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THIRLMERE DETAIL SURVEY
CUMBRIA

**Shoulthwaite Hillfort and Wythburn Lead
Mine**

Archaeological Survey Report

Commissioned by:

Lake District National Park Authority and North West Water Authority Ltd

Thirlmere Detail Survey
Cumbria

Shoulthwaite Hillfort and Wythburn Lead Mines

Archaeological Detail Survey Report

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SUMMARY

Following an identification survey of the North West Water Thirlmere estate a further programme of detailed archaeological survey of the more significant sites within the park was recommended and LUAU was commissioned to undertake a detailed survey of two of these: a post-medieval lead mine complex at Wythburn and the Shoulthwaite Iron Age Hill Fort.

A detailed survey was undertaken of the hillfort and the processing area of the Wythburn Lead mines; the mines themselves were recorded in outline.

The Shoulthwaite Hillfort is a promontory fort (NY 2998 1884), with substantial multivallate defences on the eastern side, but the western side of the fort relies solely on its natural defences. The entrance of the fort is to the east and the external defences immediately to the south of the entrance are seemingly non-existent; the area is presently occupied by a substantial mire. It is probable that this mire obscures earthwork evidence of further ramparts. At the northern end of the fort is a large natural prominent knoll which was further defended by a possible palisade base. There are a series of terraces both on the knoll and on the main plateau of the fort which could have accommodated structures. In addition a single, sub-rectangular feature within a flat bottomed quarry ditch may have been a hut structure.

It is recommended that a stratigraphic survey be undertaken through the area of mire of Shoulthwaite forts entrance in order to investigate the possibility of buried ramparts and to assess the potential for further environmental investigation. It is also recommended that a profile cross section be surveyed over the length and the width of the fort to examine the construction of the ramparts.

Wythburn lead mines (NY 3297 1497) are well documented and date from 1839. The site was owned by a series of different companies each one folding before the next emerged phoenix like from the ashes. The tumultuous history of the site reflects the general lack of productivity of the mine and at least two adits were discontinued because they did not recover ore of sufficient quality. The earliest activity was centred on two levels (Levels 1 and 2) and the processing was undertaken for the most part around the No. 2 Level. The most intensive period of activity was from 1861 when the Wythburn lead mining company was established. This company sunk two further adits above the earlier Levels 1 and 2, and then constructed a refining site at the base of the hill which was supplied by a 550m long self-acting inclined plain. In 1881 the land was sold to the Manchester Corporation Waterworks Committee, who forced the closure of the mines, and the site was then stripped of most salvageable material.

The survey has demonstrated good survival of remains around the Level 2 adit, where the initial processing took place. The main processing site is relatively poorly preserved, probably because the site was more accessible for salvage.

It is recommended that a programme of detailed survey be undertaken on the mining area of the Wythburn complex to augment the outline survey undertaken during the present programme.

1. INTRODUCTION

1.1 PROJECT BACKGROUND

- 1.1.1 In 1996 The Lancaster University Archaeological Unit (LUAU) undertook a desk-based and rapid field identification survey of the North West Water Ltd Thirlmere Estate at the request of Lake District National Park Authority (LDNPA). The survey was required to inform future management decisions with regard to conservation matters relating to the archaeological and historical content of the estate's landscape. This identification survey report (LUAU 1997) recommended a further programme of detailed archaeological survey of the more significant sites within the park and LUAU was commissioned to undertake a detailed survey of two of these: a post-medieval lead mine complex at Wythburn and the Shoulthwaite Gill Hillfort.
- 1.1.2 Fieldwork was undertaken in February and March 1998, in accordance with a verbal brief from the Lake District National Park Archaeologist and a project design prepared by LUAU (*Appendix 3*). The work was funded by North West Water Authority and LDNPA. The whole of the Shoulthwaite hillfort and the southern part of the Wythburn site were subject to a detailed level 3 survey by use of GPS and EDM tacheometric techniques (*see Section 2*) and the results are presented as site plans in conjunction with a site gazetteer (*Appendices 1 and 2*) and an analytical description of both sites.

2. SURVEY METHODOLOGY

2.1 PROJECT DESIGN

- 2.1.1 A project design (*Appendix 3*) was submitted by LUAU in response to a request from LDNPA, for an archaeological survey of two sites within the North West Water Thirlmere estate, Cumbria. This was designed to meet the requirements of a verbal brief by the Lancashire County Archaeology Service. The project design required that a level 3 survey be undertaken of the Shoulthwaite Hillfort, that a level 2b survey be undertaken of the processing area of the Wythburn lead mine (western area) and also a level 1b survey be undertaken of the eastern mining area of the Wythburn lead mine (*Appendix 4*).
- 2.1.2 The work has been undertaken in accordance with the project design (*Appendix 2*) and this written report presents the data collated during the project.
- 2.1.3 **Site Numbering:** In order to provide consistency, the site numbering of the identification survey report is continued within the present report. Component features of each site are numbered in conjunction with the site number, thus feature 11 of site 58 (as numbered within the identification survey) is shown as: 58.11. Site 58 is shown on Figs 3 and 4 and site 100 is illustrated on Figs 5-8.

2.2 DETAIL SURVEY METHODOLOGY (LEVELS 2B AND 3)

- 2.2.1 **Survey Control:** the control for the survey was established by closed traverse using a total station and was able to maintain an internal control accuracy of better than $\pm 0.05\text{m}$. The primary control points were subsequently located by the use of a Global Positioning System (GPS) which uses electronic distance measurement along radio frequencies to satellites to enable a positional fix in latitude and longitude which can be converted mathematically to Ordnance Survey (OS) national grid. The accuracy of the method is $\pm 1.0\text{m}$ but is sufficient to locate the survey onto the OS digital mapping, provided under licence by LDNPA, which is typically of a much lower order of accuracy ($\pm 4\text{m}$).
- 2.2.2 **Survey Detail:** the archaeological detail and significant topographic detail was surveyed using a Zeiss ELTA 3 total station and data-logger. The digital survey data was transferred, via DXF file format, into a CAD system. The archaeological detail was drawn up in the field with respect to field plots of the survey data and these edits were then transferred onto the raw survey data within the CAD system. The archaeological digital data was subsequently superimposed onto base digital topographic data supplied by LDNPA. Where a superimposition between LUAU survey topographic detail and the OS surveyed detail occurred, it was found that the OS error was never worse than $\pm 3.5\text{m}$ and confirmed the accuracy of the survey methodology.

2.3 WYTHBURN MINES OUTLINE SURVEY METHODOLOGY (LEVEL 1B)

- 2.3.1 The upper levels of the lead mine complex were subject to a lower level of survey than the other two sites. A level 1a survey (*Appendix 4*) was undertaken which provides a basic outline record of the archaeological features, within their local topographic context. This defines the a basic level of survey and archaeological

features were defined in outline or with only limited hachure annotation. Topography was extracted from the OS base.

- 2.3.2 The archaeological detail was appended to the raw outline GPS data from sketches within a CAD system, and the final drawing was merged with the detail survey of the ore processing site.

2.4 ARCHIVE

- 2.4.1 A full archive of the survey has been produced to a professional standard in accordance with current English Heritage guidelines (English Heritage 1991). The archive will be deposited with the County Record Office and a copy of the report will be given to the SMR. A summary of the results will be available for deposition with the National Monuments Record in Swindon.

3. HISTORICAL BACKGROUND

3.1 SHOULTHWAITE HILLFORT

- 3.1.1 Although the existence of the site has been known for a considerable period of time, no intensive archaeological work has ever been undertaken. It is first shown on the OS first edition 6" to 1 mile map 1867 and in 1877 a brief description is incorporated within a gazetteer of Cumbrian sites (Clifton Ward 1877, 247). Collingwood (1924) mentions the discovery at the hillfort of a thin slab of red sandstone lying on the surface, which was comparable with fragments of worked sandstone found at Peel Wyke (Bassenthwaite) and Castle Crag hillfort (Borrowdale). He argues, on the basis of this find and its associated parallels, that Shoulthwaite could have had Roman-British occupation.

3.2 WYTHBURN LEAD MINES

- 3.2.1 **Henry Molyneux and Partners:** In 1839 a silver-rich north-north-east/south-south-west outcropping lead vein, together with a less economic cross vein, was discovered at Wythburn. The rights to the minerals were leased to Henry Molyneux and Partners soon after. They immediately set up a mine known as Wheal Henry (the Wheal element deriving from the Cornish *huel* meaning a mine) which initially consisted of two adit levels (High Level and Low Level), and a counthouse (from account house, the Cornish equivalent of the northern mineshop) and smithy. However, in 1857, after little success and frequent periods of inactivity, the mine was closed.
- 3.2.2 **Henry Helvellyn Lead Mining Company Limited:** Molyneux and Partners regrouped in the same year under the heading of the Henry Helvellyn Lead Mining Company Limited. A new short crosscut level (New Low Level) was begun in the following year, and another in 1859. At this time the levels were renamed No.1 to No.4 Level. The venture did not realise the optimism of the new company, however, and the Henry Helvellyn Lead Mining Company Limited collapsed in 1861.
- 3.2.3 **Wythburn Lead Mining Company Limited:** In 1861, Wheal Henry was taken over by the Wythburn Lead Mining Company Limited and the mine became known as Wythburn, or Helvellyn Mine. The new company immediately embarked on a programme of modernisation. In the same year a new level was begun (Arnison's Level) and a modern crushing and separating plant was erected near the foot of the Mine Gill Beck. The mill was powered by a thirty horse-power water turbine, operated by a high pressure water supply from a newly erected dam higher up the beck. A self-acting incline, approximately 550m long on a 1 in 3 descent, was also built and established a direct link between a newly constructed drumhouse near No.2 Level and the ore bins at the dressing mill.
- 3.2.4 The mine produced excessive gangue, however, and an ore bin and gratehouse were subsequently erected near No.2 Level. Here the ore was fed directly from the mine into an ore bin and then raked over an iron grate; the obvious waste being discarded. Ore was then fed into a hopper at the bottom of the gratehouse and was trammed in tubs to the drum house, from where the tubs were coupled to the cable and sent down the incline.

- 3.2.5 A new level (Arnison's Top Level) was begun in the 1860s but was soon abandoned due to the lack of ore in the vein. At this time the company was experiencing extreme financial difficulties and finally collapsed in 1870, the mine continuing to operate under the management of the liquidator. A temporary improvement in the lead price in the following year led to the resumption of operations under the auspices of the Wythburn Lead Mining Company. However, No.3 level was abandoned for good in the following year due to lack of ore. In 1873 the shareholders withdrew support and the company collapsed once more.
- 3.2.6 ***West Cumberland Consolidated Mining Company:*** The remaining shareholders came together to form the Helvellyn Mining Company Limited which lasted less than a year. In 1873, the mine was taken over by the West Cumberland Consolidated Mining Company, trading as the West Cumberland Consols in the mid 1870s.
- 3.2.7 ***Manchester Corporation Waterworks Committee:*** In 1876 Harry Vane (both land and mineral owner) sold his Thirlmere estate to the Manchester Corporation Waterworks Committee, who forced the closure of the dressing mill in the following year, although the mine struggled on until final closure in 1881. During the construction of the Thirlmere reservoir the rails were stripped from the incline and the dressing mill was demolished.

4. SHOULTHWAITE HILLFORT

4.1 TOPOGRAPHIC CONTEXT AND BASIC FORM

- 4.1.1 The Shoulthwaite hillfort lies on a small natural craggy promontory overlooking the remote valley of Shoulthwaite Gill; it has very steep sheer sides to the west, north and south, but a relatively gently sloping approach from the east. The modern footpath leads along this gentle sloped approach and into the former entrance of the fort. The hillforts rampart defences are accordingly ranged along this eastern side of the promontory. On the northern side of the promontory is a very prominent sub-circular knoll which is edged by steep crags on three sides. To the south of the knoll is a lower, undulating broad terrace, which is edged by both ramparts and further crags. Although the basic knoll and terrace is mainly of natural origin, it has a topographic appearance similar to a medieval motte and bailey. On both the 'bailey' and 'motte' areas there is a haphazard arrangement of internally levelled areas. Overall the site measures 140m by 90m and is up to 15m in height and covers an area of c 0.85ha; it is at an altitude of c 390m AOD.

4.2 DETAILED DESCRIPTION - FIG 4

- 4.2.1 **External Ramparts:** the north and west sides of the hillfort are edged by very steep sided, or vertical slopes, too steep to allow for the construction of ramparts and too steep to warrant additional defences. Consequently the artificial defences are ranged around the south and eastern side of the fort and in these directions there are further crag edges which have been enhanced by the cutting back of the outcrop. Hence there are vertical faces up to 2m high around the base of the eastern side of the promontory, particularly at the northern end of ditch 58.19, adjacent to the area of mire 58.4 and below the 58.11 rampart. The southern end of the promontory comprises what appears to be undisturbed vertical crag, which was sufficiently high to negate any requirement for artificial enhancement.
- 4.2.2 Despite the sites natural defences a series of ramparts were constructed beyond the southern and eastern sides of the promontory. The most substantial of these was the large rampart 58.3, which was substantially enhanced by the excavation of a deep quarry ditch (58.19) on its north-western side. The quarry ditch was partially rock cut, and varies in depth from 0.35m-1.15m, dropping down substantially towards the south-west. Against the southern side of the promontory is a narrow rock terrace (58.19b) which is a surviving fragment of the original ground surface. The base of the quarry ditch is as much as 1.25m below the upper level of this terrace, demonstrating the depth of excavation at this point. The large rampart (58.3) is in part an enlarged and truncated natural feature. Prior to the construction of the ramparts there would have been a relatively uniform slope descending from the top of rampart 58.2 to the level of terrace 58.19b. This was cut into to form the quarry ditches on the either side of rampart 58.3 and the quarried material was deposited on top of the undisturbed section of slope to form the now very prominent rampart. At its highest point the rampart is as much as 1.25m above the original line of slope. Elsewhere it is less prominent and becomes a very limited and insubstantial earthwork at its north-eastern end where it merges into the area of mire (58.4).

- 4.2.3 To the south-east of rampart 58.3 is a further line of rampart (58.2) which is predominantly a natural feature, but has been cut into by a quarry ditch on its north-western side. The material from this quarry ditch does not appear to have significantly enhanced the southernmost section of the rampart, and it is therefore probable that the quarried material was deposited on the larger 58.3 rampart. By contrast the northernmost section of rampart 58.2 is largely built up, although it is not particularly prominent.
- 4.2.4 To the east of rampart 58.2 is a further linear bank (58.1), which is neither prominent or particularly long. As it lies immediately adjacent to 58.2 and is clearly an artificial feature there is an implication that it was related. However, it is distinct in character from the other ramparts and was not necessarily contemporary with their construction. If it was a further line of defence it would have been too low in itself to have provided any effective defence, however, it is possible that it was topped by a palisade.
- 4.2.5 The area of the fort with the weakest natural defences is on the eastern side of the promontory (58.4) and is adjacent to the principle approach to the fort, an area which is presently flat and boggy. Considering the very considerable artificial defences constructed around other parts of the fort which are also well covered by natural topography, at first glance it seems rather odd that there should be fairly limited obvious defences here. On closer examination it is clear that upstanding external ramparts visibly terminate at the southernmost edge of this mire, nevertheless this line is continued as a descending break of slope which defines the eastern edge of a slightly raised plateau, within which the mire sits. The fact that a mire is on a raised plateau suggesting that there is some form of bank around the eastern extent of this area retaining the mire and that it is therefore an artificial feature, which is apparently related to the fort defences, as it continues the lines of both ramparts 58.1 and also 58.3. The eastern side of the crag (western side of mire) has been deliberately cut back to reinforce the defences in this area, and similarly a ramp leading up to the fort entrance (58.7) has been formed by cutting back its southern face. These emphasise that there was an attempt to defend the area adjacent to the entrance and there are two possibilities as to the form of this defence. The first is that the eastern break of slope of the mire was a rampart and the area between it and the promontory was a large quarry ditch which has subsequently become filled by mire. The second possibility is that the outer bank, of the present mire, was constructed to deliberately create a section of 'moat' which would have been filled with water or bog as a defensive barrier. In this scenario the moat has become filled with mire. It maybe possible to resolve this uncertainty by undertaking a programme of stratigraphic survey across the mire area (*Section 6.1.2*).
- 4.2.6 **Approach:** The primary entrance to the hillfort was situated to the east and consists of a very clear gap, defined to the north and south by the sharp slopes of both ramparts (6 and 11), which provided a narrow access through the defences. A ramp leading up to the fort reflects the remains of the pre-fort slope, but this has been cut back on both its northern and southern sides accentuating the approach and providing only a very narrow route through the defensive system.
- 4.2.7 **Lower Fort Ramparts:** The interior of hillfort is naturally defended by crags to the north and west but has a rampart (58.5, 6 and 11) to the south and east. The top of the rampart is broadly level, but as the natural ground drops away towards the entrance (58.7), so the rampart is significantly more substantial and prominent in that

area. The southernmost section of the rampart (58.5) was created by the excavation of a small quarry ditch on its northern side with the spoil deposited along the top of the southern crag edge. The crag itself is particularly sheer and relatively high, and it is open to speculation as to why additional rampart defences were required to defend this section. At its north-east end it merges with the natural slope, and to the west it stops short of a descending crag edge.

- 4.2.8 The substantial rampart section 58.6 extended between the 58.5 section and the principal entrance of the fort. The rampart has a rounded profile is extremely prominent, extending up to 3m high, and was built on a marked break of slope mainly from material quarried from inside the fort. There is a substantial hollow immediately to the west of the rampart which has an artificially flat floor and is edged to the west by lines of cut back crag edge; this would therefore appear to have been partly excavated as a quarry ditch for the rampart. At the southern end the rampart merges with the natural line of the slope, whereas the north-eastern end of the rampart section is at the fort's main entrance. It has a very steep break of slope at this point thereby defining a narrow entrance gap. The northernmost section of rampart (58.11) extends between the fort entrance and the line of a substantial crag. The southernmost end is very prominent, but it decreases in height and prominence toward the north as the natural slope rises; thereby maintaining a relatively flat top to the rampart.
- 4.2.9 **Lower Fort Interior:** the internal area of the lower fort is on two distinct levels, with the ground rising in height towards the west. The vegetation consists of grass and heather, and there are numerous small outcroppings of rock. In between these outcrops are localised areas of flat or very gentle sloping ground which may have had huts constructed on them. The principal area is the flat base of the internal quarry ditch to the west of rampart 58.6. This has fairly steep sides on its western side, and therefore the feature could potentially have served a defensive function at some stage of the hillforts life. Alternatively it could also have been used as a platform for domestic structures particularly as the flat bottomed area would have been relatively protected from the elements by the rampart to the east and by the raised outcrops to the west. There is at least one structure (58.7) within this area, but this may not necessarily have been an original feature of the hillfort. It is characterised by a semi-circular bank to the south-east, and linked by a discontinuous bank to an artificially narrow ridge of outcrop to the north, which was probably cut back to fit the purpose. The interior is fairly flat and has no protruding stone. Overall the structure has a sub-rectangular shape and is 1.75m x 5m in size; although rather small this may have had a domestic function.
- 4.2.10 To the west of the quarry ditch the terrain is very undulating but incorporates natural, and possibly artificially enhanced terraces which could potentially have accommodated structures, though being on the upper surface of the ridge they would have been afforded little natural protection from the elements. The largest, and the one with the most potential for incorporating structural features, is situated on the hause between the knoll and southernmost part of the fort (58.8). The terrain is unusually flat, to the extent that it appears improved. The area is edged by crags to the south, which could potentially have been cut back to accommodate a structure. There are two further areas (58.9 and 10) which are sufficiently level to have incorporated a structure; however, the easternmost of these (58.9) does have a gentle slope which may be slightly too steep to have provided a good structural platform

and the westernmost may be too narrow for any conventional sized and shaped hut structure.

- 4.2.11 **Upper Fort:** the prominent knoll at the northern side of the fort, has very sheer crags around four sides and has only very restricted access via a sinuous path skirting around its eastern side. As such it is naturally well-defended and it potentially served as the last bastion of defence. However, it has only very limited artificial defences; there is a low bank and associated mound (58.12) which blocks the principal access onto the promontory and terminates at the steep north-western crag edge. Its height (c 0.3m ave.) is insufficient to have served any defensive function, but it may have been topped by a palisade.
- 4.2.12 Within this line of defence are a series of possible terraces, some of which may have accommodated structures. The best contender is 58.13, which is in part a natural bowl and has a gently sloping base, but may have been artificially enhanced. At the northern open side of this bowl is a rectilinear well defined and prominent mound (5.14), which has a slight oval in the middle. There is a possibility that it is a decayed structure, however, it is fairly small being only 3m x 2m (height 0.5m) in size and would therefore have been too small to have been a domestic structure. The purpose of this possible structure is unknown as is its date and it is possible that it post-dated the main phase of hillfort use.
- 4.2.13 An area to the north-west of the knoll (58.16) is edged by a low bank, and has an upper terrace bank to the south. The terrain of this irregularly defined area is relatively flat and is large enough to have accommodated a small structure. A further terrace area (58.15) to the south of the 58.16 is a further natural terrace, but this has a gentle slope which may have been too steep to have served as a base for a hut.

4.3 DISCUSSION

- 4.3.1 **Chronology:** none of the hillforts found within northern Cumbria have been subjected to more than antiquarian excavation and as a result their presumed Iron Age date is derived from indirect comparison with excavated examples from other regions such as Skelmore Heads, near Ulverston (Powell 1963) and Portfield, near Blackburn, Lancashire (Beswick and Coombs 1986). However, there is at least one hillfort (Castle Crag, Borrowdale) which has produced Roman ceramics and there is another (Castle How hillfort, nr Bassenthwaite) which has produced worked sandstone that has a tooling pattern comparable to Roman masonry (Collingwood 1924). Although these artefacts suggest possible Roman occupation of the sites they do not necessarily indicate a Roman foundation, indeed it is more likely that these forts were established prior to the Roman invasion. The dating of these generic forms will remain insecure until large-scale excavations are attempted within the interior of such enclosures in order to clarify the precise date and character of the occupation.
- 4.3.2 **Function:** There is a relative paucity of hill forts within Cumbria, certainly by comparison with those found in some parts of southern England or southern Scotland (Feachem 1966, 64). These tend to be characterised by their small internal area, their commonly univallate form, and are often promontory forts thereby the emphasis of the defence is on the natural topography. Shoulthwaite certainly has very effective natural defences which provide considerable defensive protection from three sides, but its also has prominent multivallate man-made defences to protect its south-eastern/eastern sides and in this respect is a classic promontory type of hill fort.

These defences comprise in one area, around the south-eastern side of the fort, potentially four lines of rampart and is a side which already has effective natural defences. By contrast the eastern side of the fort has the easiest point of access and correspondingly the worst natural defences, but seemingly has only a single line of rampart defence. This apparent incongruity may be explained, however, if the expanse of mire outside the main entrance obscures extensions of the principal ramparts or was a line of defence in itself.

- 4.3.3 There are seemingly conflicting arguments as to the possibility that the hillfort was constructed as a permanent settlement or was a refuge in times of crisis. Although the area of the fort covers 0.85ha, the actual area within the defences which could have accommodated any settlement is relatively small (0.17ha) and much of this area was too undulating to construct huts. Certainly by comparison with demonstrably permanent settled hillforts (eg Castlesteads or Ingleborough) this is an unusually small extent. The fort has only one putative domestic structure (58.7), and this was not necessarily contemporary with the original construction of the fort, but there are a series of terraces where structures could have been built and it is possible that the fort accommodated a small population. If the site had only a very small permanent population then it is questionable whether they would have had the resources to construct the very substantial earthworks of the Shoulthwaite defences. By contrast a larger but more remotely settled population using the site as a refuge may have had the resources to construct such a monument.
- 4.3.4 The fort would have been a hostile environment to live, considering that it is a very exposed hill at an altitude of 390m (1300') AOD, particularly during the Iron Age which was a period of wet climatic conditions (Lamb 1981, 55). However, Ingleborough hillfort in the Yorkshire Dales, is located at a greater altitude (731m AOD), but has a substantial number of hut-circles within its extent testifying to a permanent occupation.
- 4.3.5 If the site was used as a refuge then it is not apparent where the principle settlement was located as there are no other Iron Age settlement sites recorded within the Thirlmere valley and the geographically nearest known Iron Age lowland sites are on the opposite side of substantial uplands to the west (Quartermaine and Leech forthcoming). However, this apparent dearth of sites to an extent reflects an imperfect state of archaeological knowledge for the region. Prior to a study by Bewley (1994, 63) on the Solway Plain area of Cumbria there were only two known Iron Age sites recorded within the SMR from that region, but he was able to identify from aerial photography over 150 enclosures which, typologically, could be of Iron Age date and some eg. Ewanrigg and Swarthy Hill have been confirmed as having Iron Age occupation. By implication there is the potential that the apparent dearth of Iron Age sites will be resolved either by discovery of new sites or by the reinterpretation of known sites.
- 4.3.6 In general the available evidence does not provide a reliable indication of whether the site was permanently occupied, but would appear to provide a slight bias in favour of its use as a refuge.
- 4.3.7 **Economy:** the majority of the hillforts are located within isolated areas of the region and tend to exist as sole examples with little or no associated grouping of other contemporary features. This is, perhaps, a result of farming practise within the region where the high level of rainfall (over 1000mm per annum) exceeds the preferred rate for barley and wheat (Higham 1986); suggesting that animal husbandry was the

significant form of subsistence farming with a resultant fall in the level of population that was viable within upland areas during the Iron Age. Certainly there is no evidence for any arable activity associated with the Shoulthwaite hillfort, and although there is a flat area of land east of the fort which was possibly suitable for agriculture or occupation, examination did not reveal any features. Recognition of such features is hampered by the current forestry land-use of the landscape.

- 4.3.8 **Regional Characteristics:** Shoulthwaite Gill hillfort is similar in size and sophistication of construction to other examples encountered within the upland terrain of the Cumbrian fells. Carrock Fell hillfort at Mungrisdale (NY 343337) (Turner 1987), whilst having a larger internal area, is constructed from stone and is characterised by a simple defensive enhancement to the natural topography. Castle How, Bassenthwaite (NY 202308) (Collingwood 1924) is similarly built around enhancements to natural terrain although is, at 0.5ha, of similar size to Shoulthwaite Gill (0.85ha). Enhancements at Castle How include artificial scarping to the adjacent hillside and the construction of up to four ditches.
- 4.3.9 It can be suggested that the multivallate form of the Shoulthwaite fort is a fairly sophisticated defensive system. However to a great extent the generic form of the fort reflects the characteristics of the topography; the sites of the hillforts in this mountainous area incorporate impressive natural defences and thereby negate the need for full encircling artificial defences. There are often only limited areas of vulnerability within the natural defences and these 'holes' are invariably strengthened by substantial but incomplete ramparts. They can afford to be 'multivallate' as there is only a need to defend part of the sites circumference. By virtue of their altitude, often over 1500' AOD, the sites are not ideal for all year round occupation and there is a case for suggesting that at least some of them served only as refuges.
- 4.3.10 To an extent this is reinforced by the example of a very different type of hillfort at Castlesteads, Lowther (NY 518252) (LUAU 1997b) where there is an enclosure that is large by comparison with local hillforts, being c1ha in extent and is defended by three complete concentric banks and two ditches. This example differs in that its location is at a lower contour and on a more gentle slope consequently the reliance on more substantial fully enclosing ramparts and the potential for both pastoral and arable agriculture. Despite the differences between this and the generic type of high altitude fort their spatial relationship to Shoulthwaite Gill suggests that, if regional parity is assumed, they belong to the same regional group. Beyond the area of the Lake District there is a tendency to a more substantial form of hillfort, as characterised by Ingleborough, North Yorks and Warton Crag, Carnforth which enclose a large area, are very well defended with stone walls in place and, on the present evidence, were permanently occupied. The latter example is up to c 6.1ha in extent, has a relatively flat settlement area and was defended by three long ramparts (Haselgrove 1996) defining two sides of a promontory fort. The other forts of Lancashire (eg Portfield Camp and Caster Cliff for the most part reinforce this tendency to larger forts.

5. WYTHBURN LEAD MINE

5.1 MINING

- 5.1.1 The evidence for mining technology at Wythburn mine is limited to the now collapsed portals of a series of adit levels driven horizontally to intercept the ore-bearing mineral veins. The levels were a means of access to and from underground workings and are accompanied at Wythburn by corresponding spoil heaps directly opposite the portals. The levels were also used for drainage, though little direct field evidence survives of the method of de-watering the mine. The initial workings, commenced under Henry Molyneux and Partners in 1839, consisted of the High and Low Levels (100.9 and 100.13) which were situated on the north side of Mine Gill Beck. Fragments of zinc sheeting in the vicinity of the latter site indicate that ventilation tubing was employed at the mine at some time during its life. A mineshop and smithy building (100.24) was also built lower down on the opposite side of the beck. The mine at this time was supplied, and the ore transported, by packhorse.
- 5.1.2 In 1858 a new short crosscut level (New Low Level (100.25)) was begun below the mineshop and smithy (100.24), and another (100.28) a little above the 300m contour in 1859. At this time the levels were renamed No.1 to No.4 Level from the highest to the lowest respectively. No 3 Level (100.24) has only a small amount of spoil and given its proximity to the stream it is likely that much of the waste has been washed down the beck. No 4 level (100.28) was not located, but lies in the plantation lower down on the south side of the Gill. This level proved unsuccessful and was abandoned in 1860.
- 5.1.3 In 1861, under new ownership, a further level (100.4), known as Arnison's Level, was driven above No.1 Level at approximately the 640m contour. A large flat-topped spoil heap lies immediately opposite with its foot retained by a drystone revetment wall (100.7). A further level, known as Arnison's Top Level (100.2), was driven slightly above the 710m contour. This level, which was driven to test the ore-bearing capacity of the higher levels of the vein, was abandoned after extending only 45m (25 fathoms) because of a lack of ore encountered.
- 5.1.4 During the mid-1860s, the process of stoping out the vein was commenced. This involved the excavation of a linear cleft along a vein, formed by working upwards from below. Frequently stopes were worked to the surface or left a dangerously thin ground cover which subsequently collapsed. A small area of subsidence (100.8) situated in scree midway between No.1 Level and the foot of the spoil heap for Arnison's Level may have been caused by stoping immediately below.
- 5.1.5 From 1871 until the closure of the mine, operations were concentrated in Arnison's, No.1 and No.2 Levels (100.2 and 100.4).

5.2 ORE PROCESSING

- 5.2.1 The initial ore processing would have been undertaken below ground where ore and mixed material would have been separated from the more obvious waste. The ore, once on the surface, would have required further sorting in daylight conditions. This would have occurred close to No.2 Level and the flat top of the adjacent spoil heap (100.14) may have been used as a working area. It is perhaps significant that the spoil heap overlies a culvert (100.15) which may have allowed the expansion of the

- tip over the stream. The spoil heap would have also acted as a bridge across the beck thus connecting the mineshop (100.24) with No.2 Level. The culvert is now collapsed causing subsidence in the southern part of the heap.
- 5.2.2 Whilst solid galena requires very little treatment before dispatch to the smelt mill, it is likely that the mixed ore would have required further dressing at the mine. This may have involved simple washing followed by hand picking and further breaking with a sledge hammer. The ore may have been successively reduced, washed and sieved until as much of the galena as possible was extracted; fine material would then have been extracted using dully tubs. Relatively simple techniques such as these, using free-standing structures, often leave no trace except for the concentrations of waste material of a particular size which may indicate areas in which certain tasks have been undertaken. No such spoil differences were observed adjacent to No.2 Level though the subsequent reorganisation of the mine and further deposits of spoil may have removed or obscured such evidence.
- 5.2.3 In 1861, the mine was taken over by the Wythburn Lead Mining Company who immediately initiated a modernisation of the ore dressing techniques then in use. A new integrated dressing mill, connected to the mine by a 550m long self-acting incline tramway, was built towards the bottom of Mine Gill Beck. The mill itself was built on a series of artificial terraces set into the hillslope. Much of the machinery would have been free-standing and the mill itself would have been of timber-framed construction, either open-sided or enclosed. The dressing mill, however, was demolished and the plant sold in 1880, and today the site displays relatively little evidence of the processes and machinery formerly employed at the site.
- 5.2.4 Comparisons can be made, however, with contemporary mines in other parts of the country. From the 1850s onwards the processing of ores at larger mines was becoming increasingly more systematic, with every effort made to extract as much of the ore as possible. At this time ergonomically-designed dressing mills were being built on hillsides to maximise the use of gravity flow (Willies 1991, 91). Powered machinery often replaced manual ore processing and new methods of power generation were also developed. Fengoch Mill in Wales, whose design is likely to have been very close to that employed at Wythburn and dates to c1860, was illustrated by Moissenet following his visit (reproduced in Hunt 1884, 90) (Fig 9).
- 5.2.5 At Wythburn mine the initial stage of the process involved the storage of the mixed ore and waste, often called *bouse*, in ore bins (100.36) to await processing. The low earthwork remains of these structures can be seen on the upper terrace of the site. The ore would then be sorted and obvious waste would be immediately dispatched in tubs to a finger spoil heap (100.66) on the northern side of the Mine Gill Beck. The terraces immediately below would have housed the rock breaker and the crushing rolls. Both these structures were free-standing and would leave little or no surface trace when removed.
- 5.2.6 The reduced material would then pass down slope to the dressing mill itself. The remains of a 'U'-shaped drystone structure (100.53), with water conduits feeding into it, is likely to be the remains of a wash-kiln where the ore was swilled clean. Only the terraces retained by short sections of revetment wall, a few miscellaneous timbers and mounds of dressing waste testify to the former existence of the remainder of the mill. However, it is likely to have included one or more trommels (revolving sieves), possibly a rotating picking table, and a water turbine (an enclosed water wheel powered by high pressure water supply). In addition, powered jiggers (sieves agitated

- in water to assist gravity separation) may have been used to separate sand-sized or larger crushed ore. McFadzean (1987, 19) states that round buddles 3.66m (12') in diameter were used at the mill, however, no evidence of these structures was identified at the site and the use of round buddles and frames for slime grades was not common until after 1870 (Willies 1991, 91), which was as much as 10 years after the erection of the mill. At the end of the process the dressed galena would have been despatched to the smelt mill and the waste deposited on a large spoil tip (100.59) at the west end of the mill.
- 5.2.7 Power for the machinery was supplied by a thirty horse-power water turbine (McFadzean 1987, 18) supplied by a high-pressure water pipe connected to a dam (100.34), now breached, higher up the Gill. Additional water was supplied to the dam via a leat (100.1) from Brownrigg Well (a spring situated at 860m) to the head of the Mine Gill Beck. A section of the high-pressure pipe (100.56) protrudes from the terrace beneath the wash-kiln, the remainder is buried beneath the floor of the upper terrace. The pipe may have been largely above ground, as indicated by a section of pipe ledge / trench (100.35) leading down from the dam; the pipe would have been scrapped when the mill was demolished.
- 5.2.8 No certain evidence of ancillary buildings could be discerned at the mill, although a small roofed building (100.48) was recorded in a plantation to the south. Although modified from its original form, including the insertion of a chimney flue and hearth, local tradition states that the building was a powder house. Its isolation relative to the main components of the site would support this identification. It is also close to the original packhorse track and may have formed part of the original Wheal Henry mine.
- 5.2.9 The ability of the mill to cope with excessive amounts of gangue (waste minerals such as calcite and quartz) led the owners to erect an ore bin and grate house (100.21) in a drystone enclosure near No.2 Level (McFadzean 1987, 20). This allowed for more efficient separation of the ore from obvious waste and also allowed the ore to be sized over a grate so that the rock breaker could process it more efficiently.
- 5.2.10 The introduction of this additional processing stage led to a modification in the way the ore was transported to the drum house at the top of the incline. Originally, the ore was transported on a tramway from No.2 Level directly to an ore chute (100.17) which fed into an ore bin (100.18) to the rear of the drum house (100.19). However, the new arrangement required the construction of a new tramway (22) from the base of the grate house to the drum house. Though badly damaged, a single rail and timber sleeper, and a drystone revetment wall on the upslope side, have survived from this additional tramway. The ore would vary considerably in the amount of gangue minerals included and it is possible that both systems were in operation at the same time.

6. RECOMMENDATIONS FOR FURTHER WORK

6.1 SHOULTHWAITE HILLFORT

- 6.1.1 The survey has demonstrated that the site is of considerable archaeological significance, but that the lack of any archaeological attention has left some considerable uncertainties particularly with regard the development and chronology of the fort. A limited programme of archaeological recording could potentially go some way to redressing these questions.
- 6.1.2 **Stratigraphic Survey:** The area of mire outside the entrance of the fort is a key area to any investigation. It has been suggested (*Section 5.1*) that this is an artificially created mire basin either as a rampart ditch which has filled or as a 'moat', and as such the supposition needs to be tested. If it indeed proves to be an area of filled mire it provides considerable opportunities to investigate the development of the fort.
- 6.1.3 Initially it is recommended that a simple stratigraphic survey be undertaken at this site, which would be undertaken by coring at regular intervals with a Russian corer across the line of the putative rampart. This would provide a basic stratigraphic profile across the area and at the same time would extract peat from the putative quarry ditch bottom which could be used for C14 dating. Subject to the success of this technique it may be appropriate to generate a pollen section on a core through the centre of a quarry ditch.
- 6.1.4 **Survey Profiles:** the survey has shown that some areas of the external rampart have an extant original ground surface, while others have been quarried or built up. The nature of the construction technique could be clarified by surveying a series of profiles across the whole fort, but particularly along the north-west/south-east axis. These would be undertaken by instrument survey and could be vertically enhanced within a CAD system to emphasise the constructional form.

6.2 WYTHBURN LEAD MINES

- 6.2.1 The survey has demonstrated that the earliest, best preserved and therefore the most archaeologically significant remains are within the areas of the Level 1 and Level 2 mines. These have at present been recorded only by outline survey, but would warrant a more detailed level of survey. It is therefore recommended that the mining area including Levels 1-3 and the associated mine shop be subject to a level 3 survey.
- 6.2.2 The Mounuments Protection Programme Assessment of the lead industry examined the archaeological significance of monuments within a national context. However, the 'Lake District was under represented within this survey' and only assessed two mines Greenhead Gill and Greenside. In the light of the present survey it is considered that certain elements of the site are of moderate importance, notably the incline plane and the drum house at No. 2 Level, and overall the site therefore would warrant being incorporated in any future assessment for scheduling.

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APPENDIX 1

SHOULTHWAITE HILLFORT SITE GAZETTEER

Feature number 58.1
NGR NY 30009 18800
Type Earthwork
Source Detail Survey
Condition Good
Dimensions 24m long, 4m wide, c 0.4m high
Description

This is a short 24 metre long section of rampart to the east of rampart 58.2, and is located immediately at its base. It has a narrow broad bank which is up to c 0.4 m high and 4 metres wide. The extension of this line of rampart merges with the banked mire (58.4). Although it is not particularly prominent it would appear to be primary defensive rampart.

Feature number 58.2
NGR NY 29989 18793
Type Earthwork
Source Detail Survey
Condition Good
Dimensions 56m x c15m
Description

A well defined and earthfast rampart to the south of the site and standing to a height of 3m. The rampart extends from an area of naturally steeply sloping ground to the south-west and continues up towards an area of boggy ground to the north-east. The northern most section has been built up from a quarry ditch to the north, but the southern most part is broadly natural, although the quarry ditch has been excavated through it. The cut, particularly at its southern end is extremely deep, being up to approximately 3.5 metres deep. It is significant that the built up section of rampart 58.2 corresponds broadly with the built up section of rampart 58.1. The condition of the monument is extremely good with the cut edges very sharp and there does not appear to have been much slippage.

Feature number 58.3
NGR NY 29965 18793 - 30014 18831
Type Earthwork
Source Detail Survey
Condition Good
Dimensions 62m x 11m
Description

This is a prominent and very substantial rampart, and unlike the adjacent rampart 58.2, it appears to be a mainly artificial feature; the eastern and north-eastern extents have been clearly built up. The top of the south-western section to an extent corresponds approximately with the line of slope on 58.2 and further to the south, it would therefore appear that this section was cut back on either side, to the north-west and south-east, though it has also been built up. There is an element of the original ground surface up against the crag of the hillfort (58.19b), which is the residual ground surface prior to the construction of the rampart; a profile line between the top of rampart 58.2 and this 58.19b section provides an indication of the level of the original ground surface, prior to cut back and this would indicate that Rampart 3 has been built up by between 1 to 1.25 metres at its western end. The ditch on the eastern side of rampart 58.3, combined with the overall height of the rampart, forms an extremely large drop, which is potentially up to 5 to 6 metres, at the northern extent and as such provides a considerable defence. Rampart 58.3 tails to nothing where it merges with feature 58.4, presently a mire, as does rampart 58.2.

Feature number 58.4
NGR NY 30019 18844
Type Mire filled rampart

Source Detail Survey
Condition Poor
Dimensions 18.7m x 36.2m.
Description

This is a level area of mire immediately outside and to the east of the fort entrance. The upstanding external ramparts visibly terminate at the southernmost edge of this mire. It forms a slightly raised plateau; it is edged to the east by a moderate break of slope and to the north by a substantial break of slope. The fact that a mire is on a raised plateau demonstrates that there is some form of bank around the eastern extent of this area retaining the mire and is likely to be a rampart continuing the line of rampart 58.2. Similarly the eastern side of the mire merges in with the line of rampart 58.1, which would further indicate that the earthwork is linked to the fort defences. The eastern side of the crag, adjacent to the mire, has been deliberately cut back to reinforce the defences in this area, similarly the ramp of entrance of 58.7 has been cut back and this would reinforce the argument that the mire is a filled in rampart ditch.

The naturally weakest part of the hillfort defences is on the eastern side of the fort, adjacent to the entrance; it is consequently very unlikely that there was no external rampart at this point, as it would provide a defensive liability. So although there are no observed ramparts at this point it is likely that there was a defensive feature prior to any natural infill.

Feature number 58.5
NGR NY 29970 18820
Type Earthwork
Source Detail Survey
Condition Good
Dimensions 22m x 8.9m
Description

This is a small section of rampart created by the excavation of a ditch on its northern side with the spoil deposited along the line of the basic break of slope on the top of a crag edge. This is essentially an enhanced natural feature. From the base of the ditch, to the north, it is c2.5 metres high. At the north-east end it merges with the basic lie of the hill-side slope.

Feature number 58.6
NGR NY
Type Earthwork
Source Detail Survey
Condition Good
Dimensions 39m x 14m c5m height
Description

A substantial rampart to the north of ditch 58.19, extending between a natural high point of crag to the main hillfort entrance on the east side of the hill. The rampart is very well constructed and has a well-defined rounded profile of earthfast construction, with occasional sub-round and sub-angular stones protruding from its surface. The rampart consists of a natural break of slope which has been enhanced by the excavation of material, probably from its western side. There is a very substantial hollow in that area which potentially was the quarry for this rampart. However, the east side of the natural promontory has been cut back further reinforcing the defences at this point and it is possible that some of the quarried material was used in the construction of this rampart. From the base of the mire (58.4), the rampart is up to 8 metres high and is up to 3m high with respect to the ditch on its west side; as such it is a massive defensive rampart. At the southern end the rampart merges with the basic line of the slope and essentially continues along the line of rampart 58.5, which also merges into the line of the slope. At the northern end there is a dramatic drop towards the entrance, allowing for the defence of this entrance.

Feature number 58.7
NGR NY 30000 18853
Type Earthwork/structure
Source Detail Survey
Condition Good
Dimensions 1.75m x 5m x 0.35m

Description

A small irregularly shaped structure; on the eastern side it comprises a well-defined, 'U' shaped bank (0.35m in height) of earthfast construction with occasional sub-rounded stones protruding. Extending from the southern arm of this bank is an ill-defined, discontinuous and non-prominent extension which leads up to a linear natural block which potentially is part of the same feature. The banks on the south-west side are relatively ill-defined and non-prominent. The interior of the feature is concave. The structure is located to the west of entrance 58.18 and is within the base of the quarry ditch for rampart 58.6. The combined feature, including the element of natural, has the appearance of a small, sub-rectangular structure and as such is the only one surviving within the hillfort.

Feature number 58.8
NGR NY 29980 18849
Type Natural house
Source Detail Survey
Dimensions 45m x 60m

Description

This is a substantial house on the shoulder of the hill; it is edged to the north by the crags of the bastion mound and by the ditch of rampart 6 to the east and steep craggy slopes to the west. The vegetation consists of grass and heather, and there are numerous small outcroppings of rock. The natural crags outcropping to the north rise 8.4m above the interior of the fort, and debris, from silting and tumble at their base, has obscured some of its internal details. The significance of the area is that its western side is remarkably flat and level, and is edged to the south, by some small blocks of outcrops. It is one of the best areas within the whole hillfort for constructing a structure, and there is even the possibility that the ground has been artificially terraced in order to accommodate a structure.

Feature number 58.9
NGR NY 29972 18834
Type Natural terrace
Source Detail Survey
Condition Good
Dimensions 9.4m x 10.7m

Description

This is an area of gently sloping terrain, with a slope of $c50^\circ$; it is surrounded by crags and the line of a moderate slope to the east. Given that this natural terrace has a relatively gentle slope and that most of the other areas are rough, irregular and more strongly sloping there is the possibility that this could have been the location for a structure.

Feature number 58.10
NGR NY 29956 18833
Type Natural outcrop
Source Detail Survey
Condition Good
Dimensions 14m x 3.8m

Description

This is a natural terrace, on the west side of the hillfort; it is edged to the west by a crag edge, dropping down to the valley. The terrace is relatively small and narrow is edged to the east by a fairly sharp break of slope. The terrace is, however, clearly defined and it could potentially be an artificial feature. There is a possibility, therefore, that it was constructed as a terraced platform for a structure.

Feature number 58.11
NGR NY 30007 18869
Type Earthwork
Source Detail Survey
Condition Good
Dimensions 23m x 11.5m

Description

This is a rampart built-up from material extracted from a quarry ditch to its west. The base of the rampart is short of the line of a crag to the east and there is a semi-terrace, albeit sloping, between the edge of the rampart and the natural crag at the edge of the hill fort. It is not as substantial as rampart 58.6, but it matches the overall height of rampart 58.6, reflecting that the ground is rising towards the north; consequently a greater proportion of the rampart is of natural origin. It is edged to the north by the line of a sheer crag and to the south by the main fort entrance.

Feature number 58.12
NGR NY 29988 18884
Type Elliptical mound and bank
Source Detail Survey
Condition Moderate
Dimensions 9m long, 0.3m-2m wide, 0.45m-1.0m high
Description

A prominent elliptical mound, with a well-defined bank extending north-west from it, and it appears to be a small section of rampart. The narrow bank runs across the line of the present path terminating at the dramatic drop to the fort on the south-west side. Both the oval mound and bank are very ill-defined and are clearly of artificial origin. This bank and a prominent break of slope to the north-east would have served to restrict the only feasible point of access onto the promontory and it is possible that this was a small rampart serving as a last defence of this high bastion. The present path almost certainly follows the line of the original route up because there are very few routes that can be followed onto this high part of the fort. This bank extends and merges into another break of slope that drops around and defines the east side of this bastion part of the hill. At the north-west side it is non-prominent, being no more than 0.25 metres high and approximately 0.3 to 0.4 wide. At its south-eastern extent it is up to about 1 metre high and up to about 2 metres wide.

Feature number 58.13
NGR NY 29987 18828
Type Artificial Terrace
Source Detail Survey
Condition Poor
Dimensions 4.6m x 3.8m
Description

A semi-circular level area, which is generally flat, but with a shallow concave surface. It is de-limited to the west, south and east by fairly prominent breaks of slopes and it would appear to be in part terraced into the slope. It is edged to the north by a rectilinear mound (58.14). A prominent bank separates this possible terraced area from one to the west (58.15). It is one of the best candidates on this substantial and predominantly natural surfaced mound, for a structure terrace; however, there is no definitive indication of any structural remains.

Feature number 58.14
NGR NY 29987 18881
Type Rectangular Structure ?
Source Detail Survey
Condition Moderate
Dimensions 3m x 2m
Description

A rectangular, well defined and prominent mound located to the north of the sub-circular terrace (58.13); it has a slight oval in the middle. There is a possibility that it is a decayed structure; however, it is fairly small being only 3m x 2m (height 0.5m) and would therefore have been too small to have been a domestic structure. The purpose of this possible structure is unknown.

Feature number 58.15
NGR NY 29980 18880
Type Terrace
Source Detail Survey

Condition Poor
Dimensions 7.5m x 2.8m
Description

At the western side of the large natural mound is a small rectilinear area, which has a relatively flat base; it is separated from artificial terrace 58.13 by a prominent, broad bank which may have had an anthropogenic origin. The area is too ill-defined to determine if the terrace had an artificial origin, but even if natural it may have accommodated a structure as it is one of the few level areas on top of this craggy knoll.

Feature number 58.16
NGR NY 29983 18885
Type Terrace
Source Detail Survey
Condition Poor
Dimensions 6.6m x 4.2m
Description

An area to the north-west of the knoll is edged to the north-west by a low bank, and has an upper terrace bank to the south and is edged to the north-east by the 58.12 putative rampart. Within this irregularly defined area the terrain is relatively flat and is large enough to have accommodated a small structure.

Feature number 58.17
NGR NY 29994 18849
Type Earthwork
Source Detail Survey
Condition Good
Dimensions 2.5m x 1.9m
Description

A shallow depression, up to 0.5 metres deep, of well-defined circular plan, located to the west of feature 58.7. This feature is earthfast with a concave base, which at the time of survey contained water. It is located at the bottom of the quarry ditch of rampart 58.6. Given that the ditch is an artificial feature and feature 17 is set into it, it has an artificial construction which post dates the ditch.

Feature number 58.18
NGR NY 30010 18859
Type Fort Entrance
Source Detail Survey
Condition Good
Dimensions Width of entrance: 1.50m
Description

This is the principle entrance to the hillfort and is situated on the east side of the fort. It consists of a very well-defined gap, which is defined on the north and south by the sharp slopes of ramparts of 58.6 and 58.11 as such it provides a very narrow and therefore defensible access route. It is approached from the east from an area of gentle sloping ground and is led along a slight spur leading out from the edge of the hillfort which could potentially have been an artificial slope; as such this provides the only realistic point of access to the site. The probable remains of an original access path are visible to the east of the entrance, which extends along an artificially constructed ramp; this which has been edged to the south by rock cut excavation of the 58.4 ditch and similarly to the north there is a rock cut hollow enhancing the ramp edge. This ramp is essentially a part of the original slope which has been excavated away on either side to leave a narrow ramped path. There is a prominent mound immediately adjacent to the entrance of the fort and this was either a constructed or excavated feature possibly in order to provide some impedance of movement directly in front of the entrance. In summary, the entrance is elaborately constructed with a ramp formed by the excavation on both sides.

Feature number 58.19
NGR NY 30003 18829 - 29964
Type Rock cut rampart ditch
Source Detail Survey
Condition Good

Dimensions 48m x 4.5m

Description

A ditch around the south-eastern exterior of the hillfort, which is surmounted by rampart 58.3 to the south-east and is edged by the crag to the west. The ditch is rock-cut, but the cut line to the south has been obscured by the southern section of rampart. The ditch varies in depth from 0.35m-1.15m, and has an irregular and largely earthfast base. The ditch leads into the mire of 58.4 and there is a possibility that the area of mire is a filled in part of this rampart ditch.

APPENDIX 2

WYTHBURN LEAD MINES SITE GAZETTEER

WYTHBURN MINE SITES

Feature number 100.1
Site name Brownrigg Leat
NGR NY 3354 1512 - 3380 1505
Type Leat
Source McFadzean 1987
Condition Uncertain
Description
 Course of leat used to bring additional water to Mine Gill Beck from Brownrigg Well.

Feature number 100.2
Site name Arnison's Top Level
NGR NY 3316 1520
Type Adit
Source McFadzean 1987
Condition Drystone retaining walls and probable timber roof collapsed
Description Site of adit portal

Feature number 100.3
Site name Arnison's Top Level
NGR NY 3315 1518
Type Spoil heap
Source McFadzean 1987
Condition Uncertain
Description Spoil heap opposite (100.2)

Feature number 100.4
Site name Arnison's Level
NGR NY 3305 1513
Type Adit
Source Field survey; McFadzean 1987
Condition Collapsed; obscured by land slippage
Description Site of adit portal

Feature number 100.5
Site name Arnison's Level
NGR NY 3304 1510
Type Spoil heap
Source Field survey; McFadzean 1987
Condition Stable
Description
 Flat-topped spoil heap, possibly forming a working platform at the adit entrance. It incorporates large angular fragments within the spoil.

Feature number 100.6
Site name Arnison's Level

NGR NY 3306 1512
Type Trackway
Source Field survey; McFadzean 1987
Condition Stable
Description

A narrow linear depression meandering from the top of the spoil tip (100.5) down slope on the eastern side.

Feature number 100.7
Site name Arnison's Level
NGR NY 3303 1506
Type Revetment wall
Source Field survey; McFadzean 1987
Condition Relatively stable
Description

A revetment wall, measuring approximately 3m wide x 1m high, retaining the foot of the spoil heap (100.5).

Feature number 100.8
Site name Arnison's Level
NGR NY 33025 15056
Type Open stope?
Source Field survey; McFadzean 1987
Condition Choked with scree
Description

A small depression, measuring approximately 1m x 1m, in the scree below spoil heap (100.5).

Feature number 100.9
Site name No.1 (High) Level
NGR NY 3301 15025
Type Adit
Source Field survey; McFadzean 1987
Condition Original timber lintel roof has collapsed and the adit is now obscured by land slippage.
Description

External revetment walls stand to c 1m high on either side of the portal. The portal itself measures 1m wide and is of drystone construction and would formerly have been roofed by horizontal timbers. This method of construction suggests instability in the base rock.

Feature number 100.10
Site name No.1 (High) Level
NGR NY 33013 15024
Type Revetment
Source Field survey; McFadzean 1987
Condition Damaged by land slippage but otherwise stable
Description

A drystone revetment wall, measuring 2m in length by 0.8m high, was situated to the south of the adit portal .

Feature number 100.11
Site name No.1 (High) Level
NGR NY 3300 1501
Type Spoil tip
Source Field survey; McFadzean 1987
Condition Stable
Description

A flat-topped spoil heap, possibly forming a working platform at the adit entrance. There are large angular fragments within the spoil.

Feature number **100.12**
Site name No.1 (High) Level
NGR NY 3302 1501
Type Trackway
Source Field survey; McFadzean 1987
Condition Stable
Description

A slight, narrow depression meandering down the slope from the top of the spoil heap on the eastern side. It connects with (100.6).

Feature number **100.13**
Site name No.2 (Low) Level
NGR NY 3297 1497
Type Adit
Source Field survey; McFadzean 1987
Condition Probable timber lintel roof now collapsed; the portal is obscured by land slippage
Description Site of the adit portal

Feature number **100.14**
Site name No.2 (Low) Level
NGR NY 3297 1495
Type Spoil heap
Source Field survey; McFadzean 1987
Condition A major part is stable but significant damage has occurred on the eastern side due to the collapse of a culvert which carried the gill beneath the tip.

Description

A large flat-topped spoil heap extending from (100.13) across Mine Gill. The tip is likely to have acted as a bridge across the gill and may also have acted as a working area.

Feature number **100.15**
Site name No.2 (Low) Level
NGR NY 32986 14948
Type Culvert
Source Field survey
Condition Collapse of the culvert is causing damage to the east side of the spoil heap (100.14)
Description This is a presumed culvert beneath spoil heap tip (100.14).

Feature number **100.16**
Site name No.2 (Low) Level
NGR NY 32958 14974
Type Tramway
Source Field survey; McFadzean 1987
Condition The drystone revetment wall is now partly collapsed. There are no trace of sleepers or rails

Description

The remains of a tramway platform, which is revetted on the south side, running north-north-west from (100.13) to an ore chute (100.17).

Feature number **100.17**
Site name No.2 (Low) Level
NGR NY 32940 14967

Type Ore chute
Source Field survey; McFadzean 1987
Condition Stable
Description

An ore chute defined by a drystone revetment wall on the east side, which forms a stopped end to the tramway (100.16), and a curving revetment wall on the west. Its steeply inclined base is obscured though is likely to be of drystone construction.

Feature number 100.18
Site name No.2 (Low) Level
NGR NY 32940 14957
Type Ore bin
Source Field survey; McFadzean 1987
Condition There is considerable wall tumble internally. The north wall is partly overhanging, but otherwise stable.

Description

A rectangular building, measuring approximately 3.5m by 4m, situated immediately below an ore chute (100.17) and to the rear of the drum house (100.19). There is a raised platform, measuring 1.5m x 2m, in the north-east corner which is of unknown function.

Feature number 100.19
Site name No.2 (Low) Level
NGR NY 32935 14955
Type Drum house
Source Field survey; McFadzean 1987
Condition Fairly stable

Description

A three sided drystone building, measuring 2.7m wide x 5.6m long x up to 4m high. It is aligned approximately north-east/south-west with the open fronted side connecting with the upper terminus of the incline plane (100.31). The north wall of the building extends an additional 3m south-westwards forming a revetment to the hillslope. Both the north and south walls of the building contain large bolts which would have been used to secure large timber sleepers for the axle mountings. Fragments of the sleepers survive on the floor of the building. A central opening in the north east wall, measuring approximately 1m square, was used to shovel ore from the ore bin to the north-east directly into tubs beneath the drum.

Feature number 100.20
Site name No.2 (Low) Level
NGR NY 32972 14967
Type Ore chute
Source Field survey; McFadzean 1987.
Condition Stable

Description

Revetment wall retaining spoil tip (100.14) and tramway (100.16) with an ore chute for the transfer of ore to the ore bin and grate house (100.21). The ore chute measures 6m long by 2m wide with a sloping drystone floor up to 1.3m deep. The associated revetment wall stands approximately 1.8m high.

Feature number 100.21
Site name No.2 (Low) Level
NGR NY 32965 14962
Type Ore bin and grate house
Source Field survey; McFadzean 1987
Condition Internal arrangement obscured by tumble. However, structures in the form of buried remains are likely to survive.

Description

Enclosed yard defined by (100.20) to the north and drystone walls to the south, east and west. The east wall is straight and revets the spoil tip (100.14). The west wall curves noticeably downslope to a short south wall. The

latter contains a portal with a large lintel and well-built side walls. Internally, the yard area is obscured by tumble and occasional timber and metal fragments (including fragments of zinc tubing used for mine ventilation), though a small platform (possible to house the grate), marked by a short section of revetment wall, can be discerned.

Feature number 100.22
Site name No.2 (Low) Level
NGR NY 32948 14951
Type Tramway
Source Field survey; McFadzean 1987
Condition South side of tramway now lost to land slippage.

Description
 The remains of linear platform, with revetment wall on north side, leading from the grate house portal (100.21) to the drum house (100.19). An iron rail and two timber sleepers survive in situ.

Feature number 100.23
NGR NY 33061500 3235 1457
Type Trackway
Source Field survey; McFadzean 1987
Condition Prominent feature now used by walkers.

Description
 The remains of a packhorse track on the east side of Mine Gill. Runs between No.2 (Low) Level and the base of the hillslope.

Feature number 100.24
Site name Mineshop and smithy
NGR NY 3289 1487
Type Building
Source Field survey; McFadzean 1987
Condition Fairly stable

Description
 The remains of a rectangular four-roomed building, measuring 17.8m in length x 5.1m in width, with 0.68m wide walls up to 2m high. It has three external entrances on the north side and a revetment wall retaining the hillslope on the south side. There is a 2m wide platform on the north side of the building for a trackway (100.23). A midden opposite the north west corner contains coal ash, nineteenth century glazed pot sherds and clay pipe stems. Collapse against internal face of west wall may indicate the location of a hearth. There is considerable internal rubble which may obscure other features. Protruding foundation stone near the easternmost entrance has both round and triangular shot holes suggesting that manual drilling with a weighted chisel (jumper) and mechanical drilling had been employed at the mine.

Feature number 100.25
Site name No.3 Level
NGR NY 32884 14907
Type Adit
Source Field survey; McFadzean 1987
Condition Collapsed

Description
 The site of an adit portal. Metalwork from the incline drum lies on the opposite bank of the beck.

Feature number 100.26
Site name No.3 Level
NGR NY 32877 14896
Type Spoil heap
Source Field survey; McFadzean 1987
Condition Fairly stable

Description	A small fan of spoil opposite (100.25).
Feature number	100.27
Site name	No.3 Level
NGR	NY 3287 1488 - 3269 1442
Type	Trackway
Source	Field survey; McFadzean 1987
Condition	Stable; used by walkers.
Description	The remains of a trackway leading from No.3 Level (100.25) and the mineshop (100.24).
Feature number	100.28
Site name	No.4 Level
NGR	NY 32686 14700
Type	Adit
Source	McFadzean 1987
Condition	Uncertain
Description	Site of adit.
Feature number	100.29
Site name	No.4 Level
NGR	NY 32679 14704
Type	Spoil heap
Source	McFadzean 1987
Condition	Uncertain
Description	Site of spoil heap opposite (100.28).
Feature number	100.30
Site name	No.4 Level
NGR	NY 3269 1442 - 3235 1456
Type	Trackway
Source	McFadzean 1987
Condition	Uncertain
Description	Trackway linking No.4 Level (100.28) with the main packhorse trackway (100.23).
Feature number	100.31
NGR	NY 3292 1494 - 3259 1478
Type	Incline
Source	Field survey; McFadzean 1987
Condition	The lower part is stable
Description	The remains of a self-acting incline plane running downslope from the drum house (100.19) to a bridge (100.32) across the Mine Gill Beck. The upper part has been severely eroded and is now difficult to discern. The lower part survives as a prominent earthwork embankment retained on the south side by a 2m high drystone revetment wall. Two separate tracks are discernible with the impression of sleepers and rails surviving as faint earthworks.
Feature number	100.32
NGR	NY 3259 14954
Type	Bridge
Source	Field survey; McFadzean 1987
Condition	Stable
Description	

A former incline bridge now surviving as two bridge abutments on either side of the Mine Gill Beck. Its form suggests a timber superstructure.

Feature number 100.33
NGR NY
Type Incline
Source Field survey; McFadzean 1987
Condition Stable
Description

The remains of the lower part of the inclined plane. It survives as a prominent cutting running downslope from the bridge (100.32) to the dressing mill.

WYTHBURN DRESSING MILL

Feature number 100.34
Site name Wythburn dressing mill
NGR NY 3254 1479
Type Dam
Source Field survey; McFadzean 1987
Condition Breached at south end which probably dates to the demolition of the dressing mill.
Description

A large prominent dam at the head of a narrow gully; it has been breached on its southern side. The outer walls are of drystone construction, with an earthen core; it has a steep external batter. A cast iron pipe protrudes from the dam to provide a supply for water turbine and would have extended to a leat/ledge (100.35) on the downstream side.

Feature number 100.35
Site name Wythburn dressing mill
NGR NY 3254 1479 - 3247 1476
Type High pressure water pipe (course of)
Source Field survey; McFadzean 1987
Condition Moderate
Description

A ledge extending down the southern side of Mine Gill Beck from the dam (100.34), and then extends onto the shoulder of the gully where it continues as a shallow gully. It terminates at the dressing mill. The ledge / gully supported a cast-iron pipe (now gone) supplying water for the dressing mill.

Feature number 100.36
Site name Wythburn dressing mill
NGR NY 32476 14732; 32475 14738; 32475 14743
Type Ore bins?
Source Field survey.
Condition Buried remains.
Description

Earthwork remains of three, 'U'-shaped ore bins, which are open on the western side. They are supplied by a tramway (100.37) extending along their tops.

Feature number 100.37
Site name Wythburn dressing mill
NGR NY 3248 1476
Type Tramway (course of)
Source Field survey.

Condition Moderate

Description

The course of a tramway running along a terrace (100.38) situated above and to the rear of the ore bins (100.36). The tramway is likely to have transported spoil to heaps situated to the north and south (100.43 and 46, respectively).

Feature number 100.38

Site name Wythburn dressing mill

NGR NY 3247 1478

Type Terrace

Source Field survey.

Condition Earthwork

Description A platform situated above and to the rear of the ore bins (100.36).

Feature number 100.39

Site name Wythburn dressing mill

NGR NY 3247 1473

Type Terrace

Source Field survey.

Condition Earthwork

Description A platform on which ore bins (100.36) are situated.

Feature number 100.40

Site name Wythburn dressing mill

NGR NY 32470 14759 - 32470 14727

Type Terrace

Source Field survey.

Condition Earthwork

Description

A platform, possibly retained by drystone wall on eastern side, situated below the ore bins (100.36). It was possibly connected with ore breaking/crushing.

Feature number 100.41

Site name Wythburn dressing mill

NGR NY 3246 1475 - 3246 1472

Type Terrace

Source Field survey.

Condition Earthwork

Description

A platform, possibly retained by drystone wall on the eastern side, situated below and to the west of (100.40). It was probably connected with ore breaking/crushing and includes two stone-filled depressions.

Feature number 100.42

Site name Wythburn dressing mill

NGR NY 32475 14765

Type Bridge (site of)

Source Field survey.

Condition No surviving remains.

Description

The site of a bridge, probably of timber construction, conveying tramway (100.37) northwards across Mine Gill Beck to spoil heap (100.43).

Feature number 100.43

Site name Wythburn dressing mill
NGR NY 3246 1478
Type Spoil heap
Source Field survey.
Condition Prominent earthwork
Description A large finger spoil heap on the north side of Mine Gill Beck.

Feature number 100.44

Site name Wythburn dressing mill
NGR NY 3248 1472
Type Bridge (site of)
Source Field survey.
Condition No surviving remains
Description

The site of a bridge, probably of timber construction, conveying tramway (100.37) southwards across Mine Gill Beck to spoil heap (100.46).

Feature number 100.45

Site name Wythburn dressing mill
NGR NY 3247 1471
Type Spoil heap
Source Field survey.
Condition Prominent earthwork.
Description

A finger spoil heap extending beyond the terminus of the incline plane (100.33). The foot of the spoil heap is retained by a short section of revetment wall (100.50).

Feature number 100.46

Site name Wythburn dressing mill
NGR NY 32479 14714 - 32472 14654
Type Tramway
Source Field survey.
Condition Earthwork
Description

A tramway running south of spoil heap (100.43). It was possibly connected to tramway (100.37).

Feature number 100.47

Site name Wythburn dressing mill
NGR NY 32461 14715 - 32473 14634
Type Trackway?
Source Field survey
Condition Earthwork.
Description

A tramway runs southwards from the foot of spoil heap (100.45).

Feature number 100.48

Site name Wythburn dressing mill
NGR NY 32474 14631
Type Powder-store
Source Field survey; McFadzean 1987
Condition Structurally sound.
Description

A small isolated single-storey building situated to the south of the dressing mill. The building, which is partly built into the hillslope, is of mortared random rubble construction with a slate roof. The entrance in the north side and a small window in the west side are original. Later modification has included the insertion of a small brick hearth with a section of cast iron pipe acting as a chimney.

Feature number 100.49
Site name Wythburn dressing mill
NGR NY 32452 14710
Type Building? (Site of)
Source Field survey
Condition Earthwork.
Description A possible rectangular building platform.

Feature number 100.50
Site name Wythburn dressing mill
NGR NY 32464 14710
Type Revetment wall
Source Field survey
Condition Stable.
Description A short section of retaining wall at the foot of spoil heap (100.45)

Feature number 100.51
Site name Wythburn dressing mill
NGR NY 32470 14711
Type Revetment wall
Source Field survey
Condition Stable.
Description A short section of wall protruding from lower south side of spoil heap (100.45).

Feature number 100.52
Site name Wythburn dressing mill
NGR NY 3244 1474
Type Building (Site of)
Source Field survey
Condition Traces (post holes) may survive as buried remains.
Description Dressing mill. The superstructure probably comprised corrugated iron on a timber frame. It was demolished in 1880.

Feature number 100.53
Site name Wythburn dressing mill
NGR NY 32449 14744
Type Wash kiln
Source Field survey
Condition Stable; may have been excavated/cleaned out in recent times
Description

A 'U'-shaped stone-built feature, with evidence of water supply. There was pea-sized gravel waste opposite the open west end. It is related to the washing of crushed ore. Adjacent structures may have included trommels and jiggers.

Feature number 100.54
Site name Wythburn dressing mill
NGR NY 32444 14737
Type Timbers
Source Field survey
Condition Part buried
Description

This comprises Exposed timberwork, but its function is unknown. It was possibly related to machinery, such as trommels and jiggers, and/or a water supply for the site.

Feature number	100.55
Site name	Wythburn dressing mill
NGR	NY 32442 14748
Type	Revetment wall
Source	Field survey
Condition	Stable
Description	A revetment wall retaining a terrace within the dressing mill building.

Feature number	100.56
Site name	Wythburn dressing mill
NGR	NY 32443 14740
Type	Cast iron pipe
Source	Field survey
Condition	Good
Description	A high pressure water pipe protruding from wall (100.55). It may have powered a water turbine.

Feature number	100.57
Site name	Wythburn dressing mill
NGR	NY 32440 14744
Type	Dressing waste
Source	Field survey
Condition	Scattered deposit
Description	Deposit of fine grained dressing waste west of (100.55).

Feature number	100.58
Site name	Wythburn dressing mill
NGR	NY 32441 14735
Type	Revetment wall
Source	Field survey
Condition	Stable
Description	A short section of revetment wall retaining the upper terrace of the dressing mill building.

Feature number	100.59
Site name	Wythburn dressing mill
NGR	NY 3242 1474
Type	Spoil tip
Source	Field survey
Condition	Earthwork
Description	A large flat-topped spoil tip situated on the west side of the dressing mill (100.49). It consists of dressing waste.

Feature number	100.60
Site name	Wythburn dressing mill
NGR	NY 32446 14767
Type	Bridge
Source	Field survey
Condition	Good
Description	

A modern timber footbridge on the north side of the dressing mill. The stone-built abutments are likely to be contemporary with the dressing mill.

Feature number 100.61
Site name Wythburn dressing mill
NGR NY 32442 14728
Type Bridge
Source Field survey
Condition Good
Description

A modern timber footbridge on the south side of the dressing mill. The stone-built abutments are likely to be contemporary with the dressing mill.

Feature number 100.62
Site name Wythburn dressing mill
NGR NY 3243 1472 -3243 1480
Type Trackway
Source Field survey
Condition Earthwork.
Description

A trackway running north/south across the western end of the site. It continues beyond bridges (100.60) and (100.61). It may be contemporary with the dressing mill.

Feature number 100.63
Site name Wythburn dressing mill
NGR NY 32421 14764
Type Bridge
Source Field survey
Condition Stable
Description

Stone-built abutments for a road bridge.

Feature number 100.64
Site name Wythburn dressing mill
NGR NY 32451 14730
Type Trackway
Source Field survey
Condition Earthwork
Description

A possible trackway running east/west between the dressing mill and the crushing area.

Feature number 100.65
Site name Wythburn
NGR NY 3230 1479
Type Waterworks
Source Field survey
Condition Stable
Description

Water treatment features built after the closure of the mines. The structures include settling tanks, valves and water pipes.

Feature number 100.66
Site name Wythburn dressing mill
NGR NY 32442 14811

Type Finger Spoil Heap

Source Field survey

Condition Stable

Description

Finger spoil heap supplied by a track leading from the mill ore bins. The upper surface of the mound is level, but drops substantially to the west.

APPENDIX 3 PROJECT DESIGN

Lancaster
University
Archaeological
Unit

January 1998

SURVEY OF SHOULTHWAITE HILLFORT AND WYTHBURN LEAD MINES ON THE NORTH WEST WATER THIRLMERE ESTATE, CUMBRIA

ARCHAEOLOGICAL DETAIL SURVEY

PROJECT SPECIFICATION

Proposals

The following project design is offered in response to a verbal brief from the Lake District National Park Authority. The proposed project involves a programme of survey to provide a detail survey of two sites within North-West Water's Thirlmere Estate. The purpose of the survey is to enhance the existing archaeological information contained in North-West Water's Thirlmere Estate Integrated Land Use and Management Plan.

1. INTRODUCTION

- 1.1 The North West Water estate of Thirlmere, Cumbria, is wholly contained within the Lake District National Park. It is a largely upland landscape centred around the Thirlmere Reservoir. Such Cumbrian upland landscapes have considerable potential for preserved evidence of prehistoric activity, particularly from the Bronze Age, but also contain numerous other remains including Romano-British, medieval and post medieval.
- 1.2 The estate has been surveyed previously by the Lancaster University Archaeological Unit (LUAU 1997), which recorded 358 monuments, including a hillfort at Shoulthwaite Gill and an extensive lead mining complex at Wythburn, at the foot of Helvellyn. The proposed programme of detailed survey would increase our knowledge of the historical content and significance of these individual landscapes.
- 1.3 The LUAU has considerable experience of the survey of upland sites of all periods, having undertaken a great number of small and large scale projects during the past 15 years. LUAU and all its members of staff operate subject to the Institute of Field Archaeologists (IFA) Code of Conduct.
- 1.4 LUAU has undertaken a large number of upland landscape surveys for a variety of clients (both private and national agencies such as English Heritage and RCHM(E)) and employs a qualified surveyor (James Quartermaine, BA, DipSurv, MIFA) who has many years experience of the identification and survey of upland landscapes, having worked closely with the Royal Commission on the Historical Monuments of England and the Lake District National Park on a number of projects. Surveys of similar lead mining complexes to that at Wythburn include the Rimington lead mines, nr Clitheroe, the Snailbeach lead mines in Shropshire, the Gunnerside Gill lead mines of Swaledale, the Grassington lead mines of Wharfedale and the Nenthead mines, near Alston, Cumbria
- 1.5 The following project design specification sets out the objectives of the project, provides a methods statement demonstrating how these can be met, defines the resource implications of the methods statement and links these to a timetable and costings for the second season of field work. Details of quality standards and monitoring procedures are also included.

2. OBJECTIVES

- 2.1 The primary purpose of the project is to inform future management decisions with regard to conservation matters relating to the archaeological and historical content of the estate's landscape. The aims of the project are as follows:
- a) to gather sufficient information to establish the location, extent, character, period, condition, fragility and potential of the archaeological landscapes of Wythburn and Shoulthwaite Gill Hillfort.
 - b) to provide a basis for detailed management prescriptions by the National Park Archaeologist;
 - c) to provide information for display and interpretation.
- 2.2 The following programme has been designed to provide an accurate archaeological survey of the two Thirlmere sites within the broader context of the Thirlmere Estate and the national context.

3. METHODS STATEMENT

3.1 DETAIL SURVEY

- 3.1.1 The survey will involve the detailed mapping of the Shoulthwaite Hillfort and the Wythburn lead mine complex.
- 3.1.2 **Shoulthwaite Hillfort:** It is proposed to undertake a level 3 survey (see LUAU survey levels, Appendix 1) of the study area (see attached map), which is equivalent to an RCHM(E) level 3. This will involve the survey of the hillfort earthworks and the recording of considerable topographic detail around the summit of the hill to put the archaeological detail in context. Additional topographic detail will be abstracted from OS topographic detail provided under licence by LDNPA.
- 3.1.3 **Wythburn Lead Mines:** The survey will involve the provision of a level 2b detailed survey (see LUAU levels, Appendix 1) around the processing area, and including the lower, western part of the inclined plane. The survey of the processing area will incorporate considerable topographic detail to set the context for the site. The rest of the inclined plane, dam and extraction areas will be recorded in outline using GPS equipment and will be superimposed onto digital OS topographic detail provided under licence by LDNPA.
- 3.1.4 **Methodology:** Survey control will be established over both sites by closed traverse and internally will be accurate to $\pm 15\text{mm}$; the control network will be located onto the Ordnance Survey National Grid by the use of Global Positioning Survey (GPS), which will locate to an accuracy of $\pm 1\text{m}$.
- 3.1.5 The surface features will be surveyed by EDM tacheometry using a total station linked to a data logger, the accuracy of detail generation will be appropriate for a 1:200 output. The digital data is transferred onto a portable computer for manipulation and transfer to other digital or hard mediums. Although the survey data will include altitude information this will not be used for the production of the level 2b survey. Film plots will be output via a plotter. The archaeological detail is drawn up in the field as a dimensioned drawing on the plots with respect to survey markers. Most topographic detail is also surveyed, particularly if it is archaeologically significant or is in the vicinity of archaeological features. The survey drawings will be generated within a CAD system and can be output at any scale. The survey would be plotted as wet ink drawings on stable polyester film sheets.
- 3.1.6 In conjunction with the archaeological survey a photographic archive will be generated, which will record significant features and general landscapes.
- 3.1.7 The survey would be accompanied by a gazetteer description of individual archaeological features, which will relate directly to the survey mapping. This stage of the survey will involve a detailed assessment of the sites and their general context. The analysis for Wythburn will be undertaken by an experienced industrial archaeologist.
- 3.1.8 The most expedient method of generating the outline survey of the eastern part of the Wythburn extraction site is by the use of a satellite Global Positioning System (GPS). This uses electronic distance measurement along radio frequencies to satellites to enable a positional fix in latitude and longitude which can be converted mathematically to Ordnance Survey national grid, it is accurate to $\pm 1\text{m}$. Additional survey detail would be obtained by manual survey and the production of detailed dimensioned sketches at the time of the survey.
- 3.1.9 The results from both total station and GPS survey will be translated into a CAD system to facilitate the generation of survey drawings. This dispenses with the manual production of drawings and considerably increases the efficiency of the preparation of completed drawings, as well as enhancing the flexibility of map output.
- 3.1.10 Each monument or feature of the site will be recorded on pro-forma sheets on which will be recorded details of location, extent, period, character, condition, size and description. .
- 3.1.11 **Digital Output:** The survey data will be output as a DXF file, but also outline polygonalised data will be incorporated into MapInfo format for incorporation into the LDNPA GIS.

3.2 THE ARCHIVE

- 3.2.1 The results of the fieldwork will form the basis of a full archive to professional standards, in accordance with current English Heritage guidelines (The Management of Archaeological Projects, 2nd edition, 1991) and in line with the recommendations made in section 9 of the Project Brief. The project archive represents the collation and indexing of all the data and material gathered during the course of the project. The deposition of a properly ordered and indexed project archive in an appropriate repository is considered an essential and integral element of all archaeological project by the IFA in that organisation's code of conduct. LUAU conforms to best practice in the preparation of project archives for long-term storage. The expense of preparing such an archive is part of the project cost, but only represents a very small proportion of the total. This archive will be provided in the English Heritage Central Archaeological Services format, both as a printed document and on 3.5" disks as ASCII files, if appropriate. Digital survey data will be provided in a suitable format for incorporation into the GIS's of the Lake District National Park Authority and North West Water Ltd.
- 3.2.2 A synopsis (normally the index to the archive and the report) should be placed in the Cumbria Sites and Monuments Record. A similar synopsis will be prepared for North West Water Ltd. The entire archive will be deposited with the Lake District National Park Authority. It is normal LUAU practice to make a copy of the archive available for deposition with the National Archaeological Record in London. Three security copies of the archive will be made.
- 3.3 **REPORTING**
- 3.3.1 The final report will identify areas of defined archaeology. An assessment and statement of the actual and potential archaeological significance of the material within the broader context of regional and national archaeological priorities will be made. The potential for further archaeological fieldwork will be examined both in relation to individual sites and for the estate as a whole. The report will make a clear statement of the archaeological potential of the individual sites and will highlight any sites under threat where, if their significance requires it, measures to safeguard their integrity should be implemented. It will also indicate where any potential may exist for on-site interpretation and will identify and prioritise the need for any further work, including documentary research, or more detailed survey, either to establish the true significance of the site or as an aid to on-site interpretation.
- 3.3.2 The full report will consist of an acknowledgements statement, lists of contents, executive summary, introduction summarising the project design and any agreed departures from it, geomorphological and historical background, interpretative account of remains found, gazetteer of sites, assessment of potential (in accordance with The Management of Archaeological Projects, 2nd edition, 1991), list of archive contents and bibliography. Illustrative material will include location maps and plans, and photographs if appropriate.
- 3.3.3 Four bound and one unbound copy of the full report will be submitted to the Lake District National Park Authority. Each report will incorporate photographic illustrations.
- 3.3.4 The report is designed as a document for the specific use of the Client, for the particular Purpose as defined in the project brief and project design, and should be treated as such; it is not suitable for publication as an academic report, or otherwise, without amendment or revision. Any requirement to revise or reorder the material for submission or presentation to third parties beyond the project brief and project design, or for any other explicit purpose can be fulfilled, but will require separate discussion and funding.
4. **HEALTH AND SAFETY**
- 4.1 LUAU will provide copies of their written Health and Safety Statement on request. Risk assessments are carried out in advance of all projects. All site procedures are undertaken in accordance with the guidance set out in the Health and Safety Manual compiled by the Standing Conference of Archaeological Unit Managers (1991, revisions 1993). Training in mountain craft will be given to any member of staff on the project not experienced in working in upland landscapes.

5. RESOURCES

5.1 MANAGEMENT

- 5.1.1 The project will be under the project management of Jamie Quartermaine BA, DipSurv, MIFA (Project manager) to whom all correspondence should be addressed. He will monitor the progress of the project ensuring adherence to all agreed programmes and timetables. Jamie would lead the team providing technical back up, advice and would have editorial control over the compilation of the full report. He has many years experience of surveying upland landscapes, particularly in the Lake District and Yorkshire Dales National Parks.

5.2 FIELD TEAM

- 5.2.1 The survey team will consist of three members (a project officer, a supervisor and a site assistant). The survey will be under the supervision of Ian Scott, who undertook the majority of the detail survey work during the third season of the Haweswater surveys. Ian has worked for LUAU for a number of years and is an experienced archaeological surveyor, with a knowledge of upland site types through working on the Torver High Common survey and the Grassington lead mine survey.
- 5.2.2 The analysis of the site will be undertaken by Ian Hedley who has considerable experience of recording industrial monuments and the Lead industry in particular as part of the English Heritage Monument protection programme. He has also undertaken the survey and analysis of Gunnerside Gill lead mines.

6. TIMETABLE

The field work is scheduled to be completed before 1st April 1996.

6.1 FIELDWORK

- 6.1.1 **Shoulthwaite:**
3 days project Supervisor
3 days project Assistant

- 6.1.2 **Wythburn:**
2 days project Officer
6 days project Supervisor
6 days project Assistant

6.2 ARCHIVING AND REPORT

- 6.2.1 **Shoulthwaite:**
2.5 days CAD Illustrator
1 day Project Assistant (Gazetteer)
1.5 days Project Supervisor (Report production)
0.5 days Project Manager (Report production)

- 6.2.2 **Wythburn:**
4 days CAD Illustrator
2 days Project Assistant (Gazetteer)
0.5 days Project Supervisor (Report production)
3 days Project Officer (Report production)
0.5 days Project Manager (Report production)

APPENDIX 4

LEVELS OF ARCHAEOLOGICAL SURVEY RECORDING

This describes the types of survey appropriate for the various stages of archaeological evaluation undertaken in advance of development as practised by the Lancaster University Archaeological Unit. They are based on survey levels defined by the Royal Commission on the Historical Monuments of England (RCHM(E)) and are in accordance with stages of evaluation defined by the Association of County Archaeological Curators (ACAO 1993).

Level 1 Survey (Assessment)

This is a rapid level of survey (Site Inspection in project design) typically undertaken alongside a desk top study as part of the site assessment (ACAO 1993, 14). It is an initial site inspection which helps the local planning authority to consider fully the archaeological implications of a planning proposal and also serves as the basis for undertaking and planning further archaeological work on the site.

The Level 1 survey represents the minimum standard of record and is appropriate to exploratory survey aimed at the discovery of previously unrecorded sites. Its aim is to record the existence, location and extent of an archaeological site. The emphasis for the recording is on the written description which should record type and period and would not normally exceed c. 50 words.

The location and extent of the sites is typically shown on 1:2,500 or 1:10,000 OS maps as requested by the client. The extent of a site is only defined for sites greater than 50m in size and smaller sites are shown with a cross.

There are two alternative techniques (Levels 1a and 1b), which provide different accuracy levels and have different applications:

Level 1a

The sites are located by manual distance measurement techniques (eg pacing) with respect to field boundaries and provide an accuracy of +/- 10m (8 figure grid ref.). The loss of accuracy is offset by the slightly reduced costs; however, it is only appropriate for enclosed land, because of the paucity of usable topographic detail.

Level 1b

The sites are located using Global Positioning System (GPS) techniques, which uses electronic distance measurements along radio frequencies to satellites to enable a fix in Latitude and Longitude, which can be converted mathematically to Ordnance Survey National Grid. As long as differential GPS techniques are employed then it is possible to achieve accuracies of better than +/- 1m. There is a slightly increased cost implication by comparison with Level 1a survey, but it can be undertaken in most terrains, even some woodland.

Level 2 Survey (Evaluation)

Level 2 survey defines the extent of all surface archaeological features on site in relation to topographic elements (e.g. field walls) and accurately defines the extent of the overall archaeological site. It is produced in conjunction with a full objective and interpretative description of the features. The Level 2 survey defines an archaeological context for any trial excavations and shows the location of the trenches in relation to the surface features. This level is used to assess the archaeological significance of the site and serves as the basis, along with other evaluation techniques, for the submission of recommendations to the District or County Planning Officer.

There are two sub-divisions of evaluation survey (2a and 2b), which define different levels of detail and complexity. The appropriate application of these levels depends on the extent of the survey areas, the complexity of the archaeological features and the requirements of the survey product.

Level 2 survey methodology

The difference between the two sub-levels (2a and 2b) is primarily in the density of raw data and the detail of the field draughting; and the basic survey methodology is essentially the same. The surveys are undertaken using Total Station survey equipment and are located either using Global Positioning Survey (GPS) techniques or by

traverse with respect to Ordnance Survey control. The internal accuracy is typically $\pm 0.05\text{m}$ but is located with respect to the OS National Grid to an accuracy of $\pm 1.0\text{m}$ or better.

The survey methodology is designed to enable ease of upgrading of the survey levels as required. All Level 2 survey methods rely upon a permanent survey control and the raw survey data is produced with sufficient accuracy to enable their re-use on more detailed drawings at higher scales than originally intended. Fundamental to this process is that all draughting is undertaken within a Computer Aided Draughting (CAD) environment, which retains the primary accuracy of the raw data and allows flexibility of enhancement. Upgrading from Level 2a to 2b will require the provision of additional raw survey data as well as the enhancement of field drawing, but the upgrading from Level 2b to 3 will only require drawing enhancement, in the field, with respect to the raw survey data.

Level 2a

This defines the most basic level of instrument survey and is appropriate for the recording of scattered, low complexity archaeological features, typically those found during an extensive open area survey. Archaeological features are defined in outline and earthworks are shown with only minimal hachure annotation. Topography is for the most part extracted from an OS base, although topographic detail in the vicinity of archaeological features is recorded by instrument survey. The raw survey data is typically captured with sufficient density to enable the mapping of the resource appropriate for a 1:500 or reduced scale output. A requirement to output at a greater scale, would involve the provision of additional survey data and enhanced recording. The record incorporates a basic level of textual description of individual features and an overall interpretative assessment of complete site groups.

Level 2b

This enhanced level of evaluation survey recording incorporates a relatively large quantity of raw survey data, which can define the extent and form of individual monuments in considerable detail. The detail of earthworks are defined in sufficient detail, to show the character and form of individual earthworks, but does not provide a full interpretative record. The local topography is recorded in greater detail, but also incorporates OS data where spatially remote from the archaeological features. The primary distinction between the Level 2b and Level 2c survey is in the intricacy of the detail draughting. The Level 2b recording is appropriate for an upgrade of a cairnfield survey, for example, but would be inappropriate for the recording of complex earthworks for which a Level 3 survey would be more appropriate. The level of detail would enable appropriate reproduction up to a scale of 1:250. An upgrade from a Level 2b to a Level 2c survey would not need additional instrument survey data, but would require extensive field enhancement of the CAD record. This basic level of survey would typically be undertaken alongside trial excavation work as part of an evaluation (ACAO 1993). It can serve as a mitigation measure for smaller sites with poor surface survival and should be applied where sites of limited significance are under threat.

Level 3 Survey (Detailed Recording)

This is the most detailed level of purely interpretative survey and is equivalent to the RCHM(E) Level 3 survey. It involves very detailed interpretative hachure draughting of surface features and is intended for output at scales of up to 1:50. Because of the intricacy of detailed draughting it is inappropriate for large scale generalised mapping but instead is typically applied to the recording of complex earthworks, which involve considerable spatial analysis. Textually the relationship between individual features is contextually assessed and provides for detailed, internal analysis of a complex site. This is undertaken in addition to the description and overall assessment appropriate for the Level 2a survey.

Surveys undertaken at Level 3 from the outset involve the use of similar basic instrument methodologies as the Level 2b survey, although the draughting is more detailed and analytical. However, if a Level 3 survey is produced by upgrading a level 2b survey, then it is typically possible to use manual field survey techniques to enable the graphic enhancement of the more basic survey. An upgraded Level 3 survey is generally depicted on separate layers from the original Level 2b survey to enable subsequent more generalised output at lower scales if required. The design of the Level 3 survey is designed to be enhanced by the provision of contour detail into a Level 4 surface modelled survey. Subject to the requirements of the ACAO, the Level 3 survey can serve as a mitigative record for intermediary graded monuments.

Level 4 Survey (Comprehensive Recording)

Level 4 survey is a comprehensive record of the archaeological features in relation to the surface topography. It incorporates an interpretative hachure survey alongside a full computer generated model of the ground surface enacted when a full survey is needed in conjunction with excavations or in cases where detailed survey of fragile upstanding earthworks is the only appropriate mitigative measure.

The Level 4 survey is designed to record the archaeological site as fully as current technology will allow and is the appropriate mitigation response where significant sites are threatened with destruction. It is applied selectively to sites of particular importance and which have a good survival of surface features.

It is generated by the provision of additional survey data to the Level 2 or 3 surveys and is of an equivalent level of accuracy ($\pm 0.05\text{m}$). In many cases only a relatively limited amount of additional data is required to upgrade the Level 2 survey to the full surface modelled Level 4 and therefore this can be an economic recording option.

The Level 4 survey output is generated on CAD which maintains the original accuracy of the survey data and allows flexibility of drawing output at any scale. The drawing file will record the contour detail at different height separations and the final survey drawings can therefore be tailored to meet any requirements of the client.

ILLUSTRATIONS

- Fig 1 Thirlmere Estate Location Plan
- Fig 2 Study Area Location Plan
- Fig 3 Shoulthwaite Hillfort Environs
- Fig 4 Shoulthwaite Hillfort Detail Map
- Fig 5 Wythburn Mine Environs
- Fig 6 Wythburn Mining Area
- Fig 7 Wythburn Mine Western Area
- Fig 8 Wythburn Mine Ore Processing Area
- Fig 9 Schematic example of an ore processing mill at Frongoch Mill, Wales (after Hunt 1887)
- Fig 10 Shoulthwaite Fort: rampart 58.6 and quarry ditch from north
- Fig 11 Wythburn Ore Processing Area from north-east

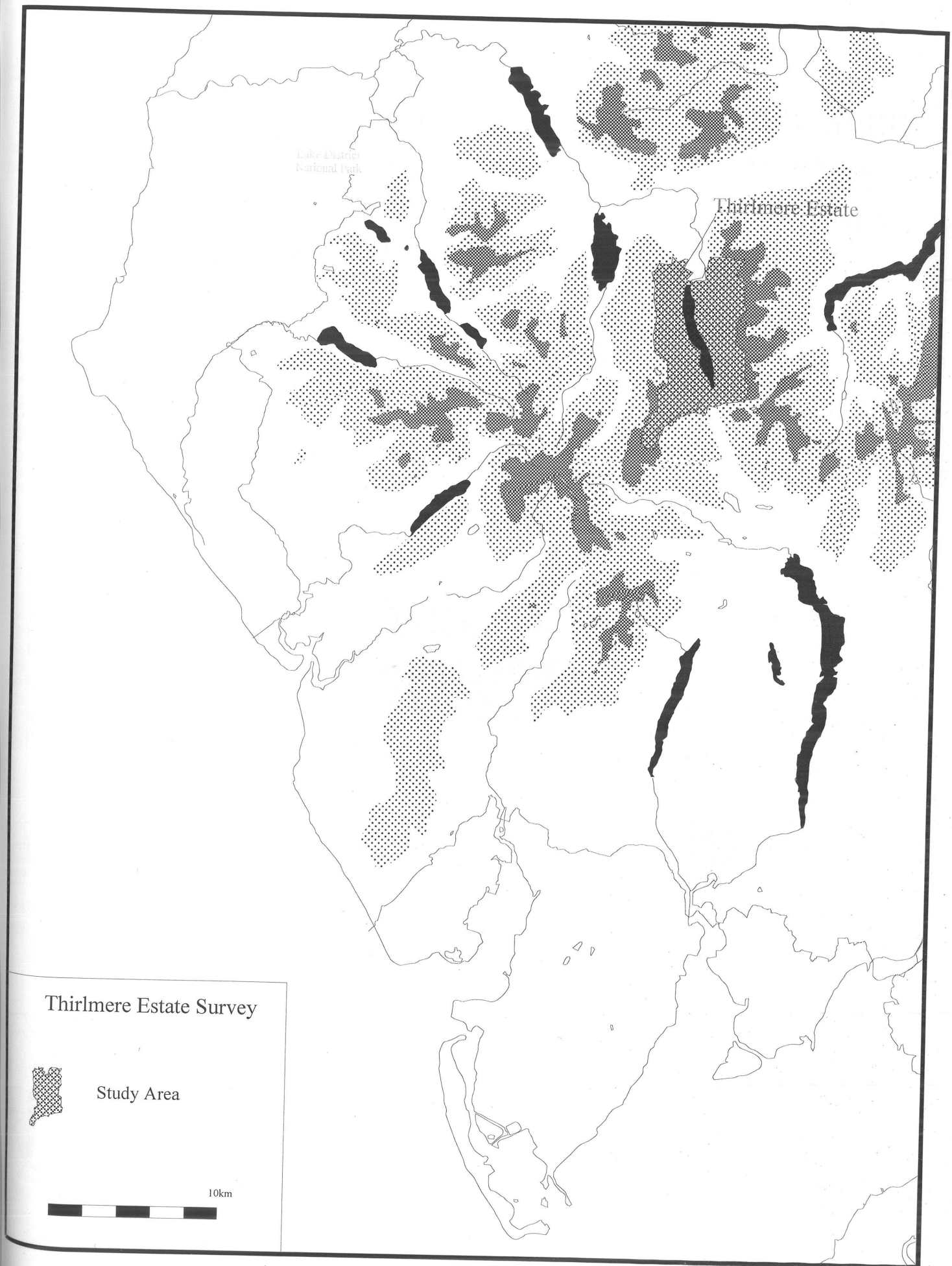


Fig. 1 Thirlmere Estate Location Plan

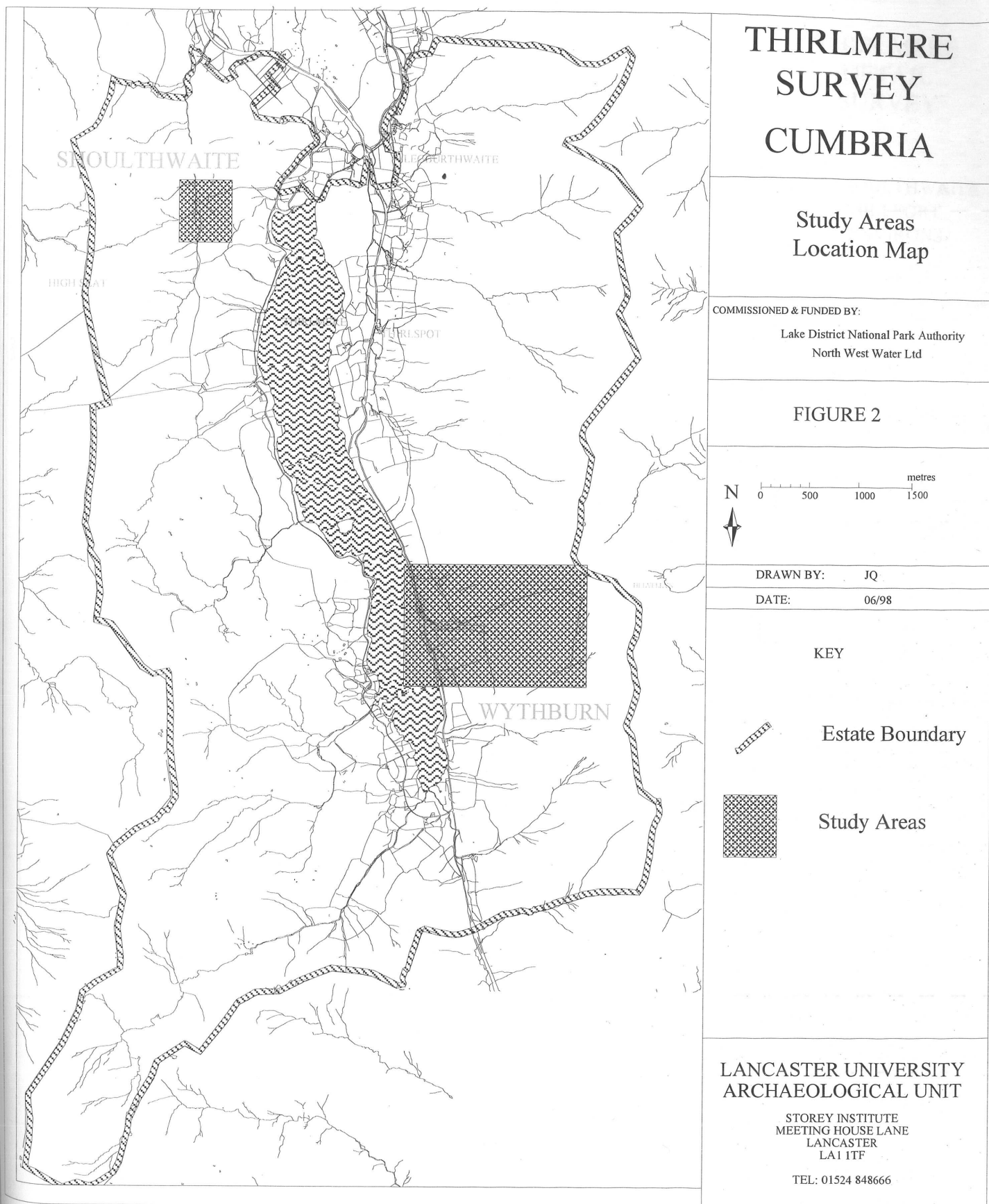
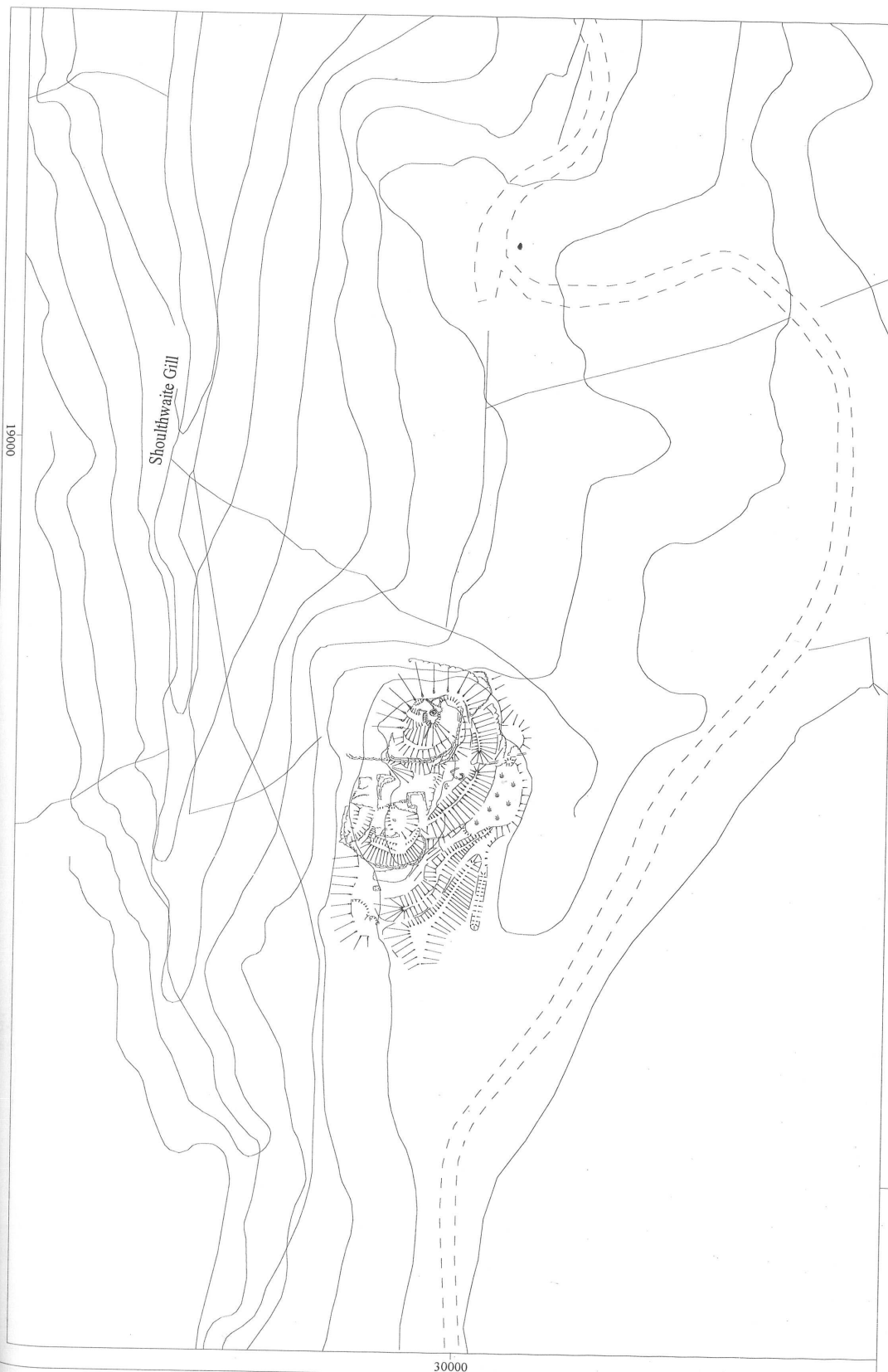


Fig 2 Study Areas Location Map



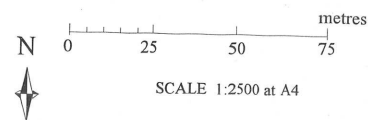
THIRLMERE DETAIL SURVEY

SHOULTHWAITE HILLFORT ENVIRONS

COMMISSIONED AND FUNDED BY:

Lake District National Park Authority
North West Water Ltd

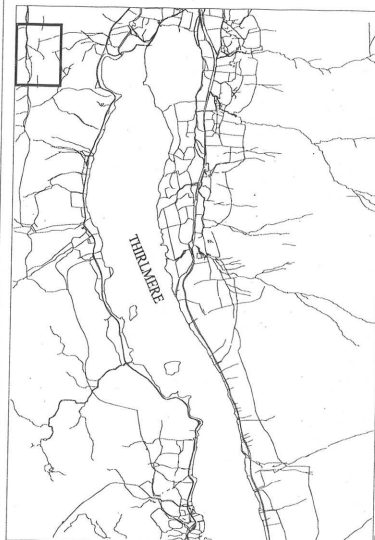
FIGURE 3



DRAWN BY: IS and JQ

DATE: 05/98

LOCATION:



LANCASTER UNIVERSITY
ARCHAEOLOGICAL UNIT

STOREY INSTITUTE
MEETING HOUSE LANE
LANCASTER
LA1 1TF

TEL: 01524 848666

Fig 3 Shoulthwaite Hillfort Environs

18600

18800

30000

THIRLMERE DETAIL SURVEY

SHOULTHWAITE HILLFORT DETAIL MAP

COMMISSIONED AND FUNDED BY:
Lake District National Park Authority
North West Water Ltd

FIGURE 4

metres
0 10 20 30

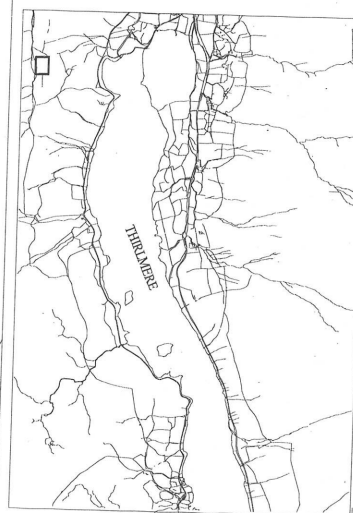


SCALE 1:500 AT A3

DRAWN BY: IS and JQ

DATE: 04/98

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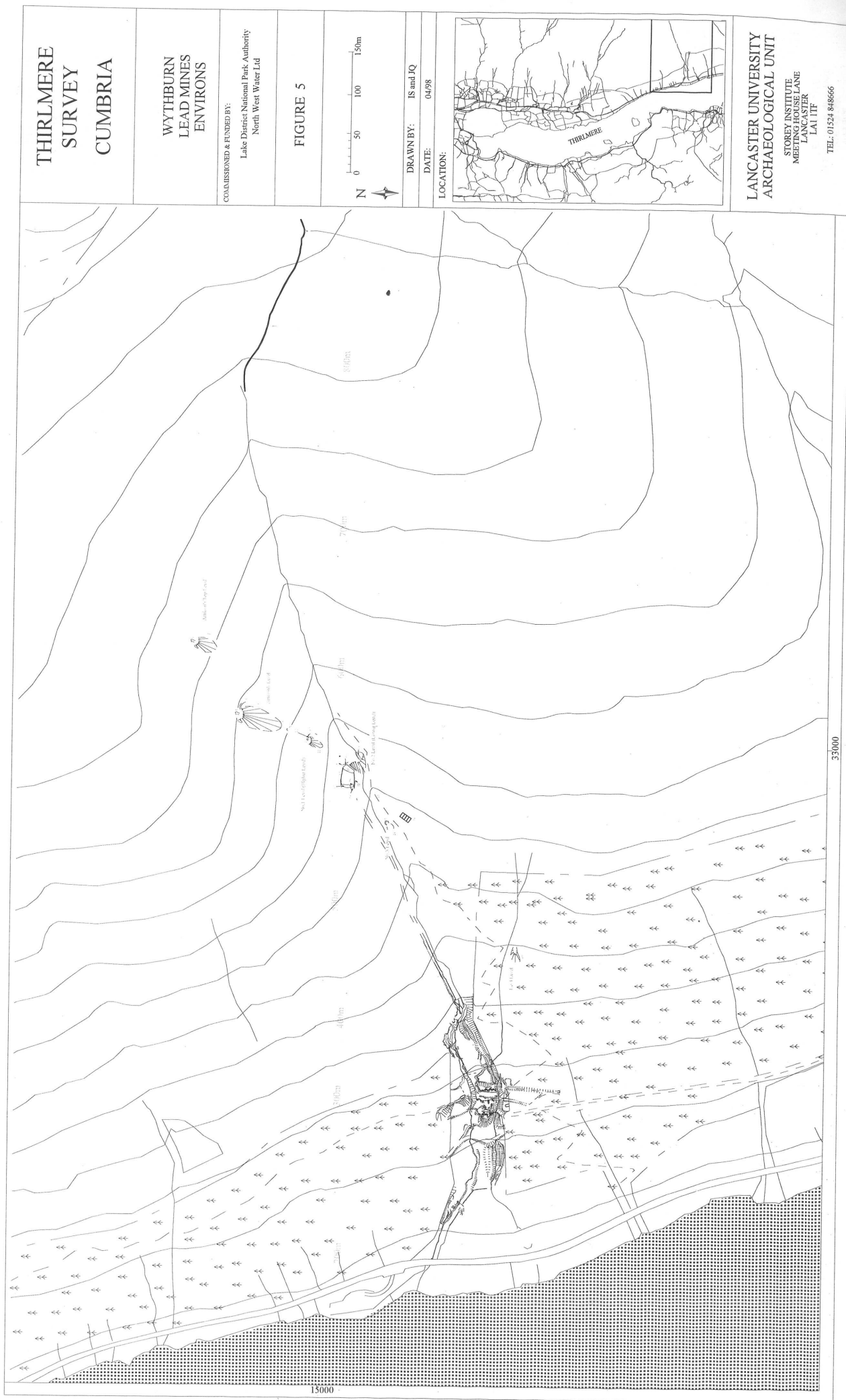


Fig 5 Wythburn Mine Environs

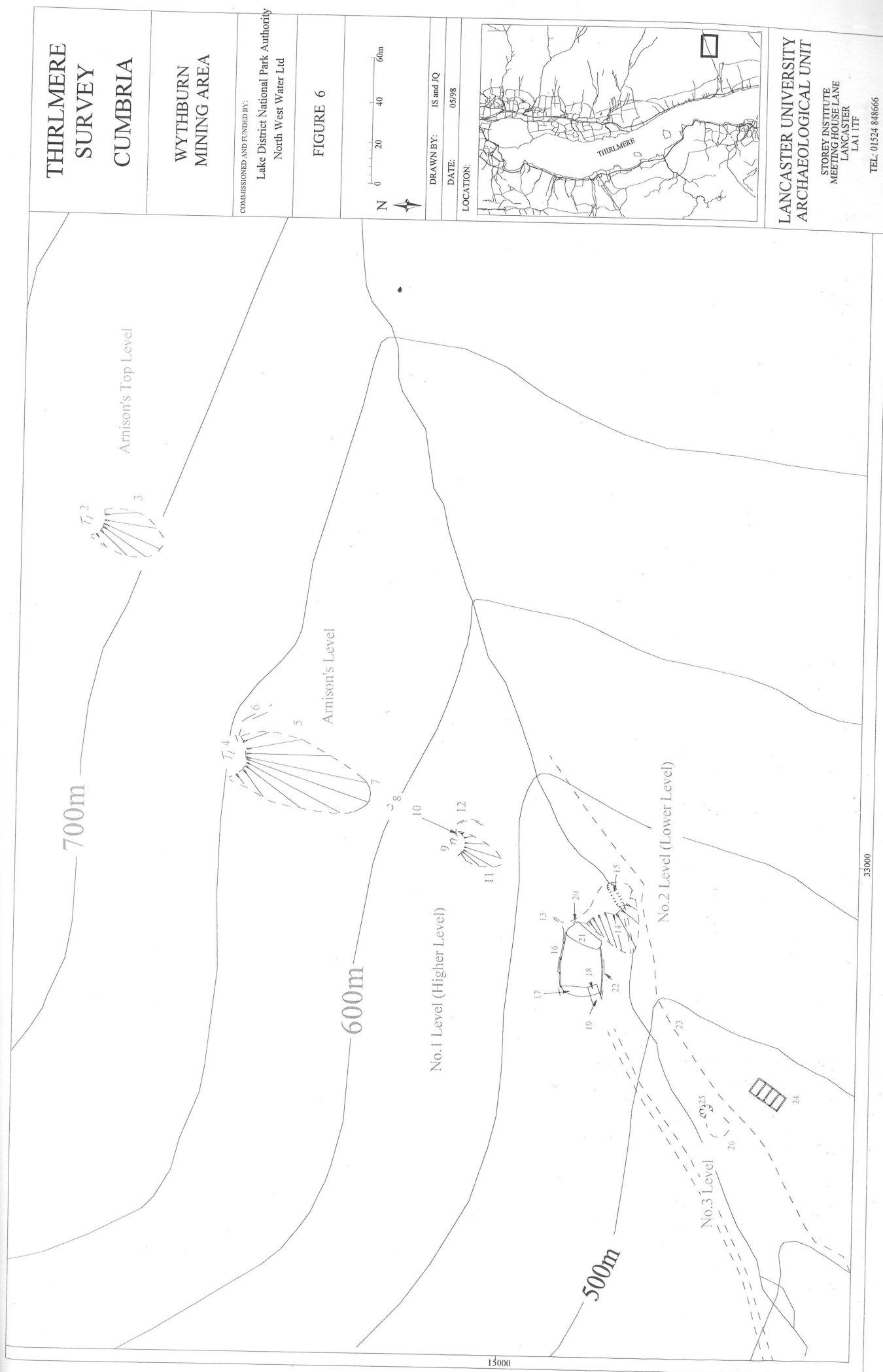


Fig 6 Wythburn Mining Area

THIRLMERE DETAIL SURVEY

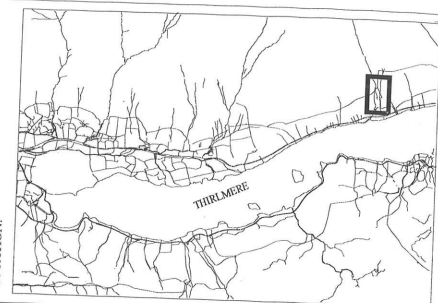
WYTHBURN
LEAD MINES
WESTERN AREA

COMMISSIONED AND FUNDED BY:
Lake District National Park Authority
North West Water Ltd

FIGURE 7



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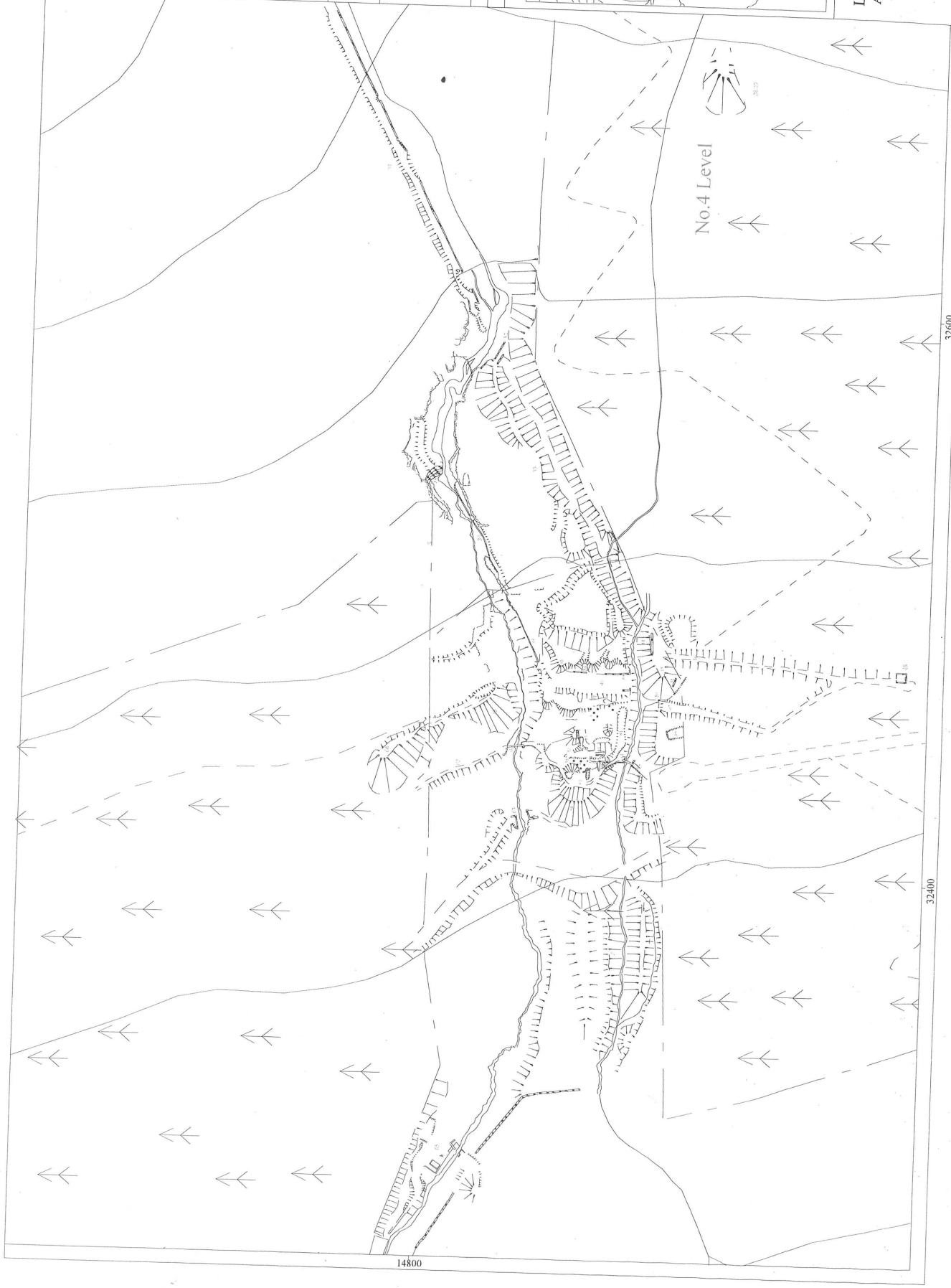


Fig 7 Wythburn Mine Western Area

THIRLMERE DETAIL SURVEY

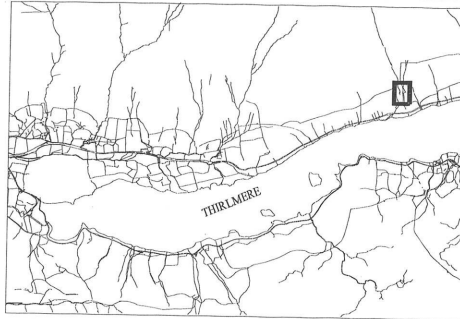
WYTHBURN
LEAD MINES
ORE PROCESSING AREA

COMMISSIONED AND FUNDED BY:
Lake District National Park Authority
North West Water Ltd

FIGURE 8



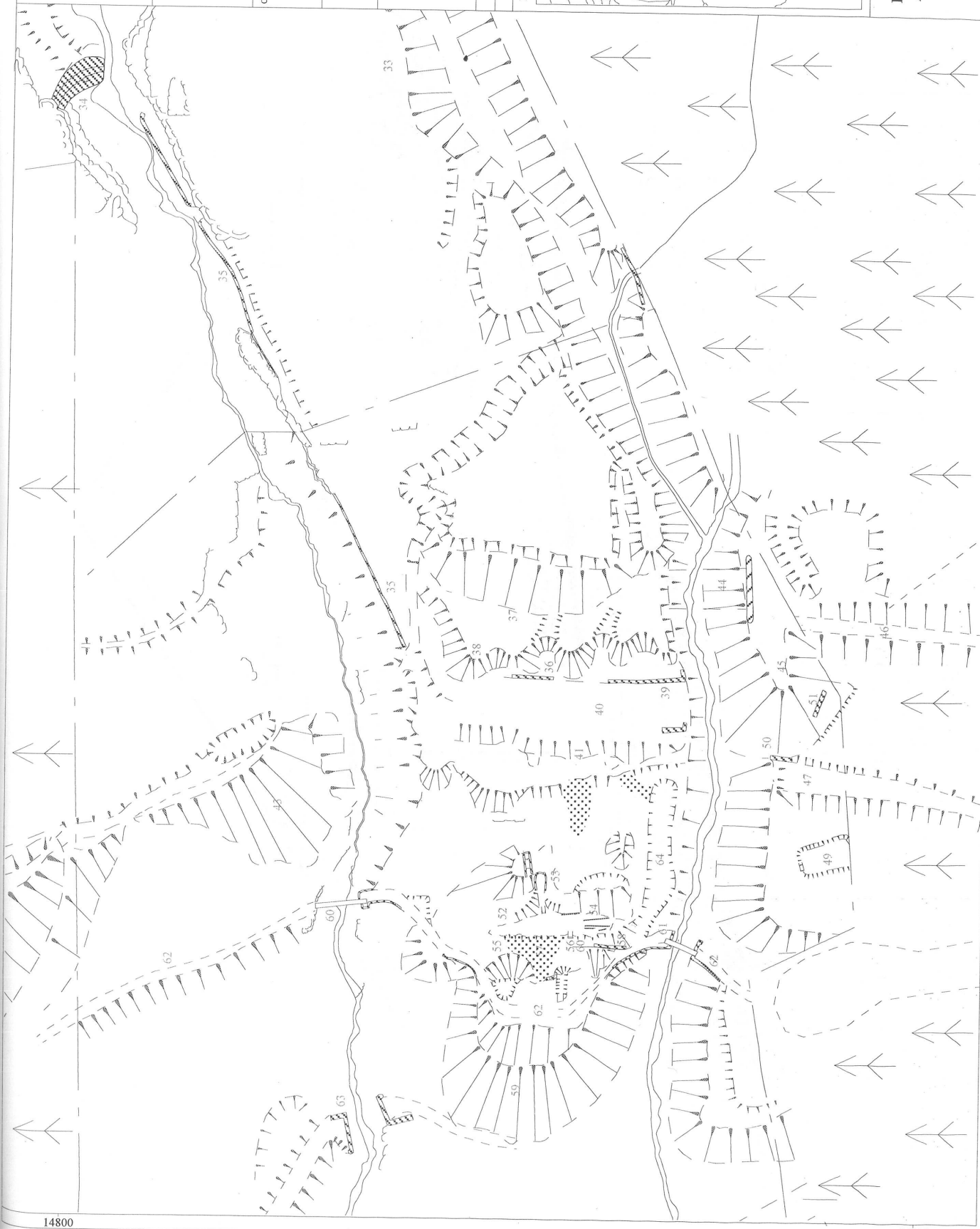
DRAWN BY: IS and JQ
DATE: 04/98
LOCATION:



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32500

Fig 8 Wythburn Mine Ore Processing Area

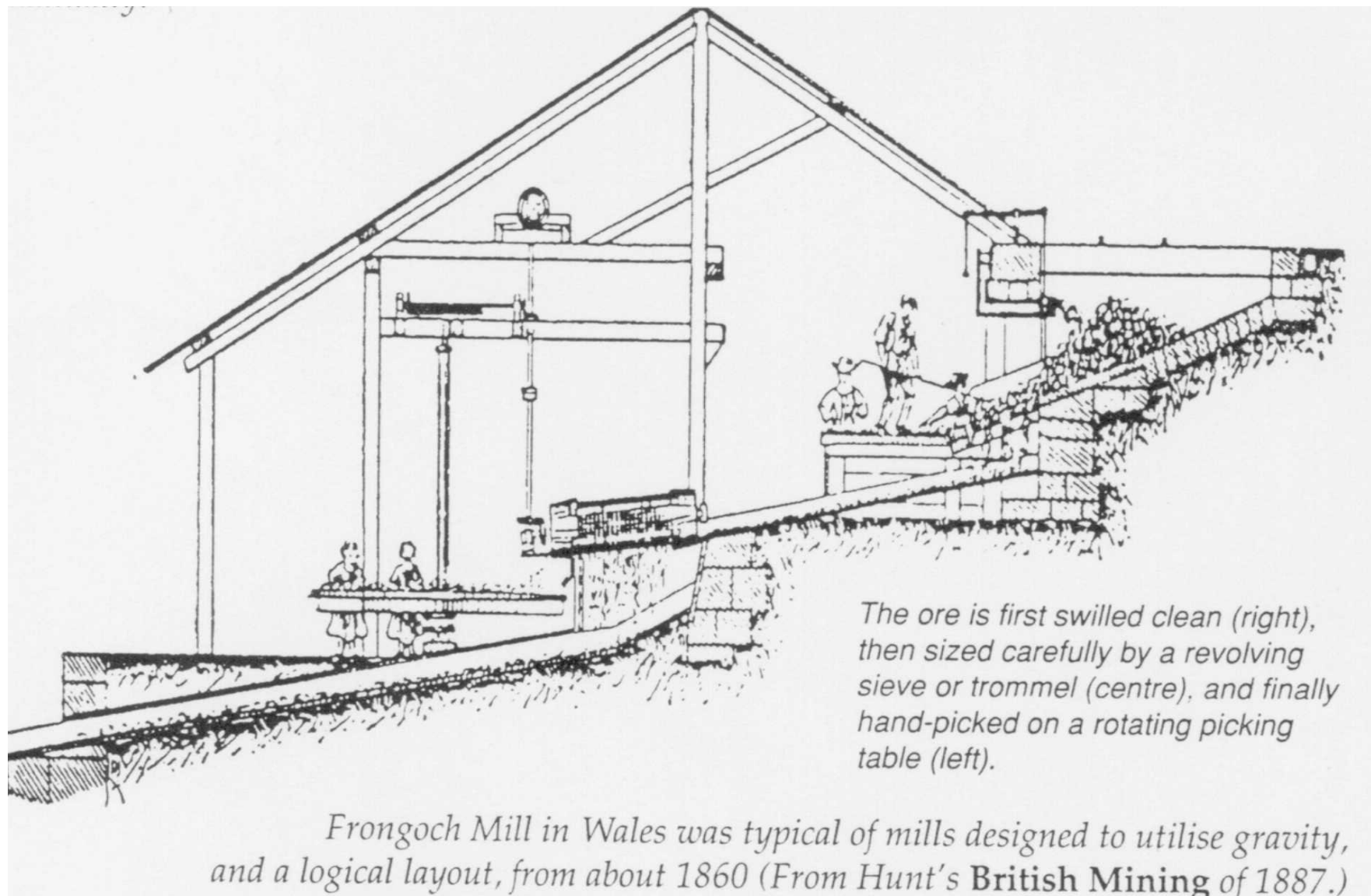


Fig 9 Schematic example of an ore processing mill at Grongoch Mill, Wales (after Hunt 1887)



Fig 10 Shoulthwaite Fort: Rampart 58.6 and quarry ditch from the north



Fig 11 Wythburn Ore Processing area from the north-east