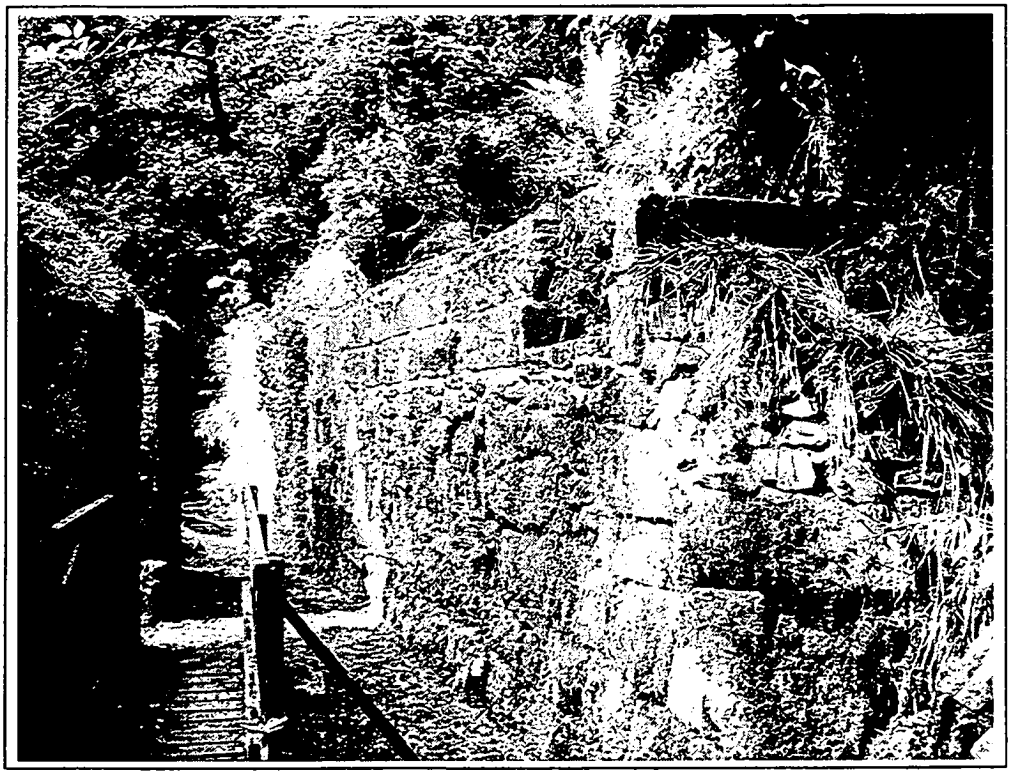
Report No: 2003R055

KENNALL VALE GUNPOWDER WORKS, CORNWALL

Repair work to leat



Cornwall Archaeological Unit

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Richard Cole BA

July 2003

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Acknowledgements

This project was organised by Cornwall Archaeological Unit, with the repair work being carried out by Mark Nicholls of Cornish Stonework under archaeological supervision. Liaison with the Cornwall Wildlife Trust was through Bena Smith. Stephen Tucker (SMT Associates) gave advice on the mix for the lime mortar.

The project was funded from Cornwall Archaeological Unit's budget for conservation management works to Scheduled Monuments; a budget to which English Heritage, the Cornwall Heritage Trust and Cornwall County Council contribute.

Within Cornwall Archaeological Unit, the report was commented on by Ann Preston Jones.

Cover illustration

The leat following repair works.

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Abbreviations

CAU	Cornwall Archaeological Unit
EH	English Heritage
NGR	National Grid Reference
PRN	Primary Record Number in Cornwall HER
HER	Cornwall and the Isles of Scilly Historic Environment Record
SM	Scheduled Monument

1 Summary

Kennall Vale lies to the west of Ponsanooth and includes the remains of the 19th century gunpowder works. It is a remarkably well preserved complex with numerous mills, leats, ancillary buildings, trackways and bridges. The complex is protected as a Scheduled Monument and the site is managed by the Cornwall Wildlife Trust as a wildlife reserve.

Cornwall Wildlife Trust has a Management Agreement with English Heritage, but capital costs of repairing the structures are beyond the funds available of the agreement. The Cornwall Archaeological Unit agreed to help with some repair works, through the Scheduled Monument Management Project.

This report details the first of these jobs, namely repairs to the stone wall of a leat, which had been damaged when a large tree fell on it during storms in November 2000. It also notes some other small repairs to a change house and a blast wall.

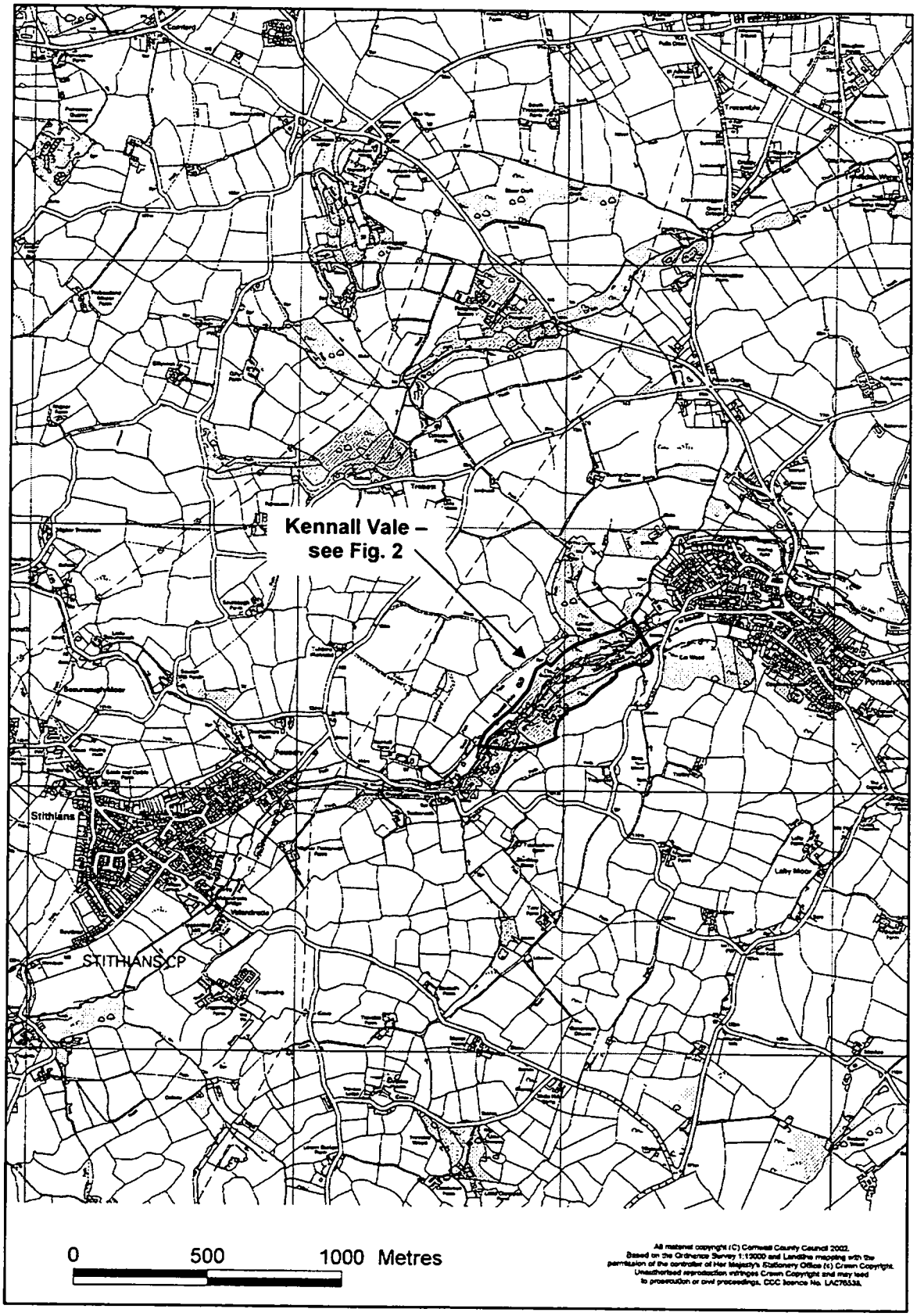


Fig. 1 *Location of Kennall Vale.*

2 Introduction

The 19th century gunpowder works at Kennall Vale is a remarkably well preserved complex with numerous mills, leats, ancillary buildings, trackways and bridges, lying beneath a cover of mature woodland managed by the Cornwall Wildlife Trust as a wildlife reserve.

Until recently, there has been little active management within the reserve, other than *ad hoc* safety work, path work and vegetation clearance (Herring 2000, 37). Many of the structures are built of large blocks of granite and some have been capped in cement. Most are ivy-covered and have saplings rooted in them, but on the whole are stable because of their large constituent stones. A few ruined structures built of smaller stone are more vulnerable and in need of consolidation.

Cornwall Wildlife Trust recently arranged a Management Agreement with English Heritage to help with managing the vegetation on the buildings. Capital costs of repairing the structures are beyond the funds available through the Management Agreement and for these, alternative funding was needed. The Cornwall Archaeological Unit agreed to help with some such repair works, through the Scheduled Monument Management Project.

This report details the first of these jobs, with repairs to the stone wall of a leat, which had been damaged when a large tree fell on it during storms in November 2000.

3 Background

This section of the report looking at Kennall Vale and its historic development has been partly reprinted from an earlier CAU report (see Herring 2001, 133-135). A detailed assessment of the industrial remains in the valley had also been previously carried out by CAU in 1986 (see Smith 1986).

3.1 Location, geology, soils, vegetation and topography

Kennall Vale (centred SW 750 374), in the parish of Stithians, is about 0.5 km west of Ponsanooth and c. 3km north-west of Penryn. The Kennall River runs north-east through the steep-sided valley and becomes tidal at Perranarworthal before joining the Carnon River, a tributary of the Fal. The reserve lies close to the north-east edge of the Carnmenellis granite; bedrock outcrops on both valley sides and there are numerous large displaced boulders. Soils are of the well-drained gritty and loamy Moretonhampstead series, and vegetation is mainly beech and sessile oak dominated woods (with sycamore, sweet chestnut and ash). Ground flora is varied and relatively rich, and there are important bryophytes in the area of the leats.

3.2 Historic landscape characterisation

In the Historic Landscape Characterisation of 1994 (Cornwall County Council 1996) the reserve was included in the Steep-sided Valley Zone in which both woodland and water-powered industrial complexes are characteristic. The characterisation provides valuable supporting information for understanding the history and archaeology of steep-sided valleys in Cornwall.

3.3 Archaeological and Historical Summary

Little detailed research has been undertaken on the form and use of Kennall Vale prior to the establishment of the gunpowder works in 1811-12. A blowing house was documented in the Vale in 1659 when it was converted into a dwelling (Smith 1986, 1) and there were probably early water-powered corn and other mills in the valley (*ibid*). The paper mill

immediately upstream, west of the reserve was recorded on the c. 1808 OS field drawing.

The northern side of the valley, known as Kennall Wood in c.1840, was shown wooded on the c. 1808 OS field drawing, confirming that the woodlands here at least were not planted to protect the gunpowder works. They were attached to the farm of Kennall and were then in different ownership to the land to the south of the stream (Roche's Wood). This was probably attached to Tregoose farm, immediately to the south. Tregoose's name contains the early medieval Cornish place-name elements *tre,* 'farming estate or settlement', and *cos,* 'wood' (Padel 1985), the latter almost certainly referring to woodland on the steep slopes of the valley. Most of Cornwall's ancient woodlands are and were in steep-sided valleys. So we can be fairly sure that the historic character of the Vale has been dominated by woodland from at least the early medieval period, no doubt managed for its timber, bark and charcoal as others in Cornwall were.

Roche's Wood was shown untreed in c. 1808 so the woodland on this side may have been planted by the gunpowder works (to contain the effect of any accidental explosions). The lower, eastern part of the southern side was recorded as Roche's Croft with a land use of 'furze' in c1840. This croft would have been used for summer grazing and as a source of 'crinnicks', furze sticks, for fuel.

The boundaries of the reserve are also the perimeters of the field systems of Kennall and Tregoose farms. They are typically Cornish hedges, stone-faced earth walls with native species of trees and shrubs growing on their tops, and are sinuous as they follow contours and in places join up with outcrops of granite. On the southern slopes there are fragments of earlier field boundaries surviving among the outcrops above the gunpowder works. One of these is the western edge of Roche's Croft (as mapped on the Tithe Map); it is now a low stony bank linking natural granite tors and boulders as it zigzags down to the stream.

On the higher parts of the northern side of the valley the reserve includes the boundaries of several disused post-medieval fields. These are now tumbling drystone or simple stone-faced earth walls.

3.3.1 The gunpowder works

See Smith 1986 for a full historical and archaeological description and discussion of the gunpowder works and its components.

In brief, the development of the gunpowder works can be divided into three basic periods; its establishment in 1812 to 1820; the period of expansion from 1820 to 1844 and the effective doubling of the works by construction of the Roches Wood section in 1844. In this third phase, Kennall Vale became one of Cornwall's most important producers of gunpowder but rapidly declined in the last quarter of the 19th century, finally closing around 1910.

Roofless granite buildings survive in generally good condition on both sides of the river. A series of seven conjoined pairs of substantial incorporating mills dominate the north bank, their wheel pits still fed by stonelined leats although only one waterwheel survives, in a fragmentary state.

One of the main elements of the site is the leat system, which supplies water power to the various processing buildings and some of the secondary industrial plants. A network of roadways, with bridges over the river, serviced the mills as well as a wide range of associated structures which included offices, carpenters shops, cooperage, packing houses, timber sheds, sawmills, magazines, etc.

Almost all buildings were of granite masonry, with very little brick or timber structures,

though some wood was used in the potentially more volatile mills; stone was also used for revetting trackways, leats and bridges.

See Fig. 2 for map of industrial remains within Kennall Vale.

3.3.2 Quarrying

There are several small scooped quarries on the southern slopes of Kennall Vale, some of which pre-date the field boundaries which curve around them and certain gunpowder works buildings which are built within them. There is no known documentation for these quarries which are likely to be early 19th century, at the latest.

The large quarry (now flooded, but with rock faces c. 15m high above water level) in the central part of the southern slopes of the reserve was opened in 1919 by James A Richards who had previously quarried at Carncrees, about two miles to the west. The granite in Kennall Vale is particularly fine-grained and was used initially to prepare memorials for the 1914-18 war.

The quarry's buildings are of concrete and survive in varying states of repair on a platform to the north of the quarry mouth; one is on top of an expense magazine of the gunpowder works and others are on the rear of the principal wasters dump. This had a revetted passage driven through it, bridged by tramways which continued to be used to dump stone further downhill. A number of the gunpowder works' buildings have been lost (presumably through burial) to the dumps of the quarry.

3.3.3 Other activities

The woods at Kennall Vale appear to have been used for timber in the earlier part of the 20th century. There are local traditions of woodsmen using the privy near the burnt out packing house. It is not yet clear what other features were used by the woodsmen. The markets for their product are also not known.

4 Archaeological recording

The damaged leat which was the subject of repair works is shown on the accompanying maps (see Figs. 2-4). It carries water to the second pair of incorporating mills (numbers 30 and 31) in CAU's survey (Smith 1986, fig 17). The leat is set on top of a rubblestone wall which is just under 2 metres high and built into the slope of the northern side of the valley. It supports a wall comprising two courses of large rectangular granite blocks which form the outer edge of the leat. There are two courses of red brick positioned on top of the walling for much of its length, the latter presumably relating to a heightening of the leat at some time.

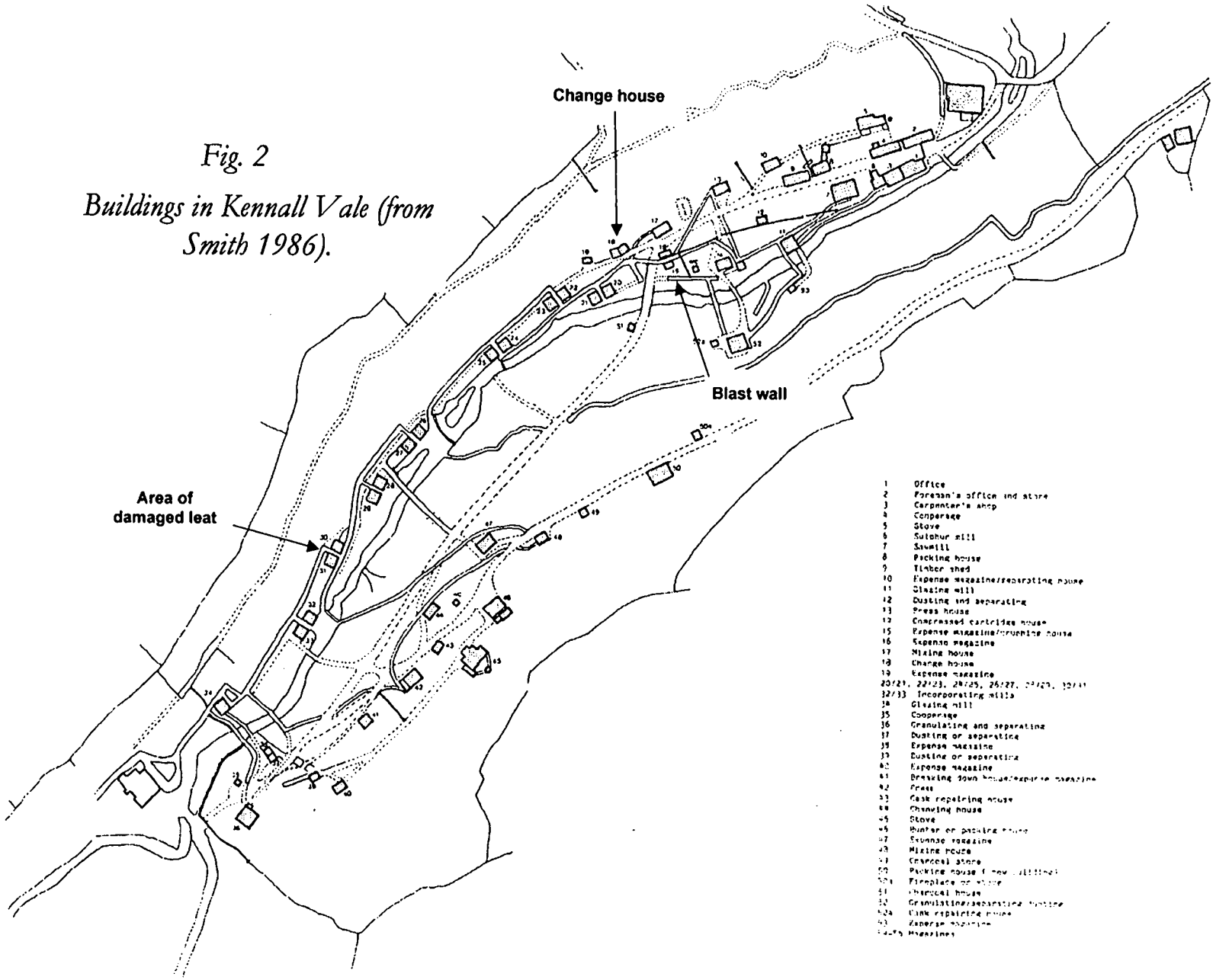
4.1 Condition of monument

A six metre long section of the leat and its walling was damaged in November 2000, when a tree rooted into the bank above was blown over in a storm. The damaged section was the end of one section of leat, where it would have fed into a launder feeding an overshot waterwheel between mill buildings 30 and 31.

The fact that the leat wall had already been weakened by tree-root action may have contributed to the damage (see the English Heritage Field Monument Warden's Damage Report; Preston-Jones 2000). A footpath used in the past for access to the mills, and now by visitors to the reserve, runs between the leat and the mill-pair which the leat served. Following the accident, debris was cleared to one side of the path, and the leat temporarily blocked just upstream to prevent water spilling onto the path.

Fig. 2

Buildings in Kennall Vale (from Smith 1986).



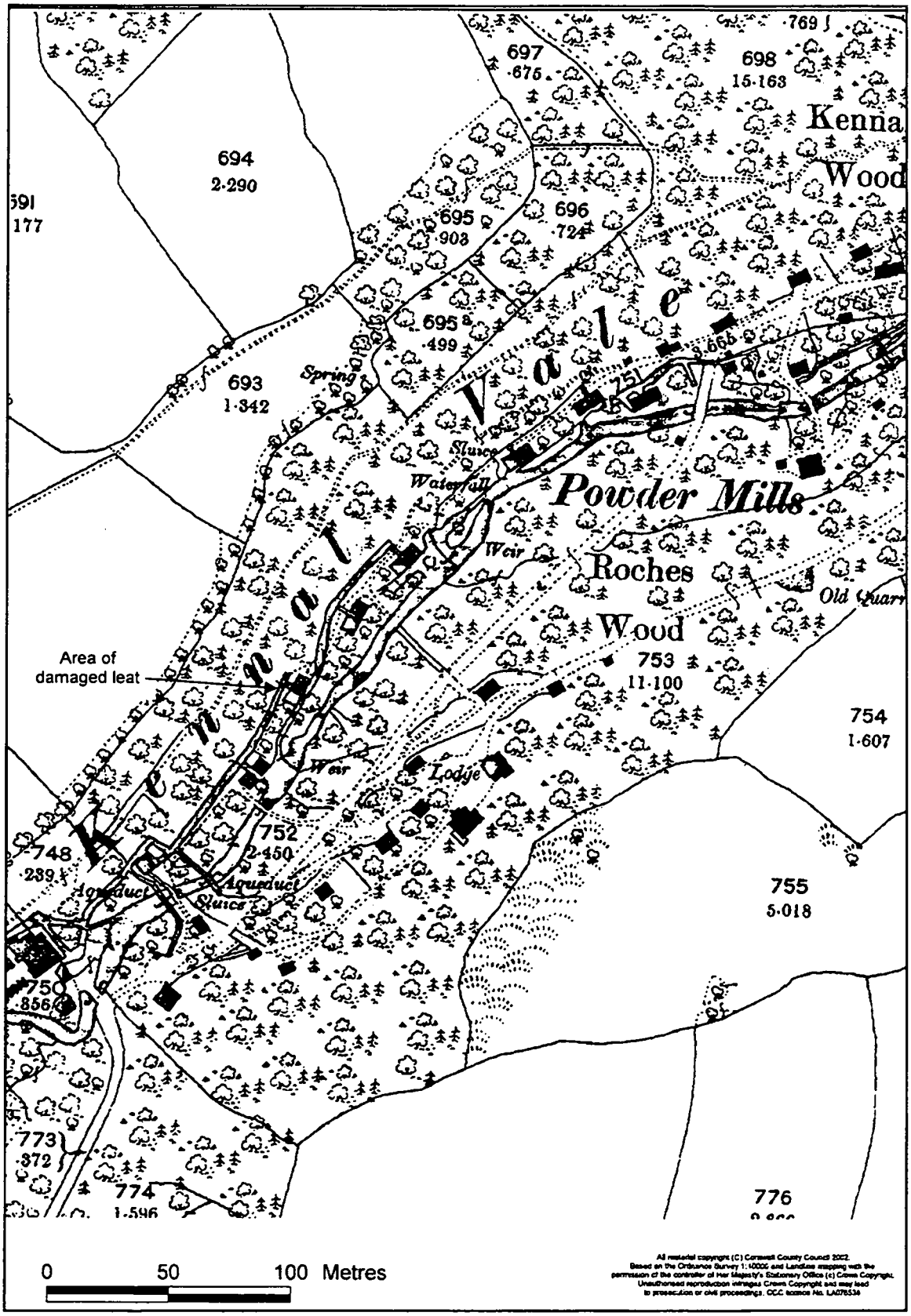


Fig. 3 *Kennall Vale in 1880.*

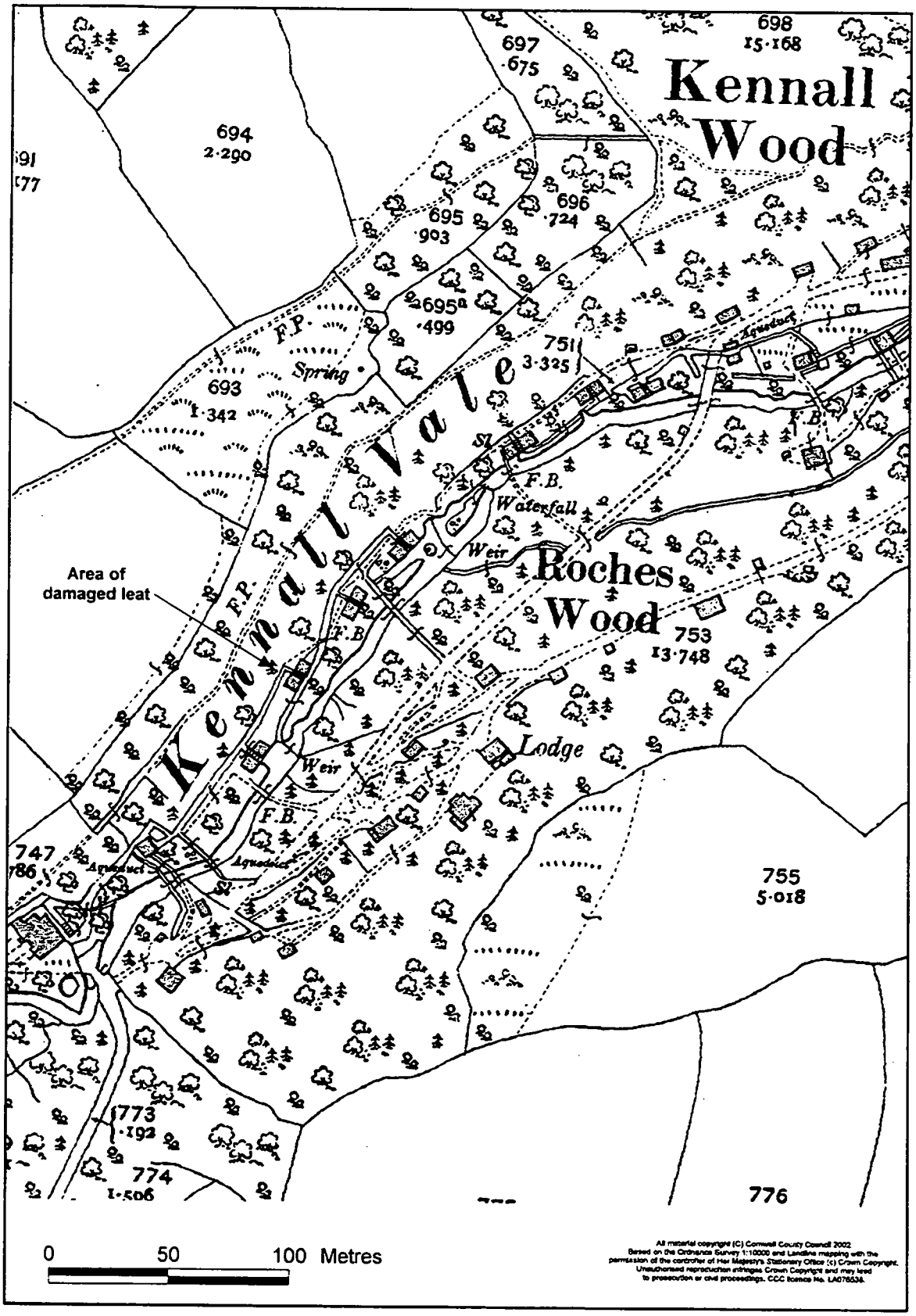


Fig. 4 *Kennall Vale in 1907.*

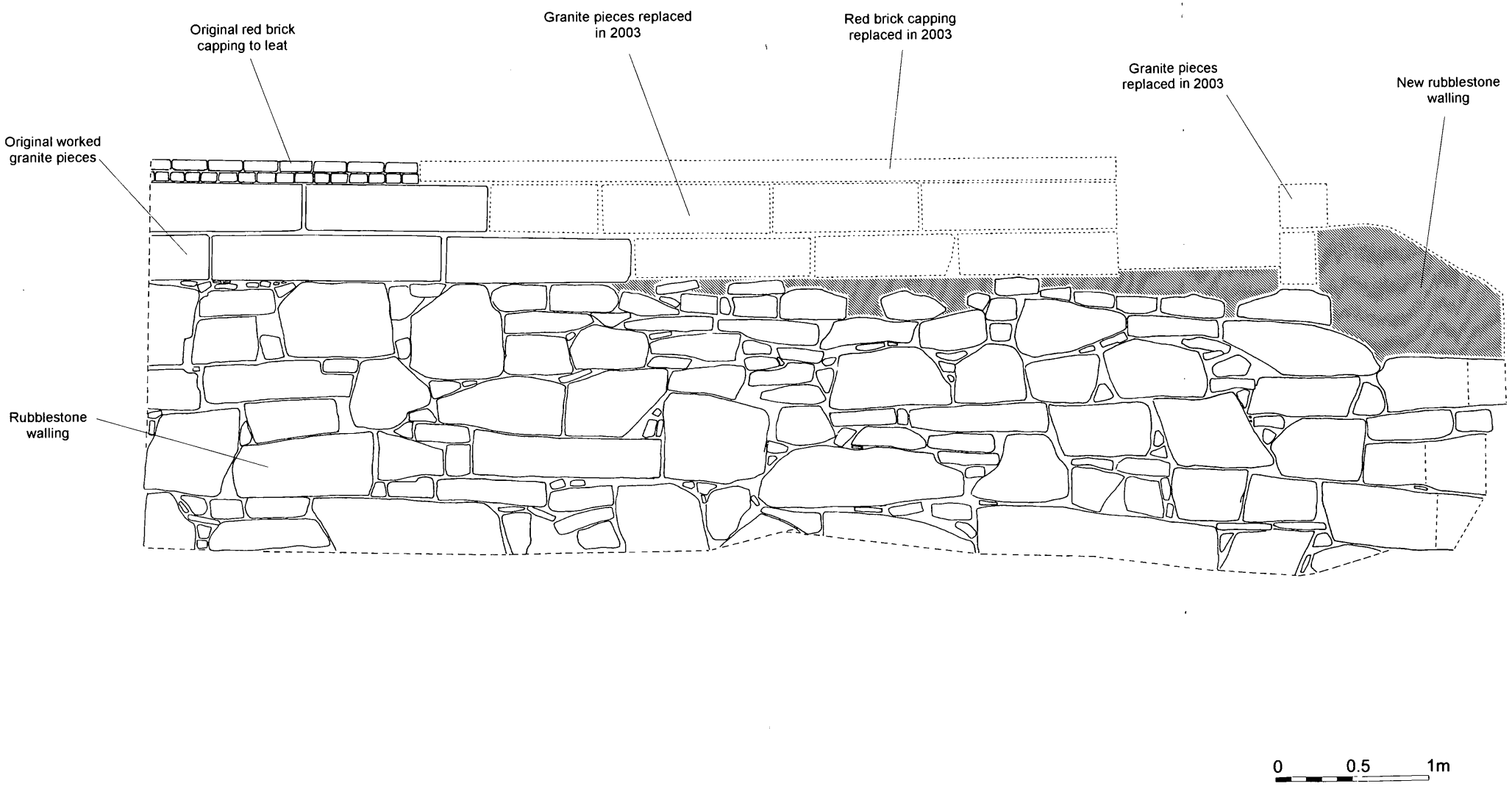


Fig. 5 *The repaired leat at Kennall Vale.*

The damage report produced by Ann Preston-Jones noted the following: "the extent of the damage is not enormous, but ... it affects a section of the monument which is close to a path used by the public at a point where the dramatic effect of leats and mills is at its greatest ... the relationship between leat, water and wheel-pit has to a small extent been sundered. If the temporary blocking of the leat upstream were to fail, as it well might do in winter storms, then there would be a risk of further erosion at this vulnerable point, as well as of water spilling all over the path, instead of into the wheel-pit."

4.2 Archaeological recording

Prior to the repair works being undertaken, the damaged section of the leat wall was planned at a scale of 1:20, both to guide the repair work and make a record of the extent and nature of the repairs. A cross-section of the silt filling the leat, visible in the damaged sections, was also recorded.

Fig. 5 shows both the extent of the upstanding remains, as well as the extent of the rebuilding which was sketched onto the main drawing, following the completion of the repair work.

Black and white record photos of the walling, to illustrate its structure and the extent of the damaged area, were also to be taken prior to, during and after works, as well as a number of colour prints.

An archaeologist was on hand to ensure that the work was being carried out according to the guidelines in the specification, discussing variations that were necessary and advising on the finished appearance of the monuments.

5 The repair work

The following actions were identified to restore the monuments and enhance their general setting. The below proposals are reprinted from original brief.

1. The wall to be rebuilt in the style in which it was originally constructed using adjoining sections and the CAU elevation drawing as a guide.
2. The wall to be rebuilt using only materials retrieved after the damage to the wall in November 2000.
3. Although the wall may originally have been mortared, all trace of this has now washed out (other than a few bits of more recent repointing) so that it now looks like a dry-stone construction. It is suggested that this appearance is retained, so that although the replaced stones will be bedded in mortar, the mortar is kept well back from the face of the wall.
4. Any roots growing in or near the section of wall to be rebuilt should be cut and treated with a herbicide to prevent re-growth.
5. The mortar to be a hydraulic lime mortar (NHL 3.5) in a 1:2.5 mix with a well-graded sharp sand (Cornwall Lime Company's New Milton sand).

The mix for the lime mortar, as noted above, was agreed in advance following advice from Stephen Tucker (SMT Associates). The works were then carried out largely in line with the original brief, between the 26th and 30th of May 2003. Mark Nicholls of Cornish Stonework and two colleagues were responsible for the works, and winched each of the

large granite blocks to the top of the walling to be relaid. Working through the loose rubble on the path, the stones were laid one by one.

In hindsight, it is noticeable that two stones had slightly chamfered ends and would have been positioned next to the opening where the launder would have been. Only one of these stones was re-erected in its original position, though this does not impact on the external appearance of the monument. At the same time, the visual impact of the mortar bed between the stones was kept to a minimum although practical considerations meant that it had to remain visible.

6 Other works

In addition to the works on the damaged leat, some limited repair works were carried out in two further areas by Mr Nicholls; repair of damage to walls in a change house and a crack in nearby blast wall.

6.1 Change House

The change house was recorded as building 18 in Smith's 1986 survey (see Fig. 2). It was recorded on the 1880 OS map as a two cell structure. At this time, the eastern cell was the smaller of the two but by 1907, the two cells were of roughly equal size.

Damage to this building had also been caused by falling trees. Herring noted in 1999 that there was "recent damage to walls and internal features like fireplaces, especially in western part. Urgent need for discreet consolidation. Remove ivy and saplings" (Herring 1999, 9).

A further internal memo from Stuart Ellis (conservation engineer – English Heritage) 1st February 2001 stated that "extensive consolidation work is needed to all walls."

At this time, only basic works were undertaken around the doorway. This included using mortar to stabilise stones that were loose but still *in situ*, the replacement of various stones around the door opening and a capping of mortar along the structure's western wall. It remains the case that a more comprehensive set of conservation works are necessary on this building, including the clearance of loose rubble from within and around the structure.

No detailed archaeological recording was taken prior to the conservation works, although the new build is distinct from the old, and this recording work can still be undertaken. A small number of photographs were taken prior to and following the works.

6.2 Blast wall

At the eastern end of the reserve, there is a freestanding section of wall which was first recorded on the 1880 OS map. It has developed a lean and there is also a crack in this wall.

The condition of this structure has been commented on in a memo from Keith Weston (English Heritage - Conservation Engineering branch). Following a site visit on 17th July 2002, he wrote:

"There is a vertical crack in the wall that is clearly visible only on one face, suggesting that the lean is not uniform but reduces to where the crack appears. I did not measure the extent of the lean but visually it appears to be within accepted limits. The limits recommended for different wall conditions allow for a factor of safety but assume that there are no serious weaknesses in the construction. The vertical crack is not a concern as it does not significantly influence the lateral stability in a freestanding wall whereas a horizontal crack calls for a different evaluation of stability. An open horizontal joint at high level at the end of the wall should be packed and pointed, and open and defective joints

should be repointed. It is also advisable to remove the ivy to prevent root activity weakening the construction. The crack should preferably be filled to prevent damaging plant growth and to ensure that the core of the wall is protected from the weather. This is not urgent but the wall should be monitored for further movement and a filled crack can be a useful means of indicating movement."

As suggested by English Heritage, the crack was repointed as a means of monitoring possible further movement. Vegetation clearance from around the wall still needs to be undertaken.

7 Conclusion

The repairs to the leat detailed in this report have stabilised the eastern end of the structure and improved its appearance to visitors to the valley. The condition of the repaired leat and other remains in the valley will continue to be monitored by both the English Heritage Monument Warden and representatives of the Cornwall Wildlife Trust.

There is also considerable scope for future works in Kennall Vale, which could be carried out through Scheduled Monument management works. In particular, this should include the change house. As part of such works, the walls of the building already consolidated, and those to be worked on, should be recorded archaeologically at an appropriate scale.

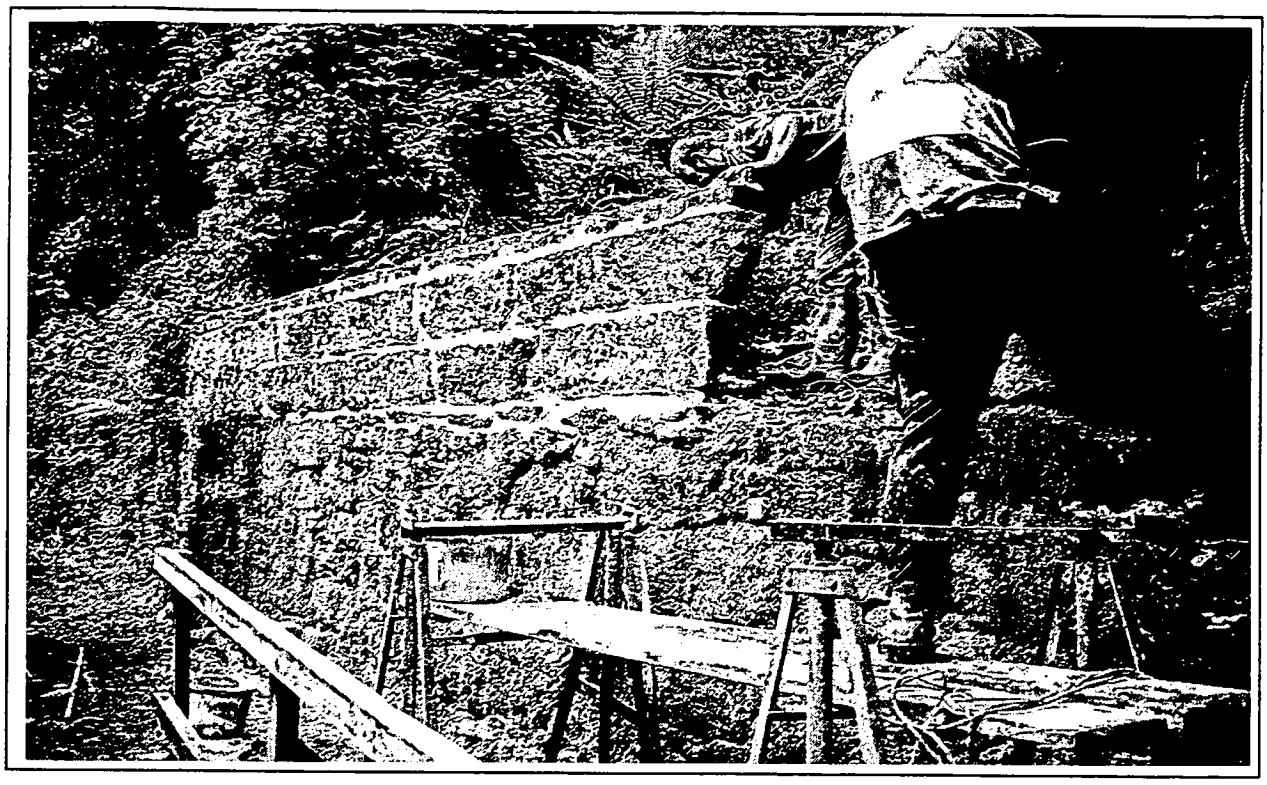


Fig. 6 *Photograph of repair works in progress*

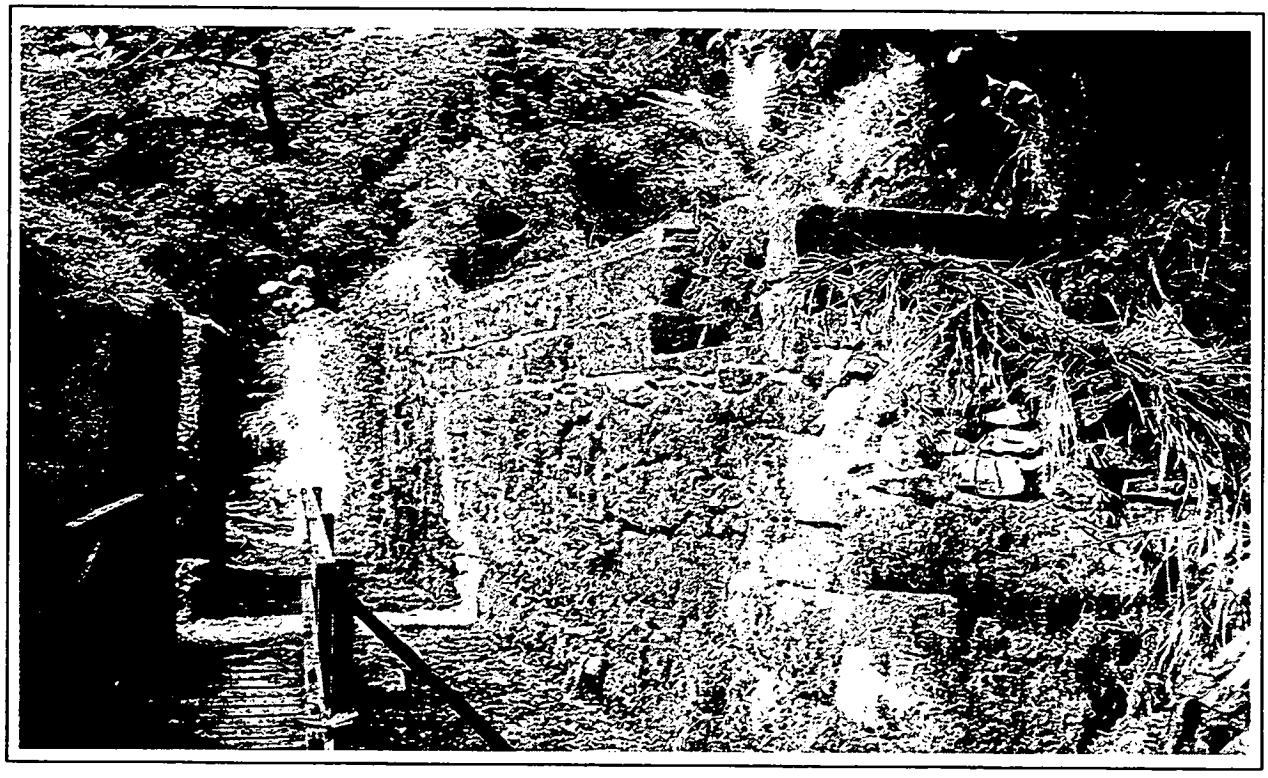


Fig. 7 *Photograph of leat following repair works*

8 References

8.1 Primary sources

1839 Tithe Apportionment Survey

1880 OS 25 inch map

1907 OS 25 inch map

8.2 Publications

Ellis, S, 2001. *Kennall Vale, Ponsanooth, Cornwall,* English Heritage – Conservation Engineering Branch memo

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Smith, J, 1986. *The Kennall Gunpowder Company, Kennall Vale, Ponsanooth – Archaeological and Historical Study,* CAU

Smith, J, 1986. *The Kennall Gunpowder Company, Kennall Vale, Ponsanooth – Structures Report and Buildings Survey,* CAU

Weston, K, 2002. *Kennall Vale, Ponsanooth, Cornwall,* English Heritage – Conservation Engineering Branch memo

9 Project archive

The CAU project number is **2002003.**

The project's documentary, photographic and drawn archive is housed at the offices of Cornwall Archaeological Unit, Cornwall County Council, Kennall Building, Old County Hall, Station Road, Truro, TR1 3AY. The contents of this archive are as listed below:

1. A project file containing site records and notes, project correspondence and administration.
2. Field plans and copies of historic maps stored in an A2-size plastic envelope: GRE 208/13.
3. Black and white photographs archived under the following index numbers: GBP 1550 1-31.
4. This report held in digital form as: G:\CAU\DOCUMENT\SITES\SITES K\KENNALL VALE GPW\KENNALL VALE GPW LEAT REPORT.DOC