



HIGHFIELD SERVICE RESERVOIR TO POAKA BECK WwTW PIPELINE, CUMBRIA

Topographic Survey and Archaeological Watching Brief



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SUMMARY

United Utilities propose the construction of a new water pipeline running from Highfield Service Reservoir to Poaka Beck Wastewater Treatment Works (SD 24347 73926–24139 77821; Fig 1). Following the results of a desk-based assessment and walkover survey (OA North 2005), the Cumbria County Historic Environment Service (CCHES) recommended that a topographic survey be carried out along the proposed new water pipeline route. A permanent presence watching brief, to be undertaken during topsoil stripping activities, and the excavation of eight geotechnical test pits along the route, was also recommended.

On the basis of the previous work (OA North 2005), the following sites were selected for topographic survey: Site **04** (mine shafts and track); Site **34** (limekiln, quarries and track); Site **41** (mill race); Site **59** (ridge and furrow); Site **61** (ditches and possible ‘clearance cairns’); and Site **64** (earthworks). Site **46** (mill dam) and Site **49** (quarry) were additionally subject to photographic recording. The topographic survey took place during May 2006.

The most significant addition to the original programme of survey involved the area around the former Dalton Iron Mine (Site **04**), where eight new sites (Sites **66** to **73**) were recorded and added to the record, comprising additional extraction scars (Sites **66** to **71**), the remains of a building (Site **72**), and further quarrying and an associated track (Site **73**). The topographic survey emphasised the importance of maintaining an archaeological presence, particularly during any groundworks within the former Dalton Iron Mine (Site **04**), where there was the possibility of encountering building remains.

The watching brief took place between May and October 2006, and the permanent monitoring of the groundworks and geotechnical test pits established that little evidence for the sites identified in the previous phases survived as archaeologically visible below-ground remains. Evidence for probable limestone quarrying (Site **30**) and for maintenance of the Lindal Rail Tunnel (Site **61**) was recorded.

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Oxford Archaeology North (OA North) would like to thank United Utilities for commissioning the project.

Steve Clarke and Neil Wearing undertook the topographic survey. Steve Clarke also undertook the watching brief, along with Jason Clarke. Neil Wearing and Chris Healey wrote the report and the drawings were produced by Mark Tidmarsh. Alison Plummer managed the project and edited the report.

1. INTRODUCTION

1.1 CIRCUMSTANCES OF PROJECT

- 1.1.1 United Utilities propose the construction of a new pipeline running from Highfield Service Reservoir to Poaka Beck Wastewater Treatment Works (SD 24347 73926–24139 77821; Fig 1). Following the results of a desk-based assessment and walkover survey (OA North 2005) the Cumbria County Historic Environment Service (CCHES) recommended that a topographic survey and archaeological watching brief be carried out along the proposed new water pipeline route.
- 1.1.2 The topographic fieldwork took place during early May 2006, the results comprising a series of outline detail and hachure plans that included additional features within appropriate proximity to the pre-targeted sites. In addition, a photographic record was made of specific buildings and upstanding structures highlighted by the previous works. The watching brief was undertaken between May and October 2006. This work was informed by the results of the topographic survey.

1.2 LOCATION, TOPOGRAPHY AND GEOLOGY

- 1.2.1 The proposed pipeline route is orientated approximately north/south. The south end is situated less than 1km to the east of Dalton-in-Furness, while the north end is approximately 3.5km north-east of Dalton-in-Furness, close to the village of Marton (Ordnance Survey 1981). The landscape rises gradually from between 80-100m above sea level at the south end to 160m at the north (*ibid*). The majority of the area is pastoral in character, with an '*undulating or gently rolling topography*' (Countryside Commission 1998, 27). The solid geology is complex, but is principally comprised of Carboniferous limestone at the south end and Bannisdale slates at the north (Plate 1). The north end also contains a patch of Brathay flags and a small mixed area of Stockdale shales, igneous granite and Coniston limestone of the Eycott group (*ibid*). This is overlain by thick deposits of glacially-derived boulder clay till (Countryside Commission 1998, 27), which in turn are overlain by typical brown earths (Soil Survey of England and Wales 1983).

1.3 HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

- 1.3.1 **Prehistoric Period:** south Cumbria, and Furness in particular, has some of the earliest evidence for prehistoric activity in the north-west of England. Caves within the limestone areas around Morecambe Bay have produced artefacts dating to the Late Upper Palaeolithic (Elsworth 1998), although these remain, as yet, unpublished. Small numbers of finds from the Mesolithic period have been found in association with these and larger collections have been identified in a number of locations along the west coast of Cumbria (Young 2002), suggesting that there was a great deal of activity in the area during this period. More

recently pottery dating to the early Neolithic has been found associated with post holes and other features and tools of Mesolithic type near Barrow-in-Furness (Jones 2001; OA North 2002). Examples of one of the most recognisable artefacts of the Neolithic, the stone axe, have been found throughout the local area (Bradley and Edmonds 1999), although settlements and burials belonging to the period are much more rare. During the Bronze Age and Iron Age these begin to appear, although many have not been studied in detail and are difficult to date (Barnes 1968, 7). A number of finds of burials and metalwork are known from across the Furness Peninsular, although these are often not well recorded (*ibid*). Large hillfort enclosures, typically thought to belong to the Iron Age, are known in the area, such as that at Skelmore Heads near Urswick (*ibid*), and may including a recently discovered site on Hoad near Ulverston (Elsworth 2005).

- 1.3.2 There are several sites of definite or probable prehistoric date within the study area. These include enclosures visible as earthworks in aerial photographs (Sites 15, 22 and possibly 03), find spots of prehistoric flint artefacts (Sites 05-06) and stone tools (Sites 21 and 58).
- 1.3.3 **Roman:** it is not clear whether the Romans arrived in force in Furness. The earliest antiquarian records mention the discovery of sections of well-built road thought to be of Roman origin and considered Dalton to be the likely site of a Roman fort (West 1805, 8-11). More recently this idea has been largely dismissed, to the extent that it is doubted that the Romans ever came to Furness at all (Trescatheric 1993, 23). A recent re-examination of the evidence suggests that the original claims may have more validity than has been thought (Elsworth forthcoming), and that Dalton may indeed have been the site of a Roman fort, although more evidence is still needed to demonstrate the proof of this. Similarly, recent work at Urswick has suggested a site with Roman origins, but until good evidence is forthcoming this remains conjecture (Dickinson 2002; 2005). The general area is thought to have been part of a large territory controlled by a native group, known to the Romans as the Brigantes (Shotter 2004, 4), although it has been argued that the area around Morecambe Bay might have been held by the *Setantii*, who are known to have had a port somewhere in the north-west (*op cit*, 6-7). Quite how they might have interacted with the Romans is not clear, although the relatively large number of coins from Furness has led to the suggestion that some form of significant contact must have taken place (Shotter 1989, 44; 1995).
- 1.3.4 There are no known sites of Romano-British date within the study area, although the road (Site 18) may have Roman origins (Elsworth forthcoming). Some of the enclosures (Sites 15 and 22, and possibly 03) may also have been occupied during the Romano-British period.
- 1.3.5 **Early Medieval:** the effect of the collapse of Roman administration in Britain on Furness is unclear, but as the impact of the Roman invasion is also unknown this is perhaps to be expected. Life may have continued much as it had done before (Trescatheric 1993, 23). Cumbria and North Lancashire probably came under the influence of a number of minor kingdoms possibly including Rheged, Strathclyde (Rollinson 1996, 33), and the Northumbrian Angles (Newman 1996, 93). Quite what the effect of these various political and military powers was on

the area is also unclear; much of the evidence survives as little more than place-names and brief historical records (*ibid*). Within the study area there are numerous names reflecting an Anglian influence, significant among which is the name Orgrave meaning ‘ore pit’: ‘*the name gives the important information that iron mining must have been carried on in the district since before the Conquest*’ (Ekwall 1922, 207). Recent reinterpretation of one of the most tangible pieces of evidence, a carved cross fragment in Urswick church, has suggested that the site may have housed an early monastery (Dickinson 2002; 2005), although more conclusive evidence is still needed to support this claim. What is more certain is the influence that the Vikings had on the area during the ninth and tenth centuries. They arrived from Ireland, the Western Isles and the Isle of Man and their principal legacy has been in place-names, which are found throughout the area (Trescatheric 1993, 27-9). Physical remains have also been discovered, including a sword from Rampside (Barnes 1968, 16), and a possible merchant’s weight (Dennett 2005). The Norse influence was to continue to have a strong effect on the area for several centuries (Barnes 1968, 16).

- 1.3.6 There are no known sites of early medieval date within the study area, although the place-name evidence suggests that some of the later sites may have early medieval origins.
- 1.3.7 **Late Medieval:** the majority of the modern settlements in the area certainly had at least medieval origins, although physical remains dating to this period are infrequent. As outlined above, the iron ore in the area was already being exploited but it is during the medieval period that the first references to it begin to appear. The mines at Orgrave are referred to in a dispute involving Furness Abbey in 1235 and in 1400 the Abbey was granted iron ore and 400 acres of land at Dalton, Orgrave and Martin (Collingwood 1928, 121). At this time bloomeries making use of iron mined in Low Furness were present across High Furness, where wood for making charcoal was plentiful (*op cit*, 121-122). This situation continued until the Dissolution of the Monasteries, at which time ‘*Furness Abbey was making no profit on its iron: probably using it all for its own purposes and for its tenants*’ (*op cit*, 122). A small number of bloomsmithies were in operation around this period (Fell 1968, 178-190), which almost certainly used Furness ore, but these were limited in scale compared to previous operations. In 1565 the bloomeries were suppressed in order to preserve the rapidly diminishing woodland of High Furness, and probably also to protect the royal monopoly held by copper miners near Coniston (Collingwood 1928, 122-123).
- 1.3.8 Only two sites thought to be of medieval origin are present within the study area, one of which, a bloomery (site **40**), is connected to the iron industry. The other, an area of ridge and furrow (Site **51**) demonstrates agricultural practices existed alongside industrial processes. The road (Site **18**) may also have medieval origins.
- 1.3.9 **Post-Medieval:** it was not until the late seventeenth century that iron smelting resumed in High Furness, so it is likely that many of the mines had been largely unused in the intervening period (*op cit*, 123). By the beginning of the eighteenth century ‘*the iron industry of Furness suddenly sprang into life*’ (Fell 1968, 32), particularly as a result of the construction of a blast furnace at Backbarrow in

1711, and others following soon after (Bowden 2000, 7). A number of leases to mine were soon granted for areas within the study area; William Matson of Tytup began working land in that area in 1707 (Fell 1968, 32), Thomas Lowther took out a lease on lands at Martin in 1717 (*op cit*, 33) and Richard Postlethwaite mined lands at Lindal from 1746 (*op cit*, 35). The majority of these mines were very productive, and Whitriggs in particular, begun in the early eighteenth century, became famous for the quantity of ore that it produced (*op cit*, 40-42), a fact that was commented on by many visitors at the time (*op cit*, 42). RR Angerstein, visiting in the 1750s described an area of mining '*That completely filled a tract of land with a circumference [sic] of half a mile*' (Berg and Berg 2001, 289). During this time Tytup Hall (situated near the centre of the development area) was home to Father Thomas West, author of *The Antiquities of Furness* in 1774 (Melville 1975).

1.3.10 The vast scale of mining operations during the eighteenth century were dwarfed, however, during the nineteenth century as operations continued to grow at a rapid pace. Many of the largest nineteenth century mines were situated within the study area; Crossgates Mine, for example was producing 420,000 tons of ore in 1849 and had at least 16 pits operating during its lifetime, which lasted into the early twentieth century (Kelly 1998, 62-65). High Crossgates too was worked sporadically into the early twentieth century until stopped by flooding (*op cit*, 66-67). Eure Pits was worked throughout the nineteenth century and as late as 1920, at which time new boreholes were still being sunk (*op cit*, 68). At Whitriggs, the most productive mine in Furness, working continued until the 1940s, when new seams of ore were still being discovered (*op cit*, 70-75). Similarly, Lindal Moore Mine and Diamond Pit were still operating into the early 1920s (*op cit*, 76-82). Other mines only began life in the nineteenth century; Highfield, for example started some time before 1879 and continued to be operated until 1901 (*op cit*, 105-106), and there are many similar examples in the general area. Ultimately, lower demand for iron and competition from coke-fuelled furnaces brought the iron industry in Furness to an end (Bowden 2000, 79). Some pits evidently lasted much longer than others, but ultimately it was their impact on the landscape that was their lasting legacy.

1.3.11 The majority of the sites within the study area have post-medieval origins, particularly relating to the Industrial Revolution. These include sites related to mining, such as the mines themselves (Sites **02, 04, 10-1, 14, 23, 28, 33, 36-7, 45, 48, 54** and **56**), associated railways (Sites **01, 12, 31** and **44**), an engine house (Site **07**), individual mine shafts (Sites **08, 16-17** and **29**) and a level (Sites **52**). In addition, there are a number of industrial sites that were probably supplying materials to the iron mines, such as limekilns (Sites **19, 27** and **34-35**), quarries (Sites **09, 13, 26, 30, 49** and **57**), and a gunpowder magazine (Site **53**). Several sites of post-medieval date hint at the agricultural character of the landscape and more rural industries, such as those connected to milling (Sites **39, 41, 46** and **50**). A variety of other types of activities are also represented in sites as diverse as a dog kennel (Site **42**), a reservoir (Site **24**), a kiln of unknown type (Site **43**) and a sand pit (Site **55**).

2. METHODOLOGY

2.1 PROJECT DESIGN

- 2.1.1 A project design (*Appendix 1*) was produced for, and accepted by, United Utilities for the topographic survey and watching brief elements of the archaeological programme of work along the proposed new transfer pipeline routes. The project design was adhered to in full, except where outlined below, and the work was consistent with the relevant standards and procedures of the Institute of Field Archaeologists, and generally accepted best practice.

2.2 TOPOGRAPHIC SURVEY

- 2.2.1 The survey concentrated on the recording of breaks of slope to define the position and extent of features, rather than blanket coverage of points by grid across a site. The survey was conducted with Leica differential GPS equipment, using real-time (RTK) corrections and equipped with mobile SmartNet technology to achieve an accuracy of $\pm 0.01\text{m}$. The digital survey data was transferred, via Leica Geo Office (V.3), as dxf drawing files into a CAD system (AutoCAD 2004), and was superimposed onto the embedded digital Ordnance Survey data. The resulting drawings provide a record of the extant archaeological features, annotated with hachures to create an accurate topographical record. Descriptive hand-written records were compiled for each surveyed feature. A photographic record was maintained in 35mm black and white print format, colour slide and digital photography.

2.3 WATCHING BRIEF

- 2.3.1 This programme of field observation accurately recorded the location, extent, and character of any surviving archaeological features and/or deposits within the course of the topsoil strip within areas of open country. The work comprised the systematic examination of any subsoil horizons exposed during the course of the groundworks, and the accurate recording of all archaeological features and horizons, and any artefacts, identified during observation.
- 2.3.2 All groundworks on the site were conducted under constant archaeological supervision and comprised stripping of topsoil and subsoil to a maximum depth of 0.4m. These works were enacted by a 360° mechanical excavator using a 2m flat ditching bucket. All exposed soil horizons were examined and described and spoil heaps were carefully checked for any unstratified finds.
- 2.3.3 A daily record of the nature, extent and depths of groundworks was maintained throughout the duration of the project. All archaeological features were recorded on OA North's *pro-forma* sheets, using a system based on that of the English Heritage Centre for Archaeology. A monochrome and colour slide photographic record was maintained throughout and, where appropriate, scaled plans and sections were produced to locate the presence of archaeological features as accurately as possible.

2.4 ARCHIVE

- 2.4.1 A full professional archive has been compiled in accordance with the project design (*Appendix 1*), and in accordance with current IFA and English Heritage guidelines (English Heritage 1991). The paper and digital archive will be deposited with the Cumbria Historic Environment Record, Kendal.

3. TOPOGRAPHIC SURVEY

3.1 INTRODUCTION

3.1.1 Eight sites were visited during the course of the topographic survey, comprising the remains of former industrial and agricultural activity. All of the sites examined were either of uncertain or post-medieval date. Site **46** (mill dam) and Site **49** (quarry) were intended for photographic recording alone. During the topographic survey, eight additional sites were identified and subsequently recorded, all of which (**66** to **73**) relate to the Dalton Iron Mine complex (Site **04**).

3.2 FORMER DALTON IRON MINE COMPLEX (INCORPORATING SITES **04**, **59**, **66-73**)

3.2.1 Site **04** is the site of the former Dalton Iron Mine (Fig 2b; 3), comprising mine workings and quarries, with associated spoil heaps and a track connecting them. These are shown on the Ordnance Survey map of 1891 (Plate 1). Much of this landscape is recorded on the current Ordnance Survey map (1981), although some detail has been lost. The topographic survey has added:

- detail to the track (appended to Site **04**);
- six additional extraction scars (Sites **66**, **67**, **68**, **69**, **70** and **71**);
- identified probable building foundations (**72**);
- identified an area of quarrying and track (**73**), which pre-dates the construction of the Dalton Iron Mine.

3.2.2 Current Ordnance Survey mapping shows the track (part of Site **04**) as being some 144m in length, visible on the ground as a linear earthwork cross-cutting the slope in a north-east/south-westerly direction, and situated alongside a series of extraction scars, spoilheaps and earthworks (Plate 2). The topographic survey recorded an additional 148m of the track, which was seen to fork to the east at its northern end. The forked section rises as it runs eastwards for a further 38m. Along the length of the track the width varies between 2.5 to 3.5m. The northern section is benched into the hillside, creating a level strip of land interrupting the declivity of the hillside (Plate 3; Fig 3).

3.2.3 At the point where the track forks, it passes to the immediate south of an irregular earthwork (Site **72**), which occupies an area 11m by 6m wide (Plate 4; Fig 3). The Ordnance Survey map of 1891 shows a small building or enclosure measuring roughly 8m x 9m with a small entrance at its south-western corner (Plate 5). It is likely, therefore, that these earthworks represent the ruins of this structure.

3.2.4 The southernmost stretch of track is raised on an embankment standing to a maximum height of 0.6m, constructed of compacted earth and stone, with a now heavily eroded metalled surface (Plate 6). The most pronounced section of

embankment is located at a point where the track crosses a disused extraction site (Site **66**, Fig 3). This embankment was most probably constructed to in-fill the extraction site in order to support the track (Plates 7 and 8). Site **66** represents a linear extraction scar measuring 54m long, 21m wide and up to 0.75m deep.

- 3.2.5 In addition to Site **66**, five further extraction scars were recorded (sites **67** to **71**); the smallest, Site **67** (Fig 3), which comprised a small sub-circular depression approximately 5m in diameter, is thought to represent a disused shaft or a sinkhole. The other extraction scars are located more centrally to the ironworks complex (Fig 3). These comprise a linear extraction scar (Site **66**); three sub-circular scars cutting into the hillside (Sites **68**, **69** and **70**; Fig 3) measuring between 16m and 18m in diameter, and one curvilinear scar (Site **71**; Fig 3) measuring 23m long. All these five sites are now grassed over and show no sign of exposed workings (Plates 9 and 10).
- 3.2.6 Site **59** comprises two areas of ridge-and-furrow and two former field boundaries (Figs 4a and 4b). The largest area of ridge-and-furrow is aligned east/west, traversing the hillside for some 200m and typically measuring 4.5m to 5m from crown to crown. In places, these ridges stand to 0.3m high (Fig 4a; Plate 11), although frequently they are only visible as slight variations in the colour and height of the masking vegetation. The area of Site **59** has been truncated by extraction site (Site **66**), and thus pre-dates it.
- 3.2.7 A second area of ridge-and-furrow, located immediately south of the building foundations (Site **72**; Fig 5), follows a north/south alignment and survives to a maximum length of 65m. It typically measures 6m to 6.5m from crown to crown. In places, it stands to 0.2m high (Plate 12), although it is fainter than the earthworks comprising Site **59** (Fig 4b). The regular appearance of the ridge-and-furrow would suggest a post-medieval date, although the relationship with the extraction site (Site **66**) and track (neither of which are shown until the 1891 Ordnance Survey mapping) shows that it pre-dates those features.
- 3.2.8 A field boundary, located at the western edge of the largest area of ridge-and-furrow (Site **59**), follows the line of a path shown on the first edition mapping (Fig 2b). This is visible today as an interrupted linear feature on a north/south alignment, measuring 88m long and a maximum of 2m wide, and rising to no more than 0.5m in height (Fig 4b; Plate 13). A second boundary survives as a similarly interrupted linear feature, aligned east/west and measuring 50m long. In places it stands to a maximum height of 0.75m. On the first edition Ordnance Survey mapping of 1850 a path is shown skirting the field boundary, and although the boundary is currently ruinous it is still shown on current mapping (Fig 4b).
- 3.2.9 Site **73** represents an additional extraction site and track recorded during the fieldwork (Fig 3). The Ordnance Survey map of 1850 clearly shows a track located to the eastern edge of the iron mine complex but it does not define any area of workings or quarrying. By the time of the Ordnance Survey map of 1891 the track has been extended westwards where it converges with another track (Site **04**). The surviving track currently follows a north-west/south-east course for 55m and is 2.5m wide. It runs into and through a substantial area of quarrying, which is sub-circular in plan and in excess of 50m across and 20m

wide (Fig 5; Plate 14). The workings have been cut into the hillside and are now grassed over and subject to soil creep (Plate 15). At least two spoil heaps are located to the immediate north of the extraction site, one 10m in diameter and the other 5m in diameter. The track has been truncated to its north and west by modern clearance and stone dumping. It would appear to have ran eastwards into the former grounds of 'Highfield House' which is shown on the 1850 Ordnance Survey mapping, but this section of the trench no longer survives. This suggests that the stone quarry was used for construction of the house. If the quarry and the track are contemporary, then both pre-date the iron mines, and represent the earliest extraction industry in the immediate vicinity of Site 04.

3.3 TYTUP FARM LIMEKILN AND QUARRIES (SITE 34)

- 3.3.1 Site 34 was identified during the walkover survey as the ruins of a limekiln, two areas of outcrop limestone quarrying, and a potential stretch of track. The kiln and quarrying were located immediately north of Tytup Farm, with the track and second extraction site further north again (Fig 6). Since the walkover survey, the area immediately surrounding the kiln has been subject to ground disturbance, with the ruins being reduced to little more than a pile of stones (Plates 16-17); as a result the remains were not considered suitable for topographic survey.
- 3.3.2 The southern area of quarrying comprised three extraction workings: two located in the same field as the limekiln, and a third in the yard of Tytup Farm. The landowner was unwilling to allow access to either survey or photograph this site, and so the following record was maintained from some distance away. The quarry face appears near-vertical, approximately 4m deep, and some 25m in diameter. It is sub-circular in plan. The site is clearly marked as a limestone quarry on the Ordnance Survey maps, both of 1850 and 1891 (Plate 18). The other two areas comprise stone outcrops that have been exploited, presumably to provide lime for the nearby kilns. The first of these is located immediately north of the quarry in Tytup Farm yard, and comprises a jagged outcrop of stone measuring 20m long by up to 6m wide. The face has a steep north-west aspect and has clearly been exploited for stone extraction (Fig 6; Plate 19). The second comprises a series of west-facing outcrops, which occupy an area aligned north-south and west. Three faces are evident within this working, which has a maximum length of 25m across a 12m slope (Fig 6; Plate 20).
- 3.3.3 Between the two extraction sites there is a stretch of track aligned north/south, which cuts into the slope of the hill. It continues for a distance of 31m and measures a maximum of 3m wide (Fig 6). It is likely that this track and the kilns represent part of the same complex of works. A second possible stretch of track, measuring up to 5m wide and flanked by a low bank varying between 2m and 3m wide, runs north/south for 35m (Fig 6; Plate 21). The feature had been truncated (presumably by modern land improvement) and it was impossible to securely identify it as a continuation of the first track. It did not survive or continue far enough to the north to connect with the adjacent quarry.
- 3.3.4 To the north of this activity (Fig 6) another small quarry site had been damaged by modern vehicle access. The working face survives as an uneven jagged

outcrop, measuring 16m long and 5m wide, with a north-west-facing aspect (Plate 22).

3.4 LINDAL TUNNEL QUARRY (SITE 61)

- 3.4.1 Three distinct earthworks were recorded at this site (Fig 2b). These comprised two linear features (one aligned north/south and the other north-east/south-west), and one further linear feature associated with cairn-type mounds.
- 3.4.2 The most northerly earthwork comprised two low earthen banks of stone rubble and earth (Fig 7). They measure 19m and 10m long respectively, both varying between 1m and 1.8m wide and no higher than 0.3m. The north-east/south-west orientated low bank and ditch was recorded, with the ditch becoming increasingly less pronounced towards its western end (Fig 7; Plate 23). It was traced for 52m, and appeared to vary between 2.6m and 1.5m in width. At its most well defined the ditch was 0.3m in depth. These features are thought to be the earthwork remains of former field boundaries.
- 3.4.3 Modern debris was observed protruding from amongst the stones within the third (most easterly) earthwork, and it is likely that the stones originated in the former field boundary walls. This was confirmed by conversation with a local landowner, which explained that the field in question had been bought many years ago by British Rail. The area was subsequently used to carry out repairs to the Lindal Tunnel, which involved the moving of heavy plant and the installation of large cranes to lower supporting beams over the hillside to the tunnel below.

3.5 SCALE BANK FARM (SITE 41)

- 3.5.1 To the north of Scale Bank Farm (Fig 2a) a mill race is known to have run from the weir at the disused slate quarry (Site 41; Plate 25), traversing the fields towards and past the east side of Scale Bank Farm (Ordnance Survey 1850 and 1891). This continued to the former 'Orgrave Mill Iron Works' located at the site of the house named 'Orgrave Villa' on the current Ordnance Survey mapping. From here the tail race is known to have exited south from the mill and returned to the Paoka Beck, which lies to the immediate north-east of what is today 'Mousel Farm' (formerly 'Mousell Farm' on the Ordnance Survey map of 1850).
- 3.5.2 The remains of this can still be seen as a linear feature running across the hillside. This is visible as a crop mark, although a short stretch survives as two narrow benches cut across the slope (Site 41; Fig 8). The upper bench measured 40m long and 2m wide at its maximum, the lower bench measuring 48m in length and up to a maximum of 2m wide. The former mill race closely follows a field boundary shown on the Ordnance Survey map of 1850. The sluice and the continuation of the race to the south were not discernible.
- 3.5.3 The remains of the mill to the rear of the farm were subject to photographic recording, and comprised the wheel pit, the remains of the flywheel and sluice, the revetment wall for the mill pond (Site 46), and the main dam wall (Plates 26, 27, 28, 29 and 30).

3.6 POAKA BECK SLATE QUARRY (SITE 49)

- 3.6.1 The remains of the former slate quarry at Poaka Beck (Site **49**; Fig 2a) were subject to a photographic record (Plates 31-33). The stone weir, as shown on both the Ordnance Survey map of 1850 and current Ordnance Survey mapping, was also recorded photographically.

3.7 'WALK MILL' EARTHWORK FEATURE (SITE 64)

- 3.7.1 Site **64** is a north-west/south-east aligned linear feature, arising from a sunken elliptical hollow (Fig 9). The hollow measures 13m long by up to a maximum of 5m wide. This would appear to be fluvial in origin, as a palaeochannel is visible occupying the central slope of the field and running into the area of the feature (Fig 9; Plate 34).
- 3.7.2 The Ordnance Survey map of 1850 shows a field boundary formerly occupying this line (Plate 35). The boundary to the north, shown on the Ordnance Survey map of 1850, is still current and also functions as a drainage ditch, transferring water to the Poaka Beck. If the former boundary also functioned as a drainage channel, then it is probable that this feature represents sediment deposition.

4. GAZETTEER OF SITES SUBJECT TO TOPOGRAPHIC SURVEY

Site number	04
Site name	Dalton Iron Mines
NGR	324324 474053
Site type	Iron Mines
Period	Post-medieval
SMR No	-
Sources	Urswick Tithe Map 1839 (CRO(B) BD/BUC); Ordnance Survey 1891; Walkover survey
Description	Mine workings and quarries with associated spoil heaps, and a track connecting them, are shown on the Tithe map of 1839. They are still partially present on the Ordnance Survey map of 1891, where they are described as 'old'. A second stretch of track was noted immediately north of that previously recorded. The track clearly survives running across the slope of the field north-east/south-west. Two earthworks marked on the current map are old mine shafts, and have been added to the record for this site During the topographic survey the full extent of the track was recorded, measuring some 244m in length. Also, six additional extraction scars and probable building foundations were recorded. At its northern end, the track forks away to the east; the forked section rising as it runs eastwards for 38m. The width of the track ranges between 2.5 - 3.5m.
Assessment	Part of the site will be crossed by the proposed development area and will be affected.

Site number	30
Site name	Melton Terrace
NGR	324030 475660
Site type	Quarries
Period	Post-medieval
SMR No	18344
Sources	SMR; Ordnance Survey 1850; Walkover survey
Description	The site of six limestone quarries in close proximity to Tytup Farm. The walkover survey revealed a linear outcrop of limestone faces, with a sub-circular quarry at the northern edge. The area west of the outcrop appeared to have been levelled, and may be the working platform or building platforms associated with the quarry works.
Assessment	The site lies close to the proposed development area and is likely to be affected.

Site number	41
Site name	Scale Bank – Orgrave Mill
NGR	323644 475516
Site type	Millrace
Period	Post-medieval
SMR No	-
Sources	Tytup Estate Plan (CRO(B) BD/BUC/Plan 15 c1780); Ordnance Survey 1850; 1891; Walkover survey
Description	The mill race for Orgrave Mill, which has its origins at Scale Bank, is clearly shown on the Tytup estate plan of c1780. Parts of it are still visible, although not named, as late as 1891. The race can be seen as an earthwork in the field north of Scale Bank Farm close to site 46. It cross cuts the slope of the field but is not perceptible in the adjacent southern field.
Assessment	Part of the site is crossed at this point by the proposed development area and will be affected.

Site number	46
Site name	Scale Bank
NGR	323658 476567
Site type	Milldam
Period	Post-medieval
SMR No	-
Sources	CRO(B) BD/BUC/Plan 7 1847; Ordnance Survey 1891; Walkover survey
Description	A small pond, possibly the mill dam for the Orgrave Mill millrace is shown on a plan of 1847. It is still shown on the Ordnance Survey map of 1891, and has an associated sluice and weir, which appear to be regulating water movement along Poaka Beck. At the barn a wheel-pit survives with both a sluice and water-wheel <i>in situ</i> . A stone retaining wall extends into the field north-east of the barn.
Assessment	The site lies within the proposed development area and will be affected.

Site number	49
Site name	Poaka Beck
NGR	323660 476850
Site type	Quarry
Period	Post-medieval
SMR No	18363
Sources	SMR; Ordnance Survey 1850; 1891; Walkover survey
Description	The site of a slate quarry marked on the Ordnance Survey maps of 1850 and 1891. A linear series of working faces, now wooded and overgrown. A ramp or wagon way leads down from the area of the current gate to a level area in front of the working faces. Low earthfast spoilheaps are still present in the area. There is a stone weir on the beck south of the current gate.
Assessment	The site is crossed by the proposed development area and is likely to be affected.

Site number	59
Site name	Dalton Iron Mines
NGR	324495 474209
Site type	Ridge and furrow
Period	Unknown
SMR No	
Sources	Walkover Survey
Description	A substantial area of ridge and furrow runs east/west to the west of the track remains, and to its east for a shorter distance. Typically, it measures 4.5m to 5m from crown to crown. In places the crowns stand up to 0.3m in height. A second area of ridge and furrow runs north/south with the slope of the field. It is up to 4m wide and rises up to 0.1-0.2 m in height.
Assessment	Part of the site is crossed by the proposed development area and is likely to be affected

Site number	61
Site name	Lindal Tunnel Quarry
NGR	324188 474846
Site type	Clearance cairns / banks
Period	Unknown
SMR No	
Sources	Walkover Survey
Description	An area of clearance cairns and low-lying banks. The cairns range from 1-2m in diameter, and modern debris was seen to be protruding amongst the small stones. Linear banks and ditches run both north/south and east/west. This appears to represent disturbance caused by the use of the area by British Rail to maintain the Lindal Tunnel. The stone debris, which is partially earthfast, has come about as the original stone boundary walls have become increasingly dilapidated. The south and western linear features are what remains of the original boundary walls.

Assessment	Part of the site is crossed by the proposed development area and is likely to be affected
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Site number	64
Site name	Near Marton
NGR	323625 476940
Site type	Earthwork feature
Period	Unknown
SMR No	
Sources	Walkover Survey
Description	The feature is aligned north-west/south-east. It comprises a sunken elliptical hollow 13m in length, and a 23m long curving level area, measuring up to 5m in width. This then curves round and up into the field along the line of the former boundary. Cross reference to the Ordnance Survey map of 1850 showed that a field boundary formerly ran along this exact line. The boundary to the north is shown on the Ordnance Survey map of 1850. It is still current and functions as a drainage ditch carrying water down slope to the Poaka Beck. If the former boundary had also been a watercourse then it would be likely that sediment deposition would have occurred at the confluence with the Poaka Beck. It is suggested that this feature is the result of such depositional action.

Assessment	Part of the site is crossed by the proposed development area and is likely to be affected
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Site number	66
Site name	Dalton Iron Mines
NGR	324295 474099
Site type	Earthwork feature
Period	Unknown
SMR No	
Sources	Topographic survey
Description	Linear extraction scar 54m in length and 21m wide, measuring up to 0.75m in depth. This has been partially in-filled by the construction of the track

Assessment	Part of the site is crossed by the proposed development area and is likely to be affected
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Site number	67
Site name	Dalton Iron Mines
NGR	3243271 474127
Site type	Earthwork feature
Period	Unknown
SMR No	
Sources	Topographic survey
Description	A small sub-circular depression 5m in diameter, which is thought to be a disused shaft or possible sink-hole.

Assessment	Part of the site is crossed by the proposed development area and is likely to be affected
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Site number	68
Site name	Dalton Iron Mines
NGR	324376 474130
Site type	Earthwork feature
Period	Unknown
SMR No	
Sources	Topographic survey
Description	A sub-circular scar cutting into the hillside, which measures 16m-18m in diameter.

Assessment	Part of the site is crossed by the proposed development area and is likely to be affected
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Site number	69
Site name	Dalton Iron Mines
NGR	324391 474200
Site type	Earthwork feature
Period	Unknown
SMR No	
Sources	Topographic survey
Description	A sub-circular scar cutting into the hillside, which measures 16m-18m in diameter.
Assessment	Part of the site is crossed by the proposed development area and is likely to be affected

Site number	70
Site name	Dalton Iron Mines
NGR	324391 474200
Site type	Earthwork feature
Period	Unknown
SMR No	
Sources	Topographic survey
Description	A sub-circular scar cutting into the hillside, which measures 16m-18m in diameter.
Assessment	Part of the site is crossed by the proposed development area and is likely to be affected

Site number	71
Site name	Dalton Iron Mines
NGR	324418 474180
Site type	Earthwork feature
Period	Unknown
SMR No	
Sources	Topographic survey
Description	Curving linear extraction scar measuring 23m in length.
Assessment	Part of the site is crossed by the proposed development area and is likely to be affected

Site number	72
Site name	Dalton Iron Mines
NGR	324448 474236
Site type	Building Foundation /Earthworks
Period	Unknown
SMR No	
Sources	Topographic survey
Description	An area of earthworks 11m by 6m wide, irregular in form. This was initially thought to be a small extraction site or disused shaft. However, the Ordnance Survey map of 1891 shows a small building or enclosure measuring roughly 8m x 9m with a small entrance way at its south-west corner. It is therefore likely that the above earthworks are the earthfast ruins of this structure.
Assessment	Part of the site is crossed by the proposed development area and is likely to be affected

Site number	73
Site name	Dalton Iron Mines
NGR	324324 474053

Site type	Extraction site and trackway
Period	Unknown
SMR No	
Sources	Topographic survey
Description	These earthworks are located to the eastern edge of the iron mine complex. The Ordnance Survey map of 1850 clearly shows a track but does not define any area of workings or quarrying. By the 1891 edition of Ordnance Survey, the track has been extended westwards and converges with other track (Site 04). Today, the surviving track runs north-west/south-east for 55m and is 2.5m wide. The track runs into and through a substantial area of quarrying. The quarry is sub-circular in plan and in excess of 50m x 20m (Fig 5, Plate14). The workings have been cut into the hillside and are now grassed over and subject to soil creep (Plate 15). There are at least two spoil heaps located to the immediate north; one being 10m in diameter and the other 5m.
Assessment	Part of the site is crossed by the proposed development area and is likely to be affected

5. WATCHING BRIEF

5.1 INTRODUCTION

- 5.1.1 A permanent presence watching brief was maintained during topsoil stripping activities, within the fields along the pipeline route; the entire length of which totalled 4.65km (Figs 2a and 2b). A series of eight geotechnical test pits (numbered 1-8) were also excavated by machine under archaeological supervision. This work was carried out during May and October 2006.

5.2 RESULTS

- 5.2.1 **Field 1:** situated to the south-west of Highfield Service Reservoir, the easement was stripped to a width of 10m, widening in places to 20m. The orangey-brown sandy-clay topsoil, **100**, was between 0.1m and 0.2m in depth. Beneath this reddish-brown, slightly sandy-clay subsoil, **101**, was revealed. No archaeological features or deposits were identified.
- 5.2.2 **Field 2:** situated to the south of Field 1, the easement ran through the middle of the field following a north/south course at a maximum width of 12m. The mid-brown sandy-clay topsoil, **200**, measured between 0.2m and 0.3m in depth. Beneath the topsoil an orangey-brown, slightly sandy-clay subsoil, **201**, was identified. No archaeological features or deposits were identified.
- 5.2.3 **Field 3:** the easement ran southwards from the northern field boundary to a maximum width of 10m. The mid-brown, slightly sandy-clay topsoil, **300**, measured between 0.05m and 0.2m in depth. This was removed to reveal a yellowish-brown sandy-clay subsoil, **301**. The depression for a natural gully, measuring approximately 5m wide and 2m deep, was observed running east/west through the easement. No archaeological features or deposits were identified.
- 5.2.4 **Field 4:** situated to the south of Field 3, the easement was aligned north/south and stripped to a maximum 12m in width. The mid-brown, slightly sandy-clay topsoil, **400**, measured between 0.1m and 0.2m in depth. Beneath this a yellowish-brown sandy-clay subsoil, **401**, was revealed. The easement passed 30m to the west of Site **64**. No archaeological features or deposits were identified.
- 5.2.5 **Field 5:** to the south of Field 4, the easement was aligned north/south and stripped to a maximum 12m in width. The topsoil comprised a mid-brown sandy-clay, **500**, measuring between 0.1m and 0.2m in depth. Removal of this deposit revealed a yellowish-brown stony-sandy-clay subsoil, **501**. No archaeological features or deposits were identified.
- 5.2.6 **Field 6:** to the south of Field 5, the easement was aligned north/south through the centre of the field, to a maximum 12m in width. The pipeline crossed the Poaka Beck at the northern end of the sluice at Scale Bank Farm. The topsoil comprised mid-brown sandy-clay, **600**, which measured between 0.1m and 0.15m in depth.

- This was removed to reveal a yellowish-brown stony-sandy-clay subsoil, **601**. No archaeological features or deposits were identified.
- 5.2.7 **Field 7:** situated to the east of Field 6, the 9m wide easement was aligned east/west for a distance of 30m from Polka Beck, before turning south towards the farm track to Scale Bank Farm. The topsoil comprised a mid-brown sandy-clay, **700**, which measured between 0.05m and 0.1m in depth. This was removed to reveal a very stony yellowish-brown sandy-clay subsoil, **701**. No archaeological features or deposits were identified.
- 5.2.8 **Field 8:** this field was situated to the south of Field 7, on the opposite side of the farm track to Scale Bank Farm. The 9m wide easement was aligned north/south through the centre of the field. The topsoil comprised a mid-brown, friable sandy-clay, **800**, measuring between 0.05m and 0.10m in depth. This was removed to reveal a very stony yellowish-brown sandy-clay subsoil, **801**. A band of reddish-brown, slightly sandy-clay subsoil, **802**, was observed on an east/west alignment, in the base of a depression visible in the centre of the field. This measured approximately 10m in width. An ovoid-shaped pit, **804**, was revealed to the immediate north of **802**. This feature was measured 3m x 1.9m x 0.1m in depth, and had a flat base. It cut through the subsoil (**801**) into the natural, **803**. The natural comprised compact yellowish-grey clay. The fill, **805**, of pit **804** comprised a reddish-brown sandy-clay with inclusions of black, friable sandy-silt and small-to-medium sub-angular sandstone.
- 5.2.9 **Field 9:** situated to the south of Field 8, on the west side of Tarn Flatt Road, the easement measured 10m in width. It sloped steeply upwards to the southern end of the field before dropping down again towards the eastern boundary. The topsoil comprised a mid-brown friable sandy-clay, **900**. This was removed to reveal a dark-reddish-brown firm, slightly sandy-clay subsoil, **901**. The subsoil contained inclusions of small-to-medium sub-angular stone, which became more concentrated as the ground rose. At the apex of the slope outcrops of large angular rock were exposed. The easement terminated at the eastern boundary as the pipeline began to follow Tarn Flatt Road in a southerly direction. No features of archaeological interest were revealed.
- 5.2.10 **Field 10:** this field is flanked by the Dalton bypass to the south side and Tarn Flatt Road to the east. The topsoil, **1000**, comprised a 0.3m in depth of friable reddish-brown sandy-clay containing <5-10% sub-angular stone inclusions. The subsoil, **1001**, comprised firm reddish-brown slightly sandy-clay, with occasional large angular boulder inclusions. No features of archaeological interest were revealed.
- 5.2.11 **Field 11:** this field was situated south of the Dalton bypass. The easement measured 20m in width and followed a course alongside the west boundary. The topsoil, **1100**, comprised 0.1m of reddish-brown friable sandy-clay with occasional inclusions of small sub-angular stones. The subsoil, **1101**, comprised firm reddish-brown, slightly sandy-clay, containing <20% inclusions of small and medium sub-angular and sub-rounded stones.
- 5.2.12 **Field 12:** the easement measured 12m in width and followed a north/south alignment alongside the western boundary, and across the brow of the hill. The

topsoil, **1200**, comprised 0.2m in depth of friable reddish-brown clay. Beneath the topsoil, the subsoil comprised firm reddish-brown, slightly sandy-clay containing <30% inclusions of small- to medium sub-angular and sub-rounded stones. A deposit of loose broken limestone fragments, **1202**, was observed aligned east/west across the easement, parallel to the north side of the earthen bank comprising Site **63** (Plate 36). This feature was located approximately 90m south of the northern field boundary, and measured 3m wide. The stone fragments were laid to a depth of 0.3m, the individual stones measuring up to 0.4m long.

- 5.2.13 **Field 13:** the easement continued at 12m wide, extending southwards from the northern field boundary to the west boundary, and onto the south-west corner of the field. Topsoil, **1300**, comprised 0.3m of friable reddish-brown sandy-clay. The subsoil, **1301**, comprised reddish-brown sandy-clay. No features of archaeological interest were revealed.
- 5.2.14 **Field 14:** the easement in this field increased to a maximum width of 13m, and continued south from the northern boundary, sloping downwards to terminate at Urswick Road. The topsoil, **1400**, comprised 0.3m in depth of friable reddish-brown sandy-clay. The subsoil, **1401**, comprised a reddish-brown sandy-clay. No features of archaeological interest were revealed.
- 5.2.15 **Field 15:** the easement, which recommenced on the south side of Urswick Road, followed the western field boundary. It was stripped to a maximum width of 13m, narrowing to 8m towards the south. The topsoil, **1500**, comprised 0.3m of friable reddish-brown sandy-clay. The subsoil, **1501**, comprised reddish-brown sandy-clay with occasional medium sub-angular stone inclusions. No archaeological features were revealed.
- 5.2.16 **Field 16:** the easement continued in a southerly direction up hill to the old field boundary. It was stripped to a maximum width of 8m and a maximum depth of 0.2m. The topsoil, **1600**, comprised 0.3m in depth of friable reddish-brown sandy-clay. The subsoil, **1601**, comprised reddish-brown sandy-clay with occasional medium sub-angular stone inclusions. No archaeological features or deposits were identified.
- 5.2.17 **Field 17:** the easement continued southwards towards the crest of the hill for a distance of 60m before turning sharply to the west. At this point it curved around the hill towards the south before terminating to the west of the reservoir. The easement was stripped to a maximum width of 8m. The topsoil, **1700**, comprised 0.2m in depth of friable reddish-brown sandy-clay. The subsoil, **1701**, comprised reddish-brown sandy-clay. No archaeological features were revealed.
- 5.2.18 **Geotechnical Test Pits 1-8:** these interventions were located along the pipeline corridor (Figs 2a and 2b) to establish the character of the natural geology. Natural deposits were observed at depths below the existing ground surface varying between 0.2m and 0.7m. Topsoil and subsoil layers were observed above the natural geology, although no archaeological features or deposits were identified.

6. DISCUSSION

6.1 SYNTHESIS

- 6.1.1 The topographic survey has achieved the preservation by record of a relict landscape comprising post-medieval agricultural and industrial activity along the length of the proposed pipeline easement.
- 6.1.2 The iron works in the area form an extensive and nationally important group of monuments, some of which undoubtedly have very early origins and are some of the earliest recorded in Furness (OA North 2005). While those sites relating to the iron industry that were subject to the topographic survey (Sites **04** and the additional Sites **66** to **72**) in general relate to later industrial activity, they still form part of this important landscape. A number of the other industries (Sites **30** and **40**) were probably also connected to the iron works, providing building materials and lime for flux. The sites relating to mills (Sites **41** and **46**) are examples of activity in the area apart from iron mining, and may have medieval origins. The unknown earthwork (Site **64**) has proven to be of modern origins.
- 6.1.3 The watching brief programme revealed very few archaeological features. A shallow sub-circular feature, **804**, was recorded in Field 8 during the watching brief. This field is known from documentary sources to have been a limestone quarry (Site **30**, OA North 2005), and so this feature probably represents limited extraction activity associated with this industry.
- 6.1.4 The limestone deposit, **1202**, identified in Field 12, is probably contemporary with the earthworks comprising Site **61** (Section 3.4). It follows the line of the top of the railway tunnel, and probably represents a modern trackway to facilitate machine access for railway tunnel maintenance.

6.2 IMPACT AND RECOMMENDATIONS

- 6.2.1 Although the topographic survey resulted in new sites being added to the record none of these are thought to warrant further investigation. The watching brief programme recorded no additional significant archaeological features during the topsoil strip or the excavation of the geotechnical pits. As such, no further work is recommended.

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Plate 36: Limestone trackway, **1202**, facing north

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APPENDIX 1: PROJECT DESIGN

HIGHFIELD SERVICE RESERVOIR TO POAKA BECK WwTW PIPELINE, CUMBRIA

**Topographic Survey,
Evaluation and Watching
Brief Project Design**



Oxford Archaeology North

April 2006

United Utilities

OA North Job No: L9560

NGR: SD 24347 73926

1 INTRODUCTION

- 1.1 This project design has been compiled for United Utilities (hereafter the client). It presents proposals for archaeological mitigation works along the route of a proposed new pipeline from Highfield to Poakabeck, in Cumbria (NGR SD 24347 73926). Section 2 of this document states the objectives of the project, Section 3 deals with OA North's methodology. Section 4 addresses other pertinent issues including details of staff to be involved, and project costs are presented in Section 5.
- 1.2 Following the results of a desk-based assessment and walkover survey (OA North 2005) the Assistant Archaeologist at Cumbria County Council Historic Environment Service (CCCHES) has recommended that a programme of topographic survey, evaluation trial trenching and watching brief, is undertaken for a number of specific sites along the pipeline.
- 1.3 OA North has the professional expertise and resources to undertake the project detailed below to a high level of quality and efficiency. OA North is an **Institute of Field Archaeologists (IFA) registered organisation, registration number 17**, and all its members of staff operate subject to the IFA Code of Conduct.

2 OBJECTIVES

- 2.1 The following programme has been designed for the purposes of recording the form and extent of known above-ground archaeological remains and to investigate the potential for below ground remains. The required stages to achieve these ends are as follows (numbers in bold refer to the OA North 2004 report):
- 2.2 **Topographic Survey:** to record the topographic detail of Site **04** (mine shafts and trackway, Site **34** (limekilns, quarries and trackways), Site **41** (millrace), Site **59** (ridge and furrow), Site **61** (clearance kilns) and Site **64** (earthworks). In addition, Site **46** (milldam) and Site **49** (quarry) will be subject to a photographic survey.
- 2.3 **Evaluation:** to undertake evaluation trial trenching of Site **64**, earthworks of unknown date, to determine the quality, extent and importance of any archaeological remains on the site. No evaluation trenching will take place outside of the area of the pipeline easement.
- 2.4 **Permanent Presence Watching Brief:** this will be maintained during all topsoil stripping activities along the route of the pipeline except where it runs within highways or along the line of existing pipelines.
- 2.5 **Report and Archive:** production of a report following the collation of data during Section 2.2 to 2.4. A site archive will be produced to English Heritage guidelines (MAP 2) and in accordance with the *Guidelines for the Preparation of Excavation Archives for Long Term Storage* (UKIC 1990).

3 METHOD STATEMENT

3.1 TOPOGRAPHIC SURVEY

- 3.1.1 The sites (see Section 2.2 above) will be located using Global Positioning System (GPS) techniques, which uses electronic distance measurements along radio

frequencies to satellites to enable a fix in Latitude and Longitude, which can be converted mathematically to Ordnance Survey National Grid. As long as differential GPS techniques are employed then it is possible to achieve accuracies of better than +/- 1m.

- 3.1.2 The data from the GPS will be downloaded into a CAD package (AutoCAD Release 14) for the production of topographic plans. Measured sketches and a photographic record (35mm colour slide and monochrome contact sheets) will enhance the data collected. Scales will be used in all photographs and an index of photographs will be compiled.
- 3.1.3 The plans produced will show outline detail and hachures only. The final drawings will be produced at a relevant scale (1:1000 to 1:2500). It is envisaged that where possible, the plans will be dropped onto Ordnance Survey maps.
- 3.1.4 A brief written record will note the nature, extent, and condition of the features. This will utilise, and where appropriate, enhance the walkover gazetteer produced in the OA North 2005 report.
- 3.1.5 If finds are noticed they should be recorded and left in position, unless this would endanger their survival or later retrieval, or unless a more detailed examination is required of individual pieces. If finds are recovered they will be recorded and treated according to best professional practice.

3.2 ARCHAEOLOGICAL EVALUATION

- 3.2.1 Sites **64** will be subject to evaluation trial trenching within the confines of the easement. The evaluation trenches will measure a maximum of 100m x 1.6m or the equivalent. The uppermost modern surface will be removed by machine (fitted with a toothless ditching bucket) under archaeological supervision to the surface of the first significant archaeological deposit. Thereafter, the trenches (stripped area) will be cleaned by hand, using either hoes, shovel scraping, and/or trowels depending on the subsoil conditions.
- 3.2.2 Any investigation of intact archaeological deposits will be exclusively manual. Selected pits and postholes will normally only be half-sectioned, linear features will be subject to no more than a 10% sample, and extensive layers will, where possible, be sampled by partial rather than complete removal. It is hoped that in terms of the vertical stratigraphy, maximum information retrieval will be achieved through the examination of sections of cut features. All excavation, whether by machine or by hand, will be undertaken with a view to avoiding damage to any archaeological features, which appear worthy of preservation *in situ*.
- 3.2.3 All information identified in the course of the site works will be recorded stratigraphically, using a system, adapted from that used by Centre for Archaeology of English Heritage, with sufficient pictorial record (plans, sections and both black and white and colour photographs) to identify and illustrate individual features. Primary records will be available for inspection at all times.
- 3.2.4 Results of all field investigations will be recorded on *pro forma* context sheets. The site archive will include both a photographic record and accurate large-scale plans and sections at an appropriate scale (1:50, 1:20 and 1:10). All artefacts and

ecofacts will be recorded using the same system, and will be handled and stored according to standard practice (following current Institute of Field Archaeologists guidelines) in order to minimise deterioration.

- 3.2.5 The deposition and disposal of any artefacts recovered in the evaluation will be agreed with the legal owner prior to the work taking place. Except for items subject to the Treasure Act, all artefacts found during the course of the project will be donated to an appropriate receiving museum.
- 3.2.6 Environmental samples (bulk samples of 30 litres volume, to be sub-sampled at a later stage) will be collected from suitable deposits (i.e. the deposits are reasonably well dated and are from contexts the derivation of which can be understood with a degree of confidence). Where such deposits are encountered, an appropriate sampling strategy will be agreed with the CCCHEs and will be subject to a variation to the project costs.
- 3.2.7 Samples will also be collected for technological, pedological and chronological analysis as appropriate. If necessary, access to conservation advice and facilities can be made available. OA North maintains close relationships with Ancient Monuments Laboratory staff at the Universities of Durham and York and, in addition, employs artefact and palaeoecology specialists with considerable expertise in the investigation, excavation and finds management of sites of all periods and types, who are readily available for consultation.
- 3.2.8 **Health and Safety:** OA North provides a Health and Safety Statement for all projects and maintains a Unit Safety policy. All site procedures are in accordance with the guidance set out in the Health and Safety Manual compiled by the Standing Conference of Archaeological Unit Managers (1997). A written risk assessment will be undertaken in advance of project commencement and copies will be made available on request to all interested parties.
- 3.2.9 The client is requested to provide information relating to services in the vicinity of the trenches, though OA North will undertake a CAT scan in advance of site commencement.
- 3.2.10 If necessary the trenches will be excavated to a maximum depth of 1.2m. Following completion of the evaluation, the trench will be backfilled with the material removed in its excavation. Any other form of land reinstatement will be the responsibility of the client.

3.3 WATCHING BRIEF

- 3.3.1 A programme of field observation will accurately record the location, extent, and character of any surviving archaeological features and/or deposits observed during all topsoil stripping activities associated with the pipeline construction. A systematic examination of any subsoil horizons exposed during the course of the groundworks, and the accurate recording of all archaeological features and horizons, and any artefacts, identified during observation.

- 3.3.2 During this phase of work, recording will comprise a full description and preliminary classification of features or materials revealed, and their accurate location (either on plan and/or section, and as grid co-ordinates where appropriate). Features will be planned accurately at appropriate scales and annotated on to a large-scale plan provided by the Client. A photographic record will be undertaken simultaneously.
- 3.3.3 A plan will be produced of the areas of groundworks showing the location and extent of the ground disturbance and one or more dimensioned sections will be produced.
- 3.3.4 Putative archaeological features and/or deposits identified by the machining process, together with the immediate vicinity of any such features, will be cleaned by hand, using either hoes, shovel scraping, and/or trowels depending on the subsoil conditions, and where appropriate sections will be studied and drawn. Any such features will be sample excavated (ie selected pits and postholes will normally only be half-sectioned, linear features will be subject to no more than a 10% sample, and extensive layers will, where possible, be sampled by partial rather than complete removal).
- 3.3.5 It is assumed that OA North will have the authority to stop the works for a sufficient time period to enable the recording of important deposits. It may also be necessary to call in additional archaeological support if a find of particular importance is identified or a high density of archaeology is discovered, but this would only be called into effect in agreement with the CCCHEs and will require a variation to costing. Also, should evidence of burials be identified, the 1857 Burial Act would apply and a Department of Constitutional Affairs Licence would be sought. This would involve all work ceasing until the proper authorities were happy for burials to be removed. In normal circumstances, field recording will also include a continual process of analysis, evaluation, and interpretation of the data, in order to establish the necessity for any further more detailed recording that may prove essential.
- 3.3.6 OA North has professional indemnity to a value of £2,000,000, employer's liability cover to a value of £10,000,000 and public liability to a value of £10,000,000. Written details of insurance cover can be provided if required.
- 3.3.7 Normal OA North working hours are between 9.00 am and 5.00 pm, Monday to Friday, though adjustments to hours may be made to maximise daylight working time in winter and to meet travel requirements. It is not normal practice for OA North staff to be asked to work weekends or bank holidays and should the client require such time to be worked during the course of a project a contract variation to cover additional costs will be necessary.

3.4 REPORT/ ARCHIVE

3.4.1 **Report:** the report will include the following:

- (i) a non-technical summary outlining the results of the survey;
- (ii) an introduction presenting the background and circumstances of the project;

- (iii) a method statement including sources of information consulted;
 - (iv) the results of the topographic survey, evaluation and watching brief;
 - (v) a gazetteer of topographic sites including a brief description and assessment;
 - (vi) a discussion of the impact of the proposed development and any relevant recommendations;
 - (vii) a bibliography of sources sources;
 - (viii) a copy of this project design;
 - (ix) illustrations including copies of relevant historic maps, photographs and plans.
- 3.4.2 Two copies of the final report will be submitted to the client and a further copy to the CCCHES Assistant Archaeologist. Additional copies will be sent to the Cumbria HER. Both paper and digital copies will be provided on CD-ROM in pdf format. Provision will be made for a summary report to be submitted to a suitable regional or national archaeological journal within one year of completion of fieldwork, if relevant results are obtained.
- 3.4.3 **Confidentiality:** all internal reports to the Client are designed as documents for the specific use of the Client, for the particular purpose as defined in the project brief and project design, and should be treated as such. They are not suitable for publication as academic documents or otherwise without amendment or revision.
- 3.4.4 **Archive:** the results of all archaeological work carried out will form the basis for a full archive to professional standards, in accordance with current English Heritage guidelines (*Management of Archaeological Projects*, 2nd edition, 1991). The project archive represents the collation and indexing of all the data and material gathered during the course of the project. This archive will be provided in the English Heritage Centre for Archaeology format and a synthesis will be submitted to the Cumbria HER (the index to the archive and a copy of the report). Arrangements for deposition of the full site archive will be made with the CCCHES.

4 OTHER MATTERS

- 4.1 **Project Monitoring:** whilst the work is undertaken for the Client, the CCCHES Assistant Archaeologist will be kept fully informed of the work. Any proposed changes to the project design will be agreed with the Archaeological Officer and the Client.
- 4.1.1 **Access:** OA North will consult with the Client regarding access to the site.
- 4.1.2 **Health and Safety:** OA North provides a Health and Safety Statement for all projects and maintains a Unit Safety policy. All site procedures are in accordance with the guidance set out in the Health and Safety Manual compiled by the Standing Conference of Archaeological Unit Managers (1997). A written risk assessment will be undertaken in advance of project commencement and copies will be made available on request to all interested parties.
- 4.1.3 **Work Timetable:** the topographic survey is expected to take ten days in the field and the evaluation is expected to take approximately three days to complete. The

duration of the watching brief will be dependent upon the progress of the contractor. The report will be completed within approximately eight weeks following completion of the fieldwork.

- 4.1.4 **Staffing:** the project will be under the direct management of **Alison Plummer BSc (Hons)** (OA North Senior Project Manager) to whom all correspondence should be addressed.
- 4.1.5 Present timetabling constraints preclude who will be undertaking the fieldwork, although it is likely that this will be undertaken by OA North supervisors suitably experienced in this field.
- 4.1.6 **Insurance:** OA North has professional indemnity to a value of £2,000,000, employer's liability cover to a value of £10,000,000 and public liability to a value of £15,000,000. Written details of insurance cover can be provided if required.

5. COSTING

The first two items below are a fixed price cost, inclusive of all management, overheads, and other disbursement costs (travel and expenses), to undertake the programme of work as defined in this project design; the third and fourth items are fixed price rates. Any other variations from this programme of work at the clients' direction will require recosting. All staff costs are inclusive of holiday entitlement, as well as NI and Superannuation.

Evaluation of Site 64	£ 2892.00
Topographic survey	£ 5465.41
Watching Brief per day	£ 185.00
Watching Brief per week	£ 899.00

Normal OA North working hours are between 9.00am and 5.00pm, Monday to Friday, though adjustments hours maybe made to maximise daylight working time in winter and to meet travel requirements. It is not normal practice for OA North staff to be asked to work weekends or bank holidays and should the client require such time to be worked during the course of a project a contract variation to cover additional costs will be necessary.

Contingencies

Assessment and processing of palaeoenvironmental samples (Approximately 8 samples in 3 days)	£ 150.00/day
Faunal Assessment	£ 140.00/day

The requirement for further analysis of samples would be costed as a variation in accordance with procedures discussed with Planning Archaeologist and the client.

NB. Following IFA policy a contingency sum equivalent to 10% of the total sum should be set aside to cover delays due to bad weather, and the discovery of particularly dense and difficult archaeology. It should be noted that the contingency figure would only be used following prior agreement with the client and the monitoring body.

Commercial in Confidence

Salaries and wages inclusive of NI, Superannuation and overheads.

All costs are exclusive of VAT, which will be charged at the standard rate.

All costs at 2006/2007 prices.

Oxford Archaeology is the trading name of Oxford Archaeological Unit Ltd.

Oxford Archaeological Unit Ltd is a registered charity.

APPENDIX 2: SUMMARY CONTEXT LIST

Context	Deposit	Description
100	Topsoil	Orangy brown friable sandy-clay, occasional small to medium sub-rounded stone
101	Subsoil	Reddish brown clay, 10% inclusions of small sub-rounded and sub-angular stones. Occasional large stone, up to 0.5m
200	Topsoil	Mid-brown friable sandy-clay, occasional small to medium sub-rounded stones.
201	Subsoil	Orangy brown firm slightly sandy-clay, occasional small to medium sub-rounded clay.
300	Topsoil	Mid-brown firm slightly sandy-clay, occasional small sub-rounded stone.
301	Subsoil	Yellow brown sandy-clay with 20% inclusions of small sub-rounded and sub-angular stones and areas of grey clay
400	Topsoil	Mid-brown firm slightly sandy-clay, occasional small sub-rounded stone.
401	Subsoil	Yellow brown sandy clay with 20% inclusions of small sub-rounded and sub-angular stones and areas of grey clay
500	Topsoil	Mid-brown firm slightly sandy-clay, occasional small sub-rounded stone.
501	Subsoil	Yellowish brown, firm sandy clay, moderately stony, 20 % inclusions of small sub-angular and sub-rounded stones.
600	Topsoil	Mid-brown firm slightly sandy clay, occasional small sub-rounded stone.
601	Subsoil	Yellowish brown, firm sandy-clay, moderately stony, 20 % inclusions of small sub-angular and sub-rounded stones.
700	Topsoil	Mid-brown friable sandy-clay,
701	Subsoil	Yellowish brown, firm sandy-clay, moderately stony, 20 % inclusions of small sub-angular and sub-rounded stones. Occasional medium to large sub-rounded stones
800	Topsoil	Mid-brown friable sandy-clay,
801	Subsoil	Yellowish brown, firm sandy-clay, moderately stony, 20 % inclusions of small sub-angular and sub-rounded stones. Occasional medium to large sub-rounded stones
802	Subsoil	Reddish brown firm slightly sandy-clay, occasional small to medium stones
803	Natural	Compact yellowish gray clay
804	Pit	Cut of possible pit
805	Fill	Compacted brown sandy-clay and black friable sandy silt with inclusions of

		small to medium sub-angular sandstone.
900	Topsoil	Mid-brown friable sandy-clay with patches of soft light grey clay showing in section
901	Subsoil	Reddish brown firm sandy-clay, stony patches, 10% inclusions of medium to large angular boulders and rocky outcrops.
1000	Topsoil	Reddish Brown friable sandy-clay, 5-10% inclusions of small to medium subangular stones
1001	Subsoil	Reddish brown firm sandy-clay, occasional large limestone subangular boulders
1100	Topsoil	Reddish Brown friable sandy-clay, occasional inclusions of small subangular stones
1101	Subsoil	Firm reddish brown, slightly sandy-clay, 30% inclusions of small and medium subangular and subrounded stones.
1200	Topsoil	Reddish Brown friable sandy-clay, 5-10% inclusions of small to medium subangular stones
1201	Subsoil	Firm reddish brown, slightly sandy-clay, 30% inclusions of small and medium subangular and subrounded stones. Very stony patches almost gravelly in appearance
1202	Structure	Loose medium to large angular stone, 0.1 - 0.4m in size
1300	Topsoil	Reddish Brown friable sandy-clay, 5-10% inclusions of small to medium subangular stones
1301	Subsoil	Firm reddish brown, slightly sandy-clay, 30% inclusions of small and medium subangular and subrounded stones. Very stony patches almost gravelly in appearance
1400	Topsoil	Reddish Brown friable sandy-clay, 5% inclusions of small to medium subangular stones
1401	Subsoil	Firm reddish brown, slightly sandy-clay, 30% inclusions of small and medium subangular and subrounded stones. Very stony patches almost gravelly in appearance
1500	Topsoil	Reddish Brown friable sandy clay, occasional inclusions of small to medium subangular stones
1501	Subsoil	Firm reddish brown, slightly sandy-clay, 30% inclusions of small and medium subangular and subrounded stones. Very stony patches almost gravelly in appearance
1600	Topsoil	Reddish Brown friable sandy-clay, occasional inclusions of small to medium subangular stones
1601	Subsoil	Firm reddish brown, slightly sandy-clay, 30% inclusions of small and medium subangular and subrounded stones. Very stony patches almost gravelly in appearance

1700	Topsoil	Reddish brown friable sandy-clay, occasional inclusions of small to medium subangular stones
1701	Subsoil	Firm reddish brown, slightly sandy-clay, 30% inclusions of small and medium subangular and subrounded stones. Very stony patches almost gravelly in appearance

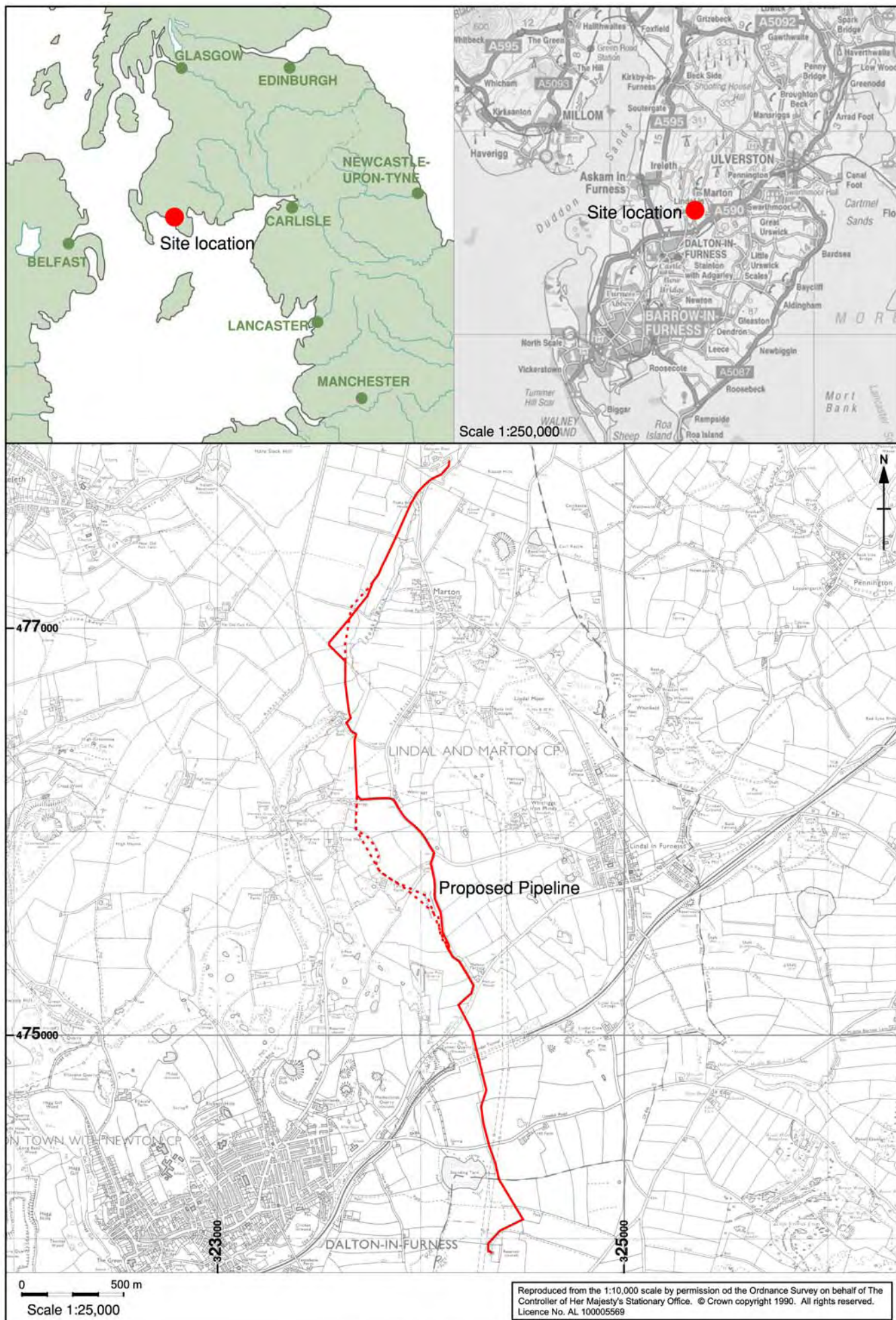


Figure 1: Site Location

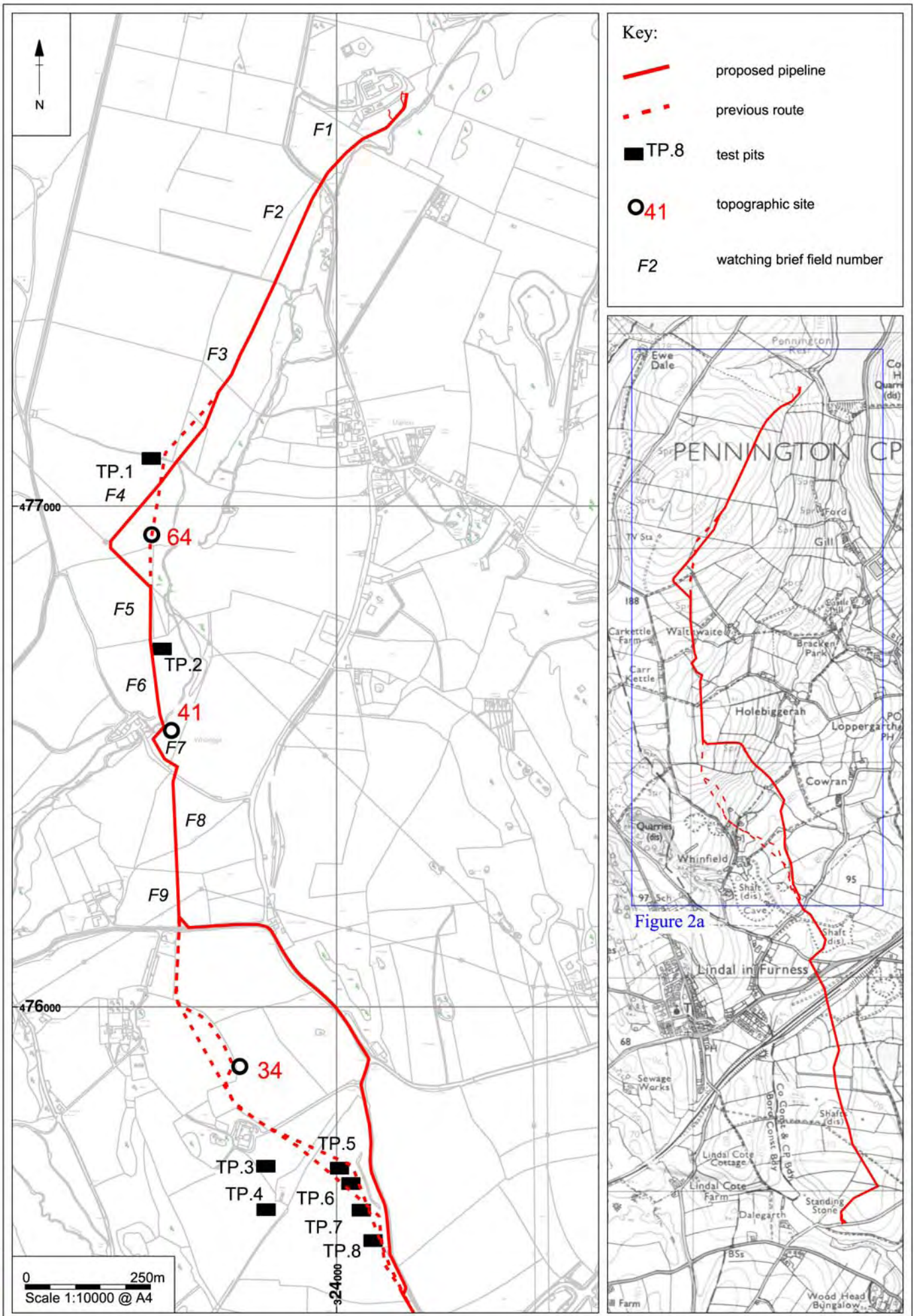


Figure 2a: Location of topographic survey sites, with fields and test pits associated with the watching brief: northern section

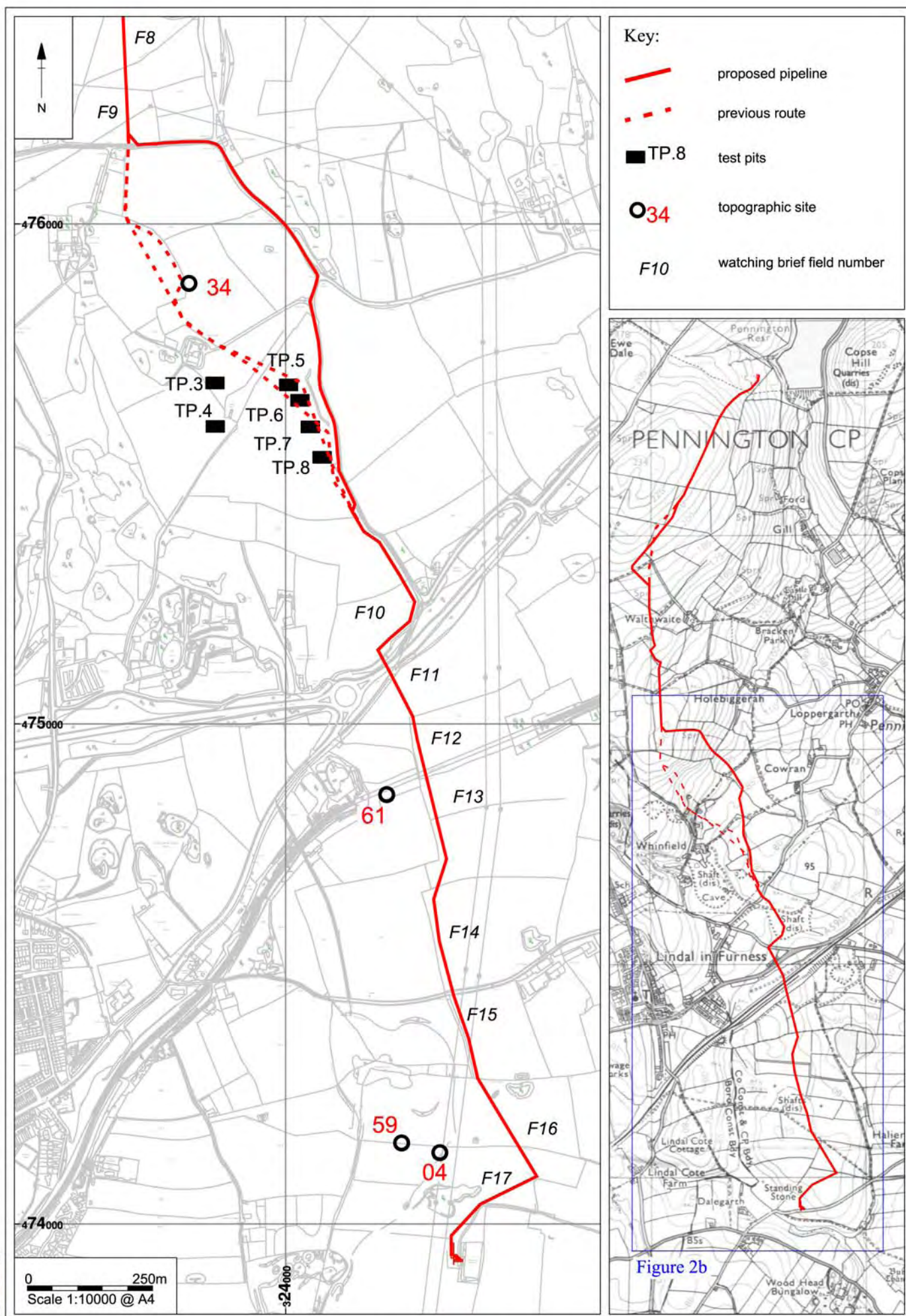


Figure 2b: Location of topographic survey sites, with fields and test pits associated with the watching brief: southern section

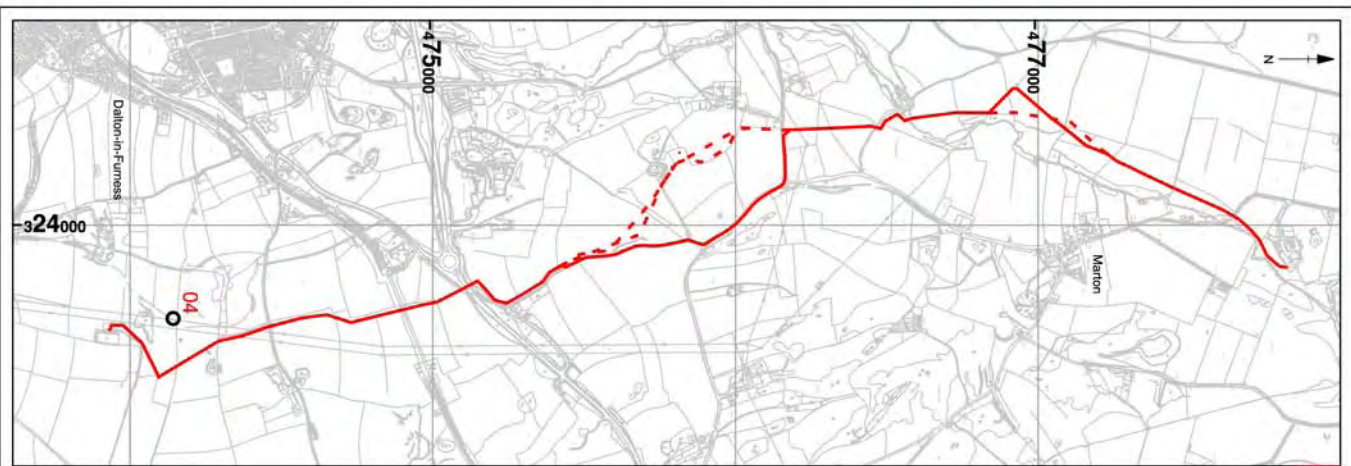
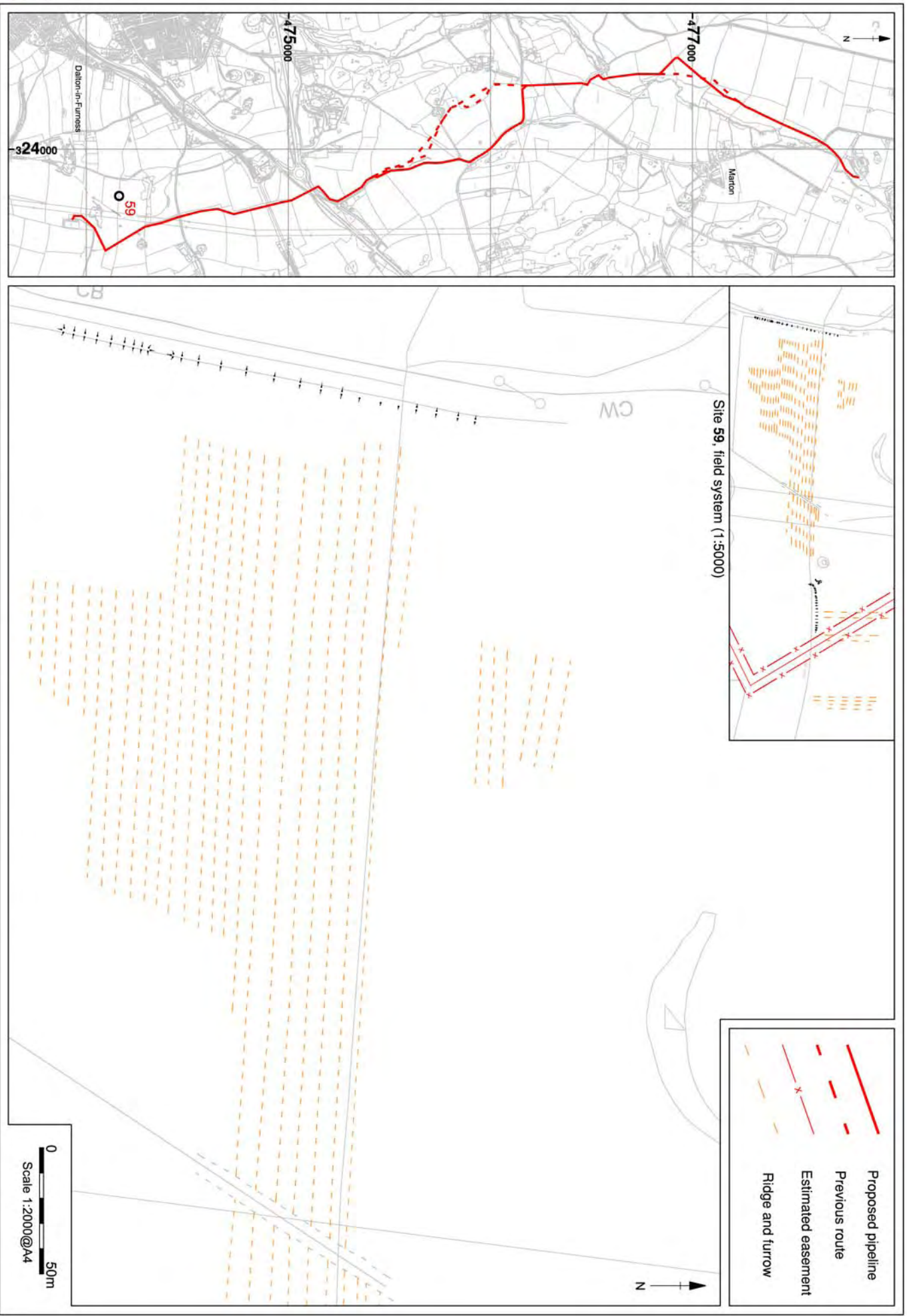


Figure 03: Topographic detail of sites associated with Dalton Iron Mines



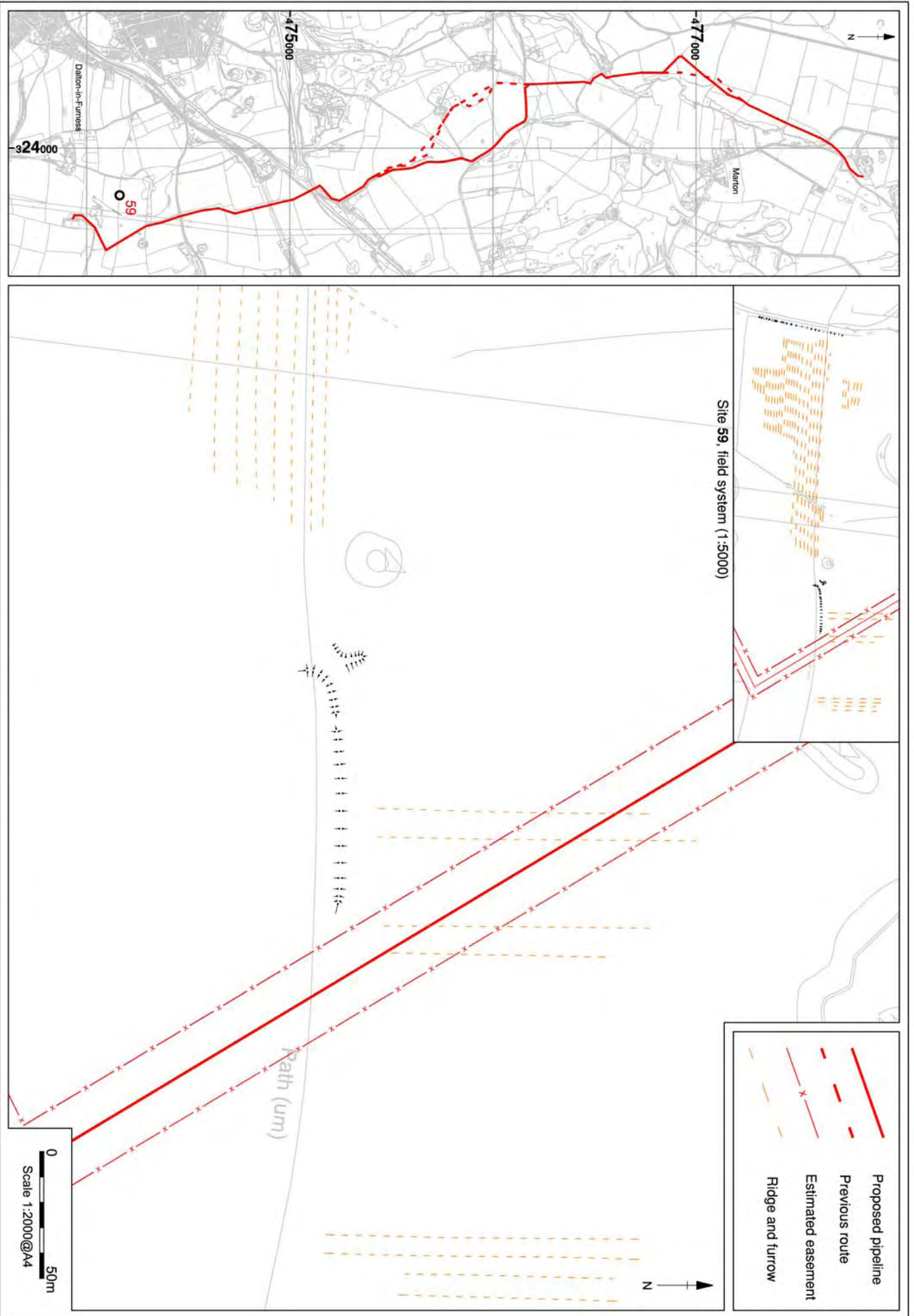


Figure 4b: Topographic detail of Site 59 (east), field system

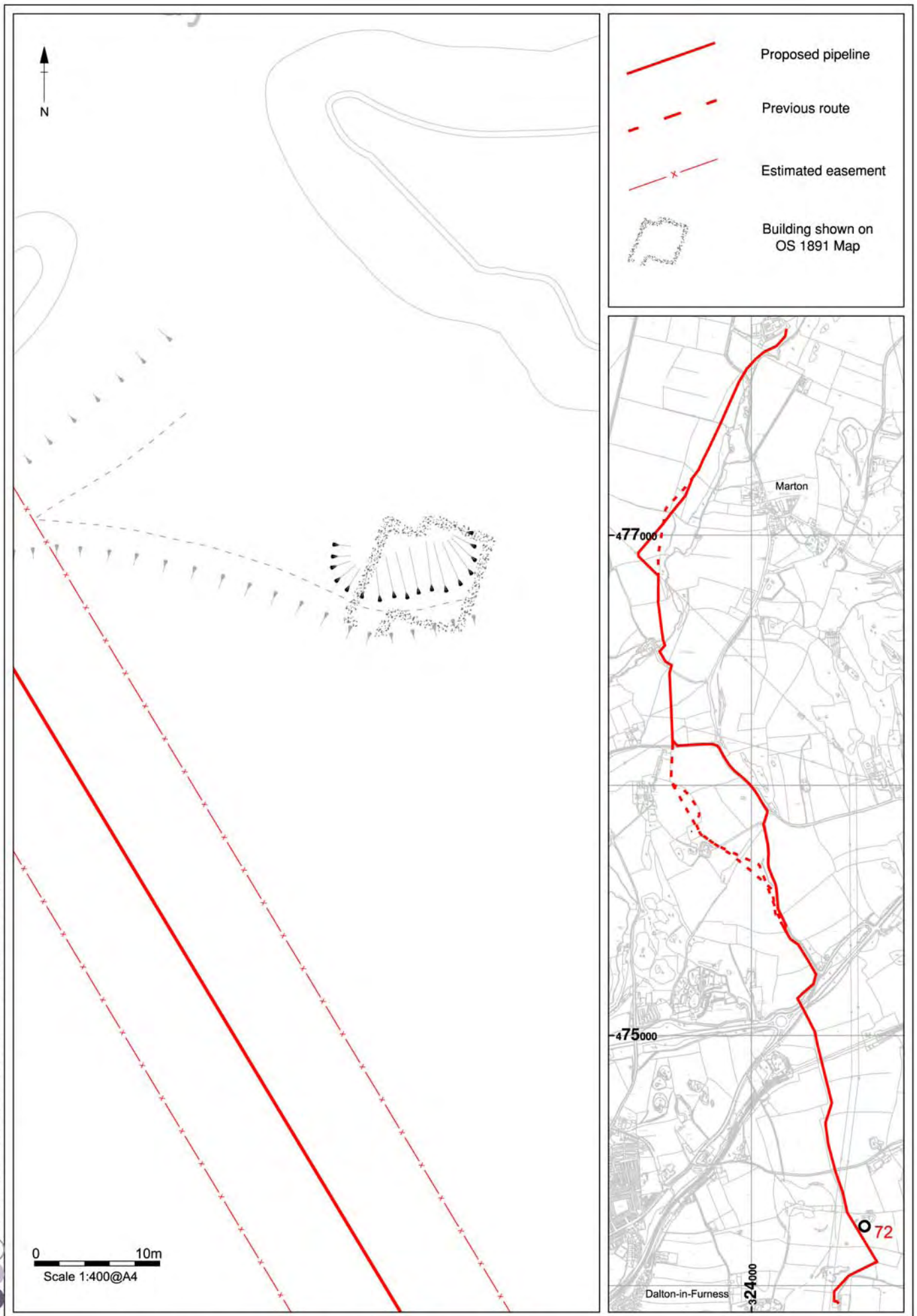


Figure 5:Topographic detail of Site **72**, earthworks / building foundation remains

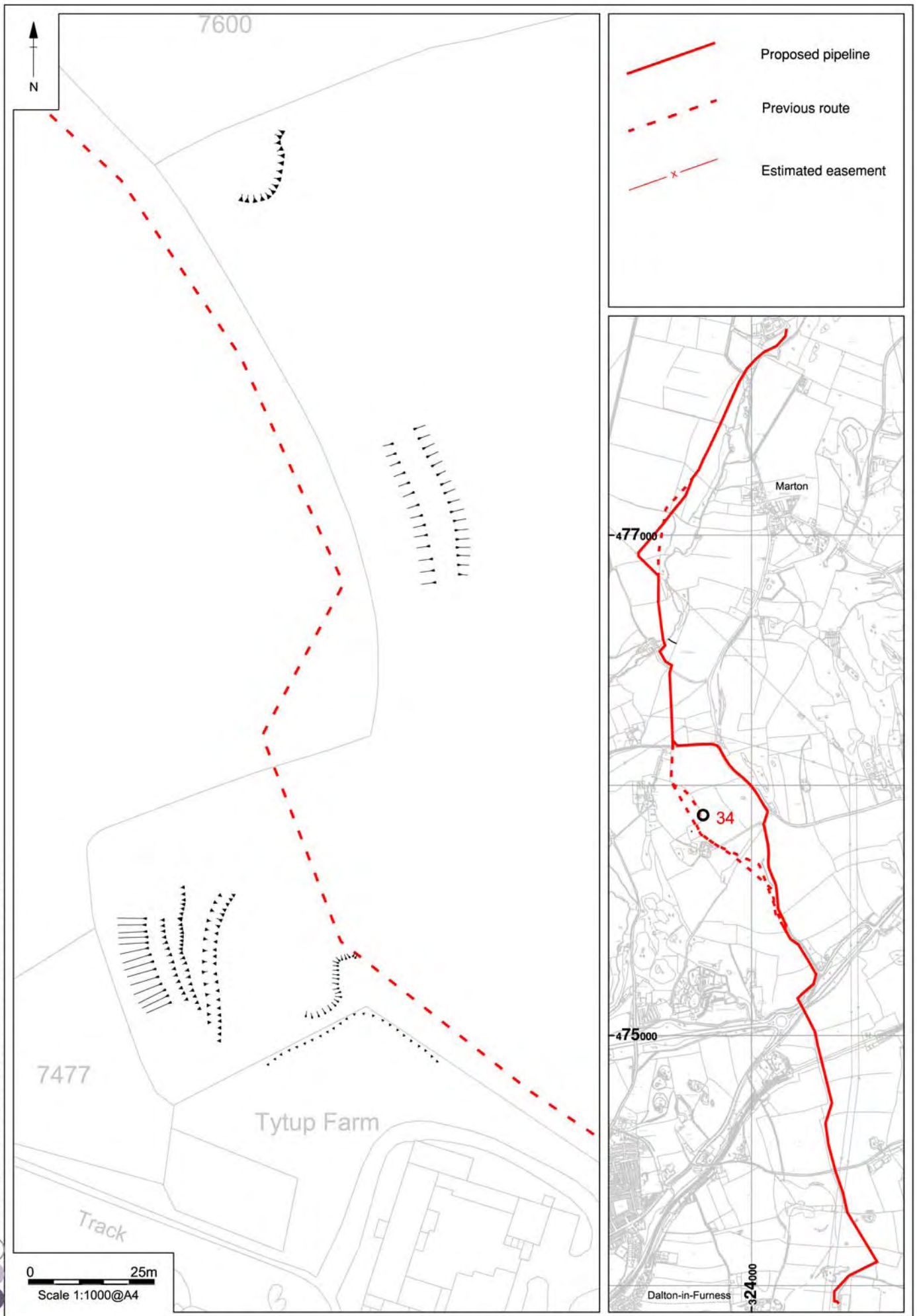


Figure 6:Topographic detail of Site 34, Tytup Farm quarry

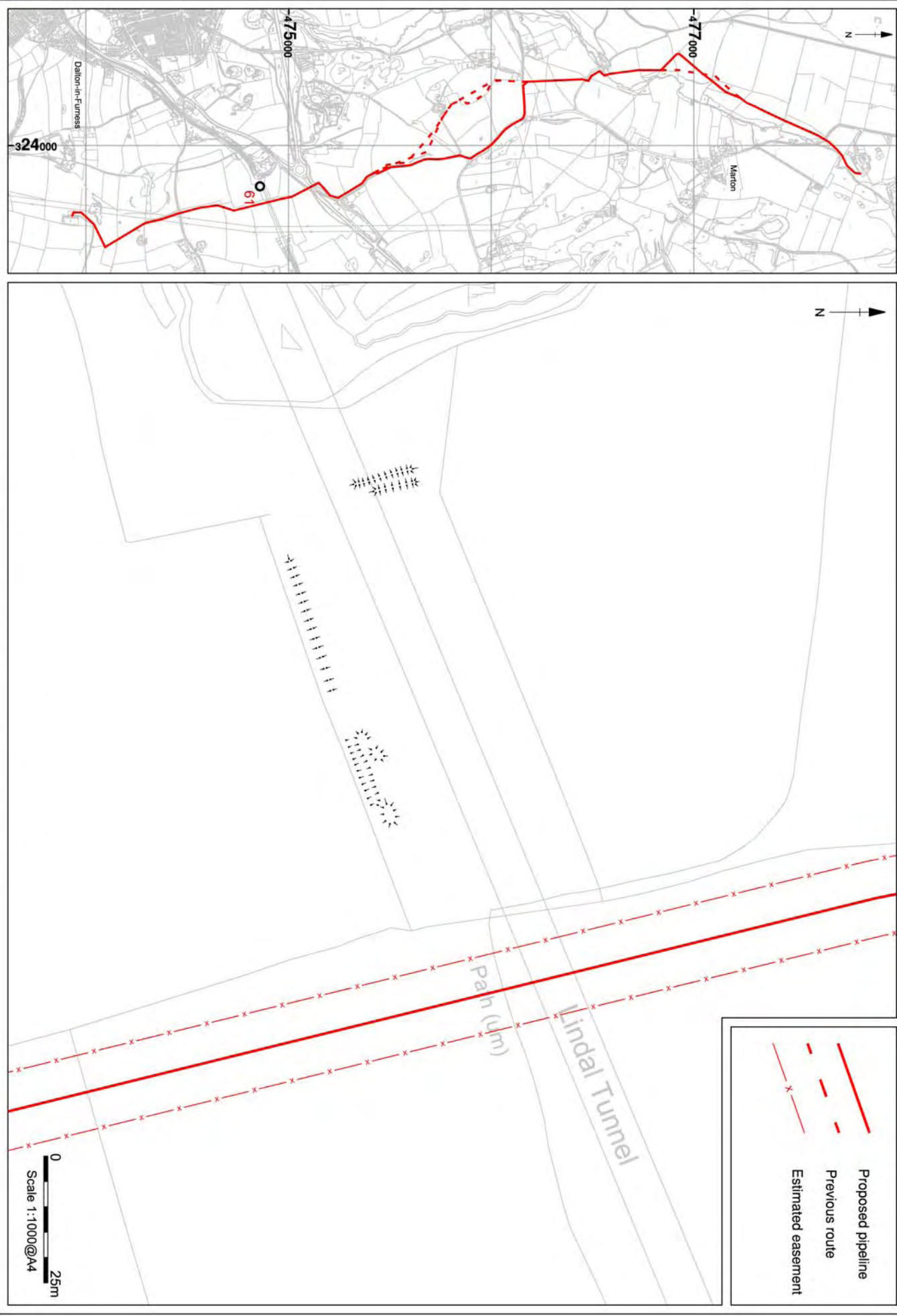


Figure 7: Topographic detail of Site 61, field system

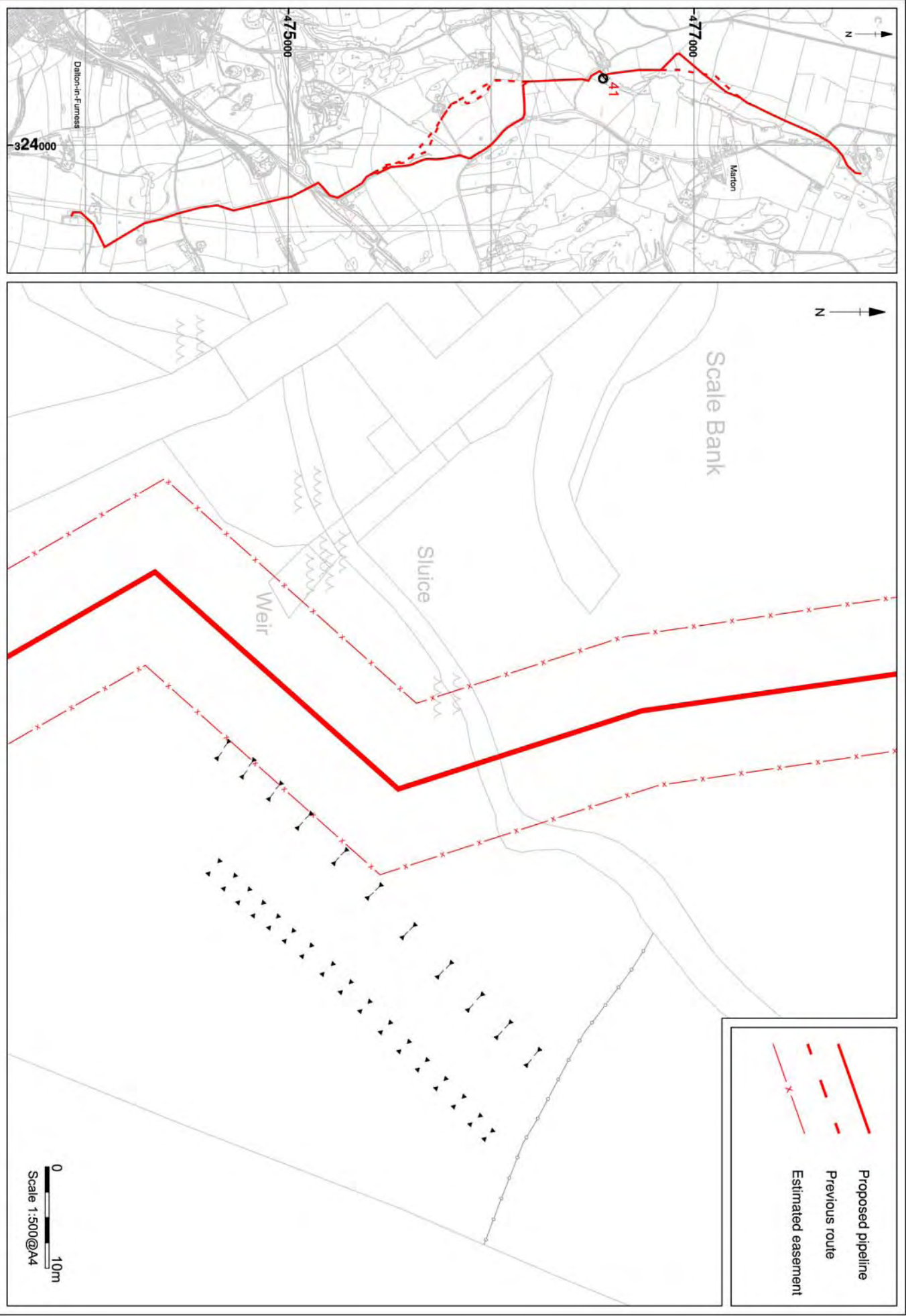
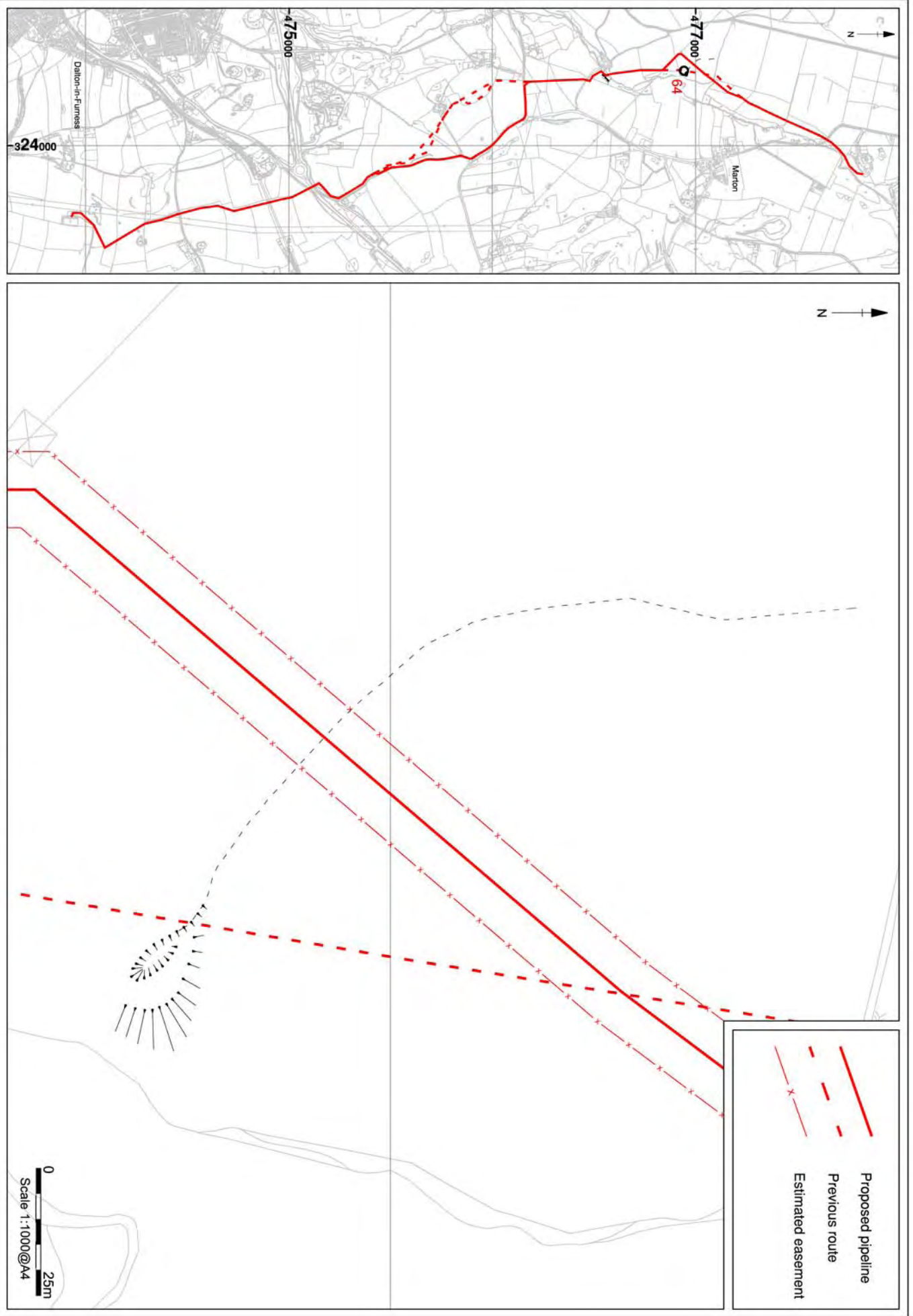


Figure 8: Topographic detail of Site 41, Mill race remains



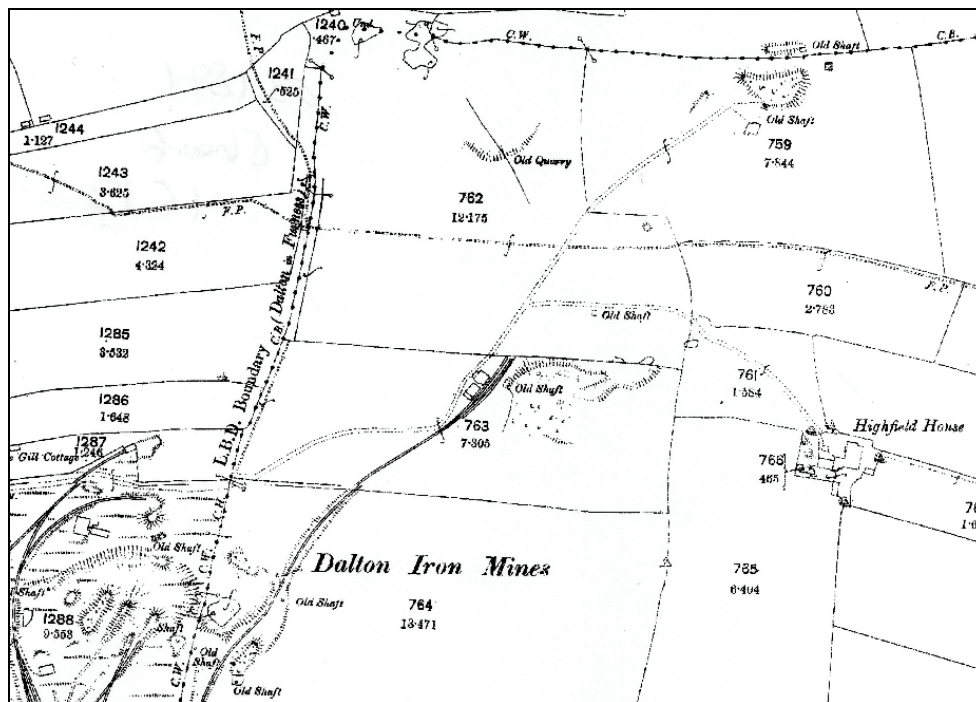


Plate 1: Ordnance Survey map of 1891 showing Dalton Iron Mines



Plate 2: Site 04, general view of Dalton Iron Mines area



Plate 3: Site **04**, Dalton Iron Mines track, northern section



Plate 4: Site **72**, probable building foundations, looking south

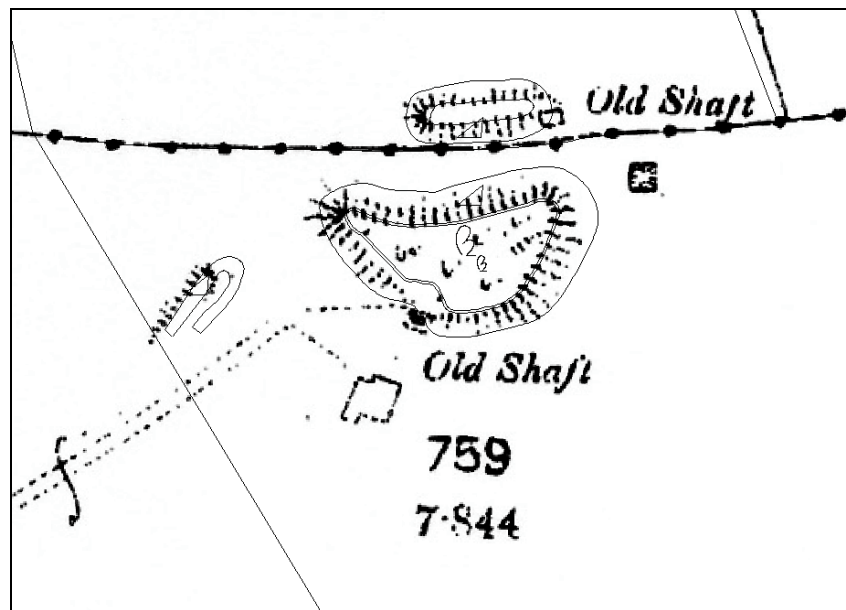


Plate 5: Site 72, Ordnance Survey map of 1891 showing building/enclosure



Plate 6: Site 04, Dalton Iron Mines track, southern section



Plate 7: Site **04**, Dalton Iron Mines track, southern section where it crosses extraction scar (Site **66**)



Plate 8: Site **04**, Dalton Iron Mines track, southern section where it crosses extraction scar (Site **66**)



Plate 9: Site **69**, additional extraction scar, Dalton Iron Mines



Plate 10: Site **70**, additional extraction site, Dalton Iron Mines



Plate 11: Site **59**, east/west aligned ridge-and-furrow



Plate 12: Site **59**, north/south aligned ridge-and-furrow



Plate 13: Site **59**, western field boundary bank



Plate14: Site **73**, additional quarry and track



Plate 15: Site **73**, additional quarry and track, showing soil creep



Plate 17: Site **34**, limekiln remains at Tytup Farm, as seen during walkover survey



Plate 17: Site 34, limekiln remains at Tytup Farm, as seen during topographic survey

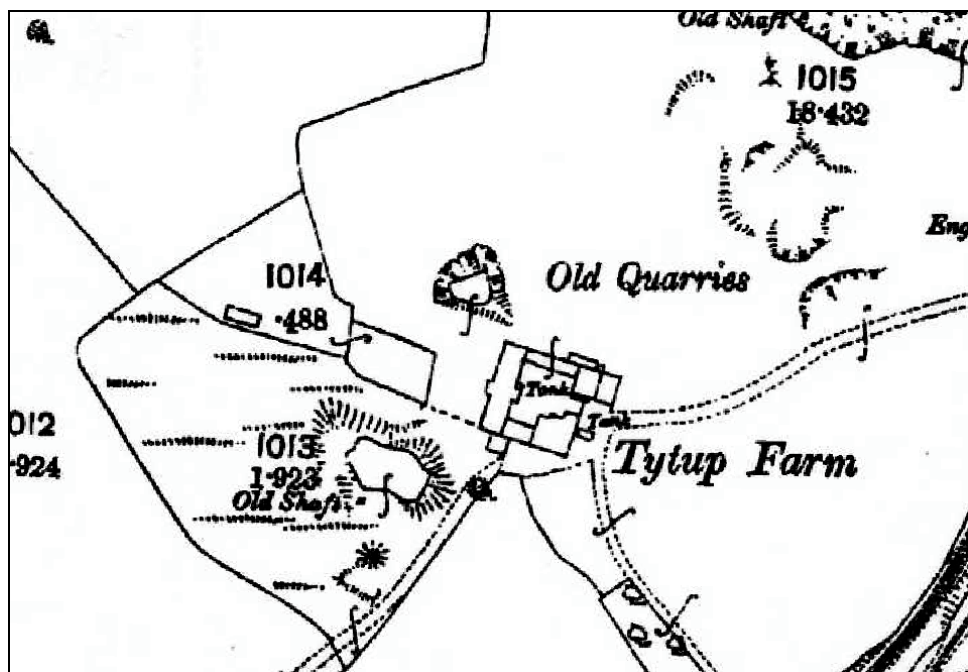


Plate 18: Site 34, quarry at Tytup Farm as shown on the Ordnance Survey map of 1891



Plate 19: Site **34**, outcrop quarry at Tytup Farm



Plate 20: Site **34**, outcrop quarry at Tytup Farm



Plate 21: Site **34**, possible stretch of trackway at Tytup Farm



Plate 22: Site **34**, outcrop quarry at Tytup Farm (northern)



Plate 23: Site **61**, former southern field boundary remains



Plate 24: Site **61**, former western field boundary remains

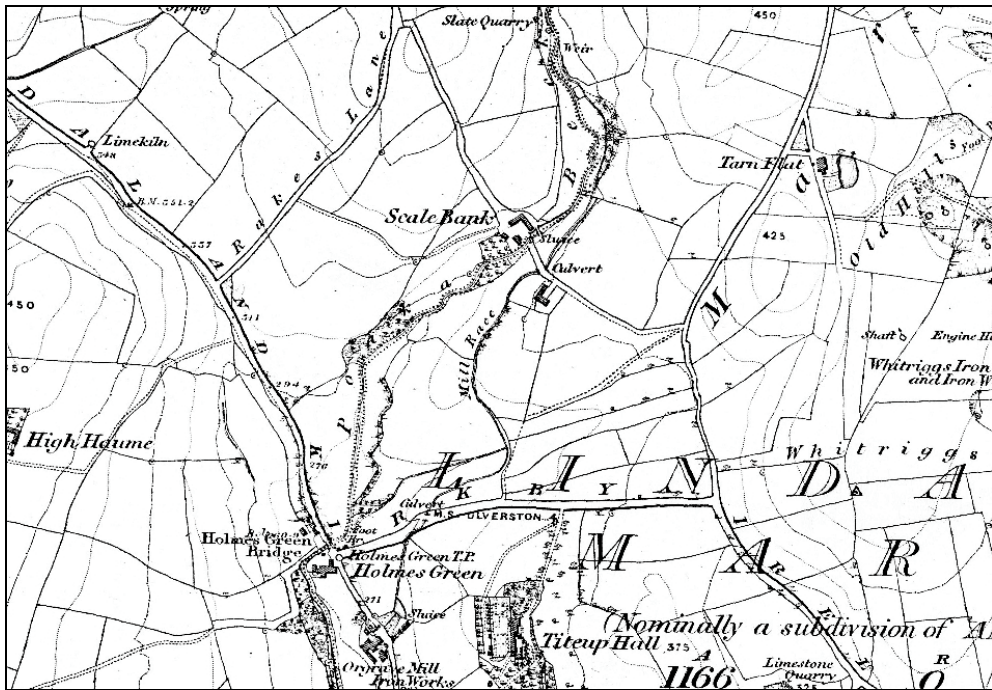


Plate 25: Site 41 Ordnance Survey map of 1850 showing millrace



Plate 26: Site 41, wheelpit at Scale Bank



Plate 27: Site **41**, sluice at Scale Bank farm



Plate 28: Site **41**, flywheel remains at Scale Bank



Plate 29: Site **46**, mill pond revetment wall remains at Scale Bank



Plate 30: Site **41**, main dam wall at Scale Bank



Plate 31: Site 41, Poaka Beck Slate Quarry, waggonway



Plate 32: Site 49, Poaka Beck Slate Quarry, weir



Plate 33: Site **41**, Poaka Beck Slate Quarry, millrace



Plate 34: Site **64**, Mill Walk earthwork

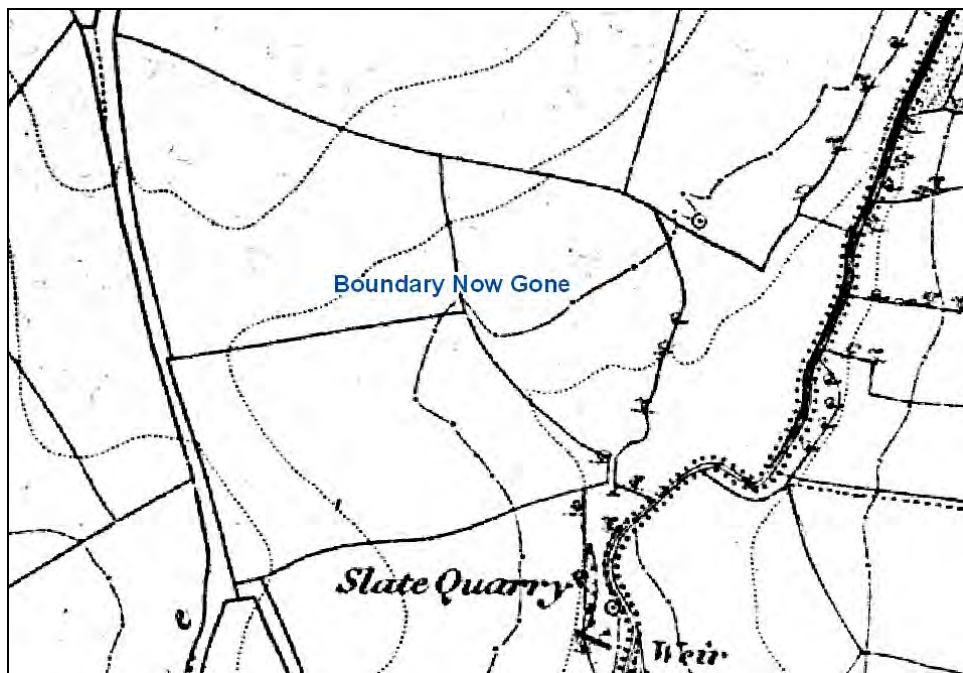


Plate 35: Site **64**, Ordnance Survey map of 1850 showing former field boundaries



Plate 36: Limestone trackway, **1202**, facing north.



Plate 37: Field 16, facing south