

HUNGRY CHERT QUARRIES, MOULDS SIDE,
ARKENGARTHDALE, NORTH YORKSHIRE

ARCHAEOLOGICAL SURVEY



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EXECUTIVE SUMMARY

In January 2015, Ed Dennison Archaeological Services Ltd (EDAS) were commissioned by Mr Robert White, Senior Historic Environment Officer of the Yorkshire Dales National Park Authority (YDNPA) to undertake a pre-intervention Level 3 archaeological survey of the core of the Hungry Chert Quarry complex on Moulds Side, Arkengarthdale, North Yorkshire (NGR NY 990 030 centred), as part of a phased programme of consolidation and repair. The work augmented an earlier descriptive and photographic record undertaken by Stephen Eastmead of the Swaledale and Arkengarthdale Archaeology Group (SWAAG) in late 2013 (Eastmead 2014), and formed part of a much wider landscape survey undertaken by EDAS in Arkengarthdale between 2012 and 2015; the chert quarry complex was surveyed between October 2014 and March 2015. The survey area covered c.1.73ha, and lay wholly within a Scheduled Monument. The project was funded by the YDNPA.

The survey area is located within a landscape that had been worked intensively for lead for at least several hundred years before the chert quarrying commenced, and so needs to be considered as part of this landscape. The survey identified several features within the survey area which relate to this earlier activity, and was also able to comment on the nature of working methods employed in the wider landscape, raising questions that can only be resolved through further detailed survey. Chert quarrying on the Main Chert limestone formation, in the form of opencasting, commenced close to the survey area in c.1932, possibly within a former hush known as Lily Jock's Hush. At a slightly later date (possibly September 1934), two levels were driven into the hillside to mine the chert from the Black Beds, with a third level apparently added later. A smithy was built close by to serve the quarry men working in the levels. A section of the by then disused smelting flue of the New Mill was removed when the levels were driven.

An incline serving the chert levels had several different phases of use. The surviving earthworks show that a western alignment is earlier than an eastern route, and so this could therefore date to c.1932 when chert opencasting started in this area; if this activity did indeed take place in Lily Jock's Hush to the west, then the western incline would have been conveniently placed to serve this. However, one should not underestimate the influence of pre-existing topography. The western incline runs down one of the many prominent gullies in this area, and the presence of this gully, providing a 'ready-made' route south-eastwards through a heavily worked landscape, may have partly determined where the incline and its siding/loading bay were based. The western incline was presumably once provided with a brake house like the later eastern incline, and was powered by the engine in the same engine shed, although this is not made clear by previous surveys. The western route of the incline may have had only a very short lifespan, perhaps little more than two years if the chert levels were worked from late 1934 onwards.

The construction of the steep upper part of the eastern incline was a major undertaking and, given the effort involved, it must surely have been used, if only for a short period. This upper part was provided with a brake house, situated midway between the trackbeds leading from two of the chert levels. It seems likely that, as has previously been proposed, the gradient of this upper incline was simply too steep for flat-bed trucks or wagons without any kind of gradient compensation mechanism. Following the abandonment of the upper incline by at least 1946, the brake house was dismantled and the mechanism was re-erected at a lower level, with a new siding and loading bay constructed to serve the dressing heaps of worked chert extracted from the nearby levels. The east incline extended for a distance of 970m from the lower brake house to a loading bay on the Reeth to Tan Hill road (1030m if the upper incline is included), to allow chert blocks to be transported out of the dale. Chert working ceased in 1950, and the incline and other equipment were dismantled soon after.

1 INTRODUCTION

Reasons and Circumstances of the Project

- 1.1 In July 2014, Ed Dennison Archaeological Services Ltd (EDAS) were commissioned by Mr Robert White, Senior Historic Environment Officer of the Yorkshire Dales National Park Authority (YDNPA), to undertake a pre-intervention Level 3 archaeological survey (as defined by English Heritage 2007) of the core of the Hungry Chert Quarry complex on Moulds Side, Arkengarthdale, North Yorkshire (NGR NY 990 030 centred), to inform management proposals for the area.
- 1.2 The work augmented an earlier descriptive and photographic record undertaken by Stephen Eastmead of the Swaledale and Arkengarthdale Archaeology Group (SWAAG) in late 2013 (Eastmead 2014). The EDAS survey area covered c.1.73ha, and it lies wholly within a Scheduled Monument (National Heritage List for England no. 1015854); the complex is also listed on the YDNPA Historic Environment Record (MYD 55465). The scope and scale of the project was defined by an EDAS methods statement which was drawn up in consultation with the YDNPA (see Appendix 2). The project was funded by the YDNPA through the Yorkshire Dales Industrial Monuments Management Scheme (YDIMMS) programme in partnership with Historic England.

Site Location and Summary Description

- 1.3 The main EDAS survey area was located wholly on the southern slope of Arkengarthdale, between the unclassified Reeth to Tan Hill road and the Moulds Side area. The area was irregularly shaped in plan, aligned north-east/south-west, measuring c.330m long by a maximum of c.130m wide (1.73ha) (see figures 1 and 2). There was also a second, much smaller, detached survey area immediately adjacent to the Reeth to Tan Hill road; this measured 52m long (east-west) by 30m wide (north-south). For budgetary reasons that portion of the incline formerly associated with the chert quarrying, and lying between the two survey areas, was not surveyed in detail.
- 1.4 Land use in the two survey areas was unenclosed rough grazing, characterised by grass and other species rather than heather, with areas of scree and rock outcrop. The main survey area is CROW access land, and is also crossed by a number of designated footpaths and unmetalled tracks used for estate management. There is a relatively level area at the south-west end of this survey area, but the greater part slopes steeply down from south-west to north-east; the highest point was set at 498m AOD, sloping downwards to 413m AOD. The detached survey area by the side of the Reeth to Tan Hill road was set on average at 325m AOD.

Details of Previous Work

- 1.5 As previously noted, the Hungry Chert Quarry complex was previously the subject of a descriptive and photographic survey by Stephen Eastmead of SWAAG in late 2013 (Eastmead 2014). Prior to this, the chert quarries had been discussed by Tyson (1995), whilst the history of chert quarrying across the wider Arkengarthdale and Swaledale area had been the subject of detailed documentary research (Jackson 2010). The smithy specifically built to serve the chert quarries has also been recorded in detail prior to consolidation work; this identified some of the chert workers by their graffiti left on its walls (Richardson & Dennison 2014).

- 1.6 In terms of the wider landscape context of the chert quarrying, the development of lead mining and smelting within Arkengarthdale is well covered in general studies such as those by Raistrick (1975), Clough (1980), Tyson (1986 & 1995) and Gill (2004). There are also more detailed studies of specific elements of the local industrial landscape (for example, Myers & Whitaker 1993). Most recently, the Octagon Smelt Mill, the New Smelt Mill (and their complete flue systems together with a substantial part of their landscape settings), and the watercourses on the southern flank of Arkengarthdale have been the subject of detailed archaeological survey (Richardson & Dennison, forthcoming (a); (b); (c)).

Aims and Objectives of the Project

- 1.7 The aims of the project were to:
- provide a detailed pre-intervention record of the complex;
 - identify and gather sufficient information to establish the extent, nature, character, condition, quality, date, significance and functional relationships of the surviving archaeological and historical features within the survey areas;
 - provide a basic structural assessment of the standing remains associated with the quarry complex (including a tramway), to establish the consolidation needs of identified features;
 - examine and document any evidence for damage to the complex that relates to either natural erosion, or current land management, drawing up a list of recommendations towards the 'ideal management' of the complex;
 - provide an accessible version of the report, suitable for publication in an appropriate academic publication.

Survey Methodologies

- 1.8 Three separate phases were required to be undertaken as part of this project, namely documentary research and collation, topographical survey, and reporting. As is usual with survey projects such as this, there were numerous cross references and links between the three phases, with initial fieldwork informing and determining the scope and scale of the reporting. The project corresponds to a Level 3 enhanced and integrated survey as defined by English Heritage (2007, 23-24; Bowden 1999, 78-80 & 189-193); English Heritage is now known as Historic England.

Phase 1: Collation of Documentary Material

- 1.9 The project did not require any new documentary research. The basic history and development of industrial activity in the area has already been established by others, and more detailed work has been undertaken on specific elements of the industrial landscape, including the chert quarrying.
- 1.10 However, existing readily-available documentary material held by the YDNPA HER and Historic England was collated for incorporation into the survey work. This information comprised records/reports of any previous historical research and archaeological activity, aerial photographs, past management and land ownership records, Scheduled Monument records, and historic maps and plans.

- 1.11 In addition, given their extensive knowledge of the area, liaison was also undertaken with the Recorder of the Northern Mine Research Society (Mike Gill), and with Stephen Eastmead of SWAAG in relation to the chert quarrying. Relevant maps and plans held by the North Yorkshire County Record Office in Northallerton were also examined. The archives of Swaledale Museum in Reeth also hold a number of relevant photographs, many taken whilst the chert quarries were still in operation; some of these are reproduced by Tyson (1995) and Eastmead (2014).
- 1.12 A full list of primary and secondary sources consulted for the project are given in the bibliography (Chapter 5) below.

Phase 2: Archaeological Topographic Survey

- 1.13 As noted above, the main survey area covered 1.73ha, and fell wholly within a Scheduled Monument, while the detached survey area adjacent to the road was considerably smaller.
- 1.14 The topographical survey was carried out in October-November 2014 at a scale of 1:500 using EDM total station equipment. Sufficient information was gathered to allow the survey area to be readily located in the landscape through the use of surviving structures, fences, walls, water courses, trackways and other topographical features. The survey recorded the position of all structures, wall remnants and revetments, earthworks, water courses, leats, paths, stone and rubble scatters, ironwork, fences, walls and other boundary features (all at ground level), as well as any other features considered to be of archaeological or historic interest. The survey also recorded any differences in the exposed surface detritus, such as sorted stone and/or rubble scatters, as well as differences in coarse vegetation; these features may aid the functional differentiation and interpretation of the site. The detailed site survey paid particular attention to the structural remains, and also recorded areas of erosion (both natural, animal and man-made) or other damage. For health and safety reasons, no underground surveying was undertaken. Individual sites or structural elements were not surveyed in any greater detail (e.g. 1:50 or 1:20 scale plans or elevations), as it was considered that a detailed photographic coverage and descriptive account (see below) would suffice to produce an appropriate level of record, which could then be used for consolidation work as necessary.
- 1.15 The site survey was integrated into the Ordnance Survey national grid by resection to points of known co-ordinates. Heights AOD were obtained by reference to the nearest OS benchmark; given the nature of the remains, contours were not plotted across the site. Survey points were taken from fixed survey stations on a closed traverse around and through the site. On completion of the total station survey, the field data was plotted and re-checked on site in a separate operation; this work was carried out in February-March 2015. Any amendments or additions were surveyed by hand measurement, and the results digitised back into the electronic survey data.
- 1.16 The resulting site survey of the main survey area has been produced at a scale of 1:500, while the smaller roadside survey area is scaled at 1:250. Both are presented as interpretative hachure plans using conventions analogous to those used by English Heritage (1999; 2002, 14; 2007, 31-35). It should be noted that the final product arising from the site survey was a series of hand-drawn wet ink hachure plans, although AutoCad (or equivalent) electronic data could also be provided if required. Larger scale plans, at 1:10,000 and 1:2,500 scale, were used to put the survey area into context.

- 1.17 The main site elements or components were given a unique identifier number, and a detailed written description has been provided, based on notes taken in the field. No pro forma record sheets or database were prepared, although the report contains detailed descriptions, including a preliminary interpretation of the extant remains (e.g. dimensions, plan, form, function, date, sequence of development), locational information (including ten figure grid references obtained from the topographical survey, OS map bases or hand-held GPS systems), and mention of relevant documentary, cartographic or other evidence, and management details such as an assessment of current condition and threats.
- 1.18 A detailed photographic record was also produced to illustrate specific well-preserved site components, details of specific sites and/or areas of erosion etc. More general photographs were also taken showing the landscape context of the survey area and of specific sites. The colour photographs were produced using a Panasonic Lumix DMC-FS10 digital camera with 12 mega-pixel resolution, in accordance with English Heritage photographic guidelines (English Heritage 2007, 14); each photograph was normally provided with a scale. All photographs have been clearly numbered and labelled with the subject, orientation, date taken and photographer's name, and have been cross-referenced to digital files etc.

Phase 3: Archaeological Survey Report and Archive

- 1.19 An EDAS archive archaeological survey report has been produced, based on the results of the documentary collation and the information obtained during the fieldwork. The report assembles and summarise the available evidence for the survey area in an ordered form, synthesises the data, comments on the quality and reliability of the evidence, and how it might need to be supplemented by further field work or desk-based research. The report is also illustrated by reduced versions of the survey drawings, historic maps and plans, and a selection of photographic plates. The report also contains various appendices, including photographic registers and catalogues. An electronic version of the final survey report (in pdf format) was also prepared, and this has been made available to the YDNPA HER and other interested parties, and a copy has been uploaded with other relevant project information to Historic England's OASIS (Online Access to Index of Archaeological Investigations) project.
- 1.20 An archive of material, comprising paper, magnetic and plastic media, relating to the project has been ordered and indexed according to the standards set by Historic England. This was deposited with the YDNPA HER at the end of the project (EDAS site code HCQ 14). The project was assigned the unique YDNPA HER event number EYD15540.

2 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

Earlier Working for Lead

- 2.1 The area in which the chert quarrying took place has a long and complex history of lead working, and it is necessary to describe this, if only in outline, as it is relevant to the later development of the remains identified within the survey area.
- 2.2 A 1718 map of the Manor of Arkengarthdale (NYCRO ZQX 5/1) marks the “High Rake” and the “Low Rake” commencing at “New Moulds” (located to the south-west of the existing Moor Intake Farm) and running south-eastwards, with the Low Rake splitting into two parallel lines (see figure 3). The latter approximately follow Martin Vein, Nixon’s Vein and Stodart Vein; it is not certain if they relate to the ‘molderset’ and ‘new work at Moldes’ drawn on a boundary dispute plan of August 1675 (Tyson 1995, 20). Rakes are usually defined as wide veins which have been worked from shallow shafts (Gill 2004, 166), and indeed shafts are visible adjacent to some of the hushes in the area, such as Stodart’s Hush (Eastmead 2014, 15). According to Tyson (1995, 39-42), several hushes were being worked by the mid 18th century in the area of Moulds Side to the west of where the chert quarries would subsequently be worked.
- 2.3 Eastmead (2014, 13) questions to what extent many of the very substantial linear depressions on Moulds Side named as ‘hushes’ on maps were ever actually hushed. He uses the example of Turf Moor Hush, to the south of the EDAS survey area, which he suggests has no evidence for associated dams or any other provision of water. He also contrasts the well-worked appearance of the bottom of the Turf Moor Hush with the hushes on Moulds Side, which are said to preserve minimal evidence for mining activity actually within them, although returns from working the hushes are documented in the late 18th century (Tyson 1995, 40-42). Furthermore, Eastmead suggests that there was little need for hushing on Moulds Side due to the thinness of the overlying soils (with the water being directed to dressing floors instead), and points out the lack of gangue or waste rock stored within even the largest hushes such as Stodart’s Hush.
- 2.4 The Ordnance Survey 1857 6" map marks an extensive complex of dams, some conjoined and still water-filled in the mid 19th century, on the level plateau of land to the south of the prominent linear depressions on Moulds Side (see figure 5). These dams may, of course, not necessarily be linked with hushing, although the area has never been surveyed or otherwise examined in the level of detail required to reveal the relationship between the two groups of features. Detailed survey, allied with documentary research, of the watercourses on the southern slope of Arkengarthdale (Richardson & Dennison forthcoming (c)) has revealed their complex development over a wide area and also the often misleading nature of map depictions. Nevertheless, some of the dams shown on the 1857 map do have a suggestive spatial relationship with some of the linear depressions; for example, the linear depression marked as ‘Martin Vein’ (set at the southern end of Dam Rigg Cross Hush, and named ‘Adam Bird’s Hush’ in 1799 (NYCRO ZQX 5/5)) has a dam aligned on its western end, with another very close to the southern side of the central part.
- 2.5 Setting aside for a moment how the substantial linear features were actually created, one of the hushes on Moulds Side was known as ‘Lily Jock’s Hush’. In contrast to many of the other hushes in this area, Lily Jock’s Hush is neither well documented nor well-defined. However, it does appear on a plan of 1787 (Tyson 1995, 41), along with ‘Bird’s Hush’ to the north-east; Lilly Jock’s Hush is depicted

as two curving parallel lines, diverging away from Bird's Hush. The name 'Lilly Jock's' was also once applied to a drovers' inn close to Eskeleth and it is still named as such on Clarkson's 1836 *Map of the Tan Hill to Reeth Turnpike* (Wright 1985, 191), although the origin of the name is not clear. Eastmead (2014, 14 & 23-24) suggests that the east end of what is sometimes marked as the 'Hungry Hush' formed the upper part of Lilly Jock's Hush, with the north-eastern end curving around into the area west of the smithy associated with the chert quarrying.

- 2.6 Early maps are generally too schematic to give a detailed idea of the form and location of the earlier lead workings (particularly surface ones) in the area. Nevertheless, a map of c.1794 (NCRO ZQX 5/35) does give a generalised depiction of what is named as 'Stodart's Hush'. The map suggests that, by the end of the 18th century, three main linear depressions came together at their eastern ends to form a single broad area running to the north-east, and it is this which is named 'Stodart's Hush' on the map (see figure 4); the location of Lily Jock's Hush, as suggested by Eastmead, would lie within this single, broad area. The earthworks and other features within Lily Jock's Hush are stated to form evidence of lead ore processing activity relating to the opencasting and dressing of ore from surface veins that were probably once visible around the entrance to Hungry Hushes. The southern end of the hush appears to be defined by outcrops of Main Chert limestone, but it gradually peters out as it descends northward across Moulds Side (Eastmead 2014, 14).
- 2.7 By 1857, the largest of the three linear depressions shown in c.1794 was marked "Stodart Hush" on the Ordnance Survey 6" map, although the overall shape of the workings across the area is still recognisable from the earlier map (see figure 5). Within the single broad area at the north-eastern end, numerous features including levels, washings, ponds and spoil heaps are marked. In the immediate area of where the chert was to be quarried, an unnamed dam was shown at the southern end, with "Old Walls" marked to the north-east, and a contour leat running off the south-western end.
- 2.8 By 1893, the New Mill's smelting flue, itself an extension of the Octagon Mill's flue had been extended across this area and the dam shown in 1857 had become disused, and was now marked as "Old Dam" (see figure 6). A mass of earthworks are depicted to the north of the dam, most prominently a wide, curving north-south depression, which merges with a much longer similar feature on a north-west/south-east alignment. All of these earthworks lay within the broad single area of Stodart's Hush in c.1794, and therefore could feasibly have dated to the late 18th century or earlier. By the end of the 19th century, the eastern end of what formed Stodart's Hush in c.1794 was marked as "Hungry Hushes". Also, within the approximate centre of the main EDAS survey area is an "Old Level", which is depicted as two conjoined levels running south and south-east into the hillside here. It is not known which these levels are, and indeed whether they provided access to the lead veins in this general area or just acted as water drainage levels; it is possible that it is the Blackhills Level (Tyson 1995, 110). The two level entrances are also shown on the 1912 edition 25" Ordnance Survey map.

Chert Quarrying and Working

Geology and Early Use

- 2.9 A detailed description of the geology and occurrence of chert within and around the EDAS survey area is given by Eastmead (2014, 5-9), with additional information provided by Tyson (1995, 8-9).

- 2.10 Chert is a fine grained microcrystalline sedimentary rock with a high silica content, ranging in colour from white to black. It is formed when the siliceous skeletons of marine plankton are dissolved and compressed, with silica being precipitated from the resulting solution, although some geologists believe it can be directly precipitated from the sea. The majority of the chert quarried in Arkengarthdale was obtained from the Carboniferous Yoredale limestone series, specifically the Richmond Chert Black Beds, and is blue-black in colour, although initially it was quarried from the Underset limestone and later the Main Chert levels. The thickness of both the Red Bed and Black Bed cherts varies throughout Arkengarthdale.
- 2.11 Prior to its quarrying for the pottery industry during the first half of the 20th century (see below), chert (and also flint) had been used locally for thousands of years. Chert and flint working sites are well known from Swaledale, and Tim Laurie has noted that artefacts of fine grained black Pennine chert are generally present on occupation sites throughout the catchments of the Ure, Swale and the Tees/Greta river systems, ranging from the Early Mesolithic through the Later Mesolithic and Neolithic periods to the Middle Bronze Age (quoted in Eastmead 2014). Wherever cores of chert are found, they are of water-rolled cobbles indicating that the chert used by early hunters and pastoralists was not quarried from an outcrop, but was carefully selected water-rolled glacial till or stream-rolled gravel. These chert cores, which are generally free from frost fractures, are limited to the fine-grained glassy black chert which outcrops above the Underset Limestone. The frost fractured blue-grey chert which outcrops above the Main Limestone was never selected for small tools, microliths and arrowpoints, although natural flakes of this material may have been used as scoring tools. In the post-medieval period, chert found a use in the firing mechanism of the flint-lock rifle or pistol, and also as a roadstone aggregate.

20th Century Chert Working in Arkengarthdale

- 2.12 The precise date that chert working for the pottery industry began in Arkengarthdale is uncertain. It is sometimes alleged that mining started on Fremington Edge in 1895, but the source of this information is unclear. However, the 1901 census returns show three chert quarrymen living in Reeth and four at Booze in Arkengarthdale, with none in 1891 (Jackson 2010, 126-127). In the 1911 census, nine chert quarrymen are listed as living in Arkengarthdale, as well as three 'quarrymen', two 'stone quarrymen' and one 'limestone quarry man' (<http://www.dalesgenealogy.com/census/arkendale11.html>); three members of the Hutchinson family, living at the Old School House, are each described as being a 'quarry man delver, pottery manufacture and worker'.
- 2.13 The chert was used as part of the grinding process in flint mills, principally those associated with the north Staffordshire pottery industry, where they required a high silica stone that was abrasive but sufficiently hard to be long lasting. Blocks of chert were placed in the round tubs used to grind flint. The inside of a tub was paved with chert blocks and rotating arms drove a second set of chert blocks in a circular motion on top of them. The tubs were then charged with flint and water, and the rotation continued until the flint was ground sufficiently fine before being mixed with clay. With flint being a form of chert, the wearing of the chert blocks did not contaminate the final product. Chert was also bought from sources in Derbyshire and North Wales - these two sources had the advantage of cheaper transport costs but in both cases the chert obtained had a lower silica content compared with that of the Swaledale chert (Eastmead 2014, 9).

- 2.14 In 1905, John Shatwell Wagstaff, a potters' merchant from Stoke on Trent, arrived in Reeth. He appears to have been associated with the Boulder Flint Company, based in Stoke on Trent, who took over the Fremington Edge chert works, and he ran the Fremington operation until his death in 1916. Before this date, he is alleged to have taken his son, Jack Wagstaff, secretly into Arkengarthdale to show him possible future sources of chert. Jack was called up for active service in 1916 but when he returned in 1919, he became manager of the Boulder Flint Company, a position he held until 1922 (Jackson 2010, 127-128 & 134). In 1922, as a result of a major dispute at Fremington (possibly concerning money), Jack Wagstaff and several of the other most experienced chert workers broke with the Boulder Flint Company and set up their own operation in Arkengarthdale. Initially, Wagstaff took out a lease from the C. B. Estates of Moulds Low Level, working chert in the former lead level until 1932 (Tyson 1995, 88; Hardy 2008, 5; Jackson 2010, 127-128 & 135).
- 2.15 According to Tyson, in 1932, the Crow Chert Beds, high on Moulds Side, began to be worked, and these workings were to become known as the Hungry Chert Quarries. Tyson (1995, 89) reproduces a photograph said to date to c.1923 and to show opencasting for chert, with a shelter visible in the background and part of an incline. However, as Eastmead (2014, 17) notes, this would be very early evidence for the presence of a chert incline, and it seems likely that the c.1923 date is in fact a typographical error, with the '2' and '3' transposed, i.e. c.1932. Tyson (1995, 88) also states that chert was first quarried at its exposure above Stodart's Hush, but Eastmead (2014, 16-17 & 23-24) disagrees. He suggests that there are no outcrops of chert within either Stodart's or Hungry Hush, and therefore it cannot initially have been worked here, suggesting instead that the opencasting area for the Main Chert was in fact in what he defines as Lilly Jock's Hush, downslope and to the north-west of a smithy building (see below). At a later (but uncertain) date, two levels were driven into the hillside close to the south-east of the smithy to work the chert from the Black Beds, cutting through the redundant flue of the New (Smelting) Mill, with a third level apparently added later (Tyson 1995, 88; Eastmead 2014, 10). There were 16 men employed in the chert quarries in Arkengarthdale in 1934 (Pontefract & Hartley 1934, 150).
- 2.16 A smithy was required close to the chert workings in order to make and sharpen the tools used to extract and dress the chert; there was, for example, a smithy at the Fremington Edge Chert Quarries by 1910 (Jackson 2010, 128). However, it is not known exactly when the smithy at the Hungry Chert Quarries was built. Jackson (2010, 136) suggests that some of the buildings at the redundant New Mill complex were used as a smithy and offices, but this would not have been very convenient for the workings. The smithy was definitely present by 1940 (and perhaps as early as 1934 on the evidence of internal graffiti), when Ramsay Hutchinson came to work at the chert quarries (Richardson & Dennison 2014). He was set to work with the blacksmith, Thomas Hird, at the smithy, and remembered that it had a corrugated iron roof and a window which provided a delightful view across the dale. The building also served as a shelter where men could get warm while eating their food, and a small red-brick red oven was made in one of the corners. Hutchinson was initially on a flat wage of 16 shillings per week, which rose to 18 shillings in 1941. In 1942, Thomas Hird was called up for active service and Hutchinson was made blacksmith in his place. When he left in 1950, the wages had risen to £5 10s for a 44 hour week (Tyson 1995, 93-94). The men had to buy their own bar steel for their tools, with Hutchinson shaping, sharpening and tempering the bars, wedges and feathers to the necessary hardness (Tyson 1995, 94); quarry smithing was a specialist branch of the craft, the temper of the tools having to be adapted to the rock that was being worked (Hartley 1939, 124).

- 2.17 Tyson (1995, 88) describes the methods of working the chert underground as follows: *“Natural joints which separated the chert bed into large blocks were exploited by the men when extracting the stone. The method of working was to cut away the overlying limestone, or ‘Bearing’, until a cross joint was reached. Each band of chert was then split away, using plugs and feathers. The top layer, which was of a pinkish hue, was the best quality and it was from here that the ‘Runners’ were obtained. The size of these was not critical, but a weight of 30 cwt was usually aimed for. The middle bed, with a bluish hue, provided the ‘Pavers’ which had to be 12, 14 or 16 inches long. The lower beds were cut lengthways to obtain the required size. As much separation and dressing as possible was done underground to avoid unnecessary carrying and to allow the deads to be used for packing the voids”*. The stability of the level’s roofs was apparently a constant worry, and on one occasion two miners, Jake Stubbs and Sidney Hird, were trapped underground for a day after a serious roof fall (Hardy 2008, 5-6).
- 2.18 Once quarried, the chert was loaded onto flat bogies or trucks, running on rails taken from old lead mines, and an initial phase of dressing put a smooth face on the base of the runner and on one end of the paver (Tyson 1995, 88); it is assumed that the final dressing took place at the north Staffordshire flint mills. The chert was then sent down an incline to a loading bay on the Reeth to Tan Hill turnpike road. Tyson (1995, 89-91) describes the incline as ‘double-acting’, i.e. using the weight of the descending trucks to haul up empty trucks on an endless rope; the speed of the descending trucks was controlled by a brake drum located at the top of the incline. Part way down, where the slope of the valley side levelled out somewhat, there was a passing point where the trucks were unhitched from the endless rope and hitched onto a winch cable, powered by a Morris Cowley engine housed in a corrugated-sheeting hut. The trucks were then lowered to a loading bay adjacent to the road, unloaded, and brought back up to be re-attached to the cable of the double-acting section of the incline. Hardy (2008, 5) gives a similar description, but with some critical differences. He suggests that the incline was built from ‘top to bottom’, with construction starting at the upper end using the large quantities of stone rubble found in this area (perhaps including material from the New Mill’s flue). As the track bed was formed, rails were laid, trucks filled with rock and continually lowered down until the bed was complete. Hardy states that the incline “ultimately worked on the principle that two laden trucks would assist the ascent of the two that were empty” and since “there was only one track, provision was made for a passing place”. Interestingly, he added that trucks were initially “lowered to the road manually with the aid of a ratchet principle to prevent the danger of them running away”, but that later a Ford engine was introduced into the system; this may have pre-dated the Morris Cowley engine noted by Tyson.
- 2.19 Eastmead (2014, 23-32) argues that there is no structural or historical photographic evidence for the presence of twin lines, or even only a section of such equipped with points at the halfway point, that would be required for a double-acting incline, and also highlights the problem of operating the system when the whole length was not visible from any single point. He instead proposes that the whole system was a continuous powered loop, organised around the car engine located in the engine shed. Power to the incline could have been controlled using the clutch mechanism of the engine, setting the endless cable in motion to haul empty trucks one by one up from the loading bay to a position adjacent to the engine shed. They would then have been uncoupled, pushed up the track for a few metres and re-attached to the up cable. At the top of the incline, the truck was uncoupled for the second time, and pushed by hand to the siding to be loaded with dressed chert. It seems likely that empty trucks would have been taken up this way to the top of the incline in the morning. The gearbox would then have been

put into neutral and the engine shut down. At the end of the working day, the laden wagons were coupled, one at a time, at the top of the incline, with the engine turned off and the gearbox left in neutral. Once pushed over the edge of the incline top, gravity would have taken the laden trucks so far, and then the system could be powered up to take them the remainder of the distance to the roadside loading bay.

- 2.20 The Hungry Chert Quarries closed in 1950. In August 1950, Johnson Brothers of Stoke-on-Trent, the main client for the Arkengarthdale chert, suddenly stated that they would no longer need a supply of the material; ironically, in April-June of the same year an article in *Yorkshire Life* had noted of the chert quarrying that 'as long as it can be supplied the Potteries will use it' (Wright 1950, 89). Although various reasons for this decision were put forward locally, the most convincing explanation is that ball-mills replaced the old chert grinding pans in the Potteries, and so the chert was no longer required (Jackson 2010, 137-38). After quarrying ceased, the three chert levels either collapsed or more likely had their entrances demolished for safety reasons (Eastmead 2014, 32). The various fixtures and fittings associated with the workings were salvaged during the early 1950s (Eastmead 2014), although the bellows remained *in situ* at the smithy until at least 1965 (Richardson & Dennison 2014). The ruins of the smithy were substantially rebuilt after 1990, but by whom and for what purpose is unknown.

3 DESCRIPTION OF THE EDAS SURVEY AREAS

Introduction

- 3.1 The identified features within the two detached survey areas are described below in a logical sequence. Reference should also be made to the survey plans and plates, and the photographic record which appears as Appendix 1; photographs are referenced in the following text in italics and square brackets, the numbers before the stroke representing the film number and the number after indicating the frame e.g. [5/32]. Finally, in the following text, 'modern' is taken to mean dating to after c.1945.

The Main Survey Area (see figure 9)

Site 1: Smithy Building

- 3.2 As has been noted previously, the smithy was subject to detailed recording in July 2014, prior to this chert quarry survey (Richardson & Dennison 2014), and the following text is taken entirely from this earlier work.
- 3.3 Although Tyson (1995, 93-94) describes the smithy as being 'left over from lead mining', there appears to be little evidence to support this view. A 'Smithey' is marked in 1799 close to the eastern end of Adam Bird's Hush (NYCRO ZQX 5/5), but this is significantly to the west of the survey area. The existing smithy is not shown on any of the late 18th, 19th or early 20th century maps consulted for this survey, and it is far more likely to have been erected as part of the 20th century chert quarrying.
- 3.4 A smithy was required close to the chert workings in order to make and sharpen the tools used to extract and dress the chert. Jackson (2010, 136) suggests that some of the buildings at the redundant New (smelt) Mill complex were used as a smithy and offices, but this would not have been very convenient for the workings. The smithy was definitely present by 1940, and perhaps as early as 1934 on the evidence of internal graffiti (see Chapter 2 above), and it was also used as a canteen. Although the chert quarries closed in 1950, the bellows remained *in situ* at the smithy until at least 1965. The ruins of the smithy were substantially rebuilt after 1990; it is not certain by who or for what purpose. The partially collapsed west gable, visible in 2014, was rebuilt as part of the YDIMMS project in 2015.
- 3.5 The smithy is actually placed on a shallow north-west/south-east alignment but, for ease of description, the long axis is considered to be aligned east-west (see figure 10). It lies on the edge of a very steep north-facing scarp; the upper break of slope, between 0.75m to 0.90m beyond the north wall of the smithy, is formed by a bare rock outcrop which drops near vertically for a short distance before becoming a very steep, largely grassed, surface. A rock outcrop can also be seen (in plan only) some 1.40m to the south of the south wall of the smithy. It runs parallel to that to the north of the building, and it seems likely that a level terrace, measuring c.8.0m east-west by 6.5m north-south, was deliberately created here to house the smithy by cutting back the surface of the rock, probably only by 0.30m. To the east and west of the smithy, the ground surface rises to either spoil heaps or disturbed ground. To the south, the ground also rises to a low scarp, along which a footpath (Site 7) runs. It appears that the smithy could originally have been approached only from the east or west, with the principal access probably from the east.

- 3.6 The smithy has a slightly sub-rectangular plan, with maximum external dimensions of 7.30m east-west by 4.32m north-south (see figure 10 and plate 3). It is of a single storey, and was originally provided with either a pitched or single-pitch roof, but subsequent collapse has removed almost all evidence for the roof form. It was formerly covered with corrugated iron sheeting, and small fragments of such survive within rubble at the base of the very steep slope above which the smithy stands, together with several decayed softwood timbers up to 2.70m in length, which are also assumed to have formed part of the roof structure, and some other fittings [1/808, 1/810-1/813]. The external walls now survive to a maximum height of 2.15m to the south side, and this probably represents something close to the original eaves level, although much results from post-1990 rebuilding. The majority of the walls are built of roughly coursed and squared gritstone rubble, set with a lime mortar. There are larger pieces of stone to the north-west and north-east corners used as quoins, but to the south-east and south-west corners the coursing does not change significantly. Where the walls have collapsed, such as at the south-west corner, the roughly coursed and squared rubble is revealed to be a facing only, with a core of small angular stone pieces. A very small use is made of brickwork to the internal south-east corner, the bricks being red, handmade (average dimensions 230mm by 110mm by 80mm) and set with a cement mortar; further examples of machine-made bricks can be seen at the base of the slope below the smithy.
- 3.7 The only doorway, positioned off-centre in the south elevation, faces away from the open valley side to the north, and there were at least two windows, one in the north elevation and one in the south. Internally, the forge was placed at the north-west corner, with the bellows to the immediate south. In the south-east corner, there was a small stove or oven, as the smithy also served as a canteen where the men could warm themselves while eating their food. The only surviving piece of smithing equipment at the time of survey was an *ex situ* slick trough. The smithy retains some internal graffiti, some of which is carved on stone which was clearly placed in its existing location after 1990, and so is unlikely to be *in situ*. Although in places quite worn and difficult to read, the graffiti is a significant survival. Some can be related to Ramsay Moralee Hutchinson, who worked at the smithy between 1940 and 1950. At the upper part of the west end of the south wall, there are a group of five separate stones, three of which bearing graffiti which is consecutive. These are important, as this part of the structure does not appear to have been rebuilt after 1990 and so they may be the only graffiti which remains *in situ*. The three consecutive stones appear to bear the date 'SEP 27 1934 (or alternatively 1937)'. As has been set out in Chapter 2 above, opencasting for chert began in the area in 1932; given that the adjacent chert levels (see Sites 2 to 4 below) were driven after 1932, it is quite possible that when this took place, a smithy housed in the disused New Mill complex was no longer conveniently sited. A new smithy on Moulds Side was therefore built, the 1934 date perhaps indicating not only when the building was finished but also providing an idea as to when the levels were started.

Site 2: Western Level

- 3.8 The western level, like the other levels to the east (Sites 3 and 4), was accessed from a footpath (see Site 7) to its north; this level was called 'Level 1' by Eastmead (2014, 21). A break has been cut through the steep north-facing scarp on the southern side of the trackway, leading into a linear depression or cutting. This cutting is initially aligned north-east/south-west, for a distance of 24.0m. It measures on average 4.0m across the top, and has a narrower flat bottom, 1.0m across, with relatively gently sloping sides up to 1.5m in height [2/811-2/813]; there

would once have been a tramway running along the flat base of the cutting. There are traces of rough rubble revetment walls to either side, particularly near where the break has been cut through the scarp next to the trackway, although they are not well preserved with some stone tumbling into the depression [2/814-2/816] (see plate 4).

- 3.9 As it moves south-west, the cutting becomes narrower and with steeper sides. It is then blocked for several metres, either by deliberate infilling or fallen material, but resumes on the same alignment and in a similar form to that before. It can be followed south-westward for a further 17.0m, with a revetment wall surviving on the south-east side. It then angles sharply to the south, and for a distance of 7.5m is formed by another linear depression up to 1.5m deep, 3.0m wide across the top, with near vertical sides and a flat bottom [2/807]. At the south end of the west side, there is short section of roughly coursed and squared rubble wall, standing 1.0m high [2/805]. This is likely to represent a fragment of the level's former flanking wall, rather than being a revetment for the tramway emerging from it. Nothing of the former entrance is now visible following slumping.

Site 3: Central Level

- 3.10 The central level, like the other levels to the east and west (Sites 2 and 4), was accessed from a footpath/trackway (see Site 7) to its north; this level was called 'Level 2' by Eastmead (2014, 21). A break has been cut through the steep north-facing scarp on the south side of the trackway, leading into a linear depression or cutting; the break is between 3.0m-4.0m wide [2/782, 2/783]. The cutting is aligned north-east/south-west, and measures a total of 37.0m in length. It is on average 3.0m-4.0m wide across the top, and has a narrower, flat bottom 1.0m across, with steeply sloping sides up to 2.0m in height; there would once have been a tramway running along the base of the depression. There are partially surviving rough rubble revetment walls to either side, standing up to 1.3m in height, particularly near where the cutting for the eastern level (Site 4) leaves the eastern side of the linear depression [2/784, 2/785] (see plate 5). Beyond this point, the cutting is slightly narrower and less well defined, although traces of revetment wall still survive to either side [2/798, 2/799].
- 3.11 At the south-west end of the cutting, the remains of the level entrance are visible, comprising two coursed and squared stone rubble walls, set 1.5m apart and standing up to 1.0m high [2/800-2/802] (see plate 6). The walls extend backwards (south-west) for just over 1.0m from the entrance, with a shallow linear gully, 7.0m long, marking the onward route of the level below ground [2/803]. Two photographs exist showing the level entrance before it collapsed or was demolished (Eastmead 2014, 60 - figures 90 & 91).

Site 4: Eastern Level

- 3.12 The eastern level was accessed by a cutting leading off the linear depression housing the tramway for the central level (Site 3) [2/781]; this level was called 'Level 3' by Eastmead (2014, 21). The cutting leaves the east side of the linear depression at a point 18.0m from a footpath (see Site 7) to its north [2/786]. It then angles to the south-east for a distance of 22.0m [2/793-2/796], and is on average 3.5m across the top, with a narrower, flat bottom 1.0m across, and near-vertical sides up to 1.2m in height. The sides of the cutting are formed by rough rubble revetments, the most substantial to survive to any of the three levels, measuring up to 1.5m wide [2/787, 2/788, 2/797]; some of the blocks used are large, being up to 0.5m square. At the south-eastern end of the cutting, the remains of the level

entrance are visible, comprising two coursed and squared stone rubble walls, set 1.5m apart and standing up to 1.2m high [2/789-2/792] (see plate 7). The walls extend back (south) for a distance of just over 10.0m from the entrance.

Site 5: Former line of New Mill Flue

- 3.13 The New Mill's flue was subject to detailed recording prior to this survey taking place (Richardson & Dennison forthcoming (a)), and the following text is taken from this earlier work.
- 3.14 That part of the flue which passed through the chert quarrying area was built between 1857 and 1893. As it approaches the trackway (Site 7) associated with the chert quarries, the flue (Site 5a) comprises a linear depression with a flattened, U-shaped profile, measuring 3.0m wide across the top, with steeply sloping sides up to 1.0m high, flanked by flat-topped banks; the size and composition of the banks varies according to what the flue has either been built across or what it has cut through. The internal side walls of the flue generally survive only in a fragmentary form, in short stretches, particularly to the north side. The route of the flue is interrupted by the trackway (Site 7); the relative levels of the two features mean that the flue could possibly have passed beneath the trackway, but there is no convincing evidence that it did so, and so it is assumed to have been destroyed in this section.
- 3.15 The flue (Site 5b) reappears on the west side of the trackway, firstly as a rubble-strewn sub-circular depression, and then as a more prominent linear depression flanked by banks. It can be traced in a west-north-west direction for c.27.0m before its route has been destroyed by the three chert levels (Sites 2 to 4). These have essentially removed almost 75m of the flue's former alignment, although it is not completely lost. The flue formerly continued to rise relatively steeply through this area (c.13m vertically across the 75m distance), and so isolated remnants can be seen between the chert levels. Between the west and central levels (Sites 2 and 3), there is a slightly raised crescentic bank (Site 5c). This bank is c.9.0m long but stands less than 1.0m high, and is reasonably well vegetated and contains a high proportion of stone rubble. To the west of the western level (Site 2), there is a prominent conical sub-circular mound (Site 5d) of reddened rubble and bare soil overlying a shaley waste; the mound is c.5.0m in diameter, and it sits on top of a long steeply-sloping scarp to the west [2/806, 2/809, 2/817]. Together, both features have a maximum height of 2.5m. Both the crescentic bank and the mound are set at the correct height to form disturbed remnants of the flue (between 491m-492m AOD). The very steep scarp defining the area removed by the chert extraction includes an extended area of bare soil (Site 5e), marking where the flue had collapsed onto it as it was undermined; wall lines within this bare area also formerly belonged to the flue.
- 3.16 At the top of this long scarp, the flue (Site 5f) recommences in a similar form to that seen to the east (Site 5a). It comprises a linear depression with a flattened U-shaped profile, measuring up to 3.0m across the top, with steep sides up to 1.0m high. It is flanked by flat-topped banks, of varying height; because of local topography, the north bank is generally much more substantial than the south bank. Both are generally covered in equal parts by a mixture of heather and long coarse grass, with some bare patches. The north internal side wall survives (in ruinous form) for a length of over 140.0m. It is built of relatively well coursed and squared stone, including some sizeable blocks, surviving to over six courses or 1.0m locally, although it is generally four courses or less.

Site 6: Dam/Reservoir

- 3.17 In 1857, a un-named reservoir is marked in this area, with a leat running towards it from the south-east, entering the southern end. An angular structure, comprising two conjoined cells, to the north-west of the water body is marked 'Old Walls'. By the time of the 1893 edition, the New Mill's flue had been extended across this area and the reservoir shown in 1857 had become disused, and is now marked as 'Old Dam'.
- 3.18 The remains of the reservoir/dam marked in 1857 are visible to the south, and possibly also to the north, of the flue line (Site 5b), on the west side of the access trackway (Site 7). To the south, there is a crescent-shaped flattened area, aligned north-west/south-east, measuring at least 15.0m long by 10.0m wide. The outer (eastern) edge of the dam is formed by a flat-topped earth bank, c.3.50m wide, 1.0m high internally but over 2.0m high to the adjacent trackway [2/780]. The bank curves around to what may be the southern end of the pond but as it returns to the north-west, it is overlain by what appears to be a small flat-topped linear spoil heap, tipped from south-west to north-east. The western side of the former pond is less well defined. To the north of the flue line (Site 5b), there is another smaller level area, but it is more likely that this has been created by other activity than the construction of the dam.

Site 7: Trackway/Footpath

- 3.19 In 1857, an east-west aligned footpath is marked, almost certainly crossing to the south of the survey area, and entering the survey area immediately to the south of an un-named dam (Site 6). By 1893, the route of the footpath stopped at the dam, which was by this date disused. The trackway/footpath originates further to the east on the unclassified Feetham to Langthwaite road.
- 3.20 Where it enters the survey area, the trackway is roughly metalled, and has an average width of 4.0m. It is set between a very steep and high east-facing scarp to the east, and a lower (but still prominent) east-facing scarp to the west [2/776-2/778] (see plate 8). The trackway runs north-west for 44.0m, before meeting the east side of what appears to be the main spoil heap (Site 10) from the chert quarries. This length is suggested to have functioned as a loading bay (Eastmead 2014, 32), perhaps taking chert down Moulds Side by lorry rather than using the tramway or alternatively being used to bring supplies of coal and timber up. There is a slight bank along the top of the eastern scarp of the spoil heap where it meets the trackway, whilst the top of the spoil heap appears to have been either disturbed or levelled off relatively recently. A footpath resumes to the west of the spoil heap, formed by a narrow terrace running west through the survey area along the top of a very steep, high, natural north-facing scarp [2/822, 2/823]. Access to all three of the levels (Sites 2 to 4) was off this footpath, which continues west beyond the smithy (Site 1) and out of the survey area. It is likely that this footpath was originally a narrow trackway running through the southern end of the survey area.

Site 8: Upper Brake House, between Central and Western Levels

- 3.21 On the south side of the track/footpath (Site 7) which runs through the site, there is a sub-oval earthwork cut into the outcropping rock which forms the north-east facing scarp here. Eastmead (2014, 19 - figure 17) reproduces an undated black and white photograph from the Swaledale Museum archive which he believes shows the Upper Brake House, which was used to carry the eastern branch of the incline (Site 17) up to the level of the chert adits, across piers and a revetted bank

(Site 11). He also reproduces a very similar photograph (Eastmead 2014, 59 - figure 89) entitled 'Chert level pulley and braking mechanism'. Both photographs were taken in heavy snow (one with an unidentified figure and one without), and both show a similar structure, with a drystone west wall and a lean-to timber and corrugated sheeting roof, sloping downwards from east to west (see figure 7c). The east side of the structure appears to be open and supported on at least one timber post set at the north-east corner. Marks on the post and roof timbers demonstrate that it is the same structure in both photographs, and in both a higher stone structure is visible to the left-hand side, with a high steeply sloping scarp behind. As Eastmead (2014, 19) notes, the background of the photographs looks different to that which now exists, the earthwork being cut into the steep north-facing scarp on the south side of a trackway (Site 7). In fact, the background more closely resembles what can be seen from the surviving brake house structure (Site 12), particularly the slope and the stone structure to the left-hand side is in the correct position to be a pier (Site 11c). Furthermore, in one photograph (Eastmead 2014, 19 - figure 17), a sloping timber on the right-hand side is in the same position as one of the fixed stays of a derrick crane standing to the west of the existing Brake House in 1946 (Eastmead 2014, 53 - figure 77). However, subsequent collapse makes it impossible to make any definitive comparisons between the older photographs and the masonry of the west wall of the brake house as it now survives. Eastmead (2014, 21) suggests that when the upper brake house fell out of use, the pulley/braking mechanism was transferred to a lower brake house (Site 12).

- 3.22 Whether the earlier photographs show the Upper Brake House or not, it is considered likely that the surviving earthwork does mark the position of such a structure, associated with the revetted bank and piers to the north-east (Site 11), with which it is aligned. The earthwork is open to the north-east, and measures up to 6.0m along each side, with steeply sloping sides up to 1.8m high to the rear. There is a curving bank of stone rubble to the north-east side of the earthwork, whilst to the interior, there may be a smaller, sub-square earthwork, 2.0m across and perhaps with traces of a rubble wall on the east side [2/826, 2/827] (see plate 9).

Site 9: Earthworks, west and north of Western Level

- 3.23 To the west and north of the western level (Site 2), there is an area of earthworks, most likely representing several different phases of activity, some of which will pre-date the chert quarrying. Various linear depressions and promontories are shown in this general location in 1893, although it is difficult to relate these with any certainty to the existing earthworks.
- 3.24 The main earthwork comprises a north-south aligned linear depression, 30.0m long, 3.0m wide across the top and with sloping sides up to 0.5m high [2/808] (see plate 10). It is flanked to the east by a parallel flat-topped bank, 5.0m wide and up to 1.5m high to the east scarp, which is only partly vegetated. There is a further flattened linear area to the east of this bank, and then a second bank, less regular than the first [2/804, 2/810]. To the west of the main earthwork, there is a shallow sub-oval depression, 13.0m long and 6.0m wide, resembling a small reservoir [2/818], although none is shown here on any of the historic maps consulted for the survey. It is noticeable that the main linear depression is on the same alignment as the southern end of the cutting for the western level (Site 2), and so it might possibly represent an earlier access route.

Site 10: Spoil Heap

- 3.25 There is a very large and prominent spoil heap on the eastern edge of the central part of the survey area. No similar spoil heap is shown here in 1857 or 1893, although it is acknowledged that the complexity of working in the area is such that it may have been present and not clearly marked on the map. However, it is equally possible, and perhaps more likely, that the spoil heap forms the main tip from the excavation of the three chert levels, as its spatial relationship to them would suggest.
- 3.26 The spoil heap essentially has two lobes, both of which are flat-topped, which have both been tipped from south-west to north-east [2/779] (see plate 11). Both are also relatively well vegetated, but where their composition is visible, it appears to comprise mostly development waste and stone rubble. The smaller, southern lobe is 25.0m long and stands up to 10.0m in height, with very steeply sloping sides. It overlies a smaller, lower spoil heap projecting from beneath its eastern end, although this may not be associated with the chert working. The larger, northern lobe measures 43.0m long and is slightly taller than the southern lobe, again with very steeply sloping sides.

Site 11: Structures associated with the Upper Incline

- 3.27 A series of built structures survive within the survey area which are associated with an upper incline which reached the height of the chert levels; there may once have been an upper Brake House (see Site 8) at its south-western end.
- 3.28 By far the largest of the structures is a revetted bank (Site 11a) [2/821] (see plate 12). The wall supporting the bank is aligned north-east/south-west and has a maximum length of 19.0m, with a return to the east at its north end. The wall has a markedly battered profile, and is over 2.0m wide in places from top to bottom, although the width at the top is on average 0.6m. The top of the wall slopes downwards from south-west to north-east, from 480.90m AOD to 475.00m AOD. There is a flattened retained area to the immediate east of the wall, averaging 2.5m wide, although in some places it is narrower due to the encroachment from the spoil heap (Site 10) above; the wall returns a similar distance to the east at its north-east end. The wall itself is built of coursed and squared stone, without mortar [3/906-3/908, 3/910]. Towards the north-eastern end of the wall, the face is inset by c.0.5m, the inset being marked by large stones, laid with a battered profile to their northern side [3/909, 3/911, 3/913, 3/915, 3/916, 3/922] (see plate 13). There may be a break in the wall face that can be traced south-westwards from the inset, and it is possible that this marks an earlier, slightly lower, phase of the revetted bank, which was later heightened and extended north-east; alternatively, it may be a simple construction break.
- 3.29 Approximately 10.0m to the north-east end of the revetted bank, there is a second structure (Site 11b). This structure is partly decayed, but appears once to have comprised a drystone pier, aligned broadly east-west, measuring 4.0m long by just over 2.0m wide. It survives to a maximum height of 1.0m, although much of the western half has collapsed to two courses or less in height. The uppermost surface of the pier is set at 469.20m AOD [3/924-3/926, 3/928, 3/929, 3/941] (see plate 14). There are the fragmentary remains of at least one other wall just uphill (i.e. south-east) of the structure, but they are difficult to interpret.
- 3.30 The remains of a third structure (Site 11c) are set some 6.0m to the north-east of the second; the two are linked by a line of stones, visible in plan only, running

between their eastern ends. This third structure is in even poorer condition than the second, but again appears once to have comprised a drystone pier, aligned broadly east-west, measuring 6.0m in length by just over 3.0m in width. It survives to a maximum height of 1.5m at its north-east corner, although much of the western half has collapsed to two courses or less in height. The uppermost surface of the pier is set at 465m AOD [3/931, 3/932, 3/937, 3/938, 3/940] (see plate 15). A low retaining wall curves eastwards from the north-east corner, and incorporates a horizontal piece of tramway rail [3/935]. Both structures 11b and 11c appear in a photograph taken in 1946 (Eastmead 2014, 18 - figure 16; Tyson 1995, plate 21), although both were already in poor condition by this date (see figure 7a).

Site 12: Lower Brake House

- 3.31 The lower brake house (Site 12) is set at an elevation of 464.00m AOD. Eastmead (2014, 19 & 59 - figures 17 & 89) reproduces two undated black and white photographs from Swaledale Museum archive which he believes shows the upper brake house (see Site 8), used to carry the eastern branch of the incline (Site 17) up to the level of the chert adits, across the piers and revetted bank (Site 11) (see figure 7c). Details in the background of the photographs suggest that they might actually show the lower brake house, rather than the upper brake house, although this is not certain. If this is correct, then the east side of the lower brake house was formerly open-sided and supported on timber posts but this has been subsequently replaced by a drystone wall, as shown in figure 7c. Eastmead (2014, 20-21) also suggests that the lower brake house must have been constructed after the upper part of the incline leading to the chert levels had gone out of use, as its roof would have obstructed the trackway between two of the incline's piers, and that the pulley/braking mechanism was transferred from the upper brake house (see Site 8) to this lower brake house. However, the existing site lines suggest that the roof would not have obstructed the trackway, although the lower brake house is clearly later in date than the upper.
- 3.32 The lower brake house is formed by a U-shaped structure, open to the north-east towards the east incline (Site 17) [3/919, 3/969], measuring a maximum of 4.0m long by 3.5m wide. The walls are up to 0.6m wide, and stand to a maximum height of 1.5m; they are built of roughly coursed and squared drystone rubble [3/961-3/963, 3/971, 3/972] (see plate 16). A straight joint is visible towards the centre of the western wall [3/965, 3/967, 3/968]. A photograph taken in 1946 (Eastmead 2014, 18 - figure 16; Tyson 1995, plate 21) shows the structure to have formerly been equipped with a roof made of corrugated sheeting weighted down with large stones (see figure 7a). There is a length of rusting wire cable partly buried amongst the rubble to the south-east corner of the interior [3/964]. This has been previously described as a section of 7 x 6 regular lay wire rope; a splicing needle for the wire rope was found nearby, and has been deposited in the Swaledale Museum (Eastmead 2014, 30). A fragmentary line of stones is visible in plan running from the north-east corner of the structure to the head of the east branch of the incline [3/973]; these can also be seen on the 1946 photograph.

Site 13: Siding/Loading Bay and Crane Base at head of East Incline

- 3.33 A siding and associated loading bay are located to the west of the head of the eastern incline (Site 17), at an elevation of 464.00m AOD; they are identified by Eastmead (2014, 21) as 'Siding 2'. This siding (Site 13a) is aligned broadly east-west and is 7.0m long. The south side is defined by a kerb of large flat stones with a level area to the south (effectively forming a platform), and a slight linear

depression to the north. The west end is defined by a line of stones set at a right angle to the kerbstones, although they are now partly concealed by an adjacent heap of chert dressings (see Site 14) [3/946-3/948] (see plate 17); in 1946, the dressings were kept clear of the west end of the siding (Eastmead 2014, 53 - figure 77; Tyson 1995, plate 18) (see figures 7b and 7e). The linear depression continues east beyond the kerbstones and begins to curve towards the head of the east incline [3/918]. It was formerly a trackway bed, which was connected to a turntable shown to the immediate north of the Brake House (Site 12) in 1946 (Eastmead 2014, 22 - figure 22; Tyson 1995, plate 20) (see figure 7d).

- 3.34 Approximately 1.5m to the south of the siding/loading bay, the remains of a second structure (Site 13b) are visible, largely in plan only. A photograph taken in 1946 (Eastmead 2014, 53 - figure 77; Tyson 1995, plate 18) shows that this appears to have formerly secured one of the wooden stays of the derrick crane positioned to the west (see figure 7b). The remaining structure is aligned broadly east-west, measuring c.5.0m long by c.2.2m wide, and is defined by a rectangular spread of rubble within which wall footings are visible, most plainly along the north and south sides [3/939, 3/942] (see plate 18). On the 1946 photograph, the foot of the second stay also appears to have been secured in a rubble structure adjacent to one of the heaps of chert dressings (Site 14b), but this is no longer clearly visible in the field.

Site 14: Chert Dressing Heaps

- 3.35 There are two heaps of chert dressings in the central part of the survey area [2/820; 3/912, 3/914, 3/917] (see plate 19). Eastmead (2014, 20) suggests that when the incline rising to the chert levels (see Sites 8 and 11) became disused, chert blocks were simply rolled down the very steep scarp to the north of the levels to this area; this would also have acted as a primitive quality control, as flawed blocks would not have survived their journey down the scarp. When at the base of the scarp, the blocks would then have been dressed and loaded onto a wagon at the nearby siding (Site 13). Both heaps are clearly visible on a photograph taken in 1946 (Eastmead 2014, 53 - figure 77; Tyson 1995, plate 18) and an 1990 aerial photograph (see figures 7b and 7e).
- 3.36 The western dressing heap (Site 14a) is slightly curvilinear in plan, and set on a shallow north-east/south-west alignment. It has a maximum length of 33.0m, and a maximum width of 7.0m at the north end, although it narrows considerably towards the south end. The top of the heap is flat, and again widens slightly towards the north end. The west side of the heap is formed by a steeply sloping scarp up to 2.0m high; it contains a very high proportion of rubble, and towards the south end, where it becomes near vertical, it is roughly revetted [3/905]. The east side is properly revetted for almost its whole length, apart from at the very north end, adjacent to the loading bay (Site 13) where there has been some collapse of the face [3/951, 3/960]; the collapse has revealed that the revetting is a single block deep, with smaller pieces of rubble behind forming a core. The revetting stands up to 1.3m in height and comprises roughly squared drystone rubble, laid to a slightly battered profile [3/952, 3/953, 3/956] (see plate 20). Towards the south end of the east side, a larger stone appears to have been deliberately set upright at a right angle to the face of the revetting, perhaps to provide additional support [3/958, 3/959].
- 3.37 The eastern dressing heap (Site 14b) is separated from the western heap by a level area of rubble-free ground up to 8.0m wide, narrowing towards the north [3/955]; this space is named as a 'dressing floor' by Eastmead (2014, 24). This

eastern heap is also slightly curvilinear in plan, but is slightly shorter at 22.0m long; it has a maximum width of 7.0m across the centre, narrowing to either end. The top is formed by a narrow flattened ridge, slightly bulbous to the north end. The west side of the heap comprises a steeply sloping scarp of roughly squared stone rubble, standing up to 1.5m in height [3/957], while the east side is similar, but somewhat taller [3/923]. The only surviving trace of revetting is at the north end of the east side, where curving roughly coursed and squared stone facing stands up to 1.1m in height [3/943, 3/944, 3/949, 3/950]; this was far better preserved when the 1946 photograph was taken.

Site 15: Siding/Loading Bay, head of West Incline

- 3.38 A siding is located to the west of the head of the west incline (Site 16), at an elevation of 461.00m AOD; this is identified by Eastmead (2014, 21) as 'Siding 1'. It is aligned north-east/south-west, and is 9.5m long [3/890, 3/892, 3/899]. It comprises a shallow linear depression, the east side being defined by a kerb of large flat stones [3/894-3/896, 3/898, 3/900] (see plate 21). At its south end, the east kerb returns to the south-west for a short distance. The west side of the siding was once also defined by kerbstones, although these do not survive as well as to the eastern side. At their south end, they also appear to have once returned to the south-west; at the time of the EDAS survey, there was a large stone placed on the point where the angle changed [3/893, 3/901]. The linear depression continues very faintly north-eastwards beyond the kerbstones towards the head of the west incline (Site 16).

Site 16: West Incline

- 3.39 The earlier western alignment of the incline commences c.5.0m to the north-east of the siding (Site 15). It is aligned south-west/north-east, and has a total length of 131.0m before meeting the later eastern branch of the incline (Site 17); the route descends from 459.20m AOD to 429.50m AOD over this distance from south-west to north-east, a fall of 29.70m. This incline was located within the bottom of a much larger gully, which is shown as a watercourse on the Ordnance Survey 1893 and 1912 25" maps (see figure 6); this gully is up to 28.0m wide across the top, and has very steeply sloping sides over 7.0m deep [3/999].
- 3.40 The head of the west incline [3/889] was initially carried along the east side of the bottom of the gully on a raised linear earth and rubble platform, c.2.0m wide. There is a deep curvilinear depression to the west of the platform, and at its north-eastern end, the platform's northern scarp slopes downwards towards a length of revetment wall [3/903, 3/904] (see plate 22). This revetment wall (Site 16a) is 8.5m long and is built of roughly squared stone rubble, standing up to 0.9m high [3/003, 3/004]. The track of the incline appears to have been carried on a flattened strip to the east of the wall, with only an average width of 1.0m [3/005, 3/006]; however, there is a similar feature to the immediate west of the wall, well-defined and raised on a rubble base, but of the same width [3/007, 3/008]. The line of the incline is indistinct around a small modern cairn that has been built on a slight promontory, but it becomes clear again to the north-east, where there is more surviving revetment wall (Site 16b) [3/009-3/012]. This revetment survives in fragments for a total length of 15.0m, and stands up to 1.0m in height, being of the same construction as the first section described above. The remains of the metal frame of a wagon also survive adjacent to the base of the revetment wall [3/013, 3/016]; this is suggested to be an earlier type of wagon, found in a lead level, that was superseded by the flatbed wagons later used on the incline (Eastmead 2014, 47).

Beyond the revetment, the bed of the incline is defined by two lines of stone, set 1.0m apart [3/017]; a small fragment of sleeper survives in the same area [3/018].

- 3.41 As it moves north-east and downslope, the course of the western incline becomes better defined. There is generally a retaining wall to the east side, with a revetment to the west side supporting a level track bed averaging 2.0m in width (Site 16c) [3/023-3/025] (see plate 23). In the lowest section, shortly before the incline joins with or is overlain by the route of the east incline (Site 17), the retaining wall on the east side survives for a length of over 19.0m and up to 1.0m in height [3/026] (Site 16d). Here, the track bed has an average width of 2.0m and is supported on a low revetment, standing up to 0.5m high [3/027, 3/028] (see plate 25).

Site 17: East Incline

- 3.42 The later, eastern, route of the incline commences c.12.0m to the north-east of its associated siding (Site 13). It is aligned south-west/north-east, and has a total length of 202.0m within the EDAS survey area; it descends from 464.00m AOD to 413.40m AOD over this distance from south-west to north-east, a fall of 50.60m. This branch was located partly to the east of a prominent gully, and only enters into this gully after some 80.0m.
- 3.43 The east side of the head of the incline retains the remains of a structure (Site 17a), similar to those seen further to the south-west and once associated with an upper incline rising to the chert levels (see Site 11 above). The structure is partly decayed, but it appears once to have comprised a drystone platform, aligned north-east/south-west, measuring at least 7.0m long by just over 2.0m wide. It survives to a maximum height of 1.3m, with the south and east faces being the best preserved [3/974-3/976] (see plate 26). The structure is clearly visible on a photograph taken in 1946 (Eastmead 2014, 18 - figure 16; Tyson 1995, plate 21) but it was apparently already in poor condition by that date (see figure 7a).
- 3.44 The upper part of the east incline is formed by a linear depression (Site 17b), up to 7.0m wide across the top, with very steeply sloping sides up to 1.5m deep, and a flattened base averaging 1.3m wide [3/978, 3/979, 3/981, 3/983] (see plate 24). There are traces of a rubble retaining wall to sections of the west side of the central part [3/984] and the north end [3/986]. In 1946, a single line of track ran down this part of the incline (Eastmead 2014, 18 - figure 16; Tyson 1995, plate 21) (see figure 7a).
- 3.45 Where the linear depression opens out, there is a sub-oval earthwork cut into the natural scarp to the east (see Site 20 below). However, at the base of the linear depression, there are several structures which were once part of the incline (Site 17c). The uppermost structure comprises a drystone platform, aligned north-east/south-west, measuring at least 7.0m long by 2.8m wide. It survives to a maximum height of 1.10m, with the west face being the best preserved [3/988, 3/989]. There is then a gap of 4.0m, and a second structure, resembling a decayed pier, aligned north-west/south-east, and measuring 2.5m long by 1.5m wide; it survives to a maximum height of 0.9m [3/991, 3/995-3/997] (see plate 27). There is also a fragment of *ex situ* sleeper in the vicinity of the pier [3/993]. A line of stones is visible in plan running north-east from the pier, terminating at a third small structure, perhaps another pier, but visible in plan only [3/001].
- 3.46 Beyond this third structure, the incline begins to slope down the east side of the prominent gully (Site 17d), and it is difficult to decide which of the natural slopes has been altered by the incline's construction. The alignment is mostly visible as a

flattened linear strip, 2.0m wide, with little surviving evidence for revetments or retaining walls [3/998, 3/002, 3/021, 3/031] (see plate 28). However, once the incline has reached the bottom of the slope, it assumes the form of a raised causeway, the hard-packed rubble track bed set between revetment walls standing up to 0.5m in height (Site 17e). It continues in this form until it passes beyond the northern limit of the main EDAS survey area [2/819; 3/029, 3/030, 3/032-3/037, 3/039-3/043] (see plate 29). In several places, wooden sleepers remain *in situ* [3/038].

Other Earthworks

- 3.47 As has already been noted, the area in which the main EDAS survey area is located had been worked for lead for at least several hundred years before the chert quarrying commenced. It would be unwise to underestimate the scale of some of these workings; although the underlying south-west to north-east downward slope of the valley side remains, the gradients and scarps have been changed beyond all recognition by earlier industrial activity, and it is sometimes difficult to determine what is natural and what is man-made. Within the survey area, there are many earthworks which relate to this activity, but which are not easily dated or ascribed a purpose. Where these earthworks can be broadly dated (such as the pond/dam forming Site 6) or if they might possibly be related to the chert working (such as earthworks to the west and north of the western level - Site 9), they have been given a unique identifier number. However, where they cannot, they have been given a brief description below.
- 3.48 It is clear that a large amount of material was removed before the chert levels were driven, and this is discussed in more detail in Chapter 4 below. The chert levels themselves are driven broadly from a height of 488.50m AOD, although in the case of the central level (Site 3), the base of the track bed slopes gently downwards towards the trackway/footpath (Site 7) which passes through the site. Along the north side of this trackway/footpath, the ground levels fall away very steeply, indeed near vertically, in a series of north, north-east and north-west facing scarps. These stand up to 5.0m in height, with some resembling grassed spoil heaps and others with a regularity of profile suggesting that they are artificial. In at least one case, shallower linear earthworks on the upper surface of a scarp may have been partly truncated by the scarp itself. These shallow linear depressions, often roughly parallel, are widespread across the main EDAS survey area and beyond. For example, to the north-east of the siding (Site 15) for the west incline, there are several parallel linear depressions, the most substantial of which is over 20.0m long, 2.0m wide but only 0.7m deep (Site 18) [3/902] (see plate 30). There are several heaps of adjacent rubble, and also several outcrops. Indeed, the whole of the area between these outcrops and the loading bay has the appearance of having been levelled off at some point.
- 3.49 Similarly, between the east and west branches of the incline, there is an area of raised ground, generally sloping downwards from south-west to north-east, but locally very uneven (Site 19). It comprises a mass of curvilinear depressions, scarps and banks, including some which are composed almost entirely of stone rubble [3/980]; some of this may be stone discarded from the adjacent loading bay.
- 3.50 There is also a sub-oval earthwork cut into the natural scarp to the east, adjacent to where the linear depression of the east branch of the incline opens out (Site 20) [3/985]. This earthwork is open to the north, up to 3.0m deep and is surrounded by a bank of rubble, with a short curved revetment wall to the south side (see plate 31). This is unlikely to be associated with the incline and it may be represented as

a walled sub-oval structure on the Ordnance Survey 1893 and 1912 25" maps (see figure 6); it may even be the remains of a lead mining level or shaft.

- 3.51 Finally, there are a series of outcrops along the western side of the main EDAS survey area, overlooking the west incline (Site 16).

The Detached Survey Area (see figure 11)

Site 21: Terminus of Incline

- 3.52 The north-eastern end of the incline runs into the south-west part of the detached EDAS survey area. That part within the survey area is 15.0m long, and it falls over a height of 1.10m from west to east over that distance; the lower end is set at 325.30m AOD. It is represented by a linear depression, 2.60m wide across the top, with steeply sloping sides 0.80m deep and a flattened track bed approximately 1m across [3/044, 3/045] (see plate 32). At its east end, the north side of the incline becomes a small bank and then a mound, standing 1.0m high [3/047]. The south-east tip of the mound overlies a flat stone, which appears to be set opposite a similar feature 1.4m to the south [3/048, 3/049]; together, they may form the remains of a structure once set at the bottom of the incline.

Site 22: Hut at base of Incline

- 3.53 The south side of the incline merges into a curvilinear, north-facing scarp [3/050], set to the south of a pulley pit (see Site 23). The level depression in front (north) of the scarp marks the former position of a hut (see plate 33). Photographs taken whilst the loading bay was still in use show that this hut was of a single storey, with a single pitch roof sloping downwards from north to south; there was a doorway in the east gable, a window in the north wall and possibly also a short chimney stack (Eastmead 2014, 57 & 60 - figures 84 & 93) (see figure 8a & 8d).

Site 23: Pulley Pit

- 3.54 Eastmead (2014, 26) suggests that a pulley pit housing the return pulley for the endless cable used on the incline was positioned here. The earthwork forming the site of the pulley pit is formed by a sub-square depression, measuring 2.4m across and up to 0.8m deep. The remains of a right-angled stone-built structure are visible on the east side of the base, with a possible retaining wall to the north side and also a stone set flat in the ground surface above the east side [3/051-3/053, 3/055] (see plate 34).

Site 24: Base for Crane Stays and Other Earthworks

- 3.55 A crudely built, stone rubble, U-shaped structure is aligned north-west/south-east. It measures 2.2m long by 2.0m wide [3/058, 3/060, 3/063]. A metal plate pierced by two partly threaded studs, each provided with a washer and square bolt, protrudes from the rubble [3/062] (see plate 35). This structure appears to have secured the base of one of the stays of the derrick crane which appears on photographs of the loading bay (Site 25) when it was still in use (Eastmead 2014, 60 - figures 92 & 93) (see figure 8b & 8d); Tyson (1995, 91) notes that there was also a weigh baulk to weigh the chert in this area, but this is no longer visible.
- 3.56 To the west of the rubble structure, above the north-facing scarp to the south of the pulley pit (Site 22), there is a sub-oval depression, 2.5m long, filled with rubble [3/056, 3/057]; a truncated wooden post projects from the north-east end of the

rubble infill. Again, this probably secured the base of the crane's other stay. There may be the fragmentary remains of built walls along the internal sides.

- 3.57 To the east of the rubble structure, there is a large sub-rectangular spread of rubble [3/064], possibly with a wall face at the base of its northern scarp, and a poorly defined north-south aligned linear depression beyond this [3/065].

Site 25: Loading Bay

- 3.58 A loading bay, set on the south side of the Reeth to Tan Hill road, is formed by a right-angled length of retaining wall [3/077] (see plate 36). The west end of the wall first becomes apparent within a north-facing scarp [3/075, 3/076], but it does not form a wall proper until it returns to the south-east for a length of 3.6m. This return stands 0.8m high, and is a drystone structure of crudely squared, large blocks [3/074] (see figure 8c); a lorry is shown backing up to this return to be loaded on an early photograph (Eastmead 2014, 61 - figure 94) (see figure 8d). At the south end of the return, the wall turns to the north-east for a further 11.0m. It is of a similar height and form to the wall previously described, but is generally better coursed [3/069, 3/073]. This longer section of wall also incorporates two timbers resembling railway sleepers to its upper surface, laid so as to extend back from the wall face. Each timber has two large square-section iron spikes with flattened heads projecting from the top, securing an iron plate [3/067, 3/068, 3/070-3/072]. Photographs taken when the loading bay was in use suggest that a timber kerb or edge extended along the whole length of the structure (Eastmead 2014, 61 - figure 94) (see figure 8c). The east end of the wall gradually peters out into another north-facing scarp, although a return, perhaps marking its original eastern extent, may be visible, in plan only, in a sheep track running along the top of the scarp [3/066].

4 DISCUSSION AND CONCLUSIONS

Earlier Lead Mining Activity

- 4.1 The main EDAS survey area is located within a landscape that had been worked intensively for lead for at least several hundred years before the chert quarrying commenced, and so this also needs to be considered as part of this landscape. Lead ore was worked using several different methods, and once obtained had to be dressed and transported to smelting mills, and the waste material disposed of; in many cases, these wastes were sufficiently valuable to be re-worked at a much later date.
- 4.2 Eastmead (2014, 13) is correct in questioning to what extent and how the hushes to the west of the survey area were worked, although some of his assertions would benefit from detailed survey and further consideration. For example, as has been noted above, in 1857 the linear depression named as “Adam Bird’s Hush” in 1799 (NYCRO ZQX 5/5) has a dam aligned on its western end, with another very close to the south side of the central part (opposite where Dam Rigg Hush leaves the north side) and also to the south side of the eastern part. By 1893, all of these were disused. Furthermore, towards the upper end of the east part, there is a substantial structure crossing the line of the main linear depression. It is now partly collapsed, but it does retain evidence for stone-facing to either side of an earth/rubble core. This structure does not appear on 1857 or 1893 maps, although at the latter date a scarp or rock-outcrop is shown on the same alignment in broadly the same place; this outcrop can be seen at the base of the structure’s western side. Eastmead (2014, 14 & 38) describes the features as a ‘dam’ or ‘earth dam’ and states that to the east of the feature, “the hush floor shows signs of once containing water”. The structure does indeed bear a resemblance to other earth dams recorded within lead mining fields, for example, the lower of the two Blakethwaite Dams at the head of Gunnerside Gill, built before c.1842 (Dennison & Richardson 2015). However, it might be argued to be a causeway crossing the hush, rather than a dam, and it is approached by a trackway along the hush’s southern side; water may have gathered above it naturally, rather than being deliberately collected. Of course, a trackway may have developed across a dam and one would also have to demonstrate why a causeway was needed to cross the hush here, rather than taking the trackway around the very eastern end, which is not too far distant. But if the structure is a dam, then what date is it, and what was the water being retained for? There are also the remains of several smaller structures within this part of the hush, both above and below the dam (some of which are shown in 1893), as well as at least one example of a possible shaft. And if the dams shown in 1857 are not connected to Adam Bird’s Hush, then what function are they fulfilling?
- 4.3 These questions of interpretation are certainly not confined to Arkengarthdale. As has been previously noted by Cranstone (1992), hushes are not well covered in published literature, with several unanswered and (frequently) unasked questions as to how they operated in practice. Cranstone constructed a tentative typology of five different types of hushes, of which the most common (and including many of the examples in Arkengarthdale) was the “exploitation hush”. These generally penetrated deep into bedrock along the line of a lead-bearing vein, although it was acknowledged that in the cherts and limestones of Arkengarthdale torrent erosion would hardly be an effective form of mining. Here, Cranstone suggested that vein material may have been broken out using manual methods, with hushing used to remove spoil, thus producing a feature very similar to both an opencut and a hush (Cranstone 1992, 46).

- 4.4 Might such a method have produced some of the features described as hushes on Moulds Side, and perhaps also influenced the wider landscape? Modern colour aerial photographs show three very extensive fan-shaped areas of lighter-coloured material downslope from and to the north-east of the hushes on Moulds Side. Two of these areas are possibly associated with linear gullies running generally south-west/north-east down the natural slope below the hushes, and many features run through them, including the New (smelt) Mill's flue and the incline from the chert quarries. Where these spreads have been surveyed in detail (Richardson & Dennison forthcoming (a)), they are formed by a mass of low (0.50m or less in height) curvilinear or linear earthworks, comprising angular stone waste which has now largely grassed over. In many places, they appear to be cut or disturbed by many other features, and could therefore represent early mining activity. Could they be the missing waste, washed out of very large opencuts by hushing? This seems unlikely, as they are surely too far away from most of the hushes to have been carried this far, and they would also be more apparent around the mouths of the hushes themselves.
- 4.5 Nevertheless, their relationship to the aforementioned gullies would be worthy of more detailed investigation. Like the hushes, some of these appear barren and may be wholly natural in origin, whereas others preserve evidence for the artificial direction of water into them, sorted waste along the sides and, in one case, a stone-lined channel in the base. On the 1857 Ordnance Survey 6" map, a very substantial gully which runs immediately parallel to the west side of the New Mill's flue appears to have a square body of water marked at its head, and a substantial earth dam with evidence for stone lining still survives here, the gully having all the appearance of what is traditionally described as a hush. A better understanding is also needed of the extensive complex of dams, some conjoined and still water-filled in the mid 19th century, on the level plateau of land to the south of the hushes on Moulds Side. Sadly, Cranstone's comment (1992, 47) made 23 years ago that in regard to hushing "perhaps the greatest need is for good field survey" still holds true.
- 4.6 There is, however, evidence for earlier mining activity within the main EDAS survey area which is easier to interpret. The reservoir/dam (Site 6) was present before 1857, and the contours shown on the Ordnance Survey map of this date suggest that it was supplied by a leat running into its south end. In the mid 19th century, this leat appears to have originated from one of the ponds close to the site of the High Mill, on Mossy Thorn, although map evidence is often very misleading in terms of how watercourses actually functioned. The latter was itself fed by a contour leat originating in the Wetshaw Bottom area. The function of the reservoir/dam within the EDAS survey area is as yet uncertain, as is that of the 'Old Walls' structure marked to its immediate north-west in 1857, although dressing might be a possibility. Interestingly, the same combination of a dam and adjacent 'Old Walls' is marked at Wetshaw Bottom. The dam was destroyed (and indeed was already likely to have been disused for some time) when the New Mill's flue (Site 5) was extended across it before 1893.
- 4.7 Finally, Eastmead (2014, 32) suggests that perhaps there was a lead level, driven towards the Chip or Justice Veins, in roughly the same area as the chert levels (Sites 2 to 4) were later to be placed. These could be the unnamed and seemingly undocumented levels shown on the 1893 and 1912 25" Ordnance Survey maps, and if the dam (Site 6) was associated with dressing, this would increase the likelihood of there having been earlier lead working in the vicinity.

Chert Quarrying

- 4.8 Chert quarrying, in the form of opencasting, commenced close to the main EDAS survey area in c.1932; if Eastmead (2014) is correct, then it took place within the former Lily Jock's Hush in the Main Chert deposits, just to the north-west of the survey area. At a slightly later date, two levels were driven into the hillside at a higher level to work the chert from the Black Beds, with a third level apparently added later (Sites 2 to 4). Within the adjacent smithy (Site 1), graffiti on three consecutive stones appears to bear the date 'SEP 27 1934'. If this indicates the date at which the smithy first came into use, then it may also give an idea as to when the chert levels were first driven, as a new smithy would have been needed at a location convenient to the levels, rather than continuing to use a smithy housed in the disused New Mill complex some distance away.
- 4.9 While it is not known with certainty, it is possible to come up with several combinations as to which pair of levels were driven first. The western and central levels (Sites 2 and 3) are perhaps the most likely pairing, with Site 4 added later. It is also possible that earthworks (Site 9) adjacent to the western level (Site 2) relate to an earlier, straighter, approach to the level which was subsequently altered when the east incline was in operation, or perhaps even an earlier level unrelated to chert which was re-used (see figure 12).
- 4.10 Comparison of the elevations of the two ends of the New Mill's flue to either side of the survey area (Sites 5a and 5f), together with the remaining fragments (Sites 5b, 5c and 5d) inside it, demonstrates that a large amount of overburden material was removed before the chert levels were actually driven. As a result, almost 75m of the flue's former alignment through the area is now missing, with the flue rising 13m vertically from east to west across the gap, and the two remaining fragments set at between 491m and 492m AOD (see figure 12). Given that the chert levels themselves are driven broadly from a height of 488.5m AOD, this suggests that in some places almost 4.0m depth of ground was removed before they were driven. It is possible that some of this material formed the prominent spoil heap (Site 10) to the north-east of the levels.
- 4.11 On balance, it is considered that the working method of the chert incline proposed by Eastmead (2014) is more likely to be correct than that proposed earlier by Tyson (1995). Nevertheless, there are still several questions relating to the chronology and function of the incline that deserve further consideration. The surviving earthworks suggest that the western alignment of the incline (Site 16) is earlier than the eastern line (Site 17) (see figure 12). This could therefore date to c.1932 when chert opencasting started in this area, and if this did indeed take place in Lily Jock's Hush to the west, then the incline would have been conveniently placed to serve it, although the quarried chert would still have had to be moved to the siding and loading bay (Site 15) at the head of the incline. However, one should not underestimate the influence of pre-existing topography. The western incline runs down one of the many prominent gullies in this area, and this feature, providing a 'ready-made' route south-east through a heavily worked landscape, may have partly determined where the incline and siding were initially based. This western incline was presumably once provided with a brake house like that seen at the head of the later eastern incline (Site 12) and the most logical place for this would have been at the south-west end of the siding (Site 15) although no evidence for it now survives. It is also assumed that the western incline was powered by the same engine in the same shed as that which later powered the eastern incline, although this is not made clear by Tyson or Eastmead. Finally, Hardy's remark (2008, 5) that the trucks were initially "lowered

to the road manually with the aid of a ratchet principle to prevent the danger of them running away” needs further consideration. This suggestion does not appear anywhere else in published sources, and it would be interesting to know where this evidence came from; unfortunately, John Hardy died in 2007, although he clearly talked to at least one ex-chert quarryman (Jake Stubbs) about the incline (Hardy 2008, 6).

- 4.12 The earlier western branch of the incline may have had only a very short lifespan, perhaps little more than two years if, as proposed above, the chert levels were worked from late 1934 onwards. The construction of the upper part of a new eastern alignment (Sites 11 and 17a) was a major undertaking and, given the effort involved, it must surely have been used, if only for a short period. It is considered more likely that the undated black and white photographs from the Swaledale Museum archive (Eastmead 2014, 19 & 59 - figures 17 & 89) show an earlier version of the existing Brake House (Site 12), rather than an upper Brake House set at the height of the chert levels (Eastmead 2014, 19), but Eastmead is undoubtedly correct in identifying an earthwork (Site 8) as being the site of the upper Brake House. Not only is this earthwork aligned on the upper part of the incline, but it is conveniently sited midway between the track beds leading from the chert levels (Sites 2, 3 and 4). It seems likely that, as proposed by Eastmead (2014, 20), the gradient of the upper part of the incline was simply too steep for flat-bed trucks or wagons without any kind of gradient compensation mechanism. The upper part of the east incline had definitely become disused sometime before 1946, and may well, like the earlier western line, have had only a very short working life.
- 4.13 Following the abandonment of the upper part of the incline (a distance of 60m), the upper Brake House (Site 8) was dismantled and the mechanism re-erected within the existing lower Brake House structure (Site 12) (Eastmead 2014, 21); the adjacent siding and loading bay (Site 13) may also have been built at the same time. Eastmead (2014, 20) proposes that from this point onwards, chert blocks were simply rolled down the very steep bank at the north ends of the level track beds to the heaps of chert dressings (Site 14) below. This action may also have acted as a quality control measure, as flawed blocks would not have survived their journey down the bank (Eastmead 2014, 20). If this was the case, given that a crane (Site 13b) was needed to load the chert blocks onto the flat-bed wagons at the siding (Site 13a), there may have been a short section of temporary trackbed between the heaps of chert dressings to assist the quarry men in moving the dressed blocks to the vicinity of the crane.
- 4.14 The east incline extended for a distance of 970m from the lower Brake House to a loading bay on the Reeth to Tan Hill road (1030m if the upper incline is included), to allow chert blocks to be transported out of the dale. Chert working ceased in 1950, and the incline and other equipment were dismantled soon after.

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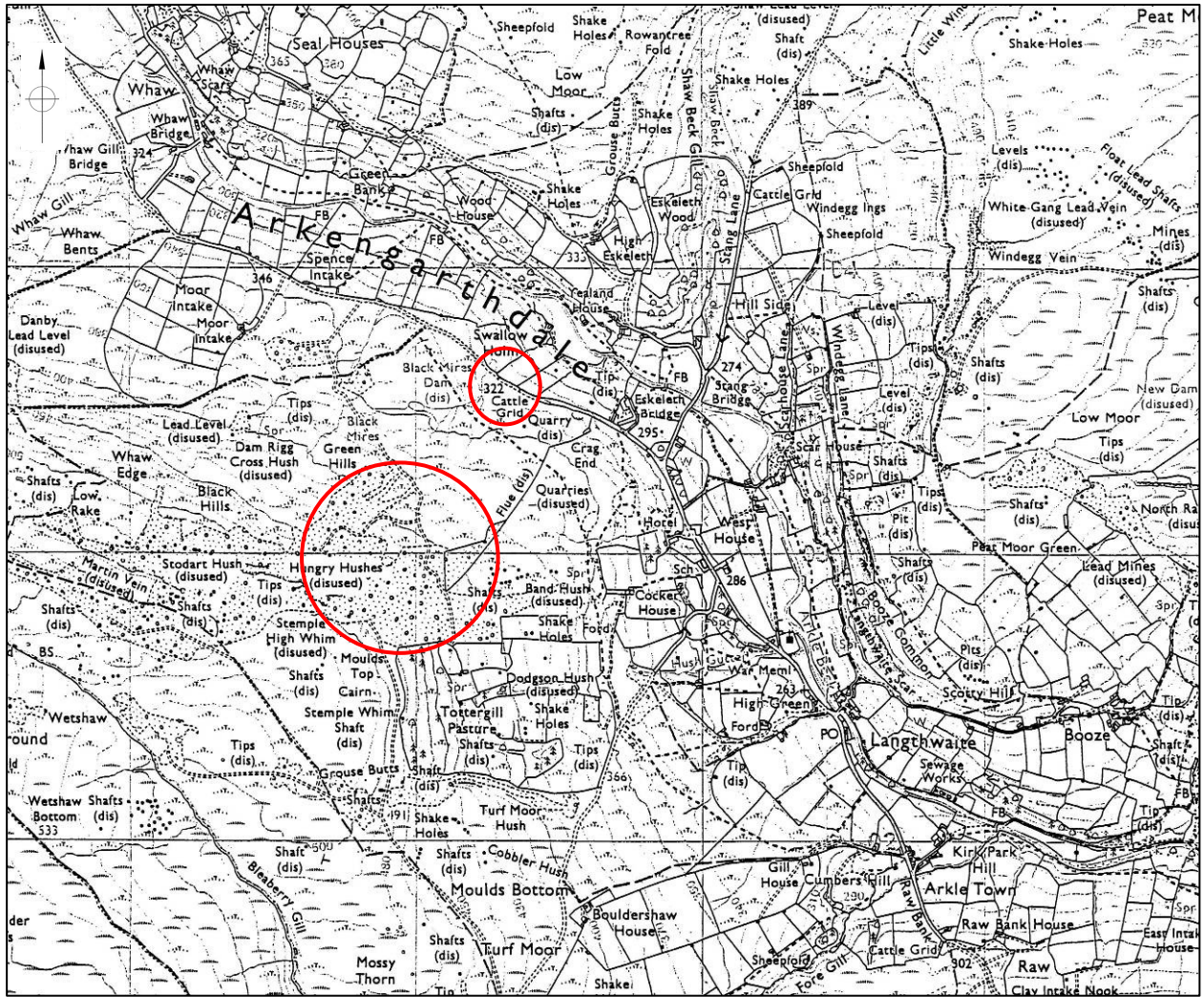
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6 ACKNOWLEDGEMENTS

- 6.1 The archaeological survey was requested by Mr Robert White, Senior Historic Environment Officer of the Yorkshire Dales National Park Authority (YDNPA), and EDAS would like to thank him for arranging access to the site. The work was also funded by the YDNPA. Thanks are also due to Dr Helen Clifford and Stephen Eastmead at Swaledale Museum, Reeth, for the supply of the historic photographs.

- 6.2 The archaeological survey was undertaken by Shaun Richardson and Benchmark Land Surveys of Leeds, and the subsequent hand enhancement of the EDM survey was by Shaun Richardson who also took the site photographs. Comments on a draft survey report were kindly provided by Robert White, and the final report was produced by Ed Dennison, with whom the responsibility for any errors remains.

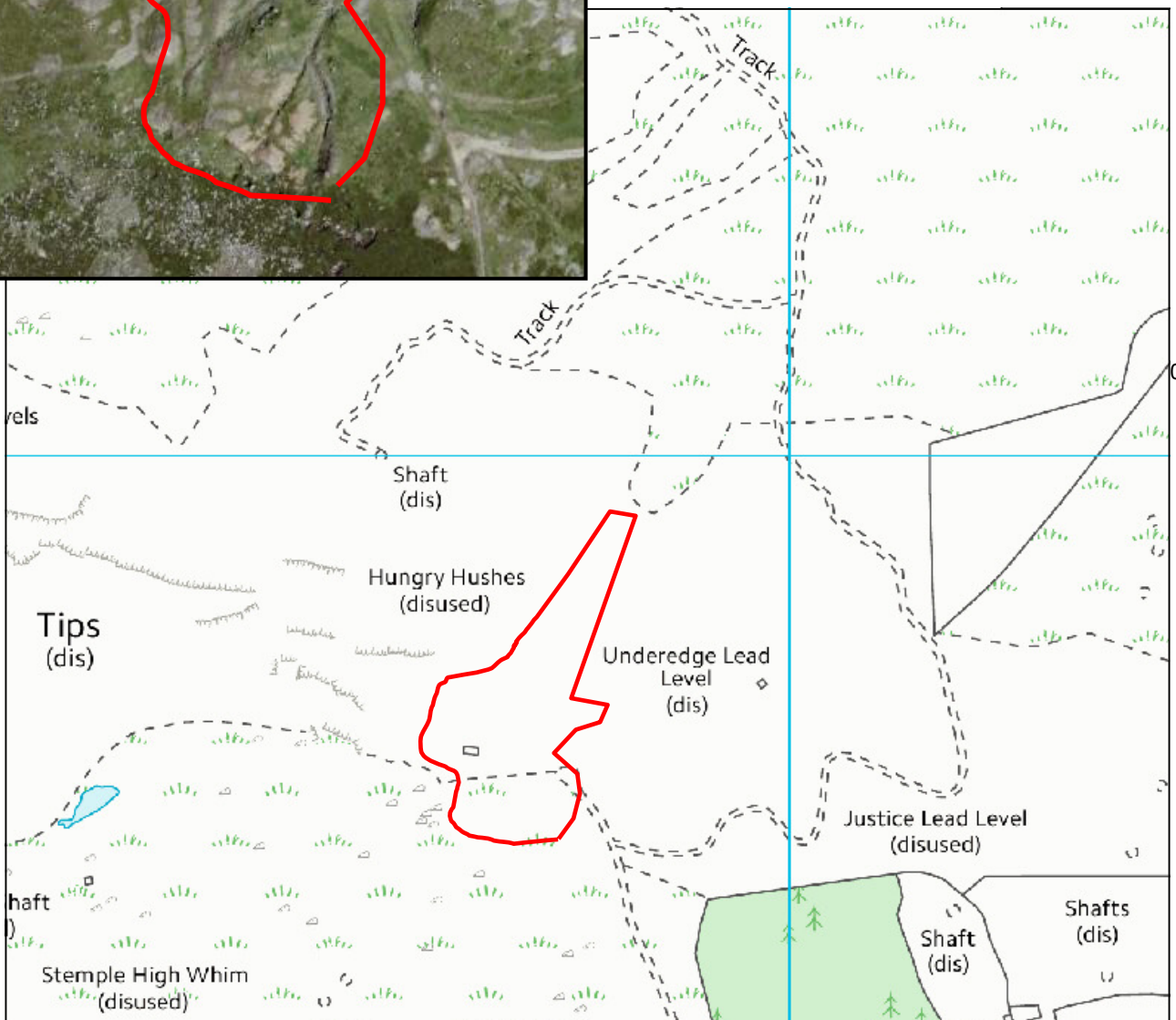


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	EDAS	FIGURE	1

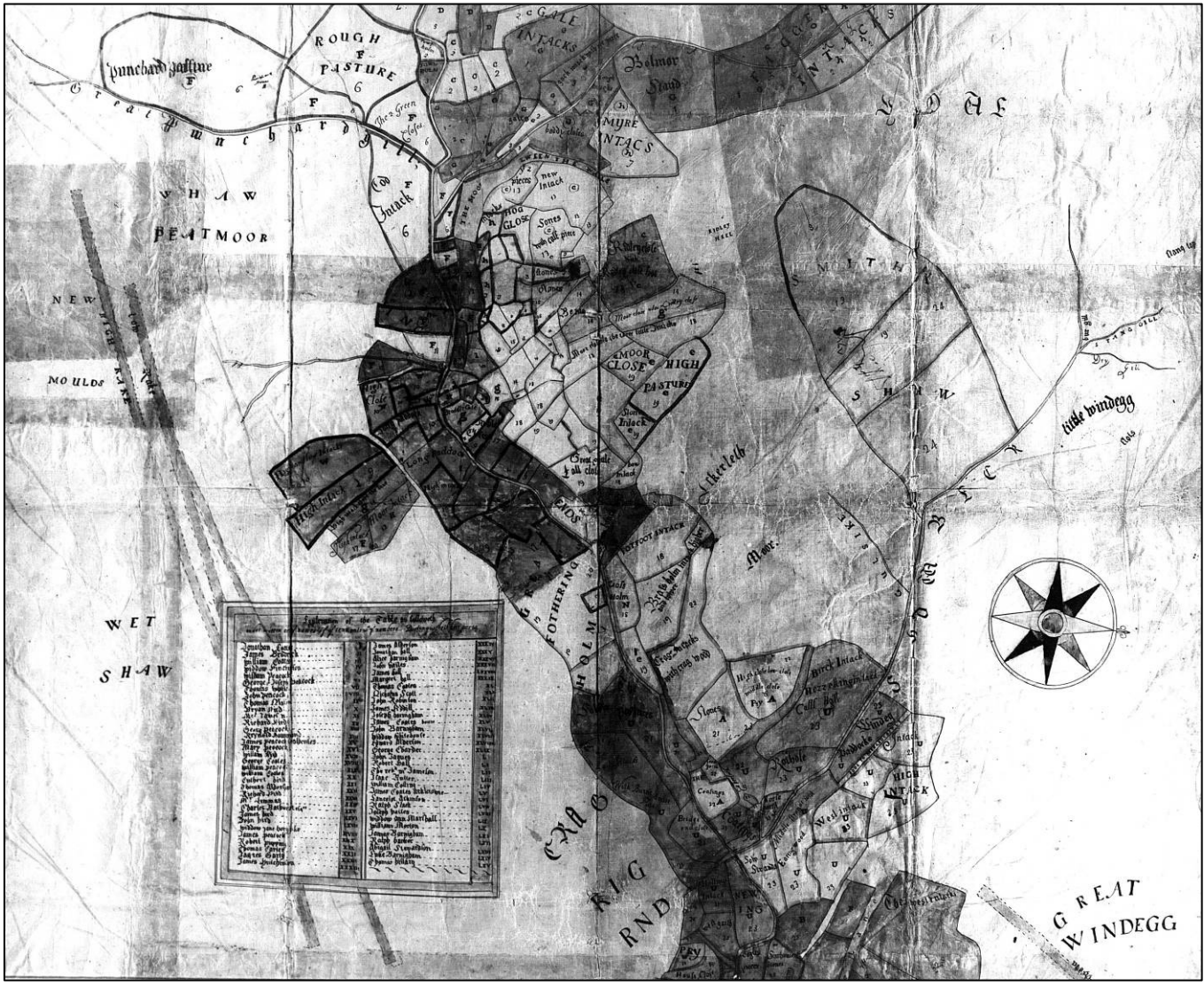


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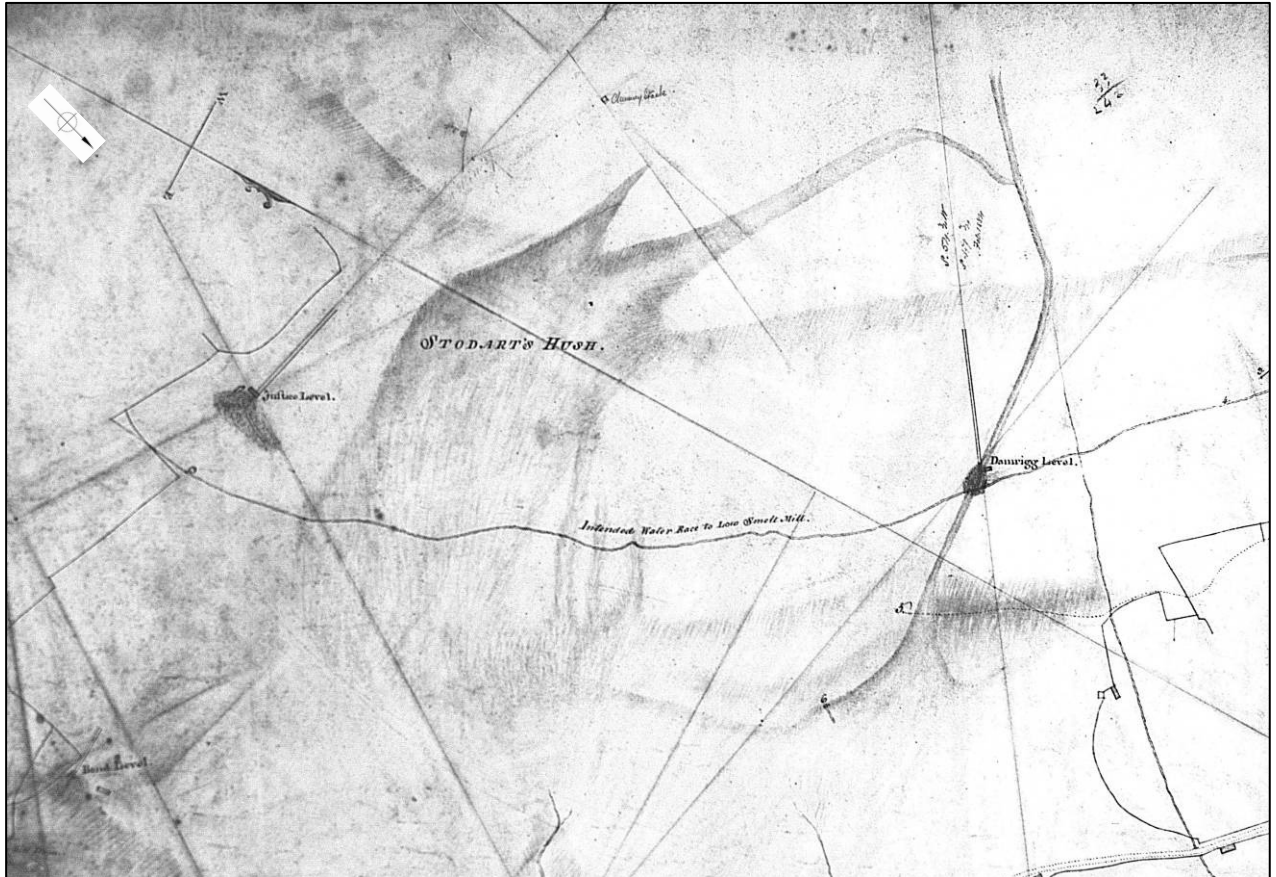
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TITLE		DETAILED LOCATION	
SCALE	NTS	DATE	FEB 2016
EDAS		FIGURE	2



'High Rake' and 'Low Rake' marked on 'New Moulds' on left side of map.

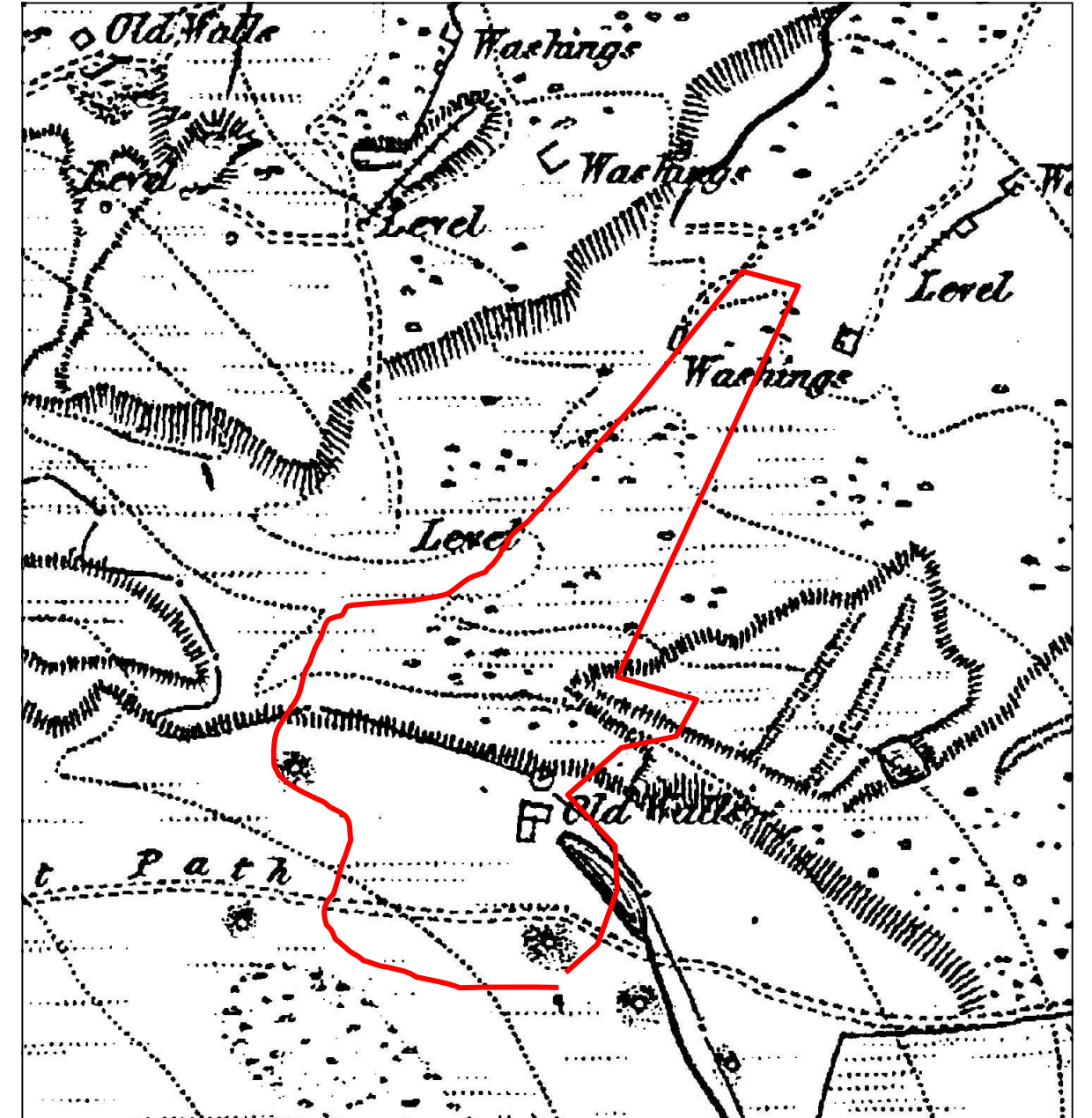
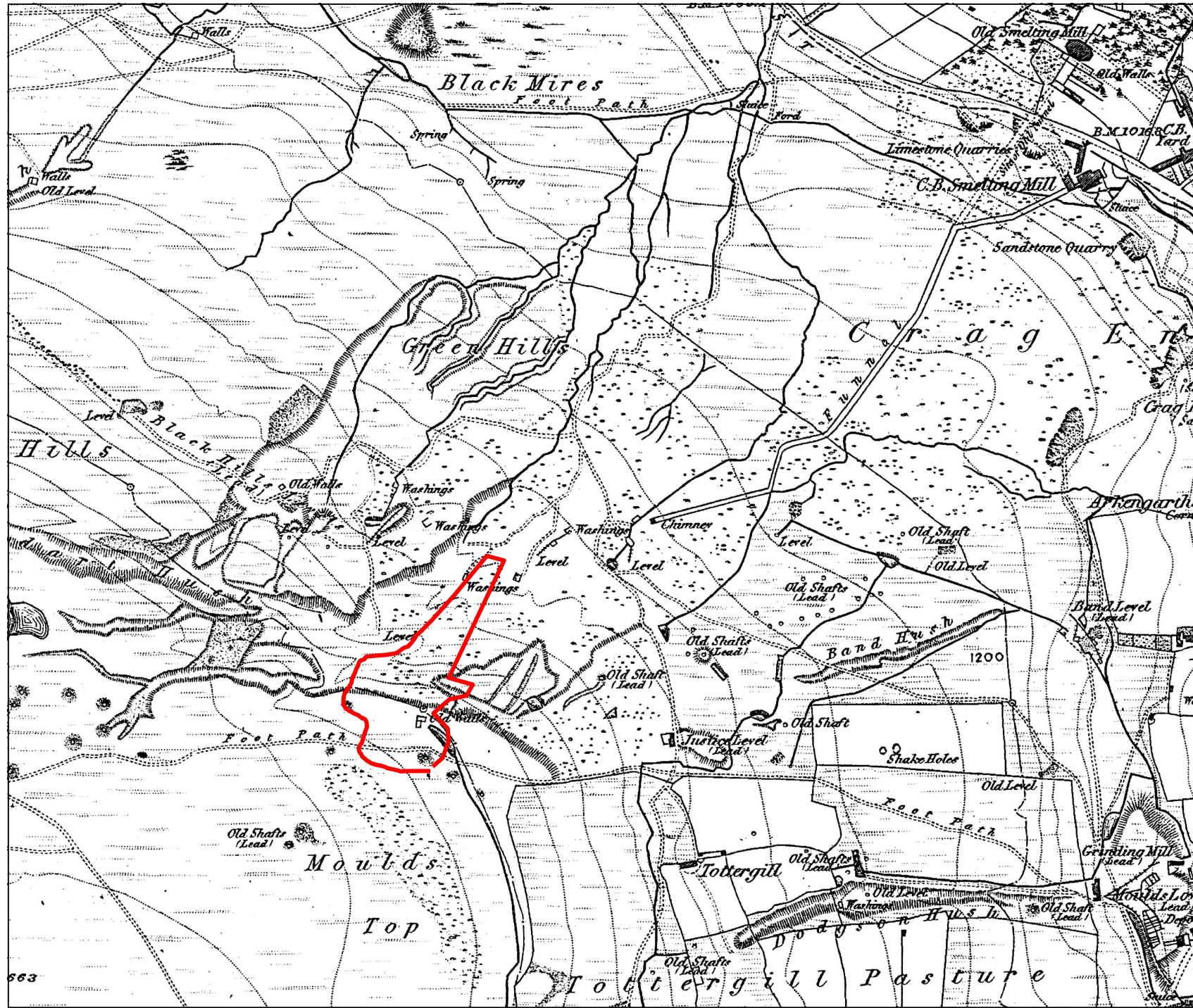
Source: 1718 A Survey of the Manor & Parish of Arkengarthdale belonging to Charles Bathurst Esq (NYCRO ZXQ 5/1 - MIC 2023/324).

PROJECT		HUNGRY CHERT QUARRIES	
TITLE		SECTION OF 1718 MAP	
SCALE	NTS	DATE	FEB 2016
EDAS		FIGURE	3



Source: c.1794 *A Plan of Part of the Manor of Arkengarthdale* (NYCRO ZQX 5/35 - MIC 2024/92).

PROJECT		HUNGRY CHERT QUARRIES	
TITLE		c.1794 MAP OF STODART'S HUSH	
SCALE	NTS	DATE	FEB 2016
EDAS		FIGURE	4

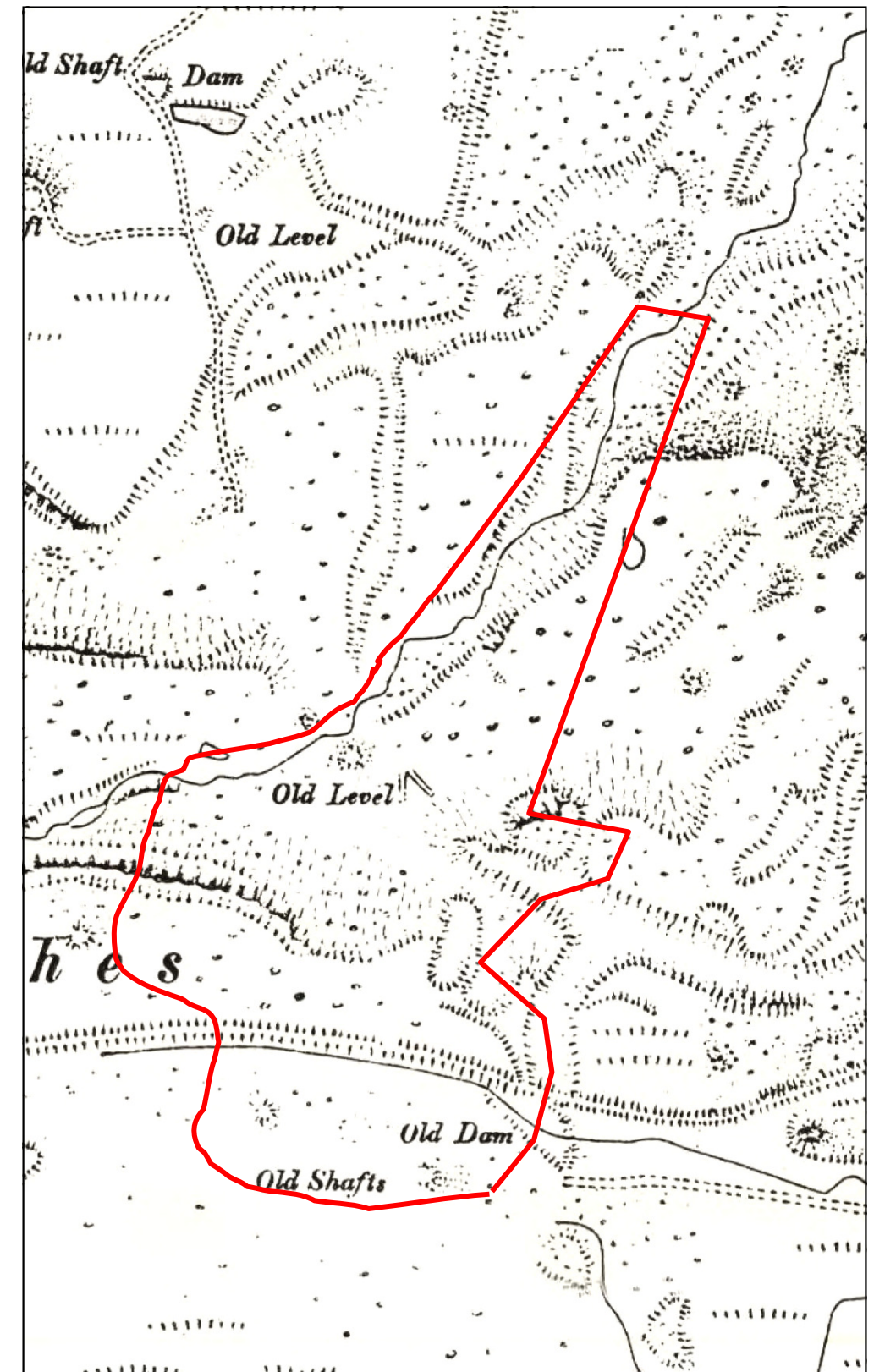
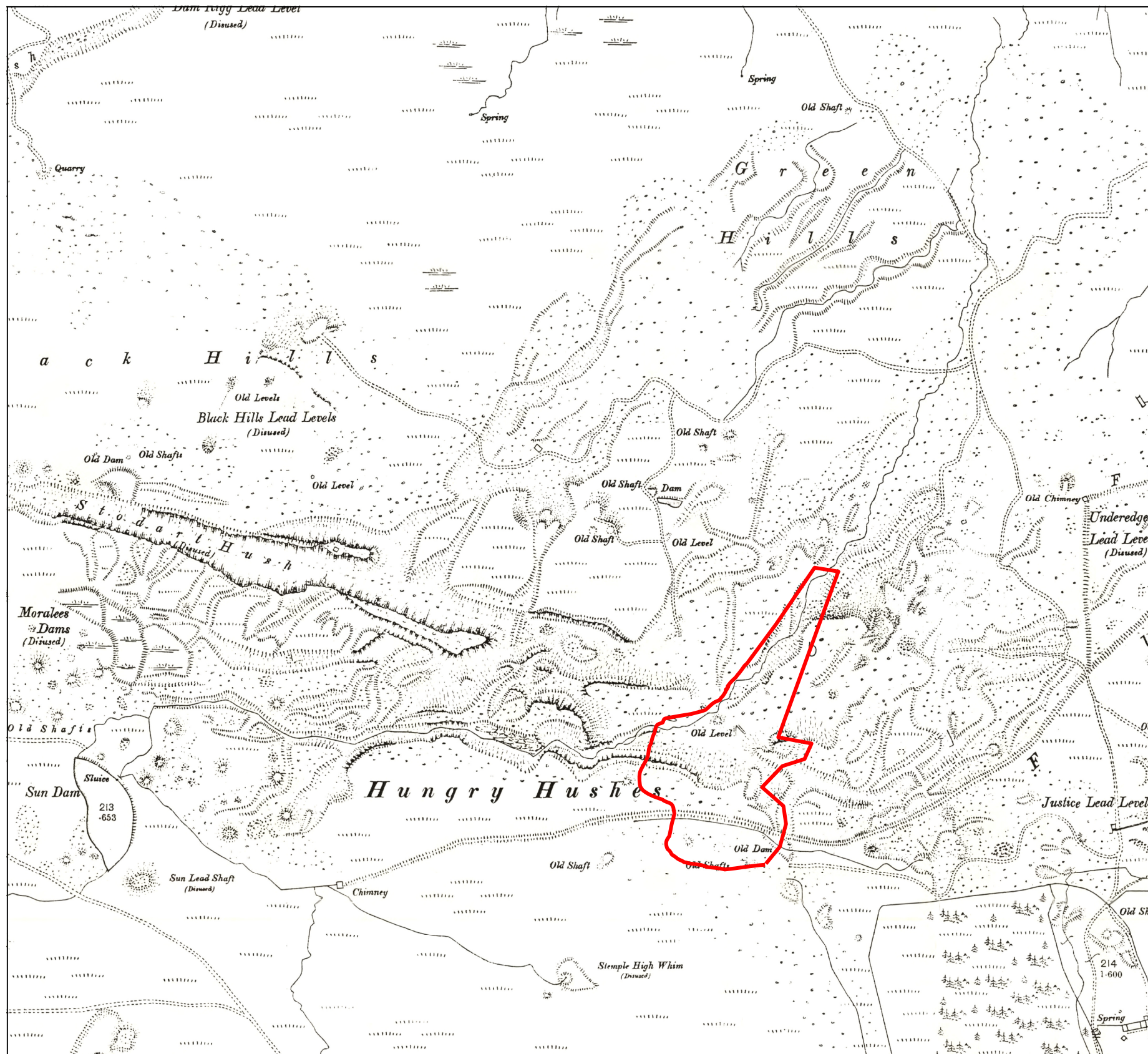


Source: 1857 Ordnance Survey 6" to 1 mile map Yorkshire sheet 37 (surveyed 1854).

EDAS main survey area shown in red.



PROJECT		HUNGRY CHERT QUARRIES	
TITLE		ORDNANCE SURVEY 1857 MAP	
SCALE	DATE	NTS	FEB 2016
EDAS		FIGURE 5	



Source: 1893 Ordnance Survey 25" to 1 mile map Yorkshire sheet 37/5 (surveyed 1891).

EDAS main survey area shown in red.



PROJECT		HUNGRY CHERT QUARRIES	
TITLE		ORDNANCE SURVEY 1893 MAP	
SCALE	NTS	DATE	FEB 2016
EDAS		FIGURE	6



a) 1946 view looking N down the east incline (Site 17) (J O Myers)
(source: Swaledale Museum IMG5).



b) 1946 view of east incline loading bay (Site 13) with crane and chert dressing heaps (Site 14), looking NW (J O Myers)
(source: Swaledale Museum IMG9).



c) Upper brake house (Site 8) (Jean Hutchinson)
(source: Swaledale Museum IMG11).



d) Salvaging track from the east incline, with engine shed, in the early 1950s, looking N
(source: Swaledale Museum IMG38).



e) Aerial photograph of the chert quarry complex, looking W, taken 5th May 1990, showing ruined smithy (top) and east incline with lower brake house and chert dressing heaps
(source YDNPA 040/030).



f) Turntable at head of east incline (Site 17) leading to siding and loading bay (Site 13), with lower brake house (Site 12) to rear, looking S (J O Myers)
(source: Swaledale Museum IMG3).

PROJECT		HUNGRY CHERT QUARRIES	
TITLE		HISTORIC PHOTOGRAPHS	
SCALE	NTS	DATE	FEB 2016
EDAS		FIGURE	7



a) Workers and hut at the lower roadside loading bay (Site 22)
(source: Swaledale Museum IMG40).



b) Crane at the lower roadside loading bay (Site 24)
(source: Swaledale Museum IMG14).



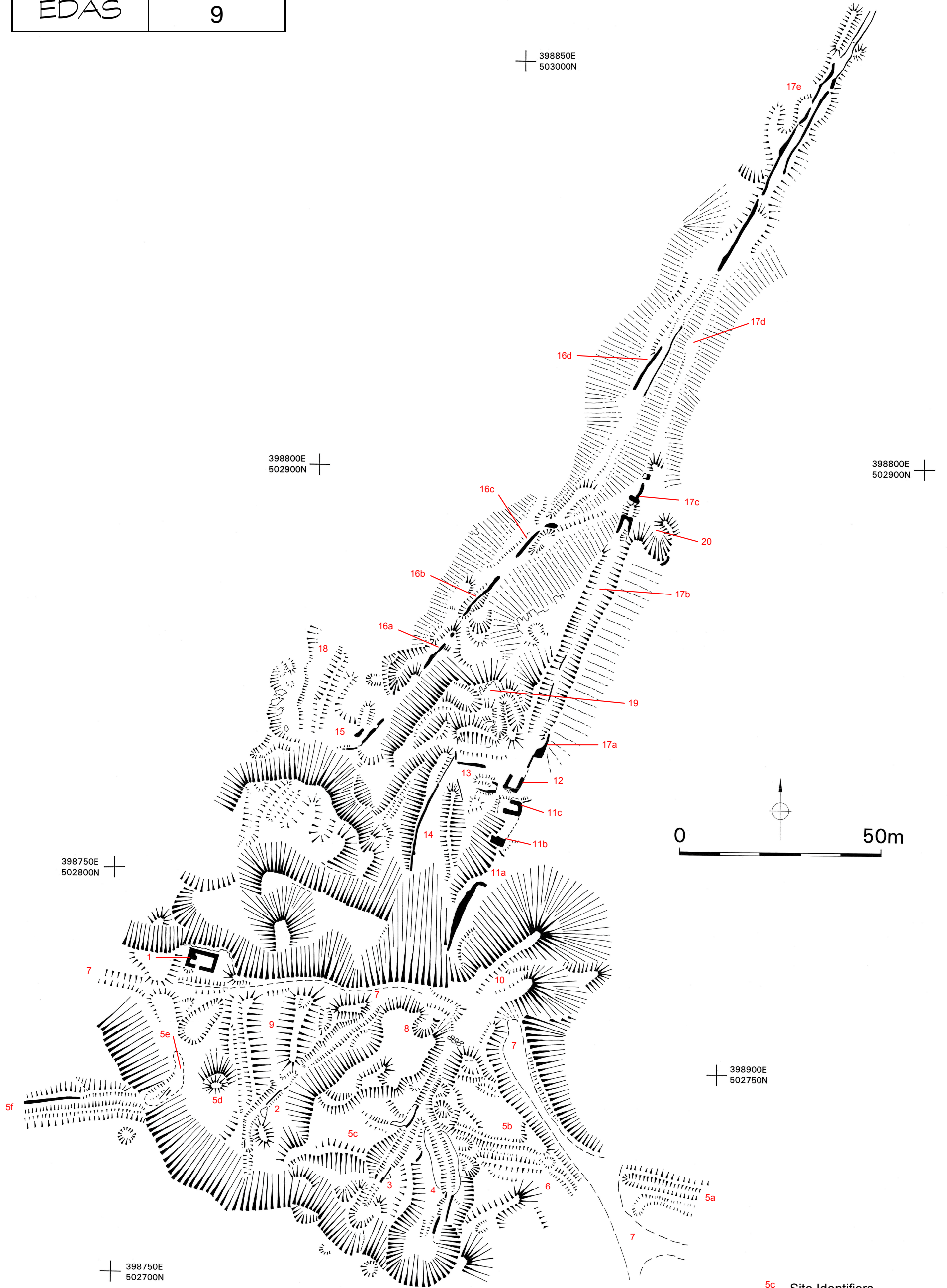
c) Loading chert at lower roadside loading bay (Site 25)
(source: Swaledale Museum IMG45).



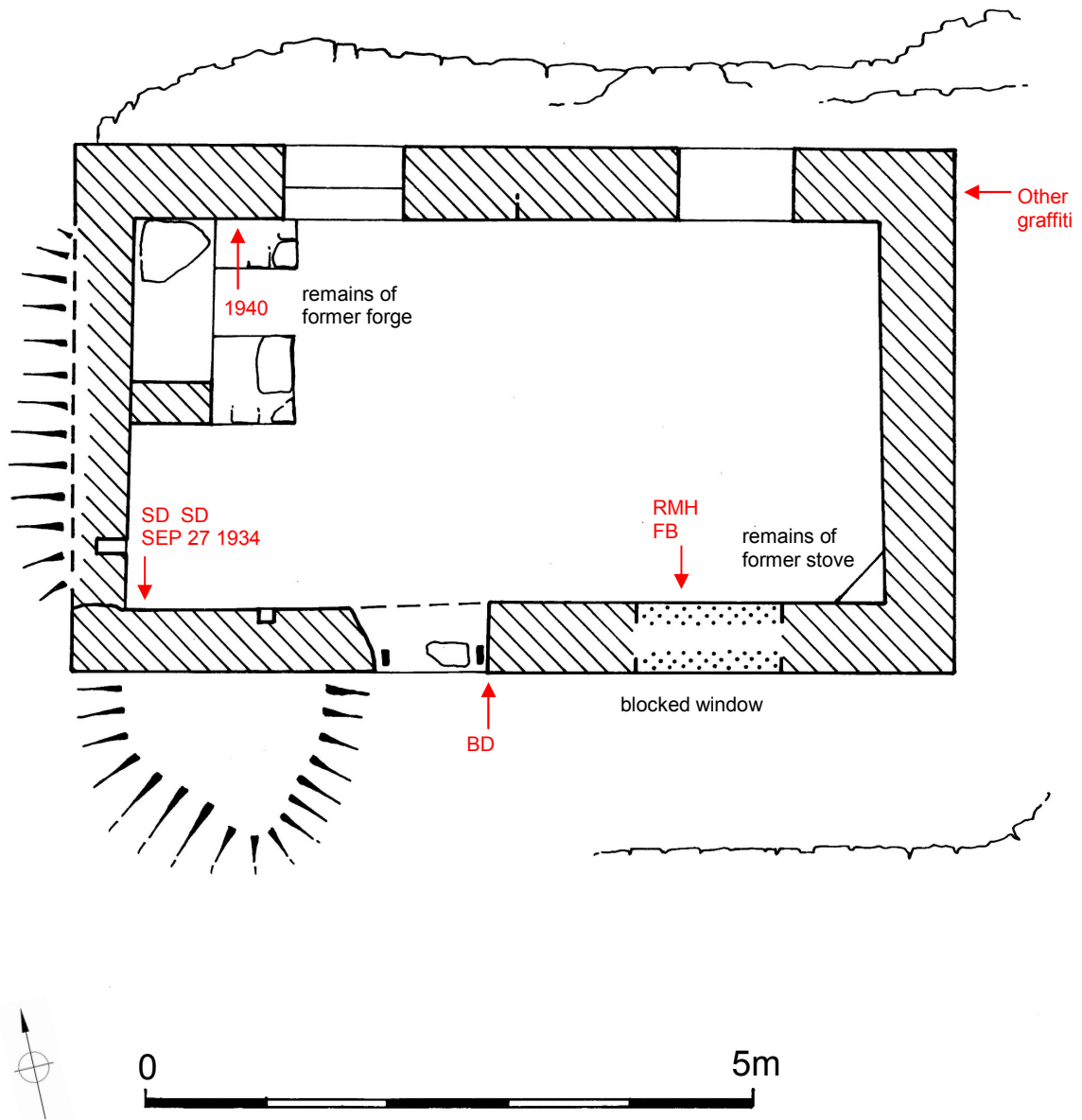
d) Roadside loading bay with crane and hut (Sites 22, 24 and 25)
(source: Swaledale Museum IMG39).

PROJECT		HUNGRY CHERT QUARRIES	
TITLE		HISTORIC PHOTOGRAPHS	
SCALE	NTS	DATE	FEB 2016
EDAS		FIGURE	8

PROJECT HUNGRY CHERT QUARRIES	
TITLE MAIN SURVEY AREA	
SCALE AS SHOWN	DATE FEB 2016
EDAS	FIGURE 9



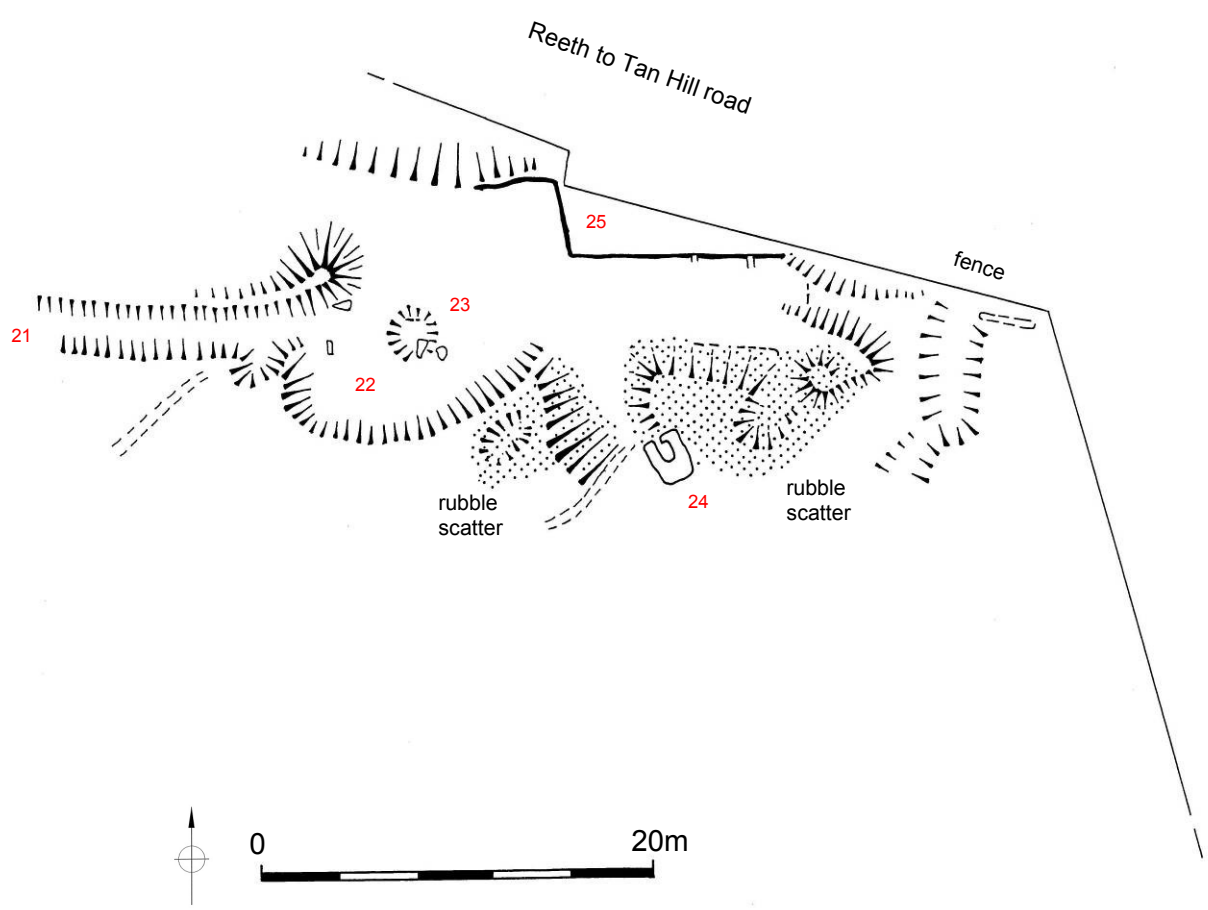
5c Site Identifiers
Survey data March 2015



Position of graffiti shown in red.

Source: Richardson & Dennison
2014, figure 5.

PROJECT		HUNGRY CHERT QUARRIES	
TITLE		GROUND PLAN OF SMITHY	
SCALE	AS SHOWN	DATE	FEB 2016
	EDAS	FIGURE	10



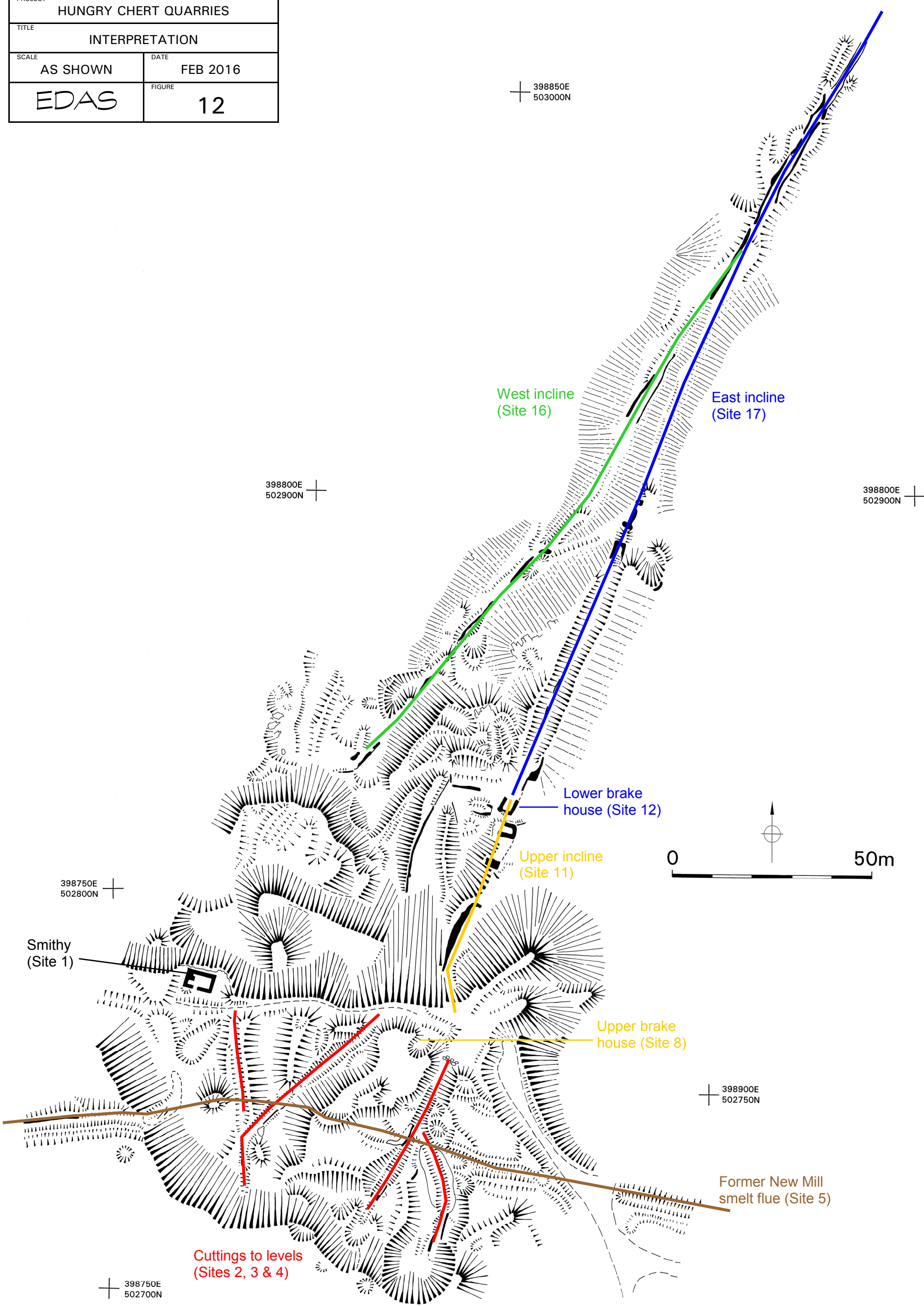
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24 Site Identifiers

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TITLE		DETACHED SURVEY AREA	
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EDAS		FIGURE	11

PROJECT		HUNGRY CHERT QUARRIES	
TITLE			
INTERPRETATION			
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EDAS		FIGURE	12

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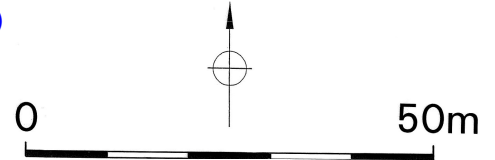
398800E
502900N

398750E
502800N

Smithy
(Site 1)

Lower brake
house (Site 12)

Upper incline
(Site 11)



Upper brake
house (Site 8)

398900E
502750N

Former New Mill
smelt flue (Site 5)

Cuttings to levels
(Sites 2, 3 & 4)

398750E
502700N



Plate 1: General view of chert quarry complex with Stodart Hush to top centre, looking SW
(© Historic England photograph 28814_008 taken 23rd September 2015, reproduced with permission).



Plate 2: General view of south end of chert quarry complex with smithy (Site 1) to right, looking SE
(© Historic England photograph 28814_072 taken 23rd September 2015, reproduced with permission).



Plate 3: Smithy building (Site 1), July 2014, looking NE.



Plate 4: Cutting leading to western level (Site 2), looking SW (photo 2/816).



Plate 5: Junction of cuttings to central and eastern levels (Sites 3 and 4), looking S (photo 2/784).



Plate 6: Entrance to central level (Site 3), looking S (photo 2/801).



Plate 7: Revetted entrance to eastern level (Site 4), looking N (photo 2/791).



Plate 8: Trackway (Site 7) leading to top of spoil heap (Site 10), looking NW (photo 2/777).



Plate 9: Remains of upper brake house (Site 8), looking SW (photo 2/827).

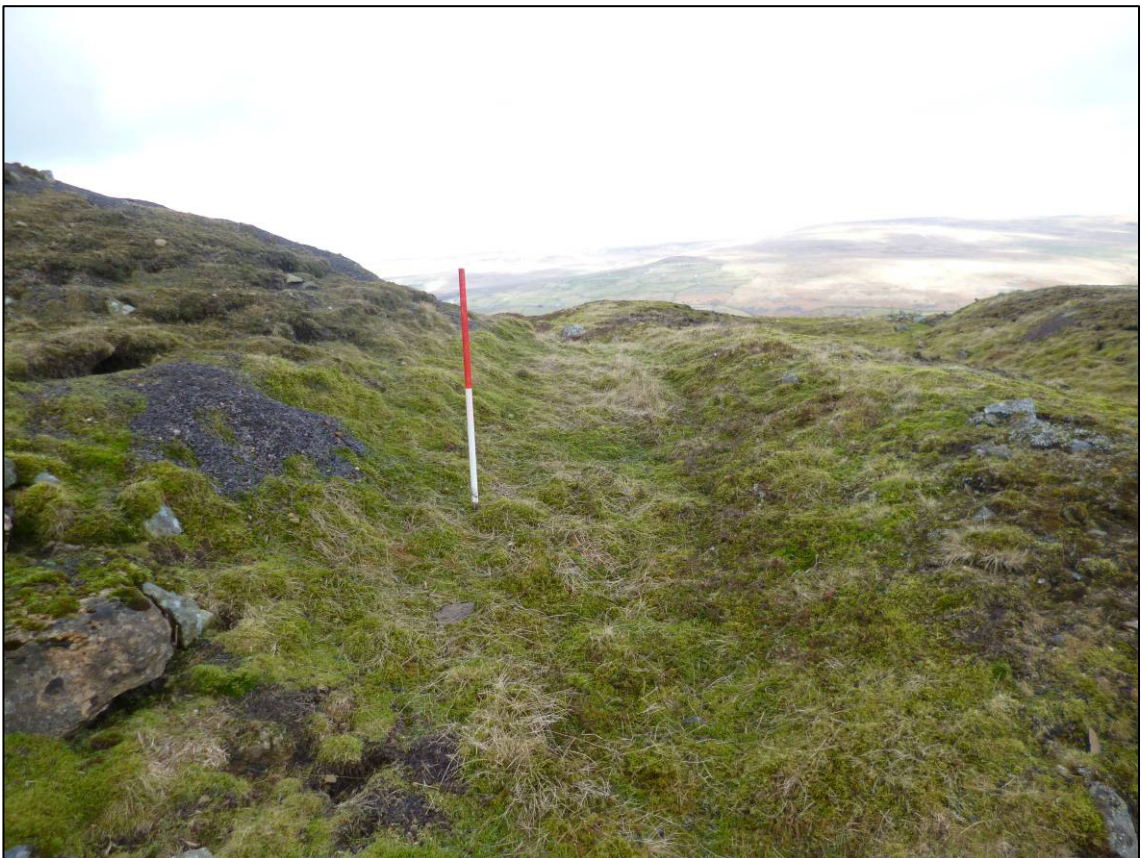


Plate 10: Linear depression (part of Site 9), north of western level (Site 2), looking N (photo 2/808).



Plate 11: View to main spoil heap (Site 10), looking NW (photo 2/779).

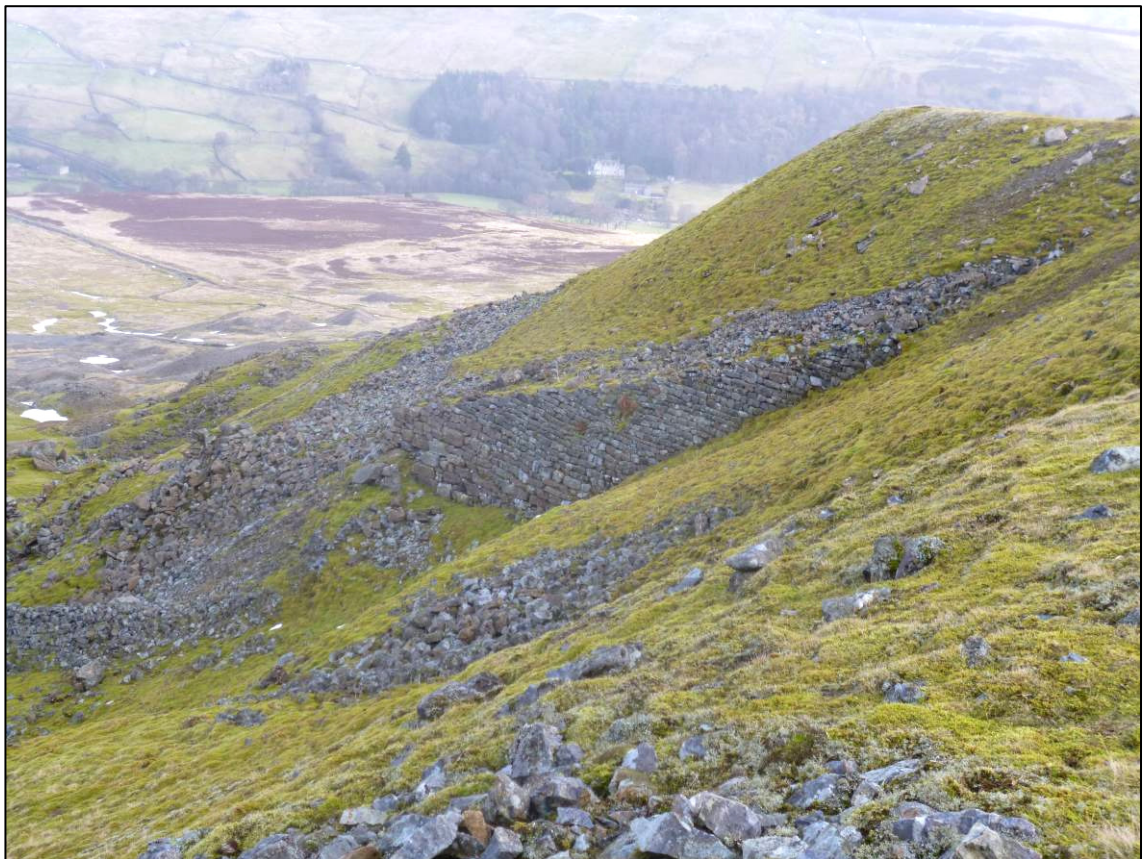


Plate 12: Revetted wall to upper incline (Site 11a), looking NE (photo 2/821).



Plate 13: North end of revetted bank to upper incline (Site 11a), looking E (photo 3/911).



Plate 14: Remains of pier to upper incline (Site 11b), looking SW (photo 3/941).



Plate 15: North face of probable pier to upper incline (Site 11c), looking SE (photo 3/938).



Plate 16: Remains of lower brake house (Site 12), looking SE (photo 3/962).



Plate 17: Siding/loading bay (Site 13a) at head of east incline, looking W (photo 3/948).



Plate 18: Remains of crane stay (Site 13b) above siding/loading bay at head of east incline, looking W (photo 3/939).



Plate 19: Chert dressing heaps (sites 14), looking NW (photo 3/917).



Plate 20: Revetted east face of western chert dressing heap (Site 14a), looking S (photo 3/953).



Plate 21: Siding/loading bay (Site 15) at head of west incline, looking NE (photo 3/895).



Plate 22: Top of west incline (Site 16), looking NE (photo 3/903).



Plate 23: Central part of west incline (Site 16c), looking SW (photo 3/023).

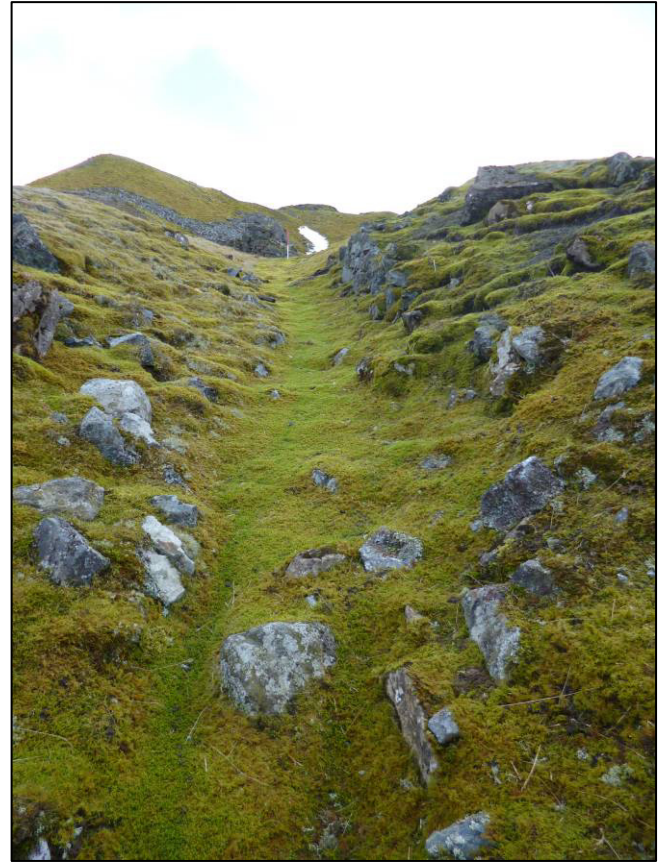


Plate 24: Top of east incline (Site 17b), looking SW (photo 3/981).



Plate 25: Lower part of west incline (Site 16d), looking S (photo 3/027).



Plate 26: Platform (Site 17a) at head of east incline, looking NW (photo 3/975).



Plate 27: Possible pier and platform (Site 17c) on east incline, looking SW (photo 3/996).

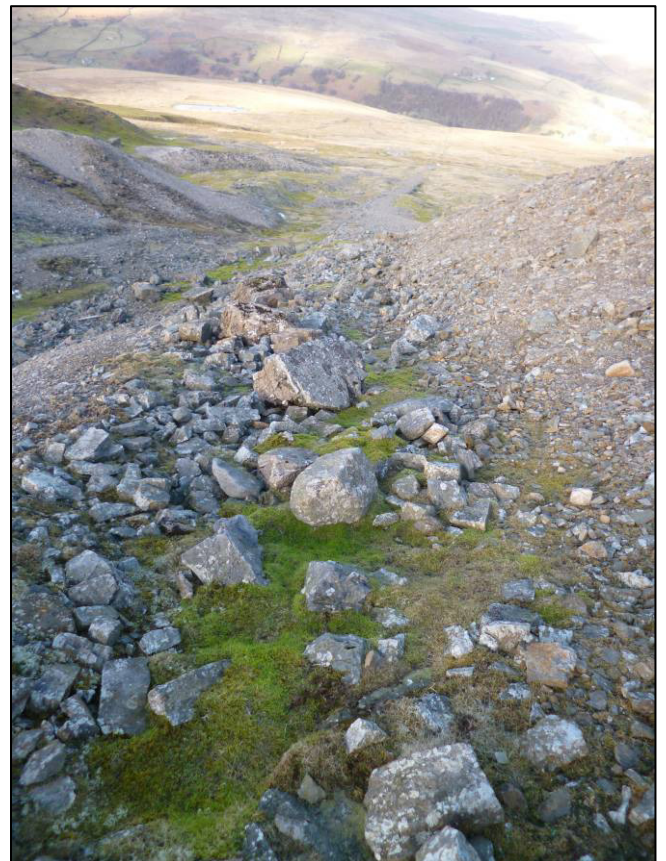


Plate 28: Lower part of east incline (Site 17d), looking NE (photo 3/021).



Plate 29: Lower part of east incline (Site 17e), looking NE (photo 3/036).



Plate 30: Earthworks (Site 18), north-west of siding/loading bay (Site 15) at head of west incline, looking NW (photo 3/902).



Plate 31: Wall and depression (Site 20) to east of east incline, looking SE (photo 3/985).



Plate 32: Cutting for end of incline (Site 21) adjacent to Reeth to Tan Hill road, looking SW (photo 3/044).



Plate 33: Site of loading bay hut (Site 22) at end of incline adjacent to Reeth to Tan Hill road, looking N (photo 3/050).



Plate 34: Pulley pit and associated structure (Site 23) at end of incline, looking N (photo 3/051).



Plate 35: Crane stay with protruding ironwork (Site 24), adjacent to Reeth to Tan Hill loading bay, looking NE (photo 3/058).



Plate 36: Loading bay (Site 25) adjacent to Reeth to Tan Hill road, looking W (photo 3/074).

APPENDIX 1
PHOTOGRAPHIC RECORD

HUNGRY CHERT QUARRIES: PHOTOGRAPHIC CATALOGUE

Film 1: Colour digital photographs taken October 2014

Film 2: Colour digital photographs taken 17th February 2015

Film 3: Colour digital photographs taken 26th February 2015

Film	Frame	Subject	Scale
1	808	Ex situ roof structure and fittings, S of smithy (Site 1), looking N	-
1	810	Ex situ fitting, S of smithy (Site 1)	-
1	811	Ex situ fitting, S of smithy (Site 1)	-
1	812	Ex situ fitting, S of smithy (Site 1)	-
1	813	Ex situ roof timber, S of smithy (Site 1), looking N	-
2	776	E end of trackway (Site 7), looking NW	1m
2	777	E end of trackway (Site 7), looking NW	1m
2	778	E end of trackway (Site 7), looking SE	1m
2	779	View to spoil heap (Site 10), looking NW	-
2	780	Dam/Reservoir (Site 6), looking SE	1m
2	781	Cuttings to levels (Sites 3 & 4), looking S	-
2	782	Cutting to levels (Sites 3 & 4), looking NE	-
2	783	Cutting to levels (Sites 3 & 4), looking SW	1m
2	784	Junction of cuttings to levels (Sites 3 & 4), looking S	1m
2	785	Cutting to level (Site 3), looking SW	1m
2	786	Cutting to level (Site 4), looking SE	1m
2	787	Cutting to level (Site 4), looking SE	1m
2	788	Cutting to level (Site 4), looking NW	1m
2	789	Revetment walls to level (Site 4), looking S	1m
2	790	E revetment wall to level (Site 4), looking E	1m
2	791	Level (Site 4), looking N	-
2	792	Level (Site 4), looking N	1m
2	793	Cutting to level (Site 4), looking NW	-
2	794	Cutting to level (Site 4), looking NW	-
2	795	Cutting to level (Site 4), looking NW	-
2	796	Cutting to level (Site 4), looking NW	-
2	797	Cutting to level (Site 4), looking N	-
2	798	Cutting to level (Site 3), looking N	1m
2	799	Entrance to level (Site 3), looking S	1m
2	800	Entrance to level (Site 3), looking S	1m
2	801	Entrance to level (Site 3), looking S	1m
2	802	Entrance to level (Site 3), looking S	1m
2	803	Entrance to level (Site 3), looking S	1m
2	804	View to smithy (Site 1) across cutting to level (Site 2), looking NW	-
2	805	Revetment wall to level (Site 2), looking W	1m
2	806	Cutting to level (Site 2) and flue remnant (Site 5d), looking N	-
2	807	Cutting to level (Site 2), looking S	1m
2	808	Linear depression (part of Site 9), N of level (Site 2), looking N	1m
2	809	Flue remnant (Site 5d), looking NW	1m
2	810	Cutting to level (Site 2) and linear earthwork (part of Site 9), looking N	-
2	811	Cutting to level (Site 2), looking NE	-
2	812	Cutting to level (Site 2), looking NE	1m
2	813	Cutting to level (Site 2), looking NE	1m
2	814	Cutting to level (Site 2), looking NE	1m
2	815	Cutting to level (Site 2), looking SW	1m
2	816	Cutting to level (Site 2), looking SW	1m
2	817	Flue remnant (Site 5d) and flue (Site 5f), looking SW	-
2	818	Earthworks (part of Site 9), N of level (Site 2), looking SW	-
2	819	General view of survey area & incline, looking N	-
2	820	General view of survey area, looking NE	-
2	821	Revetted wall to upper incline (Site 11a), looking NE	-
2	822	Central part of footpath (Site 7), looking E	1m
2	823	Central part of footpath (Site 7), looking W	1m
2	825	View from survey area, looking NW	-
2	826	Remains of upper brake house (Site 8), looking SW	1m

2	827	Remains of upper brake house (Site 8), looking SW	1m
3	001	Structure, adjacent to pier on E incline (Site 17c), looking SW	1m
3	002	Lower part of E incline (Site 17d), looking N	-
3	003	Revetment wall on central part of W incline (Site 16a), looking E	1m
3	004	Revetment wall on central part of W incline (Site 16a), looking NE	1m
3	005	Central part of W incline (Site 16), looking NE	1m
3	006	Central part of W incline (Site 16), looking NE	1m
3	007	Central part of W incline (Site 16), looking SW	1m
3	008	Central part of W incline (Site 16), looking SW	1m
3	009	E revetment wall to central part of W incline (Site 16b), looking NE	1m
3	010	E revetment wall to central part of W incline (Site 16b), looking E	1m
3	011	E revetment wall to central part of W incline (Site 16b), looking NE	1m
3	012	E revetment wall and cart remains to central part of W incline (Site 16b), looking NE	1m
3	013	E revetment wall and cart remains to central part of W incline (Site 16b), looking S	1m
3	016	Cart remains adjacent to E revetment wall to central part of W incline (Site 16b), looking E	1m
3	017	Central part of W incline (Site 16b), looking W	1m
3	018	Ex situ sleeper to central part of W incline (Site 16b), looking S	1m
3	021	Lower part of E incline (Site 17d), looking NE	1m
3	023	Central part of W incline (Site 16c), looking SW	1m
3	024	Central part of W incline (Site 16c), looking NE	1m
3	025	Central part of W incline (Site 16c), looking NE	1m
3	026	E revetment wall to lower part of W incline (Site 16d), looking S	1m
3	027	Lower part of W incline (Site 16d), looking S	1m
3	028	Lower part of W incline (Site 16d), looking S	1m
3	029	W revetment wall to lower part of E incline (Site 17e), looking E	1m
3	030	Lower part of E incline (Site 17e), looking NE	1m
3	031	Lower part of E incline (Site 17e), looking SW	-
3	032	W revetment wall to lower part of E incline (Site 17e), looking S	1m
3	033	Lower part of E incline (Site 17e), looking SW	1m
3	034	Lower part of E incline (Site 17e), looking SW	1m
3	035	Lower part of E incline (Site 17e), looking NE	1m
3	036	Lower part of E incline (Site 17e), looking NE	1m
3	037	Lower part of E incline (Site 17e), looking SW	1m
3	038	In situ sleeper on lower part of E incline (Site 17d), looking SW	1m
3	039	W revetment wall on lower part of E incline (Site 17d), looking S	1m
3	040	W revetment wall on lower part of E incline (Site 17d), looking S	1m
3	041	W revetment wall on lower part of E incline (Site 17d), looking S	1m
3	042	W revetment wall on lower part of E incline (Site 17d), looking S	1m
3	043	Lower part of E incline (Site 17d), looking NE	1m
3	044	Cutting for end of incline (Site 21), adjacent to road, looking SW	1m
3	045	Cutting for end of incline (Site 21), adjacent to road, looking NE	-
3	047	Mound at end of incline (Site 21), adjacent to road, looking N	1m
3	048	Possible wall footing at end of incline (Site 21), adjacent to road, looking SW	1m
3	049	Mound at wall footing at end of incline (Site 21), adjacent to road, looking N	1m
3	050	Site of hut site at end of incline (Site 22), looking SE	1m
3	051	Pulley pit (Site 23) at end of incline, adjacent to road, looking N	1m
3	052	Pulley pit (Site 23) at end of incline, adjacent to road, looking SE	1m
3	053	Pulley pit (Site 23) at end of incline, adjacent to road, looking E	1m
3	055	Pulley pit (Site 23) at end of incline, adjacent to road, looking SE	1m
3	056	Crane stay (Site 24), adjacent to loading bay, looking NE	1m
3	057	Crane stay (Site 24), adjacent to loading bay, looking NE	1m
3	058	Crane stay (Site 24), adjacent to loading bay, looking NE	1m
3	060	Crane stay (Site 24), adjacent to loading bay, looking S	1m
3	062	Ironwork to crane stay (Site 24), adjacent to loading bay, looking SE	-
3	063	General view of loading bay area, looking NW	-
3	064	Rubble spread (Site 24), adjacent to loading bay, looking NW	-
3	065	Earthworks (Site 24) to E of loading bay area, looking SE	1m
3	066	E end of revetment wall to loading bay (Site 25), looking W	1m
3	067	In situ timber, E end of revetment wall to loading bay (Site 25), looking S	-
3	068	In situ timber, E end of revetment wall to loading bay (Site 25), looking SE	-
3	069	Revetment wall to loading bay (Site 25), looking SE	1m
3	070	Revetment wall to loading bay (Site 25), looking S	1m

3	071	In situ timber, E end of revetment wall to loading bay (Site 25), looking SE	1m
3	072	In situ timber, E end of revetment wall to loading bay (Site 25), looking S	-
3	073	Main length of revetment wall to loading bay (Site 25), looking SE	1m
3	074	Main length of revetment wall to loading bay (Site 25), looking W	1m
3	075	W end of revetment wall to loading bay (Site 25), looking SE	1m
3	076	W end of revetment wall to loading bay (Site 25), looking SE	1m
3	077	Main length of revetment wall to loading bay (Site 25), looking W	-
3	888	W part of survey area, looking NW	-
3	889	Top of W incline (Site 16), looking NE	-
3	890	Siding/loading bay (Site 15) at top of W incline, looking W	1m
3	892	Siding/loading bay (Site 15) at top of W incline, looking W	1m
3	893	Siding/loading bay (Site 15) at top of W incline, looking E	1m
3	894	Siding/loading bay (Site 15) at top of W incline, looking E	1m
3	895	Siding/loading bay (Site 15) at top of W incline, looking NE	1m
3	896	Siding/loading bay (Site 15) at top of W incline, looking NW	1m
3	898	Siding/loading bay (Site 15) at top of W incline, looking NW	1m
3	899	Siding/loading bay (Site 15) at top of W incline, looking NE	1m
3	900	Siding/loading bay (Site 15) at top of W incline, looking SE	1m
3	901	Siding/loading bay (Site 15) at top of W incline, looking W	1m
3	902	Earthworks (Site 18), west of siding at top of W incline, looking NW	1m
3	903	Top of W incline (Site 16), looking NE	-
3	904	Top of W incline (Site 16), looking NE	-
3	905	W face of W chert dressing heap (Site 14a), looking N	-
3	906	N end of revetted wall to upper incline (Site 11a), looking E	1m
3	907	Central part of revetted wall to upper incline (Site 11a), looking E	1m
3	908	Revetted wall to upper incline (Site 11a), looking SE	1m
3	909	N end of revetted wall to upper incline (Site 11a), looking E	1m
3	910	Central part of revetted wall to upper incline (Site 11a), looking SE	1m
3	911	N end of revetted wall to upper incline (Site 11a), looking E	1m
3	912	Chert dressing heaps (Sites 14a & 14b), looking N	-
3	913	N end of revetted wall to upper incline (Site 11a), looking NE	1m
3	914	Chert dressing heaps (Sites 14a & 14b), looking NW	-
3	915	Inset at N end of revetted wall to upper incline (Site 11a), looking NE	1m
3	916	Inset at N end of revetted wall to upper incline (Site 11a), looking S	1m
3	917	Chert dressing heaps (Sites 14a & 14b), looking NW	-
3	918	Siding/loading bay (Site 13a) above E incline, looking N	-
3	919	Lower brake house (Site 12) above E incline, looking N	-
3	922	N face of revetted wall to upper incline (Site 11a), looking S	1m
3	923	Chert dressing heaps (Sites 14a & 14b), looking W	-
3	924	S face of pier to upper incline (Site 11b), looking NE	1m
3	925	S face of pier to upper incline (Site 11b), looking NE	1m
3	926	S face of pier to upper incline (Site 11b), looking NE	1m
3	928	E face of pier to upper incline (Site 11b), looking SW	1m
3	929	N face of pier to upper incline (Site 11b), looking W	1m
3	931	Probable pier to upper incline (Site 11c), looking N	1m
3	932	E face of probable pier to upper incline (Site 11c), looking W	1m
3	935	Tramway rail adjacent to probable pier to upper incline (Site 11c), looking S	1m
3	937	N face of probable pier to upper incline (Site 11c), looking S	1m
3	938	N face of probable pier to upper incline (Site 11c), looking SE	1m
3	939	Crane stay (Site 13b) above loading bay to E incline, looking W	1m
3	940	Probable pier to upper incline (Site 11c), looking W	1m
3	941	Pier to upper incline (Site 11b), looking SW	1m
3	942	Crane stay (Site 13b) above loading bay to E incline, looking N	1m
3	943	N end of E face of E chert dressing heap (Site 14b), looking W	1m
3	944	N end of E face of E chert dressing heap (Site 14b), looking SW	1m
3	946	Siding/loading bay (Site 13a) to E incline, looking W	1m
3	947	Siding/loading bay (Site 13a) to E incline, looking SE	1m
3	948	Siding/loading bay (Site 13a) to E incline, looking W	1m
3	949	N end of E face of E chert dressing heap (Site 14b), looking S	-
3	950	N end of E face of E chert dressing heap (Site 14b), looking S	1m
3	951	E side of W chert dressing heap (Site 14a), looking N	1m
3	952	Revetted E face of W chert dressing heap (Site 14a), looking N	1m
3	953	Revetted E face of W chert dressing heap (Site 14a), looking S	1m
3	955	Gap between chert dressing heaps (Sites 14a & 14b), looking N	1m

3	956	Revetted E face of W chert dressing heap (Site 14a), looking NW	1m
3	957	E chert dressing heap (Site 14b), looking N	1m
3	958	Projecting stone in revetted E face of W chert dressing heap (Site 14a), looking S	1m
3	959	Projecting stone in revetted E face of W chert dressing heap (Site 14a), looking S	1m
3	960	Gap between chert dressing heaps (Sites 14a & 14b), looking N	-
3	961	Lower brake house (Site 12) to E incline, looking S	1m
3	962	Lower brake house (Site 12) to E incline, looking SE	1m
3	963	Internal E wall of lower brake house (Site 12) to E incline, looking E	1m
3	964	Internal S wall of lower brake house (Site 12) to E incline, looking S	1m
3	965	Internal W wall of lower brake house (Site 12) to E incline, looking W	1m
3	967	Internal W wall of lower brake house (Site 12) to E incline, looking NW	1m
3	968	External W wall of lower brake house (Site 12) to E incline, looking E	1m
3	969	External S wall of lower brake house (Site 12) to E incline, looking N	1m
3	971	External E wall of lower brake house (Site 12) to E incline, looking W	1m
3	972	External E wall of lower brake house (Site 12) to E incline, looking W	1m
3	973	Footings, N of lower brake house (Site 12) to E incline, looking SW	1m
3	974	S face of platform (Site 17a) at head of E incline, looking N	1m
3	975	Platform (Site 17a) at head of E incline, looking NW	1m
3	976	E face of platform (Site 17a) at head of E incline, looking W	1m
3	978	Top of E incline (Site 17b), looking NE	1m
3	979	Top of E incline (Site 17b), looking NE	1m
3	980	Stone spread (Site 19) between inclines, looking NW	-
3	981	Top of E incline (Site 17b), looking SW	1m
3	983	Top of E incline (Site 17b), looking NE	-
3	984	Retaining wall, W side of E incline (Site 17b), looking NW	1m
3	985	Wall and depression (Site 20) to E of E incline, looking SE	1m
3	986	Retaining wall (part of Site 17c), N end of W side of E incline, looking W	1m
3	988	N face of platform (part of Site 17c) on E incline, looking S	1m
3	989	W face of platform (part of Site 17c) on E incline, looking E	1m
3	991	Possible pier (part of Site 17c) on E incline, looking SW	1m
3	993	Ex situ sleeper in possible pier (part of Site 17c) on E incline, looking SW	1m
3	995	N face of possible pier (part of Site 17c) on E incline, looking SW	1m
3	996	Possible pier and platform (part of Site 17c) on E incline, looking SW	1m
3	997	W face of possible pier (part of Site 17c) on E incline, looking E	1m
3	998	View down E incline (Site 17d), looking NE	-
3	999	View up upper part of W incline (Site 16), looking SW	-



1-808.JPG



1-810.JPG



1-811.JPG



1-812.JPG



1-813.JPG



2-776.JPG



2-777.JPG



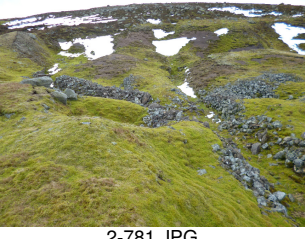
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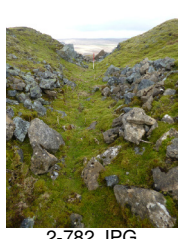
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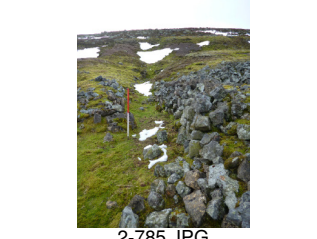
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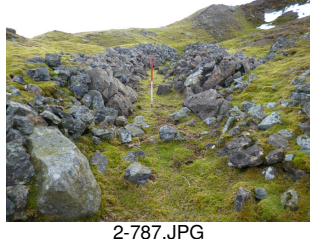
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2-791.jpg



2-792.jpg



2-793.JPG



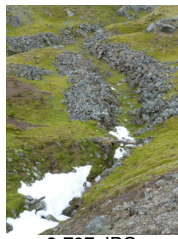
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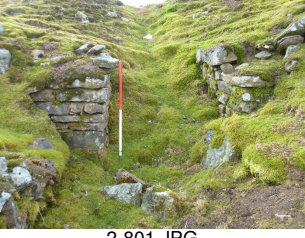
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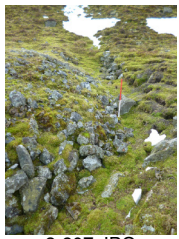
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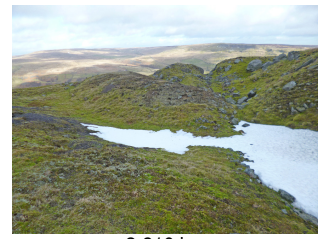
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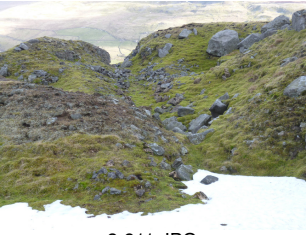
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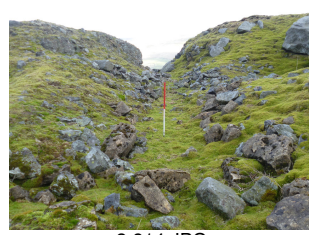
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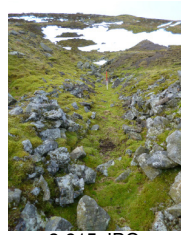
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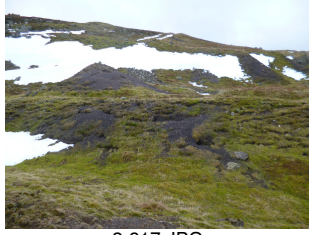
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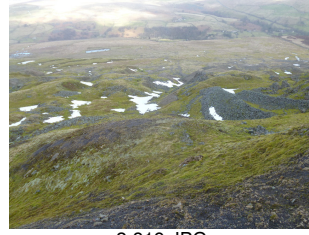
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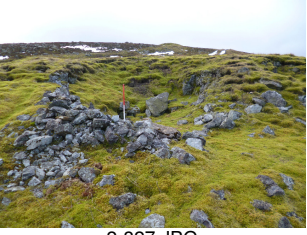
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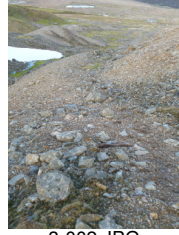
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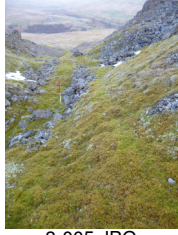
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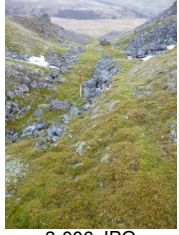
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3-010.jpg



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3-013.JPG



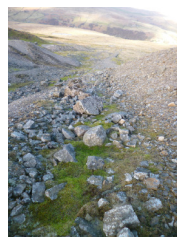
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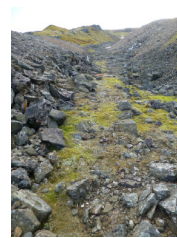
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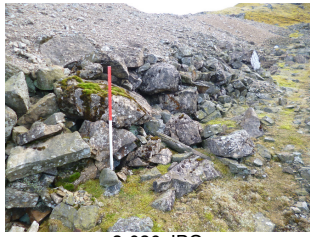
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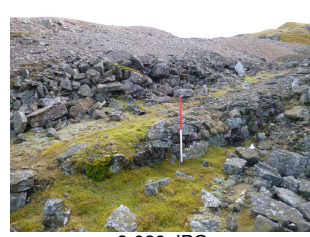
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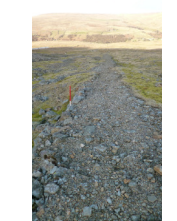
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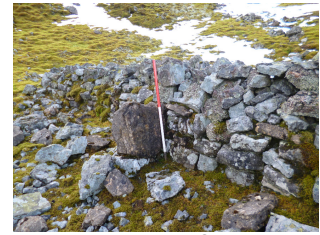
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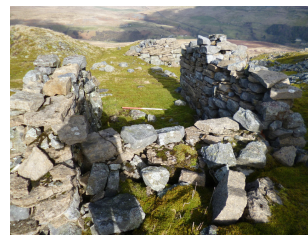
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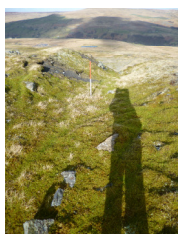
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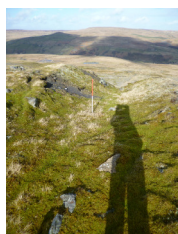
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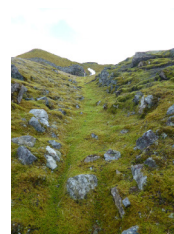
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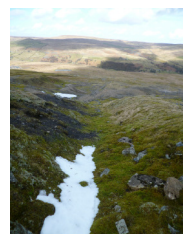
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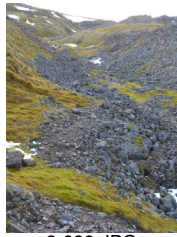
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APPENDIX 2
EDAS METHODS STATEMENT

ARCHAEOLOGICAL SURVEY, HUNGRY CHERT QUARRIES, MOULDSIDE, ARKENGARTHDALE, NORTH YORKSHIRE

YDNPA have requested a pre-intervention Level 3 archaeological survey of the core of the Hungry Chert Quarry complex on Mouldside, Arkengarthgate, North Yorkshire, as part of a phased programme of consolidation and repair. This work would build on an earlier descriptive and photographic record undertaken by Stephen Eastmead in late 2013. The survey area is shown on the attached figure, and it wholly lies within a larger Scheduled Monument (List entry 1015854).

The aims of the project would be:

- to provide a detailed, pre-intervention record of the complex;
- to identify and gather sufficient information to establish the extent, nature, character, condition, quality, date, significance and functional relationships of the surviving archaeological and historical features within the survey area;
- to provide a basic structural assessment of the standing remains associated with the quarry complex (including a tramway), to establish the consolidation needs of identified features;
- to examine and document any evidence for damage to the complex that relates to either natural erosion, or current land management, drawing up a list of recommendations towards the 'ideal management' of the complex;
- to provide an accessible version of the report, suitable for publication in an appropriate academic publication.

No additional or new historical research would be undertaken for the project, although existing and readily-available sources such as Eastmead's survey report and data held by the Northern Mines Reserach Society would be consulted. The YDNPA would also make available any historic Ordnance Survey map bases, aerial photographs and other records which might be relevant to the project.

The topographical survey will be carried out at a scale of 1:500 using EDM total station equipment. Sufficient information will be gathered to allow the survey area to be readily located through the use of surviving structures, fences, walls, water courses, trackways and other topographical features. The survey will record the position at ground level of all structures, wall remnants and revetments, earthworks, water courses, leats, paths, stone and rubble scatters, ironwork, fences, walls and other boundary features, and any other features considered to be of archaeological or historic interest. The survey will also record any differences in the exposed surface detritus, such as sorted stone and/or rubble scatters, as well as differences in coarse vegetation; these features may aid the functional differentiation and interpretation of the site. The detailed site survey will pay particular attention to any structural remains, and will also record areas of erosion (both natural, animal and man-made) or other damage. For Health and Safety reasons, no underground surveying will be undertaken.

The site survey will be integrated into the Ordnance Survey national grid by resection to points of known co-ordinates. Heights AOD will be obtained by reference to the nearest OS benchmark; given the nature of the remains, contours will not be plotted across the site. A temporary bench mark could be established and left on site using a ground marker approved by the YDNPA if required. Survey points would be taken from fixed survey stations on a closed traverse around and through the site. The locations, descriptions and values of the Bench Marks and control points would be stated in the final survey data.

On completion of the total station survey, the field data will be plotted and re-checked on site in a separate operation. Any amendments or additions will be surveyed by hand measurement, and the results digitised back into the electronic survey data.

The resulting site survey will be produced at a scale of 1:500 and presented as an interpretative hachure plan(s) using conventions analogous to those used by English Heritage. It is envisaged that the final survey drawing will comprise one or more A1 size sheets. It should be noted that the final product arising from the site survey will be a series of hand-drawn wet ink hachure plans, although AutoCad (or equivalent) electronic data could also be provided if required. Smaller scale plans, at 1:10,000 and 1:2,500 scale, will be used to put the survey area into context (OS map bases to be provided by the YDNPA).

The main site elements or components will be given a unique identifier number, and a detailed written description provided based on notes taken in the field. No pro forma record sheets or database will be prepared, although the report will contain detailed descriptions, to include a preliminary interpretation of extant remains (e.g. dimensions, plan, form, function, date, sequence of development), locational information (including ten figure grid references obtained from the topographical survey, OS map bases or hand-held GPS systems), and mention of relevant documentary, cartographic or other evidence, and management details such as an assessment of current condition and threats.

A detailed photographic record will be produced to illustrate specific well-preserved sites, details of specific sites and/or areas of erosion etc. More general photographs will also be taken showing the landscape context of the area and of specific sites. The colour photographs will be produced using a digital camera with 12 megapixel resolution, in accordance with English Heritage photographic guidelines; each photograph will normally be provided with a scale. All photographs will be clearly numbered and labelled with the subject, orientation, date taken and photographer's name, and will be cross-referenced to digital files etc.

Individual sites or structural elements will not be surveyed in any greater detail (e.g. 1:50 or 1:20 scale plans or elevations). It is considered that the detailed photographic coverage and descriptive account will be sufficient to produce an appropriate level of record, which can then be used for consolidation work as necessary.

An EDAS stand-alone archive archaeological survey report for the site will be produced, based on the results of the documentary research, the topographical survey, the photographic record and detailed site descriptions. The report will be a standard A4 typed and bound document, which will assemble and summarise the available evidence for the survey area in an ordered form, synthesise the data, comment on the quality and reliability of the evidence, and how it might need to be supplemented by further site work or desk-based research. The report will be illustrated by selected colour digital images, historic maps and plans (reduced to A4 or A3 size) and final hachured survey drawings (reduced to A4 or A3 size). A draft copy of the report will be made available for discussion with the YDNPA prior to completion, and two copies of the final approved survey report will then be provided in hard copy format (comb bound reports); a CD containing a pdf copy of the report and digital photographs will also be provided.

A properly ordered and indexed project archive (paper, magnetic and plastic media) will also be deposited with the YDNPA at the end of the project.

It is envisaged that the on-site survey work will be undertaken in late September-October 2014, subject to access agreements.

