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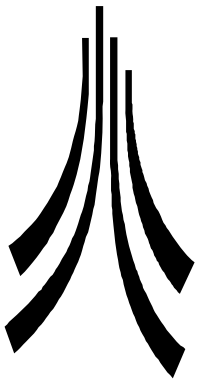

April 1996

BASINGILL GUN POWDER WORKS

CUMBRIA

FABRIC SURVEY

Commissioned by:

National Rivers Authority

Basingill Gun Powder Works
Levens
Cumbria

Archaeological Fabric Survey

Checked by Project Manager. ..... Date
Passed for submission to client. ..... Date

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April 1996

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ACKNOWLEDGMENTS

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EXECUTIVE SUMMARY

A fabric survey was undertaken at Basingill Powder Works (SD 507 867), near Levens, Cumbria in February 1996 by Lancaster University Archaeological Unit (LUAU) on behalf of the National Rivers Authority. The aim of the survey was to record two blast walls which had become unstable and needed to be made safe by controlled demolition. The walls separate a series of three powder mills, which for the most part will not be directly affected by the controlled demolition of the upper sections of the blast walls. It was therefore agreed, in conjunction with the county archaeologist, that the fabric survey be limited to a record of the blast wall elevations.

Because of the instability of the walls, it was not possible to safely approach them, and it was necessary, therefore, to use a reflectorless survey instrument survey which enabled the execution of the survey from a remote and safe distance.

The survey recorded all significant elements of the elevations in outline form and demonstrated that the walls were of a single phase of construction.

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1. INTRODUCTION

A fabric survey was carried out by Lancaster University Archaeological Unit (LUAU) at the Basingill Powder Mill, Cumbria (SD 507 867) on 19th February 1996. The work was prompted by the structural deterioration of two blast walls between a series of three powder mills at the site; an engineers report, in January 1996, had indicated that the walls were dangerous and could collapse at any time. The County Archaeologist agreed that, despite the importance of the site, the walls could be subject to controlled demolition to satisfy health and safety requirements. The County Archaeologist, however, required that the walls be recorded prior to demolition and LUAU were requested by the National Rivers Authority to write a project design, defining a methodology, timetable and costs for the fabric survey.

The project design (appendix 1) was based on the verbal recommendations of the County Archaeologist, and in accordance with the requirements of the client. It allowed for the recording of both internal and external elevations of both walls, to be prepared to a context-outline level of detail. This would define all significant structural elements but not all individual stones.

Because of the structural condition of the walls, the health and safety requirements of the project largely dictated the methodology, and extent of the recording programme. Physical access to the walls was not permitted and although the walls were extensively covered in ivy, this could not be removed because of the risk to the staff safety. The objective of the fabric survey was therefore to provide the best practicable survey of the two walls within the financial and safety constraints.

The present programme of archaeological works was commissioned by National Rivers Authority on 12th February 1996 and was undertaken in accordance with the agreed project design.

The purpose of the report is to set out the methodology of the recording works and to present a brief summary of the interpretation of the structure arising from the survey.

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2. METHODOLOGY

The objectives of the fabric survey were to record the elevations of the condemned walls by a method which, for safety reasons, would not involve physical contact with the wall and would enable staff to work at a distance from the wall. It was considered that the most effective survey technique in these circumstances was to use a reflectorless total station, which is capable of measuring distances to a point of detail by reflection from the wall surface. It does not need a prism to be located against the masonry and therefore does not require physical access to the wall.

The instrument used was a Leica T1010 theodolite coupled to a Disto electronic distance meter (EDM). The survey control was established by closed traverse using the reflectorless total station; the elevation detail was surveyed by reflectorless EDM tacheometry using the same instrument. The Disto emits a powerful laser beam which can be visually guided around points of detail; the method is fast and so a large number of detail points can economically be recorded on the wall surfaces. Some elements of the walls were too obscured by ivy to enable recording and these are shown on the drawings below with dashed lines. Bright low sunlight on the elevations made it difficult to observe the laser beam, and this necessitated surveying the individual elevations at times when they were in shade.

The digital data was internally stored within the theodolite and subsequently transferred to a computer for processing and transfer to an industry standard Computer Aided Draughting (CAD) system. The final drawings were generated by enhancing the digital survey data with respect to detailed photographs of the elevations. Although the illustrations have been reproduced at a scale to fit the A4 format of the report, they are held on a CAD system and can be produced at the scales stated in the project design. All work was produced to a professional standard in accordance with current IFA and English Heritage guidelines.

General internal and external photographs were taken along with more detailed coverage of architectural details.

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3. HISTORICAL BACKGROUND

3.1 Manufacture of Gunpowder in Cumbria

The earliest recorded use of gunpowder by English military forces, was at the battle of Crecy in 1346, when it was manufactured on a small scale by hand with a pestle and mortar (Crocker 1986). The mechanised industrial manufacture of gunpowder began in Britain in the 16th century; there is evidence for water powered gun-powder mills at Rotherhithe, on the Thames, by 1543, and there were possibly mills at Tolworth, in Surrey, prior to 1561. The most important factories prior to the eighteenth century were in the south of England (Waltham Abbey in Hertfordshire, Faversham in Kent and Hounslow in Middlesex) and supplied military bases throughout the south. The development of the industry in England has been recently synthesised by Gould (1993), drawing on the work of Crocker and others.

By contrast the origin of the Cumbrian gunpowder industry was attributable to the increasing use of gunpowder for mining purposes. Blasting was introduced in about 1670 and was in common use by 1750. In 1764 John Wakefield opened the gunpowder mill at Sedgwick ('The Old Sedgwick Gunpowder Mills'), which was converted from a former corn mill. The mill took advantage of the River Kent, and the earlier head race was expanded to drive water wheels and provide power for the manufacturing process.

The business continued to be profitable and prompted further expansion, new works were established in 1790 at Basingill, just below the Old Force bridge and involved the construction of a series of large incorporating mills.

The business continued to be profitable, and the congestion of the original Sedgwick site prevented expansion, so the industry was moved to Gatebeck in 1852, where there was an ample water supply and considerable available land. Despite the abandonment of the original Old Sedgwick site during this period, the Basingill mills continued in use and were not closed until 1935 (Crocker 1988).

3.2 Gunpowder Manufacture

Blasting gunpowder is made by the intimate mixing of the following ingredients:

Saltpetre (Potassium Nitrate)	70%
Sulphur	15%
Charcoal (Carbon)	15%

The manufacturing process as practiced in the late eighteenth century was undertaken in the following defined stages:

1. *Mixing:*
   The three ingredients in a fine powder form were mixed in rotating barrels containing brass 'bullets'.

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2. *Incorporating:*
   The ingredients, combined with water, were intimately mixed. This was undertaken in an 'edge runner' mill, which comprised heavy stone rollers revolving around a tray in which the powder was placed. The rollers were typically driven by large waterwheels.

3. *Pressing*:
   The 'mill cake' produced by the incorporating mills was compressed into thin slabs ('press cake'), using screw presses operated by hand or hydraulic pumps driven by water wheels.

4. *Corning*:
   The 'press cake' was broken into grains by means of a corning machine, which sifted the powder into different grain sizes.

5. *Glazing and Reeling*:
   The powder was rotated within wooden drums along with black lead to provide a polish to the powder grains.

6. *Drying:*
   The water retained from the incorporating process was removed by drying with hot air.

7. *Moulding*:
   The black powder for blasting was moulded into cylindrical charges using hydraulic presses.

8. *Packing*:
   The gunpowder was packed into wooden barrels, made of well seasoned wood, which each held *c* 40kg.

3.3 Basingill Powder Mill

The site was established in 1790 by John Wakefield as an extension to the old Sedgwick mill. It continued in use throughout the 19th century and in 1918 it was incorporated within the Nobel division of ICI. It was finally closed in 1935.

The site was unusual in that it was not a self contained gun-powder works, but merely a set of incorporating mills serving the Old Sedgwick and subsequently Gatebeck powder mills. It was not used for the other gunpowder manufacturing processes.

The earliest mills at Basingill are two incorporating mills near the bridge end of the site and were powered conventionally by central water wheels; the water for these wheels was channelled through vaulted tunnels.

The main feature of the site, however, is a large terrace of three incorporating mills, separated by two high blast walls, which were the subject of the present fabric survey. The mills were powered by a water wheel, which was located

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within a large wheel pit between the northernmost mill and the other two. Within the wheel pit are the remains of a hatch for controlling the water feed onto the wheel; it is of a type developed by John Rennie, the engineer responsible for the nearby Lancaster canal and dates to the early 19th century.

The plan arrangement of the three incorporating mills (fig 3) incorporates a wheel pit between the northernmost and the other two mills. The wheel is supplied by a leat on the north-eastern side and runs off through a channel into the River Kent. The water wheel drove a shaft that ran through the door shaped apertures within the blast walls and drove a separate fly wheel for each incorporating mill. Each mill contained a narrow fly-wheel pit at the end closest to the water wheel. There was no evidence of any underlying gearing and it would therefore appear that the mill gears used the conventional arrangement whereby the incorporating mill was driven from above. The incorporating mill is likely to have comprised a conventional pair of large stone edge runners, on a bedstone within an enclosed kerb. Because of soil build up within the mill buildings, there was no visible evidence of the individual incorporating mills.

With the present triple mill arrangement the main drive shaft would have passed through the central mill structure, which potentially would have restricted the location of the incorporating mill. There is not enough space within the central mill structure to have allowed the incorporating mill to have been offset from the middle of the room and therefore it is probable that the mill was set on a raised platform above the drive shaft.

The remains of the Basingill works are well-preserved, but incorporate only a limited range of components, by comparison with the self contained mills, such as at Sedgwick and Gatebeck, where all stages of the process were carried out. They were identified as being of national importance, with a single star grading, in the MPP step 3 report of the gunpowder industry (Gould 1993, Appendix 2).

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4. FABRIC SURVEY

4.1 Blast walls

The fabric survey of the blast wall elevations was severely limited by extensive ivy cover, which could not be removed for safety reasons. This restricted examination of the upper sections of the walls and consequently the wall tops could only be imprecisely mapped. Fortunately most of the significant architectural detail was on the lower elements of the walls which were relatively clear of ivy. The survey brief required only an outline survey, and as the higher sections of the wall incorporated uniform masonry relatively little fabric detail was recorded in these sections.

The blast walls had a triple function; they provided the end wall of the mills, they provided blast protection between the mills and they supported the main drive shaft, fly wheels and water wheel. This multiple function is reflected in their design; the lower section up to the top of the adjacent mill walls is of broader width by comparison with the higher blast wall section. The break between the two wall sections is only evident on one side (elevations 1 and 4), the other side of each wall has a uniform, flat face and there is no evidence of any structural discontinuities. This would indicate that both sections of the wall, irrespective of the change of wall thickness, are attributable to a single constructional phase.

The construction of both walls were similar; they had large partly dressed masonry blocks incorporated into the lower section, while the higher section is constructed of smaller partly dressed blocks. The size of the blocks, coupled with the greater wall thickness of the lower section provided it with considerable structural strength, and is the section that would have taken the greatest force in the event of an explosion. It is therefore presumed that the construction technique was intended to improve the explosion performance of the wall.

Despite the evident similarities there were, however, two significant structural differences:

1. *Elevation 2 corbels*
   There are two corbels on both sides of elevation 2 at a height of 4.45m above the wall aperture base. Since this is the only elevation to face directly onto wheel pit, it is presumed that they supported a superstructure for the wheel housing.

2. *Wall aperture arch*
   The arches over the apertures through the two blast walls have a different design. The arch through the northern wall is constructed of five crudely worked voussoir stones, whereas that through the southern wall is constructed of two dressed voussoir stones.

The tops of the blast walls were flat rather than pitched and were featureless (as far as could be ascertained through the ivy) and as there were no gables at the ends of the combined mill structure it is reasonable to assume that there was no

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roofing at the tops of the walls. Surprisingly there is no evidence on the blast wall faces of a pitched roof that may have been set at a lower level and it is not apparent how the mills were roofed.

4.2 Conclusion

Each wall was clearly a product of a single constructional episode and despite the subtle differences between the two walls they display considerable similarity of form and design. There are no discontinuities in these walls or in the associated mill structures that would indicate differential construction. It would appear that all three incorporating mills, and all sections of the blast walls were a product of a single constructional phase.

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ILLUSTRATIONS

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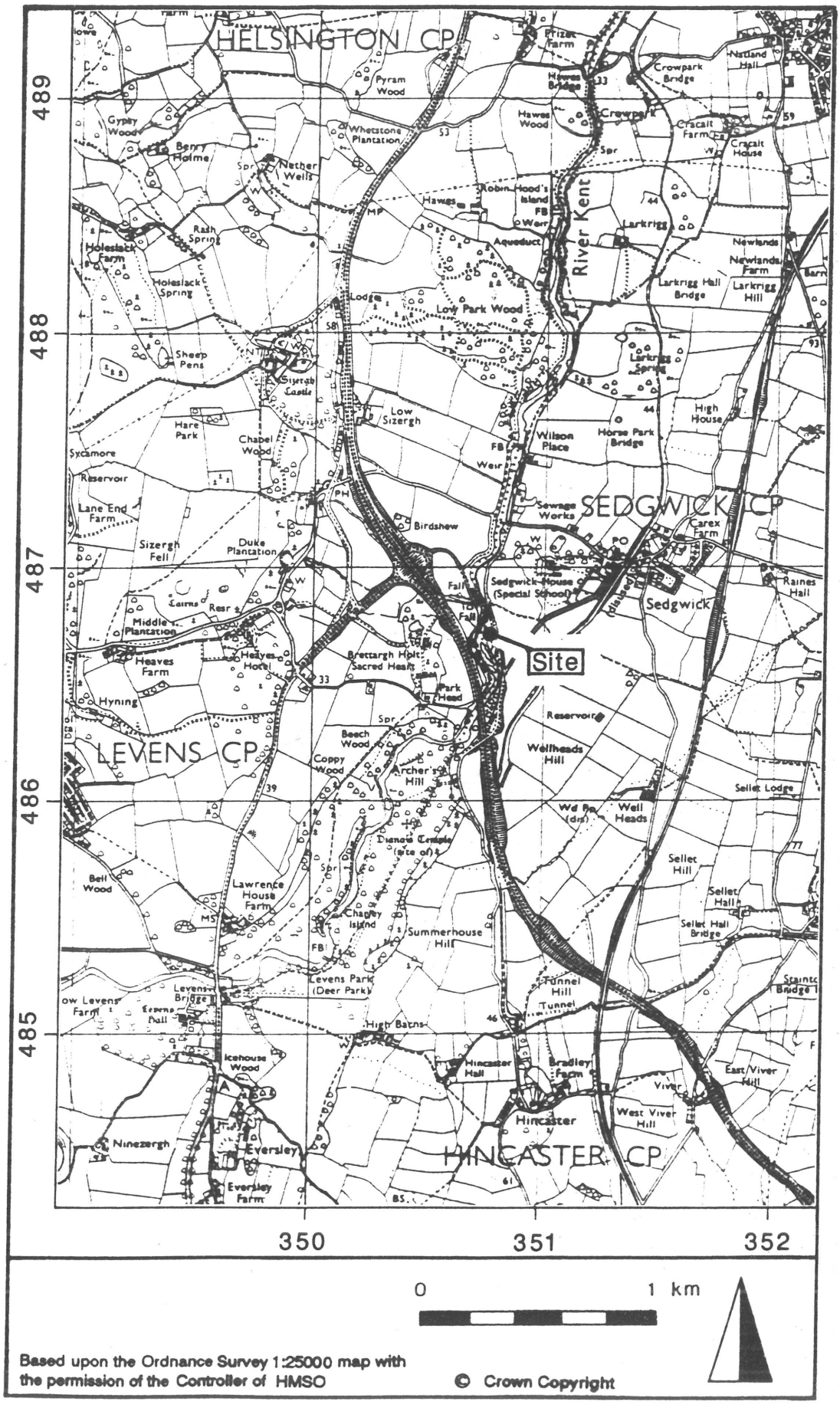

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Fig.1 Basingill Gunpowder Works

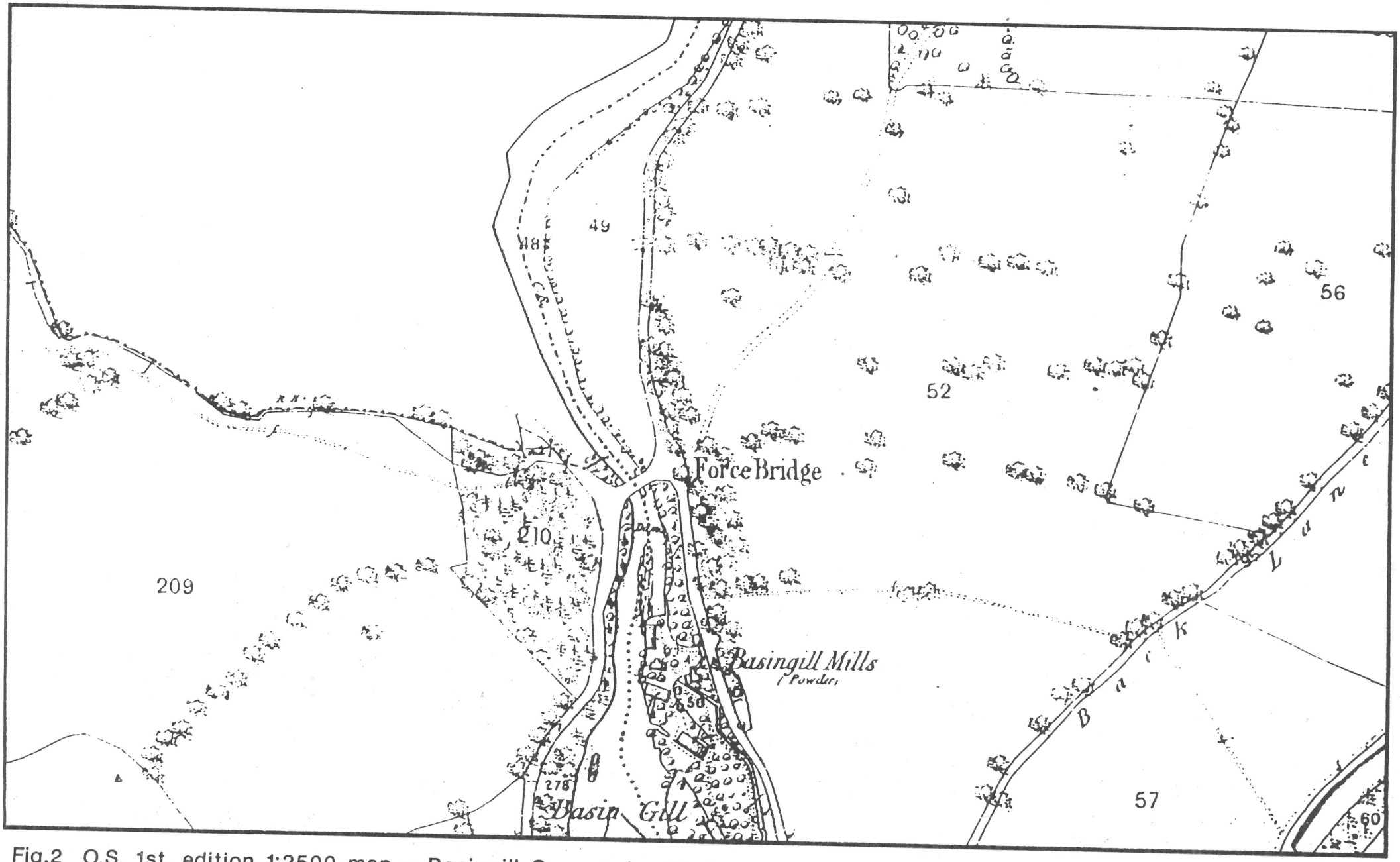

Fig.2 O.S. 1st. edition 1:2500 map – Basingill Gunpowder Works

Sketch Plan of Incorporating Mills

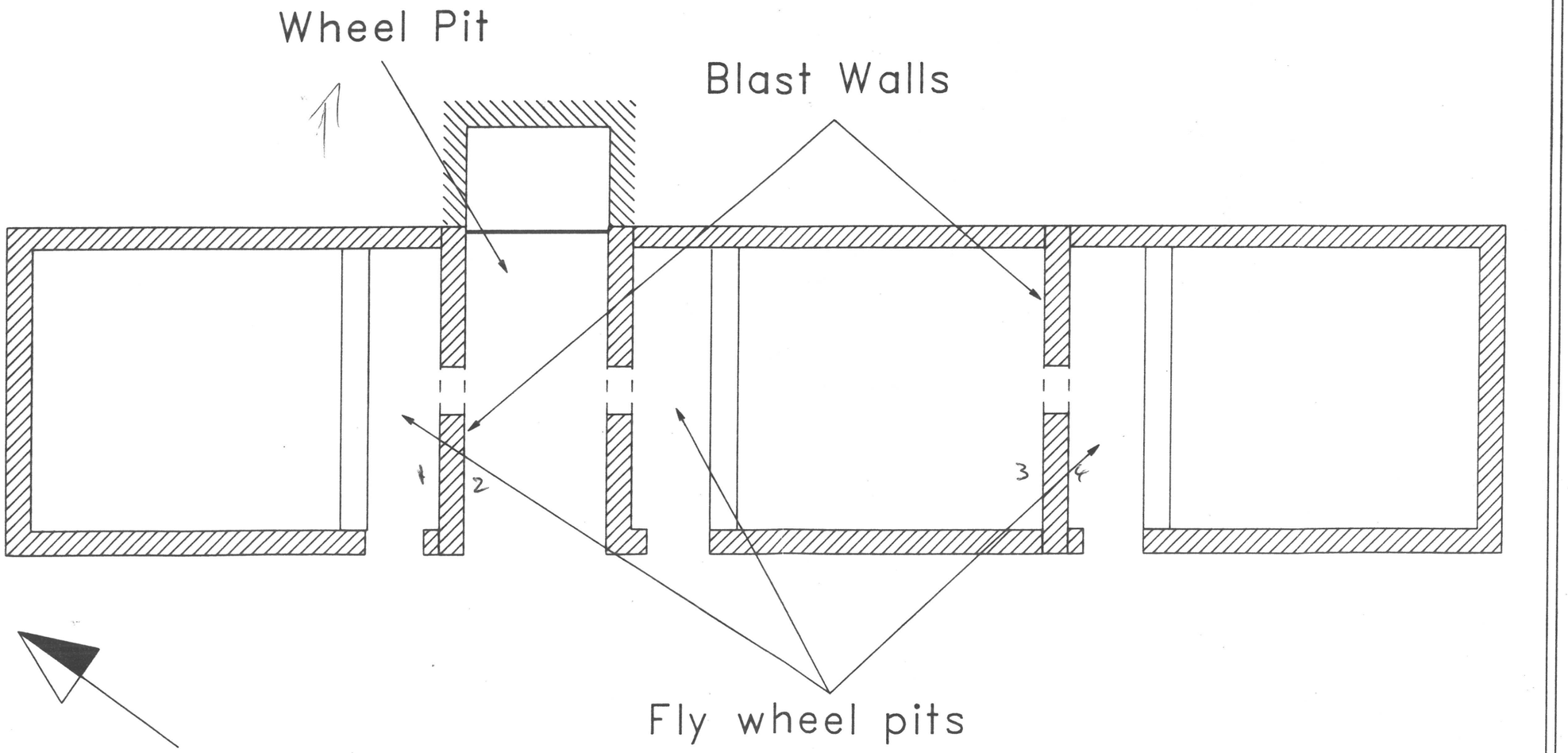

Fig. 3

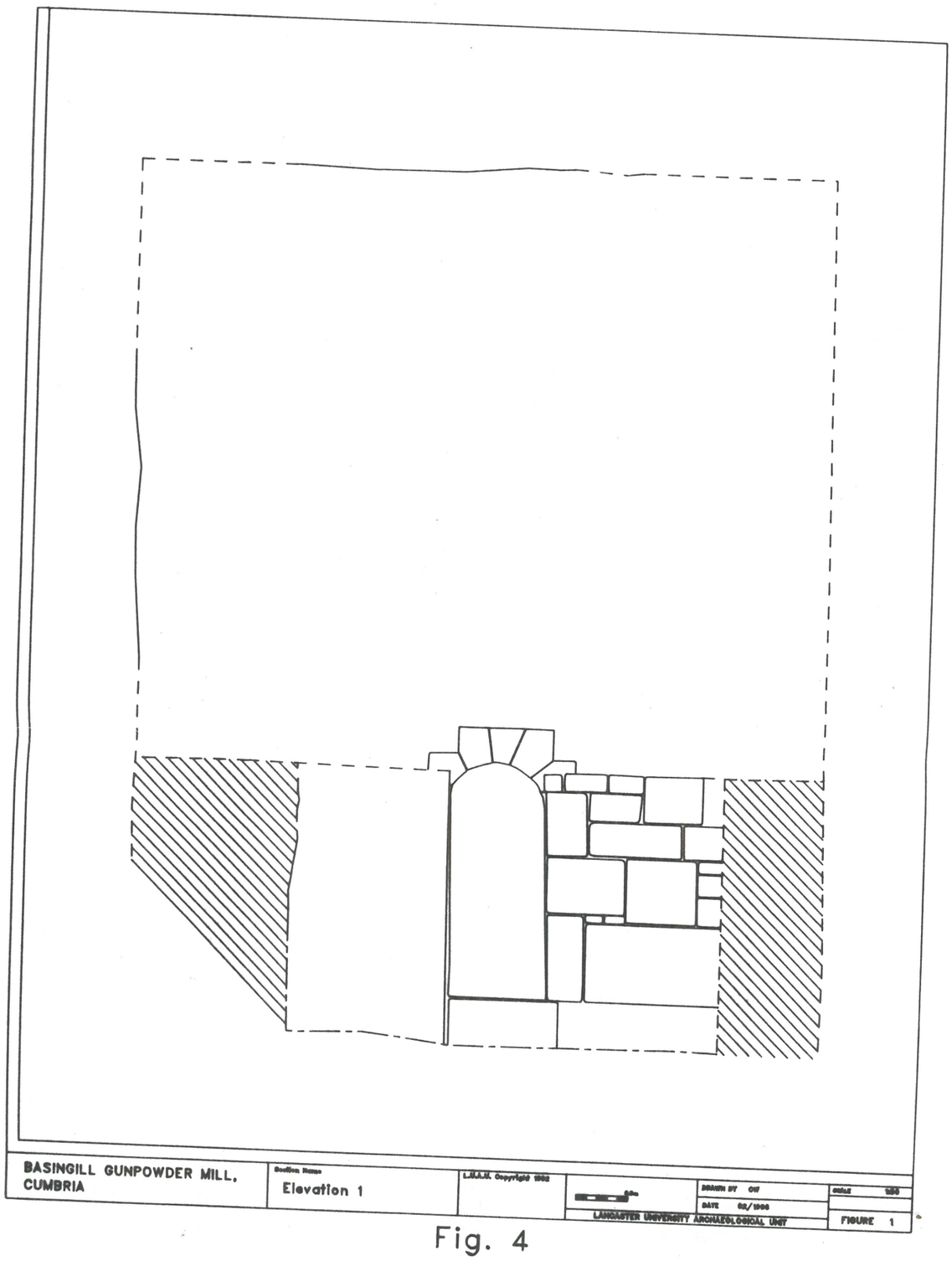
BASINGILL GUNPOWDER MILL,
CUMBRIA
Elevation 1
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FIGURE 1

Fig. 4

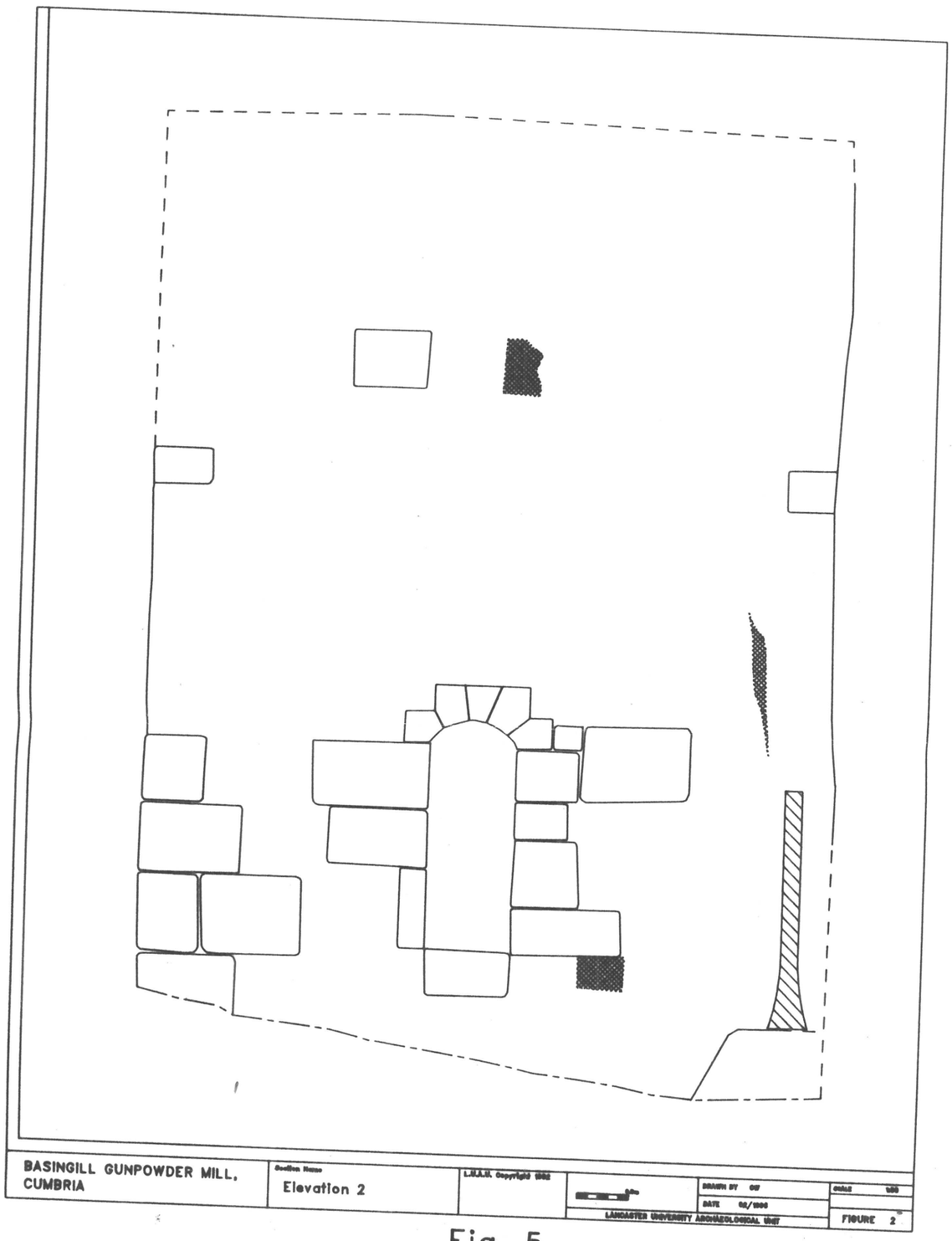
BASINGILL GUNPOWDER MILL, CUMBRIA
Elevation 2
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FIGURE 2

Fig. 5

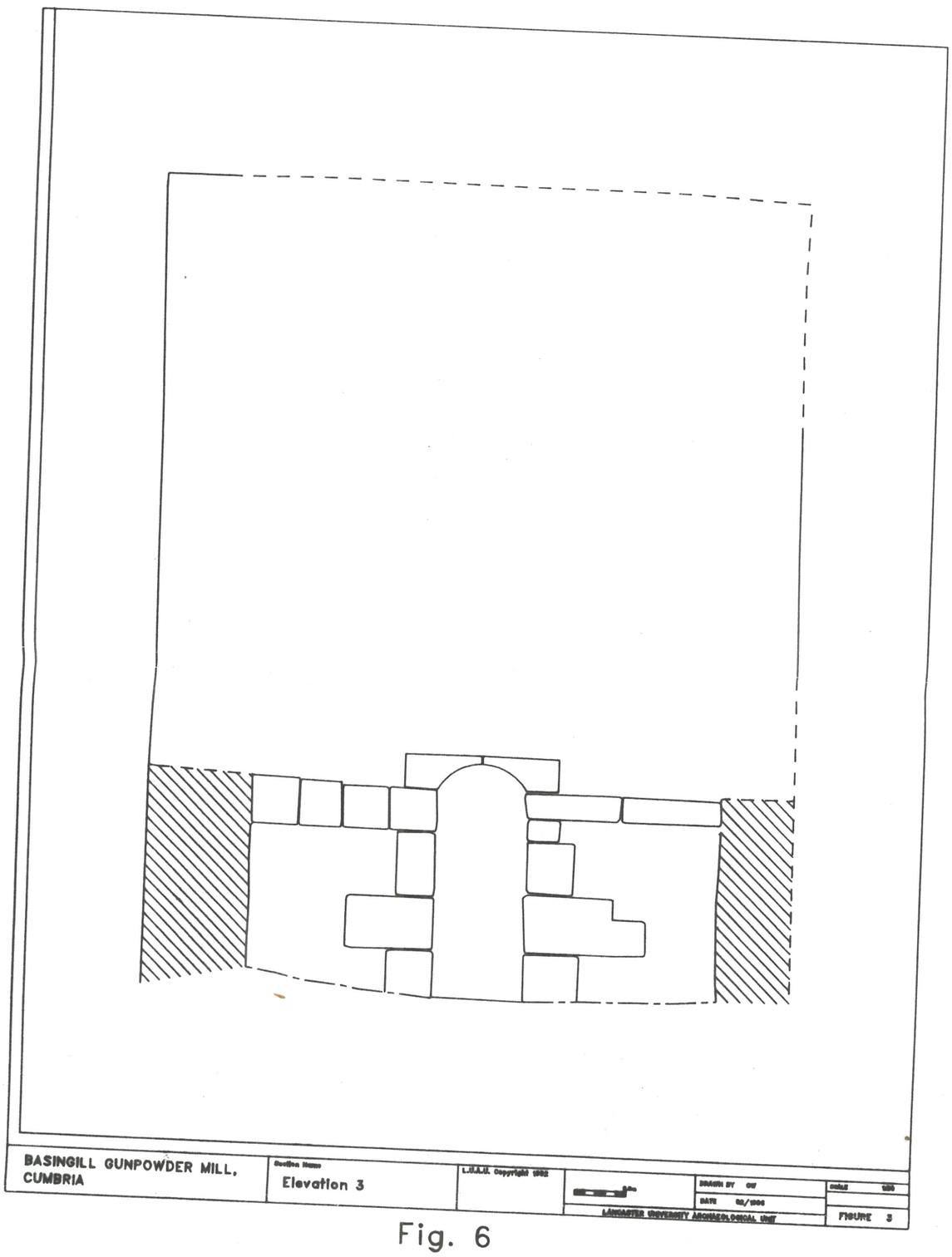
BASINGILL GUNPOWDER MILL,
CUMBRIA
Elevation 3
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FIGURE 3

Fig. 6

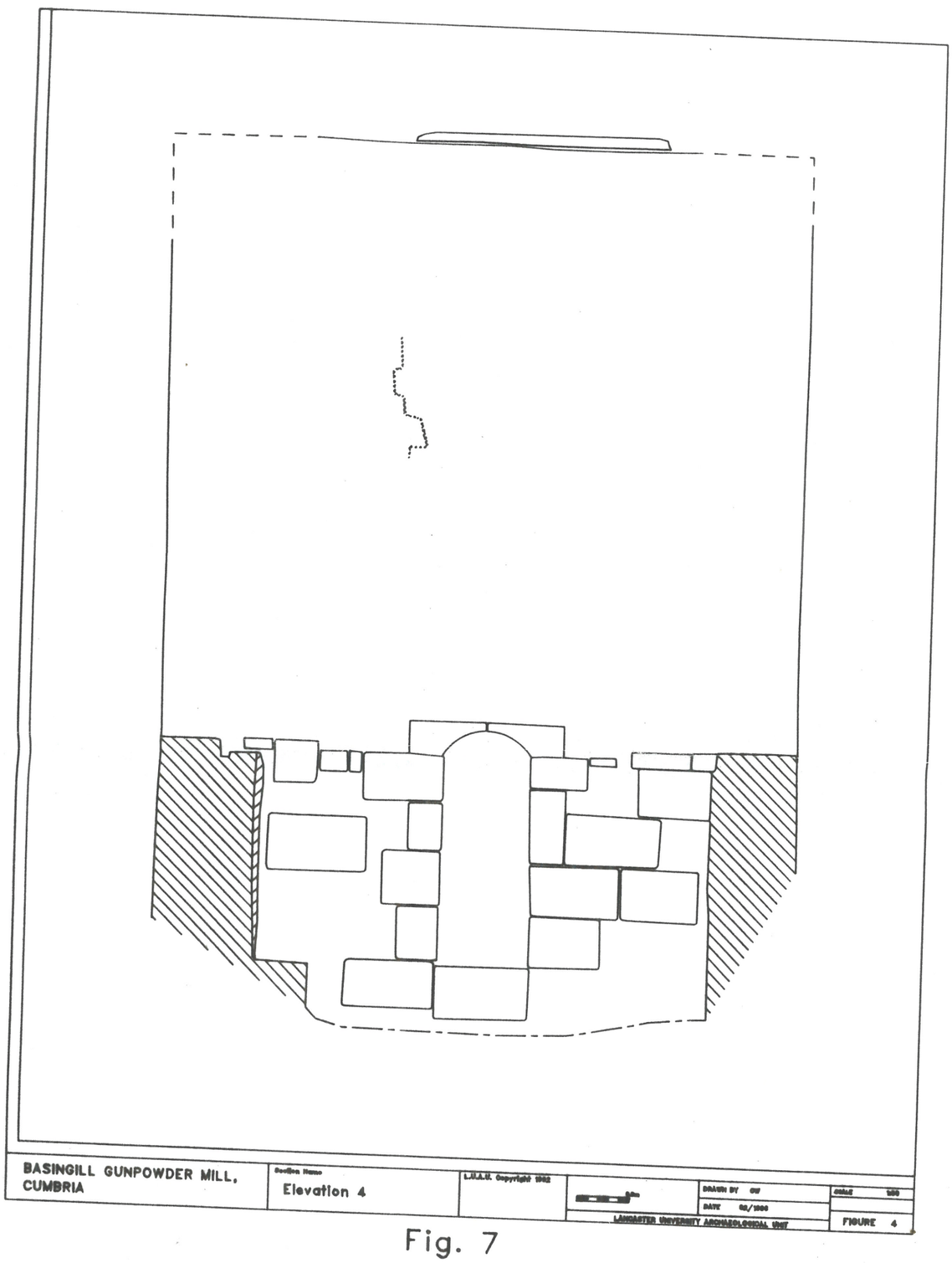
BASINGILL GUNPOWDER MILL, CUMBRIA
Elevation 4
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FIGURE 4

Fig. 7

APPENDIX 1: PROJECT DESIGN

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