BELMONT MILLS,

BELMONT, CO OFFALY:

INDUSTRIAL HERITAGE SURVEY

Fred Hamond

for

Mr Thomas Dolan

May 2003

Contents

Preface

This report was commissioned by Mr Tom Dolan, the owner of Belmont Mills. Its purpose is to assess the site's industrial heritage merit and set out an action plan for the conservation of those buildings which are of special heritage significance.

The first chapter reviews the site's historical development from the mid 1700s to the present day. This is followed by a description of the various buildings within the complex and also the waterworks by which it was powered. Chapter four focuses on the oat mill and the machinery therein. The next two chapters assess the buildings' industrial heritage merit and highlight the threats to which those of most significant are exposed. Finally, chapter 7 sets out an action plan for the physical conservation of these buildings.

I should like to thank Tom and his family for their most generous hospitality during by survey work, and also David Perry, the site's previous owner, for additional historical information.

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Summary

1. Historical development

1.1 Belmont Mills originated in the 1760s with the construction of a water-powered mill, probably for grinding oats and wheat. In the later 1700s or early 1880s, a tuck mill (for fulling woollen cloth) and a rape mill (for the production of vegetable oil) were also erected. By the 1840s, however, all three mills were no longer operational and were falling into dereliction.

1.2 In the early 1850s, Captain John Collins built a large flour mill beside the earlier mill complex. In 1859 this mill and nearby Belmont House were bought by Henry Robert Perry of Clara, Co Offaly. In the 1860s, the operation of the flour mill was in the hands of Thomas and James Perry.

1.3 In 1866, Thomas leased the adjoining derelict corn and rape mills. The corn mill was enlarged and converted to a granary. The rape mill was likewise enlarged and converted to an oat mill. A drying kiln was also erected.

1.4 Thomas acquired outright ownership of the flour mill in 1878 and made a number of additions to it and the site in general (eg the mill house and mill office). Unfortunately, the flour mill was gutted by fire in the following year. It was quickly rebuilt and roller mills (an innovation at that time) installed in addition to conventional millstones. The machinery in the oat mill was probably upgraded at the same time. Both mills were powered by water.

1.5 In 1893, the business was restructured as Robert Perry & Co Ltd. Upgrading of the flour mill continued and a new maize mill was added in 1906-09.

1.6 Another disastrous fire in 1925 resulted in the destruction of the flour/maize mill. Again the mill was rebuilt and operations recommenced in 1928 under Robert Perry & Co (1927) Ltd.

1.7 The oat mill functioned until the mid 1970s. The maize mill continued to produce animal feed until it was once again gutted by fire in 1982. Excepting the granary, the entire block was demolished. The generation of hydro-electricity for the national grid also began in this year.

1.8 The installation of a small hammer mill and two mixing plants enabled its owner at that time, Mr David Perry, to continue producing animal feed until 1997. In that year, the entire site was purchased by Mr Thomas Dolan, its present owner.

2. Buildings

2.1 The complex comprises a substantial block containing an oat mill, kiln, granary and screen house, the former flour mill granary, mill house, stables and coach house, mill office, miller's house, and two hydro-electric stations (one of which is in separate ownership).

2.2 These buildings are in various states of use and repair. The mill house is still occupied, some buildings are earmarked for adaptive reuse, and others are disused but in reasonable repair.

3. Waterworks

3.1 The waterworks comprise an impressive weir across the Brosna River and several head- and tailraces. One of the headraces is still live, supplying water to the generating station; the other, to the oat mill, has been infilled.

4. Oat mill machinery

4.1 The oat mill contains virtually all its machinery - waterwheel, shafts and gears, millstones (two French burr stones, dated 1880, and one pair of gritstones for shelling oats) and roller mill, as well as numerous ancillary devices for screening and processing oats, and for grading the oatmeal.

5. Heritage significance

5.1 Belmont Mills is a Protected Structure and of regional significance because of its architecture, history, landscape contribution, and technical content of the oat mill.

5.2 Of special heritage merit is the oat mill block and flour mill granary. The oat mill itself is especially notable on account of its well preserved assemblage of machinery, much of it of later 19th century date.

6. Threats to significance

6.1 The roof of the oat mill has collapsed and the interior is currently protected with plastic sheeting. The roofs to the kiln and screen house have disappeared entirely. The granary still retains its original slate roof, but this is fast deteriorating.

6.2 The mill machinery is potentially vulnerable to damage and loss as a result rainwater ingress should the plastic sheeting on the roof fail.

7. Conservation actions

7.1 It is recommended that the entire oat mill block be reroofed with corrugated metal sheeting. The most urgent priority is the oat mill itself.

7.2 Less urgent, but no less essential, is the upgrading of the rainwater goods to this block and the repair of all windows.

7.3 The reinstatement of the waterwheel and machinery, whether to a static or operational state, is a matter for future consideration.

1. Historical development

Belmont Mills are situated south of Belmont village, on the right bank of the River Brosna and south-west of Ferbane (fig.1; grid N 0721 2212).

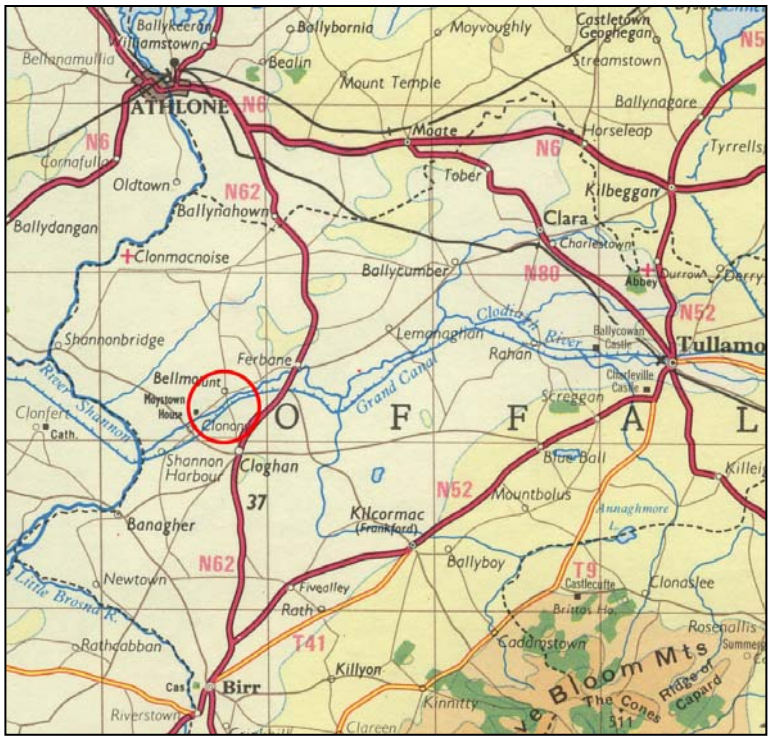

Fig.1 Location of Belmont Mills.

1.1 Grain, rape and tuck mills

The earliest attested mill on this site dates from 1769 and was built by John Clifford for Gilbert Holmes and Thomas L'Estrange.[1] Although its function is unknown, it may well have been a flour and/or oat mill, for the grinding of wheat and oats respectively.

An L-shaped building captioned 'flour mill' is depicted on the 1838 Ordnance Survey 6" map (fig.2).[2] It was fed by a headrace from a weir upstream of Belmont Bridge and its tailrace utilized a meander of the Brosna for most of its return path to the river.

The OS map also shows a small tuck mill on the right bank of the river a short distance down from the bridge. This was used to full woollen cloth (a process of cleaning and shrinking) and was fed by a channel off the corn mill's headrace. Its date of construction is unknown.

The Valuation mill and house books, compiled in the mid 1840s, give details of the site at this time.[3] When the mill book was being compiled, both the grain and tuck mills were held by Charles Atkinson under lease from Thomas L'Estrange (probably a descendant of the Thomas cited in 1769). However, when the house book was being prepared, L'Estrange had repossessed the corn mill but Atkinson still held the tuck mill.

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[1] Inscription incorporated into the west façade of the present oat mill.

[2] OS 6" (1:10,560) map, Co Offaly sheet 14, surveyed 1838 (published 1840).

[3] Valuation mill book for Co Offaly and Valuation house book (cat. no. OL 5.1379), both in National Archive, Bishop St, Dublin.

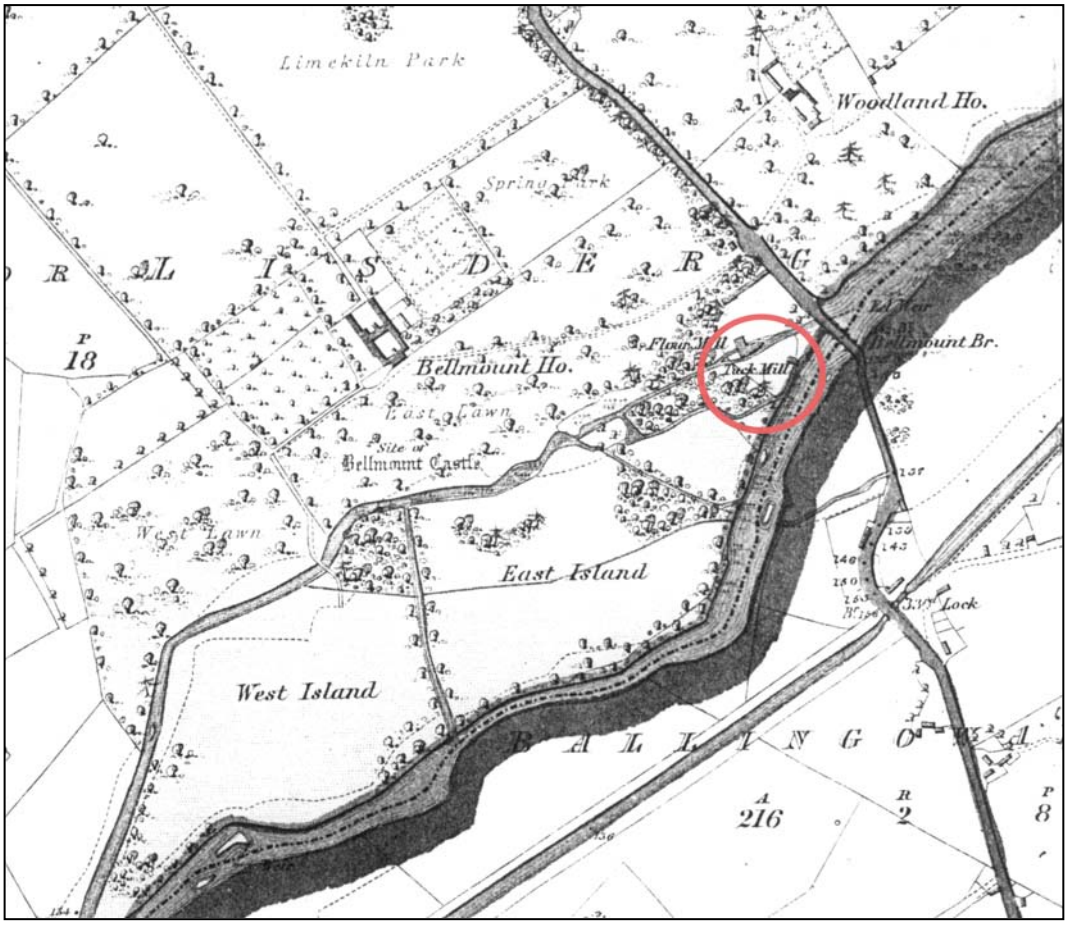

Fig.2 Belmont Mills as shown on 1838 OS 6" map (enlarged to 150%).

The grain mill is described in the Valuation mill book as a "flour and oat mill", indicating that both wheat and oats were being ground. The mill is also recorded as "very old slated buildings 75 years built"; this accords with its 1769 datestone. It is described as "working for the county" which implies that it was a toll mill, to which people brought several sacks of grain at a time for milling; a proportion of the meal was given to the miller by way of payment.[4] The Valuation house book gives its statistics as follows:

	Quality letter	Length (ft)	Breadth (ft)	Height (ft)
Oat mill	1C-	70½	37	26½
Return to above Old rape mill not used	1C-	32	25	25
Chaff house	1B-	35	13½	7

Key to quality letter: 1B- = slated, not new, slightly decayed; 1C- = slated, old and dilapidated.

The mill contained two sets of millstones, powered by a low breastshot wheel measuring 15ft 0in in diameter by 4ft 8in wide. To what extent the mill was operational is uncertain as it is described in the mill book as "out of repair and all in very poor and bad order".

It would appear that the grain mill was now engaged in oatmeal milling and that a defunct oilseed rape mill was attached. No further details of the latter's construction date or contents are

[4] Generally, 1/12th to 1/16th of the meal was paid over. In merchant mills, by contrast, the miller bought the grain on his own account, milled it, and then sold it on the open market.

known. Close inspection of the 1838 map shows the headrace bifurcating as it approaches this block – presumably one race supplied the grain mill and the other the rape mill.

The tuck mill is described as old and dilapidated (quality letter 1C-) and its upper section (noted as a loft) is recorded as "nearly all down". The building's dimensions are given as 35ft by 22ft by 14ft high. The waterwheel measured 12ft in diameter by 3ft wide and had a low breastshot feed. Also extant at this time were the following buildings:

	Quality letter	Length (ft)	Breadth (ft)	Height (ft)
Old kiln house: not in use, nearly in ruin	1C-	25	17½	8
Stable: not now in use	2C-	21	12½	6½
Pig house: nearly ruins	1C-	5	15	4½

Key to quality letter: as above; 2C- = thatched, old and dilapidated.

The overall impression given by the valuation books is that the site was in a derelict state and had not been operational for a number of years.

This situation was to continue through the famine years and beyond. The 1854 Griffith valuation recorded the site, which was now held directly by Thomas L'Estrange, as comprising a house, offices, corn mill (dilapidated) and tuck mill; the house and offices were rated at £15 and the mills at £26.[5]

1.2 Flour mill

In the early 1850s, Captain John Gunn Collins, owner of the adjoining Belmont House (or Bellmount House as it was then spelt) built a large flour mill just downstream from the existing mills.[6] It was completed by 1854 as it is cited in the Griffith valuation published in that year.[7] This new mill had a rateable valuation of £55 which indicates a sizeable enterprise, much larger than L'Estrange's adjoining mills.

The valuation cites the mill as a "steam mill", implying that it was powered by a steam engine. However, in March 1854, Collins paid £500 to Thomas L'Estrange for the water rights to the tuck mill and there is no evidence that a steam engine was ever installed.

Under the agreement with L'Estrange, Collins was also permitted to demolish the tuck mill. This he seems to have done as there are no subsequent references to it. He was also allowed to make any necessary changes to the headrace in order to supply his new mill. The only restrictions were that the water supply to L'Estrange's corn and rape mills was not to be reduced, and that no water was to be drawn off by Collins until the Drainage Commissioners had constructed a new weir across the river. The latter were undertaking a major drainage scheme on the Brosna at this time and had dismantled the earlier weir which supplied L'Estrange's three mills.[8]

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[5] 1854 Griffith Valuation Book: Parsonstown Union/ Tisaran Parish/ Bellmount townland, p.200.

[6] A conveyance dated 13 March 1854 notes "John Gunn Collins has lately erected a flour mill adjacent to the said mills of the said Thomas L'Estrange". Unless otherwise stated, all primary documents (such as this one) are in the possession of Tom Dolan, the owner of the mill complex. Copies of the deeds etc are also held in the Land Registry, Dublin; this particular deed was registered 1855, in book 5, entry no.185.

[7] 1854 Griffith Valuation Book, *op.cit.*

[8] Conveyance dated 13 March 1854, *op.cit*.

1.3 Messrs Perry take over

In July 1859, Henry Robert Perry of Clara Mills, Co Offaly purchased, through the Landed Estates Court, the flour mill, its water rights, Belmont House, office and demesne lands from the estate of John Collins for the sum of £3275.[9] To what extent the mill was a going concern at that time is uncertain.

The first attested reference to Perry's direct involvement in his new acquisition is in 1863 when an account book notes the installation of flour bolting equipment (cited in the accounts as "silk machines") and belt drives.[10]

In May 1866, Henry conveyed the entire premises to William Perry of Ballinagore, Co Westmeath.[11] Henry had apparently borrowed the purchase money from William James Perry of Moistown, Co Westmeath. William Perry acquired the right to this debt and Henry was now settling it by way of a transfer of ownership.[12]

Although William was the new owner, he was probably not involved in the mill's day to day operation. It would seem that the mill was actually run by Thomas Perry (the principal tenant) in partnership with James Perry.[13]

James Perry appears to have been responsible for the construction of Belmont Cottage (now called Mill House). This was extant in 1876 and probably dates from the later 1860s when he became involved with William in the flour mill.[14]

Thomas also leased the derelict corn and rape mills from Thomas L'Estrange's in August 1866.[15] He erected a new kiln the following year and the valuation officer noted the premises as "improved".[16] Judging by what stands here today, Perry heightened the original grain mill and converted it into a granary for the new oat mill. The former rape mill was also enlarged and converted into an oat mill; new machinery was undoubtedly installed as well, but their details await more detailed research.

In June 1878, Thomas purchased the flour mill from William James Perry of Blackrock, Co Dublin for £5000.[17] Various additional buildings were added to the complex: two- and five-storey buildings to the flour mill in 1878 and a new general office in 1880.[18]

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[9] Conveyance dated 30 July 1859 (Land Registry: 1859, book 29, no.144).

[10] Account entitled "Silk machines etc Belmont". This account runs from 7 Nov 1863 to 2 May 1865. In account book entitled "Building and Improvements". The Perry business records contain a notebook of James Perry giving details and sketch plans of the buildings and machinery in 1863 (National Archive, OFF/9/4/46). This probably relates to the flour mill.

[11] Conveyance dated 7 May 1866 (Land Registry: 1866, book 16, no.159). According to David Perry, William James was a solicitor and brother of Robert Henry.

[12] Mortgage dated 3 Jan 1866 from William Perry to William James Perry (Land Registry: 1866, book 2, no.133).

[13] This arrangement is noted in an agreement dated 12 March 1874 between Thomas, James and William Perry. The first two are described as millers at Belmont and William was living in Bray, Co Wicklow. According to David Perry, Thomas and James were brothers, but their relationship to Henry and William is uncertain.

[14] Agreement dated 23 December 1876 between Thomas and James Perry.

[15] This lease is cited in a document dated 8 June 1893 (Land Registry: 1893, book 37, no.36).

[16] Valuation revision book, 1866, p.10, entry 10 (Valuation Office, Abbey Life Centre, Dublin).

[17] Agreement dated 21 June 1878. William James Perry had presumably inherited or acquired ownership of the flour mill from William Perry of Ballinagore.

[18] The dimensions of the new mill buildings are given in the 1878 Valuation revision book (p.12, no.6) as 23yds x 9yds x 5 storeys and 10yds x 6yds x 2 storeys. The office's dimensions are given in the 1880 revision (p.13, no.10b) as 10yds x 6yds x 2 storeys.

1.4 Rebuilding of flour mill

In August 1879, there was a fire in the flour mill.[19] Repair work commenced shortly afterwards and was completed in November of the following year, although operations had probably restarted during the summer. It would appear that much of the original flour mill was rebuilt as the *King's County Chronicle* of 1883 describes it as "quite modern in style, having been erected in 1879-80 immediately after the destructive fire".[20] At this time, the mill contained nine sets of millstones and seven roller mills. The adjoining granary had a capacity of 20,000 barrels of corn.

Four of the rollers were Friedrich Wegmann's patent porcelain rollers and were purchased from his Naples factory through his British agent A.B. Childs & Son at a cost of £282 (fig.3).[21] The use of rollers at this time is highly significant, these being a more effective and efficient way of producing white flour than is possible with traditional millstones. The first complete roller system in Ireland was installed in 1879 by the Manchester firm of Henry Simon in Ebenezer Shackleton and Sons' Carlow mill.[22] However, it was not until well into the 1880s that rollers were finally accepted by the milling fraternity as superior to stones and began to be adopted widely in Ireland. Their presence at Belmont in 1880 was therefore an innovative and progressive move by the Perrys.

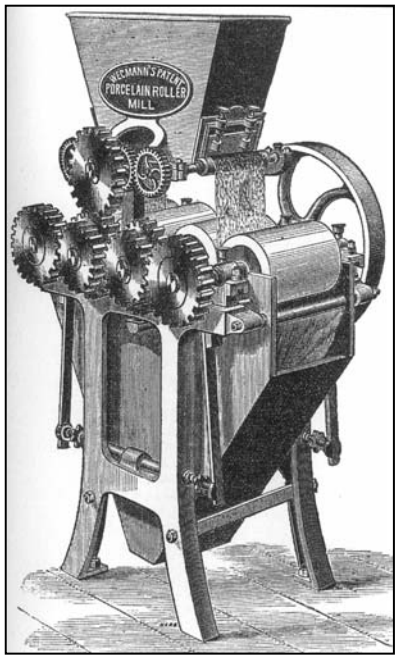

Fig.3 A Wegmann roller mill (*The Miller*, Feb 1877).

Although no water turbine is recorded before 1908, one may well have been installed at the same time as the rollers in order to provide the extra power and fast shaft speeds required by the rollers.

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[19] Account entitled "Belmont Mills: Cost of rebuilding mill and granaries after fire of 14th August". This account runs from 6 Sept 1879 to 5 Nov 1880. In notebook cited in reference 10.

[20] This report is reproduced in the *Offaly Independent* and on the Offaly Historical & Archaeological Society website (www.offalyhistory.com/perrys_belmont.htm). The original newspaper article also notes previous report on the damage caused by the fire. Although the account book records costs of £1442 (mainly wages), the newspaper report states that the actual cost was over £7000; clearly the account book only tells part of the story (none of the new machinery is cited for example). The Mountmellick Foundry supplied various shafts and gears, as itemised in an invoice to Messrs Perry for work carried out between August 1879 and June 1880.

[21] Invoice dated 28 May 1880 from Childs to Messrs Perry.

[22] G. Jones, 2003, 'The introduction of rollers into flour milling, 1880-1925', table 1. In A. Bielenberg (ed), *Irish Flour Milling a Thousand Year History* (Dublin: Lilliput Press).

According to the above 1883 report, the oat mill contained four sets of stones and its machinery was "all new and of the improved kind, worked by water power and remarkable for scrupulous cleanliness." It is possible that the machinery was 'improved' in 1880 as the two sets of millstones which are still in the mill bear this date.[23]

Thomas and James Perry, still the proprietors of the business, also had offices in Tullamore, Mullingar, Ballinasloe and Moate. Both native and American wheat were milled and the flour was dispatched throughout the region.

The layout of the site in 1880 is shown in sketch form in fig.4 and is broadly similar to its depiction by the Ordnance Survey in 1884 (fig.5). The oat and flour mills are shown on the OS map, as is Belmont House and various buildings to the west. Most of these mill-related buildings were probably erected by the Perrys after they acquired control of the two portions of the site.

An insurance schedule for the flour mill dated 1888 noted that the flour mill had three pairs of stone and nine sets of roller mills.[24] The oat mill contained four pairs of stones, one of which was a sheller for removing the outer skin of the oat grains. There was also a newly installed oat winnowing machine in the oat mill's adjoining grain store, driven off the waterwheel.

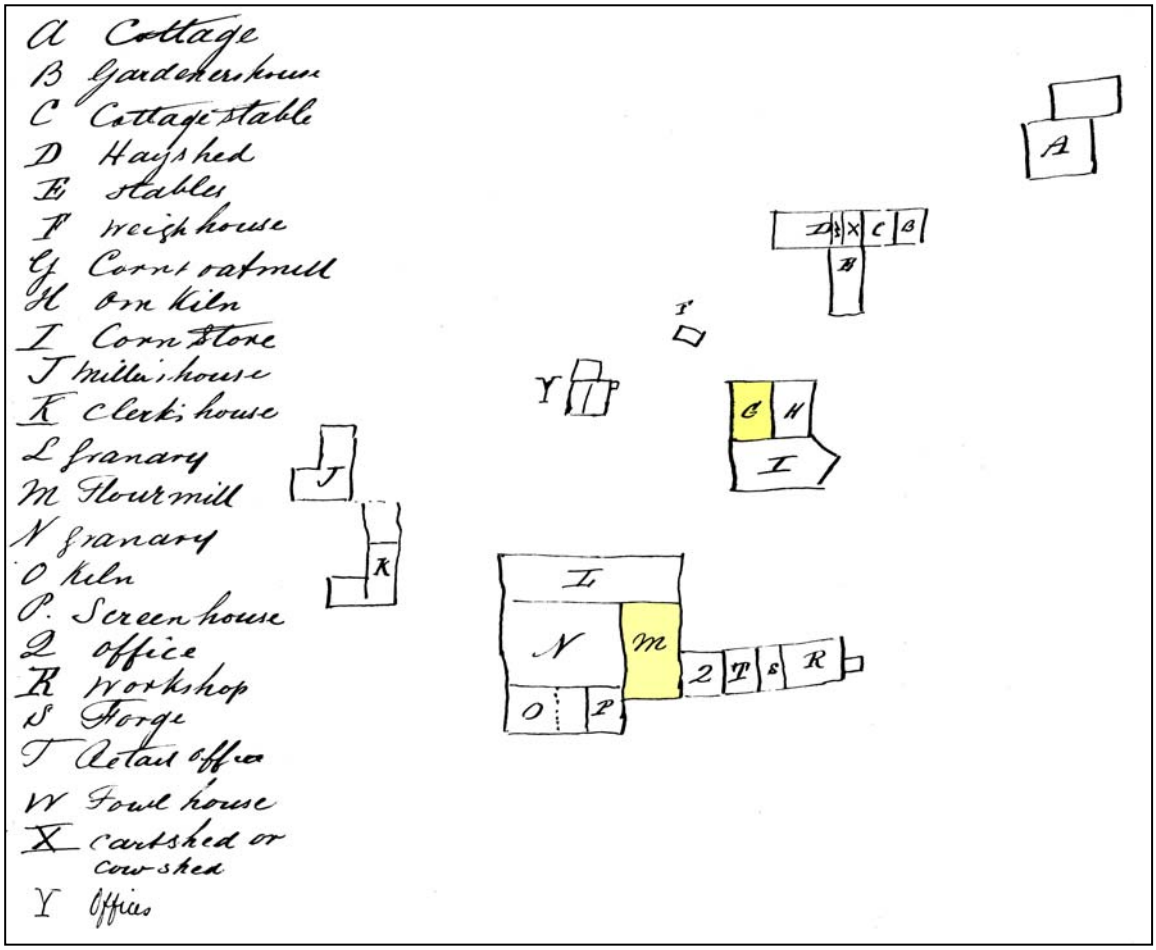

Fig.4 Sketch layout of site in 1880 (the flour and oat mills are highlighted in yellow).[25]

[23] A letter dated 1880 to Messrs Perry from Kay & Hilton reads: "We have shipped today … 2 French Burr runner millstones. … We are proceeding quickly with remainder of your order".
[24] Insurance schedule for period 29 Sept 1885 to 29 Sept 1886.
[25] Based on "Reference Plan to correspond with that in possession of Messrs Shields & Stride of the Royal Insurance Co, February 1880"..

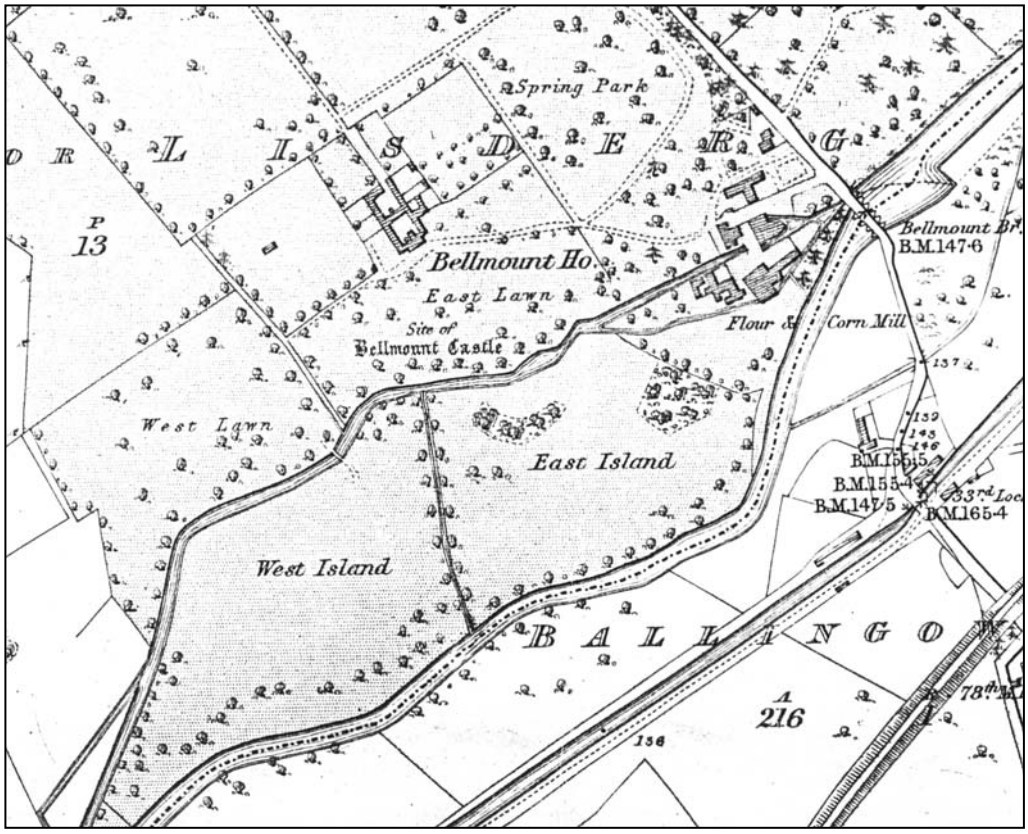

Fig.5 Belmont Mills as shown on 1884 OS 6" map (enlarged to 150%).[26]

1.5 Robert Perry & Co Ltd

In 1893, the business was restructured as Robert Perry & Co Ltd.[27] Shares in this new company were held by seven members of the Perry family: Thomas and James, Harriett (Thomas's wife), Ernest (Thomas's son), Francis Woodstock, Mary, and Elizabeth. Thomas Disturnal, the mill manager, also had a stake.[28]

In 1896, stores were erected along the north bank of the nearby Grand Canal, just west of the road bridge.[29] This canal had opened in 1804 and connected Dublin with Limerick via the River Shannon (fig.6). The dispatch of flour was doubtless also facilitated by the nearby Clara-Banagher railway which opened in 1884.

Some modernization of the flour mill was carried out in 1897. The account book notes "charges for remodelling, viz putting in new drive, 3 new rolls and 2 plansifters".[30] This book also notes the erection of a new maize mill in 1906-09, undoubtedly for animal feed.[31]

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[26] Based on OS 6" (1: 10,560) map, Co Offaly sheet 14, surveyed 1884 (published 1885).

[27] Conveyances dated 8 June 1893 from Thomas Perry to Robert Perry & Co. The new company may have been named after Henry Robert Perry's father.

[28] Perry business records (National Archive, OFF 9/4/19, 20, 28). The appointment of Disturnal as manager is noted in an agreement dated 8 June 1893 between him and Robert Perry & Co.

[29] Account entitled "Charges in connection with fitting up of machinery in *new* canal store". This account runs from 1 August to 24 Oct 1896. In notebook cited in reference 10. According to David Perry, the grain was brought by barge from Limerick.

[30] Account entitled "Charges for remodelling …". This account runs from 11 Feb 1897 to 3 July 1898. In notebook cited in reference 10.

[31] Account entitled "New Maize Mill". This account runs from 3 May 1906 to 29 Jan 1909. In notebook cited in reference 10.

Fig.6 Aerial view of Belmont district, showing Grand Canal at left and Brosna River at right. The canal stores are just beyond the road bridge and the actual mills are at middle right.[32]

A detailed inventory of 1908 notes the flour mill block as comprising a flour mill, maize mill, screen rooms, granaries, fire engine house and gas engine house.[33] The flour mill contained 12 sets of double rollers and the maize mill a three-high roll and two double rollers. A flour bleaching plant was also in operation. Power was supplied by a 16ft diameter by 13ft 6in wide paddle wheel, a turbine and a gas engine.[34]

Nine of the flour roller mills were made by Simon and the remaining three by Briddon & Fowler. The latter must have been installed in or after 1902 as Briddon & Fowler were not established until that year.[35]

According to the 1908 inventory, the oat mill contained three sets of stones (one set of French burr grindstone and a set of Derbyshire shellers), two Simon roller mills and assorted fan-aspirators, sieves, winnowers, separators, worm conveyors and bucket elevators. The adjoining granary contained elevators and grading reels. All this machinery was driven off a 14ft diameter by c.5ft wide paddle wheel. These contents and the wheel's dimensions largely correspond with what is in the mill today. The fact that the 1883 report noted the machinery as being "all new and of the improved kind" suggests that it is a replacement of that installed by Thomas Perry in 1867. It could well have date from around 1880 when the flour mill was being re-equipped.

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[32] Aerial photograph reproduced from *Ireland - the Inner Island: a Journey through Ireland's Waterways* by Kevin Dwyer (Collins Press, Cork, 2000).

[33] Valuation inventory dated May 1908 by Wood & Newland, Manchester. There is a similar inventory for 1910.

[34] No details of the turbine are given. In a radio interview, David Perry stated that it was made in America (taped copy of interview in possession of Tom Dolan). It may therefore have been a Liffel or Alcott. However, a document of 14 Oct 1982 notes the presence of a 112hp Gilkes turbine (of British manufacture) in the flour mill. It is not impossible that this was actually the original turbine. The gas engine was a Crossley (type Z.A) and ran off producer gas made by spraying steam over red-hot coke.

[35] G. Jones, 2001, *The Millers: A Story of Technological Endeavour and Industrial Success, 1870-2001*, p.256 (Lancashire: Carnegie Publishing).

Around 1909, the turbine was also coupled up to 220v DC dynamo which supplied electricity to the premises and to employees' houses in the nearby village. Some additional equipment appears to have been installed in the flour/maize mill block at the same time.[36]

The 1909 OS 25" map shows the complex in detail (fig.7).[37] There is little change since 1884 except for a slight enlargement of the flour mill. The entire complex is now captioned 'Belmont Mills (corn)'.

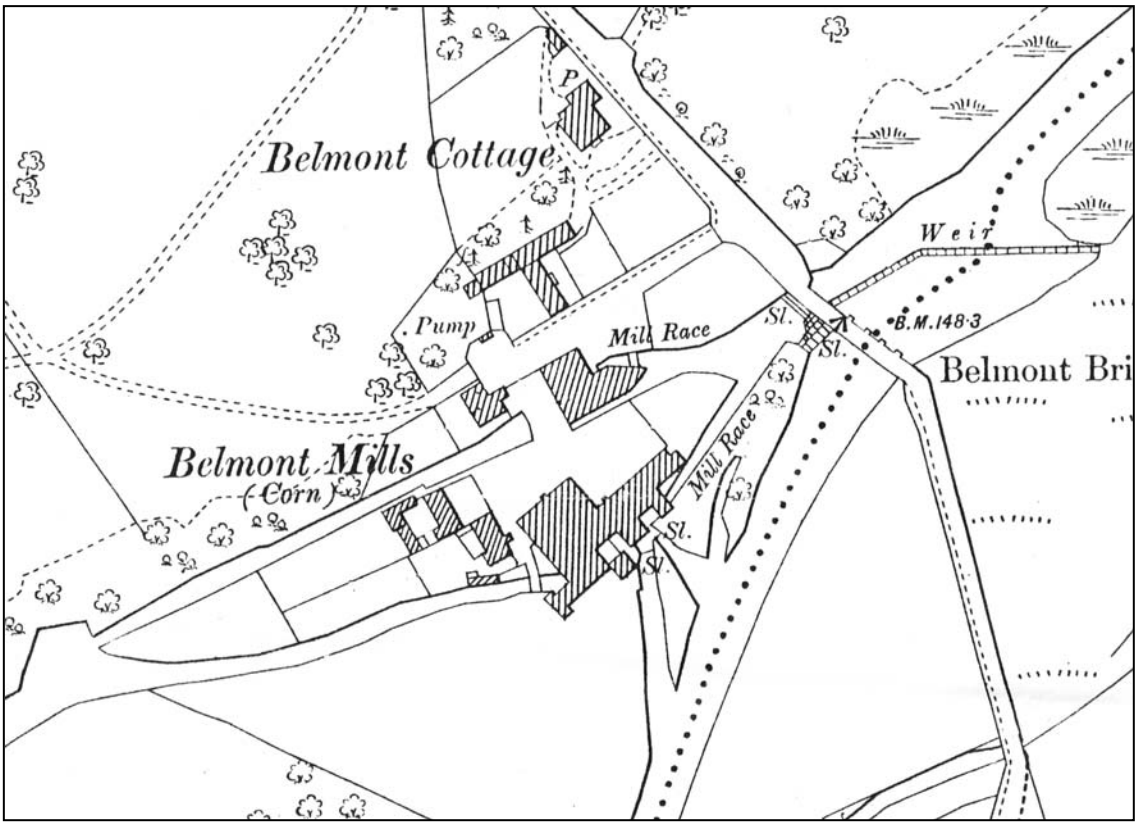

Fig.7 Belmont Mills, 1909 (scale 1:2500).

An advertisement in *The Miller* of 25 October 1924 shows an artist's impression of mill complex at this time, as viewed from the north (fig.8). The oat mill is shown at foreground left, complete with vented ridge to the kiln. In the middle is the flour/maize mill and in the background are the company's stores along the Grand Canal. Some artistic license is evident in the detailing (particular the number of windows), but the arrangement and relative sizes of the buildings is probably fairly accurate. Flaked maize, wheatmeal, oatmeal and flaked oatmeal were all now being produced.[38]

Ernest Perry died in December of that year and his share in the business passed to his brother Wilfred.[39]

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[36] Valuation inventory dated June 1910 by Wood & Newland. Electric lights are now recorded throughout the premises (there was no mention of them in May 1908). The dynamo, by Walsall Electric Co, produced 94 amps at 900 rpm.

[37] OS 25" (1: 2500) map, Co Offaly sheet 14-14, surveyed 1909 (published 1911).

[38] Radio interview cited in reference 29.

[39] Deed of disclaimer by Harpur Perry dated 4 Sept 1926.

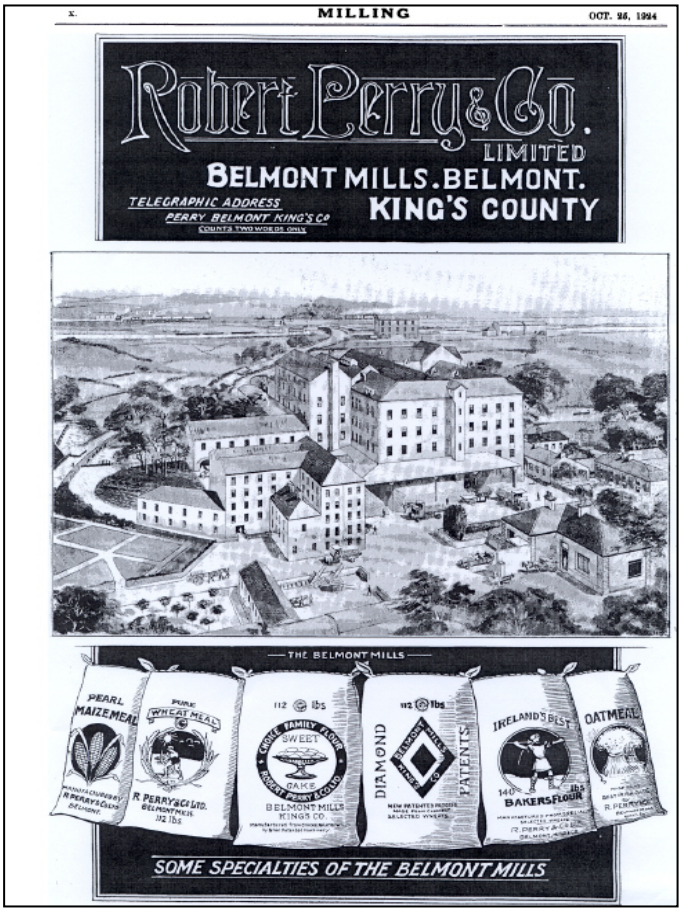


Fig.8 Advertisement in *The Miller*, 1924.

1.6 Robert Perry & Co (1927) Ltd

In 1925, the flour mill was extensively gutted by fire. Repairs were again carried out to most of the buildings and operations restarted in 1928 under the direction of Wilfred, now trading as Robert Perry & Co (1927) Ltd.[40]

The mills subsequently passed to Wilfred's son Philip. The oat mill ceased commercial production in its own right in the 1960s as it no longer met hygiene requirements (fig.9). Upon Philip's death in 1967, his wife ran the business with the assistance of a manager.[41] The

Fig.9 Pinhead oatmeal was produced in the oat mill until the 1960s.

[40] Counterpart conveyance dated 2 April 1928.

[41] Information from David Perry, 2003.

flour/maize mill was now mainly engaged in the production of flaked maize for animal feed. It contained a dryer, steamer for pre-cooking the grain, rollers, kibblers and mixers. The oatmeal mill continued to be used until c.1974 for the production of pinhead oatmeal which was then cooked and rolled in the flour/maize mill as sold as 'Groato' (fig.10).

Fig.10 Groato bag.

Pictures taken in 1976 show the complex at this time (fig.11).[42] In 1980 their son David took over the running of the business.

Fig.11 View of flour mill granary from north-east (*left*). View of oat mill and stores from headrace (*above*).

In 1982, work began on a new hydro-power station for the generation of 3-phase electricity for the maize mill. Unfortunately, on 18 September of the same year, the mill was completely gutted by fire. Although fully insured, it was decided not to rebuild it but to demolish all but the front granary which had survived unscathed.[43]

Machinery for mixing animal compounds was installed in the maize mill granary, and a second mixing plant set up in a purpose-built corrugated metal shed on the south side of the oat mill

[42] Pictures taken from a school project report by Keith Perry, 1976.

[43] Document dated 14 Oct 1982, probably written by David Perry just after the fire.

granary (fig.12). A small hammer mill was also installed in the triangular building at the east end of this granary.

Fig.12 Animal feed mixing shed *(courtesy Tom Dolan).*

The Gilkes turbine also survived the fire and was linked up to a generator for the temporary supply of electricity to the new mill complex. It was quickly superseded by a much larger Kaplan turbine and AC generator housed in an adjoining purpose-built shed. The headrace was also refurbished at the same time.

Milling operations ceased in 1997 when the entire site was purchased by Mr Tom Dolan, its present owner. However, Mr Perry continues to generate electricity for the ESB grid under the name of Wilmoor Holdings Ltd.

2. The buildings

The complex comprises a number of buildings in various states of repair and usage (fig.13; appendix 2, plates 1-3).

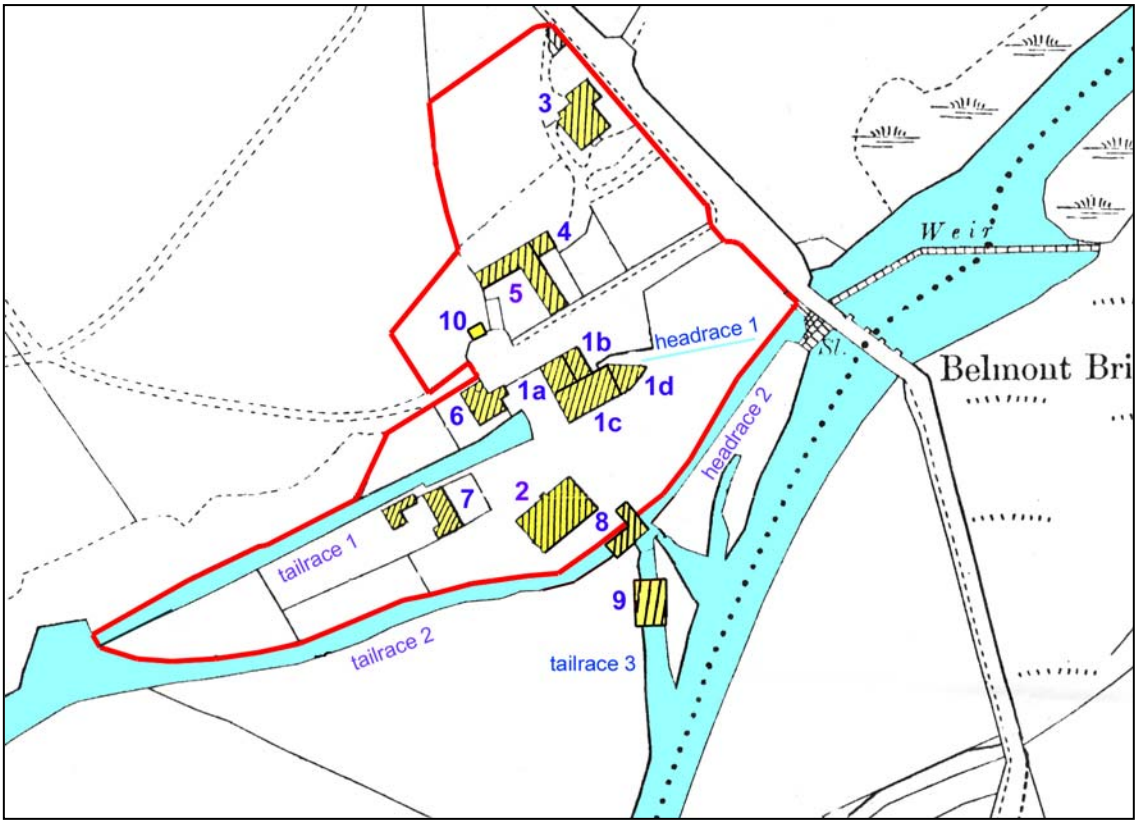


Fig.13 Location of buildings cited in the text.

2.1 Oat mill, kiln and granary

An L-shaped block containing the oat mill, kiln, grain store and screen house (marked 1a-1d respectively on fig.13).

1a Oat mill (appendix 2, plates 4-6)

A five-storey/ single-bay block aligned north-south and measuring 32ft 4in by 25ft 1in in plan (9.85m x 7.65m). These footprint dimensions correspond with those of the oil mill noted in the 1840s valuation (32ft by 25ft). However, the oil mill was 25ft high – ie three storeys – whereas the present building has five floors. Its raising by two floors undoubtedly reflects Perry's refurbishment in 1867/68. The building contains virtually all its oat milling machinery.

Exterior

This building has a natural slate roof, hipped at its north end and continuous with building 1c but separated from it by a raised firewall. The slates have gone and the surviving framework (tied common rafters, without purlins or trusses) is now covered with protective plastic sheeting. The walls are of lime-rendered random rubble brought to courses; there is an advanced eaves course of yellow brick.

The west elevation of this block is three openings wide. There is a small entrance door at ground floor left and windows to centre and right. There are three regularly spaced windows to each upper floor; those at top are of diminished height. All these openings have brick heads and jambs (rendered over) and the windows have 6-over-6 sliding sashes (but 3/3 to the top floor) and stone cills.

The north gable is devoid of openings. However, there is a wide arched opening visible just above ground level. Its segmental head has been formed with roughly dressed masonry voussoirs but the opening has been infilled with rubble. Its function is unknown.

The east elevation is abutted by the building 1b and only its top two floors are visible; neither has any openings.

Interior

The mill is accessed from external ground level and also from the first floor of building 1c. All the walls are plastered and all the upper floors are of timber boards resting directly on cross beams without joists; the ground one is covered with stone and cement. Timber stairs connect each floor. That between the ground and first floors is missing, however, and the only access to the latter is now via the first floor of building 1c. The mill contains virtually its full complement of machinery, all of which will be described in chapter 4.

1b Oat kiln (plates 8, 31-34)

A two-storey/ single-bay grain drying kiln in the corner between buildings 1a and 1c. It is aligned north-south and measures 32ft 6in by 21ft 10in (9.90m by 6.65m). This is undoubtedly the kiln erected by Perry in 1868. This building is now in poor repair.

The function of the kiln was to dry the grain prior to milling. Grain is normally stored and milled at a moisture content to 10-12%; any higher and it may go mouldy. Oats destined for human consumption required additional drying. This was because it comprises an inedible outer husk (shell) and edible inner groat. As only the latter is ground into oatmeal, the shell must be separated and discarded. This can only be achieved if the oats' moisture content is 1-2% - hence the importance of the kiln.

Exterior

Originally this building had a pitched natural slate roof, hipped to its north end (its ghost is visible on the wall of building 1c). This was superseded by a shallow monopitched corrugated iron roof, the north gable being built up in concrete blockwork to accommodate its profile. This later roof has also disappeared. The walls are detailed as building 1a, but are rendered with cement.

On the north elevation, there are two 6/6 windows to the ground floor and a shuttered opening to the first floor, all trimmed with yellow brick. There is a weighbridge directly outside. The east elevation has a 6/6 window and a door to the ground floor. The headrace enters at left as a 1.50m wide channel. There are two shuttered openings to the first floor (now without frames), with machined red-brick trim. There is a small opening at left between the two floors (probably to access the space directly underneath the drying floor).

Interior

The ground floor is accessible from external ground level and via a sliding metal firedoor from the mill. Most of the floor is flagged in stone, but the south end is of timber (with the headrace passing underneath). The walls are lime plastered. The ceiling is of brick jack arches at 3ft (92cm) centres. A timber beam runs at right angles along the bottom of the arches to give

additional support. It, in turn, is propped at intervals with timber uprights. Against the inside face of the east wall are two brick and rubble masonry hearths; these heated the space directly under the drying floor above. A chute discharged oat shells from a separator on the third floor of the mill. There is a 52in (132cm) diameter French burr stone set against the NE corner of the room; its grinding surface has a right-hand dress.

The drying floor is accessed from the mill's first floor (and is at a slightly higher level). The walls to this section have been rendered with cement. There are grain intake chutes from the second, third and fourth floors of building 1c. The floor comprised 12in square (305mm) perforated ceramic tiles resting on cast-iron beams which slot over three cast-iron beams running longitudinally at right angles. Only a few tiles now remain (c.20) and part of the supporting framework has disappeared. Directly underneath is a hot-air chamber, with ducts across the jack arches from the two hearths on the ground floor.

Two openings are evident in the party wall with building 1c. These were originally windows to the latter and confirm the kiln's later addition to the existing buildings.

1c Oat mill granary (plates 5-8, 35-44)

This five-storey/ double-pile/ single-bay store abuts the south ends of buildings 1a and 1b. It is aligned east-west and measures 70ft 8in by 37ft 5in (21.55m by 11.40m). These dimensions correspond with the footprint of the oat mill cited in the 1840s valuation (70ft 6in by 37ft). However, the latter is only 26ft 6in high (ie 3-3½ storeys), whereas the present building is five storeys high. As with the oil mill, it was heightened by Perry in the 1860s. It is in reasonable repair apart from a section of its roof.

Exterior

This building has a double-pile natural slate roof, the ends of which are hipped at west and half-hipped at east.

The west elevation incorporates the remains of the original oat mill The latter is evident as unrendered random rubble walling to the ground floor; it extends to half way up the third floor window at right to terminate in what appears to have been the eaves line of a hipped roof. This wall was subsequently raised by 1½ storeys in rendered random rubble brought to courses. The left half of this elevation has an infilled window at left and doorway at right. The right half has an infilled doorway at left; the wide doorway at right is an enlargement of an original window. The infilled doorway has dressed stone jambs and an entabulated head over. There are three inscriptions above the doorhead. From bottom to top, they read: "Gilbert Holmes & Tho^{s} L'Estrange Esq^{r}. may y^{e} 21"; "1769"; and "Erected/ by John Clifford/ mill wright". Each of the floors above have two windows, all in line with those on building 1a and also diminished in height to the top floor. The window at first floor left has been enlarged to form a loading door. As with the windows to 1a, the ones to 1c are trimmed in yellow brick. However, they are all without cills and only one original 6/6 sash frame survives.

Rising above the eaves at left is a projecting timber lucum carried on two cantilevered timber beams. It has a pitched natural slate roof, decorative bargeboards and timber walls. It originally contained a sack hoist and then a bell (now removed).

The south elevation is of lime-rendered random rubble with advanced brick eaves. There are four regularly spaced windows to each floor, in line with those to the west façade and all trimmed in yellow brick (under the render). There are traces of louvred frames to the openings on the upper floors; the ground floor opes have been sheeted over but there are internal traces of 6/6 sash windows. Only the ground floor openings have cills. Half-way along the base of this elevation, the stonework changes to squared random rubble and projects slightly beyond the face of the

wall. This probably signifies the position of the emplacement to the waterwheel powering the former oat mill.

The east elevation is abutted to its bottom three floors by building 1d. There are two louvred openings to the top two floors (one per bay). There is a brick relieving arch at second floor level, to a window or loading door now obscured by the roof of 1d.

Interior

The building is accessed via the ground floor doorway on its west gable. This floor is variously flagged, boarded and concreted and the walls are lime plastered. The timber floor above rests directly on transverse timber beams resting on pillow blocks over a line of brick piers running the length of the building. There were formerly two elevator intakes at the east end of this floor, both now removed. There is a ladder to the first floor in the NW corner.

The first floor is decked with 3in (75mm) thick timber boards with metal feathers between. The floor above is supported on transverse timber beams, each with three intermediate timber supports (and pillow blocks). There is a sliding metal door at NW to the first floor of the mill; its concrete jambs and head indicate that it is a modern insertion (or enlargement of an earlier door). There is also an opening to the kiln, with steel shutter. There are two bucket elevators at the east end of the floor; these rise to the top floor. This section of the floor is in poor repair and unsound. There is a third elevator towards the west end of the floor, supplied by a screw conveyor; it rises to the third floor. A 46in (116cm) dia right-hand dress French burr stone lies against the wall at SE. There is a ladder to the second floor in the NW corner.

The second floor is of similar construction to the one below. The eastern half of the floor is unsound. There is an infilled opening in the party wall with the kiln; this was undoubtedly a shuttered opening, infilled when the kiln was subsequently built. There is a ladder to the third floor in the NW corner.

The third floor is of similar construction to the one below. Part of the floor has been removed. As below, there is an infilled opening to the kiln, undoubtedly a shuttered opening, before the latter was built. The elevator towards the west end of the floor feeds into the top of the cylindrical mixer which discharges on the first floor. Both the elevator and mixer are powered by a lineshaft driven by a belt off an electric motor mounted on the floor. There is a ladder to the fourth floor in the NW corner.

The fourth (top) floor is in poor condition at its east end due to a leaking roof. The two elevators at this end discharge at this level; their belt drives have been disconnected. One of the elevators fed an overhead screw conveyor which runs the length of the room. At the NW corner is a floor-mounted sack hoist driven by a belt off an electric motor. The chain from this sack hoist passed through a trapdoor in each floor to ground level. It presumably once ran over a pulley in the lucum and down the outside of the building. There is also a shaft through the party wall with the top floor of the mill, on the end of which is a flat pulley and crown wheel. The pulley presumably drove the sack hoist prior to the present arrangement.

The roof is of common rafters, without purlins and trusses. The valley between each roof pitch is carried on a line of timber uprights down the middle of the floor. The undersides of the slates are lime plastered.

1d Screen house (plates 7-8, 45-46)

A two-storey/ single-bay building abuts the east gable of building 1c. It is triangular in plan, and its sides measure 37ft 5in, 35ft 5in and 28ft 10in (11.40m, 10.80m and 8.80m). Although a building of this shape is shown on the 1838 map, it is not explicitly cited in the 1840s valuation.

Its precise date is uncertain. Now roofless and derelict, it contains the remains of 20th century grain cleaning equipment.

Exterior

The roof was originally pitched, with its ridge sloping down to the east. The walls are detailed as building 1a but are cement dashed.

The NE façade has a sliding metal door at ground floor left. The concrete jambs and head to this opening indicate that it is a later insertion. To its right are two original windows. There are three shuttered openings to the first floor. All the openings are without cills. The south-east elevation is blank except for a window at ground floor left.

Interior

The interior is accessible from external ground level and also from the ground floor of building 1c. The ground floor is of concrete and the first floor of tongue-and-groove boarding over transverse beams (no joists); the latter has mostly collapsed. The insides of the walls are cement rendered.

The ground floor contains an intake to a bucket grain elevator, a circular steel cyclone (for collecting dust generated in the cleaning process), and cockler (for removing weed seeds from the grain). The latter is by E.R & F. Turner Ltd (Ipswich) and is mounted on concrete piers.

The first floor contains the discharge from the bucket elevator, the remains of a screw conveyor and a cleaner, also by Turner. The latter comprises a bank of reciprocating sieves and two fans for the removal of under- and over-sized material and dust. It is now out of position, having partly fallen through the rotten floor. A lineshaft runs along the party wall with building 1c. This drove the elevator, cleaner and cockler and was in turn driven by a belt off an electric motor, now removed.

Although the building is of 18th or 19th century date, its equipment appears to have been installed in the 20th century. All the grain was cleaned here before onward movement to the adjoining kiln.

2.2 Flour mill granary (plates 47-53)

The five-storey/ single-bay granary is all that now remains of the 1850s flour mill block (no.2 on fig.13). It measures 73ft 6in by 27ft 0in in plan (22.4m x 8.2m). This section has a hipped corrugated iron roof (a later replacement of slates) and lime-rendered random rubble walls. All openings are trimmed in yellow brick (rendered over). Where not infilled, the windows mostly have 4/4 top-hung cast-iron frames.

A fire-storey/ triple-pile building was formerly attached to the south elevation of this block but was demolished in 1982 after the fire; the connecting doorways were subsequently infilled. A mass-concrete elevator shaft projects from the middle of the north façade. The 1908 inventory notes this as ‘new’. It rises above eaves level to terminate in a gable with a pitched corrugated iron roof. A corrugated iron awning envelopes the bottom two floors of the north and east elevations.

Internally, the timber floors rest directly on steel beams. These date from the mill’s refurbishment in the 1920s. There are the remnants of equipment for mixing animal compounds (dating from the 1980s). The mass-concrete section to front contains a bucket elevator which supplies a screw conveyor on the top floor. There is also a sack hoist in the roofspace. The elevators and hoist were driven by electric motors. This building is in fair condition.

2.3 Mill House (plate 54)

A two-storey dwelling formerly known as Belmont Cottage, situated at the north end of the site (no.3 on fig.13). The front section faces south and has a hipped natural slate roof and boxed bracketed eaves; only the upper floor is visible to this elevation. A pitched roof section abuts the rear of the front block and there is also a return at NW. The eaves are boxed and carried on paired brackets. The walls are of random rubble brought to courses, but all openings are trimmed in brick. The main entrance, in the middle of the first floor of the front block has sidelights and a segmental margined transom light over. All the windows are 2/2 sliding sashes. This building is in excellent condition and occupied by the site owner.

2.4 Stable (plate 55)

A one-storey/one-bay former stable (no.4 on fig.13). Its roof was of pitched profile but has collapsed. The walls are of random rubble masonry with brick trim to the openings. The entrance door is on the south elevation. One of the original 6/6 window frames also survives on this facade. The west end of the house is abutted by the stable block. There was formerly a small gardener's house abutting its east side, but this has long gone save for the fireplace in the party wall. What remains is in very poor condition.

2.5 Stables, hay lofts and coach house (plate 56)

An L-shaped block comprising a two-storey stable block (with hay loft over) to south and a two-storey stable block (also with a hay loft over) and coach house to west, both facing into a small yard bounded by a rubble stone wall (no.5 on fig.13).

The south block has a pitched natural slate roof and random rubble walls. There are two vehicle entrances to its west façade. Some original 6/6 sliding sash windows survive. There are stables to the ground floor and offices and hayloft to the first floor. It is unoccupied and falling into disrepair.

The west block has a curved corrugated iron roof and random rubble walls. It has stables on the ground floor and a hayloft over. At its east end is a coach house. At the time of survey it was derelict, but has since been converted into craft studios and accommodation.

2.6 Mill office (plate 57)

A one-storey former office of L-plan (no.6 on fig.13). It has a hipped natural slate roof, smooth cement-rendered walls (lined to mimic ashlar) and stucco quoins. There is an entrance porch to its east elevation. A painted timber fascia board across the east side of the north bay reads 'Robt Perry & Co (1927) Ltd Belmont Mills'. The windows are 2/2 sliding sashes and originally had metal security bars, since removed. This building has been refurbished internally as a dwelling.

2.7 Miller's house and out-buildings (plates 58-59)

A two-storey dwelling towards the SW corner of the site which was occupied until 1996 (no.7 on fig.13). It has a half-hipped natural slate roof with a pair of yellow brick chimneys towards the centre. The walls are of lime-rendered random rubble. The principal façade faces east and is four openings wide. The entrance door has a fanlight over. The windows are 6/6 sliding sashes. The ground-floor window at the north end of the east elevation is set into an infilled segmental headed opening. There is a slightly lower two-storey return at the south end of the rear wall. This building is in fair condition and is to be refurbished as accommodation.

In the yard behind the dwelling are several outhouses. Along the yard's west side is a two-storey yellow brick store with curved corrugated iron roof. Along its north side is a range of one-storey random rubble buildings, all now roofless and derelict.

There were formerly several buildings south of the miller's house (cited as a clerk's house on the 1880 map and as a traveller's house in a map associated with an 1893 deed), but these are long demolished.

2.8 Hydro-electricity station 1 (plates 60-62)

A short distance SE of the surviving block is the pit of a Francis-type turbine (no.8 on fig.13). Although now in separate ownership, it is included here for completeness. The turbine survives in situ but could not be accessed for detailed inspection. The top of its vertical shaft is supported on steel beams set into mass concrete emplacements. These materials suggest that the turbine may well date to the mill's refurbishment after the fire. The turbine pit undoubtedly once contained a waterwheel which powered the flour mill.

The turbine drive is linked by a crown wheel and two-step pulley arrangement to two electricity generators. The pulleys and generators are enclosed in a relatively modern corrugated iron shed; remnants of the original rubble stone walling to this section of the mill are also still apparent. One of the generators appears to be of relatively modern date. It is by Brook Motors Ltd, rated at 75kW (@ 925rpm), and connected to a modern switch panel. The second generator is of earlier date but is disconnected from its drive. It is wired to a switch panel containing an ammeter and voltmeter.

2.9 Hydro-electricity station 2 (plates 63-64)

A hydro-power site dating from 1982 and now in separate ownership (no.9 on fig.13). A one-storey corrugated iron and concrete block shed encloses a Kaplan turbine (by Dumont, France) with a 2.20m runner. It has a rated output of 515kW based on a 3.60m head and 17cum/sec flow. The electricity – some 2.2 million kW-hours - is exported to the ESB grid.

2.10 Air-raid shelter (plate 65)

A mass-concrete World War II shelter, partly buried in the ground and heavily overgrown (no.10 on fig.13). Its flat concrete roof has been cast in situ over corrugated iron formwork. The entrance is on the south gable.

3. Waterworks

The two mills were originally water powered, the water being diverted off the River Brosna and channeled along two headraces to the mills (fig.13).

3.1 **Weir** (plate 66)

A vee-shaped weir runs diagonally across the river immediately upstream of the road bridge. It has a steeply sloped face of squared masonry blocks and a fish pass to centre. It is aligned such that the water naturally flows under the two end arches of the bridge and into the headrace. The level of the water in this race could be controlled by two sluice gates set into a concrete emplacement on the downstream side of the bridge, any excess water being returned to the river. A short distance further on, the headrace bifurcated, with a race going to each mill.

3.2 **Headrace 1** (plate 67)

This fed the oat mill, but has been infilled. The feed to the waterwheel ran along the north side of the two stores and through the kiln. It is only now visible where it enters the kiln. There was also a spillway along the south side of the two stores. As already noted in the external description of building 1c, there appears to have been a sluice to regulate the level of water.

3.2 **Headrace 2** (plates 68-70)

This channel formerly fed the flour mill. It has been widened in the recent past to supply the new hydro-electricity station. There is a modern sluice emplacement just above the latter.

3.3 **Tailrace 1** (plate 71)

Once the water had passed through the waterwheel in the oat mill and/or along the spillway, it was discharged along this tailrace back into the river.

3.4 **Tailrace 2** (plate 72)

This race returned the water from the waterwheel/turbine in the flour mill back to the river.

3.5 **Tailrace 3**

This race was probably originally a spillway for excess water along headrace 2. It now acts as the tailrace for the turbine in the modern hydro-electric power station.

4. Oat mill machinery

The mill contains a waterwheel, power transmission machinery, milling equipment and ancillary machinery. See appendix 1 for a technical description of the oat milling process, machinery layouts, power transmission trains and stock flow diagrams.

4.1 Waterwheel (plates 9-12)

The wheel sits in a 5ft (150cm) pit at the east end of the ground floor and was fed from headrace 1 running below the ground floor of the kiln. It measures 14ft 0in in diameter by 4ft 6in wide (427cm x 137cm). It is of cast-iron throughout except for the timber soleplates and floats. Its two rims are each carried on eight arms affixed to a hub mounted on the axle. The rims are 10ft 8in (325cm) in diameter and 38in apart (97cm); each has been cast in two halves. Thirty-two floats (paddles) are affixed to pairs of angled starts mortised through the rims and additionally secured with metal side rings. The water feeds on to the floats at just below nine o'clock (ie breastshot feed). Power is generated by a combination of the speed and weight of the water. A sole plate to each float and the curvature of the apron at the back of the wheel serve to contain the water within the wheel and thus maximise the power extracted from the water's kinetic and potential energy. Although long disused, the wheel is complete and in reasonable condition, albeit with some floats and sole plates missing or loose.

The amount of water flowing on to the wheel was controlled by an inclined timber sluice gate just behind the wheel. This was manually operated through a two-step gear and pinion system to a pair of cast-iron racks affixed to the back of the gate.

4.2 Power transmission gearing (plates 13-14)

The rotative power of the waterwheel was transmitted through a standard great spurwheel arrangement to three sets of millstones. There was also a drive off the great spurwheel to ancillary machinery for processing the grain and meal (fig.14).

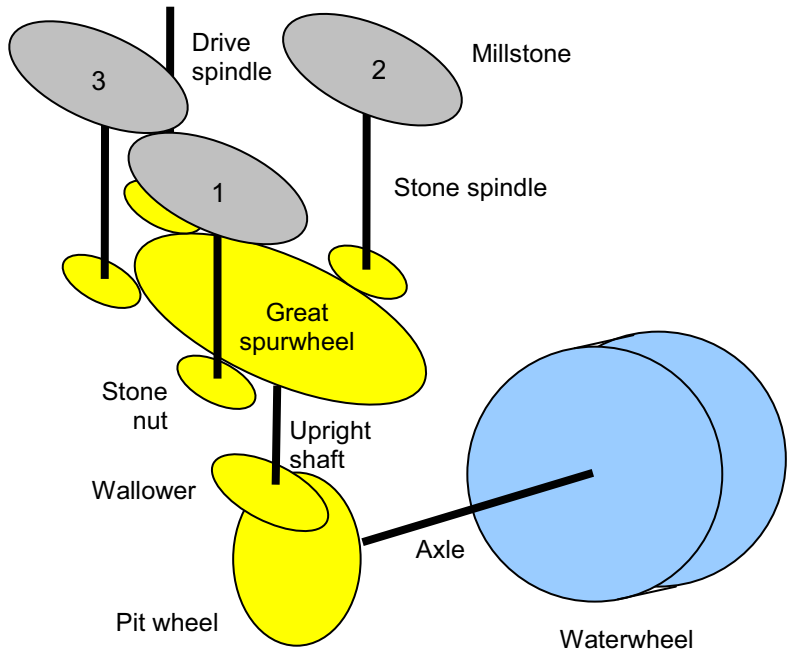


Fig.14 Schematic layout of drives to millstones.

The technical specifications of these shafts and gears are as follows:

Gear	Casting	No.	Tooth face (ins)
Pit wheel	Two halves	120 teeth	6
Wallower	One piece	50 teeth	6
Upright shaft	One piece		
Great spurwheel	Two halves	160 teeth	5
Stone nut 1	One piece	Missing	--
Stone spindle 1	Missing		
Jack ring	In place		
Stone gap adjuster	Missing		
Stone nut 2	One piece	Missing	--
Stone spindle 2	Lying elsewhere in mill.		
Jack ring	In place		
Stone gap adjuster	In place		
Stone nut 3	One piece	25 cogs	5
Stone spindle 3	One piece		
Jack ring	In place		
Stone gap adjuster	In place		
Drive nut	One piece	25 cogs	5
Drive spindle	In place		

All components are of cast iron save the stone spindle cogs, which are of wood. The entire assembly is supported by a sturdy timber frame. Each stone spindle runs on an adjustable footstep bearing on top of a bridge tree. The gap between the millstones was altered by means of a screw adjuster underneath each footstep bearing. This raised and lowered the runner (top stone) relative to the bedstone (bottom), so altering the distance between them and therefore the coarseness of the resultant meal. Each nut could also be raised out of contact with the great spurwheel by means of a jack ring, thus enabling the miller to drive one, two, or all three stones simultaneously (water permitting).

4.3 Milling equipment (plates 16-19, 21)

Three sets of millstones are located at the east end of the first floor. One of them removed the shells from oats (a process known as shelling), and the other two were for grinding groats (as the shelled oats were known) and wheat. Their details are as follows:

	Function	Material	Diameter (ins)	Maker's plate	Remarks
Stone 1	Grinding	French burr	46 (runner) 52 (bedstone)	Kay & Hilton, Bank Hall Bridge, Liverpool, 1880.	4 balance boxes. Two-prong mace. Circular wooden vat (elsewhere on this floor). Crane shared with stone 2. Feed chute disconnected.

Stone 2	Grinding	French burr	52	Kay & Hilton, Bank Hall Bridge, Liverpool, 1880.	4 balance boxes. Two-prong mace. Circular wooden vat (elsewhere on this floor). Crane shared with stone 1. Feed chute disconnected.
Stone 3	Shelling	One-piece gritstone	60	--	Circular wooden vat. Three feed chutes.

The shelling stones are of a relatively soft stone as they were not designed to grind the grain, merely to 'nip' the shell whilst leaving the groat intact. The runner and bedstone were set relatively far apart (1/8-1/4in) so that no grinding took place. The gear ratio between the waterwheel and sheller is 15.36 (= 120/50 x 160/25). In other words, for every 10 rotations of the wheel, the runner made 153.6 rotations. In practice, the wheel probably turned at 5-7 revolutions per minute and the runner at 75-105rpm.

The two sets of grindstones are made up from small pieces of hard French burr (a type of quartzite) set in plaster of Paris and bound with iron hoops. Unlike many other types of stone, this hard wearing material did not find its way into the meal (to the detriment of one's teeth). In order to achieve a fine grind, these stones were set close together (up to 1/8in). Coarser material could also be produced by raising the runner through the screw adjuster below the footstep bearing of the stone spindle. The gear ratios to the grinders is likely to have been higher as the stones are somewhat smaller (the precise rations cannot now be established as both nuts are missing). Unusually, the runner of stone 1 is smaller than its corresponding bedstone; the former is probably a later replacement as the two stones would have been of the same diameter originally.

As noted above, the drives to the two grinders have been removed. Although this may have occurred after the mill closed, in this case it may well have happened whilst it was still operational, the pair of them being superseded by the small roller mill on the first floor. This belt-driven machine is by Buhler (Uzwil, Switzerland).

4.4 Ancillary machinery (plates 15, 20, 22-30)

The mill contains various pieces of equipment for handling the grain and meal, for cleaning the grain, separating the shells from the groats, and grading the ground product.

The waterwheel drove all this equipment through the auxiliary drive nut off the great spurwheel. This connected with various lineshafts, pulleys and belts on the floors above. As this nut was always in contact with the spurwheel, individual machines were disengaged by slipping their belts from their driving pulleys.

5. Heritage significance

Apart from the flour/maize mill, this complex is remarkably complete and retains much of its original character. Its heritage significance is recognised by the fact that the complex is a Protected Structure under the 2000 Planning and Development Act. This designation applies to all the buildings and structures within the site's curtilage, not just to the surviving mill building. A consequence of this protection is that planning permission must be obtained for all development work which will impact upon the protected structures. Such works are defined as construction, excavation, demolition, extension, alteration, repair and renewal.

Belmont Mill became a Protected Structure because it was already listed in the 1996 Co Offaly County Development Plan (table 32, entry 35). Whilst the site merits such recognition and is of 'regional' significance in the author's view, it has yet to be surveyed in detail by the National Inventory of Architectural Heritage (NIAH). Of the various criteria used by the NIAH to gauge a site's heritage significance, the following are particularly relevant here:

Architectural	A good exemplar of the development of a style (including the relationship between differing styles in one building).
Historical	Illustrative of a past age by virtue of design, plan, materials or location.
Cultural	This includes landscape setting.
Technical	Industrial heritage artefacts which describe the character of production processes.

In the author's view, the site's components can be rated against each of these criteria as follows:

Building	Architectural	Historical	Cultural	Technical	*Overall rating*
1a. Oat mill	M	H	H	H	H
1b. Oat kiln	M	H	H	M	H
1c. Oat granary	M	H	H	M	H
1d. Screen house	M	H	H	M	H
2. Flour mill granary	M	H	H	M	H
3. Mill House	M	H	M	L	M
4. Stable	L	M	L	L	L
5. Stables/ coach ho	L	M	L	L	L
6. Mill office	M	H	L	L	M
7a. Miller's house	M	H	L	L	M
7b. Outbuildings	L	L	L	L	L
8. Hydro station 1	L	H	L	H	M
9. Hydro station 2	L	M	L	H	L
10. Air-raid shelter	L	L	L	L	L
Weir	M	H	H	H	H
Mill races	L	H	H	H	H

Key: H = high merit, M = medium merit, L = low merit

From the above table, it is evident that the oat mill block, flour mill granary and waterworks are all of 'high' significance in a regional context. The oat mill machinery is of particular importance due to its intactness and the fact that many items correspond with those listed in the 1908 and 1910 inventories (footnote 33).

The mill house, office, miller's house and hydro-electricity station 1 are all of 'medium' significant, and the remaining features are of 'low' merit. It should be emphasised, however, that even though a particular feature may be of low interest, it is still of group value in contributing to the site's overall heritage value.

6. Threats to significance

The Belmont Mill complex is occupied by an owner with an interest in architectural conservation and is under no threat of unsympathetic alteration or demolition. The mill house is still used as a dwelling and the mill office and stables/ coach house are being adaptively reused for the same purpose. It is also intended to reutilize the miller's house and flour mill granary. In all cases, the buildings' external character will be maintained and any surviving significant internal features will be retained. Nor are the weir and waterworks under threat as the functioning of the modern hydro-electricity station demands a live water supply.

The major conservation issue at Belmont Mill is undoubtedly the oat mill block. Although there have been no alterations to it since stopped working in the 1960s (save the infilling of the headrace), it has lain disused and is increasingly at the mercy of the elements. This situation has been exacerbated by the difficulty of reusing the internal spaces due to low head heights, presence of machinery etc.

The roofs on the kiln and screen house have collapsed and the buildings' contents are now exposed to the rain and wind. Metal is rusting and the woodwork is being attacked by worm and rot. The double-pile roof of the granary is leaking, and the floors underneath have deteriorated. The slates on the oat mill have blown off and the rafters have been sheeted with heavy-duty polythene by Mr Dolan in an attempt to curtail the deterioration of the internal machinery, most of which is of timber and therefore particular prone to loss. However, this can only be regarded as a temporary expedient and not a long-term solution to the problem. Rainwater penetration is also facilitated by the fact that the rainwater goods are now mostly missing, causing leakage into the eaves and along the line of the downpipes. Many of the window frames are also missing, particularly on the upper floors of the mill and granary.

Should this situation continue, the floors will eventually collapse, taking with them any surviving machinery. Once the roofs have gone, the eaves will be saturated by rain, cracks will appear due to frost action, and the walls will eventually collapse.

In short, the weatherproofing of the entire block, and the mill in particular, is an urgent priority if its heritage significance is to be physically conserved for the benefit of future generations.

7. Conservation actions

The main priority is to weatherproof the oat mill block by carrying out repairs to its roofs, rainwater goods and windows.

7.1 Roof repairs

As noted in the previous chapter, the immediate and most urgent priority is to repair the roofs on the oat mill block, and that on the mill in particular. The roof cladding on all these buildings was originally slate, but this now survives only on the granary.

Conservation principles dictate that, as the roofs were originally slated, they should be re-clad with slates of matching size and colour. Unfortunately this is not feasible at present due to the very high cost (in scaffolding a five-storey building, procurement of second-hand slates and labour) and fact that there will be no financial return for the foreseeable future (particularly as the mill will be preserved intact and therefore of little use for anything else).

An alternative solution would be to use corrugated galvanized metal sheeting in place of slates. This is a material traditionally used on farm buildings, is already in use on the flour mill granary, and has been demonstrated to last many decades with minimal maintenance. Any savings compared with slates can also be used to carry out the additional repairs noted below.

7.2 Rainwater goods

If and when re-roofing takes place, the gutters and downpipes should be closely inspected and repaired or replaced as necessary. Planning guidelines indicate that permission will be given for cast-metal gutters and downpipes but not for plastic ones.

7.3 Window repairs

Good conservation practice dictates that existing windows should be repaired if at all possible, and that all replacements should be of similar material, dimensions and finish to the originals. However, the very large number of windows in the mill and granary makes their reinstatement extremely expensive, particularly in the case of those openings which have glazed sliding sashes rather than shutters. A short- to medium-term measure might be to insert secondary polythene-covered timber frames (against the inside faces of any existing frames). This might then be followed by the piecemeal reinstatement of the proper windows over the longer term.

7.4 Future actions

The weatherproofing of the buildings will certainly prolong the survival of the internal machinery even if little or no further action is taken to conserve the latter. Ideally, the machinery would best be conserved by bringing it back to an operational state. This could be done in two stages. Firstly, by reinstating the water supply and refurbishing the waterwheel and power transmission gearing. Secondly, by refurbishing some or all of the auxiliary machinery and drives thereto. These actions would, however, require the preparation of a detailed feasibility study, method statement and costing, all of which are beyond the scope of this particular report.

Appendix 1:

Technical description of oatmeal production

Introduction

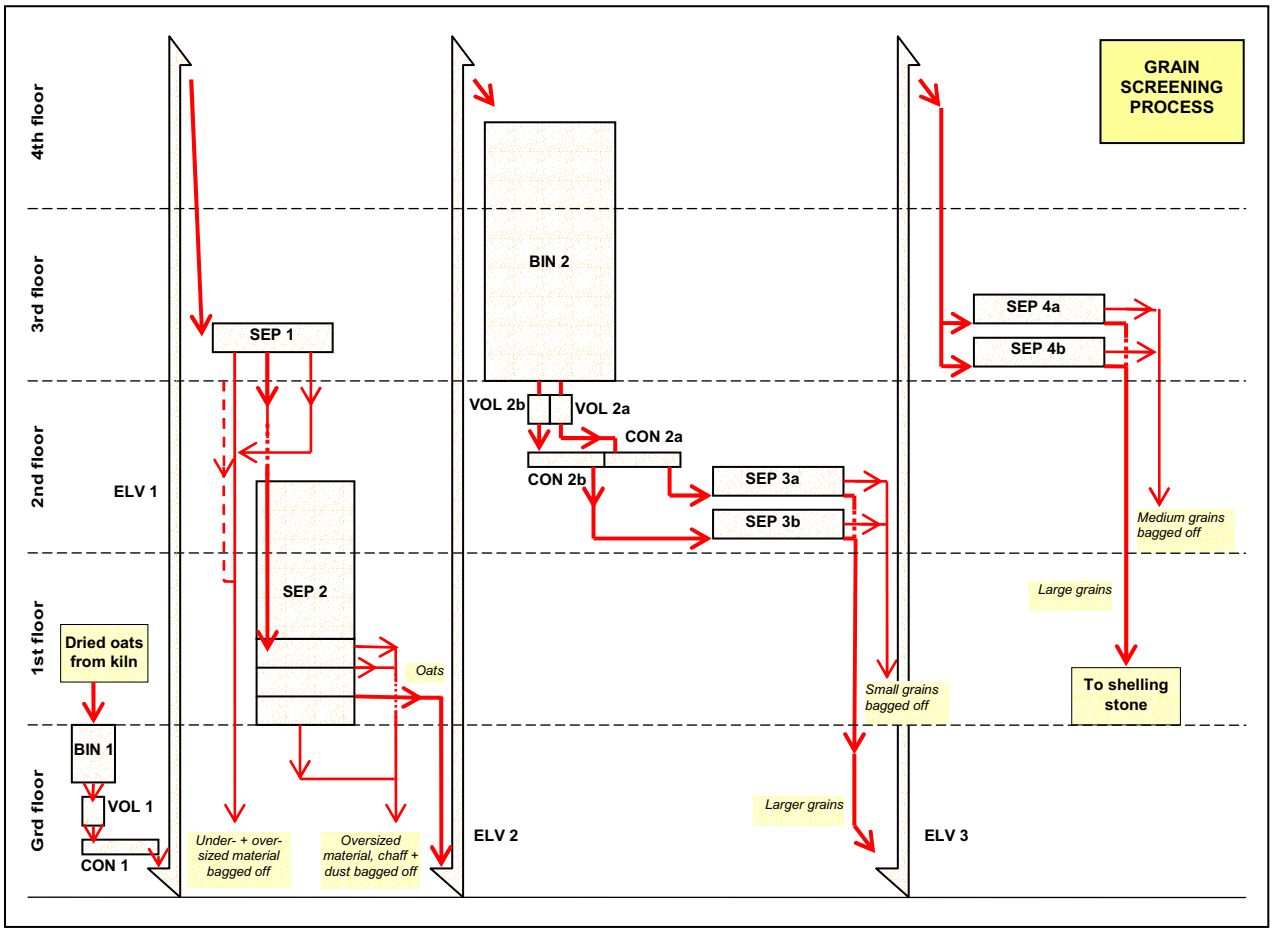
The process of oatmeal manufacture entails three sequential stages: (1) cleaning the incoming oats (screening), (2) shelling the oats and recovering the groats, (3), grinding the groats and grading the resultant oatmeal. These stages are carried out in a variety of machinery, the layout of which is shown at this end of this appendix (each machine is coded for brevity).

It should be noted that some of the connections between machines are now missing and can only be reconstructed on the basis of holes in floors etc. Indeed, some connections may have been altered in the latter years of the mill's operation, when its primary function was to produce pinhead oatmeal (for flaking in the maize mill), rather than oatmeal. This is particularly so of the devices involved with stage 3.

Stage 1: screening

In order to achieve consistently high quality oatmeal fit for human consumption, it was necessary to remove foreign matter from the dried grain and also grade it by size. This entailed removing stones, chaff, weed seeds and any other under- and over-sized matter from that to be milled. Undersized oats could potentially escape shelling and result in inedible shells finding their way into the meal. Small weed seeds were also problematic as they could be poisonous and/or detract from the meal's appearance.

Pre-cleaning of the grain was carried out in the screen room abutting the east end of the oat mill granary. This removed the bulk of the chaff, stones etc. It was then dried in the kiln, sacked and brought across to the NE corner of the mill's first floor where it was dumped in what had once been a in a partitioned-off area. From here it trickled into a large bin (BIN 1) on the ground floor whence it discharged into a short worm conveyor (CON 1) which in turn fed into the bottom of a



bucket elevator (ELV 1). The output from the bin could also be directed into the conveyor through a volumetric feeder (VOL 1). This regulated the grain's rate of flow into the screening apparatus; too much could lead to incomplete cleaning, whilst too little could result in the shelling stones running dry.

The elevator discharged into an inclined herringbone reel (SEP 1) on the third floor, the purpose of which was to separate under- and oversized material from the grain (e.g. straw, chaff, dust), all of which was bagged on the ground floor. There are also the remains of a defunct vertical chute below the top end of the sieve. On it is painted: "Gravity separator/ Pat'd Feb 2 1897/ Jessop & Wheelan/ 2240 California/ San Francisco/ Manufactured in the/ United States of America". Apart from the millstones, this is the only item of machinery in the mill which bears a date; it seems to have belonged to a previous screening system rather that the present one.

The partially cleaned grain then fell down a chute into a cleaner at the west end of the first floor (SEP 2). This device, by Buhler Brothers of Uzwil, Switzerland, removes under- and oversized material and any residual lighter material. It comprises a fan mounted on its top and two perforated metal reciprocating sieves, one below the other. The material overtailing the lower sieve – mainly clean grain - is ducted to a bucket elevator (ELV 2), whilst the rest is bagged on the ground floor. The light material removed by the fans settled out in an expansion chamber on the floor above.

The grain was discharged from the elevator into a bin (BIN 2) in the NE corner of the third floor. The output from the bin was split into two channels. Each discharged via its own volumetric feeder (VOL 2a, 2b) into a worm conveyor (CON 2a, 2b) and onward to two cylindrical separators (SEP 3a, 3b; also called trieurs). These split any under-sized material from the rest of the grain.

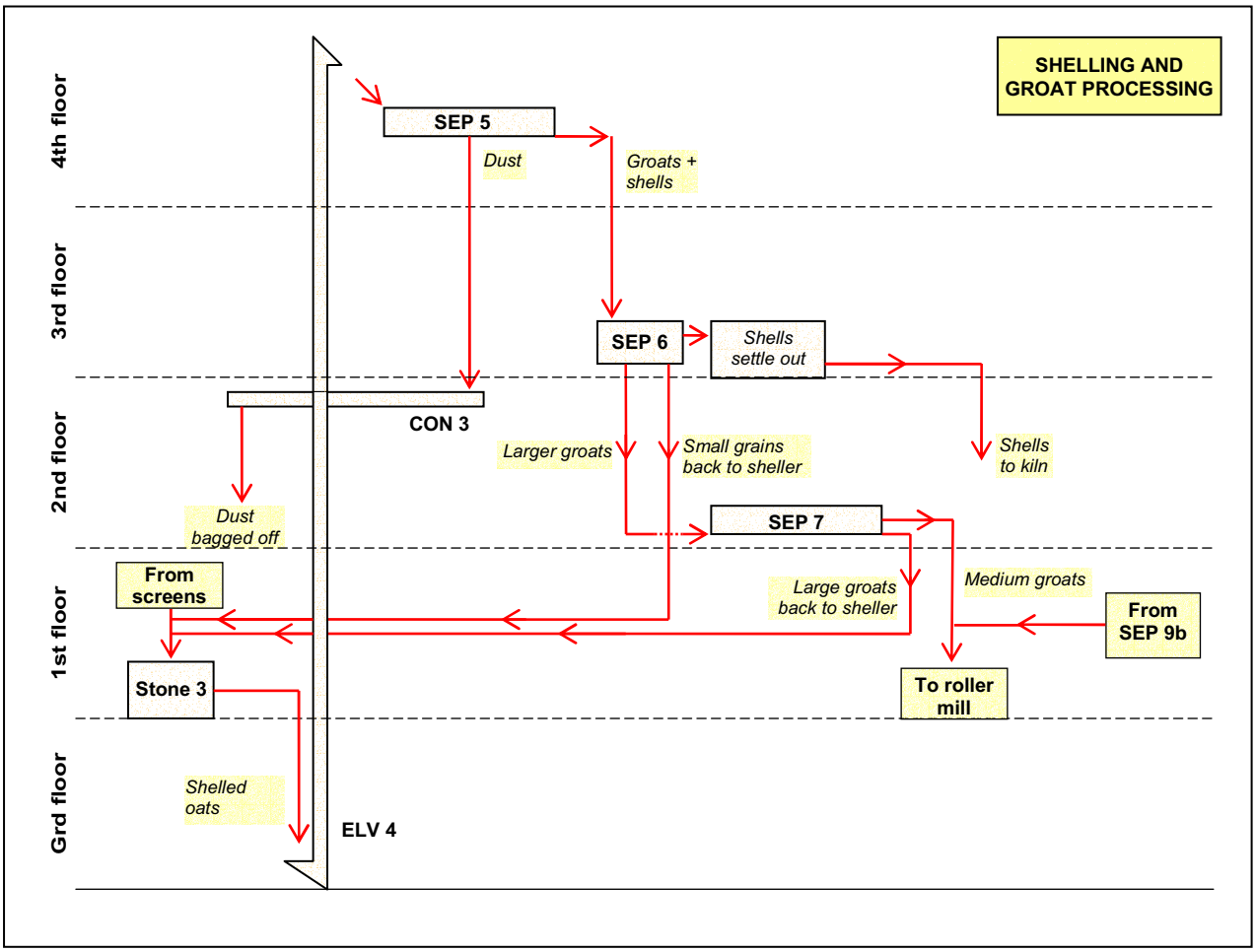
Each trieur comprises an inclined metal cylinder, 21in in diameter by 84in long, and indented internally with pockets having the same size and shape as the grain to be removed. The cylinders worked in parallel and rotated in unison by means of a connecting belt. As each cylinder turned, small grains were caught up by the indentations. Towards the top of the cylinder's rotation, this material fell on to a tray running down the inside the cylinder. A worm conveyed it to the bottom end of the tray, whence it discharged into a chute to the first floor where it was bagged. As the larger grains were too big for the indents, they continued along to the bottom end of the cylinder, whence they were ducted to the ground floor and into the base of another elevator (ELV 3).

The larger fraction was returned to the top floor, whence it was fed into two parallel-working trieurs on the third floor (SEP 4a, 4b). These devices, which are 16in diameter by 65in long, removed the smaller grains (ie medium-sized grain) which were then ducted to the second floor and bagged off. The larger grains – plump oats - were of the correct size for milling and were fed directly into the eye of the shelling stones on the first floor.

Stage 2: shelling and groat processing

Shelling entailed the separation of the outer shell from the inner groat. The material entered the shelling stones (Stone 3) as grains of oats and emerged onto the skirt between the bedstone and vat as groats, shells and dust. This mixture was discharged through a hole in the skirt into a chute linked to the bottom of the groat elevator on the ground floor (ELV 4).

Before the groats were ground into oatmeal, it was first necessary to dispose of the dust and shells generated during the shelling process. This was achieved by exploiting differences in their size and weight. Accordingly, the material was raised to the top floor and discharged into a reel separator (SEP 5; also known as a rotary sieve). The reel measures 30in in diameter by 96in long and was probably once totally encased to minimise the escape of dust; the top of the casing has



now rotted away. This device comprises an inclined metal frame covered in fine wire mesh. Any dust fell through the mesh and down a duct at the base of the machine to a worm conveyor (CON 3) on the second floor, where it was bagged. The groats and shells, being larger, overtailed the end of the reel and discharged into an aspirator on the third floor (SEP 6).

This aspirator exploits differences in particle weight to achieve separation. It comprises a small wooden chamber with internal slats and on top of which is a high-speed fan which sucks air through the box. The output from the reel separator entered the top of the aspirator where a roller fed it at a constant rate into a duct across which the air current flowed. The lightest material – shells and any residual dust - was almost immediately sucked off sideways and passed into a wooden expansion chamber in the corner where it settled out on the floor. Periodically the accumulated shells were shovelled into a duct down to the ground floor of the kiln, where they were burnt in the two fire holes. The slightly heavier material - mostly small oats which had survived the shelling stones intact – fell further inside the aspirator duct before they, too, were diverted into a chute which returned them to the shelling stones for a second pass. The heaviest material – mainly plump groats - continued downwards and out the bottom of the aspirator. There was a hinged flap within the aspirator by which the proportion of lighter and heavier material could be adjusted manually.

The heaviest material was ducted into a separator on the second floor (SEP 7). This is identical in operation to SEP 3 (also on the second floor) and split the groats into their larger and smaller fractions. The former was returned for a second pass in the shelling stones and the latter was fed into a small roller mill on floor 1. Why the larger material was not fed into the stones, rather than the medium material, is not clear to the author. Partially milled groats were also passed into the roller from an oatmeal aspirator on the top floor (SEP 9 – see stage 3 description).

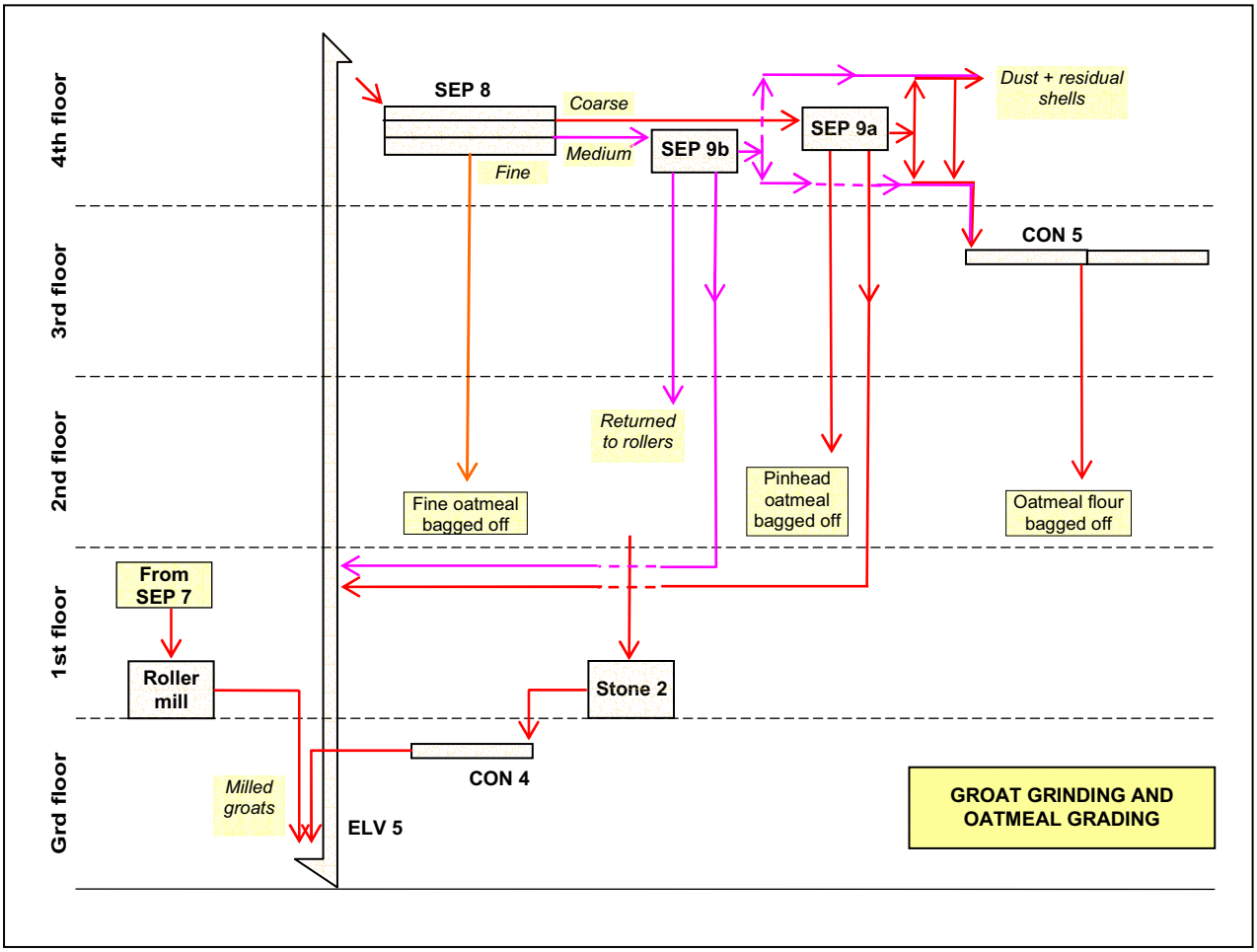
Stage 3: oatmeal production and processing

The roller mill (ROL 1) comprises two fluted cast-metal rollers travelling at slightly different speeds. As the groats passed between the rollers, the grain was sheared open and their contents pulverized into oatmeal. This fell down a chute and into the base of an elevator (ELV 5) which brought it up to the top floor for grading into its differently sized components.

This elevator was also fed from Stone 2, a pair of French burrs, via a short worm conveyor in the ceiling of the ground floor (CON 4). The feed to these stones is unclear, but it was probably through a chute from the second floor. Whether the roller and millstones were worked simultaneously is now uncertain.

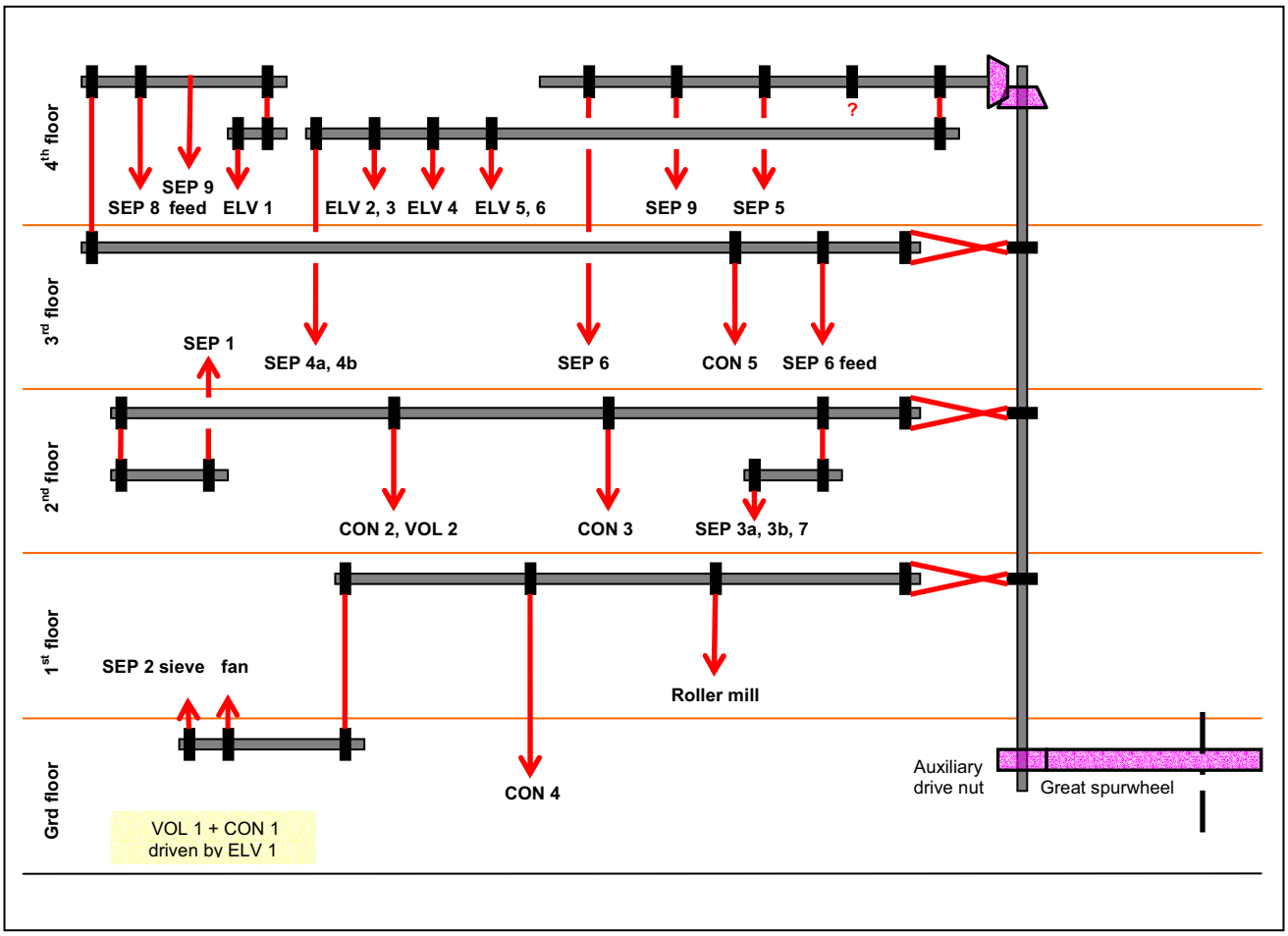
The elevator discharged into a reciprocating two-tier sieve which differentiates the coarse, medium and fine material. This sieve measures 6ft long by 2ft wide. The fine material passes through both sieves and down a chute to be bagged off on the second floor. The coarse material (which overtailed the upper sieve) and medium material (which overtailed the lower sieve) each passed into an aspirator (SEP 9a, 9b respectively). These are identical in operation to SEP 6 and split each of their respective flows into three sizes.

The heaviest material which emerged from SEP 9a - pinhead oatmeal – was bagged off on the second floor. The heaviest material from SEP 9b - medium-sized, partially ground groats - was returned to the roller mill on the first floor. The medium material from both aspirators appears to have been returned to ELV 5 for resieving. The fine material from both aspirators was split into oatmeal flour and dust/ residual shell. The former was taken along a worm conveyor on the third floor for bagging off on the floor below. The dust and shell settled out in a timber box against the east wall of the top floor.



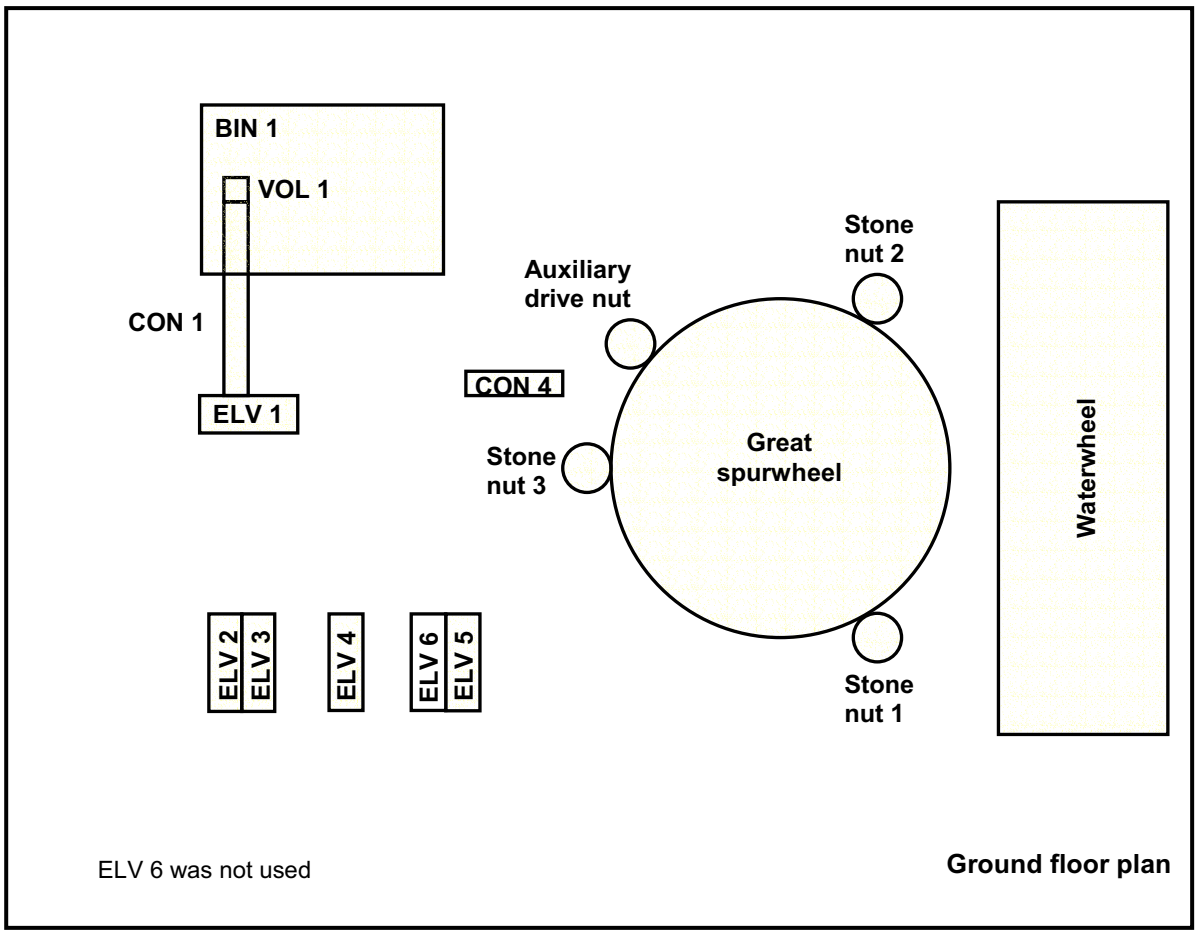
Power transmission

Apart from the millstones, all the above devices were driven off the auxiliary drive shaft. This vertical shaft runs from the ground to top floor and was driven off the great spurwheel. It connects via figure-of-eight belts to lineshafts on the first, second and third floors, and via a crown wheel and pinion to a lineshaft on the top floor. These lineshafts were connected by flat pulley belts to the various devices and also drove secondary lineshafts, which in turn drove machinery. The drive configuration is as shown below. All the shafts, pulleys and most of the belts are still intact.



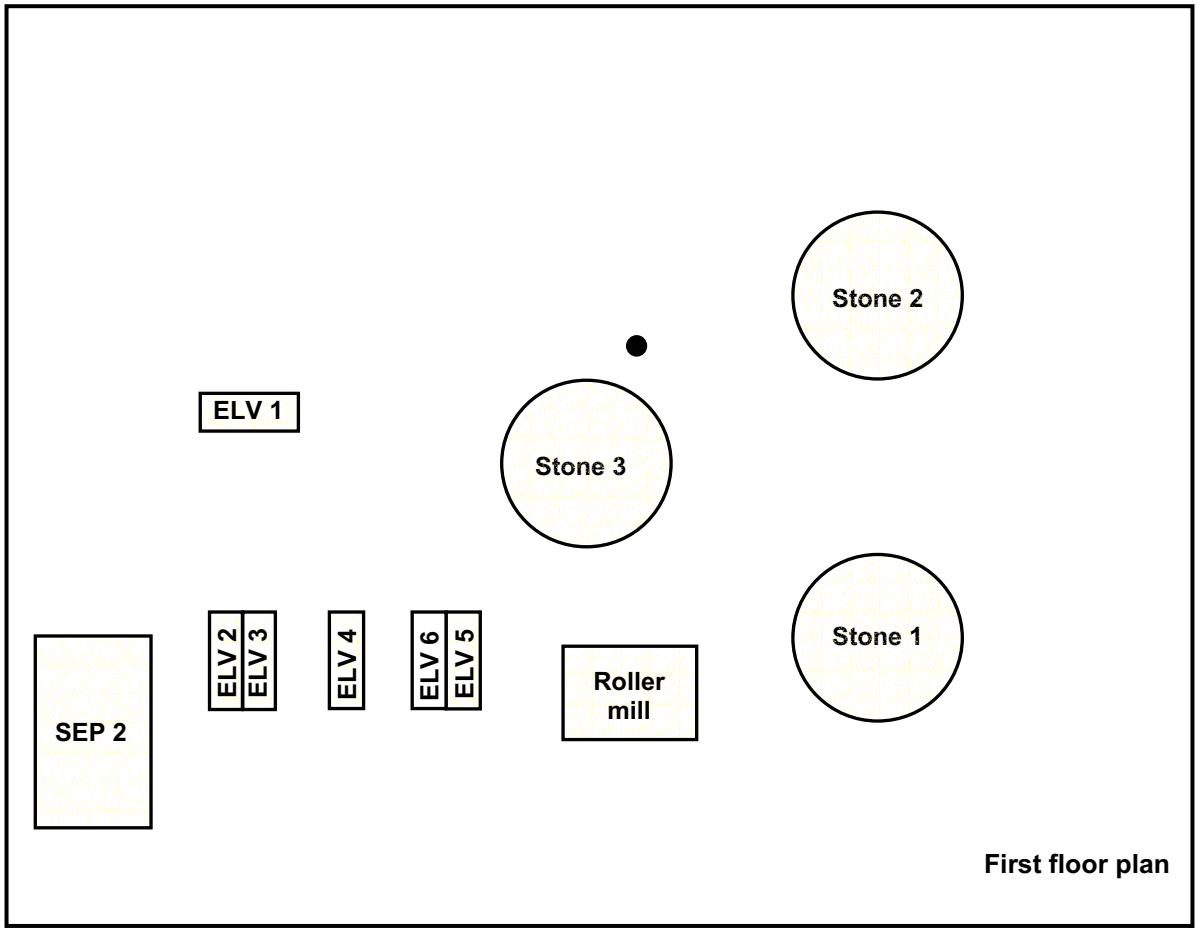
Floor configuration

The layout of the machinery on the various floors is as shown in the following schematic plans (not to scale).

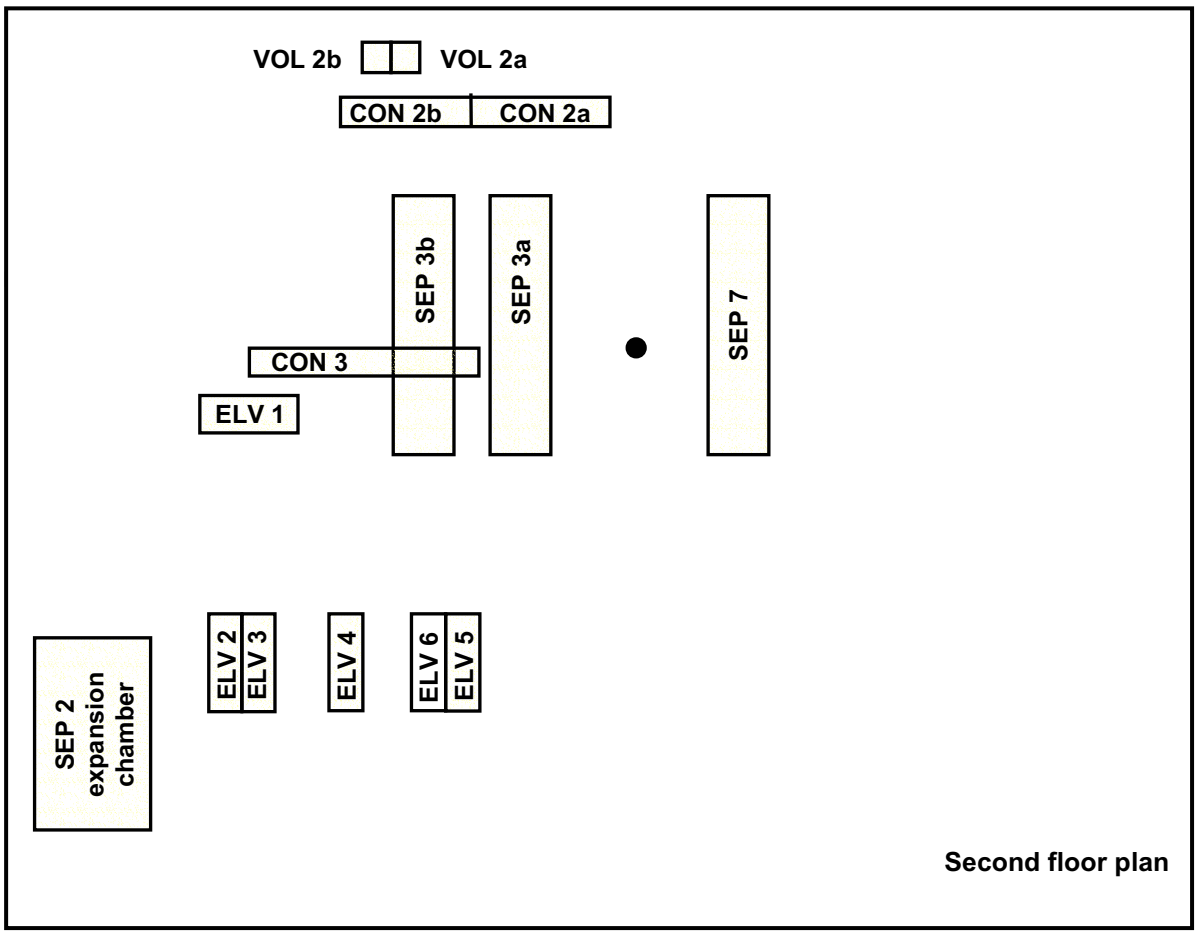


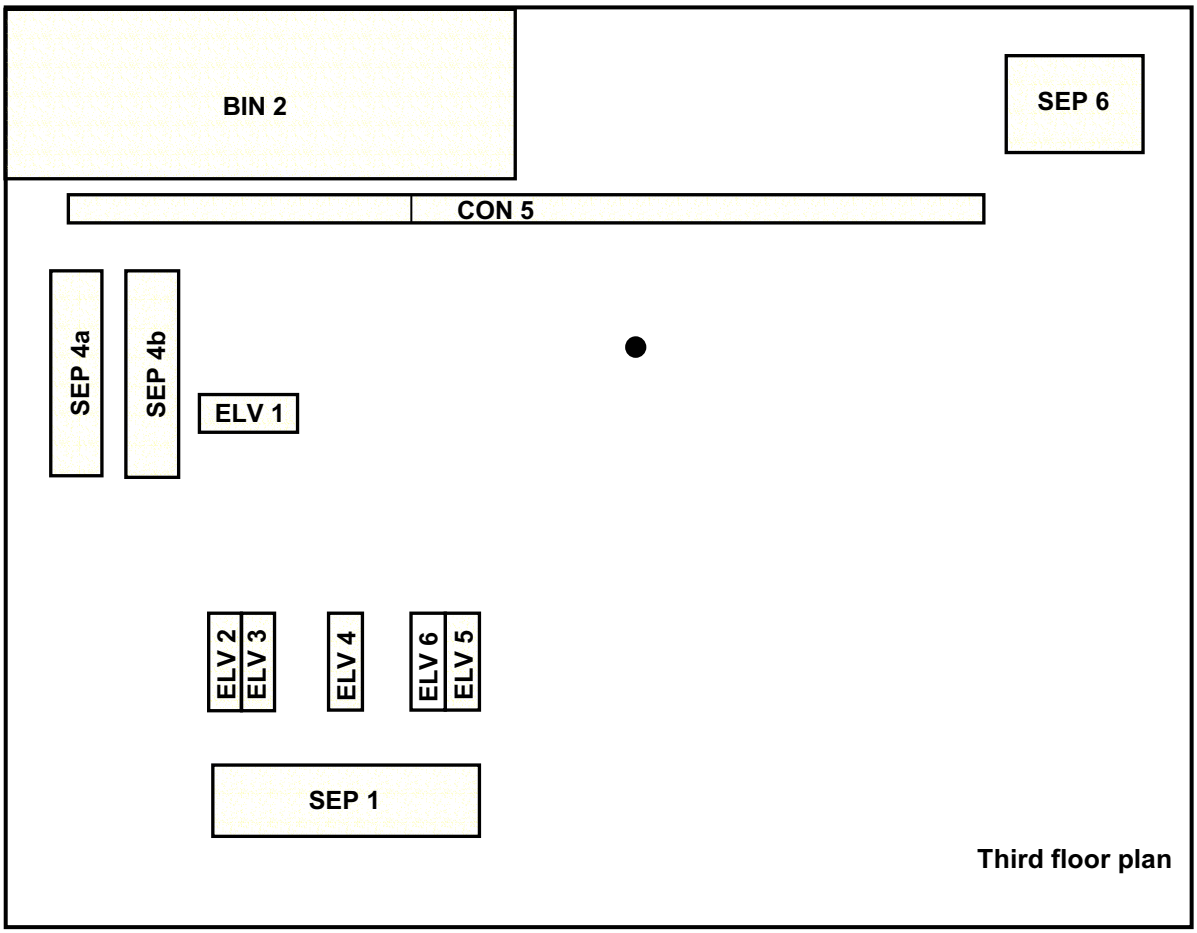
ELV 6 was not used

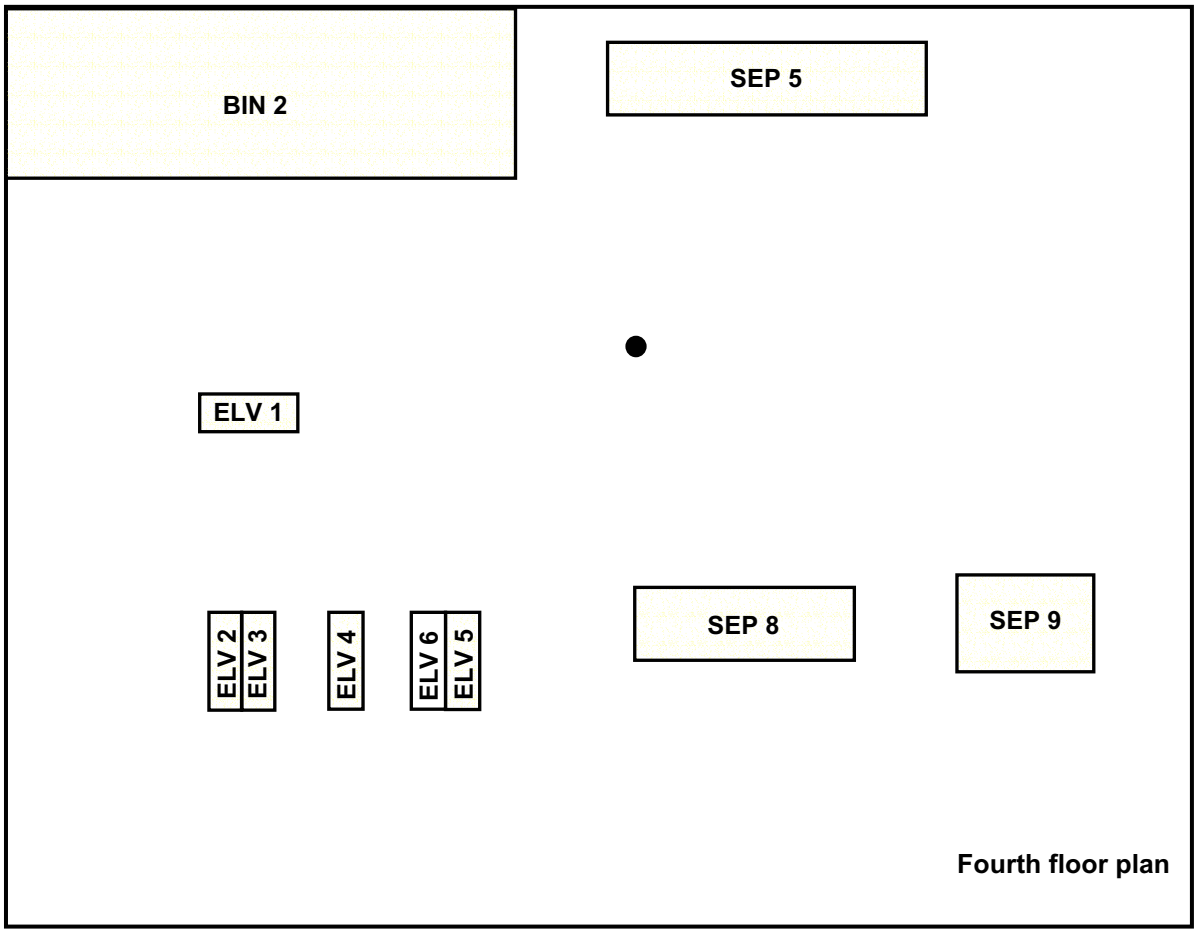
Ground floor plan



First floor plan


VOL 2b
VOL 2a
CON 2b
CON 2a
SEP 3b
SEP 3a
SEP 7
CON 3
ELV 1
SEP 2 expansion chamber
ELV 2
ELV 3
ELV 4
ELV 6
ELV 5
Second floor plan


BIN 2
SEP 6
CON 5
SEP 4a
SEP 4b
ELV 1
ELV 2
ELV 3
ELV 4
ELV 6
ELV 5
SEP 1
Third floor plan


BIN 2
SEP 5
ELV 1
ELV 2
ELV 3
ELV 4
ELV 6
ELV 5
SEP 8
SEP 9
Fourth floor plan