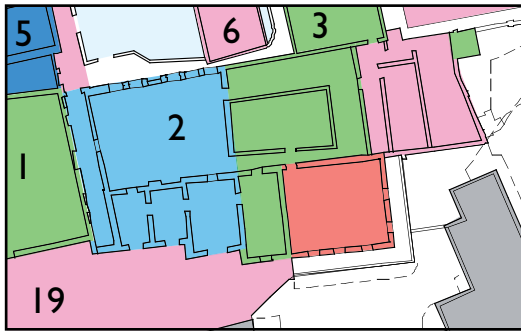


Figure 46: Building 2

Building 2 (the Salle and strong rooms) is a multi-phase late-19th-century *salle* with the rare and specialised addition of secure storage facilities for banknote paper. This ensemble is a characteristic example of the incremental, compact layout at Laverstoke.

This complex developed piecemeal between 1872 and 1894, as indicated by map evidence and the many-gabled south elevation (fig. 47). The north-

western building is of two storeys and six bays. The fenestration comprises metal-framed casements with painted lintels and cast-iron sills (fig. 48). The first floor of the north elevation is a later rebuild in a darker brick with a different bay-rhythm. Both of these phases show evidence of former abutting buildings, which are shown on the fire insurance plan of 1931 (Appendix 12). This building was the *salle*, where the finished paper was trimmed, sorted, bundled, cured and packed.¹⁰² The rebuilt *salle* corresponds to the position of the *salle* in the pre-1854 building, as shown on a c.1848 plan (see Appendix 6).

To the southwest are four later strong rooms, where the stockpile of packed notes was stored prior to despatch.¹⁰³ These are a series of small cells with thick internal walls of brick. A number of security features survive including stone flags, and iron strong room doors and windows. At ground and first floor level these chambers have corrugated iron barrel-vaulting, haunched with concrete: a measure that combines fireproofing with security.¹⁰⁴



Figure 47: Building 2, south elevation. In the foreground are Buildings 19 (with metal roof and 18 (slate roof). (photograph: Andrew Barber, B&DBC).



Figure 48 (left): Building 2, north elevation. The ground floor was the *salle* (photograph: Jon Clarke; DP098889).

The eastern part of Building 2 is an iron-framed and galvanised corrugated iron-clad building of 1872-1894. This structure is of interest as an early corrugated iron structure preserving unusual wrought-iron truss forms. Corrugated iron was in manufacture from 1829 and prefabricated iron structures with corrugated iron cladding, typically including a semi-circular roof, were available from at least the 1840s.¹⁰⁵ Corrugated-iron was being used as a cladding material at Laverstoke by 1860, although surviving instances of the material post-date 1872.¹⁰⁶ It was doubtless favoured at Laverstoke as a cheap means of rapidly erecting light and flexible structures at short notice and with little need for skilled site labour. It is more likely that the corrugated-iron structures were fabricated locally, perhaps by the on site blacksmith, than pre-fabricated to a standard design.

The ground floor of the corrugated-iron building contains a secure 'room within a room' which can be dated to the 1880s or 1890s on the basis of its construction details.¹⁰⁷ This is again steel framed, with fishplate connections and corrugated-iron cladding. Its was a probably a counting house and in the mid-20th century was divided into counting booths.¹⁰⁸

To the south east is a larger secure area with parquet flooring, perhaps for weighing, counting, inspection or packing. The present layout of the room seems to have been established between 1894 and 1910; the parquet flooring may be of that date or slightly later. The room may date from 1909 when large stockpiles of Indian note paper were stored at Laverstoke to relieve the Bank of England's storerooms.¹⁰⁹ Into the flooring has been inserted a large early- or mid- 20th-century steel plinth, which represents the base of a safe, weighing machine or press. The room was latterly used for archive storage.

To the east is an extension built between 1894 and 1910. In the mid-20th century, and possibly earlier, it was a storehouse for ream wrapping paper, with clerical offices over.¹¹⁰

In the early-20th century the first floor of Building 2 was utilised as the offices of the accounts department, although a former employee recalls that the interior was of white glazed bricks, implying an industrial function and possibly wet processes.¹¹¹ There is also evidence for bearing boxes at first-floor level, indicating at least two north-south aligned shafts.



Two undated, c.1950s photographs of the sale in Building 2. Figure 49 (left) shows paper being sorted, and Figure 50 (bottom left) may be a view of a guillotine or punching machine (photographs supplied by Nick Pearson).

Figure 51: (bottom right) Building 2, high security stores (photograph: Derek Kendall; DP017504).



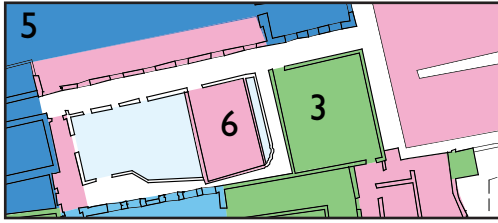


Figure 52: Building 3.

Building 3 (the Mill office) was built between 1872 and 1894 is a small structure straddling the river on I-beams. It is iron-framed with painted, galvanised corrugated iron cladding. The wrought-iron trusses, with their unusual connectors, were probably fabricated locally, perhaps on-site.

The Offices postdate the eastern part of Building 2, with which they interconnect at first-floor level. Building 3 has a semi-circular roof of double-skin type (the outer skin was replaced in the late 20th century). Earlier in the century it accommodated the Foreman's office, and in the latter half of the century the southern part was used as a sick-bay and the northern part as offices.¹¹² The mid-20th century interior survives.

Figure 53: West elevation of Building 3 (photograph: Derek Kendall; DP017516).

Figure 54: Building 3, detail of wrought-iron truss connectors (DP098890).



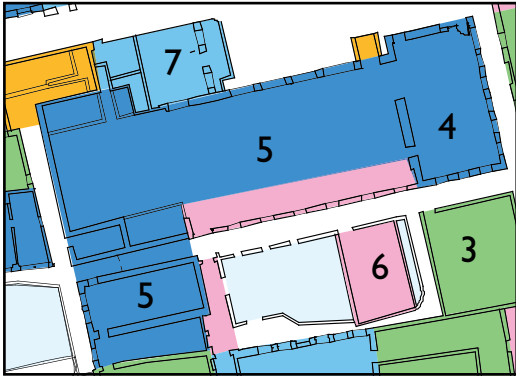


Figure 55: Building 7.

Building 7 was built between 1872 and 1894 and was known in the 20th century as the 'old bobbin room'.¹¹³ This is thought to refer to the cylinders used to store the silver security thread.¹¹⁴ The building was recently used as a welding room. The water tower above is square in plan, with a pyramidal slate roof surmounted by a weathervane. The structure is of orange brick with vitrified dressings and gauged-brick oculi are set below the eaves.



Figure 56: Building 7, watertower (DP098891).



Building I (the Glazing house) is listed at grade II. It is a two-storey, six-bay structure of red brick with vitrified dressings and a dentilled eaves course. The pitched roof is covered with slate and incorporates three louvres. The iron-framed casements have painted lintels and cast-iron sills. The northernmost bay incorporates a door and the second bay from the south contains two commemorative plaques at sill band level (fig 1). The older plaque is resited and reads 'This house and mill was built by Henry Portal in the Year 1719'. The plaque below this reads 'Rebuilt by Wyndham S. Portal 1881'.

Figure 57: Building I.

Building I was probably associated with the 1881 contract to supply paper for postal orders. In the early 20th century and probably earlier, the ground floor functioned as a *glazing* room and contained plate-glazing machines.¹¹⁵ In 1919, the glazing room contained six 'boarding *calenders* [and] copper *plates*'.¹¹⁶ The room above was also a glazing room and contained a single calender and a hand-edge trimmer. By the early 20th century it had become a counting and picking room, where women workers in cubicles removed blemishes from trade paper with picking knives.¹¹⁷ The subdivision of the interior into clerical offices in the mid-1950s leaves little physical evidence for prior function.



Figure 58: Building I, west elevation (DP098892).

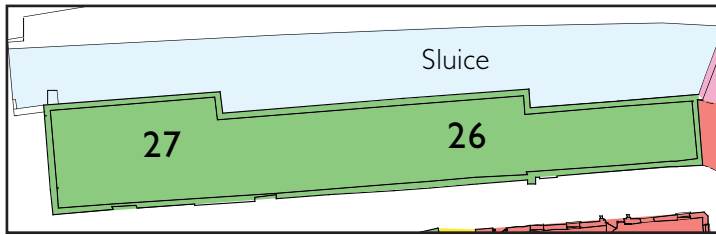


Figure 59: Building 27.

Building 27 is a **Fourdrinier machine house** of 1885, and together with Building 26 comprised a machine-made paper mill.¹¹⁸ Building 27 is a single-storey structure to the west of the three storey part of Building 26. It has

particularly large metal-framed casements on the north elevation and a full-height loading door to the south. The west elevation was rebuilt in the late-20th century and the roof was renewed.

The roof of the building has slender iron versions of the Polonceau trusses found in earlier buildings on the site (see page 22). It carries the original purlins and rafters, and a modern metal roof. The northern end of the trusses rest on a longitudinal iron joist carried on stanchions: this enables a north aisle. The north external wall adjoins the water and is secured to the main structure with ties that clasp onto the longitudinal beam. The large S-plates are conspicuous on the north external elevation.

This is the likely location of the Fourdrinier machine, based on information gained from a former employee corroborated with an inventory of 1919.¹¹⁹ The machine was removed in the early 1920s, having been described by the chairman in 1920 as a 'prehistoric *object d'art*', although the stuff chests remained until the 1940s.¹²⁰ This machine was installed for the manufacture of Postal Order forms and rupees.¹²¹ The machine, which was 66 inches wide, was manufactured by G.&W. Bertram & Co. of Edinburgh.¹²² It was the only Fourdrinier machine installed at Laverstoke. In February 1885, Melvin Portal specified, 'in the Machine House to be erected to hold the Machine there will be ample room on each side for passage room etc—with perhaps a recess or two for tubs tins etc etc'.¹²³ The 1919 inventory states that the Fourdrinier house also contained two *stuff chests* with agitators, and two flat *strainers*. A single sheet paper cutter was installed at the same time.¹²⁴ In the 1950s or 1960s the structure was converted to an engineers' store and fabricating workshop.¹²⁵



Figure 60: Building 27, north elevation (DP098893).

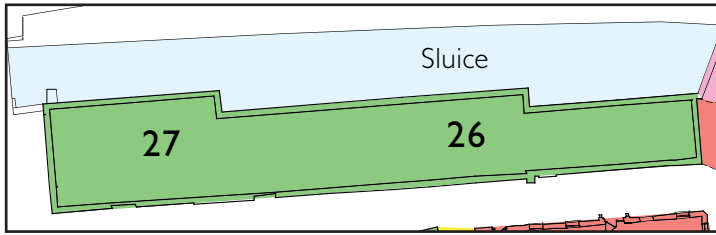


Figure 61: Building 26.

Building 26 (the Sizing and size-drying house) was erected between 1885 and 1894, with late-20th-century alterations and additions. The structure, which abuts Building 27 and therefore postdates 1885, comprises three phases of three, two

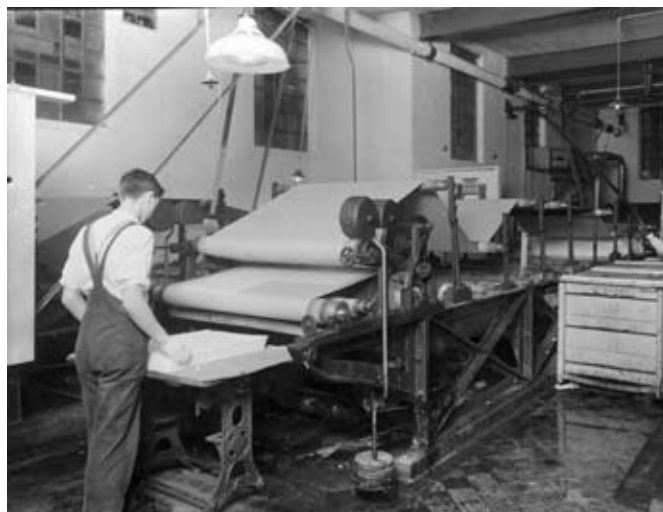
and one storeys respectively. The three storey section represents a sympathetic late-20th-century partial rebuilding of an older two-storey building, by the Whitchurch builder G.J. Smith.¹²⁶ The fenestration of the two storey building is typical of the late 19th-century buildings on this site: metal-framed sashes with concrete lintels and cast-iron sills. The east gable end has a large carriage opening, acknowledged by the semi-circular corrugated iron roof of the abutting single storey extension.

In the 20th century, £5 note paper produced on the Fourdrinier machine (Building 27) were sized and air-dried in Building 26. The two-storey building may have contained a ground-floor size boiler, with a drying loft over.¹²⁷ The building to the east may have housed cylindrical *air-driers*, which were old, cast-iron machines.¹²⁸ In 1919 the building also contained a single four roll *calender*.¹²⁹



Figure 62 (top): Western, three storey part of Building 26, looking east (photograph: Derek Kendall; DP017493).

Figure 63: Undated, c.1950s photograph of sizing machine. The location is either Building 26 or 21 (supplied by Nick Pearson).



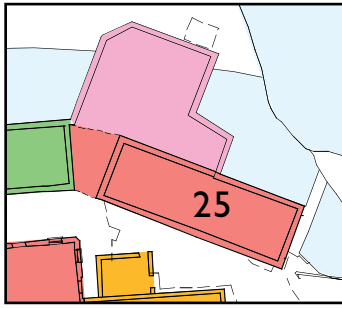


Figure 64: Building 25.

Building 25 was built between 1894 and 1910, possibly as a gas plant.¹³⁰ It is a modest single storey brick structure abutting Building 26 on a different alignment. By the 1930s, and possibly earlier, this was a *air-drying* house for trade paper. The plant was probably manufactured in the early 1930s at the Koebig-Radebeul Machine Works, Dresden, a major manufacturer of paper machines.¹³¹ The machine consisted of a series of moving belts which continually circulated trays of paper.¹³² Warm air was circulated from cast-iron heating pipes below.



Figure 65: South elevation of Building 25 (to the right). In the background is Building 26 (photograph: Andrew Barber, B&DBC).

To the north is a early-20th-century corrugated-iron extension erected between 1910 and 1931. This straddles the river on concrete piers resembling bridge cutwaters. This may have been the early 20th-century powerhouse, prior to the building of a larger plant to the southeast of the site in the 1940s.¹³³ In the mid- and late-20th century it was an engineers' and carpenters' workshop.¹³⁴

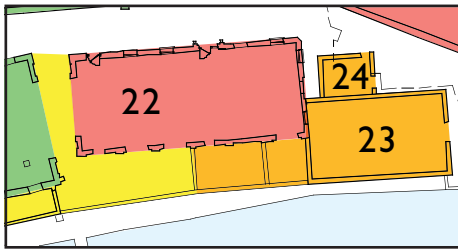


Figure 66: Building 22.



Figure 67: Building 22, north elevation (photograph: Derek Kendall; DP017525).

Building 22 (the Size-drying house) was built between 1894 and 1910, perhaps c.1909. A smaller and later version of Building 21, it is a two-storeyed brick building of six recessed bays, articulated by pilasters. The metal-framed windows with central casement elements, concrete lintels and cast-iron sills are identical to those of Building 21.

In the early 20th century, the ground floor housed *size-drying* machines, with a laboratory over.¹³⁵ The manager's annual report of 1909 mentions that the 'sizing machines are being reconstructed', and in 1912 there is a reference to the 'new size drying room'.¹³⁶ These may be the five 'old' sizing drying machines by G.&W. Bertram & Co and three cylinder driers referred to in the 1919 inventory.¹³⁷

The north entrance, with its ashlar surround, is an enlargement of a former window. This work was by the Basingstoke firm of Mussellwhite and Sapp and is associated with a conversion to research and development labs in the late 1950s.¹³⁸ The laboratory included machines which tested the tensile strength of paper, and destructive testing machines, which folded notes many thousands of times.¹³⁹ The additions to the east (buildings 23 & 24), south (a variety of single storeyed, 20th-century monopitch additions, and west, (the later infill between 21 & 22) are of no interest.

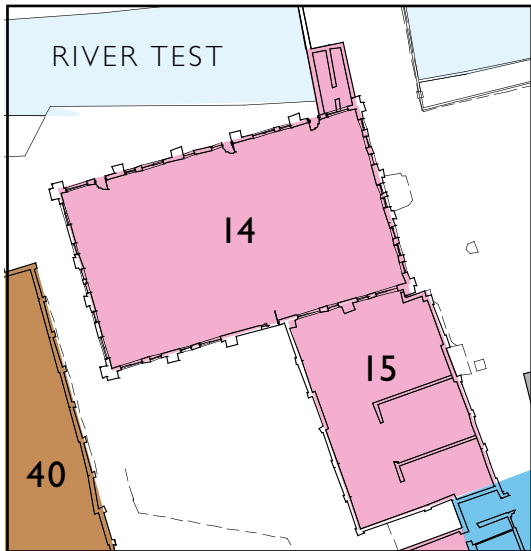


Figure 68: Building 14.

Building 14 (the Cylinder mould machine house) of 1916 was formerly known as 'D Mill'. It is an English machine-mill involved in the manufacture of paper currency for the Bank of India. The exterior is an imposing set-piece in an English Baroque revival style with the side bays articulated by battered buttresses. The windows occupy the bay-width and are set high to admit maximum light. The slate pitched roof incorporates small lucarnes and a continuous gabled louvre. The exterior is well-detailed, with a large dentilled eaves course. The pedimented east elevation incorporates an oculus and a lucam (a projecting hood whose purpose was to shelter a loading winch), the latter taking

the architectural form of a deep curved canopy on consoles. The external staircase is associated with the insertion of the mezzanine floor. The external staircase is a later addition; it is presumed that the original stair was internal.



Figure 69: Building 14, east elevation (photograph: Andrew Barber, B&DBC).

The building has a load-bearing brick envelope with an internal reinforced-concrete frame (cast insitu). The joists and floors are also of shuttered concrete. This would seem to be an early Hampshire example of a wide-span reinforced concrete structure. The use of the material may be attributed to the war-time steel shortage, or perhaps to concrete's abilities to absorb machine noise and vibration. The roof structure, by contrast, shows the perseverance of vernacular carpenters' and blacksmiths' techniques. The king-post trusses are of timber, joined with three-way forged iron straps.¹⁴¹ A walkway rests on the tie beams.

The mill is of two-and-a-half storeys. The roof-space is ventilated by a continuous louvre and triangular lucarnes, and may have served as a drying loft. The high-ceilinged, open-plan ground floor space has been subdivided by the insertion of a mezzanine floor in the mid-20th century which cuts the windows.¹⁴² The ground floor housed two cylinder mould machines by Escher Weiss of Zurich, installed in 1917 and 1919.¹⁴³ The associated *vats* adjoined the machines to the east. The *stuff chests* were located near the east wall.

The first floor (known as 'D mill top') was the *finishing* house, and contained slitters, a super-calender machine by Eck, and smaller guillotines which cut the calender rolls into sheets.¹⁴⁴ Reels of *sized* paper were transported on trolleys from the machine house to



Figure 70 (top left): Building 14, north elevation (DP098894).

Figure 71 (bottom left): Building 14, detail of roofspace showing truss and walkway. (photograph: Derek Kendall; DP017474).

Figure 72: Building 14, south-facing view of machine floor. Note reinforced concrete tie beam, joists and ceiling (photograph: Derek Kendall; DP017469).

the air-driers in Building 26. The dried paper was then returned and taken up through the lucam to the finishing room in Building 14.¹⁴⁵ There is also an internal hatch at the west of the building.

These functions became redundant after the cylinder mould machines were transferred to Overton in 1954.¹⁴⁶ In 1956 the mould office was relocated to the first floor.¹⁴⁷ On the north side of the building was a studio for the design of watermarks.¹⁴⁸ Office partitions were inserted at first floor level around this time.¹⁴⁹ It is probable that the first floor refenestration is associated either with the mould office or the later uses.

According to Francis Portal, the Cylinder mould machine house was erected with a view to securing Bank of England contracts for new denominations: the £1 and 10/- notes.¹⁵⁰ This speculation may have been partially due to a shortage of coinage at the end of the first world war. The first handmade paper at Laverstoke, however, was the Indian rupee paper, wartime demand for which was so high in 1917 that the Portals purchased an 'overflow mill' for this purpose.¹⁵¹

The Cylinder mould machine house is therefore an early mill for the manufacture of banknote paper. Again, it may have been driven by changes in printing technology which demanded specific grades of paper. In 1916, the Bank of England established new presses at St Luke's Printing Works, Old Street. Additionally the shortage of mill workers necessitated the further automation of the manufacturing process.

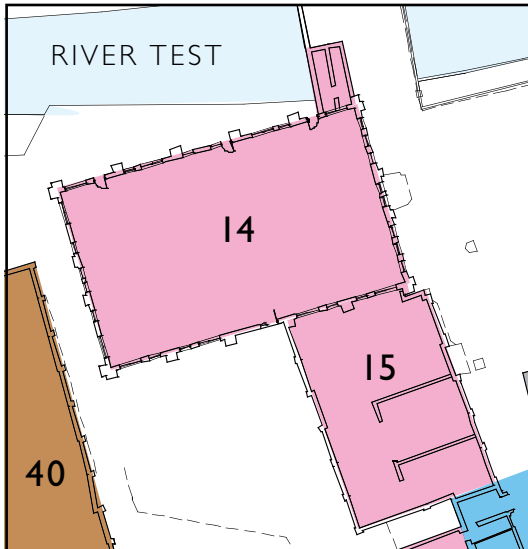


Figure 73: Building 15.

Building 15 (the Finishing and despatch building) is a planned extension of 1920 to the cylinder mould mill (building 14) to the north. Architecturally, it is a modest copy of the 1916 mill, and may have been designed by a Portal's engineer rather than an external architect. The two-storey building adopts the ceiling heights of Building 14 as well as its external detailing. The structure, however, varies: a load-bearing brick envelope encloses an internal steel-frame. The flat roof (which indicates that no drying-loft function was required) is concealed from exterior ground level by the boldly projecting eaves. Internally, the tie beams are carried on non-fireproofed steel stanchions. The

east and west elevations have opposing full-height loading doors. The dimensions of the ground floor space suggests an intention to accommodate additional milling machinery, although in the event this did not happen.

After the paper was *finished* on the first floor of Building 14, it was transferred to the first floor of Building 15 via an interconnecting door. There it was examined, counted and trimmed. It was then transferred to the ground floor packing and despatch room, where it was bundled and despatched through a large east door. From 1957-72 Building 15 became a research and development machine test area.¹⁵² As a group, these two buildings represent the last significant investment in papermaking technology at Laverstoke.



Figure 74 (left): Building 15, internal west-facing view (photograph: Derek Kendall; DP017467).

Figure 75 (right): Building 15, west elevation. (photograph: Andrew Barber, B&DBC).

Ancillary buildings

Building 8 (the former Blacksmith's shop) is of late 19th-century origin, but the north and east walls were largely rebuilt in breeze block in the late-20th-century, incorporating a loading door in the north wall. In the mid-20th century, the smithy was relocated and the building was used for the storage of portable *stuff* tanks.¹⁴⁰

Building 19 (the Despatch building) was built between 1928 and 1930. It is a single storey brick shed, where packets of paper were loaded onto the delivery lorry.¹⁵³ It functioned as the staff canteen in the late-20th century.

Building 33 (the Power house) was built between 1910 and 1931. A large steam turbine and generator was located in the north part of the building (33); and a diesel Lister Petter engine to the south (33a).¹⁵⁴

Building 41 (the former Garage) is a single storey shed, built between 1910 and 1931. This was a garage for the 'stuff lorry' that transported *half stuff* from Overton Mill (see Appendix 1). To the west is a post-1975 garage for the delivery lorry.¹⁵⁵

Building 6 is a corrugated-iron clad structure with a corrugated pitched roof and horizontal metal windows. It sits on a brick and concrete plinth above large steel joist which spans the watercourse (hence the choice of lightweight material). It was built between 1910 and 1931. In the mid-20th century it was the works-manager's office.¹⁵⁶

Building 40 (the single-storey canteen) was built in the early 1940s by the Basingstoke firm of Mussellwhite and Sapp.¹⁵⁷ It is of brick and has metal windows with concrete lintels.

Building 12 is a small, mid-20th-century office, abutting Building 11. It is a single-storey, pitched roof building with metal-framed windows and dogtooth eaves course. It was built between 1946 and 1975 by R. Cousins, who recalled installing the south windows so the occupant could see the mill manager approaching.¹⁵⁸

Building 23 (the Pump house) is a single-storey structure of brick with a pitched roof. It was built between 1946 and 1975 to pump water to a storage reservoir south of Laverstoke Mill.¹⁵⁹

Building 28 (an additional post-war **Pump house**) was built by R. Cousins between 1946 and 1975.¹⁶⁰

Building 29 is a **WC and shower block**, built between 1946 and 1975.

Building 24 is a single storey, flat roofed brick A/C **electrical substation** of the mid-1960s.¹⁶¹

Building 35 is a **Water softening plant**, housed in an 'Atcost' building built after 1975.

Building 49 was built after 1975 by the Southern Electricity Board as a transformer house. It is on the site of a large mid-20th-century boiler house complex (see Appendix 12).¹⁶²

Buildings 13, 32, and 38 are situated at the north end of the site. They date to the last quarter of the 20th century and relate to later engineering and water-treatment uses.

CONTEXTS

The regional context

Papermaking was widespread in Hampshire, although the vast majority of the 18th-century Hampshire sites were small mills of one or two vat capacity.¹⁶³ The county offered a good supply of clean water, required for the motive power and for 'wet processes'. Upper courses of rivers were favoured for the low amount of fine particles they carry in suspension. The head of water could be increased by the addition of a mill pond, as at Laverstoke. The introduction of steam and the use of imported wood pulp and esparto grass as raw materials saw a complete change in the location of new mills, and many smaller mills closed: 'the casualties were particularly numerous in Hampshire'.¹⁶⁴

Banknote paper mills

Besides Laverstoke, early paper mills associated with the manufacture of Bank of England notes are Sutton mill, Sutton Courtenay, Berkshire (now Oxfordshire; grade II); and Bere Mill, Laverstoke, Hampshire (grade II). Overton Mill, the successor to Laverstoke, is the key example of a working 20th century banknote paper complex. Many other mills manufactured security paper. Nash Mill, Hemel Hempstead, Hertfordshire (facing redevelopment proposals at the time of writing) is notable as the mill where John Dickinson manufactured security paper incorporating silk threads.¹⁶⁵

A number of other mills manufactured banknote paper for other countries and for private banks. The following is an incomplete list of such mills active in the 19th century: Tuckenhay Mill, Devon, (grade II); Kings Mill, Alton, Hants; Chilworth Mill, Surrey; Bramshott and Liphook Mills, Hants; Withnell Fold Mill, Chorley, Lancs; Sunnysdale Mill, East Morton, West Yorkshire; Joynson's mill, St. Mary Cray, Kent; and Taverham Mill, Norfolk.

Designated paper mills

Approximately 35 purpose-built paper mills are on the statutory list, and a further 13 listed paper mills were converted from other building types (see Appendix 2). Of these, the following paper mill complexes are of national significance:

- Frogmore Mill, Hemel Hempstead, Hertfordshire, where the first Fourdrinier machine was installed in 1803 by John Hall and Bryan Donkin). The mill retains various *in situ* machinery including a Fourdrinier machine (installed in the early 20th century). Frogmore and Apsley Mills are today run as a visitor centre. Part of the complex is listed.
- Apsley Mill, Hemel Hempstead, Hertfordshire, where the cylinder mould machine was first developed and patented by the former Laverstoke apprentice John Dickinson in 1809. Part of the complex is listed.
- Wookey Hole, Mendip, Somerset: a large, working rag-paper mill of 1860, elements of which are grade II listed;

- Horton Kirby, Sevenoaks, Kent: a late 19th-century complex retaining much machinery. Elements of the complex are grade II listed;
- Hayle Mill Maidstone, Kent: multi-phase, grade II-listed complex, with a unique drying loft listed at grade II*.¹⁶⁶

SIGNIFICANCE

Historical associations: banknote manufacture

The contrast between Laverstoke's rural setting and its historical significance as the principal mill of the Bank of England was first recognised by William Cobbett, who intensely disliked paper money, in 1825:

'the river of Whitchurch, [...] merely by turning a wheel, which wheel sets some rag-tearers and grinders and washers and recompressors in motion, has produced a greater effect on the condition of men, than has been produced on that condition by all the other rivers, all the seas, all the mines and all the continents in the world'.¹⁶⁷

Portals have been the sole manufacturers of Bank of England notes since 1724 and Laverstoke Mill was their principal mill between c.1725 and the mid-20th century. It is also significant for the manufacture of Indian rupees from 1860 to c.1950, which can be seen to mirror the fortunes of the British empire during this period.

Many experiments and innovations in banknote paper were developed at Laverstoke. A Bank of England anti-forgery commission set up in 1818, chaired by Sir William Congreve, commissioned a variety of trials, which were carried out by John Portal at Laverstoke Mill. These included a four-coloured watermark, the triple-couched note, and paper made from flax. 20th-century innovations at Laverstoke include the early manufacture of machine-made banknote paper (Indian rupees were machine made in Building 14 in 1917); and the incorporation of security thread into notes, today a widespread feature.



Figure 76: Detail of strong-room door, Building 2. (DP098895).

Architectural merit

Laverstoke was a prestigious site which received frequent high-profile visits and inspections, amongst them five royal visits.¹⁶⁸ That the Portal family was aware that visitors would associate the quality of their facilities with quality of their paper is indicated by the built environment at Laverstoke Mill. The Portals displayed awareness of architecture through their patronage of J. Bonomi, T. Hellyer, G.E. Street, P.C. Hardwick and J.L. Pearson, all of whom designed buildings in Laverstoke parish.

At Laverstoke Mill, the 1854-60 elements of buildings 5, 4, 9, and 11 are of particular architectural merit. The architect for the 1850s rebuilding was Thomas Hellyer of Ryde (1811-1894), a distinguished and prolific architect practising in S.E. England, and principally in Hampshire and the Isle of Wight. A pupil of William Gover of Winchester, he is principally a church architect, and Laverstoke represents his largest surviving secular

project. No less than twenty of his works are listed, two of them at grade II* (see Appendix 2).

The 1854 *Illustrated London News* article commented that 'while great care appears to have been taken to provide for every convenience and possible desideratum as regards light, ventilation and comfort for the workman, Mr Hellyer has at the same time, succeeded in giving to the whole an appearance of beauty and chasteness, which is but rarely to be found in works of a similar character'.¹⁶⁹ Hellyer's work at Laverstoke is an accomplished example of mid-19th century industrial architecture and forms the core of the complex. The buildings are carefully-detailed, bringing in additional materials and techniques such as ashlar, rubbed and gauged heads, and vitrified and flint dressings to avoid a monotony of red brick. Many of these draw from the local vernacular with which Hellyer would have been familiar.

Rarity as a major hand-made paper mill

Laverstoke Mill has a particular claim to significance as a hand-made paper mill that survived into the mid-20th century. The early- to mid-19th century saw many paper mills achieve a higher output of machine-made paper through the use of Fourdrinier machines. Those small or rural mills that were unable to mechanise closed. It was against this background that Laverstoke Mill expanded and became known as a centre of expertise in handmade paper. In 1885 the *Paper Trade Review* called it 'the oldest as well as the foremost vat mill in Great Britain'.¹⁷⁰

The manufacturing process at Laverstoke represented a unique combination of handmade and mechanised techniques. Laverstoke was also unusual in continuing to manufacture rag paper on a large scale: most large mills introduced wood pulp and other fibres after 1860.



Figure 77: Undated (c.1950s) view of Bill Barnet, a vatman at Laverstoke (photograph supplied by Nick Pearson).

Technical innovations associated with Bryan Donkin & Co

The involvement of Donkin & Co in the mid-1850s rebuilding of Laverstoke Mill is of considerable historical significance. Bryan Donkin (1768-1855) was a significant figure in engineering, and was key in the mechanisation of papermaking in the 19th century.¹⁷¹ It was Donkin who in 1802-06 developed a continuous automated papermaking machine in conjunction with the Fourdrinier brothers and John Hall.¹⁷²

In particular, the involvement of Donkin & Co at Laverstoke is noteworthy for two significant installations, the cylinder drying machine and the turbine. The drying machine was installed in Building 5 (east-west wing) as a replacement for the slow and inefficient drying loft. Robert Stevenson developed a means of drying paper continuously over steam-heated cylinders, and installations of this type date from c.1830.¹⁷³ The significance

of the Laverstoke machine can be gauged by the fact that in 1861 Donkin & Co asked Portal for permission to install a copy of the Laverstoke dryer at the Imperial Mills at St Petersburg, the largest installation ever undertaken by the firm.¹⁷⁴

The turbine at Laverstoke may be the earliest English example of a Fontaine turbine.¹⁷⁵ Donkin exhibited examples of this type at the 1862 Great Exhibition. In 1854, turbines were 'little known, as yet, in this country, though much used and highly appreciated in some parts of the continent'.¹⁷⁶

Influence and innovation from France

A major theme running through the development of Laverstoke Mill is the introduction of technology originated and developed in France, such as the Polonceau truss, the water-turbine, and the Fourdrinier machine. Even the rags were frequently imported from the continent. France was a major centre of paper-making developments and one which the Portals were well-placed to exploit, having many correspondents in their native country and visiting French paper mills on at least one occasion. The Portal archive contains several late-19th-century French volumes on paper-making.¹⁷⁷

Endnotes

1. Portal 1925 & 1962; Wood 1975.
2. Edis and Lowe 2005.
3. Page 1912, 2093
4. Page 1912, 62
5. Thomas 1977
6. Page 1912, 62
7. Wood 1975, 2
8. Wood 1975, 3
9. Wood 1975, 7
10. Portal 1962, 55
11. Portal 1962, 55
12. 'There are now 280 Fourdrinier machines at work in the United Kingdom, making collectively 1600 miles of paper per day [...] Messrs. Brian [sic] Donkin & Company have made 133 completely automatic paper machines, each at a value of from £1,200 to £2,000 [...] Mr John Hall Jr, of Dartford is another machine maker' (Wood 1975, 11). Hall Jr was the son of John Hall (1765-1836): see endnote 172.
13. This comprised the following denominations: £5, £10, £20, £50 (on watermarked paper); £100, £200, £300, £500, and £1000 (on plain paper) (Portal 1962, 55).
14. *London Illustrated News*, 30 December 1854, p.703. The article presents the principal primary evidence for the attribution of the 1854-60 buildnigs to Hellyer. Additionally, the mill cash book records a £100 payment to Hellyer for 'repairs etc' in April 1856 (**HRO:132M98/C6/6**).
15. Crocker and Franklin 2009.
16. Lloyd-Jones 2004.
17. **HRO:132M98/P3/21**.
18. Crocker and Franklin 2009, 9.
19. **HRO:132M98/F1/1**.
20. **HRO:132M98/F1/1**.
21. **HRO:132M98/E5/2**.
22. Portal 1962, 55.
23. Wood 1975, 3; Portal 1962, 76.
24. **HRO:132M98/P3/21**.
25. **HRO:132M98/F1/1**.
26. Portal 1962, 80.
27. Portal 1925, 18.
28. **HRO:132M98/F1/1**.
29. Wood 1974, 13.
30. **PRO:132M98/B9/1**.

- 31 Wood 1975, 16.
- 32 **PRO:I32M98/FI/1.**
- 33 Wood 1975, 16. The head engineer of the London and South West Railway Company, G.S. Szlumper advised on the construction of the Overton mill in 1919 (**HRO:I32M98/BI/14**).
- 34 Wood 1975.
- 35 **HRO:I32M98/FI/1.**
- 36 **HRO:I32M98/FI2/1.**
- 37 **HRO:I32M98/FI/1.**
- 38 R. Cousins, pers.comm.
- 39 Wood 1975, 22.
- 40 Basingstoke & Dean Borough Council 2003.
- 41 A. Barber, pers.comm.
- 42 Ashworth 1972.
- 43 **HRO:I32M98/P3/21.**
- 44 R.J.Eastman et al, pers.comm.
- 45 R. Cousins, pers.comm.
- 46 The c.1848 map suggests that there may have been an earlier building on, or near its footprint.
- 47 D. Wormsley, pers.comm.
- 48 Crocker and Franklin 2009, 10.
- 49 Grimwood-Mears 1895,131; R.J.Eastman, pers.comm.
- 50 R. Cousins, pers.comm.
- 51 **HRO:I32M98/LI/7.**
- 52 Crocker and Franklin 2009, 11.
- 53 R. Cousins, pers.comm.
- 54 *Illustrated London News*, 30 December 1854.
- 55 **HRO:I32M98/LI/7.**
- 56 Crocker 2000.
- 57 Crocker and Franklin 2009, 11.
- 58 **HRO:I32M98/LI/7.**
- 59 R. Cousins, pers.comm.
- 60 R.J. Eastman, pers.comm.
- 61 **HRO:5M52/P4.**
- 62 R.Cousins, pers.comm.
- 63 Ibid.
- 64 As originally devised by Polonceau, they were entirely of cast- and wrought-iron, as were the first British examples: Denison (1843) reported roofs of the Polonceau design used in railway station roofs at Manchester, Birmingham and Derby. Timber and iron versions were probably a

development of this arrangement (David Yeomans, pers.comm.); this makes sense since it might have been cheaper to substitute timber for the principal rafters. This would seem to be an early example of a timber and iron Polonceau truss used for an industrial building (as opposed to railway shed), although they can also be seen in, among other places, mid-19th-century waterfront warehouses in Liverpool. Polonceau trusses enjoyed considerable success, especially after the introduction of steel, and are still used today. (J. Clarke, pers.comm).

- 65 Crocker and Franklin 2009.
- 66 **HRO:I32M98/G3/1.**
- 67 **HRO:I32M98/LI/7.**
- 68 R.J. Eastman, pers.comm.
- 69 R. Cousins, pers.comm.
- 70 Ibid.
- 71 D. Wormsley, pers.comm.
- 72 R. Cousins, pers.comm.
- 73 R.J. Eastman.
- 74 **HRO:I32M98/C6/6.**
- 75 **HRO:I32M98/LI/7.**
- 76 Ibid.
- 77 R.J. Eastman, pers.comm.
- 78 R. Cousins, pers.comm.
- 79 D. Wormsley, pers.comm.
- 80 R. Cousins, pers.comm.
- 81 **HRO:I32M98/LI/7.**
- 82 Ibid, R.J. Eastman, pers.comm.
- 83 R.Cousins, pers.comm.
- 84 R. Cousins, R.J. Eastman, pers.comm.
- 85 The early 20th-century process for producing watermarks was as follows: the watermark was engraved directly onto nine-inch square wax tablets, which were then placed in a liquid hardening agent and pressed into a phosphor-bronze wire mesh (R. Cousins, pers.comm.).
- 86 **HRO:I32M98/LI/5.**
- 87 **HRO:I32M98/LI/7.**
- 88 **HRO:I32M98/G3/3.**
- 89 D. Wormsley, pers.comm.
- 90 **HRO:I32M98/LI/7;** R. Cousins, pers.comm.
- 91 R.J. Eastman, R. Cousins, pers.comm.
- 92 D. Wormsley, pers.comm.
- 93 R.J. Eastman, R. Cousins, pers.comm.; **HRO:I32M98/DI/8.**
- 94 R.J. Eastman, pers.comm.

- 95 R. Cousins, pers.comm.
- 96 **HRO:I32M98/LI/5.**
- 97 **HRO:I32M98/FI/1.**
- 98 **HRO:I32M98/LI/7.**
- 99 R.J. Eastman, R.cousins, pers.comm.
- 100 **HRO:I32M98/B5/1 and /2.**
- 101 R. Cousins, pers.comm.
- 102 R. Cousins et al, pers.comm.
- 103 Ibid.
- 104 Corrugated-iron and concrete vaulted floor systems were first employed in the late 1840s, and later used in well-published buildings such as George Gilbert Scott's Midland Grand Hotel, St Pancras of 1868-74 (J. Clarke, pers.comm.).
- 105 Herbert 1978.
- 106 **HRO:I32M98/J6/7.**
- 107 J. Clarke, pers.comm.
- 108 R. Cousins, pers.comm.
- 109 **HRO:I32M98/FI/1.**
- 110 N. Richards, pers comm.
- 111 R. Cousins, pers.comm.
- 112 Ibid.
- 113 D. Baker, pers.comm.
- 114 D. Harvey, pers.comm.
- 115 R. Cousins, pers.comm.
- 116 **HRO:I32M98/LI/7.**
- 117 R. Cousins, pers. comm.
- 118 **HRO:I32M98/G2/5.**
- 119 R.J. Eastman; **HRO:I32M98/LI/7.**
- 120 **HRO:I32L98/B1/14;** R. Cousins, pers.comm.
- 121 **HRO:I32M98/FI/1.**
- 122 Wood 1975, 13.
- 123 **HRO:I32M98/G2/5.**
- 124 **HRO:I32M98/LI/7.**
- 125 R. Cousins, pers.comm.
- 126 D. Baker, pers.comm.
- 127 D. Wormsley, pers.comm.
- 128 Ibid.

- 129 **HRO:I32M98/LI/7.**
- 130 R.J. Eastman, pers.comm.
- 131 Ibid.
- 132 R. Cousins, pers.comm.
- 133 R.J. Eastman, pers.comm.
- 134 D. Baker, pers.comm.
- 135 R.J. Eastman, pers.comm.
- 136 **HRO:I32M98/B4/7; HRO:I32M98/B4/8.**
- 137 **HRO:I32M98/LI/7.**
- 138 R. Cousins, pers.comm.
- 139 R.J. Eastman, pers.comm.
- 140 R. Cousins, pers.comm.
- 141 J. Clarke, pers.comm.
- 142 D.Wormsley, pers.comm.
- 143 **HRO:I32M98/FI/1.** Cylinder mould machines were first developed and patented by John Dickinson at Apsley Mill, Hertfordshire in 1809. The mould, a wire-covered cylinder, is submerged into the vat and as the mould rotates, water is drawn through the wire and a layer of stuff deposited on the cylinder. Dickinson's machine was the principal competition to the Fourdrinier machine throughout the 19th century. The technology may have been chosen at Laverstoke because of their ability to produce complex, high-quality watermarks. Involved in the Laverstoke installation, probably as engineers, were Green, Son and Waite of Orpington, Kent, a firm responsible for improvements to the cylinder mould machine in the late 19th century (**HRO:I32M88/B3/1**).
- 144 **HRO/I32M98/LI/7.**
- 145 R. Cousins, pers.comm.
- 146 **HRO:I32M98/FI/1.**
- 147 **HRO:I32M98/G3/3.**
- 148 D. Wormsley, pers.comm.
- 149 D. Baker, pers.comm.
- 150 Portal 1962, 91.
- 151 Wood 1975, 14.
- 152 D. Wormsley, pers.comm.
- 153 R.J. Eastman, pers.comm.
- 154 R. Cousins, pers.comm.
- 155 Ibid.
- 156 D. Harvey, pers.comm.
- 157 R.J. Eastman, pers.comm.
- 158 R. Cousins pers.comm.
- 159 Ibid.

- 160 Ibid.
- 161 D.Wormsley, pers.comm.
- 162 R.J.Eastman, pers.comm.
- 163 Shorter 1953.
- 164 Hudson 1968, 184.
- 165 Dagnall 1996.
- 166 Thomas 2004.
- 167 Cobbett 1825, 415-17.
- 168 Wood 1975, 22.
- 169 *Illustrated London News*, 30 December 1854, p.703.
- 170 Wood 1974, 13.
- 171 Lloyd-Jones 2004.
- 172 John Hall sr. (1765-1836) was an apprentice at Laverstoke Mills before setting his own smithy in Dartford. Donkin was apprenticed to him from 1792, and they later worked together on the development of the Fourdrinier machine. It is therefore probable that either Hall, or his son John Hall jnr introduced the Portal family to Donkin & Co.
- 173 A.Crocker, pers.comm.
- 174 Crocker and Franklin 2009.
- 175 Ibid.
- 176 *London Illustrated News*, December 30, 1854.
- 177 **HRO:I32M98/K4.**

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Appendix I: Hand-making paper at Laverstoke c.1900

The following text gives a brief summary of handmade paper manufacture as it was practised at Laverstoke at the turn of the 20th century.¹ Technical terms relating to papermaking processes and plant are *italicised* for ease of reference. Experiments with proprietary paper-making machines were carried out from the 1850s, but multi-process machines never entirely supplanted traditional, labour intensive techniques, although single tasks could be mechanised. This account outlines that process and does not enter into detailed arrangements, plant or buildings at Laverstoke, factors which varied according to paper type and were subject to a near-continuous process of refinement and adjustment.

Sacks of rags were delivered, hand-graded, and bagged. The rags comprised strips of linen one or two inches long. On occasion, *half-stuff* was delivered: fibres already partially broken or beaten. The finer material was reserved for the Bank of England notes and the coarser fabric for rupees, dividend warrants, postal orders and Bank of Ireland notes. The rags were soaked for three-and-a-half hours until the fibres loosened. They were then pulped in small *beating* and *breaking machines* until the required consistency was reached. The resulting 'stuff' was then screened through *strainers* and pumped into stuff chests, which in turn supplied the *vats*. Whilst being stored in the chests the mixture was stirred by *agitators*.

The vatman dipped a *mould* into the pulp, moving it to drain excess water and evenly distribute the fibres before placing it on the side of the vat for further draining. The hand mould consisted of a removable, rectangular wooden frame (the *deckle*) about 18"×12" covered with either a laid or wove wire screen (the *cover*) containing the watermark



Figure 78: Undated (c.1950s) view of Bill Barnet, a vatman at Laverstoke (photograph supplied by Nick Pearson).



Figure 79: Undated (c.1950s) view of coucher at Laverstoke. He is building up a 'post' of alternating layers of felt and paper (photograph supplied by Nick Pearson).

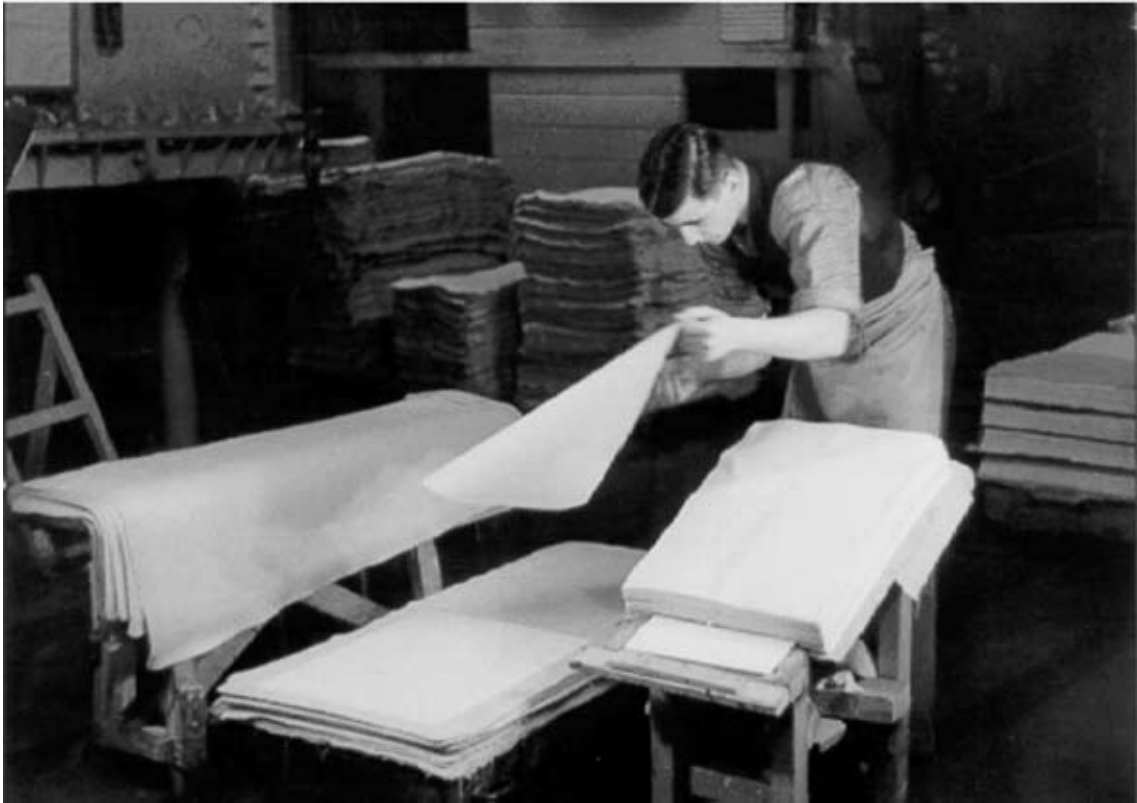


Figure 80: Checking pressed sheets prior to drying. (Undated, c.1950s photograph, supplied by Nick Pearson).

device (see endnote 85). At Laverstoke, the mould was divided by 'tearing wires' to give two or four banknotes per mould.²

After some minutes the coucher turned the mould face down onto a 18"×27" drying felt. Another felt was placed on top and this process repeated to form a 'post' of alternating sheets and felts, forms on a low truck. The 'layman' or 'layer' then removed the post to a pressing room, where the post is placed into a hydraulic press to remove the excess water and compress the fibres.

The posts were then conveyed to a *drying machine* and individual notes transferred two-by-two by an operator onto an endless web of felt. (Prior to the rebuilding of the Mill in the 1850s, the upper floors accommodated a number of drying lofts (Appendix 7). The first floor of Building 21 was also a drying loft). The notes passed between steam-heated *cylinders* and were collected and checked at the end before being transferred to the *sizing* room.

Sizing is the process of adding size, in this case a mixture of gelatine and glycerine, to the paper to decrease the surface porosity of the paper. Sizing at Laverstoke seems always to have been an external or surface process (ie applied after paper formation rather than added to the vat). Hide, hooves or bones were boiled down in a gelatine size plant and the resulting size stored in wood-lined tanks. The notes were transferred onto another endless felt web and a coat of size applied by rollers. The notes were dried a second time, again by a machine with heated rollers about 36" in diameter. Finally the notes

were plate glazed. This is a method of producing a smooth surface on sheets of hand made paper by placing them between polished plates of zinc or copper and passing them between press rolls or calenders. The finished notes were then *cured* (stored in order to 'mature'), counted and weighed. These activities occurred in a *salle* (one of several terms of French origin), before storage in an adjoining strong room to await loading and dispatch to the Bank of England's stores in London.

Endnote

- 1 The principal source is Grimwood-Mears 1895.
- 2 Crocker and Franklin 2009; Hills 2006.

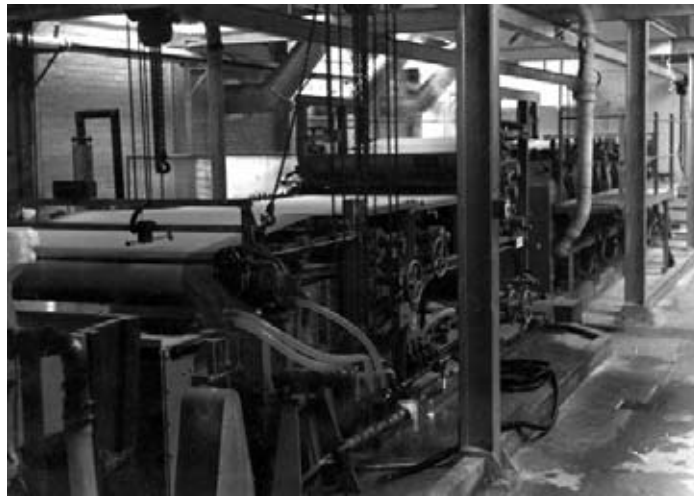


Figure 81: Undated, c.1950s photograph of gelatine sizing machine, ground floor of Building 21 (photograph supplied by Nick Pearson).



Figure 82 Undated, c.1950s photograph of a 'bundler' packing paper ready for dispatch (photograph supplied by Nick Pearson).

Appendix 2: Paper mills on the statutory list

Purpose-built paper mills and other building types converted for use as paper mills are listed under separate sub-headings. The lists include isolated remains of paper mills such as chimney stacks etc. Where multiple listed buildings are part of a single mill complex this is noted in a single entry. Mill houses and cottages (ie residential buildings associated with mills) have been omitted. All designations are grade II unless otherwise noted.

Purpose-built paper mills

Old Paper Mill [Freedom's Mill], Boroughbridge Road, Bishop Monkton, Harrogate, North Yorkshire

Olive Wheel Mill , Black Lane, Bradfield, Sheffield, South Yorkshire

Paper mills , Newmarket Road, Cambridge, Cambridgeshire

The Priest House Hotel [King's Mills] , Park Lane, Castle Donington, Leicestershire

Tuckenhay Paper Mills, Cornworthy, South Hams, Devon

Weir Mill, Mill Street, East Malling And Larkfield, Tonbridge And Malling, Kent

Elsing Mill Including Wheel House And Wheel Adjoining East , Mill Street, Elsing, Breckland, Norfolk

Countess Weir Paper Mill , Mill Lane, Exeter, Devon

Eynsham Mill , Mill Lane, Eynsham, Oxfordshire

Former Paper Mill now offices adjacent to Stoke Mill , Woking Road, Guildford, Surrey

35, Friday Street, Henley On Thames, Oxfordshire

The chimney at Horton Kirby Paper Mill, Horton Kirby and South Darenth, Sevenoaks, Kent

Haughton Mill House, Haughton Mill Cottage And Storage Building between, Humshaugh, Tynedale, Northumberland

Stowford Paper Mills , Harford Road, Ivybridge, South Hams, Devon

Castle Mill [various buildings separately listed] Building To North , Waterside, Knaresborough, Harrogate, North Yorkshire

Laverstoke Mill [various buildings separately listed] London Road, Laverstoke, Basingstoke and Deane, Hampshire

Bere Mill, Laverstoke, Basingstoke And Deane, Hampshire

Highbury Works [various buildings separately listed], Green Road, Leeds, West Yorkshire

Former Drying Loft at Turkey Mills, Ashford Road, Maidstone, Kent

Hayle Mill, Hayle Mill Road, Maidstone, Kent (drying loft grade II*)

Beam from a Beam Engine set in a brick plinth at Springfield Mill, Sandling Road, Maidstone, Kent

Rear wing to Yews Mill House, Haven Hill, Maltby, Rotherham, South Yorkshire

Blakewell Mill, Marwood, Devon

Carrow Works Blocks 7, 7a, 8a And 8 and attached metal canopy , King Street, Norwich, Norfolk

The Mill , Mill Lane, Shoreham, Sevenoaks, Kent

Chimney to former mill at rear of the old Mill House , St Cuthbert Out, Mendip, Somerset

Wookey Hole Paper Mill , High Street, St Cuthbert Out, Mendip, Somerset

Former paper mill [Lintzford Mill], Stanley, Derwentside, Durham

Coppice Mill , Longton Road, Stone, Stafford, Staffordshire

High Paper Mill Farmhouse and attached outbuildings , Ellerburn Road, Thornton Le Dale, Ryedale, North Yorkshire

Coldharbour Mill, Uffculme, Devon (grade II*)

Fourstones Paper Mill East Buildings, Fourstones, Warden, Tynedale, Northumberland

Clock House at Hamper Mill , Hamper, Mill Lane, Watford, Three Rivers, Hertfordshire

Bill Mills, Weston Under Penyard, Herefordshire

Mill House, Wimborne St Giles, Dorset

Mill Building , Castle Street, Winchcombe, Tewkesbury, Gloucestershire

Grey Mill , Grey Mill Lane, Wootton Wawen, Stratford On Avon, Warwickshire

Wootton Mill , Stratford Road, Wootton Wawen, Stratford On Avon, Warwickshire

Offices of the British Paper Company Limited [part of Frogmore Mill] , Mill Street, Hemel Hempstead, Dacorum, Hertfordshire

Buildings converted for use as paper mills

Solesbridge Mill House , Solesbridge Lane,, Chorleywood, Three Rivers, Hertfordshire

The Paper Mill and Mill House, Deddington, Cherwell, Oxfordshire

John Pitts and Sons Limited, Trew's Weir Lane, Exeter, Devon

The cottage building at Dickinson's Mill [part of Apsley Mill], London Road, Hemel Hempstead, Dacorum, Hertfordshire

Turkey Mill, Goose Eye, Keighley, Bradford, West Yorkshire

Langcliffe High Mill, Langcliffe, Craven, North Yorkshire

Mill at Gun's Mills, Littledean, Forest of Dean, Gloucestershire

Payford Mill, Pauntley, Forest of Dean, Gloucestershire

Knights Mill, Church Road, Quenington, Cotswold, Gloucestershire

Beoley Paper Mill, Paper Mill Drive, Redditch, Worcestershire

Old Mill House , Loudwater Lane, Rickmansworth, Three Rivers, Hertfordshire

Perio Mill House and attached mill buildings , Perio Lane, Southwick, Northamptonshire

Thorp Arch Mill (premises of Blabella Limited) [various buildings separately listed], Bridge Foot, Thorp Arch, Leeds, West Yorkshire

Premises of Slater Harrison Limited [Lowerhouse Mill], Albert Road, Bollington, Macclesfield, Cheshire

Appendix 3: Thomas Hellyer: a chronology

This chronology of major works by Thomas Hellyer (1811-1894) of Ryde, Isle of Wight is based on Edis and Lowe 2005, Appendix 19; the RIBA drawings catalogue; the Hampshire Record Office catalogue; and the *Building Trade Directory*, 1868 (held on the RIBA architect's file). The completion date and any known designations are shown.

- (nd) Additions to Westfield House, Ryde, including picture gallery, vestibule & belvedere
- (nd) Public Assembly Rooms, Deal, Kent
- (nd) Appley Towers, Ryde.
- (nd) 'Alterations at Quarr Abbey' [probably Quarry Abbey Farm, Binstead, Isle of Wight, a grade II listed farmhouse incorporating reused stones from the C12 abbey]
- (nd) Alterations at Laverstoke House, Hants
- (nd) Alterations at Hackwood Park, Hants
- (nd) restoration of Brading Church, Isle of Wight
- (nd) ?Parsonage house, Havenstreet, Isle of Wight, Hants
- (nd) Andover Cemetary
- (nd) Work at Ryde Cemetary, possibly St Paul's Chapel (1842) and lodge

- 1842 — Extensions to the pier head at Ryde
- 1842 — St John, Ryde, Isle of Wight, Hants (1864 enlargement also by TH). Grade II.
- 1845 — Holy Trinity, Ryde, Isle of Wight, Hants. Grade II.
- 1845 — enlargement of Holy Cross, Binstead, Isle of Wight. Grade II.
- 1846/60 — St Paul, Kingsclere, Hants. Grade II.
- 1846 — Parsonage house, Kingsclere, Hants
- 1846 — St James, Seacroft, Leeds. Grade II.
- 1846 — rebuilding of Holy Trinity, Bembridge, Isle of Wight, Hants. Grade II.
- 1848 — Parsonage house, Brading, Isle of Wight, Hants
- 1849 — rebuilding, St Mary, Kingsclere, Hants. Grade II*.
- 1850 — Vicarage house, Kingsclere, Hants
- 1852 — St Peter, Havenstreet, Isle of Wight, Hants. Grade II
- 1855 — Laverstoke Mill', Whitchurch, Hants
- 1855 — Bouverie House, 29 Melville Street, Ryde (architects' own house) Grade II.
- 1857 — rebuilding of St Mary, Thatcham, Berks. Grade II*.
- 1859 — St Peter, Seaview, Isle of Wight. Grade II.
- 1861 — St Luke, Portsea, Portsmouth. Grade II.
- 1861 — Sturbridge House, Ryde
- 1864 — Wesleyan Chapel, Deal, Kent. Gradell.
- 1866 — St Simon, Southsea, Portsmouth, Hants. Grade II.
- 1866 — Trinity Congregational Church, Ringwood, Hants. Grade II.
- 1868 — rebuilding of St James, East Cowes, Isle of Wight. Grade II.
- 1868 — Parsonage house, East Stoke, Dorset.
- 1871 — alterations to St John the Evangelist, Forton, Alverstoke, Hants
- 1871 — National Hospital of Diseases of the Chest (dem. 1969), Ventnor, Isle of Wight
- 1873 — Grove Middle School, Hants
- 1873 — New Road School, Fratton, Hants.
- 1875 — Royal Naval Club, Portsmouth. Grade II.
- 1877 — St Saviour, Shanklin, Isle of Wight. Grade II.

1880 — Convalescent Home, Ryde, Isle of Wight.

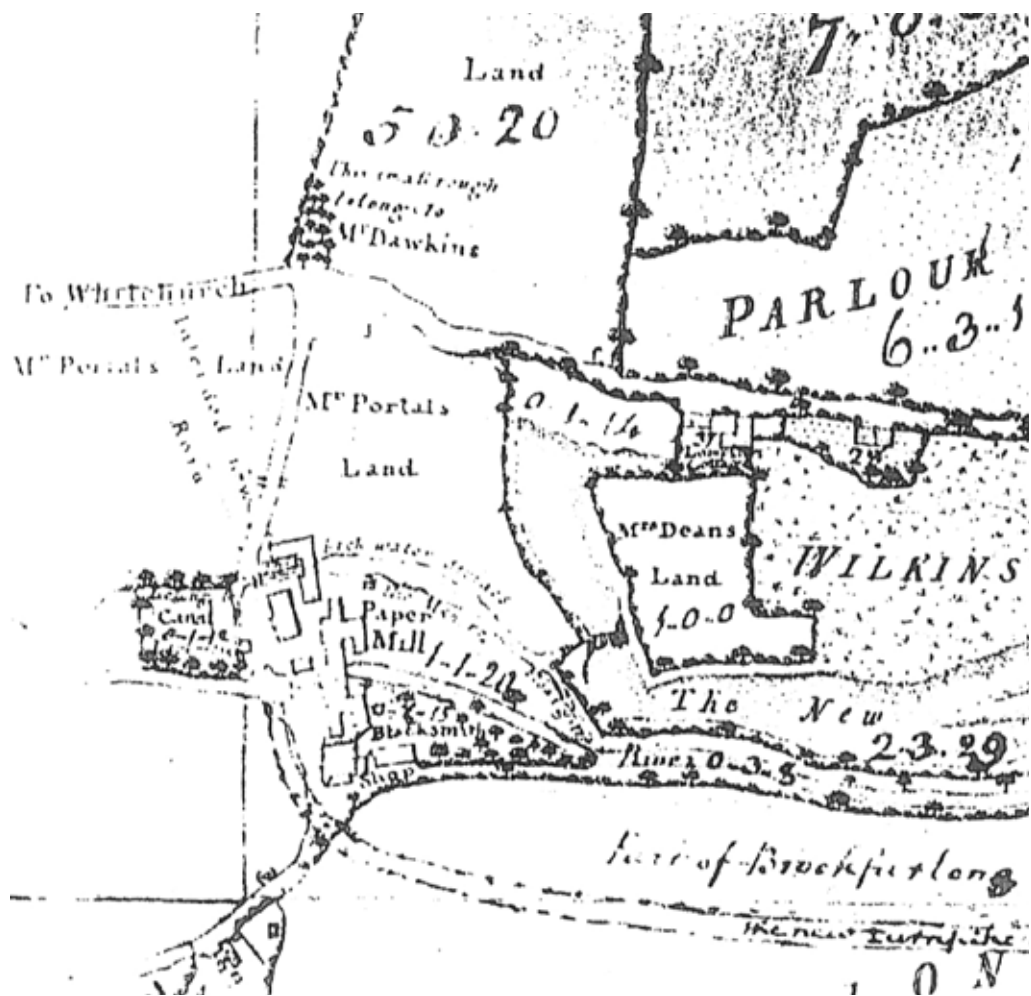
Endnote

1. The 1868 Building Trade Directory lists 'new building to the paper mill at Tavistock' but it is probable that this is a transcription error for Laverstoke

Appendix 4: 1750s Estate map

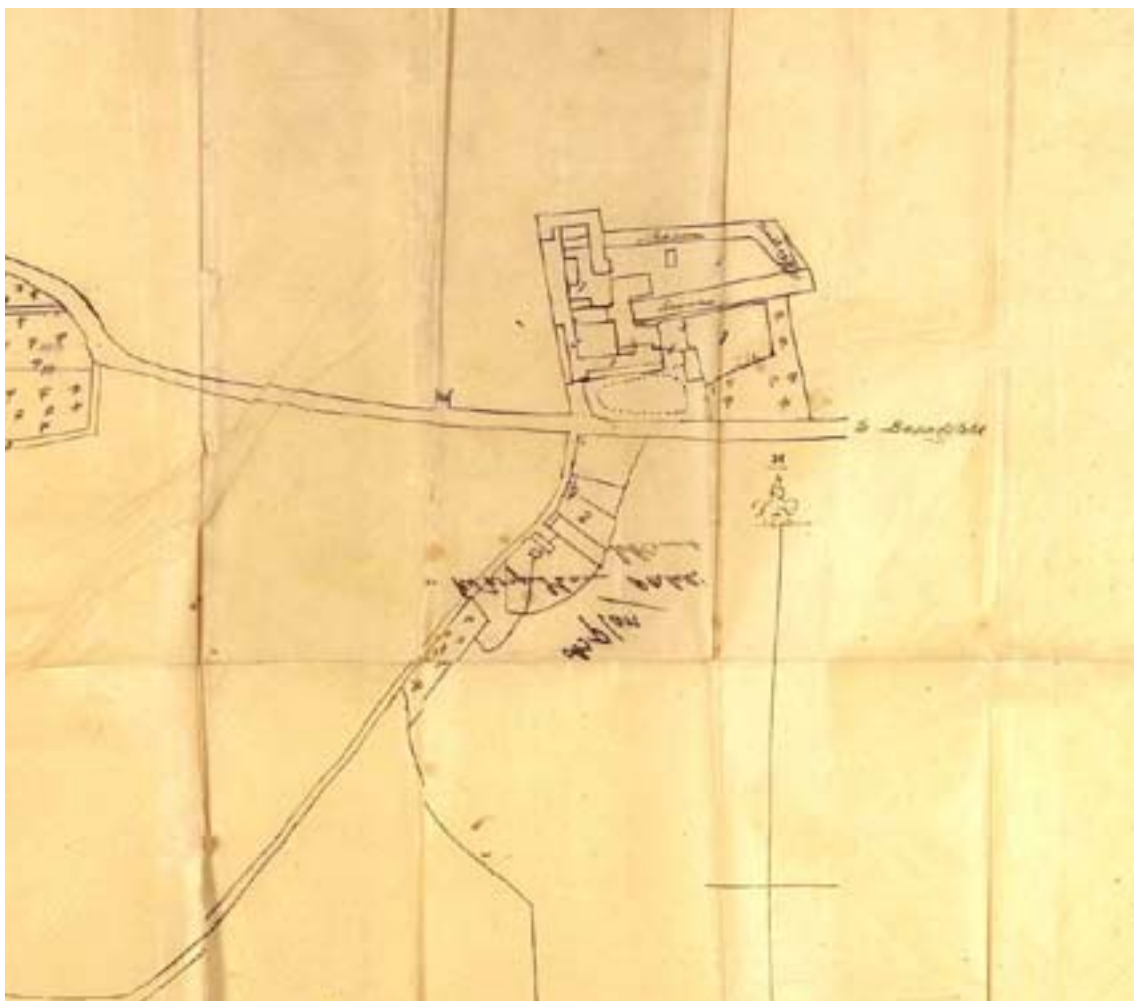
Map of Manor of Laverstoke, surveyed by Isaac Taylor between 1754 and 1759 (HRO: COPY701/1).

Reproduced from Edis and Lowe (2005) with the kind permission of CGMs and the authors.



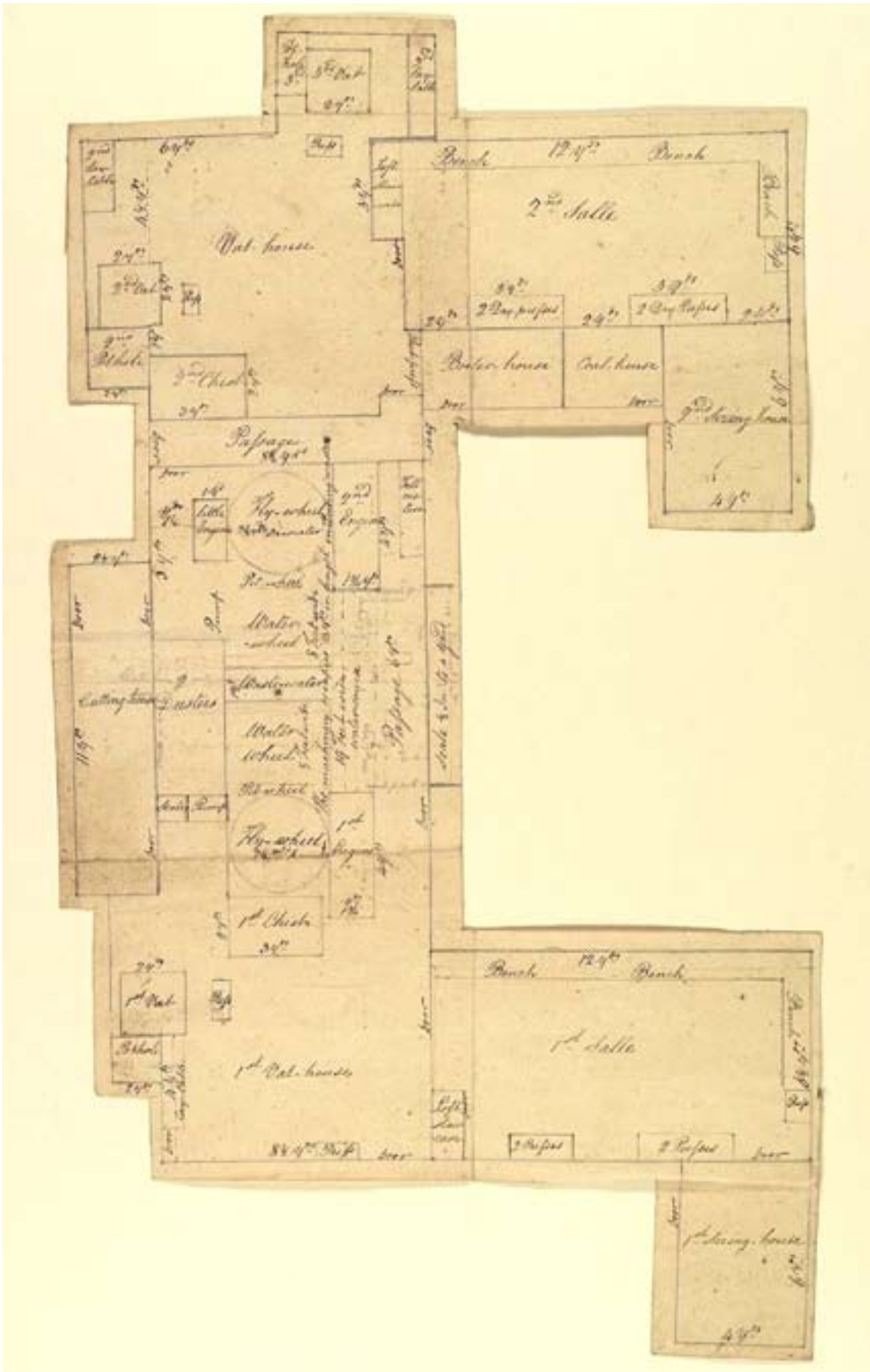
Appendix 5: 1848 Site plan

From papers concerning disputed rights of water to Laverstoke Mills (HRO:132M98/M1/1).
Reproduced from Edis and Lowe (2005) with the kind permission of CGMS and the authors.



Appendix 6: 1848 Ground floor plan of '1st mill'

From papers concerning disputed rights of water to Laverstoke Mills (HRO:132M98/M1/1).
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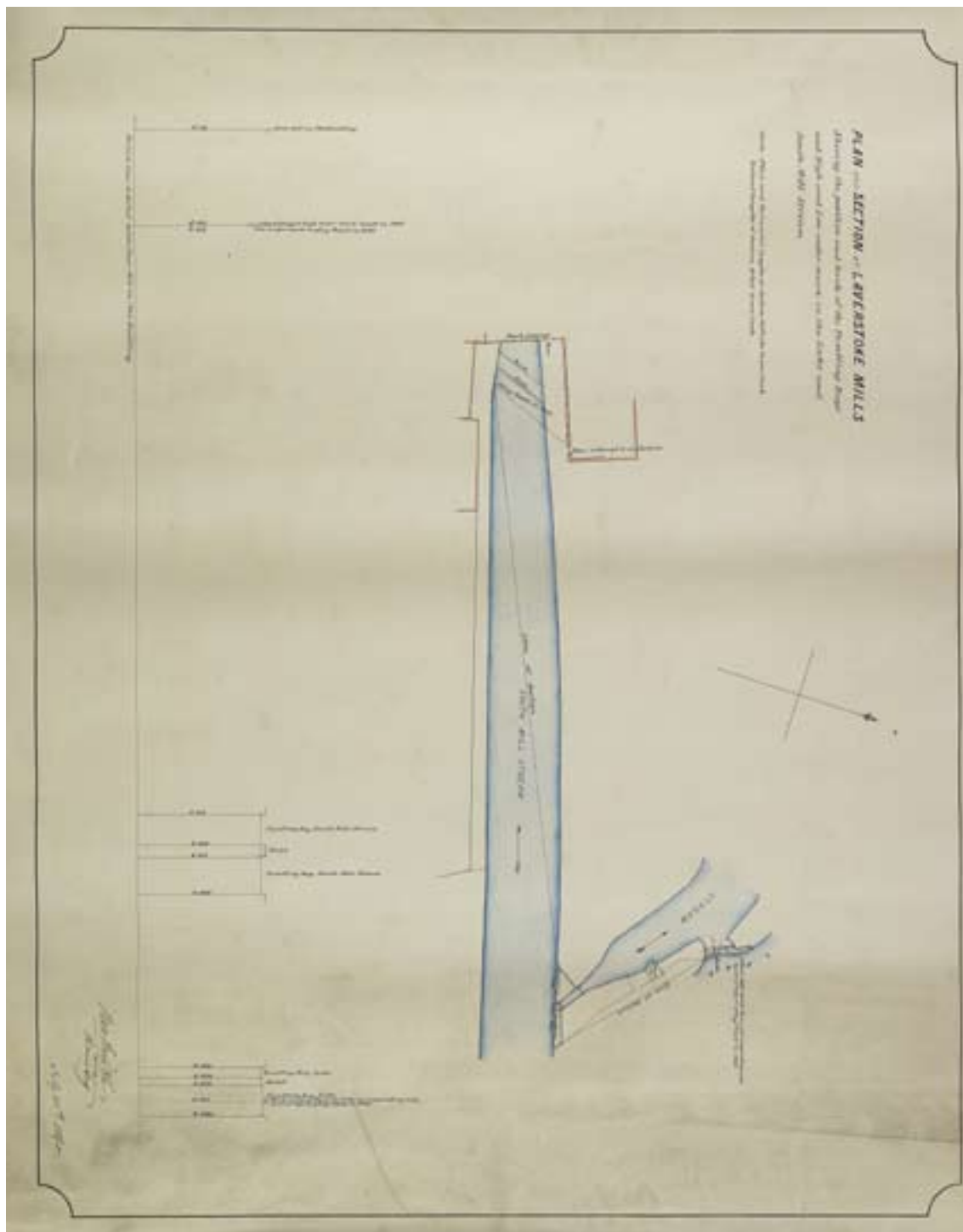
Appendix 7: 1848 First floor plan of '1st mill'

From papers concerning disputed rights of water to Laverstoke Mills (HRO:132M98/M1/1).
Reproduced from Edis and Lowe (2005) with the kind permission of CGMS and the authors.



Appendix 8: 1860 Plan of mill races

HRO:5M52/P4



Appendix 9: 1872 Ordnance Survey map

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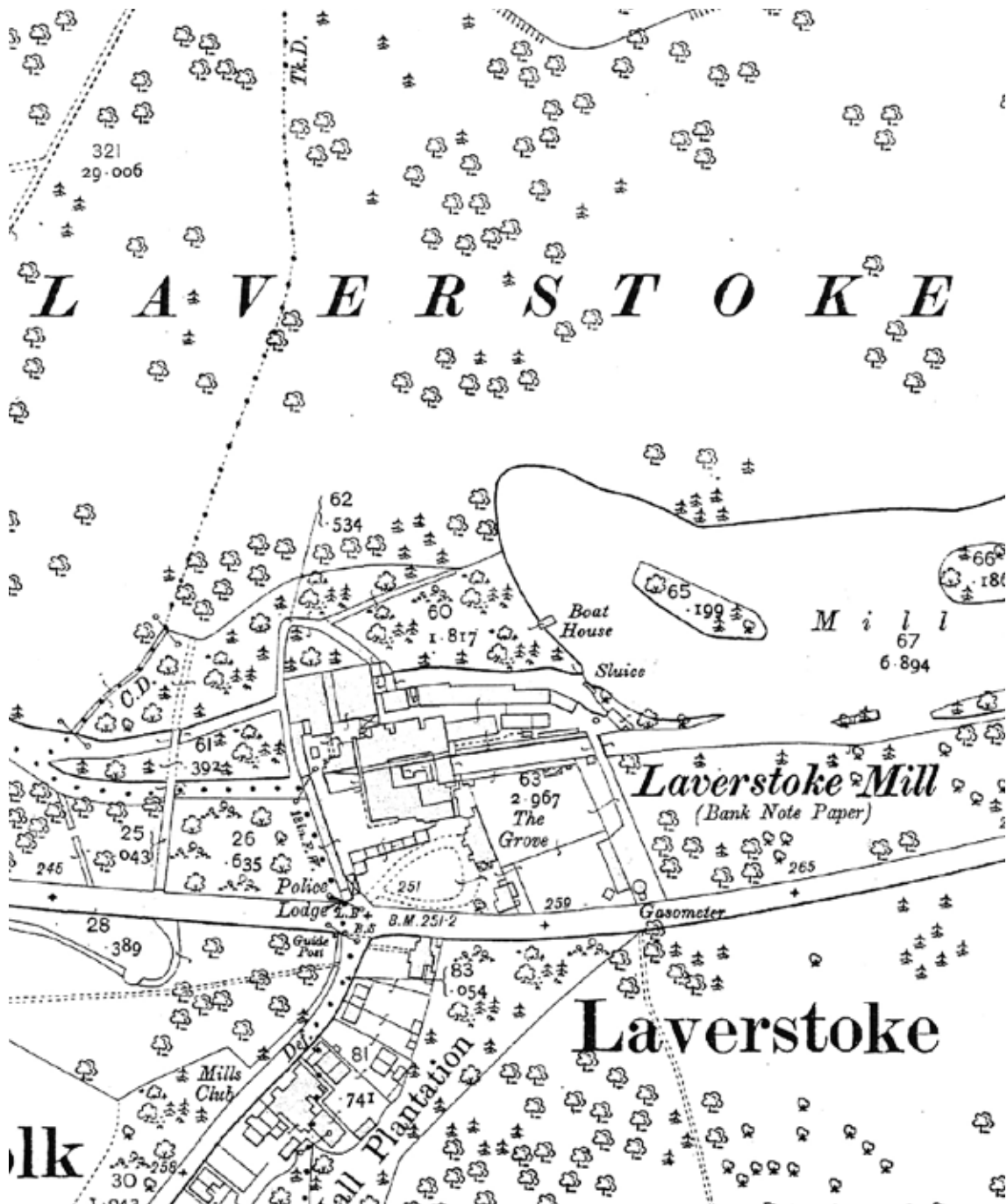
Appendix 10: 1894-6 Ordnance Survey map

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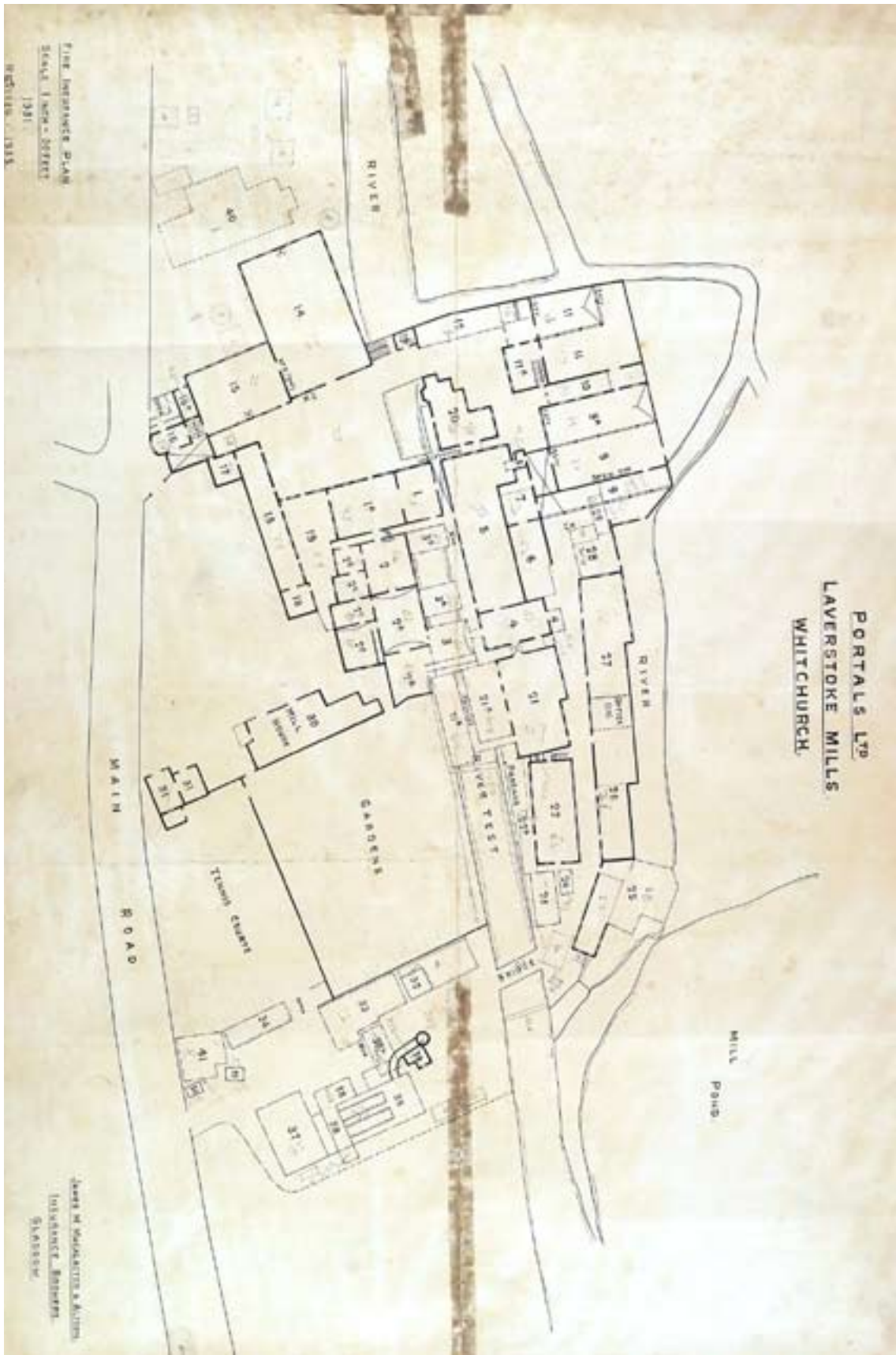
Appendix II: 1909-1910 Ordnance Survey map

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Appendix 12: 1931/1935 Fire insurance plan

HRO:86M76. Reproduced from Edis and Lowe (2005) with the kind permission of CGMS and the authors.

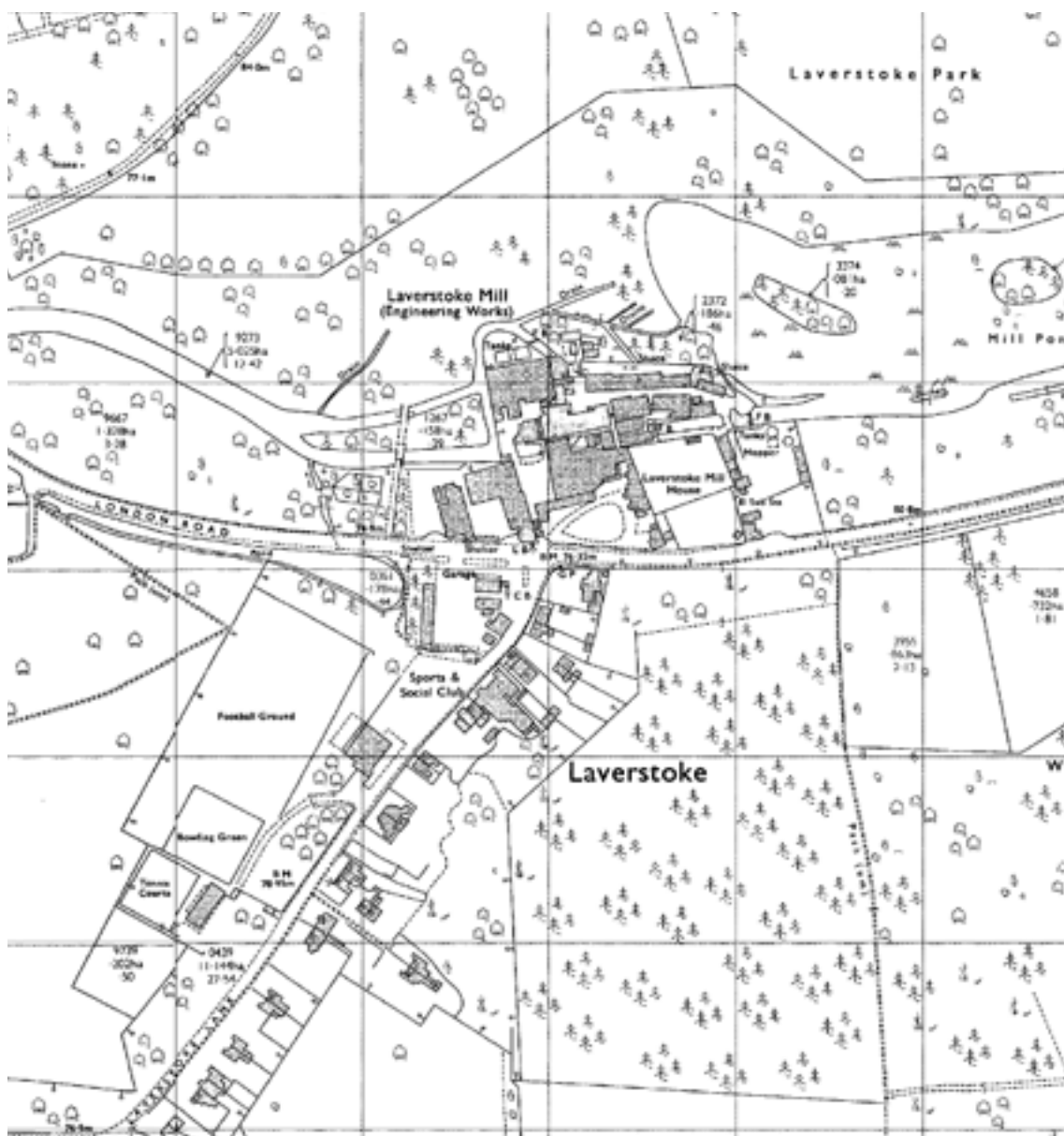


Appendix 13: 1941-6 Ordnance Survey map

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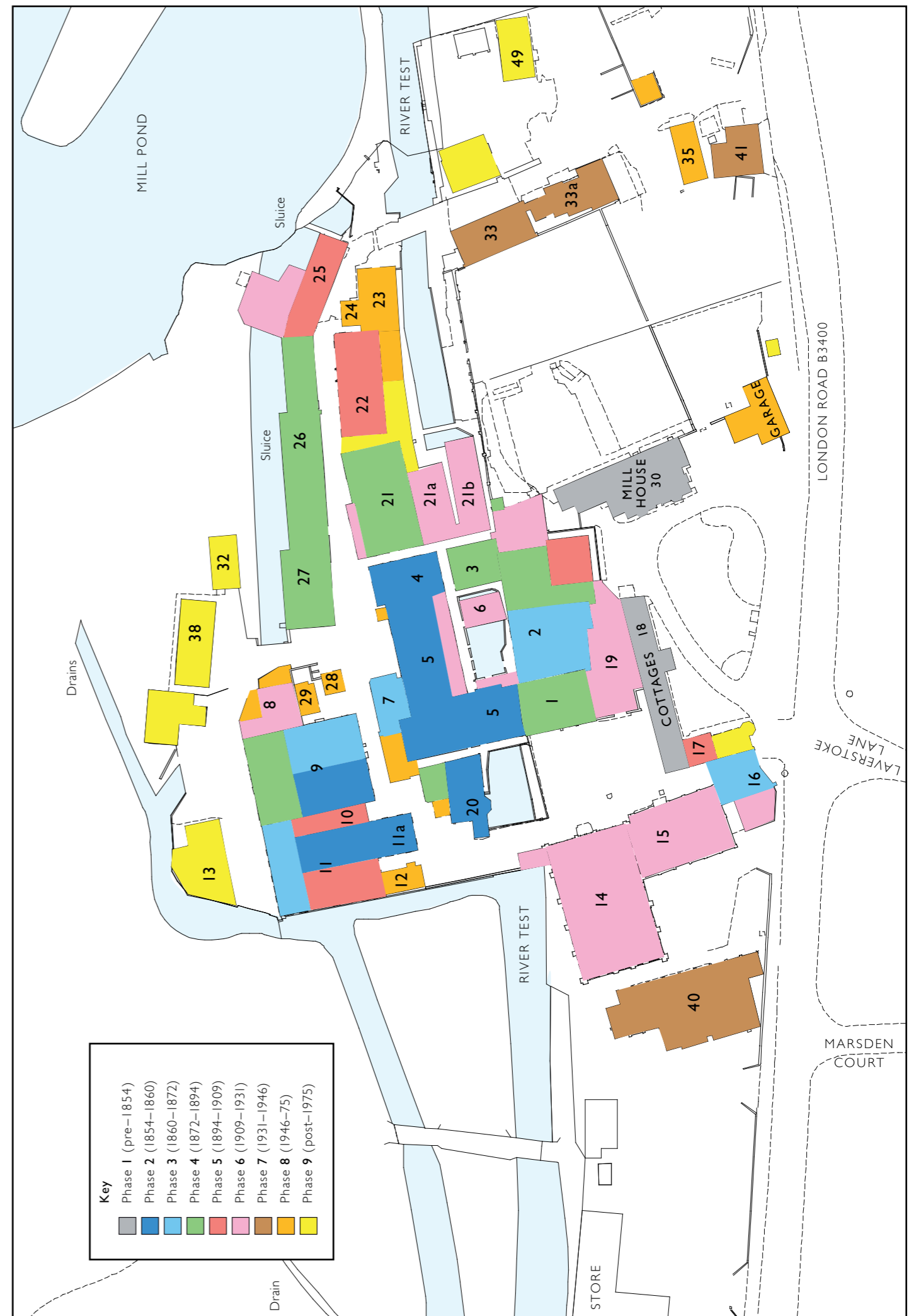


Appendix 14: 1975 Ordnance Survey map



Appendix 15: Phase plan

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