Silverband Mine Brake House, Dufton Fell, Milburn, Cumbria

Built Heritage Assessment Report

On behalf of **Natural England Moor House National Nature Reserve**

Project Ref: 330201954 | Rev: A | Date: July 2022

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For and on behalf of Stantec UK Limited				

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Executive Summary

Stantec carried out a built heritage assessment of Silverband Mine Brake House, Milburn, Cumbria, England, NGR NY 6949 3070, on behalf of the Natural England Moor House National Nature Reserve (MHNNR) in March 2022. The works were carried out prior to the proposed conservation of the Brake House as part of a Conservation Management Plan being put together by Countryside Consultants of Alston. The Brake House and its associated aerial ropeway were built in 1939 to serve Silverband Mine, a former lead and barytes mine which operated intermittently from at least the 17th century until its final closure in 2006. Both the aerial ropeway and Brake House form part of a Scheduled Monument (NHLE 1021009), and as such are of national importance. The scheduling identifies the site as a rare example of a 20th century aerial ropeway, few of which now survive, and the site is identified as the best surviving example of an aerial ropeway used in a metal-mining context in England.

A full Historic England Level 2 survey of the Brake House and aerial ropeway was carried out. The survey identified that, although the ropeway had been damaged by attempts to salvage and remove it when the mine closed in 1964, and the Brake House had suffered through having lost its roof and having partially collapsed, sufficient evidence of its original form and function survived to be able to interpret the structure and provide an understanding of how it had functioned.

A complete archive of digital photographs from the survey will be deposited with Archaeological Data Services (ADS). This report and the archive are considered a complete record of the Brake House and aerial ropeway, and no further work is recommended prior to its conservation.

1 Introduction

1.1.1 This built heritage assessment has been carried out by Stantec in March 2022 prior to conservation works at Silverband Mine Brake House, Milburn, Cumbria, England, NGR NY 6949 3070 (Figure 1). The site forms part of the Moor House National Nature Reserve (MHNNR) managed by Natural England. The Brake House and its associated aerial ropeway were built to serve Silverband Mine, a former lead and barytes mine which operated intermittently from at least the 17th century until its final closure in 2006. Both the aerial ropeway and Brake House form part of the *Silverband mine aerial ropeway, brake house and inclined plane* Scheduled Monument (NHLE 1021009) and are described as follows:

"Despite being dismantled in the early 1960s, Silverband Mine aerial ropeway remains the best surviving example of an aerial ropeway used in a metal-mining context in England. Together with its associated brake house and the earlier inclined plane, the monument illustrates well two differing constructional and operational methods of moving mineral ore across a rugged and hostile natural environment between the mine and the ore processing plant.

The monument includes an approximately 1.75km length of Silverband mine aerial ropeway, an associated brake house, and the remains of an inclined plane located high on the south western slopes of Great Dun Fell. The aerial ropeway was used to transport ore from Silverband Mine at over 700m, down the steep fellside to the ore processing works at Milburn Grange approximately 5km away. Part of the earlier inclined plane, down which ore-filled trucks ran on rails, runs parallel to the aerial ropeway."

1.1.2 The MHNNR are currently proposing to conserve the Brake House and pylons as part of a Conservation Management Plan being put together by Countryside Consultants of Alston, Cumbria (Countryside Consultants *forthcoming*). The plan builds on an earlier phase of works carried out by Countryside Consultants for the conservation of a mine shop at the mine, which was also archaeologically recorded by this author in 2019 (NAA 2019). As part of the current proposed plan, Stantec have been requested to carry out a similar level of building recording on the Brake House to that carried out as part of the earlier phase, to ensure a permanent archive of the Brake House is made prior to the conservation works, for MHNNR's own records and for public benefit via deposition with the local Historic Environment Record. Whilst planning permission is not required, this approach fulfils Natural England's obligations under NPPF 2021 and the Ancient Monuments And Archaeological Areas Act 1979, and enables good heritage outcomes for the scheme.

1.1.3 This report presents the results of the assessment of the Brake House in accordance with the relevant standards and guidance as published by Historic England (2016) and the Chartered Institute for Archaeologists (CIfA 2014). The restoration works are limited to the Brake House only, but some general consideration of the aerial ropeway has been included for context. The inclined plane was examined but not considered as part of this report.

2 Background

2.1 Topography and Geology

2.1.1 The Silverband (or Silver Band, or Westmorland Silverband) mine workings lie 850m to the south-west of the summit of Great Dun Fell, Milburn, Cumbria (NGR NY 702 318, Figure 1), at 652m aOD. The mine workings occupy a broad yet gently sloping shelf, which steepens to the north as it rises towards Dun Fell, and south as it drops down into the valley below.

2.1.2 The aerial ropeway extends from the mine workings 1.28km south-westwards and downslope to the Silverband Brake House (NY 6949 3070). The Brake House sits on a further broad shelf overlooking the valley, at 525m aOD. From the Brake House the landscape drops away suddenly, down to 325m in just 750m. The aerial ropeway carried on for a further 2.75km

south-west from the Brake House to the village of Milburn, where it terminated at Milburn Grange (Plate 1).

2.1.3 Silverband was mined for lead, lead and barytes and later for barytes only; the geology of the mines at Silverband is described as '*lead, with massive and Crystallized Sulphate of Barytes, in Strata, from the Fire-stone to the bottom of the Great Lime-stone*' (Forster 1821, 317). The underlying bedrock geology at the Brake House is recorded as limestone, sandstone, siltstone, and mudstone of the Alston Formation. The superficial deposits overlying the bedrock are not recorded, but the site lies within 1.5km of peat deposits recorded to the north-east (BGS 2021) and similar superficial deposits would be anticipated here.

Plate 1: the Brake House during the survey, April 2022, facing south-west; the white building in the distance marks the position of the former terminus for the ropeway in Milburn

2.2 Historical Background

Silverband Mine

2.2.1 Mining is recorded at Silverband from the 16th century; though there is no reference to the mine specifically, there is a reference to the '*myndes of Knok and mylburnefell*' in an indenture by the late Earl of Cumberland to Christopher Bainbridge, dated around 1567 (Smith and Murphy 2011, 45).

2.2.2 From the mid-17th century, the mines were under the control of the Earl of Thanet (Smith and Murphy 2011, 45), and leased to a succession of small mining companies, with records of leases starting in September 1681. Lead ore was initially smelted at Bollihope smelt mill (near Frosterley, Weardale, Co. Durham) but from c. 1703 the lead ore was smelted at the Knock

smelt mill, 765m south of the Brake House and 1.9km south-east of the mine (NAA 2014), thought to have been built by the sixth Earl, Thomas Tufton (Murphy and Smith 1999, 106).

2.2.3 Throughout the 17th and 18th centuries, the mines continued to be worked, though the mines were occasionally idle for long periods and by the later 18th and early 19th century, only takenotes (in effect short leases) were being issued, which suggest the mines were in a state of flux and were struggling to provide enough to warrant individuals taking out the longer leases. Productivity improved between 1800 and 1821: records of duty paid from the mines of Dufton Fell, Dun Fell, Silverband and Hilton indicate that they produced around 1500 bings[1] of lead per annum (Forster 1821, 420).

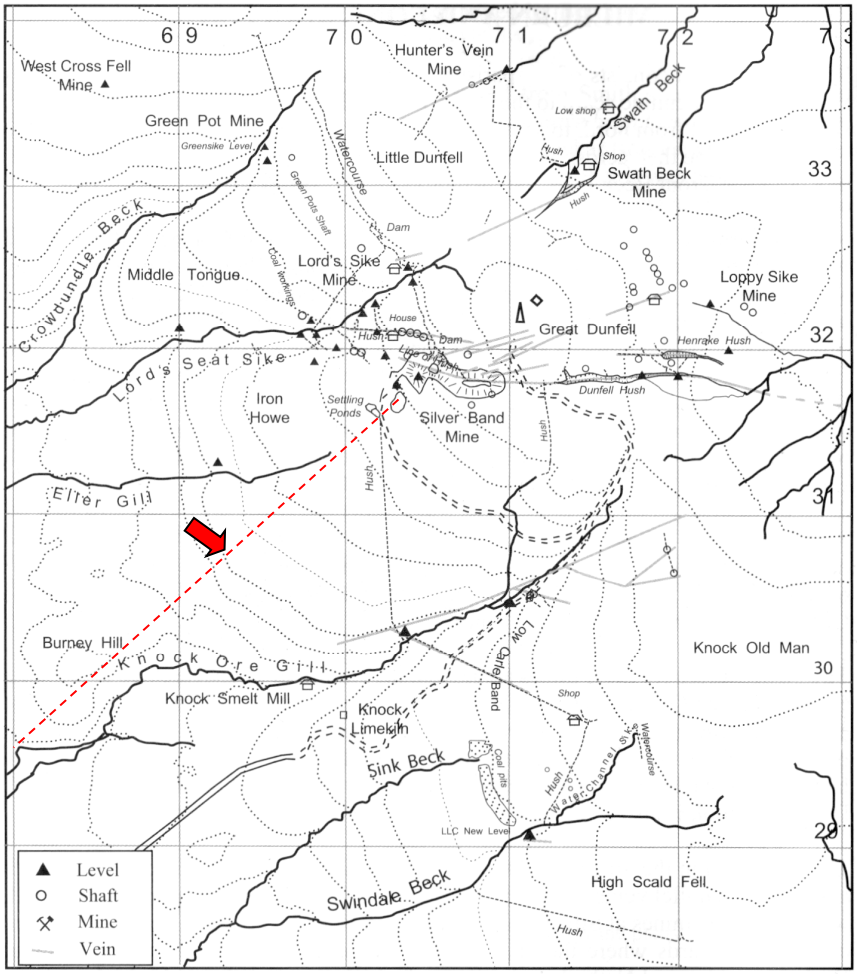

Plate 2: principal mine workings (reproduced from Smith and Murphy 2011, 44); location of Brake House arrowed, and course of ropeway dashed

2.2.4 In 1820, a two-year agreement was drawn up between the Earl of Thanet and the *Governor and Company for the Melting of Lead with Pit Coal and Sea Coal* (known as the London Lead Company - LLC) to search and mine lead, and to carry out a detailed survey of the mining potential of the manors of Milburn, Dufton, and Knock. The LLC was the most important single producer of lead and silver in the North Pennines, accounting for between one quarter and one third of total output in Cumberland, rising to two thirds in 1866. The LLC had taken over the smelt mill at Dufton in 1801, which was convenient for its Westmorland operations. In 1823, the mines were leased to the LLC for 21 years at a general grant of 1/7 duty in ore apart from those with existing leases and takenotes, and this lease was renewed in 1844.

[1] a measure containing 8 cwt. of clean ore

2.2.5 The returns for the period prior to the expiry of the first lease suggest that most of their mining was only carried out at Silverband, though it was probably a convenient collecting point for the other mines. Between 1821 and 1879, the London Lead Company only mined a total of 15,062 tons of lead concentrates from all its mines in the Thanet-Tufton royalty, with perhaps only half coming from Silverband. Between 1863 and 1876, 1,007 tons of lead concentrates were obtained, containing 75% lead, with 6.9oz silver per ton of lead obtained (Dunham 1990, 111).

2.2.6 Mining by the London Lead Company was abandoned in 1877, and the mine was reported as idle in 1880 (Smith and Murphy 2011, 63). Between 1884 and 1888, the Silverband Mining Co. Ltd operated the mine, but it became idle again in 1888. During the First World War, the need for barytes lead to the mine reopening between 1914 and 1918, as prices for the mineral trebled during the War (Tyler 2013, 306). Barytes is used in paint manufacture, as a drilling lubricant, and as a filler in the cloth and paper industries. The mine was reopened under the direction of Vincent Brammall to mine for barytes at Silverband, which was then disused (Welch 1974, 8; Dunham 1990, 111), but only a few tonnes were mined. Following the War, the price of barytes plummeted again. In 1936, the mine was run by the Silverband Syndicate (cited on the Durham Mining Museum website), again with only limited returns.

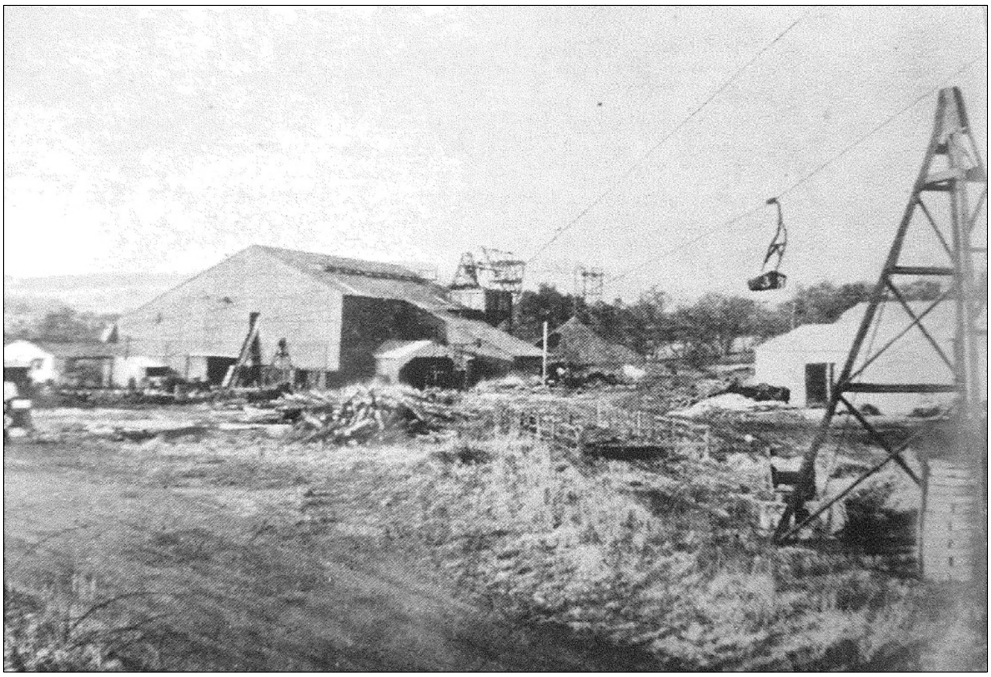

Plate 3: the mill at Millburn Grange (Tyler 2013, 292)

2.2.7 With the advent of World War II and the increased need for minerals including barytes and the concomitant increase in prices, mining resumed. In 1939, the site was worked by B. Laporte & Company (Laporte Chemicals Ltd from 1949) who extracted over 215,000 tons of dressed barytes from the Silverband Low Level (Dunham 1990, 111); in 1950, 65 employees were recorded at the mine (40 below ground, 25 above).

2.2.8 Mining ceased in 1964 because drainage problems made extraction uneconomic and cheaper ore was available in Eyam, Derbyshire. Despite the closure, considerable reserves remained, and opencast operations resumed in 1973, when Mr H. Taylor acquired it and built a mill at the mine itself, working the spoil heaps west of the High Level, and producing 75,000 tons of barytes (Dunham 1990, 111). Smith and Murphy (2011, 64) record the mines as being run by a Mr Horace Taylor (Minerals) Ltd in 1980, but from 1983, it was being worked by Crag and Cutriss Ltd, a local haulage contractor (Dunham 1990, 111). In the later 1980s, it was being run by the Silverband Barytes Company (cited on the Durham Mining Museum website) and in

the late 1990s by Waitings Minerals of Cliburn, who were reprocessing spoil heaps for barytes (Smith and Murphy 2011, 65).

2.2.9 Barytes extraction has caused a lot of damage to the historic workings, and subsequently, after the closure of the modern operations in 2006, the site was landscaped leading to the loss of many of historic features (Smith and Murphy 2011, 55).

The Aerial Ropeway

2.2.10 An aerial ropeway is defined as a transport system whereby the material to be transported is carried in purpose-built buckets, suspended from overhead ropes, typically carried by trestles, often with very wide spans between each trestle. Aerial ropeways were introduced as a response to several factors in mine transport: scarcity of labour (to move the material, and ropeways are reasonably easy to automate); difficult terrain (particularly the ability to negotiate very steep gradients); and long distances to be covered (often without impacting on the use of the land being covered – Plate 4). In theory there is no limit to the length of an aerial ropeway, with sections usually being up to 8km in length, with additional sections having their own driving system, with buckets being transferred at divide stations along the ropes of each section without stopping. Aerial ropeways are also not thwarted by bad weather (fog, rain, snow) though strong winds would be an issue (Walker 1988, 406).

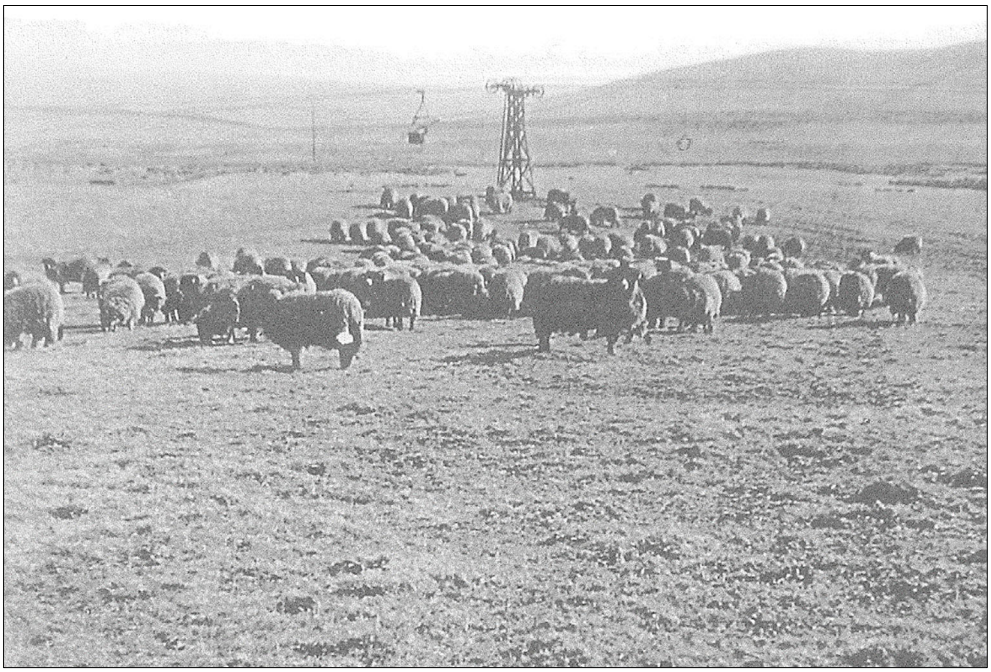

Plate 4: the aerial ropeway crossing farmland, c.1950, facing west (Tyler 2013, 293)

2.2.11 The use of an aerial ropeway proved an ideal answer, therefore, for handling minerals at low to medium capacities. The service life of an aerial ropeway could exceed 10 to 15 years. The UK Gazetteer of Aerial Ropeways (http://www.ropeways.co.uk/uk/rw_ukgaz.htm) records 128 aerial ropeways, with a further 350 examples with only limited records, as having existed at one time. There is now only one working aerial ropeway left in existence, the gravity-powered ropeway at Claughton brickworks in Lancashire, built in 1924 and still transporting shale to the brickworks in the valley.

2.2.12 The aerial ropeway at Silverband Mine was constructed by Laporte in 1939, to transport the crude ore from the mine to a mill at Milburn Grange (Plate 3). The route for the flight had been surveyed from 1937 by Robert Sibson, an unenviable task as the fall for the whole route was 1,600ft (488m) and required careful positioning of pylons and changeover points (Tyler 2013, 306). The firm commissioned the British Ropeway Engineering Company of London (later known as BRECO) to install the ropeway, and the ropeway was to deliver 10 tonnes an hour

(http://www.ropeways.co.uk/uk/rw_ukgaz.htm); this is generally quite low for a mono-cable ropeway which can deliver 200 tonnes per hour (Frenkiel 1969, 713). The flight from the mine to the mill was 16,134ft (4,918m) in length, with 58 trestles and 82 buckets, suspended from 7/8" wire rope (Plate 4). The power for the operation was supplied by a 35-horsepower electric motor located at the mine, providing an operating speed of 3-4mph (Tyler 2013, 308). The engine would be started at the mine by Arthur Craig, who would leave his home in Milburn at 5am to walk the 5.7km to get to the mine in time for the start of the working day (*ibid*).

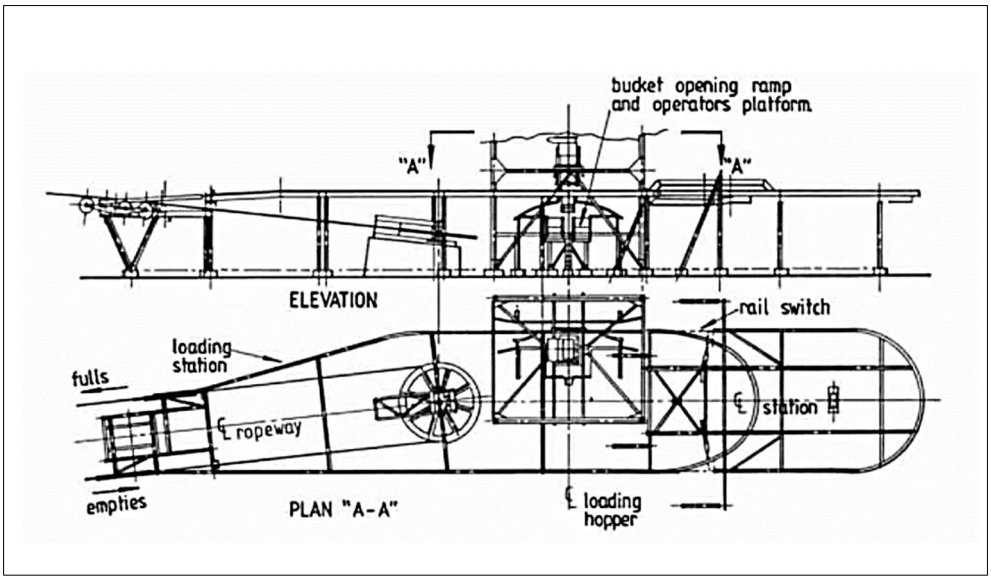

Plate 5: general arrangement of a loading station (Walker 1988, 419)

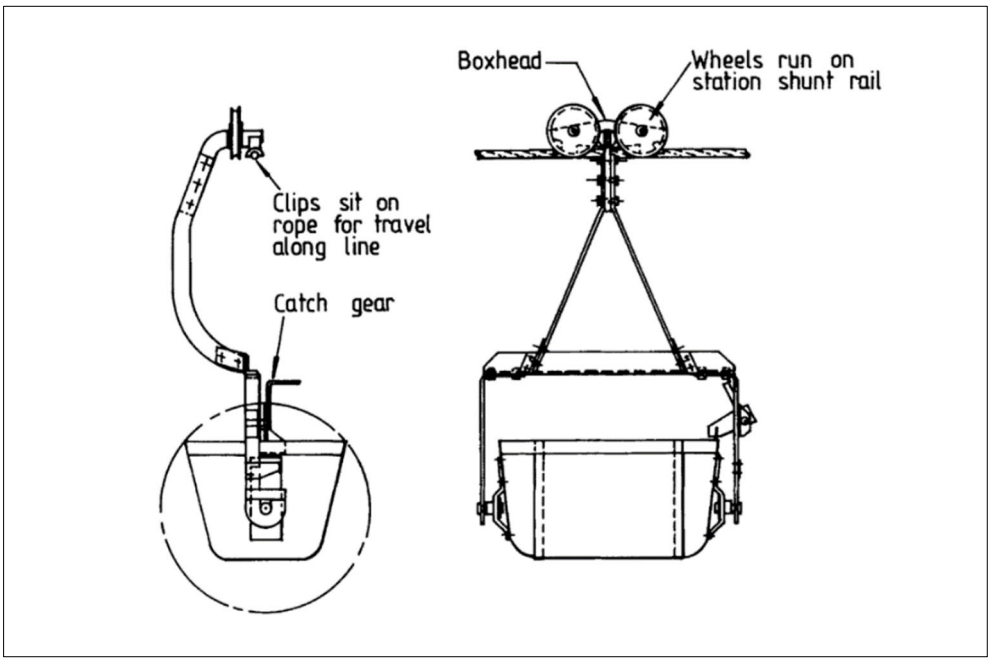

Plate 6: bucket and hanger in mono-cable system (after Walker 1988, 409)

2.2.13 The ropeway was of mono-cable construction, employing a single rope (an endless semi-flexible steel wire) for both supporting and transporting the loaded and unloaded buckets which circulated around the system. The ropeway passed round the driving sheave (a horizontally set wheel) in one terminal and then returned via a second sheave in the second terminal (Plate 5 but see below regarding discussion on change-over stations).

2.2.14 Each bucket was suspended from the wire by a swan-neck shaped hanger, to allow the bucket to negotiate trestles and the station shunt rail (Frenkiel 1969, 705). The hanger was affixed to a box-head equipped with two clips at 430mm centres for driving contact with the rope, the projections in the clip, essentially an inverted 'U', engaging with the grooves in the wire rope (Frenkiel 1969, 712; Walker 1988, 416). Two 200mm diameter wheel mounted on the box-head at 340mm centres were used for traversing the station shunt rails (Walker 1988, 409; Plates 5 and 6). The payload of the buckets was usually kept relatively even, to not put additional and undue wear on the cable and the infrastructure, or to put too much sag on the cable, so regularly spaced and evenly filled buckets were the ideal. This type of bucket arrangement was limited to lines of 23° or less; steeper gradients required projecting pips to ensure better grip of the rope, but this wore the rope out quicker (Frenkiel 1969, 712).

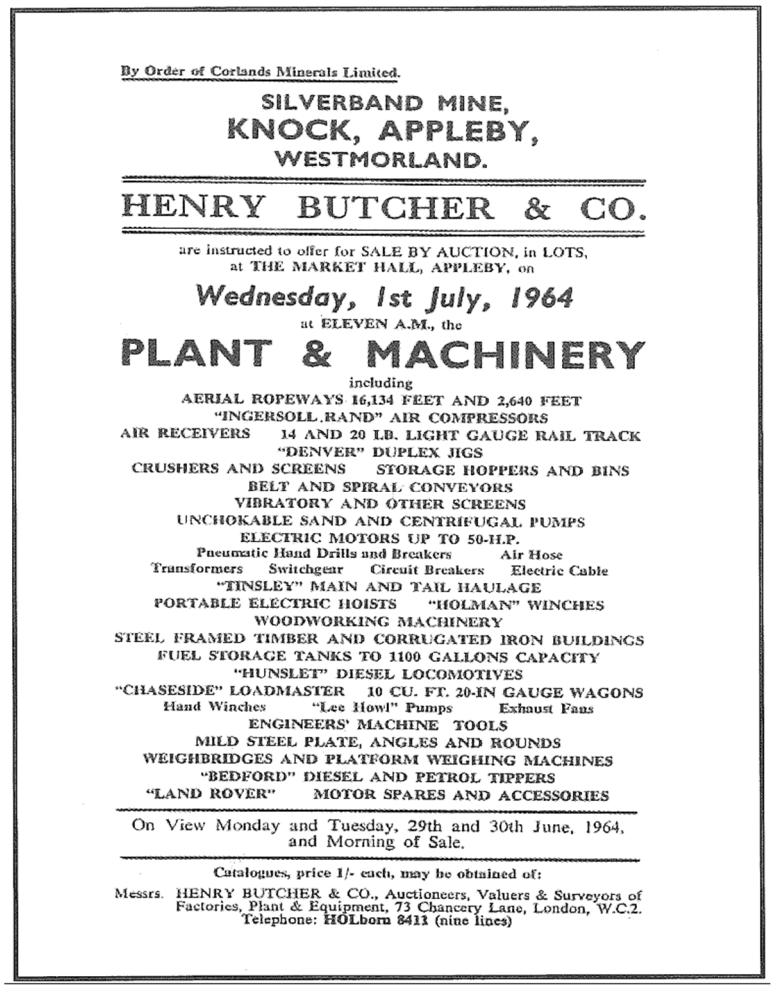

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Plate 7: auction particulars (Tyler 2013, 303)

2.2.15 At the loading and unloading stages in the terminals, the buckets were disengaged from the rope and continued running along a rigid shunt rail using their wheels under the control of an auxiliary heavy duty chain haulage and controller system (Plate 5). The catch gear on the buckets was unclipped and rotated to tip the contents into a hopper at its destination, the bucket then self-righting and latching for the return journey. Loading stations sometimes incorporated a continuous feed of material directly into the buckets without disengaging the buckets from the rope, but it seems unlikely the volumes of material from Silverband would have been sufficient for this type of arrangement. Ore in the mill was washed and processed by hand before being fed into a crusher and loaded into a bunker, where it was loaded into lorries and taken to Warcop Station.

2.2.16 In April 1940, the ropeway was extended to Long Marton railway station, again built by BRECO of London (Tyler 2013, 309). This ropeway comprised 24 trestles and 72 buckets and was powered by a 20-horsepower electric engine in the mill. The ropeway was 12,640ft (3,853m) in length and the barytes was discharged into bunkers for loading onto railway waggons and its onward journey (*ibid*).

2.2.17 The miners would travel to and from the mine in the aerial ropeway buckets. Accounts describe how they would assemble in the mill and mount a makeshift wooden trestle before climbing onto a bucket and crouching down. The buckets would set off with a jolt as the power kicked in and they would be then travel to the change-over station, a concrete plinth measuring 11m by 4.6m with a timber frame and covered in corrugated iron sheeting known as Burnah Hod Down and operated by Tommy Willis. The men would disembark and walk up the very steep hill to the second change-over station called Top Hod Down (the current Brake House), operated by Laurie Dunn, where they would alight the buckets again, and travel the rest of the way to the mine, the whole journey taking approximately one hour (Tyler 2013, 308). The ride could be particularly difficult in bad weather, being frequently cold and wet, but was better than walking; in the winter, the miners would freeze. At the end of the day the miners would ride back down, and the plant would be stopped. In 1947, the practice of riding the buckets was stopped for safety and insurance reasons, and the miners instead rode to the mine in lorries (Tyler 2013, 313). It was recorded that the steep downhill section between the two stations was at the mercy of the wind, and the empty buckets would swing violently, causing them to come off the rope and they would have to be fixed back on frequently (Tyler 2013, 318).

2.2.18 Following the closure of the mine, the plant and machinery were put up for auction on the 1st of July 1964 at the Market Hall, Appleby (Plate 7); included in the lots were '*aerial ropeways 16134 feet and 2640 feet*' (the latter figure incorrect by 10,000 feet). The ropeway and mill were dismantled (the ropeway supposedly taken to Aviemore ski resort in Scotland – Smith and Murphy 2011, 64). Though mining resumed again in the early 1970s, all material from the mine was transported by road from this point onwards.

2.3 Methodology

2.3.1 The general aims of the building recording were to provide an outline survey (Historic England Level 2) of the Brake House, along with an assessment of significance, to allow the restoration of the building. The historic building record required a photographic, written, and drawn record of the building, its setting, and a brief discussion about its group value to ensure the record met the required level stated.

2.3.2 This survey comprised:

- a written and photographic record of the Brake House, providing details of its form, function, date and significance; and
- Sufficient record of the aerial ropeway and surrounding area to provide context to the survey.

2.3.3 The written account for the structure recorded included:

- The precise location of the building as an address and in the form of a National Grid Reference
- A note of any statutory or non-statutory heritage designations
- The date when the record was made, the name(s) of the recorder(s) and the location of any archive material.

2.3.4 The photographic record of the Brake House included:

- A general view or views of the structure in its wider setting or landscape
- The structure's external appearance
- A series of oblique views to show all external elevations of the structure and give an overall impression of size and shape.
- The overall appearance of the principal rooms and circulation areas
- Any external or internal detail, structural or decorative, which was relevant to the building's design, development and use.
- Any machinery or other plant, or evidence for its former existence.
- Any dates or other inscriptions; any signage, makers' plates or graffiti which contributed to an understanding of the building
- Any contents which have a significant bearing on the structure's history

2.3.5 The photographic record comprised high-quality digital format (RAW and jpg) taken with a Pentax K70 full frame digital camera (with 24-megapixel capability). All photography was undertaken in accordance with Historic England guidance (Historic England 2015 and 2016). A photographic scale of an appropriate size was included in all general and detailed views, where possible and safe to do so. The location and direction of photographic views was recorded during the survey. Accompanying photographic registers recorded, as a minimum, the direction of the view and a brief description of the subject and location.

2.3.6 Detailed descriptions of Brake House and its location were provided. To accompany the written record, photographs were taken of the interior and exterior of the Brake House along with each archaeological feature identified. All photographs were taken from an angle as near parallel to the elevation or feature as possible, with each photograph containing an appropriate scale.

Plate 8: the pylon base at the mine (Pylon -1), recorded in 2019 (NAA 2019, 18); Pylon 1 is visible in the middle distance

3 Building Survey Results

3.1 The Aerial Ropeway

3.1.1 The trestles for mono-cable ropeways were usually made of rolled steel angled sections and varied in height from 6m to 10m (Walker 1988, 414). The upper part of the trestle carried a cross-arm, forming a T-shape, onto which the sheave train, being a series of vertical sheave wheels in sequence, was affixed. The sheave train included a walking beam, a series of articulated sections which are designed to allow the sheaves to move up and down in response to changes in weight, which support the sheaves in differing numbers (usually between 4 and 8 sheaves per train) affixed in pairs to each section of the walking beam. Trestles were usually affixed to a concrete base, and the upper positions of the trestle were accessed by means of a ladder affixed to one side.

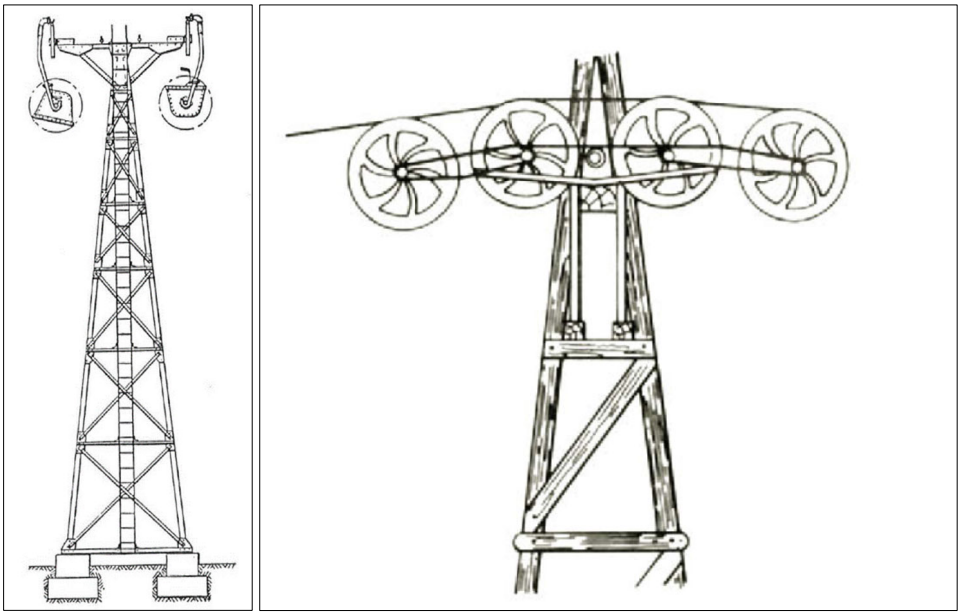

Plate 9: typical mono-cable trestle, left (Frenkiel 1969, 708) and sheave train, right (Walker 1988, 414)

3.1.2 Of the 58 trestles installed between Silverband Mine and the mill at Milburn Grange, the positions of only 17 are recorded as surviving within the Scheduled Monument list entry, which correlates with the results of the survey undertaken in April 2022 (Figure 2 - HE records these as 'pylons' so this term is used from hereon). There is an additional concrete base for a pylon which still survives close to the mine (presumably one of the first, if not the first, on the flight down to the mill). This was recorded by the author in 2019 (Plate 8), and is additional to the 17 identified, which start immediately south of the access road to the mine, where the list entry terminates.

3.1.3 Historic England record a pylon at NY 7014 3155 (the first south of the access road) as follows: "*only the base of the pylon remains in situ. It has been twisted as though attempts have been made to rip it out of the ground. Remains of an external ladder are still attached.*" This pylon (referred to as Pylon 0) was not seen during the 2022 survey, the first identified being Pylon 1 which sits on top of a large mound of spoil – Historic England describe this as an '*earlier*' spoil heap, but it appears that the heap was deliberately dumped to allow the pylon to sit higher up in the landscape, and to operate as an intermediate pylon, so minimising the drop down from the loading station to the ground level, which is a 40m drop in 250m (Plate 10).

Plate 10: Pylon 1, facing south, photographed in 2019; Pylon 2 is visible on its side, left of the photograph

Plate 11: Pylon 3, facing east

3.1.1 Apart from Pylon 1 (discussed above) and the pylons south-west of the Brake House, all the pylons have been forcibly removed by sawing through their legs close to the base of each pylon (Plate 11), and in a lot of cases only the pylon base, or the lowest part of the pylon frame, now survives as evidence of its former location (Plate 12). Several of the pylons have been toppled close to their original position or have been physically dragged from their original position (e.g. Pylon 4, which is 30m north-east of its base, and has been dragged using the ropeway cable, which is still knotted to the frame – Plate 12). The removal (or attempted removal) of the pylons presumably equates to their sale in July 1964, and it seems that some of the pylons were left purely because it was too difficult to remove them, even though they had been felled in anticipation of them being removed for shipping. Most of the surviving, *in situ*, pylons appear to be the most inaccessible, being those running down the steep hill from the Brake House (Pylons 12 to 17), or on top of a high spoil heap (Pylon 1). Pylon 12 may have been left as also too short.

Plate 12: Pylon 4, base facing north with displaced pylon to the north

Plate 13: Pylon 12, facing west

3.1.2 The pylon bases, where these survive, appear to be entirely built of random coursed roughly dressed stone and are c.2.5m square and up to 1m in height (Plates 12 and 13); some (e.g., Pylon 12) have been capped with cement. It is unclear whether all the pylon bases were originally bonded with cement, though it seems likely; most are now heavily turfed over, making confirmation of this difficult. Where only the lowest part of a pylon frame was identified as a pylon location, it was also unclear whether the pylons originally were affixed into a base, since buried in peat, or whether directly fixed into the ground without a base (though this seems implausible as it would be liable to become unstable through vibrations from the buckets moving along the ropeway).

3.1.3 The pylon towers taper inwards from the base to a slender column, approximately at their midpoint, and conform to the standard description of trestles above, being constructed of angled steel sections cross braced on each side for strength (Plates 11 and 13). The pylons vary between 2.8m and 9m in height, and their height seems to be entirely dependent on their position within the landscape, to provide an even displacement for the ropeway. Each of the pylons has a ladder affixed to its northern side allowing access to the cross-arm. The pylons are mostly quite simple, with only two sheaves on each side connected to an articulated section (walking beam), compared to the examples with four or more shown above (Plate 9). Only one pylon, Pylon 12, has a comparable arrangement of sheaves, having a sheave train made of three articulated sections (walking beams) on each side and four wheels (Plate 13). This sits just above the crest of the hill, before the descent, so may have need the additional articulation to support the forces in the ropeway as it began its descent down the hill. Pylon 12 is the best surviving and most complete of the pylons surveyed.

Plate 14: ropeway cable on the route of the pylons (left, facing north) and in the Brake House (right, plan view)

3.1.4 Lengths of ropeway cable were identified partially buried across the survey area, but traceable in isolated areas of erosion along the alignment of the ropeway, or closely associated with the felled pylons. A section of rope was also visible partially buried and *in situ* in the Brake House (Plate 14). Large quantities of wire rope were also rolled up and stored on the north-west side of the Brake House, probably stock-piled for later removal but then never used.

3.2 The Brake House

3.2.1 The Brake House is a broadly rectangular structure, measuring 12.40m in length by 5.85m in width, and orientated north-east to south-west, aligned with the course of the ropeway (Figure 3). On the north-western side of the building is a small outshut, contemporary with the main building and measuring 2.75m by 2.45m (Plate 15). This is referred to as the brakesman's hut.

3.2.2 The building was constructed on a large floor slab, which served as both the foundation for the building and the floor of the building itself (though the arrangement of the foundations of the south-east wall is more complicated). To make the floor even, the slab was set into the hillside, so that the north east and north end of the slab is at ground level, and the south-west side extends to 0.75m in height. The slab appears to have been built as a rectangular structure of random coursed stone up to four courses in height and cement mortared, onto which was later poured concrete up to 200mm in thickness to form the levelled surface; the construction technique seems very similar to the pylon bases, which is to be expected. On the north-west and south-east sides, the floor slab projects 300mm from the walls, forming an outer ledge. The ledge on the south-east side is not covered in concrete, suggesting the floor may have been resurfaced later, after the walls had been built.

Plate 15: the Brake House, facing east; note coiled wire rope bottom left

3.2.3 The building was open on both the north-east and south-west sides, to allow the movement of the buckets of the aerial ropeway through the building. The north-west and south-east sides comprised large walls, 2.95m in height and 450mm in width, and extending the full length of the building (Figure 4). The walls were blind and built of at least 26 courses of random coursed squared rubble stonework, with cement mortar bonding. Between 2m and 2.25m from the ground level, both walls incorporated a series of wooden battens into the stonework of the inner face, and evenly spaced along both walls (labelled 'S' on the drawings – Figure 5); at least six battens were included in both faces. Slightly lower than the line of battens was a series of iron fixings with wire remnants (labelled 'W' on the drawings – Figure 5), approximately positioned in-between the battens though the positioning was quite random. The walls appear to be later than the floor slab, and built directly onto it in most cases, though there was a suggestion that the south-eastern wall may have been earlier, as it abutted the slab in places, but was built on top of it in others (Plate 16). The building may therefore have had several phases of construction and may have been rebuilt several times during its use.

Plate 16: the Brake House, facing north; the collapsed wall is on the right of the picture, and the wall appears to abut the floor slab at this point. One of the external mounting blocks is visible to the left.

Plate 17: interior (left) and south-west facing elevation (right) of the brakesman's hut.

3.2.4 The building originally had a gable roof, which was covered with corrugated iron sheeting, as evidenced by the impressions of the sheeting within the cement capping on the tops of the walls; fragments of sheeting were noted scattered near the building. It seems that the iron fixings and battens in the walls were used as hold-down points for the roofing, probably as additional bracing to stop the roof from blowing off in high winds (of which there must have

been many). The remains of eight roof trusses, comprising sawn-off ends of the timbers, were visible affixed into the walls, or their positions were evident through rectangular sockets for the joists in the same positions (labelled 'R' on the drawings – Figure 5). The south-east wall had half-collapsed, down to the floor slab, seemingly in a single event, as the wall is visible splayed out on the ground to the east of the building. Only a 7.5m length of this wall now survives (Figures 4 and 5, Plate 16).

3.2.5 There was open and direct access to the brakesman's hut from the interior of the Brake House; there was no evidence of a door, suggesting the hut was open to the Brake House, to allow the brakesman the opportunity to inspect the buckets as they passed through the interior. The concrete floor, which measured 2.45m by 1.85m, extended directly into the brakesman's hut, with no sign of any divisions. The hut included windows on its north-east and south-west sides. The windows were square (0.6m by 0.6m) and rectangular (1.25m by 0.65m) respectively and served the same purpose – allowing the brakesman to see any issues which could be coming down the line from a position seated in the hut (Figures 3-5, Plate 17). The windows retain remnants of their timber frames, though very decayed. The hut was warmed by a very small fireplace set into the wall, 0.95m high and 0.5m wide, slightly off-centre and built of brick and tile. The fireplace looked like a later addition to the building, as it was roughly cemented into the wall (Figure 5, Plate 17). The walls of the outshut were 2.15m at the western end, sloping up to the same height as the walls of the main building. The walls also included sockets for timber battens, again to allow anchor points for the pent roof, which was also corrugated iron, and long since lost. Timber roof beams extend laterally across the hut, still *in situ* though now quite decayed (Figure 3).

Plate 18: the rectangular mounting blocks, facing south-west (left) and plan view (right); note rectangular impressions and iron fixing pins

3.2.6 The floor of the Brake House included 7 concrete mounting blocks set into the surface, each measuring 1.25m by 0.45m, with rectangular impressions in the surface spaced 0.75m apart; a further two blocks, free-standing and quite damaged, were located to the south-west and external to the building on the same alignment (labelled 'B' on the plan – Figure 3). Associated

with the latter two blocks were large deposits of turfed over spoil, which appears to be accumulated spillage from the buckets as they passed through the building; this confirms that the laden buckets passed down the line on the northern line and returned up on the southern line.

3.2.7 The rectangular impressions appear to have been impressions from the trestles within the building, which carried the buckets through, with each impression associated with iron pins set within the blocks. The blocks appear to be set in pairs, approximately 1.6m apart, with each pair 0.85m from the next, though there very minor variations to this (see Discussion). The arrangements suggest a further block is likely to survive under the turf north-east of the building, and not currently visible. No other fixtures or fittings were evident within the interior of the building.

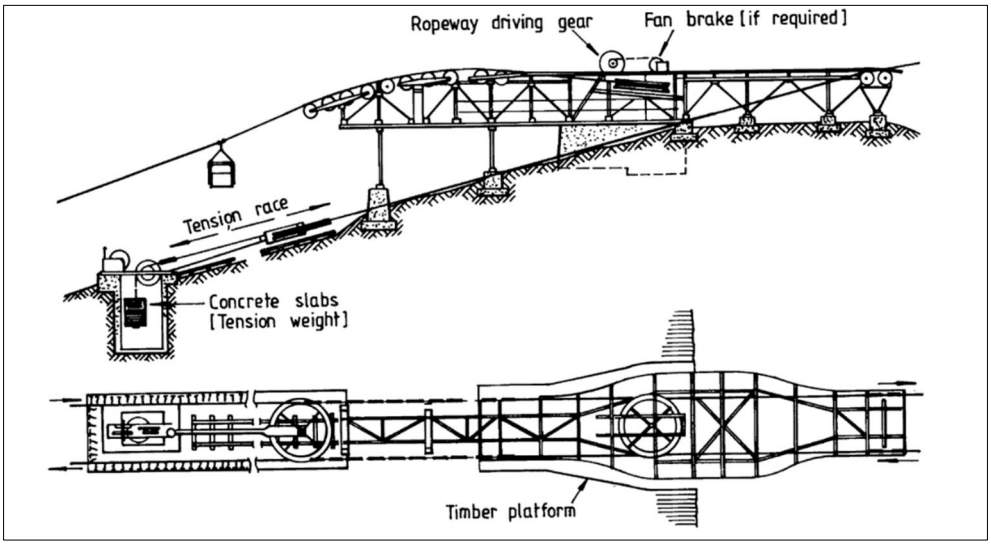

Plate 19: a typical mono-cable divide station (Walker 1988, 425).

Plate 20: the 'shed' (left) and Brake House (right) taken from Google Earth digital imagery.

4 Discussion

4.1.1 It seems likely that the Brake House (so named) is in fact a divide station, as seems to be suggested in the historical sources (cf. Tyler 2013, 308), in particular the references to Burnah Hod Down and Top Hod Down, the "*change-over stations*" (see section 2.2.17). A divide station is, as the term suggests, a dividing point in an aerial ropeway, whereby buckets are transferred from one line to another, the first line returning to the loading terminal by means of a driving sheave in the divide station. The buckets are unclipped and pass along a track or

shunt rail to the second ropeway, where they clip on and continue their journey. Plate 19 shows a typical arrangement for a divide station, and the arrangement of mounting blocks corresponds very closely with the arrangement identified within the Brake House.

4.1.2 There is a second building on the line of the ropeway, which is referred to in the Scheduled Monument listing as a "*shed*" and described thus: "*at NY69113023 there is the stone and concrete base of a shed which accommodated a workman who oversaw the progress of the buckets on the ropeway*". This building, which was not surveyed, is identical in floorplan to the Brake House and aerial photographs (Plate 20) show a similar arrangement of mounting blocks within the interior of the building and extending out south-westwards. This building does not seem to survive beyond its foundations and appears to have been robbed for building stone. A corresponding turfed over dump of spoil is evident leading up to the building, suggesting the buckets may have lurched as they reached the bottom of the slope and changed gradient.

4.1.3 The presence of the second building provides some interesting points of discussion with regards how the aerial ropeway functioned. Frenkiel (1969, 714) suggest that for steep lines the ropeways would be self-operating i.e., gravity-powered rather than electrically powered. This seems plausible, and it seems likely that, whilst electrical power was needed to get the aerial ropeway moving at the start of the day, once the laden buckets were moving down the line, any power to the line could be reduced or switched off, as the buckets could travel independently under their own weight (as is the case, for example, at Claughton).

4.1.4 If, as documentary records suggest, the line between the two divide stations was separate and independent of the line descending from the mine terminus, then it is possible that this section was entirely gravity-fed, and relied solely on the arrival of the laden buckets to provide enough motive force to carry them down the slope to the second divide station, their descent controlled by the brakesman in the Brake House so as to not run on too quickly through the use of brakes (see for example as illustrated in Plate 19). The third line, between the second divide station and the mill (the ultimate terminus) may also have had some measure of electrical power within the mill itself to keep the buckets moving, though there remained sufficient gradient between the second divide station and the mill for the route to have been self-powered through gravity, at least once the buckets had begun moving down the line. This arrangement could well account for the need to walk up the hill between the two divide stations (as suggested in the documentary sources), as this section had no power directly applied, and as such could not carry the miners up the hill, as there would have been no corresponding weight from filled buckets to counter-balance them going down.

4.1.5 There is little evidence of the arrangement of sheave wheels or shunt rails within the Brake House to help with any interpretation as to the layout of the machinery in the building, though there is a slight break in the arrangement of mounting blocks directly opposite the brakesman's hut, which may mark the point where the lines changed over. Plate 19 shows the return sheave wheel for the first line as mounted externally to the building, and it is possible that the two external blocks recorded during the survey mark the position of this wheel.

5 Significance

5.1.1 The following section summarises the site-specific significance of the Brake House according to four high level themes as set out in Conservation Principles, Policies and Guidance for the Sustainable Management of the Historic Environment (English Heritage 2008):

- **Evidential Values** - the potential capacity of the Brake House to yield primary evidence about past human activity (building design, extent of survival, etc).

- **Historical Values** - the potential of the Brake House to offer a connection between the present and the past through association with people, events and aspects of life.

- **Aesthetic Values** - the potential for people to derive sensory and intellectual stimulation from a place, through design, art, character, and setting.

- **Community Values** - the potential for the Brake House to hold meaning for people to relate to it or whose collective experience or memory it holds (often closely related to Historical and Aesthetic values).

5.1.2 The aerial ropeway is of national significance as reflected in its designation as a Scheduled Monument, and the Brake House, as a component part of this designation, shares its significance, due primarily to its historical, communal, and evidential values. Whilst the ropeway is not considered unique, it is a rare example of a 20th century aerial ropeway, few of which now survive, and is the best surviving example of an aerial ropeway used in a metal-mining context in England (per Scheduled Monument listing). The ropeway has been damaged by attempts to salvage and remove the pylons, and other parts of its infrastructure, in 1964, and parts of the ropeway have been wholly removed, including many the original pylons. Both the termini for the ropeway have also been destroyed or damaged by later activity. However, sufficient of the structures survive to allow an interpretation of the development and function of the aerial ropeway, and the Brake House survives largely intact and has strong evidential value in relation to its original construction and use. The position of the Brake House set high up on the south slopes of Great Dun Fell also has a strong aesthetic appeal.

5.1.3 The ropeway and Brake House form an integral part of the long history of the operation of the mine at Silverband, which extends back to at least the 16th century in particular the links with the Earl of Thanet, with the London Lead Company, and other smaller concerns. The historical links with local industry, particularly with Laporte who built and operated the ropeway, are important, and the ropeway also has important connections with the British Ropeway Engineering Company of London (later known as BRECO), which is still operating to this day. The ropeway remains an important part of the local history of the local and mining community, who worked the mine and operated the ropeway, and the Brake House is an important focus for these links.

6 Conclusions

6.1.1 The proposed conservation of the Brake House as part of the Conservation Management Plan (Countryside Consultants forthcoming) will secure the structure from any further deterioration, and any proposed interventions to stabilise the structure will be guided by this report and by accepted best practice.

6.1.2 This report is considered to be a comprehensive record of the Brake House. No further work is recommended prior to any proposed conservation works to the building. This report will be deposited with the Cumbria County Council Historic Environment Record, a copy will be provided to Historic England, and a copy of the report and digital photographs will be archived with the Archaeological Data Service (ADS).

7 Acknowledgements

This built heritage assessment was authored by Matthew Town, Principal Archaeologist, Stantec UK, and Dr Cathie Barnett, Technical Director, Stantec UK, coordinated the archaeological work and approved this report. Ian Barnes, Principal Archaeologist, Stantec UK, managed the project for Stantec UK. Countryside Consultants, in particular John Widdaker, Justin Seviour and Peter Speight, are cordially thanked for their assistance during the recording and Natural England Moor House National Nature Reserve, including Martin Furness, Senior Reserve Manager - North Pennine NNR, are thanked for their support. Peter Jackson of Nenthead Mines Conservation Society provided invaluable information and help during interpretation and is also thanked.

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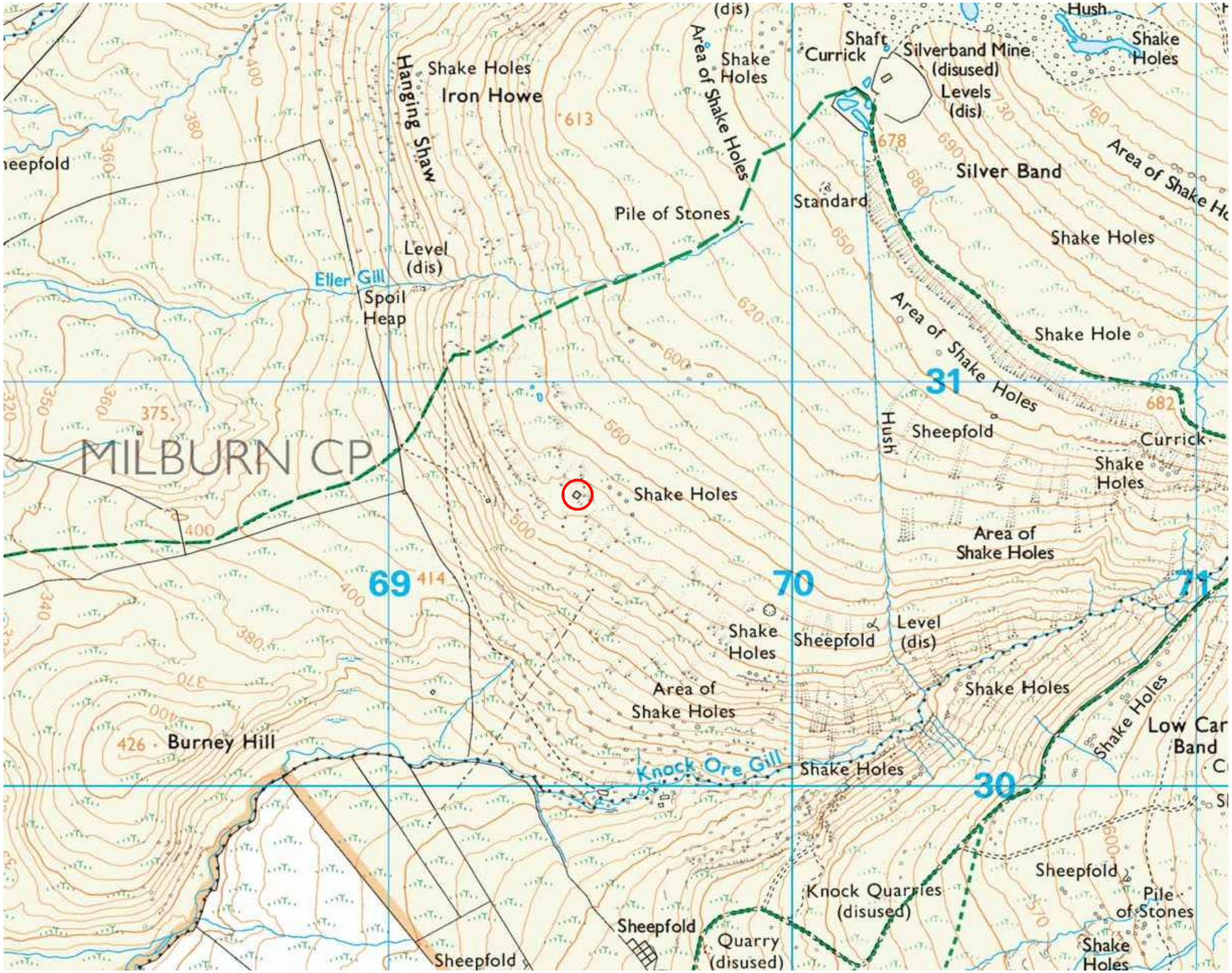
Appendix 1: Illustrations (Countryside Consultants)



Bar Scale in metres

0 500m

North

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Silverband Mine Brake House, Knock Fell, NY 6949 3070
CONSERVATION MANAGEMENT PLAN
Job no: 21/24 May 2022

LOCATION PLAN
Dwg no: L1
Approx Scale: 1:10,000 at A3

Description	Grid Reference	Latitude	Longitude	Altitude (m)
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Pylon 0	NY 7014 3155	54.6781	-2.4646	669
Pylon 1	NY 70082 31479	54.677347	-2.465551	654
Pylon 2	NY 70027 31406	54.67682	-2.466337	644
Pylon 3	NY 69968 31330	54.676131	-2.467242	633
Pylon 4	NY 69914 31255	54.675456	-2.468075	628
Pylon 5	NY 69856 31187	54.674841	-2.468964	617
Pylon 6	NY 69755 31053	54.67363	-2.470523	600
Pylon 7	NY 69731 31022	54.673348	-2.470888	594
Pylon 8	NY 69685 30964	54.672824	-2.471592	576
Pylon 9	NY 69567 30801	54.671353	-2.473408	548
Pylon 10	NY 69525 30767	54.671042	-2.47406	534
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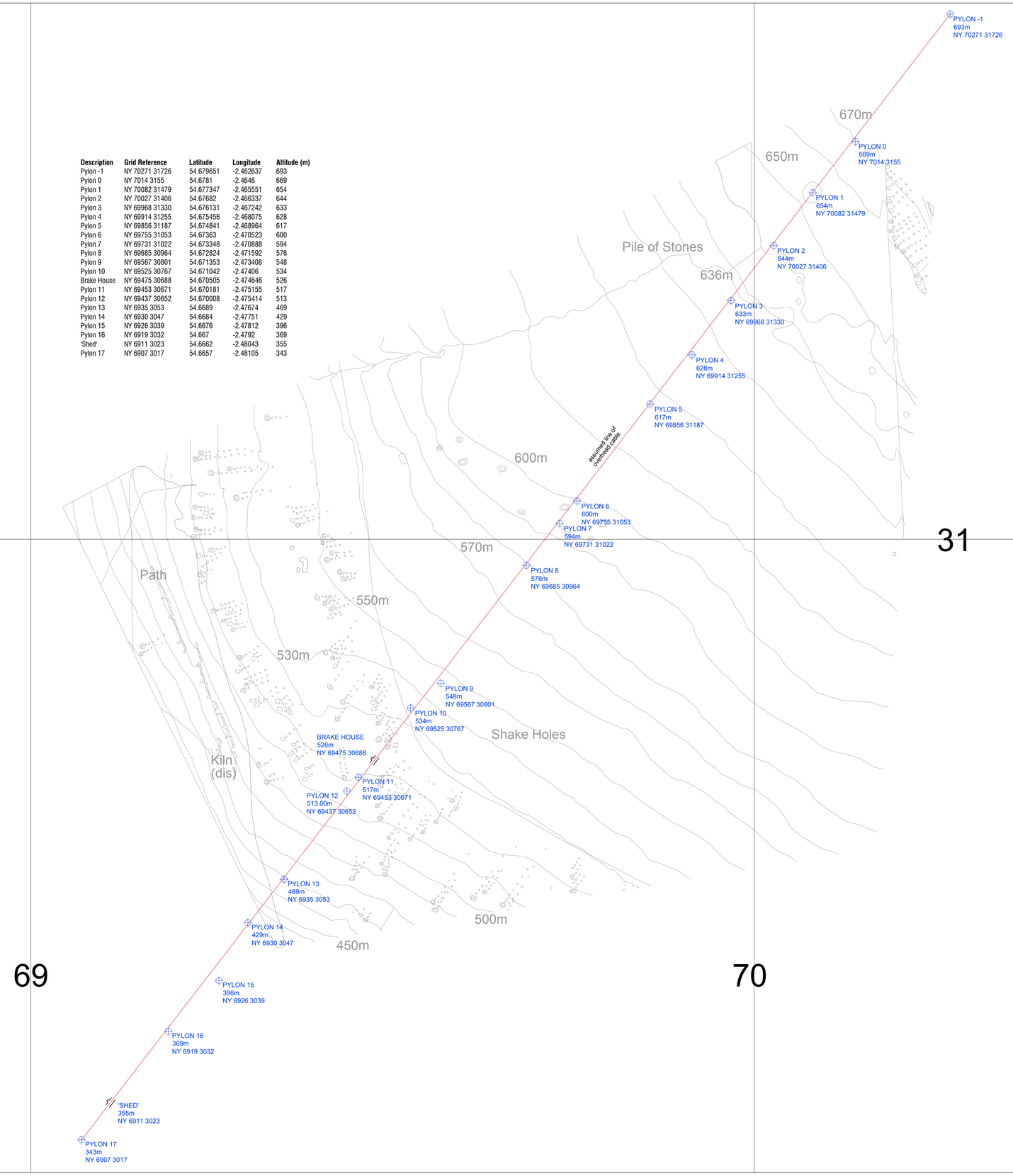
Pylon 11	NY 69453 30671	54.670181	-2.475155	517
Pylon 12	NY 69437 30652	54.670008	-2.475414	513
Pylon 13	NY 6935 3053	54.6689	-2.47674	469
Pylon 14	NY 6930 3047	54.6684	-2.47751	429
Pylon 15	NY 6926 3039	54.6676	-2.47812	396
Pylon 16	NY 6919 3032	54.667	-2.4792	369
'Shed'	NY 6911 3023	54.6662	-2.48043	355
Pylon 17	NY 6907 3017	54.6657	-2.48105	343



69

70

Bar Scale in metres
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North

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APPROX. ROUTE OF AERIAL ROPEWAY
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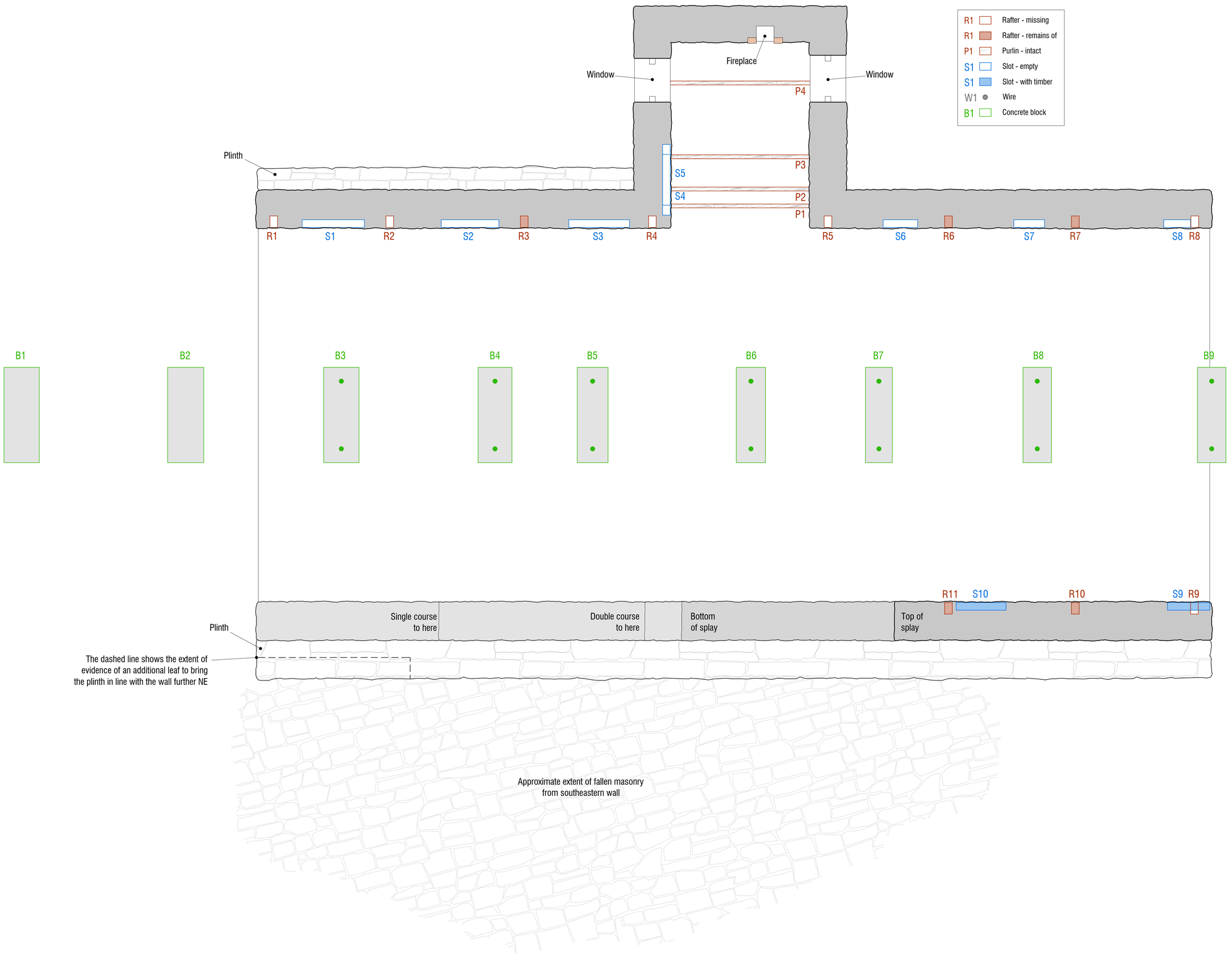

Bar Scale in millimetres
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All dimensions in millimetres

North

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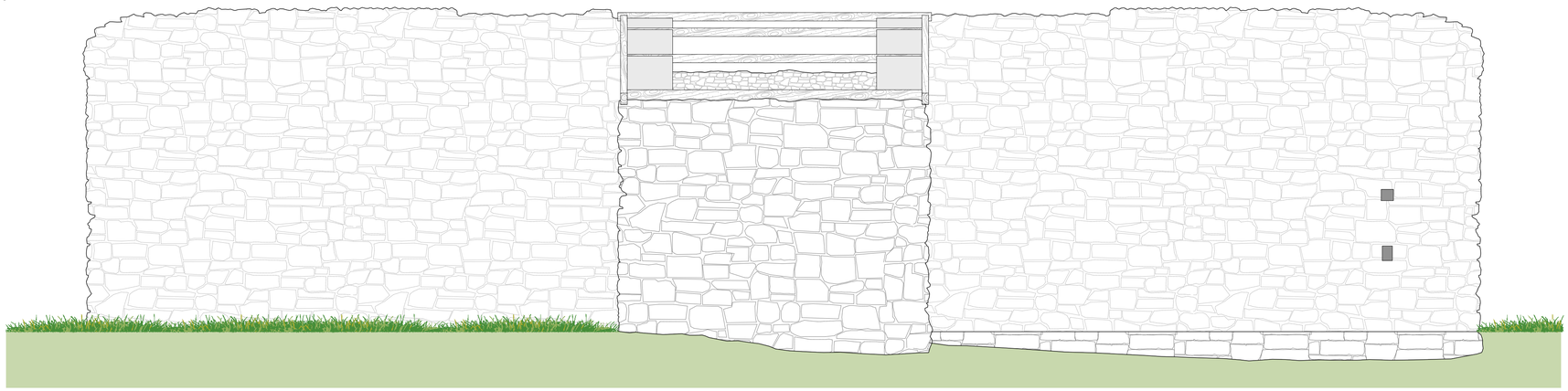
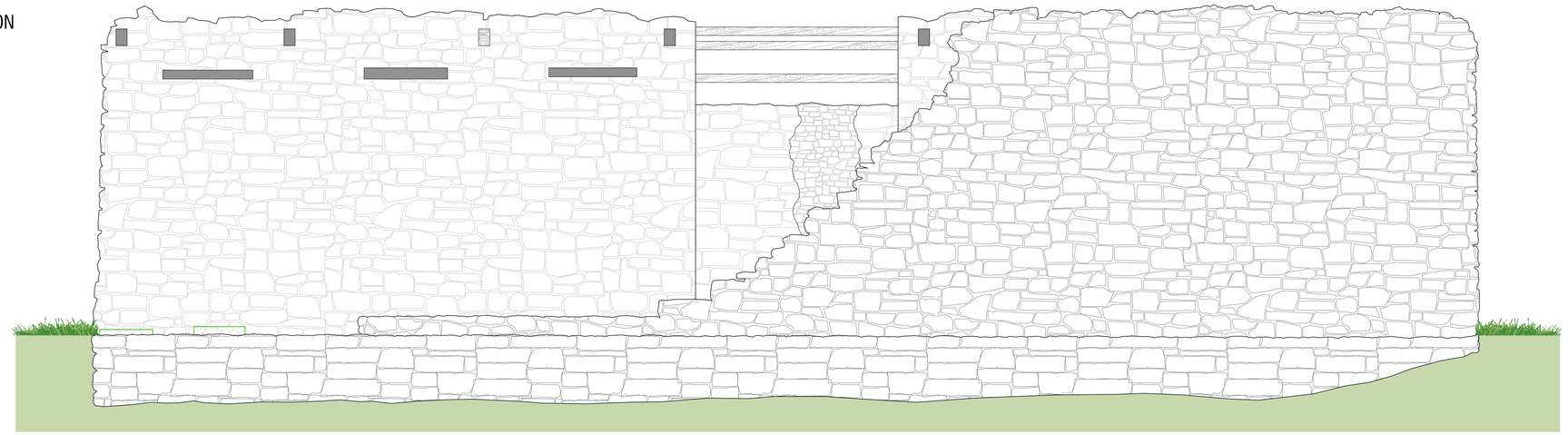
Silverband Mine Brake House, Knock Fell, Cumbria
CONSERVATION MANAGEMENT PLAN
Job no: 21/24 June 2022

PLAN - AS EXISTING
Dwg no: E1
Scale: 1:25 at A1 / 1:50 at A3

NORTHWEST ELEVATION



SOUTHEAST ELEVATION



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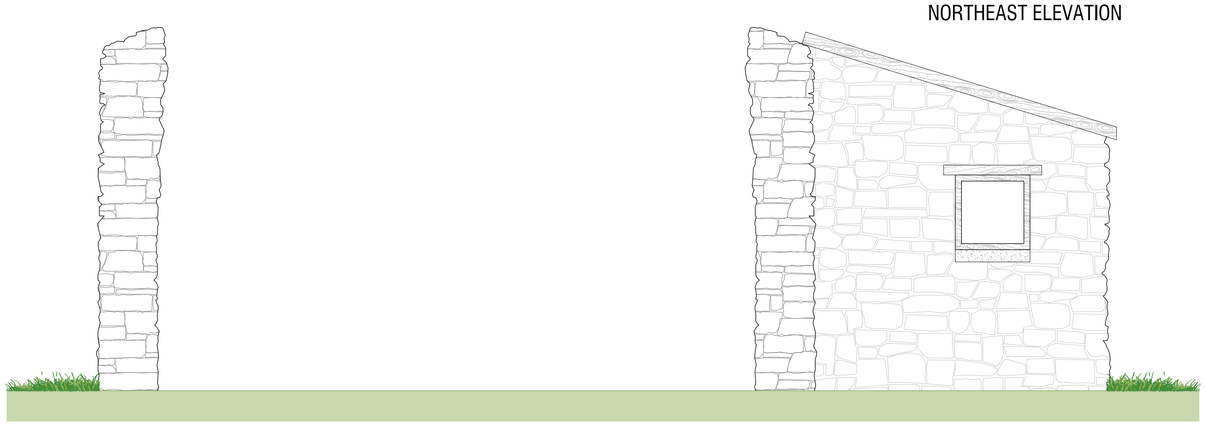

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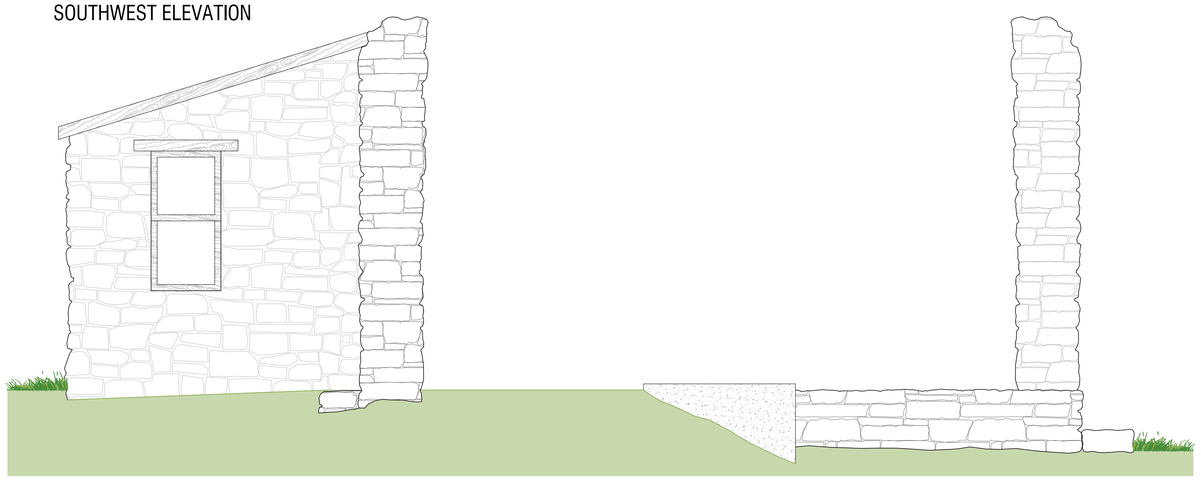

Bar Scale in millimetres

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All dimensions in millimetres

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CONSERVATION MANAGEMENT PLAN
Job no: 21/24 June 2022

EXTERNAL ELEVATIONS - AS EXISTING
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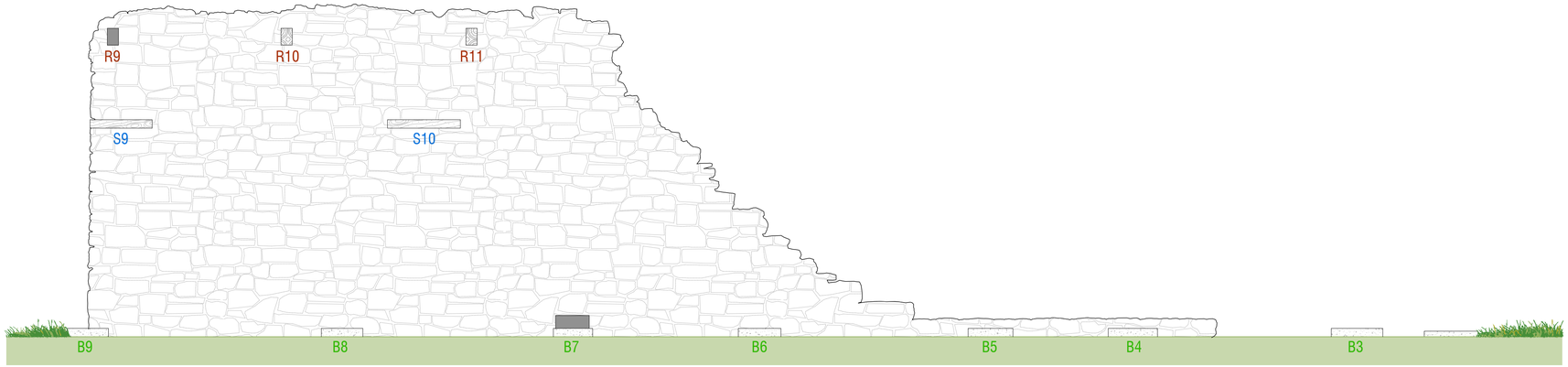
Scale: 1:25 at A1 / 1:50 at A3

SOUTHEAST ELEVATION



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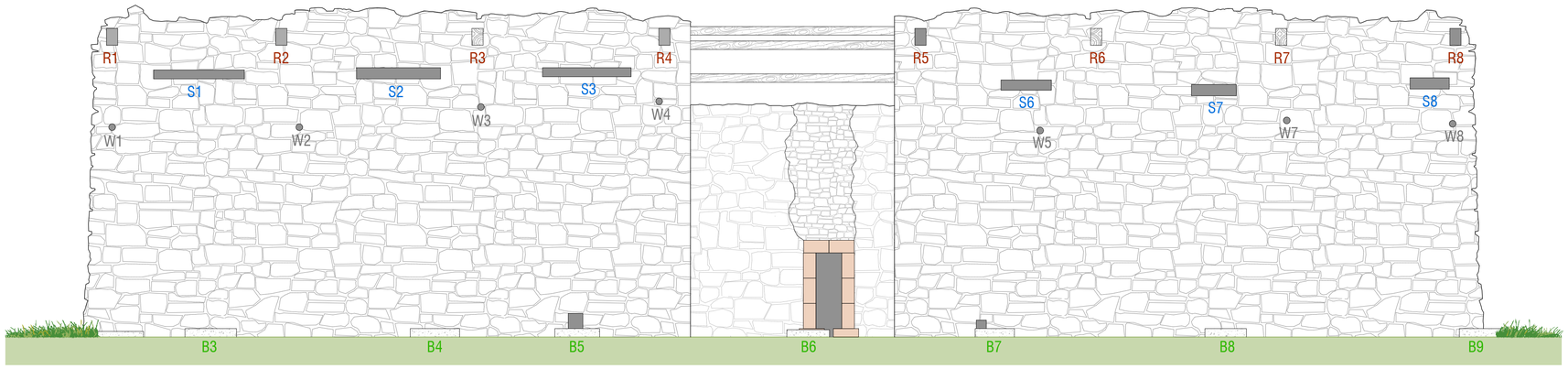

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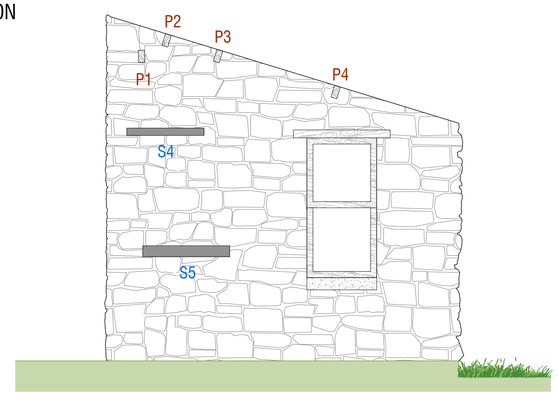

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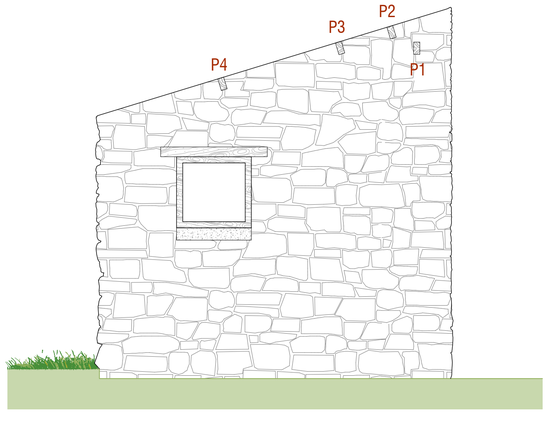

Bar Scale in millimetres
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All dimensions in millimetres

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CONSERVATION MANAGEMENT PLAN
Job no: 21/24 June 2022

INTERNAL ELEVATIONS - AS EXISTING
Dwg no: E3
Scale: 1:25 at A1 / 1:50 at A3